Wheelchair Skills Program Manual 5.0

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WARNINGS, DISCLAIMERS AND CONDITIONS OF USE

Some of the wheelchair skills addressed in this Wheelchair Skills Program (WSP) Manual can be dangerous and result in severe injury or death if attempted without the assistance of trained personnel. Attempting these skills may not be appropriate for some wheelchair users or caregivers. If the skills are attempted, for assessment or training purposes, one or more experienced spotters should be available to intervene. The ultimate responsibility for safety during the performance of wheelchair skills lies with the person performing the skills. Even if a spotter acts properly, injuries can occur. Safely performing a skill in the supervised WSP context provides no guarantee that the same or similar skills will be performed safely on other occasions.

The information in this WSP Manual is provided for educational purposes only. The information is not intended to be and does not constitute health-care advice. Any decision concerning the health, treatment and/or wheelchair of a wheelchair user or caregiver should be made in consultation with a qualified health-care professional. The members of the team that developed the WSP, the members of the WSP Manual Editorial Committee, Dalhousie University and the Nova Scotia Health Authority are not responsible for any injuries or deaths arising from the use of the WSP materials. Users of these materials assume full responsibility for their actions.

Anyone wishing to use the WSP materials may do so without permission or charge, as long as they accept and comply with the Conditions of Use posted on the Wheelchair Skills Program website.
ACKNOWLEDGEMENTS

This WSP Manual and related materials have resulted from the work of many people. Those who have had the greatest recent involvement constitute the members of the WSP Manual Editorial Committee listed in the title page. We thank the models for the photographs and videos that illustrate the WSP Manual.

The list of colleagues who have contributed and research funding agencies that have supported this work since it began is extensive and continues to grow. Their names are noted in the specific peer-reviewed papers that can be found on the WSP website.

This work would not have been possible without the many excellent papers, textbooks and training manuals that have been published by others. Some of this literature has been acknowledged in the reference sections of the published papers.
LIST OF ABBREVIATIONS

• NP Not possible
• SCI Spinal cord injury
• TE Testing error
• UN United Nations
• WHO World Health Organization
• WSP Wheelchair Skills Program
• WST Wheelchair Skills Test
• WST-Q Questionnaire version of the WST
• WSTP Wheelchair Skills Training Program
PROLOGUE

In the 2008 World Health Organization (WHO) Guidelines on the Provision of Wheelchairs in Less-Resourced Settings, it was estimated that there were 65 million people globally who would benefit from wheelchairs but that a great many of these people did not have access to appropriate wheelchairs. The prevalence of wheelchair use is rising, in part due to the aging of the population. Of the wheelchairs in use in highly developed parts of the world, about 70% are manual wheelchairs, with the remainder divided about equally between powered wheelchairs and scooters. In less-resourced settings, almost all wheelchairs are manually propelled (either by using hand-rims or an arm crank).

The wheelchair is arguably the most important therapeutic tool in rehabilitation. Research studies have documented such benefits as improved mobility, improved participation, reduced caregiver burden and reduced likelihood of placement in long-term-care facilities. Yet, despite the importance of wheelchairs, they are far from perfect. Many wheelchairs are inappropriate for their users, fit them poorly or are poorly set up. Repairs are needed often and many wheelchair users suffer from acute or chronic injuries due to wheelchair use. Improvements in safety often come at the expense of performance and vice versa. For instance, a highly stable manual wheelchair may be less likely to tip over, but will create problems when the wheelchair user attempts to unload the front wheels (casters) to overcome obstacles. Inaccessibility and societal barriers restrict the usefulness of wheelchairs for many users.

The manner in which people receive wheelchairs varies widely. At the “commodity” end of the spectrum, a wheelchair can be purchased without any clinical input, “over the counter” at the corner drugstore or health-care dealership. Similarly, well-meaning organizations or individuals may donate wheelchairs, sometimes in mass-distribution events involving 250 or more wheelchairs over a few days, without adequate (or any) supporting services.

Optimally, as described by the 2008 WHO Guidelines, there is a care pathway that includes assessment by professionals, the development of a wheelchair prescription with the involvement of the wheelchair user and family, assistance (if needed) with the organization of funding for the wheelchair, proper fitting and adjustment of the wheelchair, training of the wheelchair user and caregiver in maintenance and wheelchair handling skills, and long-term follow-up for refinements, routine servicing and periodic replacement.

Two important elements in this care pathway are wheelchair skills assessment and training for wheelchair users and their caregivers. The WSP is a set of assessment and training protocols related to wheelchair skills. Wheelchair skills assessment and training are topics that have received relatively little attention until the past two decades. The accumulating body of research evidence has spurred current interest in this topic.

Skill in wheelchair use is not an end in itself, it is a means to an end. In terms of the WHO’s 2001 International Classification of Functioning, Disability and Health (ICF), wheelchair skills are “activities”. The ability to perform these skills represents “capacity” and their use in everyday life represents “performance”. The purpose of these activities is to overcome barriers in the environment and to thereby permit the wheelchair user to fulfill his/her desired role in society.
Other target benefits of wheelchair-skill training for wheelchair users and caregivers include fewer acute and overuse injuries, an improved sense of wellbeing (through self-esteem, confidence and personal control, and the sense of becoming newly enabled, empowered and having accomplished something of worth), improved development (of children) and having fun.

In addition to or instead of learning wheelchair skills, there may be alternative ways to accomplish the learner’s goals (e.g. by changing wheelchairs, by accepting the assistance of a caregiver or by eliminating accessibility barriers). Alternatively, if the goal of performing a wheelchair skill proves to be unrealistic, the most appropriate strategy may be to assist the learner in adjusting his/her expectations to a more realistic level.

Although there are many similarities in how to best perform a skill, regardless of the characteristics of the wheelchair user and the impairments that have led to wheelchair use, there are also differences. What is safe and effective for a young fit woman with incomplete paraplegia may be different for a middle-aged and overweight man with complete tetraplegia, and even more different for the elderly foot-propelling person with a stroke.

The characteristics of the wheelchair – its features, fit and setup – can have major effects on skill performance. In helping improve the safety, effectiveness and efficiency of wheelchair use, service-delivery providers should try to optimize the wheelchair user (e.g. by improving fitness or range of motion), to optimize the wheelchair (e.g. by moving the axles of a manual wheelchair forward or adjusting the programming of a powered wheelchair) and/or to provide training.

Major independent bodies such as the United Nations (UN) 2006 Convention on the Rights of Persons with Disabilities and the 2008 WHO Guidelines, have endorsed the importance of wheelchair skills training.

The Wheelchair Research Team at Dalhousie University and the Nova Scotia Rehabilitation Centre (now part of the Nova Scotia Health Authority) in Halifax, Nova Scotia, Canada began in the early 1980’s with a research project to determine why rehabilitation professionals were observing that lightweight wheelchairs were tipping over as often as they were. This was followed by a series of research studies that developed testing methods and answered questions about the nature of static and dynamic stability of occupied wheelchairs.

The work on dynamic stability led to the development of the Wheelchair Skills Test (WST) in 1996 as a means of assessing the ability of wheelchair users to safely perform the skills they need in their everyday lives. Subsequently, a questionnaire version (the WST-Q) has been added. There has been a growing number of peer-reviewed papers about the measurement properties of the WST/WST-Q or that have used the WST/WST-Q as outcome measures.

Having developed a useful measurement tool, it became apparent that many wheelchair users could not perform all of the skills that seemed feasible and that might be helpful to them. This led to the development of the Wheelchair Skills Training Program (WSTP), using the best available evidence on motor skills learning principles and the best available evidence on wheelchair skill techniques. Since then, there has been a growing number of peer-reviewed papers about the measurement properties of the Wheelchair Skills Training Program (WSTP).
papers, including two systematic reviews and meta-analyses (by Tu et al. and Keeler et al.), that have documented the safety and effectiveness of such training.

As noted, the WSP is a set of protocols for the assessment and training of wheelchair skills – the WST/WST-Q and WSTP respectively. The WSP has expanded its scope from manual wheelchairs to include powered wheelchairs and scooters (by which we mean “motorized mobility scooters”), and to include caregivers in addition to wheelchair users. The WSP website, materials on which are provided free of charge, had 144,955 visits from 93,373 users in 182 countries as of April 1, 2018. Members of the Wheelchair Research Team have provided practical training on the WSP to therapists in a number of countries around the world, in both highly developed and less-resourced settings. The WSP is now recognized by a variety of national and international organizations.

The WSP has evolved over time, in response to research, feedback and experience with it. Various iterations of the WSP – #1.0, 2.4, 3.2, 4.1, 4.2, 4.3 and 5.0 to date – have been released for general use. WSP 5.0 (the basis for this WSP Manual) was originally released for use on August 17, 2018. Even within the lifespan of an iteration, the WSP materials are periodically updated. As such, the materials are “living” rather than fixed. If the iteration number has not changed (e.g. from 4.2 to 4.3) despite an update, it is because the changes have been deemed by the WSP Manual Editorial Committee to be predominantly of a minor nature. However, for academic purposes, users of the WSP materials should cite the date of the iteration that they use. This can be found in the footer of each page.

We had a number of goals in updating from Version 4.3 to Version 5.0, specifically:

1. To refine the content based on new evidence, experience and suggestions from WSP users.
2. To broaden the scope by enhancing the caregiver elements.
3. To reduce the number of versions.
4. To simplify the administration of the WST and WST-Q.
5. To reduce WST and WST-Q ceiling and floor effects.
6. To increase WST and WST-Q sensitivity to change.

In an attempt to meet these goals, we have modified WSP Version 5.0 in the following notable ways:

1. The skill set has evolved. We have deleted some skills (e.g. “operates battery charger”), we have added skills (e.g. “rolls forward and backward in wheelie position”) and we have broadened the scope of others (e.g. “performs wheelchair-ground transfers”).
2. The skill sets for wheelchair users and caregivers are now identical.
3. When a caregiver is being assessed, the scores recorded are those that include whatever assistance from the wheelchair user is available. As such, there is no longer a “caregiver” score, but rather a “caregiver-assisted” score whenever the “subject” of testing includes the wheelchair user and caregiver acting together.
4. The skill sets for powered wheelchairs and scooters are now identical, with both types of mobility devices being considered under the heading of “powered wheelchair version”.
5. The scoring for the WST and WST-Q has been modified to increase scoring sensitivity and reduce floor and ceiling effects.
6. The components of the individual-skill sections dealing with the WST/WST-Q and WSTP have been separated.
7. We have eliminated skill “levels” (indoor, community and advanced) because they did not apply equally well to the manual and powered wheelchair versions.

The WSP is different from most other resources on wheelchair skills in a number of ways:
1. It is based on the best evidence on how to perform, assess and teach wheelchair skills.
2. Where there are gaps in evidence, ongoing evaluation of the WSP has been initiated with as much scientific rigor as possible.
3. The process and sequence of the training is important.
4. The materials are frequently updated.
5. The WSP deals with both assessment and training.
6. The WSP deals with the skills of the wheelchair user alone or in combination with a caregiver.
7. The WSP deals with the full spectrum of wheelchair users (e.g. hand propellers such as those using wheelchairs due to SCI as well as foot propellers such as those using wheelchairs due to stroke or dementia).
8. The WSP is relevant for manual wheelchairs, powered wheelchairs and scooters.
9. All of the materials on the WSP website are available free of charge (“open source”).

In this WSP Manual, we have attempted to provide a wide spectrum of readers with comprehensive but easily understandable materials. The target audience includes practicing and student rehabilitation therapists (e.g. occupational, physical and recreational), their aids and assistants, rehabilitation nurses and rehabilitation medicine physicians and residents. In addition to clinicians, researchers may find the WSP Manual to be a useful resource. Additionally, because the WSP Manual has been written in plain language, many wheelchair users and caregivers should be able to understand the content. Because the assessment and training of wheelchair skills are low-tech and the training program is high-impact, the WSP is equally relevant for highly developed and less-resourced parts of the world.

As recommended in the 2008 WHO Guidelines, a new wheelchair user should go through an 8-step process in the course of his/her wheelchair service delivery. One of those steps is assessment. As part of this assessment, the wheelchair skills of the wheelchair user should be assessed. This should be done at intake, as part of the prescription and fitting steps (e.g. to compare how well the wheelchair user can perform skills with a rigid vs. a folding wheelchair, or with the rear axles in more and less stable positions) and during follow-up to determine what revisions in the wheelchair are needed. The assessment can be performed using the WST and/or the WST-Q. Another WHO step is training, that includes wheelchair skills training of the wheelchair user and/or caregiver. For this training, the WSTP can be used during the initial provision of the wheelchair and as necessary at follow-up. The WHO’s eight steps of wheelchair service delivery need not be sequential and are often iterative. For instance, following training, it may be possible to revise the wheelchair prescription and set-up.

This WSP Manual provides chapters dealing with overviews of the WSP, safety issues, the assessment of wheelchair skills, the WST, the WST-Q and the WSTP. Each of the individual skills that make up the WSP skill set is dealt with in detail. At the end of the WSP Manual, there
is a chapter on games that can be played to reinforce learning. Finally, appendices provide some options regarding the organization of training sessions for individuals or groups.
CHAPTER 1. INTRODUCTION TO THE WHEELCHAIR SKILLS PROGRAM

1.1 Scope

The WSP is intended for manual or powered wheelchairs, operated by wheelchair users with or without the assistance of their caregivers. Whenever appropriate in the WSP Manual, the word “powered wheelchair” should be understood to include motorized mobility scooters (scooters). Throughout the WSP Manual, to simplify descriptions, unless otherwise specified it has been assumed that the wheelchair being used is one with rear-wheel drive (i.e. large diameter wheels in back and smaller diameter swivel or steerable wheels in front). Other types of wheelchairs and scooters can be dealt with using WSP materials, but some of the instructions and explanations may need to be adapted accordingly. Wheelchair technology is diverse and is evolving at a rapid rate. There may be wheelchairs that do not easily fit the categories described. In such situations, the tester or trainer needs to exercise judgement regarding which skills are appropriate. For instance, for power-assisted wheelchairs, a combination of skills from the manual and powered wheelchair skill sets would be appropriate.

The WSP is not intended to be an adequate approach for other important wheelchair skills (e.g. maintenance and repair skills), more extreme skills (e.g. some wheelchair sport activities) or community-integration activities that combine a number of skills (e.g. use of accessible transport, shopping). The skills chosen for inclusion in the WSP are intended to be representative of the range of skills that wheelchair users and caregivers may need to regularly perform, varying from the most basic to the more difficult. However, it would be impossible to be all-inclusive without making the size of the WSP unmanageable.

1.2 Subjects

In the WSP Manual, the term “subject” is often used because the person who is the object of testing or training may be a wheelchair user, a caregiver, a health-care student or a research participant. In addition to testing or training for a wheelchair user alone, the WSP may be used to assess or train the extent to which one or more caregivers and a wheelchair user can function as a team; the “subject” in such situations is the blended combination of the wheelchair user and the caregiver(s). If an animal (e.g. a service dog) is used to assist with a skill, the animal is considered an “aid” rather than a caregiver.

1.3 Special Considerations for Caregivers

The term “caregiver” is often used in the literature. We use the term “caregiver” in the WSP Manual to refer to someone other than the wheelchair user who may be involved in carrying out the wheelchair skill. We intend this term to apply broadly to include formal caregivers (e.g. health-care or personal-care workers who are paid for their services), informal caregivers (e.g. family members or friends) and others (e.g. passersby who do not know the wheelchair user but who are willing to provide assistance). The assistance provided by a caregiver may be under the direction of the wheelchair user. Receiving assistance from a caregiver is often the safest and most effective way to carry out an activity.
If the usual circumstance for a skill in real life is that a wheelchair user and his/her caregiver ordinarily share the duties, then “blended” wheelchair user/caregiver testing or training may be the most appropriate choice, but the relative contributions of the two people involved should be documented. It is not a reasonable expectation that a single caregiver could complete some skills alone without special equipment or the assistance and cooperation of the wheelchair user. The testing score achieved is a combination of the score of the wheelchair user and caregiver functioning together (i.e. a “blended” score). The caregiver-assisted score is specific not only to the wheelchair and setting (as is the case for the WST in general), but is also specific to the wheelchair user and caregiver being assisted.

In addition to physical assistance, caregiver assistance may consist of no more than the presence of the caregiver (e.g. for reassurance, moral support, spotting) without necessarily any cues being provided. This is sometimes referred to as “standby assistance”. If a wheelchair user/caregiver pair is the subject of testing, the caregiver must generally meet the same criteria used for the wheelchair user (e.g. keeping the caregiver’s feet as well as the wheelchair wheels inside any designated limits). Special additional caregiver considerations are noted in the later chapters on individual skills.

1.4 The Circle of Education

Assessment and training are both elements in the classical circle of education. In this circle, one begins with an assessment (including the WST and/or WST-Q) to identify the learner’s starting point. From this, the educational objectives (goals) are identified. This is followed by the curriculum (the WSTP), aimed at meeting those objectives. This is followed by another assessment to confirm that the objectives have been met. If not, the cycle continues.

1.5 Cost-Effectiveness of the Wheelchair Skills Program

Although no formal studies of cost-effectiveness have yet been conducted, there is some basis for believing the WSP is cost-effective. The WST requires an average of about 30 minutes to conduct and the WST-Q about 10 minutes. The training studies to date suggest that significant improvements in capacity can be accomplished with as few as four hours of training (although many more are recommended). No equipment is required, only trained personnel. For personnel, occupational or physical therapists or their assistants have the most appropriate backgrounds. However, there have also been good results when using university students, research assistants or peers as trainers. The potential benefits of training include reduced costs due to fewer injuries, lowered caregiver needs and helping appropriate wheelchair users return to gainful employment. Learning a new skill lasts a lifetime, unlike strength or endurance training that requires ongoing efforts to maintain benefits. For all of these reasons, the WSP can be considered to be a cost-effective intervention that would compare favorably with other rehabilitation assessment measures or interventions.

1.6 Languages

The WSP was originally developed in the English language. It has since been translated by a team led by Francois Routhier (Deputy Chair of the WSP Manual Editorial Committee) into
1.7 Warnings to Subject

Prior to beginning the initial WSP session, the subject should be warned by the WSP personnel that some wheelchair skills can be dangerous and that the subject should not attempt any task that he/she is not comfortable performing. Also, to avoid overuse injury, the subject should be instructed to avoid overexerting him/herself in the mistaken belief that success on every skill is expected. These warnings may be repeated at any time during a WSP session. If, with the subject’s knowledge and permission, the rear anti-tip devices are adjusted or removed, the WSP personnel should inform the subject that this has been done.

1.8 Wheelchair Skills Program Personnel

WSP personnel are important elements in testing and training. During WSP activities, the roles of the tester and trainer are primarily to oversee the assessment and training of participants. The spotter is the person, other than the person performing the skill, who is primarily responsible for ensuring the safety of the subject from the moment the session begins until it is completed. The spotter focuses on the prevention of major acute injury. Wheelchair users, caregivers, testers and trainers also play roles in preventing injury.

Although it is common for the tester or trainer to simultaneously fulfill the role of the spotter, it is useful to consider the roles separately. Although related, the competencies of spotters are different from those of testers and trainers. If the spotter and tester or trainer roles are being fulfilled by different people, and there is a difference of opinion between the WSP personnel, the tester or trainer shall make the final decision, after carefully considering the opinion of the spotter. For most skills, a single spotter can adequately minimize the likelihood of serious injury. However, for some situations (e.g. a heavy or impulsive wheelchair user), one or more additional spotters may be needed. If more than one spotter is used, one spotter should take the lead role.

Although testers and trainers need not be able to perform the physical spotter tasks themselves, they should understand the spotter’s role and be able to supervise the spotter.

WSP personnel may be rehabilitation clinicians who are regularly involved in wheelchair provision, but there are no minimum educational requirements. However, WSP personnel should be thoroughly familiar with all elements of the WSP for which they have responsibility. WSP personnel should feel free to refer to the WSP Manual whenever necessary.

Those interested in becoming WSP personnel should read this WSP Manual, study the related materials, review practice materials (e.g. videos on the website), observe in-person how experienced WSP personnel function and perform the activities themselves under supervision. Ideally, the WSP should only be used by personnel who have been trained in its administration. However, good results are possible by careful attention to the WSP Manual and other materials.
because the materials have been designed to be reasonably self-explanatory and to reflect normal clinical practices.

Because practice outside formal training sessions can be useful, members of the rehabilitation team (e.g. members of the nursing profession, personal care workers, recreation therapists, volunteers, physicians) other than the primary trainer can be of assistance. Good team communication among team members about a learner’s progress can help to ensure that the input from multiple team members is complementary rather than conflicting. Because the principles of motor skills learning used for wheelchair skills are the same as those used when learning other skills (e.g. music or sport), a background in teaching such other motor skills is an asset for a trainer. Similarly, experience in managing groups (e.g. coaching sports or supervising children) is an asset to any trainer teaching wheelchair skills in a group setting.

Both experts and non-experts can play important roles in the training process. Wheelchair-using or caregiver peers may possess or be able to acquire the necessary knowledge, skills and attitudes to function as WSP personnel. Peers have a number of advantages over able-bodied personnel – real-life experience with barriers, familiarity with practical solutions to common problems, credibility and superior capacity to empathize with the difficulties being experienced by a wheelchair-using subject. However, the peer may have limited clinical knowledge (e.g. about what triggers a spasm), his/her expertise in performing wheelchair skills is likely to be highly specific (e.g. a peer with SCI may have difficulty advising a person using a wheelchair due to a stroke) and a wheelchair user may have difficulty spotting some skills (particularly moving skills).

The personal characteristics of WSP personnel (especially trainers) are also important. Personnel should be credible, friendly, supportive, non-judgemental, interested and honest. Personnel should be familiar with the structure and operation of the specific wheelchair used by the subject.

1.9 Versions of the Wheelchair Skills Program

There are two versions of the WSP, one for manual wheelchairs and one for powered wheelchairs (including scooters). Although there are a number of skills that apply to both manual and powered wheelchairs, there are some skills that apply only to manual wheelchairs (e.g. performing wheelies [balancing on the rear wheels]) and some that apply only to powered wheelchairs (e.g. operating the controller).

1.10 Individual Skills

The individual skills are the units of assessment, some of which have been combined for training. Table 1.1 shows which skills are included in which version of the WST. The order of skills in Table 1.1 reflects the functional groupings of skills (e.g. inclines in different directions and with different slopes are grouped together) and the approximate order of difficulty (although this can vary depending upon the subject and wheelchair).

These skills can be put together in various combinations and permutations to allow participation (e.g. going shopping, attending an educational event, performing a job). A brief description of each skill and the rationale for including it in the WSP can be found in the later chapters on
individual skills. In naming the individual skills, we have attempted to be as generic and
universal as possible. This is in recognition that the environments in which wheelchairs are used
differ widely around the world, although they share many common characteristics.

The WST, the WST-Q and the WSTP for each of the two versions of the WSP all deal with the
same set of skills, but the correspondence should not be considered exact. For instance, for the
“rolls forward short distance” skill, the WST by necessity deals with exact dimensions (10 m),
whereas the WST-Q questions are stated in more general terms because subjects may not be able
to easily visualize such exact distances and the WSTP involves variations that enhance learning.

### Table 1.1: List of Individual Skills for WST for both Versions

<table>
<thead>
<tr>
<th>#</th>
<th>WST Skill Names</th>
<th>Manual</th>
<th>Powered</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Positions and operates controller</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Operates body positioning options</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Rolls forward short distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Rolls backward short distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Stops on command</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Turns in place</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Turns while moving forward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Turns while moving backward</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Maneuvers sideways</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Picks objects from floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Relieves weight from buttocks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Performs level transfers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Folds and unfolds wheelchair</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>14.</td>
<td>Gets through hinged door</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Rolls longer distance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Ascends slight incline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Descends slight incline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Ascends steep incline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Descends steep incline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Rolls across side-slope</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>Rolls on soft surface</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Gets over obstacle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Gets over gap</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.</td>
<td>Ascends low curb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Descends low curb</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>Ascends high curb</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>27.</td>
<td>Descends high curb</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>28.</td>
<td>Performs wheelchair-ground transfers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29.</td>
<td>Performs stationary wheelie</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>30.</td>
<td>Turns in place in wheelie position</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>31.</td>
<td>Rolls forward and backward in wheelie position</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>32.</td>
<td>Descends high curb in wheelie position</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>33.</td>
<td>Descends steep incline in wheelie position</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
### 1.11 Skill Groups

Most of the individual skills can be grouped, as listed in Table 1.2 and as described below, although some of these groupings only apply to manual wheelchairs.

#### Table 1.2: Skill Groups

<table>
<thead>
<tr>
<th>#</th>
<th>Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>How to operate the parts of the wheelchair.</td>
</tr>
<tr>
<td>2</td>
<td>Understanding the dimensions of the wheelchair.</td>
</tr>
<tr>
<td>3</td>
<td>Getting into, out of and repositioning oneself with respect to the wheelchair.</td>
</tr>
<tr>
<td>4</td>
<td>Moving the wheelchair around on smooth level surfaces.</td>
</tr>
<tr>
<td>5</td>
<td>Using the environment.</td>
</tr>
<tr>
<td>6</td>
<td>Skills that require leaning in the wheelchair.</td>
</tr>
<tr>
<td>7</td>
<td>Skills that require popping the casters briefly off the surface.</td>
</tr>
<tr>
<td>8</td>
<td>Skills for which balancing on the rear wheels is necessary.</td>
</tr>
<tr>
<td>9</td>
<td>Working with a caregiver.</td>
</tr>
</tbody>
</table>

1. **How to operate the parts of the wheelchair.** Wheelchairs vary widely in their components and how they work. It is important that wheelchair users and caregivers learn about the structures and operating idiosyncrasies of the wheelchairs they use. This includes normal daily operations, transportation and storage of the wheelchair, as well as regular maintenance duties. At the time of sale, new wheelchairs are usually delivered with user manuals. Wheelchair users and caregivers can learn about special features of their wheelchairs by studying the user manuals. If the user manual has been lost, instructions can often be found on-line. Maintenance and repair issues are also usually dealt with in the user manual (e.g. how to recognize when maintenance or repair are needed, how often a battery needs to be charged).

2. **Understanding the dimensions of the wheelchair.** The dimensions of the occupied wheelchair are important to understand, for instance when judging if a door is wide enough to pass through, if there is enough space in which to turn around or if there is enough clearance beneath the wheelchair to pass over an object on the ground.

3. **Getting into, out of and repositioning oneself with respect to the wheelchair.** This includes transferring between the wheelchair and various other surfaces, unloading pressure-sensitive body parts and changing position in the wheelchair.

4. **Moving the wheelchair around on smooth level surfaces.** Although the method of propulsion may vary, depending upon the impairments of the wheelchair user (e.g. using two hands, one hand and one foot, or power), basic propulsion includes being able to move the wheelchair forward and backward, being able to turn in place or while moving, and being able to maneuver the wheelchair into position (e.g. to pick something up off the ground, getting close enough to a bed to make a transfer, or negotiating doors).
5. **Using the environment.** Although the environment is often a barrier to activities, there are times when it can be an asset, especially for manual wheelchair users. For example, a wheelchair user may use the hand rails on a ramp to pull the wheelchair up the slope.

6. **Skills that require leaning in the wheelchair.** The wheelchair user’s position in the wheelchair has a dramatic effect on the amount of weight that is on the front versus rear wheels because the wheelchair user’s trunk and upper body constitute a considerable proportion of the combined mass of the wheelchair and wheelchair user. This is especially true for manual wheelchairs. Leaning to alter weight distribution with respect to the wheels will affect the stability of the wheelchair in a predictable way. For instance, when ascending an incline in a manual wheelchair, there is a risk of the wheelchair tipping over backward. To prevent this, the wheelchair user should lean forward enough to keep the front wheels on the surface.

In addition to stability, the balance of weight between the front and back wheels has an effect on rolling resistance. Wheels with large diameters have lower rolling resistance, whereas small-diameter wheels will tend to dig into soft surfaces. When crossing soft surfaces (e.g. carpet, gravel, grass), the wheelchair user should keep his/her weight on the rear wheels to the extent possible. When crossing side slopes, the tendency for the wheelchair to turn downhill can be reduced by leaning away from the swivel casters. Leaning toward one side can also affect the lateral stability of the wheelchair. Also, if one wheel is spinning due to a lack of traction, this can often be corrected by leaning toward the spinning wheel.

7. **Skills that require popping the casters briefly off the surface.** There are some obstacles that require the casters clear the obstacle. These skills are most appropriate for manual wheelchairs. Examples include negotiating soft surfaces, obstacles (e.g. door thresholds), gaps and level changes (e.g. curbs).

8. **Skills for which balancing on the rear wheels is necessary.** For manual wheelchair users, the full wheelie position (balancing on the rear wheels) can be used to deal with situations like those described above that require the front wheels to be unloaded. However, there are some desirable skills that can only be carried out by keeping the front wheels off the surface. These skills include the stationary wheelie (e.g. to improve neck comfort), turning around in a tight space, the forward descent of large level changes (e.g. a high curb) and the forward descent of steep inclines. These skills require the ability to perform a stationary wheelie, to turn around in the wheelie position, and to move forward or backward in the wheelie position. Wheelie skills are impossible in most powered wheelchairs.

9. **Working with a caregiver.** Most wheelchair users have at least some skills that they cannot safely perform themselves or that they find stressful. In such situations, the wheelchair user can benefit from the assistance of a caregiver (as defined earlier). This may be in the form of minimal assistance (e.g. someone standing nearby to respond to a tip), the caregiver doing the task completely (e.g. ascending a curb) or the caregiver working in combination with the wheelchair user.
1.12 Wheelchair Skills Program Forms

The forms that facilitate the administration, recording and reporting of each of the versions of the WSP can be found at www.wheelchairskillsprogram.ca/eng/manual.php.
CHAPTER 2. INTRODUCTION TO SAFETY ISSUES

2.1 General

Wheelchair use can be dangerous. Each year, 5-18% of wheelchair users experience injuries related to wheelchair use. Of the injuries that are of at least moderate severity, about two-thirds are related to tip-over accidents and/or falling from the wheelchair. Wheelchair users and caregivers are also at risk of chronic injuries, for instance due to poor ergonomic technique.

Improving a person’s wheelchair skills may not necessarily reduce the likelihood of injury. Providing people with an appropriately set-up wheelchair and helping them to acquire the abilities and confidence that they need to get around in their communities may, counterintuitively, increase the risk of a tip or collision.

Nevertheless, the goal of wheelchair skills training is for the learner to be able to perform skills safely, effectively and efficiently. Safety includes both the safety of the wheelchair user and the safety of others. If there are two or more ways for a learner to perform a skill and one is considerably safer to perform than the other, the trainer should encourage the learner to use the safer technique. For some learners and some skills that cannot be performed in a consistently safe manner, the most successful outcome of training will be if the learner recognizes that the skill should not be attempted without assistance. A probationary period of supervision may be appropriate before coming to a decision that a person is acceptably safe to use a wheelchair independently.

Because WSP participants are assessed and trained in wheelchair skills with which they may be unfamiliar, participation in assessment and training activities can be dangerous. This chapter deals with issues affecting safety during these activities. The focus is on the types of risks that can occur and how the spotter can minimize them without unduly interfering with the activity.

Although the safety of WSP personnel (i.e. spotters, testers and trainers) and bystanders is also a concern, this chapter primarily addresses the safety of the wheelchair user. There are a wide range of safety concerns associated with wheelchair use (e.g. hand scrapes, overuse injuries), but this chapter deals only with the major acute risks that a spotter might reasonably be expected to address (e.g. wheelchair tips and falls from the wheelchair).

The best way to spot a skill may vary, depending upon the spotter, the wheelchair user, the wheelchair and the setting. The material provided in the WSP Manual, although based on experiences with WSP activities, represents only our consensus opinions. There is no scientific evidence as yet on the best way to spot wheelchair skills.

2.2 What is a Spotter?

A spotter is a person who acts to reduce the likelihood of injury to another person who is performing an activity, without unnecessarily interfering with the performance of that activity.
2.3 Who can Function as a Spotter?

The spotter may be a member of the WSP personnel. Spotter skills can also be useful as wheelchair users go about their everyday activities with friends, family members and caregivers. Wheelchair users may need to instruct a bystander or passerby on how to best spot a skill that the wheelchair user finds difficult or hazardous.

2.4 Equipment and Supplies for the Spotter

**Spotter strap.** A spotter strap can be used to assist the spotter in controlling a manual wheelchair during skills during which there is the risk of a rear tip or of the wheelchair running away (e.g. down an incline). The necessary requirements of a spotter strap are a means of attaching one end of the strap to the wheelchair, a loop or handle for the spotter’s hand at the other end and sufficient tensile strength to withstand high loads (equivalent to 200 kg or more). Details about one design for such a strap can be found on our website. Alternatives (e.g. a piece of rope, a dog leash) are equally acceptable if they meet the criteria above.

For a wheelchair with an X-shaped cross-brace, the spotter strap is attached where the brace members intersect, to avoid any lateral movement of the strap. The low attachment point of the spotter strap helps to resist forward movement of the rear wheels (“submarining”) during a rear tip. For a rigid-frame wheelchair, the spotter strap is placed near the midline of a lower frame member or camber tube, but additional means (e.g. tape) may be needed to keep the strap from sliding to one side. If a knapsack is present or if there are other wheelchair parts (e.g. to provide rigidity to the backrest or to allow the backrest to be folded forward), the path of the spotter strap should be as close to the backrest as possible.

The length of the spotter strap should be adjusted so that it is long enough to allow the spotter to stand upright with the elbow flexed 30-60° from full extension for most skills but short enough that the spotter can be sufficiently close to the wheelchair to intervene. The spotter should hold the hand loop or handle with the palm up and the loop or handle across the palm at the base of the fingers, not just across the fingers themselves or around the wrist. The spotter strap should be held ready, but without tension in the strap, because tension can affect the performance of some skills. When not in use, the hand loop or handle can be hung out of the way over a push-handle or other wheelchair part.

**Seat belt.** For any skills during which there is a risk of the subject pitching or sliding forward out of the wheelchair, a seat belt is recommended. If the subject’s wheelchair is not equipped with one, a temporary one may be provided by the WSP personnel for training. The wheelchair user may decline to use the seat belt, after being instructed about its availability. A seat belt should not be provided by WSP personnel for WST testing purposes if the subject does not ordinarily use one because this may alter the natural state that is being assessed.

**First aid kit.** A first aid kit should be available, in the event that an injury occurs. Also, a means of communication should be available in case the WSP personnel require assistance to deal with an injury.
2.5 Obtaining the Subject’s Permission to be Spotted

Wheelchair users with advanced skills perform most of the skills in their daily lives without spotters. Such users may be offended by being spotted unnecessarily. Also, they may be legitimately concerned that inappropriate intervention by a spotter could interfere with the performance of a skill, thereby causing injury rather than preventing it.

However, during the initial WST assessment, a spotter is mandatory, at least to the extent of the spotter positioning him/herself where he/she could intervene if necessary. During subsequent WSP activities, the tester or trainer may permit the subject to waive the spotter, if the tester or trainer is convinced that the subject or learner will not be placed at undue risk by making this decision. It is the subject’s or learner’s right to refuse to be spotted. Indeed, to spot without the subject’s or learner’s permission could be considered a form of assault. However, if the WSP personnel believe that the subject’s or learner’s decision to waive a spotter is inappropriate, the personnel should not permit the subject or learner to participate in WSP activities.

2.6 Spotter Warnings to Subject

The spotter should let the wheelchair occupant know whenever he/she is or is not in place – the phrases “spotter on” and “spotter off” (with a corresponding pat on the shoulder if in a noisy environment) are useful shorthand means of communicating this information, having explained to the subject what the phrases mean on the first occasion that they are used.

2.7 Ensuring Safety During Wheelchair Skills Program Activities

A spotter should be present for any formal Wheelchair Skills Program activities. The tester or trainer should not permit the subject or learner to attempt or complete any task that he/she has reason to believe that the subject or learner will be unable to complete without risk. For some skills (specified later in the chapters on individual skills), the tester or trainer should ask the subject or learner about whether he/she feels able to perform the skill. For such skills, if the subject or learner believes that he/she would be able to perform the skill, the tester or trainer should then inquire about the intended method to be used. If an unsafe method is described, the tester or trainer should not permit the attempt of that skill in the way described. Despite these precautions, as a general rule, the tester or trainer should try to avoid preemptively disqualifying the subject or learner and should allow him/her to attempt a skill.

Injuries can also occur between skill attempts, while the wheelchair user moves from one skill site to another or even at rest (e.g. while the spotter steps away to take a phone call). It is the spotter’s responsibility to pay close attention to the subject or learner both during and between skill attempts.
2.8 When the Spotter Should Intervene

The spotter should always intervene to prevent a complete tip of the wheelchair, a complete fall from the wheelchair or a runaway. The spotter should generally not interfere with minimal transient tips (self-limited by definition) that are inadvertent or may even be necessary for the completion of some skills (e.g. getting up a curb). For risks other than tips and falls, it is the WSP personnel’s responsibility to stop any skill attempt as soon as it is clear that it is unsafe or about to become unsafe. The WSP personnel should provide feedback to a subject or learner if he/she uses potentially unsafe methods.

2.9 Extent of Spotter Intervention

The spotter should not intervene to any greater extent than is necessary to ensure that a serious injury is prevented. The extent of spotter intervention may consist of a warning to a subject or learner to stop or change the approach being used, minor physical contact from the spotter (even if the subject or learner is able to complete the trial) or full intervention (e.g. if the subject or learner requires the spotter to prevent him/her from potentially injuring him/herself). If there is significant intervention by WSP personnel during a session, the extent of intervention and the reason for it should be recorded. A significant spotter intervention is one that interferes with the skill performance. Full tips should never occur, because the spotter should intervene. A skill performance is obviously unsafe if it results in a significant acute injury (e.g. lacerations, sprains, strains, fractures or head injury) that interferes with test continuation. Note that a spotter may occasionally intervene inappropriately. If this is a minor intervention, that neither hinders nor helps the subject or learner, it can be ignored.

2.10 Stopping a Wheelchair Skills Program Session

If a subject or learner persists in potentially unsafe activities, despite the warnings of the WSP personnel, the personnel should stop the session and take whatever steps are necessary to ensure safety (e.g. contacting the nursing or security staff). This decision will usually be made by the tester or trainer. However, the spotter (if someone other than the tester or trainer) has the right to refuse to participate further, if he/she is concerned about the safety of the subject, learner or personnel.

2.11 Injury Determinants

The likelihood and nature of injury varies depending on the wheelchair user and/or caregiver, the wheelchair and the nature of the skill being attempted. For instance, a wheelchair user who has poor vision, poor judgement or who is a risk-taker by nature is more likely to be injured than one without these characteristics. Similarly, some wheelchairs are less stable than others. Although this can be an advantage when attempting skills that require the casters to be popped off the surface, the trade-off is that such wheelchairs are at a greater risk of an unintentional rear tip.
2.12 Common Types of Risks and How to Prevent Them

There are several types of common incidents that can cause injury. Those that require spotter intervention and a general approach to preventing them will be described in this section. Risks during specific individual skills and an approach to preventing them will be described in the chapters on individual skills. Other less acute or less serious injuries (e.g. pinches, scrapes and jarring) are difficult to prevent, because they occur without sufficient time for intervention. These can best be dealt with by training the subject in how to avoid such risks.

Rear tips. A rear tip occurs when the pitch of the wheelchair exceeds the rear stability limit to the extent that the wheelchair user cannot rescue him/herself and the wheelchair falls backward. This may occur while the wheelchair is stationary or moving. If the wheelchair user lets go of the rear wheels during a rear tip, the wheelchair will roll quickly forward while tipping backward. The forward movement is called “submarining”.

For most skills that pose a risk of a rear tip, the spotter should be positioned behind the wheelchair with one hand holding a spotter strap (if a manual wheelchair). The spotter may stand in a lunge position (with the forward foot on the opposite side to the hand holding the spotter strap) and close enough to the backrest so that, if the subject tips backward, the spotter can rest the wheelchair on his/her forward thigh for additional support.

When using this spotting technique during a skill that requires the spotter to be elevated above the subject or learner (e.g. when descending a curb or incline in the forward direction) the spotter may use a longer spotter strap to reduce any forward bending that could injure the spotter’s back.

If the spotter catches the subject or learner but cannot return the wheelchair to its upright position, the spotter should inform the subject or learner and then slowly lower the wheelchair backward to the ground. Once the wheelchair is on the ground and the subject or learner is safe and as comfortable as possible, the spotter may need to seek additional help to return the wheelchair to the upright position.

It is also possible to resist a rear tip from the front, for instance when practicing the stationary wheelie skill. The spotter may be positioned just to the side of the front wheels with a hand near the subject’s or learner’s leg or a part of the wheelchair that will not come off if downward and backward force is applied to it. When a rear tip occurs, the spotter can push down and backward on the leg or wheelchair part to resist the tip and forward movement of the wheelchair.

For many of the skills, the rear anti-tip devices of a manual wheelchair need to be repositioned or removed. While the rear anti-tip devices are inactivated, the WSP personnel need to be particularly attentive to the risk of a rear tip-over. At the end of the session, the WSP personnel should restore the rear anti-tip devices to their original positions, unless the subject or learner has progressed to the stage where they can be abandoned.

Forward tips and/or falls. A forward tip occurs when the pitch of the wheelchair exceeds the
forward stability limit to the extent that the wheelchair tips forward. This may occur while
the wheelchair is stationary or moving. The tip may be partial, but sufficient to allow the
wheelchair occupant to slide or fall forward out of the wheelchair. In some instances, such as
during a sudden deceleration, the subject or learner may slide or fall forward out of the
wheelchair without any tip. When there is a risk of a forward tip/fall and the wheelchair is
stationary, the spotter should be positioned in front of and just to one side of the wheelchair.

If there is a risk of a forward tip/fall and the wheelchair is moving forward, the spotter may be
positioned behind the wheelchair with one hand in front of (but not touching) the wheelchair
user’s shoulder to prevent a forward tip/fall. However, this can be distracting to the subject or
learner and it can be difficult to react quickly enough from this position. A seatbelt can be
provided by the trainer for training, but should not be provided for testing. If a second spotter is
available, he/she can be positioned to limit the extent of a forward tip or fall.

Sideways tips/falls. A sideways tip occurs when the pitch of the wheelchair exceeds the
sideways stability limit to the extent that the wheelchair tips sideways. This may occur while
the wheelchair is stationary or moving. The spotter should be positioned to the side to which
the tip/fall is expected to occur. On level changes or stairs, where a sideways tip may occur if
one wheel is on a higher level than the other, the spotter should position his/her hands near
the push-handles (if a manual wheelchair).

Combination tip/fall risks. Tips and falls do not always occur in the pure rear, forward or
sideways directions. For instance, when descending an incline with one footrest elevated and
the other lowered, a combined forward and sideways tip may occur when the lowered
footrest strikes the ground at the bottom of the incline-level transition.

Another combination possibility is when different risks present themselves sequentially. For
instance, during an attempt to get over an obstacle while moving, there is the risk of a rear tip
when the wheelchair user attempts to pop the casters high enough to clear the obstacle. If the
casters do not clear the obstacle, the sudden deceleration of the wheelchair can cause a
forward tip or fall. When such combination risks are present, the spotter should choose a
position where all risks can be minimized. This position will vary, depending upon the skill
being attempted and the wheelchair set-up. A seat belt or second spotter can be helpful in
such situations.

Runaways. A runaway occurs when the wheelchair user loses control of the wheelchair (e.g.
when descending an incline) and is unable to bring it to a stop. To prevent the runaway of a
manual wheelchair, the spotter should be positioned behind the wheelchair holding a spotter
strap. If the wheelchair user loses control, the spotter should pull back on the spotter strap or
grasp a push-handle to bring the wheelchair to a controlled stop. During the resulting
deceleration, the spotter should be alert to the possibility that the subject or learner may fall
forward out of the wheelchair, and should position the other hand on the front of the
shoulder. A seatbelt or second spotter can be helpful in such situations. Powered wheelchairs
or scooters can also runaway if the controls are accidentally activated (e.g. by being caught in
loose clothing).
Injury due to contact with a wheelchair part. Pinches can occur when a part of the subject’s or learner’s body becomes caught in a wheelchair part (e.g. when opening a folded wheelchair). Injury can also occur if a body part is dragged over or rubbed against a sharp wheelchair part (e.g. the under-surface of a flipped-up footrest). Also, during some activities (e.g. curb ascent) that require the manual wheelchair user to push forcefully on the hand-rims, the backs of the thumbs may get abraded by the wheel locks. During incline descent with a manual wheelchair, the wheelchair user’s hands slowing the wheelchair by friction on the hand-rims can experience friction burns or lacerations due to sharp burrs on the hand-rims. Gloves can be used to protect the hands.

Injuries due to contact with the environment. When exposed parts of the wheelchair user’s body (e.g. hands, feet or head) strike or get pinched by objects in the environment (e.g. doors or walls), injury may occur. The lower limb can be injured if the wheelchair moves forward with the foot planted on the ground (e.g. at an incline-level transition, or when negotiating obstacles or level changes). Examples of injuries are hyper-flexion sprain of the knee or fracture of the tibia or femur due to the knee being forcibly flexed beyond its available range.

Jarring. Sudden jarring forces can be experienced when the wheelchair decelerates suddenly (e.g. when rolling into a threshold or dropping off a curb).

Over-exertion injuries. If subjects or learners over-exert themselves when attempting skills with which they are unfamiliar or are incapable of performing, they may experience overuse injuries (e.g. affecting the shoulder or back). Similarly, subjects or learners with limited exercise tolerance due to medical conditions (e.g. of heart or lung) may cause themselves harm by over-exertion.

Poor ergonomic technique. Subjects or learners are at risk of acute or chronic injuries due to poor ergonomic technique (e.g. folding the wheelchair with a bent and twisted back).

2.13 Dealing with Injuries

Despite the best precautions, injuries occasionally occur. Once a tip or fall has occurred, unless this has occurred in a dangerous location (e.g. a city street), there is usually no urgency in getting the wheelchair user back into the upright wheelchair. The WSP personnel can take the necessary time to see if the wheelchair user has been injured, to assess for wheelchair damage and to formulate a plan. The WSP personnel may need to administer first aid (e.g. cleaning and covering an abrasion). Personnel should have a plan for dealing with any emergency that is beyond their expertise.

2.14 Special Considerations When a Caregiver is Spotted

If a caregiver is the subject or learner, he/she is expected to behave in a manner that is safe for both the wheelchair occupant and him/herself. The spotter in such situations should remain close enough to intervene if the caregiver fails to exercise due caution. A spotter strap held by the spotter is not practical when spotting a caregiver, because this would interfere with the caregiver’s performance.
2.15 Special Considerations for Powered Wheelchairs and Scooters

For powered wheelchairs (including scooters), the spotter’s primary strategy is to be in a position where the power can be turned off and, if that fails, to take over the controller (e.g. joystick). For some powered mobility devices, a remote device may be available that allows the WSP personnel or caregiver to intervene by slowing or stopping the wheelchair when a potentially dangerous situation arises. The spotter should also be alert to impending tips or falls. A spotter strap is not a practical solution. A second spotter can be helpful in such situations.

2.16 Risks Involved in Specific Skills

The nature of the skill being attempted should allow the spotter to anticipate the types of injuries that might occur. The chapters on individual skills describes the most common types of risks that should be watched for by the spotter and the usual starting position for the spotter.
CHAPTER 3. INTRODUCTION TO THE ASSESSMENT OF WHEELCHAIR SKILLS

There are a variety of measures that can be used to assess wheelchair skills, a comprehensive discussion of which is beyond the scope of the WSP Manual. However, it may be helpful to consider the available measures as ranging along a spectrum of granularity from less to more detailed measures.

At the less detailed end of the spectrum, there are questionnaire-based measures. One of these, the Life Space Assessment, provides a score corresponding to being limited to the room where one sleeps, being in other rooms of the home, being outside the home, being in the neighbourhood, being outside the neighbourhood and being outside one’s town.

More technology-based measures at the low granularity level are data-loggers (e.g. to document the distance travelled in a day or the number of times the tilt mechanism is used) and global positioning system sensors (e.g. to document where the wheelchair travelled during the day).

At the very detailed level, examples are the use of instrumented rear wheels to document the forces applied to the hand-rims, the Wheelchair Propulsion Test (to assess such parameters as cadence, push efficiency), video-recordings, three-dimensional motion analysis to document the relative movement of body parts, electromyography to document muscular activity during a task and oxygen consumption studies to document the metabolic energy cost of wheeling.

The WST and WST-Q are measures that focus on the intermediate level of granularity. These measures test a subject’s ability to perform a representative set of skills and, in the case of the WST-Q, confidence in performing the skill and how often these skills are performed. Arguably, this intermediate level of detail is the level of greatest interest to wheelchair users, their caregivers and their health-care providers. Such details provide the data needed for intervention through a change in wheelchair type, wheelchair set-up, skills training, modification of the physical environment or provision of needed assistance. The WST and WST-Q are not intended to serve as “readiness” tests for independent wheelchair use, although they may be components of such an assessment.

Which of the above measure(s) should be used to assess wheelchair skills depends upon the purpose of the assessment, the measurement properties (e.g. reliability and validity) of the tool, the characteristics of the test subject, the features of the wheelchair, the propulsion method, the equipment necessary, the skill of the assessor and the time available. However, for the purpose of this WSP Manual, the emphasis will be on the WST and WST-Q.
CHAPTER 4. THE WHEELCHAIR SKILLS TEST (WST)

The WST is a standardized evaluation method that permits a set of representative wheelchair skills to be simply and inexpensively documented. This test is intended to assess a specific subject using a specific wheelchair in a standardized manner at a specific point in time.

As noted earlier, the measurement properties of the WST have been studied to a moderate extent, judging by the number of peer-reviewed papers listed in the dynamic link on the website. In these studies, the WST has been found to be safe, practical, reliable, valid and useful. The WST has been used as a screening or outcome measure in a number of studies. Further study is needed to re-evaluate the measurement properties of the WST as it evolves, in different settings and with different clinical populations.

4.1 Initial Interview

Wheelchair skills assessment and training in the clinical setting usually takes place as part of a broader process. Prior to beginning testing, the tester should screen the subject for the ability to communicate and should obtain consent to proceed. If appropriate, demographic, clinical and wheelchair-related data are recorded. These data may be obtained from the wheelchair user, the caregiver and/or the health record. Forms for such documentation of important data other than wheelchair-skills data are beyond the scope of the WSP but are available on-line from other sources.

4.2 Wheelchair and Subject Set-Up

The wheelchair user and/or caregiver should be dressed and equipped as usual (e.g. wearing artificial limbs or braces) when using the wheelchair. The wheelchair should be set up as usual for that user. This is important because changes in the personal equipment or wheelchair set-up can affect how and how well the skills are performed.

If the wheelchair has user-adjustable features that could affect handling (e.g. rear anti-tip devices for a manual wheelchair or a more powerful controller mode for a powered wheelchair), the subject is permitted to adjust them for testing as long as the subject can do so without assistance. If tools are needed to make the adjustment, then they must be carried by the subject. The tester must not cue the test subject to make the adjustment. Having adjusted the wheelchair to accomplish a skill, unless otherwise specified, the subject may leave the wheelchair in the new configuration for the remainder of the WST. If the subject wishes to restore the wheelchair to its original configuration, he/she must do so without assistance and without cueing from the tester. When the WST is over, the tester should remind the subject about any adjustment that has been made, especially if the adjustment might affect safety.

4.3 Getting Out of the Wheelchair to Accomplish a Task

If it is possible to do so safely, a wheelchair user may get out of the wheelchair to accomplish a task or to adjust a wheelchair feature (e.g. the rear anti-tip devices). For the WST, this does not include using any sitting surface other than the ground, unless specifically noted in Chapter 5 on individual skills, because such a surface might not always be available when
such an adjustment is needed. The policy of permitting wheelchair users to get out of their wheelchairs is in recognition that many people who use wheelchairs do so in combination with walking for their mobility.

4.4 Starting Positions

Unless otherwise noted, the starting positions for each skill are as follows:

- **Wheelchair user:** The wheelchair user is seated in the wheelchair, in whatever position and state that he/she prefers.

- **Caregiver:** If a caregiver is being assessed, his/her starting position is generally standing near the wheelchair.

- **Wheelchair:** All of the wheelchair components that are usually used should be in place. The wheel locks (commonly referred to as “brakes”) may be applied or not. A rolling start is permitted (i.e. there is no need to come to a complete stop before beginning the skill attempt). When a starting position for the wheelchair is defined (e.g. relative to an obstacle), the tester may assist the subject or learner in getting into this position. The tester should be careful not to provide inadvertent cues to the subject on how to perform the skill. For instance, with a powered wheelchair that has both caregiver and user-operated controls, the tester should use the caregiver controls because they are usually out of the wheelchair user’s line of sight. If the subject expresses the wish to attempt a task by moving the wheelchair backward, the tester may assist him/her in getting into the requested starting position, but the tester must not suggest such an alternative approach. Also, when the testing instructions call for the axles of the leading wheels to be behind a starting line, the leading wheels are ones that are normally in contact with the ground (i.e. not the wheels of anti-tip devices that are usually off the ground).

- **Tester:** The starting position for the tester is initially where he/she can be well seen and heard when providing instructions for the skill. After initially communicating instructions to the subject, the tester may need to reposition him/herself where he/she will be best able to observe the skill.

- **Spotter:** The starting position for the spotter is near the wheelchair (within an arm’s reach) where he/she will be best able to respond to any safety concerns. The exact position varies with the skill being attempted, the number of spotters involved and the method being used to complete the skill. For powered wheelchairs, the spotter should be in a position where the power can be turned off or the joystick accessed. If a caregiver is being assessed, he/she is expected to behave in a manner that is safe for both the wheelchair occupant and the caregiver. The spotter in such situations should remain close enough to intervene if the caregiver fails to exercise due caution.

If the starting positions are different for a specific skill, this is specified in Chapter 5 on individual skills.

4.5 Setting and Equipment Needed

The test setting for the WST should be reasonably quiet, private, free from distractions and well lit. A standardized obstacle course may be used, but is not necessary. The equipment needed is described in more detail later in Chapter 5 but is summarized here in Table 4.1.
Table 4.1: Equipment Needed for Individual WST Skills*

<table>
<thead>
<tr>
<th>#</th>
<th>WST Skill Names</th>
<th>Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Positions and operates controller</td>
<td>None.</td>
</tr>
<tr>
<td>2.</td>
<td>Operates body positioning options</td>
<td>None.</td>
</tr>
</tbody>
</table>
| 3. | Rolls forward short distance                        | • Smooth level surface 10 m long and at least 1.5 m wide.  
• Starting and finish lines at 0 and 10 m.  
• Space at least 1.5 m before the starting line and beyond the finish line.  
• A stop target (e.g. a wall or pylon) at least 1.5 m beyond the finish line and in the line of progression. The marker should be large enough to be visible from the starting position.  
• Means (e.g. a tape measure) of measuring distance to the nearest cm.  
• Means of recording time to the nearest second. |
| 4. | Rolls backward short distance                       | • Smooth level surface 5 m long and at least 1.5 m wide.  
• Space at least 1.5 m before the starting line.  
• Starting line 5 m from the stop target.  
• A stop target, at 5 m from the starting line, should be an object at least 1.5 m wide and at least as high as the rearmost aspect of the wheelchair.  
• Means (e.g. a tape measure) of measuring distance to the nearest cm. |
| 5. | Stops on command                                    | • As for #3 and 4 with the addition of “stop command” marks at about the half-way points.                                             |
| 6. | Turns in place                                       | • Smooth level surface.  
• Two 2.0-m-long lines, 90° from each other that intersect at the starting point. Each of the 4 resulting lines running away from the starting point should be marked at 0.75, 1.0 and 1.25 m from the starting point.  
• Means (e.g. a protractor or goniometer) of identifying the extent to which the wheelchair has turned (to the nearest 20°). |
<table>
<thead>
<tr>
<th></th>
<th>Turns while moving forward</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>• Smooth level pathway that is 6 m long and at least 2.0 m wide.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A means (e.g. tape measure) to measure distances.</td>
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</tr>
<tr>
<td></td>
<td>• 4 pylons or equivalent (each with a base of about 10 cm and at least 10 cm high) the centers of which are positioned in the middle of the pathway at any or all of the following intervals separately:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 0.0, 2.0, 4.0 and 6.0 m creating two intervals of 2.0 m each.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 0.0, 1.5, 3.0 and 4.5 m creating two intervals of 1.5 m each.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• 0.0, 1.0, 2.0 and 3.0 m creating two intervals of 1.0 m each.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The line connecting the first two pylons represents the starting line for the first turn.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The line connecting the second and third pylons represents both the finish line for the first turn and the starting line for the second turn.</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Turns while moving backward</td>
<td>As for #7.</td>
</tr>
<tr>
<td>9.</td>
<td>Maneuvers sideways</td>
<td>• Two lateral targets, large enough for the subject to see, for the subject to approach. The targets need not be identical. The target on the first side toward which the wheelchair is to be maneuvered can be fixed (e.g. a wall). However, the target for the second side may need to be movable (e.g. a pylon) because wheelchair widths vary.</td>
</tr>
<tr>
<td></td>
<td>• A rear barrier (e.g. a wall) that is at least 1.5 m wide and at least as high as the rearmost aspect of the wheelchair.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A means (e.g. tape measure) to measure distances.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• A means (e.g. a protractor or goniometer) to measure angles.</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Picks objects from floor</td>
<td>• Large object about the size of a cell phone.</td>
</tr>
<tr>
<td></td>
<td>• Medium-size object about the size of a pen.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Small object about the size of a coin.</td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Relieves weight from buttocks</td>
<td>• Means of measuring the extent of tilt or recline, if that is the technique used by the subject.</td>
</tr>
<tr>
<td>12.</td>
<td>Performs level transfers</td>
<td>• A transfer surface at least 1.0 m wide, at least 0.5 m deep and 45-47 cm high.</td>
</tr>
<tr>
<td></td>
<td>• Transfer board.</td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Folds and unfolds wheelchair</td>
<td>Sitting surface as for #12.</td>
</tr>
<tr>
<td>14.</td>
<td>Gets through hinged door</td>
<td>Door about 81cm wide, with no resistance to opening, preferably with a lever handle &gt;10 cm in length and 75-90 cm above the floor, and preferably with no threshold.</td>
</tr>
<tr>
<td>15.</td>
<td>Rolls longer distance</td>
<td>A smooth level surface 50 m long and at least 1.5 m wide. Using multiple laps of a shorter distance is permissible.</td>
</tr>
<tr>
<td>16.</td>
<td>Ascends slight incline</td>
<td>Incline at least 2.5 m long and at least 1.5 m wide with a slope of 5°.</td>
</tr>
<tr>
<td>17.</td>
<td>Descends slight incline</td>
<td>As for #16.</td>
</tr>
<tr>
<td>18.</td>
<td>Ascends steep incline</td>
<td>As for #16, except that the incline has a 10° slope.</td>
</tr>
<tr>
<td>19.</td>
<td>Descends steep incline</td>
<td>As for #18.</td>
</tr>
</tbody>
</table>
| 20. | Rolls across side-slope | Incline of 5°, at least 2.5 m long (in the line of progression) and at least 1.5 m wide.  
Means of monitoring if any of the downhill wheels drift or turn downhill by greater than 10 cm from the starting position. |
| 21. | Rolls on soft surface | Pathway that includes a soft surface at least 2.5 m long and at least 1.5 m wide. |
| 22. | Gets over obstacle | Smooth level surface 1.5 m wide, with at least 1.5 m before and after the obstacle.  
Obstacle 5 cm high, 10 cm across (in the line of progression) and at least 1.5 m wide, rectangular in cross-section. |
| 23. | Gets over gap | Smooth level surface 1.5 m wide, with at least 1.5 m before and after the gap.  
The gap should be ~5 cm deep, 15 cm across (in the line of progression) and the full width of the path. |
| 24. | Ascends low curb | Smooth level surface 1.5 m wide, with at least 1.5 m before and after the curb.  
The curb should be 5 cm high. |
| 25. | Descends low curb | As for #24. |
| 26. | Ascends high curb | As for #24, but the curb should be 15 cm high. |
| 27. | Descends high curb | As for #26. |
| 28. | Performs wheelchair-ground transfers | Smooth level surface. |
| 29. | Performs stationary wheelie | As for #6.  
Means of measuring distance. |
| 30. | Turns in place in wheelie position | As for #6. |
31. Rolls forward and backward in wheelie position
   • A smooth level surface, 1.5 m wide and 2 m long.

32. Descends high curb in wheelie position
   • As for #26.

33. Descends steep incline in wheelie position
   • As for #18.

34. Ascends stairs
   • At least 3 stairs, with the following approximate dimensions – 18 cm rise, 28 cm run and width of at least 1.2 m.
   • Rails on both sides.
   • Level surface or platform at the bottom and top of the stairs.

35. Descends stairs
   • As for #34.

* For more detail, see the sections on the individual skills.

Some of the tests (e.g. “positions and operates controller”) require no equipment and can be performed anywhere. In general, the settings listed in Table 4.1 and described in Chapter 5 on individual skills should be considered as guidelines to enhance standardization, rather than as rigid constraints. Comparable challenges in the existing natural or built environment (e.g. in and around a hospital or the wheelchair user’s home), may be used. Indeed, the WST can be completed as part of a community outing. However, if the setting is materially different from the one specified, this should be noted in the Comments section of the WST Form and may preclude the WST values from being compared to those conducted in more standardized settings.

4.6 Indications

For clinical purposes, the WST can be used early in the course of a rehabilitation program as a diagnostic measure, especially to determine which (if any) skills might be addressed during the rehabilitation process (e.g. by training or equipment change). However, predicting future performance on the basis of early attempts is of limited use. The trainer should not prejudge the outcome of training. By repeating the test on completion of the rehabilitation phase (or later during follow-up), the WST can be used as an outcome measure. The WST may also be used for program evaluation, to answer research questions and to assist in wheelchair design.

4.7 Contraindications

No skill should be objectively evaluated if the subject is unwilling to attempt it or if, in the tester’s judgement, the subject or WSP personnel would be placed at undue risk during testing (e.g. due to the subject’s unstable cardiac disease, uncontrolled seizures or excessive weight).

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Current edition: August 17, 2018
4.8 General Instructions to Test Subject

The paragraph below may be paraphrased or read to wheelchair-using subjects when the WST is being administered. It can be modified slightly if a caregiver is assisting or if the purpose of the WST is research.

“For about the next 30 minutes, I will be asking you to perform a number of different skills in your wheelchair. The reason for this is to find out which skills you do well and which might benefit from some practice or from changes to your wheelchair. We want to see if you can perform the skill properly and safely. We do not want you to hurt yourself, but there are some mild risks involved. To reduce the chances of you hurting yourself, we will be spotting you while you try each skill. Please wait until the spotter is in position before attempting each skill. The spotter will say “spotter on” to indicate when he/she is in position to protect you and “spotter off” to indicate if he/she is no longer in position. Please do not overexert yourself. We do not expect you to be able to perform every skill. Please do not try any skill that you are not comfortable performing. If you do not understand what we are asking you to do, feel free to ask questions. There is no need to hurry; this is not a race. If you would like to take a rest or to stop at any time, feel free to tell us. Do you have any general questions now, before we begin?”

Instructions may include gestures for people with language disorders or be in writing for people with hearing disorders but the tester should not demonstrate the skill. When giving instructions for each skill, before moving into the best position for observing and spotting the skill (if the tester is also serving as the spotter), the tester should stand or sit to the front or side of the subject so the subject can see and hear the tester well. The tester must not instruct the subject in how to accomplish the task. If the tester asks for the task to be performed on both the left and right sides (e.g. for the “turns in place” skill) but the subject performs the skill on only one side, the tester may prompt the subject (e.g. “Now in the other direction”) without penalty.

4.9 Feedback

After the attempt, non-specific feedback may be given on how the subject did – for instance, “You did well”. If the subject receives less than a full score for a skill, neither feedback on the reason for the low score nor instruction on how the skill might have been performed better should be given prior to completion of the entire WST. To do so would not affect the score for the skill already tested, but there may be other skills later in the WST that could be influenced by premature instruction. If observers (e.g. students or family members) are present during the test, they should be asked to remain silent and to refrain from providing cues or feedback. Once the entire WST has been completed, the tester may review the results with the subject and explain the reasons for reduced scores unless the WST is being administered to a research participant and the protocol precludes such feedback.
4.10 Disclaimer re Sensitivity and Specificity

The WST is a sensitive and specific test. A change in the subject (e.g. by a reduction of spasticity), the subject’s personal equipment (e.g. removal of a prosthesis), a change in the wheelchair (e.g. by removal of rear anti-tip devices) and/or a change in the test environment (e.g. by lowering lighting conditions) may affect the test scores. The objective WST findings are sensitive to such changes and specific to the situation assessed.

4.11 Use of Aids

Aids (e.g. for reaching) are permitted if the subject carries them with him/her. An animal (e.g. a service dog) that assists with the performance of a skill is considered an aid, not a caregiver, for the purpose of the WST.

4.12 Scoring of Individual Skills on Capacity

The tester scores the success in accomplishing each skill, using the general scale shown in Table 4.2. If there are criteria specific to individual skills, these are noted later, in Chapter 5 on the individual skills in the WST.

Table 4.2: General Scale for WST Skill Capacity Scoring

<table>
<thead>
<tr>
<th>Advanced pass (Score of 3):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The subject meets all pass evaluation criteria and carries out the skill in a highly proficient or advanced manner (e.g. using proper technique, in a tighter space, more rapidly or more efficiently) and on the first attempt. There is no significant room for improvement. Descriptions of proper technique can be found in the training tips section for each individual skill in Chapter 8.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pass (Score of 2):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The subject meets all evaluation criteria independently and safely, but imperfectly (e.g. with difficulty, with room for improvement or requires more than one attempt).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partial pass (Score of 1):</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The subject safely meets a majority of the evaluation criteria, but not all.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fail (Score of 0): A fail score should be awarded if any of the following apply:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The subject does not meet a majority of the evaluation criteria.</td>
</tr>
<tr>
<td>• The subject demonstrates unsafe performance on any attempt. A skill is considered unsafe if the subject requires spotter intervention to prevent injury to the subject or others.</td>
</tr>
<tr>
<td>• The subject is considered likely to be unsafe on the basis of the subject’s description of how a task will be attempted.</td>
</tr>
<tr>
<td>• The subject is unwilling to try.</td>
</tr>
<tr>
<td>• The subject has failed a prerequisite skill.</td>
</tr>
</tbody>
</table>
Not Possible (NP):

- The wheelchair does not have the parts to allow this skill. For instance, if a manual wheelchair does not fold, the “folds and unfolds wheelchair” skill cannot be tested.

Testing Error (TE):

- The tester cannot assess the skill for some reason (e.g. because a necessary item of equipment is not available).
- The skill was not sufficiently well observed to provide a score (e.g. if the skill is being scored from videotape and the entire skill could not be viewed).

* If a correctable testing error is recognized when it occurs, the test should be repeated without penalty. If there is a minor testing error that the tester judges as not affecting his/her ability to score the test, this can be ignored.

4.13 Number of Attempts Permitted

An actual wheelchair user in real life may be safe and effective in performing a skill (e.g. getting over an obstacle), even though a few attempts may be needed. For the purposes of the WST, no additional attempt should be permitted if the first attempt was unsafe. However, if the subject does not achieve a pass score on the first attempt but is successful on an additional attempt, the subject may be awarded a pass score, but should not be awarded an advanced-pass score.

Additional attempts should not be considered a routine; ultimately, this is at the tester’s discretion. If an additional attempt is believed to be appropriate, the tester should provide no feedback on the reason for the failure, nor any instruction on how to perform the task, between the two attempts. The task instructions may be repeated.

During the course of any single attempt, a subject may use different approaches (e.g. in a manual wheelchair first attempting the “rolls on soft surface” skill forward, then backward if unable to proceed or, in a powered wheelchair, pausing to change controller settings or the degree of tilt). It is only considered an additional attempt if the subject clearly starts over with a significant pause between attempts.

There are some circumstances in which an additional attempt may be permitted without penalty:

- If the subject misunderstands the instructions.
- If a correctable testing error is recognized when it occurs (e.g. the spotter intervened prematurely).
- If a subject appears to be rushing his/her skill attempts and failing to meet test criteria because of this, on the first occasion that this occurs, the tester may permit an additional attempt and explain the importance of listening carefully to the instructions before beginning the skill attempt.

If a subject is unsuccessful when asked to perform a task (e.g. the “maneuvers sideways” skill) but does it correctly later, incidental to the assessment of a separate skill (e.g. the...
“performs level transfers” skill), the score must not be revised. The WST requires that the
subject be able to perform the skill on demand.

If a skill has been unsuccessful early in the attempt (e.g. being unable to go through a door in
one direction), it may still be useful to allow the subject to attempt the remainder of the skill
(e.g. going through the door in the other direction) as a means of seeing whether a partial-
pass score is warranted or identifying issues that can be dealt with later during training.

4.14 Comments

In addition to the scores for each skill, the comments add valuable qualitative data to the WST.
The tester should record any comments that are appropriate (e.g. the reasons for any scoring
decisions that may be useful to trainers). If there is appropriate spotter intervention during a
skill attempt, the extent of the intervention and the reason for it may be recorded in the
Comments section.

The nature of any potentially dangerous incident should be documented. Note should be made
of any observations that require action (e.g. further training in alternative ways to accomplish a
task or a change in equipment that might help). The WST tester should be alert to potentially
correctable limiting factors in the wheelchair user’s health (e.g. limited range of motion),
wheelchair (e.g. rear axles set too far back) and environment (e.g. if the WST is performed in
the subject’s home, a doorway that is too narrow). Comments by the test subject may also be
recorded.

4.15 Training Goals

If, at the beginning of the WST, it is decided by the tester or subject that one purpose of the
assessment is to identify potential training goals then, before the assessment of individual
skills, the subject should be asked if there are any specific wheelchair skills for which he/she
would be interested in receiving training. Doing this before assessing the individual skills is
intended to reduce the likelihood of “training to the test”. After the assessment of each skill
has been completed (regardless of the scores recorded) and if an assessment of training goals
is one of the purposes of the assessment, the subject may be asked whether that skill is one
for which he/she would like to receive further training. On completion of the assessment of
individual skills, the subject may be asked if there are any other skills on which he/she would
be interested in receiving training. The quantification of goal attainment is dealt with later, in
section 4.21. Goal setting is dealt with in more detail later in section 7.5.

4.16 Timing

The WST only requires the timing of 3 skills – “rolls forward short distance”, “relieves
weight from buttocks” and “performs stationary wheelie”. These need only be timed to the
nearest second. However, the time required to perform other individual skills, a series of
skills or the entire WST can provide an additional level of sensitivity to change (e.g. due to
training or the use of a different wheelchair) that clinicians or researchers may wish to use.
Generally, there is no formal upper time limit for each skill or for the entire WST. This is to avoid the necessity of the tester timing every skill and to avoid having the subject feel rushed to complete the task. Although, in real life, a skill must be performed within a practical time to be useful, the definition of what such a time limit should be may vary with the circumstances. Fortunately, when administering the WST, this does not present a dilemma because the subject usually stops a task when it is taking too long. However, if a subject is persistently taking an apparently hopeless approach, the tester may gently intervene (“let’s move on to the next skill”).

4.17 Rests and Breaks

Rests are permitted during the skill attempts, unless precluded by the nature of the skill (e.g. the “performs stationary wheelie” skill). If the subject is making progress, he/she should be allowed to continue. Resting and then continuing is not considered a second attempt. For instance, a subject may get the casters up on the low curb, rest for a moment, then get the rear wheels up on the curb. It is also permissible for subjects to rest between skills. Indeed, there is no need for all of the skills to be performed on the same day. The WST is a test of individual skills, not a test of endurance. However, if the testing is conducted on more than one day, the tester should document the dates. Also, the wheelchair, its set-up and subject aids must remain the same on both test occasions if an overall score is to be valid.

4.18 Order of Tests

Tables 4.3 and 4.4 show the individual skills for the manual and powered wheelchair versions of the WST, in the same order shown earlier in Table 1.1.

Table 4.3: Individual Skills for the Manual Wheelchair Version of the WST

<table>
<thead>
<tr>
<th>#</th>
<th>WST Skill Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rolls forward short distance</td>
</tr>
<tr>
<td>2.</td>
<td>Rolls backward short distance</td>
</tr>
<tr>
<td>3.</td>
<td>Stops on command</td>
</tr>
<tr>
<td>4.</td>
<td>Turns in place</td>
</tr>
<tr>
<td>5.</td>
<td>Turns while moving forward</td>
</tr>
<tr>
<td>6.</td>
<td>Turns while moving backward</td>
</tr>
<tr>
<td>7.</td>
<td>Maneuvers sideways</td>
</tr>
<tr>
<td>8.</td>
<td>Picks objects from floor</td>
</tr>
<tr>
<td>9.</td>
<td>Relieves weight from buttocks</td>
</tr>
<tr>
<td>10.</td>
<td>Performs level transfers</td>
</tr>
<tr>
<td>11.</td>
<td>Folds and unfolds wheelchair</td>
</tr>
<tr>
<td>12.</td>
<td>Gets through hinged door</td>
</tr>
<tr>
<td>13.</td>
<td>Rolls longer distance</td>
</tr>
<tr>
<td>14.</td>
<td>Ascends slight incline</td>
</tr>
<tr>
<td>15.</td>
<td>Descends slight incline</td>
</tr>
<tr>
<td>16.</td>
<td>Ascends steep incline</td>
</tr>
<tr>
<td>17.</td>
<td>Descends steep incline</td>
</tr>
<tr>
<td>18.</td>
<td>Rolls across side-slope</td>
</tr>
<tr>
<td>#</td>
<td>WST Skill Names</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Positions and operates controller</td>
</tr>
<tr>
<td>2.</td>
<td>Operates body positioning options</td>
</tr>
<tr>
<td>3.</td>
<td>Rolls forward short distance</td>
</tr>
<tr>
<td>4.</td>
<td>Rolls backward short distance</td>
</tr>
<tr>
<td>5.</td>
<td>Stops on command</td>
</tr>
<tr>
<td>6.</td>
<td>Turns in place</td>
</tr>
<tr>
<td>7.</td>
<td>Turns while moving forward</td>
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<tr>
<td>8.</td>
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<td>9.</td>
<td>Maneuvers sideways</td>
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</tr>
<tr>
<td>17.</td>
<td>Ascends steep incline</td>
</tr>
<tr>
<td>18.</td>
<td>Descends steep incline</td>
</tr>
<tr>
<td>19.</td>
<td>Rolls across side-slope</td>
</tr>
<tr>
<td>20.</td>
<td>Rolls on soft surface</td>
</tr>
<tr>
<td>21.</td>
<td>Gets over obstacle</td>
</tr>
<tr>
<td>22.</td>
<td>Gets over gap</td>
</tr>
<tr>
<td>23.</td>
<td>Ascends low curb</td>
</tr>
<tr>
<td>24.</td>
<td>Descends low curb</td>
</tr>
<tr>
<td>25.</td>
<td>Performs wheelchair-ground transfers</td>
</tr>
</tbody>
</table>

Table 4.4: Individual Skills for the Powered Wheelchair Version of the WST
However, during the administration of the WST, the tests may be performed in any order. For instance, it is usually practical to test the subject’s ability to fold and unfold the wheelchair after testing the ability to transfer out of the wheelchair, but before evaluating the transfer back into the wheelchair. The order of testing may also vary depending on the availability and layout of equipment and test settings. An example of an efficient optional WST for manual wheelchairs order of skills can be found in Appendix 1.

For highly skilled test subjects, it may even be practical to use a “top-down” approach, starting with the more advanced of similar skills. If the subject can achieve an advanced-pass score on a more difficult version of a skill (e.g. “ascends high curb”), then the same score may also be awarded for the simpler version of the same skill (“ascends low curb”). However, if the subject only achieves a lower score (e.g. a pass or partial pass) on the more difficult version of the skill, the subject should demonstrate his/her capacity on the less challenging skill. The top-down order should be used with caution because a timid subject may become discouraged by an early failure and different approaches may be used for skills that differ only in their degree of difficulty.

4.19 Left- versus Right-Sided Components of Skills

In objectively evaluating skill performance, both sides are tested (e.g. turning to left and right). Although this may be redundant for subjects with symmetrical impairments (e.g. of strength or range of motion), it may be valuable for subjects with asymmetrical impairments (e.g. due to hemiplegia or amputation) or for wheelchairs with asymmetrical flaws (e.g. a bent wheel rim on one side). A left-sided skill can be performed using the right hand without penalty and vice versa. If a subject stops after performing the skill in one direction, the tester should prompt the subject (without penalty) to perform the skill in the other direction. Failure to do so constitutes a testing error by the tester.

4.20 Minimizing Ways in Which Training Can Invalidate WST Scores

There are three avoidable ways in which wheelchair skills training can have undesirable effects on WST scores:

- **Inflation of the baseline score:** If the same person is serving as both the tester and trainer, he/she may be tempted to conduct testing and training together. For instance, if the subject fails the “gets over obstacle” skill, the tester/trainer may be tempted to provide instruction immediately, before continuing with the testing. However, the tester should complete as much of the pre-training WST as possible before beginning any training because the pre-training score of some skills may be artificially inflated by just having received training on a similar skill. In the obstacle-skill example, training is likely to improve the subject’s ability to perform the subsequent “gets over gap” skill. To reduce potential frustration by a subject who wants to proceed immediately with training, the tester should explain the process and indicate when training on the skills will be provided.

- **Failure to ensure skill retention:** It is not unusual for a subject learning a new skill to...
experience transient success during a training session (skill “acquisition”), but to be unable to perform the same skill at the next session (skill “retention”). The ultimate goal of training is that the subject will be able to perform the skill in a variety of settings at any time in the future (skill “transfer”). To ensure at least short-term retention, the post-training WST (or WST-Q) should be performed at least three days after the training has been completed.

- The “training to the test” or “specificity of training” phenomenon: If the training and testing are carried out in the same setting, it is possible that the subject may perform well in that setting, but not others. The trainer should be aware of this phenomenon, should have the subject practice in a variety of settings (e.g. indoors and outdoors) and should vary the order of skills during practice (at least once they have been acquired and retained). This increases the likelihood that the subject will be able to transfer or generalize the skill.

4.21 Calculated Scores

The following scores can be calculated by hand (as described below) or by using software developed for the purpose. Subtracting the number of NP (not possible) scores from the denominator avoids penalizing test subjects by the inclusion of skills that would be impossible to complete. Subtracting the number of TE (testing error) scores has a similar purpose. However, there may not be more than two TE scores for a calculated score to be valid.

- **Total WST Capacity Score (%):** The formula is shown below. Possible percentage scores range from 0-100%.

\[
\text{Total WST Capacity Score} = \frac{\text{sum of individual skill scores}}{\left(\frac{\text{number of possible skills} - \text{number of NP scores} - \text{number of TE scores}}{3}\right)} \times 100\%
\]

- **Goal Attainment Score (GAS) (%):** Goal setting is discussed later, in section 7.5. The GAS is of use when only a limited number of skills are addressed, such as through wheelchair modifications or training. (The GAS for the WSP should not be confused with the Goal Attainment Scale for which the scoring is more complicated.) The numerator is the number of skills that are met and the denominator is the number of goals set. The formula below is based on a simple yes/no score for each skill. The GAS at baseline is 0% by definition. Possible percentage scores after intervention range from 0-100%.

\[
\text{Goal Attainment Score} = \left(\frac{\text{number of skills met}}{\text{number of goals set}}\right) \times 100\%
\]

- **Special Purpose Scores (optional):** Subtotal scores may be calculated for any subset of individual skills. For instance, a score may be calculated that deals only with skills that might be appropriate for foot-propellers of manual wheelchairs. Any such modifications should be documented so that the results can be interpreted. It should be recognized that the measurement properties (e.g. reliability and validity) of such customized Special Purpose Scores may not have been documented.
The calculated scores should not be used to predict the overall safety of using a wheelchair. Someone with a low total score may be very safe within his/her limits whereas someone with a high total score may be a risk-taker and more likely to get injured. However, the calculated scores can be helpful in comparing different time points (e.g. pre- vs. post-training), different wheelchairs or different populations (e.g. people with SCI vs. people with stroke).

### 4.22 WST Test Report

There is one WST Form for each of the two versions of the WST. The WST Form may be completed by hand or be generated by software. The completed WST Form includes identifying data, the scores for individual skills, the calculated score, comments and the skills (if any) for which the subject would be interested in receiving training.
CHAPTER 5. INDIVIDUAL SKILLS FOR THE WST

This chapter is organized by the individual skills assessed in the WST, in the order listed in Table 1.1. For each skill in this chapter, the following headings are used:

- **Versions applicable**: For which of the WSP versions (i.e. manual and/or powered wheelchairs) this skill is applicable. The corresponding skill number from Tables 4.3 and 4.4 are shown in parentheses.

- **Description**: A brief general description of the skill.

- **Rationale**: The reason why this skill has been included in the WST skill set.

- **Prerequisites**: If the ability to perform an earlier skill is necessary for this skill to be assessed.

- **Spotter considerations**: If there are other than the general instructions regarding safety discussed earlier, these are mentioned here, in particular the starting position for the spotter and common risks requiring spotter intervention. These considerations are primarily for manual wheelchairs operated by their users but may be adapted for the powered-wheelchair version of the WST.

- **WST equipment**: Suggested equipment (other than the wheelchair) and set-up (if any) for the WST. Equivalent alternatives may be used. Whenever a “line” is mentioned, it does not need to be an actual continuous line that is visible to the test subject. It may be some other indicator, such as a wall or a virtual line connecting two or more pylons. Note that, whenever dimensions are preceded by the words “at least” (e.g. “a path at least 1.5 m wide”), the intention is to ensure that the subject has enough room, not to restrict the subject to those dimensions.

- **WST starting positions**: If other than the general starting positions described earlier, the starting positions of the wheelchair user, the wheelchair and the tester are described. These positions may need to be altered, depending upon the subject’s approach to the skill. When a spotter strap is mentioned, this only applies to the version of the WST for manual wheelchairs.

- **WST instructions to subject**: An example is provided of the language that the tester might use in directing the completion of the skill. Also, any actions by the tester are noted here. One or more of the following optional screening questions may be used as needed to determine:
  - “Does your wheelchair…?”: Whether the subject’s wheelchair has the necessary features to allow performance of this skill (if it is not obvious to the tester).
  - “Can you…?”: Whether the subject believes him/herself to be capable of performing the skill –This is equivalent to the capacity question used in the WST-Q for this skill. If the subject answers “no”, there is no need to assess that skill and a “fail” score is awarded. If the subject answers that he/she can do part of the
skill, he/she should be given the opportunity to demonstrate the parts that he/she is capable of performing.

- “How?”: How he/she ordinarily performs the skill. This may be helpful in preparing to spot the subject or allowing the tester to reach a decision that the subject’s attempt is likely to be unsafe.

- **WST Capacity scoring criteria:** The evaluation criteria are noted here, including an indication if there are any beyond the general scoring criteria described earlier. Descriptions of what constitutes “proper technique” may be found in the appropriate section of Chapter 8 where training tips are provided. It is also noted here whether failure on a related easier prerequisite skill may result in an automatic fail without needing to actually attempt the skill. If a NP (not possible) score is an option because the wheelchair does not have a necessary feature (e.g. the ability to be folded), it is noted here. If there are aspects of the skill performance that are worthy of note in the Comments section, these are noted here.

- **Special considerations:** If the descriptions up to this point for this skill require any special considerations, these are noted here. These might be related to the type of wheelchair being used or whether a caregiver’s assistance is being assessed.
5.1 POSITIONS AND OPERATES CONTROLLER

Versions applicable

- Manual wheelchair: X
- Powered wheelchair: (skill #1)

Description

- The subject moves the controller (e.g. joystick) of a powered wheelchair or scooter away from its usual operating position and then returns it to its original position. The subject turns the power of a powered wheelchair or scooter on and off. The subject operates the controller of a powered wheelchair or scooter to switch between drive modes, speeds and other functions (excluding those controlling body position that are dealt with in the next skill), then returns to the original setting.

Rationale

- Moving the controller away and back is useful when the controller is in the way for some activities (e.g. approaching a table, feeding, transferring).
- The functions of the powered wheelchair require power. However, when the wheelchair is not being used for position changes or mobility, the power should be turned off when sitting in the wheelchair doing other activities. Otherwise, an article of clothing (e.g. the cuff of a sleeve) can catch on the joystick and unintentionally drive the wheelchair into a person or object. Turning the power off also better maintains the battery charge.
- Most powered wheelchairs and some scooters provide an opportunity for the user to operate the wheelchair in different modes and speeds. The controller settings that are most appropriate for driving slowly in tight quarters are different from the settings that would work best when driving longer distances outdoors or when ascending low curbs.
- Some powered wheelchairs use the controller to activate and use other functions (e.g. communication aids).

Prerequisites

- None.

Spotter considerations

- Spotter starting position: Beside the wheelchair, on the side of the controller in a position where it is possible to intervene.
- Risks requiring spotter intervention:
  - When moving the controller away and back, the mechanisms can pinch fingers or clothing.
  - Runaway if the subject activates the joystick unintentionally.

Equipment

- None.

Starting positions

- Wheelchair: Controller in its usual operating position and the power off.
- Scooter: Key in the ignition.
Instructions to subject

- Optional screening questions: “Does your wheelchair...?”, “Can you...?”
- “Move the controller out of the way, then return it to its usual position.”
- “Turn the power on.”
- “Put the wheelchair controller into each of the drive and speed settings that you can, one at a time.” For wheelchairs that have separate controls for the mode and speed settings, if the subject demonstrates one but not the other, he/she may be prompted without penalty (e.g. “Are there any other ways to adjust the speed or power of the wheelchair?”).
- “Put your chair back into the original drive mode/speed”.
- “If there are any other functions that you activate with your controller, please demonstrate their use.”
- “Turn the power off.”
- If the subject chooses to demonstrate controls that are more relevant to the next skill (“operates body positioning options”), this is permitted even though the scoring will be for the next skill.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
- “Partial pass”: As for the general scoring criteria.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: If the subject can perform some components of this skill, but not others, this should be recorded.

Special considerations for scooters

- The controller for a scooter is usually in the midline, on top of the tiller, between the two handles. For many scooters, the tiller can be unlatched and tilted toward or away from the user, to ease transferring onto and off of the scooter.
- There is no need for a scooter user to remove and replace the key in the ignition.
- Most scooters have some form of speed control on the tiller (e.g. in the form of a dial), in addition to the lever mechanism that provides moment-by-moment speed control.
- Some scooters have different modes or programs for different operating conditions.
- If the scooter has other operating features (e.g. horn, turn indicators, lights) that are controlled on the “dashboard” of the tiller, the scooter user should be able to operate them to receive a “pass” score.
5.2 OPERATES BODY POSITIONING OPTIONS

Versions applicable
- Manual wheelchair: X
- Powered wheelchair: ✔ (skill #2)

Description
- The subject changes body position (e.g. tilts, reclines, elevates the seat, elevates the leg-rests and/or uses the sit-to-stand feature) using the available options of a wheelchair and then restores the wheelchair to the original position.

Rationale
- Powered wheelchairs and scooters capable of variable body positions or postures are used for a variety of reasons, including to assist with pressure redistribution, comfort, breathing, postural control, stability, transfers, obstacle negotiation, bladder management, tone and venous return from the legs. Not all powered wheelchairs have body-positioning options.
- Although some manual wheelchairs also have options for modifying body position, these will only be assessed with the skills that require changes in body position (e.g. caregiver-assisted tilt as a means of relieving weight from the buttocks).

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Beside the wheelchair, in a position where it is possible to intervene.
- Risks requiring spotter intervention:
  - Runaway.
  - Tips.
  - Damage to body parts from the wheelchair mechanism or the external environment.

Equipment
- None.

Starting positions
- Wheelchair: In whatever position the person is in so as not to demonstrate the skill while getting into a standard position.

Instructions to subject
- Optional screening questions: “Does your wheelchair...?”, “Can you...?”
- “Show me how your wheelchair allows you to change body positions.”
- “Bring the wheelchair back into the original position.”
- If there are other positioning options that have not been demonstrated, the tester may prompt the subject without penalty (e.g. “Are there any other options that you can show
me?”).

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
- “Partial pass”: As for the general scoring criteria.
- “Fail”: As for the general scoring criteria.
- “Not possible”: As for the general scoring criteria.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations for powered wheelchairs

- Note that some wheelchairs have apparent controls for which the wheelchair is not actually equipped (e.g. a button labelled “tilt” when the wheelchair does not have a tilt function).

Special considerations for scooters

- Some scooters allow the seat back to be mechanically (i.e. not electronically) reclined, slid forward, slid backward and/or rotated to the side or back. If such options exist, the scooter user must be able to operate them to receive a “pass” score.
5.3 ROLLS FORWARD SHORT DISTANCE

Versions applicable
- Manual wheelchair: ✓ (skill #1)
- Powered wheelchair: ✓ (skill #3)

Description
- The subject moves the wheelchair forward a short distance on a smooth level surface and stops the wheelchair at a specified location.

Rationale
- Forward rolling is a skill used during many wheelchair activities. The short distance is intended to simulate moving about indoors or the distance involved when crossing a two-lane street. Most bouts of wheelchair use (periods of wheelchair activity with intervening periods of inactivity) are relatively short but occur many times a day. While the subject is moving the wheelchair forward, he/she may need to intentionally stop at a predetermined location (e.g. next to a table).

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If a manual wheelchair, the spotter should be behind the wheelchair, holding onto a spotter strap with one hand.
  - If a powered wheelchair, the spotter should be beside the wheelchair on the side of the controller.
- Risks requiring spotter intervention:
  - If a manual wheelchair, rear tip when accelerating (especially during the first push).
  - If a powered wheelchair, runaway or collision.

Equipment
- Smooth level surface 10 m long and at least 1.5 m wide.
- Starting and finish lines at 0 and 10 m.
- Space at least 1.5 m before the starting line and beyond the finish line.
- A stop target (e.g. a pylon) at least 1.5 m beyond the finish line and in the line of progression. The stop target should be large enough to be visible from the starting position.
- Means (e.g. a tape measure) of measuring distance to the nearest cm.
- Means of recording time to the nearest second. Timing this skill provides a means of identifying whether the subject would be able to get across a street quickly enough to be safe (e.g. when traffic flow is controlled by lights). Although there is considerable variability, most traffic signals provide at least 30 seconds for a full cycle.
Starting positions

- Wheelchair: Stationary, facing the midpoint of the starting line, with the front-wheel axles behind it.

Instructions to subject

- Optional screening questions: “Can you...?”
- “Move the wheelchair forward and stop as close as you can to the target (indicate it).”
- Subjects who stop short of the 10 m finish line may be prompted, without penalty, to continue until the leading axles are over the finish line.
- Note: Clinicians or researchers who wish to assess propulsion in more detail than the WST requires, can use the Wheelchair Propulsion Test, by also recording the number of propulsion cycles.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The wheelchair may gently touch the target.
- “Partial pass”: As for the general scoring criteria.
- “Fail”: As for the general scoring criteria.
  - The subject covers < 5 m.
  - The subject does not stop in a controlled manner.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: Distance covered (if < 10 m), time taken (to the nearest second if > 30 seconds) and final distance from the stop target (if > 10 cm).

Special considerations for caregivers

- Powered wheelchairs and scooters can be moved short distances without power, by disengaging the motors. If a caregiver uses this technique, he/she may be awarded a pass score.

Special considerations for manual wheelchairs

- An advanced score should not be awarded unless the subject uses proper propulsion mechanics (e.g. for two-hand propulsion, using long strokes and hand recovery below the hand-rims).
- If the subject strays too close to a wall, it is acceptable for the subject to avoid injuring his/her fingers by pushing off the wall to correct direction.
5.4 ROLLS BACKWARD SHORT DISTANCE

Versions applicable
- Manual wheelchair: ✓ (skill #2)
- Powered wheelchair: ✓ (skill #4)

Description
- The subject moves the wheelchair backward a short distance on a smooth level surface and stops the wheelchair at a specified location.

Rationale
- Backward rolling is a skill used during many wheelchair activities. A short distance is usually all that is necessary, unless overcoming high rolling resistance (e.g. on a soft surface or ascending an incline using foot propulsion). While the subject is moving the wheelchair backward, he/she may need to intentionally stop at a pre-determined location (e.g. next to a wall or toilet).

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - For a manual wheelchair the spotter may be behind the wheelchair holding onto a spotter strap (if a manual wheelchair) until close to the stop target at which point he/she should move to a position beside the wheelchair near a push-handle or beside the wheelchair near the front in position to push downward on a knee or wheelchair part.
  - Risks requiring spotter intervention:
    - Rear tip when stopping.
    - Collision with fixed or moving objects.

Equipment
- Smooth level surface 5 m long and at least 1.5 m wide.
- Space at least 1.5 m before the starting line.
- Starting line 5 m from the stop target.
- A stop target, at 5 m from the starting line, should be an object at least 1.5 m wide and at least as high as the rearmost aspect of the wheelchair. To avoid excessive jarring if the subject fails to stop, the target should be moveable (e.g. a cardboard box) but may be fixed (e.g. a wall) if it is padded.
- Means (e.g. a tape measure) of measuring distance to the nearest cm.

Starting positions
- Wheelchair: The back of the wheelchair facing the midpoint of the starting line and the axles of the rear-most wheels (that touch the ground) behind the starting line.
Instructions to subject
- Optional screening questions: “Can you...?”
- “Move the wheelchair backward and stop the wheelchair as close as you can to the target (indicate it) without touching it.”

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
- The subject looks backward over each of the shoulders at least once to monitor that the path is clear. A mirror attached to the wheelchair may be used. These two shoulder checks can be performed immediately after one another or be separated in time.
- The wheelchair may gently touch the target.
- “Partial pass”: As for the general scoring criteria.
- “Fail”: As for the general scoring criteria.
- The subject covers < 2.5 m.
- The subject does not stop in a controlled manner.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: Distance covered (if < 2.5 m) and final distance from the stop target (if > 10 cm).

Special considerations for caregivers
- Powered wheelchairs and scooters can be moved short distances without power, by disengaging the motors. If a caregiver uses this technique, he/she may be awarded a pass score.

Special considerations for manual wheelchairs
- If there is a transient tip when stopping, an advanced pass should not be awarded.
5.5 STOPS ON COMMAND

Versions applicable
- Manual wheelchair: ✔ (skill #3)
- Powered wheelchair: ✔ (skill #5)

Description
- While the subject is moving the wheelchair forward or backward on a smooth level surface, he/she stops the wheelchair on command.

Rationale
- While the subject is moving the wheelchair forward or backward, he/she may need to come to a sudden stop in reaction to an unexpected event (e.g. other wheelchairs or pedestrians moving into the path) to avoid injury to him/herself or others.

Prerequisites
- “Rolls forward short distance” for the stops while moving forward.
- “Rolls backward short distance” for the stops while moving backward.

Spotter considerations
- Spotter:
  - As for the appropriate shorter-distance skill (forward or backward).
- Risks requiring spotter intervention:
  - As for the appropriate shorter-distance skill (forward or backward).
  - Forward or backward tip or fall due to the sudden stop.

Equipment
- As for the “rolls forward short distance” skill, as well as a “stop command” mark at about 5 m visible to the tester but not obvious to the test subject to indicate the location where the tester will ask the subject to stop.
- As for the “rolls backward short distance” skill, as well as a “stop command” mark at about 2.5 m visible to the tester but not obvious to the test subject to indicate the location where the tester will ask the subject to stop.

Starting positions
- As for the “rolls forward short distance” and “rolls backward short distance” skills except that, when moving forward, the tester should stand in a position that is in the subject’s view-plane but that does not indicate where the stop command will be given, for instance a short distance ahead of the stop-command line. The tester need not be in the subject’s field of view when moving backward because the subject may be looking over either shoulder while moving backward.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Move your wheelchair forward toward the target. If I ask you to stop, please do so as
quickly and safely as you can.”

- When the leading wheels (that touch the ground) reach the stop-command line, the tester should say “stop” and hold up a hand with the palm facing the subject.
- “Move your wheelchair backward toward the target. If I ask you to stop, please do so as quickly and safely as you can.”
- When the leading wheels (that touch the ground) reach the stop-command line, the tester should say “stop”.

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The subject stops in a controlled manner in both forward and backward directions without partial falls or transient tips.
- “Partial pass”: As for the general scoring criteria.
  - The subject stops in a controlled manner in one direction (forward or backward) without partial falls or transient tips.
  - The subject stops in a controlled manner in both forward and backward directions but with a partial fall and/or transient tip.
- “Fail”: As for the general scoring criteria.
  - The subject fails to stop in a controlled manner in at least one direction (forward or backward).
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: The stopping distance (how far the leading wheels are from the stop-command line after the wheelchair has stopped) if > 1.0 m.

**Special considerations**

- None.
5.6 TURNS IN PLACE

Versions applicable

- Manual wheelchair: ✓ (skill #4)
- Powered wheelchair: ✓ (skill #6)

Description

- The subject turns the wheelchair around to the left and right to face in the opposite direction, in as tight a space as possible.

Rationale

- Turning around in tight spaces is a common challenge for wheelchair users. The type of wheelchair and its dimensions affect the ease with which this skill can be performed. The environment may be such that the preferred direction of turn is not possible, so the subject must be capable of turning in both directions.

Prerequisites

- None.

Spotter considerations

- Spotter starting position: Near the wheelchair.
- Risks requiring spotter intervention: No common risks.

Equipment

- Smooth level surface.
- Two 2.0-m-long lines, 90° from each other that intersect at the starting point. Each of the 4 resulting lines running away from the starting point should be marked at 0.75, 1.0 and 1.25 m from the starting point. (These anchoring locations can be used to conceptualize concentric circles with diameters of 1.5, 2.0 and 2.5 m.)
- Means (e.g. a protractor or goniometer) of identifying the extent to which the wheelchair has turned (to the nearest 20°).

Starting positions

- Powered and manual wheelchairs should be positioned with the mid-point between the drive wheels directly over the starting point and the wheelchair in line with one of the two intersecting lines.
- Scooters should be positioned with the mid-point between the rear and front wheels directly over the starting point and the wheelchair in line with one of the two intersecting lines.

Instructions to subject

- Optional screening questions: “Can you...?”
- “Keeping the wheelchair in as tight a space as possible, turn the wheelchair around until you are facing in the opposite direction.”
- If the subject has turned, but has not yet turned fully, he/she may be prompted, without penalty, to continue.
• After the initial turn in one direction, if necessary, the wheelchair should be repositioned before the turn in the other direction.
• “Now turn the chair in the other direction.”

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - Angle reached $\geq 160^\circ$ in both directions.
  - Turning diameter $\leq 1.5$ m.
- “Partial pass”: As for the general scoring criteria.
  - Angle reached $\geq 90^\circ$ in one or more direction.
- “Fail”: As for the general scoring criteria.
  - Angle reached $< 90^\circ$.
  - Turning diameter $> 2.5$ m.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: After each turn, the tester notes the angle reached (if $\leq 160^\circ$), the turning diameter (if $> 1.5$ m), displacement in any direction from the starting point (if $> 0.5$ m) and, if three-point turns (e.g. forward to one side, followed by backward turn to other side, repeated as necessary) are used, the number of steps.

**Special considerations for caregivers**

- The caregiver’s feet should be considered equivalent to a wheel touching the ground for the purpose of identifying the turning diameter.

**Special considerations for manual wheelchairs**

- Performing the skill in the wheelie position is considered an advanced version of the skill. See also, skill #30.

**Special considerations for scooters**

- Because of the way that scooters turn, three-point turns will usually be necessary.
5.7 TURNS WHILE MOVING FORWARD

Versions applicable
- Manual wheelchair: ✔ (skill #5)
- Powered wheelchair: ✔ (skill #7)

Description
- The subject turns the wheelchair to the left and right while moving forward through progressively smaller openings.

Rationale
- Moving turns are often necessary to avoid obstacles or to change direction. The amount of space needed for turning is affected by such factors as the type of wheelchair, the wheelbase (distance between the ground contact points for the front and back wheels), the overall length of the wheelchair and the freedom of the steering wheels to turn.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Behind the wheelchair, holding onto a spotter strap (if a manual wheelchair), unless the subject has safely performed the “rolls forward short distance” and “stops on command” skills, in which case the spotter needs only to be nearby.
- Risks requiring spotter intervention:
  - Rear tip when accelerating, especially during the first push.

Equipment
- Smooth level pathway that is 6 m long and at least 2.0 m wide.
- A means (e.g. tape measure) to measure distances.
- 4 pylons or equivalent (each with a base of about 10 cm and at least 10 cm high) the centers of which are positioned in the middle of the pathway at any or all of the following intervals separately:
  - 0.0, 2.0, 4.0 and 6.0 m creating two intervals of 2.0 m each.
  - 0.0, 1.5, 3.0 and 4.5 m creating two intervals of 1.5 m each.
  - 0.0, 1.0, 2.0 and 3.0 m creating two intervals of 1.0 m each.
- Note: Alternatively, if a pathway 11 m long is available, 8 pylons may be positioned in the middle of the pathway at 0.0, 2.0, 4.0, 6.0, 7.5, 9.0, 10 and 11.0 m, creating two intervals each of 2.0, 1.5 and 1.0 m.
- The line connecting the first two pylons represents the starting line for the first turn.
- The line connecting the second and third pylons represents both the finish line for the first turn and the starting line for the second turn.

Starting positions
- Wheelchair: Facing the midpoint of the starting line for the first turn, with the front-wheel axles behind it.
Instructions to subject

- Optional screening questions: “Can you...?”
- “Move the wheelchair forward around each of the pylons (indicate them) without touching them.” The tester may walk through the pylons to illustrate the path to be taken.
- The intervals may be tested in any order.
- Subjects who stop short of the final finish line may be prompted, without penalty, to continue.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
  - The turns through the pylons spaced 1.0 m apart are successfully completed.
  - If a subject is successful at the 1.0 m intervals, there is no need to assess the 1.5 or 2.0 m intervals.
- “Pass”: As for the general scoring criteria.
  - The turns through the pylons spaced 1.5 m apart are successfully completed.
  - The pylons may be touched but not significantly displaced.
  - If a subject is successful at the 1.5 m intervals, there is no need to assess the 2.0 m intervals.
- “Partial pass”: As for the general scoring criteria.
  - The turns through the pylons spaced 2.0 m apart are successfully completed.
- “Fail”: As for the general scoring criteria.
  - Does not complete the turns through the pylons spaced 2.0 m apart.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: If three-point turns (e.g. forward to one side, followed by backward turn to other side, repeated as necessary) are used for any interval, this should be noted.

Special considerations for caregivers

- The feet of the caregiver must remain within the defined space.

Special considerations for manual wheelchairs

- Part or all of the skill may be performed in the wheelie position.

Special considerations for scooters

- The length of a scooter and the limitations on how far the steering wheel(s) can be turned may require that a three-point turn be used. There is no scoring penalty for using such a turn, as long as the other criteria are met.
5.8 TURNS WHILE MOVING BACKWARD

Versions applicable
- Manual wheelchair: ✔ (skill #6)
- Powered wheelchair: ✔ (skill #8)

Description
- The subject turns the wheelchair to the left and right while moving backward.

Rationale
- As for the “turns while moving forward” skill although, for most wheelchair users, such turns are usually required less often in everyday life than moving turns in the forward direction.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Behind the wheelchair, holding onto a spotter strap (if a manual wheelchair), unless the subject has safely performed the “rolls backward short distance” and “stops on command” skills, in which case the spotter needs only to be nearby.
- Risks requiring spotter intervention:
  - Rear tip when stopping.
  - Collision.

Equipment
- As for the “turns while moving forward” skill.

Starting positions
- Wheelchair: The back of the wheelchair facing the starting line, with the rear-wheel axles behind it.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Move the wheelchair backward around each of the pylons (indicate them) without touching them.”
- Subjects who stop short of the final finish line may be prompted, without penalty, to continue.

Capacity scoring criteria
- As for the “turns while moving forward” skill.

Special considerations for caregivers
- As for the “turns while moving forward” skill.
Special considerations for manual wheelchairs

- As for the “turns while moving forward” skill.
- An advanced-pass score should not be awarded if the wheelchair transiently tips backward when stopping.

Special considerations for scooters

- As for the “turns while moving forward” skill.
5.9 MANEUVERS SIDEWAYS

Versions applicable
- Manual wheelchair: ✔ (skill #7)
- Powered wheelchair: ✔ (skill #9)

Description
- The subject maneuvers the wheelchair sideways to the left and right.

Rationale
- Repositioning the wheelchair sideways in a tight space is commonly necessary to get closer to or farther away from objects (e.g. a window, bed or table).

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Near the wheelchair.
- Risks requiring spotter intervention: No common risks.

Equipment
- Two lateral targets, large enough for the subject to see, for the subject to approach. The targets need not be identical. The target on the first side toward which the wheelchair is to be maneuvered can be fixed (e.g. a wall). However, the target for the second side may need to be movable (e.g. a pylon) because wheelchair widths vary.
- A rear barrier (e.g. a wall) that is at least 1.5 m wide and at least as high as the rearmost aspect of the wheelchair.
- A means (e.g. tape measure) to measure distances.
- A means (e.g. a protractor or goniometer) to measure angles.

Starting positions
- Wheelchair:
  - The rear-most part of the wheelchair should be positioned as close as possible to the rear barrier.
  - The first lateral target should be at least 0.5 m lateral to the widest part of the wheelchair. For manual wheelchairs, the widest aspect of the wheelchair will usually be the rear-wheel hand-rim; for powered wheelchairs, this will usually be the drive wheels themselves.
  - The second lateral target should be placed on the other side of the wheelchair. It may be necessary to wait until the subject has moved toward the first target before placing the second target, so as not to limit the subject’s freedom to maneuver.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Get this wheel (indicate the one closest to the first target) as close as you can to this
target (indicate it), using as little forward-backward space as possible and ending facing forward as you are now.”

- If the wheelchair is close to the desired finish position, but not quite there (too far away or at too great an angle), it is permissible to prompt the subject, without penalty, (e.g. “Can you get a little closer?” or “Can you straighten out the wheelchair?”).
- Repeat toward the other side. The finish position for the movement to the first side is the starting position for the movement to the other side.

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The subject must meet the criteria in both directions.
  - **Lateral distance** (between the widest aspect of the wheelchair and the lateral barrier) ≤ 10 cm. The wheelchair may touch the target.
  - Angle between wheelchair and the lateral barrier ≤ 20 °.
- “Partial pass”: As for the general scoring criteria.
  - Lateral distance ≤ 25 cm.
  - Angle ≤ 45 °.
  - The subject meets the pass criteria in one direction, but not the other.
- “Fail”: As for the general scoring criteria.
  - Lateral distance > 25 cm.
  - Angle > 45 °.
  - Forward distance (farthest forward from the rear barrier that the front wheels have moved during the maneuver) > 2.5 m.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: On completion of each sideways maneuver, the tester should note the lateral distance (if > 10 cm), the angle between wheelchair and the lateral barrier (if > 20 °), the forward distance (if > 2.5 m) and, if using a series of forward and backwards turns, the number of steps required.

**Special considerations for caregivers**

- If a caregiver chooses to perform the skill from behind the wheelchair, the caregiver represents the “rearmost aspect of the wheelchair”.

**Special considerations for manual wheelchairs**

- Most subjects will use to-and-fro motions (as in parallel parking a car), but “bunny hopping” or rocking (from the wheels on one side to those on the other) is permitted.
5.10 PICKS OBJECTS FROM FLOOR

Versions applicable

- Manual wheelchair: ✓ (skill #8)
- Powered wheelchair: ✓ (skill #10)

Description

- The subject picks objects up from the floor and passes them to the tester.

Rationale

- Objects that need to be picked up from the floor or ground vary from those as small and light as a coin or a piece of paper to those as bulky and heavy as a young child.

Prerequisites

- None.

Spotter considerations

- Spotter starting position: Near the wheelchair, on the side toward which the subject leans (if any).
- Risks requiring spotter intervention:
  - Forward or sideways tip or fall when reaching, leaning or standing up.
  - Forward fall or tip due to standing on a footrest.

Equipment

- Large object about the size of a cell phone (about 6 cm wide, 13 cm long and 1 cm thick).
- Medium-size object about the size of a pen (about 6 cm in length and 1 cm in diameter).
- Small object about the size of a coin (about 2-3 cm in diameter and 2 mm thick).
- The tester places the objects in a line with the large object at one end and the small object at the other end, each about 0.5 m from the medium-size object in the middle.

Starting positions

- Wheelchair: At right angle to the line, facing the medium-size object with the front-wheel axles about 0.5 m away.

Instructions to subject

- Optional screening questions: “Can you...?” If showing the objects to the subject, the tester should show the largest object first. If the subject answers “no” about the largest object, there is no need to proceed to the smaller objects.
- “Pick the three objects (indicate them) up from the floor and pass them to me, one at a time. You may move your wheelchair.”
- When the subject is ready to pass each object to the tester, the tester should position his/her hand at about the subject’s waist height and within an arm’s reach of the subject.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
• The subject successfully picks up and passes all three objects.
• “Pass”: As for the general scoring criteria.
• The subject successfully picks up and passes two of the objects.
• The subject may use either hand.
• The subject may pick up more than one object at a time.
• The subject may pass more than one object to the tester at a time.
• A reaching aid may be used, if it is carried by the subject.
• If the subject chooses to remove or reposition parts of the wheelchair (e.g. the footrests) to improve the reach, this is permitted as long as the subject can remove and replace the parts independently. After completing the skill, the subject may be prompted, without penalty, to restore the wheelchair to its original state.
• A wheelchair with a seat-height-variation feature may be used, as long as the subject can operate it independently.
• The subject may get out of the wheelchair to perform this skill.
• If the wheelchair user chooses to stand to accomplish the task, he/she need not apply the wheel locks and/or clear the footrests away if he/she can perform the tasks safely.
• If the subject drops an object while picking it up or passing it, but then successfully retrieves it, this is considered a second attempt.
• “Partial pass”: As for the general scoring criteria.
• The subject successfully picks up and passes one object.
• “Fail”: As for the general scoring criteria.
• “Not possible”: This score is not an option for this skill.
• “Testing error”: As for the general scoring criteria.
• Comments recorded: As for general scoring criteria.

Special considerations for caregivers
• When bending or stooping to pick up an object, the caregiver may place the non-reaching hand on the wheelchair for balance.

Special considerations for powered wheelchairs
• The power may be on or off. However, the spotter should intervene and award a fail score if he/she is concerned that the subject is about to move the wheelchair in a way that appears likely to result in the fingers being run over by the wheels.
• If a powered-wheelchair user chooses to stand, an advanced-pass score should not be awarded if the power is not turned off.

Special considerations for scooters
• Scooter users often get out of their scooters to pick up objects. This is safer than leaning from the seat, due to the high center of gravity of most scooters and the possibility of a sideways tip.
• If a scooter user chooses to stand, an advanced-pass score should not be awarded if the power is not turned off.
• When bending or stooping to pick up the object, the scooter user may place the non-
reaching hand on the wheelchair for balance.
5.11 RELIEVES WEIGHT FROM BUTTOCKS

**Versions applicable**
- Manual wheelchair: ✔ (skill #9)
- Powered wheelchair: ✔ (skill #11)

**Description**
- The subject relieves weight from both buttocks, although not necessarily at the same time.

**Rationale**
- Weight relief is important for comfort and the prevention of pressure sores. Although research-based recommendations are evolving, for the purposes of the WST, complete unloading for a duration of 15 seconds is considered representative of the subject’s capability.

**Prerequisites**
- None.

**Spotter considerations**
- Spotter starting position: Near the wheelchair, on the side toward which the subject leans (if any).
- Risks requiring spotter intervention: Forward or sideways tip or fall when leaning.

**Equipment**
- Means (e.g. an inclinometer) of measuring the extent of tilt or recline, if that is the technique used by the subject.

**Starting positions**
- Wheelchair user: In the wheelchair, sitting upright.

**Instructions to subject**
- Optional screening questions: “Can you...?”
- “Demonstrate how you relieve weight from your buttocks. Hold your position until I tell you to stop.”
- The tester tells the subject to stop after 15 second.
- If a subject chooses to lean to one side, the tester may prompt the subject “Now to the other side” without penalty.
Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The subject relieves ≥ 90% weight from the buttocks. For the purpose of the WST, this is considered to be the case if the tester is able to easily slide a hand between pressure-sensitive areas (the “sitting bones” and “tailbone”) and the wheelchair seat or cushion. However, placing a hand into the pressure-sensitive areas is ordinarily not required for the WST and this should only be done with the permission of the subject. The tester must make his/her best judgment about the extent of the pressure relief achieved.
  - Weight is significantly relieved for ≥ 15 seconds.
  - It is permissible for the wheelchair user to lean to one side at a time, to lean forward with the elbows or chest resting on the thighs, to stand up or to bridge (lifting the buttocks by extending the legs, pushing the feet on the footrests or floor) to relieve pressure.
  - If the subject leans, he/she must recover independently (e.g. using push-handles or armrests).
  - If the wheelchair user chooses to stand to accomplish the task, he/she need not apply the wheel locks and/or clear the footrests away.
  - If the subject uses tilt or recline, a pass may be awarded if the extent of the tilt or recline is ≥ 45°.
  - If the subject is using a positioning belt that is tight enough to prevent effective weight relief, it should be undone or loosened. After the weight-relief maneuver, it should be reapplied or tightened.
  - If the subject’s wheelchair is fitted with an alternating pressure cushion, a pass may be awarded if the tester is convinced by palpation that there is adequate relief under the pressure points.
- “Partial pass”: As for the general scoring criteria.
  - If the subject relieves weight from the buttocks but < 90%.
  - If the subject relieves weight from the buttocks but for < 15 seconds.
  - If the subject uses tilt or recline, the extent of the tilt or recline must be ≥ 45°.
  - The subject transiently tips the wheelchair while leaning.
  - The subject uses the “push-up” technique. The push-up method, applying forces to the armrests or seat to lift the buttocks straight up, requires more force than most of the alternative methods. Over time, this may have adverse effects on the wheelchair user’s wrists and shoulders. Also, this technique is difficult to maintain for the recommended 15 seconds.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
  - This score should be awarded if the tester is uncertain about the extent of weight relief and the subject refuses to permit the tester to perform a manual check.
- Comments recorded: As for general scoring criteria.
  - The tester should record the method used by the subject.
  - If the subject chooses to lean forward to relieve weight from the buttocks, the

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tester should note if the direction of caster trail is suboptimal (i.e. rearward trail).

- The tester should note the tilt or recline angle if the subject uses these methods.

**Special considerations for caregivers**

- The caregiver is only expected to assist the wheelchair user into and out of the weight-relieving position and to prevent any tips or falls.

**Special considerations for powered wheelchairs**

- If a powered-wheelchair user chooses to stand to achieve pressure relief, an advanced-pass score should not be awarded if the power is not turned off.

**Special considerations for scooters**

- If a scooter user chooses to stand to achieve pressure relief, an advanced-pass score should not be awarded if the power is not turned off.
5.12 PERFORMS LEVEL TRANSFERS

Versions applicable
- Manual wheelchair: ✔ (skill #10)
- Powered wheelchair: ✔ (skill #12)

Description
- The wheelchair user transfers from the wheelchair to another surface that is about the same height as the wheelchair seat and back again.

Rationale
- A level transfer is a commonly used skill to move between the wheelchair and a chair, bed, tub, toilet, car or other surface. The average wheelchair user spends about 10 hours per day in his/her wheelchair and performs about 8 transfers a day, but the range is high. A greater number of transfers per day increases the likelihood of overuse injury to the upper limbs. Proper technique is advisable as a means of reducing overuse and minimizing pain during transfers. The level wheelchair transfer should only be considered a representative transfer. More difficulty may be experienced when transferring to and from other surfaces or heights.
- Note: Clinicians or researchers who wish to assess transfers in more detail than the WST requires can use the [Transfer Assessment Instrument](#).

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - Usually in front of the wheelchair and slightly to one side, close enough to catch the subject if he/she falls and to prevent the wheelchair from rolling or sliding away or tipping.
  - The spotter may ask the subject where it would be best to stand, given the subject’s previous experiences.
- Risks requiring spotter intervention:
  - Forward or sideways tip or fall when reaching or standing.
  - Rear tip when sitting back down in the wheelchair after a standing-pivot or crouching transfer.
  - Fall between the wheelchair and bench if the wheelchair rolls or slides away.
  - In the course of a standing pivot or crouching transfer, a fall due to tripping over the footrests.

Equipment
- Bench or equivalent with a padded flat surface, no backrest and no armrests. The sitting surface should be at least 1.0 m wide, at least 0.5 m deep and 45-47 cm high.
- Transfer board (a piece of wood or plastic with bevelled edges).
Starting positions
- Wheelchair user: Seated in the wheelchair, and oriented in the chair as if he/she is ready to propel the chair (e.g. feet on footplates, if used).
- Wheelchair: Facing the bench and at least 0.5 m from it.

Instructions to subject
- Optional screening questions: “Can you...?”
- "Transfer from the wheelchair to the bench (indicate it).”
- If, during the transfer, the subject is sitting on the target surface with part of the transfer board under him/her, it is permissible to prompt the subject, without penalty, to “move the transfer board away from you”.
- “Transfer back into the wheelchair.”
- After transferring back into the wheelchair, the subject may be prompted, without penalty, to restore the wheelchair to its original condition (e.g. “Is your wheelchair ready to go?”), but without itemizing specific deficiencies.

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The wheelchair user is able to independently and safely set up the wheelchair for the transfer, transfer to and from the target surface and restore the wheelchair to its operational condition.
  - The transfer is not considered complete until the subject is off the transfer board, if one is used.
  - If the wheelchair user’s arm is secured to an arm support he/she must independently release and later replace his/her arm in the original position and state.
  - The wheel locks (if any) need not be used as long as the wheelchair does not roll away significantly.
  - The subject need not clear the footrests if the transfer can be effectively and safely completed without doing so. After transferring back into the wheelchair, the footrests and feet should be as they were prior to the transfer.
  - If a positioning belt is intended for independent use and is fastened around the wheelchair user at the beginning of the test, then the subject is expected to be able to undo it and fasten it again after transferring back into the wheelchair. If the wheelchair is equipped with a positioning belt, but the wheelchair user is not using it, the subject is not required to be able to use it.
  - If the subject needs to reposition the unoccupied wheelchair between the transfer out of the wheelchair and the transfer back into it, the subject must do so him/herself.
- “Partial pass”: As for the general scoring criteria.
  - The subject is successful in transferring out of the wheelchair, but not back into it.
- “Fail”: As for the general scoring criteria.
• If the subject is the wheelchair user and the wheelchair has a rear-closing seat belt or other restraint that is not intended for independent use, a fail score should be awarded.

• “Not possible”: This score is not an option for this skill.

• “Testing error”: As for the general scoring criteria.
  • If a subject routinely uses a transfer board but one is not available at the time of testing, a TE score should be awarded.

• Comments recorded:
  • The transfer method used (e.g. sideways vs. standing-pivot transfer).
  • If, during a sideways transfer, the buttocks scrape significantly over the rear wheel or wheel-lock extension.
  • If the lower limbs scrape over a footrest to a significant extent.
  • If, during a standing-pivot or crouch transfer, a 270° turn is used instead of using the shortest possible rotation.

Special considerations for caregivers
• The caregiver may receive physical assistance from the wheelchair user in performing the skill because it is not a reasonable expectation that a single caregiver could carry out this skill alone without additional equipment.

• The caregiver may use a transfer belt, as long as it is carried by the wheelchair user or caregiver.

Special considerations for powered wheelchairs
• The controller may be on or off. Although the transfer is likely to be safer with the power off, the subject may need to move the wheelchair during the transfer and may not be able to control the power when out of the wheelchair.

• If the wheelchair seat can be swivelled to the side or back, this may be done.

Special considerations for scooters
• If the scooter seat can be swivelled to the side or back, this may be done.
5.13 FOLDS AND UNFOLDS WHEELCHAIR

Versions applicable
- Manual wheelchair: ✓ (skill #11)
- Powered wheelchair: X

Description
- The subject folds or takes apart the unoccupied wheelchair to make it as small and light as possible, and then restores it to its original condition.

Rationale
- For transport or storage, the size or weight of the wheelchair may need to be reduced. This can be done by folding the wheelchair. Removal of the rear wheels or other parts is a useful way to further diminish the size and weight of the wheelchair. Although, in everyday life, wheelchair users may not need to break their wheelchairs down completely, for the purposes of the WST, this is required. For the purposes of the WST, this skill is considered “not applicable” for powered wheelchairs and scooters, even though some parts of some models may be readily foldable or removable.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - Near the subject, on the side toward which the subject leans (if any).
- Risks requiring spotter intervention:
  - Forward fall while reaching.
  - Pinching fingers between folding or rotating parts.
  - Injury to lower leg or foot due to dropping or rotating wheelchair parts.

Equipment
- Surface for the subject to sit on (e.g. the one used for the “performs level transfers” skill), if needed.

Starting positions
- Wheelchair user: Seated or standing near the wheelchair.
- Wheelchair: In the same position and condition as it is immediately after the wheelchair user has transferred out of it. This skill is usually assessed with the “performs level transfers” skill, while the wheelchair user is out of the wheelchair. For a wheelchair with a spotter strap around a cross-brace, the strap may be removed by the tester, to permit the wheelchair to fold fully.
Instructions to subject

- Optional screening questions: “Does your wheelchair...?”, “Can you...?”
- “Fold the wheelchair as tightly as you can or take it apart as completely as possible, as if you were going to store it.”
- If the wheelchair is incompletely folded or taken apart, it is acceptable to prompt the subject without penalty (e.g. “Can you get it a little tighter or smaller?” or “What if it was still too big or heavy?”) but the tester must not suggest the solution.
- “Put the wheelchair back together and open it so that you can get back into it.”
- If the wheelchair is incompletely restored to its original condition, it is permissible, without penalty, to cue the subject by inquiring “Is the wheelchair in the same condition that it was in before you folded it?” but the tester must not suggest the solution.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - If the subject has removed some wheelchair parts (e.g. an armrest or footrest) as part of the transfer out of the wheelchair and restores the wheelchair to its original state after transferring back into it, the tester may also consider these actions as part of the “folds and unfolds wheelchair” skill.
  - The wheelchair is folded or taken apart such as to reduce the dimensions of the wheelchair as much as possible without tools.
  - If wheelchair components or accessories (e.g. cushion, rigid seat, backrest, knapsack, armrests, footrests, clothing guards) need to be removed to achieve the smallest and lightest condition, this should be done.
  - For a rigid wheelchair with a backrest that folds forward, the backrest canes and the seat rails should be as close to parallel with each other as is mechanically possible.
  - The rear wheels should be removed if this can be done without tools (i.e. if they are of the quick-release type).
  - For the unfold component of the skill, the wheelchair should be opened fully.
  - After putting the rear wheels back on the frame, the subject should check that they are firmly in place by pulling on them.
- “Partial pass”: As for the general scoring criteria.
  - The subject is successful in folding and unfolding the wheelchair but neglects to remove and replace all components.
  - The subject is successful in folding the wheelchair, but not unfolding it.
  - The subject opens the wheelchair in a way that precludes normal use of the wheelchair (e.g. putting a contoured cushion in backward, tangling a seatbelt strap in a way that will cause it to rub on a wheel, or failing to get the seat rails properly into the rail saddles). The tester should intervene and ask the subject to correct the problem before the wheelchair user gets back into the wheelchair (to avoid the necessity of a second transfer to correct the problem).
- “Fail”: As for the general scoring criteria.
  - The subject does not know that the wheelchair folds or can otherwise be reduced in size or weight.
“Not possible”: As for the general scoring criteria.

- The wheelchair cannot be folded or reduced in size or weight in any way.

“Testing error”: As for the general scoring criteria.

- If the subject cannot achieve the “performs level transfers” skill out of the wheelchair, the “folds and unfolds wheelchair” skill cannot be tested. The tester is not required to assist the wheelchair user out of the wheelchair but a caregiver (if available) may do so to allow the “folds and unfolds wheelchair” skill to be tested.

Comments recorded: As for general scoring criteria.

**Special considerations**

- None.
5.14 GETS THROUGH HINGED DOOR

Versions applicable
- Manual wheelchair: ✔ (skill #12)
- Powered wheelchair: ✔ (skill #13)

Description
- The subject opens, passes through and closes a hinged door that opens away from the subject, then repeats the task in the opposite direction (with the door opening toward the subject).

Rationale
- Wheelchair users frequently encounter such hinged doors or gates. Although there are many door types, the hinged door is considered a representative skill.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Near the wheelchair, on the side toward which the subject leans (if any).
- Risks requiring spotter intervention:
  - Rear, forward or sideways tip or fall due to reaching and pulling on the door handle.
  - Pinching the fingers between the door and the frame.
  - Scraping the hands between the door frame and the wheelchair.

Equipment
- Door about 81cm wide, with no resistance to opening, preferably with a lever handle >10 cm in length and 75-90 cm above the floor, and preferably with no threshold (because the ability to get over an obstacle is evaluated separately later).
- There should be enough space (preferably at least 1.5 m²), before and after the door as well as on the side of the door that opens, to allow the subject to maneuver.

Starting positions
- Wheelchair: Facing the mid-point of the closed door with the front wheels about 0.5 m from it.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Open the door, move the wheelchair through it and close the door behind you.”
- “Now, go back through the door the other way.”
- The order of performing the two components of this skill test is not important.
- If the subject leaves the door ajar, he/she may be prompted, without penalty, to finish closing it.
Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
  - Meets the criteria for a pass score but also the additional criteria below.
- “Pass”: As for the general scoring criteria.
  - The skill in each direction is completed when the door closes firmly.
- “Partial pass”: As for the general scoring criteria.
  - The subject is successful in one but not both directions.
  - The subject is able to open the door in both directions, but fails to close it.
  - The subject is able to pass through the door and close it in both directions, but not open it.
- “Fail”: As for the general scoring criteria.
  - A finger pinch seems likely between the door and the frame. The spotter should intervene to prevent injury.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations for manual wheelchairs

- The subject may use the door-frame to assist in passing through the door.
5.15 ROLLS LONGER DISTANCE

Versions applicable
- Manual wheelchair: ✔ (skill #13)
- Powered wheelchair: ✔ (skill #14)

Description
- The subject moves the wheelchair a longer distance on a smooth level surface. This may be done in the forward or backward direction.

Rationale
- The ability to manage longer distances allows wheelchair users to get around in the community (e.g. getting from a parking lot to an office or getting around inside a store). Subjects who are able to move their wheelchairs short distances may not be able to roll longer distances due to the additional endurance or attention required.

Prerequisites
- The “rolls forward short distance” skill is a prerequisite if this skill is carried out in the forward direction and the “rolls backward short distance” skill is a prerequisite if this skill is carried out in the backward direction.

Spotter considerations
- Spotter: If the subject has already safely performed the appropriate shorter-distance skill (forward or backward) and “stops on command” skill, the spotter need only be nearby.
- Risks requiring spotter intervention:
  - As for the appropriate shorter-distance skill (forward or backward) and the “stops on command” skill.
  - Rear, forward or sideways tip or fall due to a sudden stop or turn.
  - Because speeds are usually faster if the skill is being performed in an open space, the higher momentum can cause greater injury or damage if there is a collision with a fixed or moving obstacle.

Equipment
- A smooth level surface 50 m long and at least 1.5 m wide is ideal. Using multiple laps of a shorter distance is permissible, but it is preferable for the straight stretches to be at least 10 m in length, to minimize the number of turns. A curved path may be used.
- If the space to be used requires laps to and fro through the same space, a pylon at the end of each lap is a helpful guide for the subject to turn around.
- Space at least 1.5 m before the starting line and beyond the finish line.

Starting positions
- Wheelchair: Leading wheel axles facing the starting line and behind it.

Instructions to subject
- Optional screening questions: “Can you...?”
• “Move the wheelchair to the finish line (indicate it or the number of laps and the pylons if used).”

• Note: Clinicians or researchers who wish to assess propulsion in more detail than the WST requires can use the Wheelchair Propulsion Test, by also recording the time taken and the number of propulsion cycles.

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - As for the “rolls forward short distance” or “rolls backward short distance” skill depending upon the direction of travel.
  - The subject needs to avoid any contact with fixed or moving obstacles that he/she encounters, by stopping, slowing down and/or changing direction.
  - “Partial pass”: As for the general scoring criteria.
  - The subject covers ≥ 25 m.
- “Fail”: As for the general scoring criteria.
  - An automatic “fail” score is awarded if the subject has failed the “rolls forward short distance” skill if a forward propeller or if the subject has failed the “rolls backward short distance” skill if a backward propeller.
  - The subject covers < 25 m.
  - “Not possible”: This score is not an option for this skill.
  - “Testing error”: As for the general scoring criteria.
  - Comments recorded: As for general scoring criteria.

**Special considerations for powered wheelchairs**

- If there are potential hazards (e.g. people or wheelchairs emerging from office doorways or intersecting hallways), an advanced-pass score should not be awarded if the subject is driving the wheelchair too quickly.

**Special considerations for scooters**

- If there are potential hazards (e.g. people or wheelchairs emerging from office doorways or intersecting hallways), an advanced-pass score should not be awarded if the subject is driving the scooter too quickly.
5.16 ASCENDS SLIGHT INCLINE

Versions applicable
- Manual wheelchair: ✓ (skill #14)
- Powered wheelchair: ✓ (skill #15)

Description
- The subject moves the wheelchair from a level surface up a slight incline to another level surface.

Rationale
- Inclines with different slopes are encountered frequently in the natural and built environments. For instance, a 5° (~1:12) grade meets the current building codes for ramps in North America.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Behind the wheelchair, holding onto a spotter strap (if a manual wheelchair).
- Risks requiring spotter intervention if moving forward up the incline:
  - Rear tip when initially accelerating.
  - Forward tip or fall due to deceleration when striking the lower floor-incline transition.
  - Hyper-flexion injury of the lower limb at the lower floor-incline transition if the foot catches on the ground.
  - Rear tip while ascending the incline.

Equipment
- Incline with a slope of 5°, at least 2.5 m long and at least 1.5 m wide.
- A lip and a handrail on both sides of the incline are desirable to prevent injuries although the handrails should not be used during the performance of the skill.
- The incline should end at the upper end on a level surface or platform that is large enough to allow wheelchairs of all types, caregivers and WST personnel to turn around safely (2.0 m² or more is recommended). A lip around the open edges of the platform is recommended.
- There should be little or no lip at the lower junction of the floor and incline. The ability to overcome such obstacles is tested elsewhere.

Starting positions
- Wheelchair: On the level at the bottom of the incline, with the leading wheels of the wheelchair facing the incline and at least 0.5 m away. Some subjects may prefer to start farther away if they wish to use momentum to get up the ramp. This is the subject’s choice but the tester should not suggest this solution.
Instructions to subject

- Optional screening questions: “Can you...?”
- “Move the wheelchair up the ramp.”
- If the subject attempts to perform the skill using the ramp handrails he/she may, without penalty, be instructed not to use this method for the purposes of the test.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The subject may use any type of propulsion, in the forward or backward direction.
  - The end of the skill occurs when all wheelchair parts are completely off the incline at the top.
  - The subject or wheelchair may make contact with the ramp lips or rails without penalty.
- “Partial pass”: As for the general scoring criteria.
  - The subject does not ascend at least 2.0 m.
  - The subject successfully handles a slope of lesser degree (e.g. if a 2.5° slope is available).
- “Fail”: As for the general scoring criteria.
  - A wheel moves outside the lateral boundaries of the incline.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded:
  - The footrests or rear anti-tip devices make enough contact with the surface at the lower transition to significantly interfere with progression.
  - A transient wheelchair tip occurs.

Special considerations

- None.
5.17 DESCENDS SLIGHT INCLINE

Versions applicable
- Manual wheelchair: ✔ (skill #15)
- Powered wheelchair: ✔ (skill #16)

Description
- The subject moves the wheelchair from a level surface down a slight incline to another level surface, stopping part-way.

Rationale
- As for the “ascends slight incline” skill. In addition, being able to stop during incline descent is valuable for safety and demonstrates control.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If the wheelchair is to move forward down the incline, the spotter should be behind the wheelchair, holding onto a spotter strap (if a manual wheelchair) with one hand and holding the other hand in front of the wheelchair user’s shoulder.
  - If using two spotters, one spotter should be behind the wheelchair, holding onto a spotter strap and the second spotter should be in front of and beside the wheelchair to resist a forward tip or fall.
- Risks requiring spotter intervention:
  - Rear tip if performed in the wheelie position.
  - Forward tip or fall due to deceleration when stopping or when striking the lower incline-floor transition.
  - Hyper-flexion injury of the lower limb at the lower incline-floor transition due to catching the foot on the ground.
  - Runaway leading to collision or tip-over.
  - Hand injuries to the wheelchair user due to friction burns or lacerations due to hand-rim irregularities if the wheelchair is allowed to descend too rapidly.
  - Thumb injury on the wheel locks if the wheelchair user grabs the hand-rims when they are rolling too quickly because the hands can get pulled forward into the wheel locks by the wheels.

Equipment
- As for the “ascends slight incline” skill.
Starting positions

- Wheelchair: All wheels are on the level surface at the top of the incline with the leading wheels of the wheelchair facing the incline and at least 0.5 m away.

Instructions to subject

- Optional screening questions: “Can you...?”
- “Move the wheelchair down the ramp under control, stopping about half-way down.”
- After the stop: “Carry on to the bottom and stop when you are off the ramp.”
- If the subject attempts to perform the skill using the ramp handrails, he/she may, without penalty, be instructed not to use this method for the purposes of the test.

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The end of the skill occurs when all wheelchair parts are completely off the incline at the bottom and the wheelchair has been brought to a controlled stop.
  - The subject must come to a complete stop part-way down the incline.
  - The subject or wheelchair may make contact with the ramp lips or rails without penalty.
- “Partial pass”: As for the general scoring criteria.
  - The subject does not descend at least 2.0 m under control.
  - The subject descends the full incline under control but does not come to a complete stop part-way down the incline.
  - The subject successfully handles a slope of lesser degree (e.g. if a 2.5° slope is available).
- “Fail”: As for the general scoring criteria.
  - A runaway requires the spotter’s intervention.
  - A wheel moves outside the lateral boundaries of the incline.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comment recorded:
  - The footrests or rear anti-tip devices make enough contact with the surface at the lower transition to significantly interfere with progression.

Special considerations for caregivers

- For a caregiver of a powered wheelchair user, disengaging the motors and letting the wheelchair roll down the ramp is not considered a safe method so a fail score should be awarded.

Special considerations for manual wheelchairs

- “Advanced pass”: As for the general scoring criteria.
  - If the subject performs the skill in the wheelie position, an advanced pass may be warranted but the wheelie method is not necessary.
- “Pass”: As for the general scoring criteria.
- “Partial pass”: As for the general scoring criteria.
“Fail”: As for the general scoring criteria.

- The handrails of the ramp are grasped.

Comments recorded:

- The subject uses the wheel locks to limit the speed of the wheelchair (e.g. by partially or repeatedly applying them).
- The subject drags the feet to slow the wheelchair.
- A foot catches on the floor as the wheelchair continues to move forward, without injury.
- The subject sustains mild friction burns of the hands.
- There is minor thumb injury on the wheel lock because the hand gets pulled forward into the wheel lock by the wheel.
5.18 ASCENDS STEEP INCLINE

Versions applicable
- Manual wheelchair:  ✓ (skill #16)
- Powered wheelchair:  ✓ (skill #17)

Description
- The subject moves the wheelchair from a level surface up a steep incline to another level surface.

Rationale
- As for the “ascends slight incline” skill. Inclines with slopes greater than the standard recommended value are encountered frequently in the natural and built environments. The appropriate technique for a steep incline may differ somewhat from that used for a lesser slope.

Prerequisites
- “Ascends slight incline” skill.

Spotter considerations
- As for “ascends slight incline” skill.

Equipment
- As for “ascends slight incline” skill, except that the incline has a $10^\circ$ slope.

Starting positions
- As for “ascends slight incline” skill.

Instructions to subject
- As for “ascends slight incline” skill.

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
  - As for the “ascends slight incline” skill.
- “Pass”: As for the general scoring criteria.
  - As for the “ascends slight incline” skill.
- “Partial pass”: As for the general scoring criteria.
  - As for the “ascends slight incline” skill.
- “Fail”: As for the general scoring criteria.
  - As for the “ascends slight incline” skill.
  - An automatic fail score can be awarded if the subject has failed the “ascends slight incline” skill.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded:
• As for the “ascends slight incline” skill.

**Special considerations**

• As for the “ascends slight incline” skill.
5.19 DESCENDS STEEP INCLINE

Versions applicable
- Manual wheelchair: ✔ (skill #17)
- Powered wheelchair: ✔ (skill #18)

Description
- The subject moves the wheelchair from a level surface down a steep incline to another level surface, stopping part-way.

Rationale
- As for the “descends slight incline” skill.

Prerequisites
- “Descends slight incline” skill.

Spotter considerations
- As for “descends slight incline” skill.

Equipment
- As for “ascends steep incline” skill.

Starting positions
- As for “descends slight incline” skill.

Instructions to subject
- As for “descends slight incline” skill.

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
  - As for the “descends slight incline” skill.
- “Pass”: As for the general scoring criteria.
  - As for the “descends slight incline” skill.
- “Partial pass”: As for the general scoring criteria.
  - As for the “descends slight incline” skill.
- “Fail”: As for the general scoring criteria and the “descends slight incline” skill.
  - An automatic fail score should be awarded if the subject has been awarded this score on the “descends slight incline” skill.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations for caregivers
- As for the “descends slight incline” skill.
Special considerations for manual wheelchairs

- As for the “descends slight incline” skill.
5.20 ROLLS ACROSS SIDE-SLOPE

Versions applicable
- Manual wheelchair: ✔ (skill #18)
- Powered wheelchair: ✔ (skill #19)

Description
- The subject moves the wheelchair across a slight side-slope without turning downhill or uphill significantly, then repeats the task in the opposite direction.

Rationale
- Side-slopes (or cross-slopes) are frequently encountered in built and natural environments. Sidewalks, for instance, are usually sloped 2% (1:50) toward the street to allow water to run off. Steeper grades are also often found (e.g. where sidewalks cross driveways). The yaw axis of a wheelchair (i.e. the vertical axis around which the wheelchair turns toward the left or right) is between the drive wheels. If the combined center of gravity of the wheelchair and user is ahead of the drive wheels and more on the casters that are free to turn (as is usually the case with rear-wheel-drive wheelchairs), the wheelchair will tend to turn downhill on a side-slope (“downhill turning tendency”). If the combined center of gravity of the wheelchair and user is behind the drive wheels (as is usually the case with front-wheel-drive wheelchairs), the wheelchair will tend to turn uphill on a side-slope (“uphill turning tendency”).

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - Slightly behind and downhill from the wheelchair.
- Risks requiring spotter intervention:
  - Sideways tip or fall downhill.

Equipment
- Incline of 5°, at least 2.5 m long (in the line of progression) and at least 1.5 m wide.
- Starting and finish lines perpendicular to the line of progression.
- At least an extra 1.5 m before the starting line and beyond the finish line.
- Means of monitoring if any of the downhill wheels drift or turn downhill by greater than 10 cm from the starting position. The slope-level transition can be used, or any line parallel to it.

Starting positions
- Wheelchair: With the wheel locks off, and all wheels on the sloped surface, oriented in the line of progression across the slope. The downhill drive wheel is positioned 10 cm up the slope from the line used to detect if the wheelchair has turned downhill. The axles of the leading wheels must be behind the starting line. The casters should be trailing appropriately for the direction of travel so that there is no initial deflection of the
wheelchair due to the casters realigning themselves. If the subject wishes to perform the
skill in the backward direction, the tester may assist the subject in getting the wheelchair
into position to do so.

Instructions to subject
- Optional screening questions: “Can you…?”
- “Move the wheelchair straight across the slope to the finish position (indicate it).”
- “Now do the same thing in the other direction.”

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The skill may be performed in the forward or backward direction.
  - The leading wheels cross the finish line.
  - No downhill wheel crosses the line 10 cm downhill from the starting position.
- “Partial pass”: As for the general scoring criteria.
  - The subject covers < 2 m in both directions.
  - The subject is successful in one direction, but not the other.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations for caregivers
- The caregiver’s feet need not remain above the line being avoided because the
caregiver’s usual position relative to the wheelchair is slightly downhill to the
wheelchair.

Special considerations for manual wheelchairs
- An advanced-pass score may be awarded if the subject performs the skill in the wheelie
position but the wheelie position is not necessary for an advanced-pass score.

Special considerations for powered wheelchairs
- A front-wheel-drive wheelchair will tend to self-steer uphill instead of downhill, but there
is no penalty for this if the wheelchair is able to complete the distance in the space
available without any downhill wheel (e.g. a rear caster) in contact with the surface
moving below the line.
5.21 ROLLS ON SOFT SURFACE

Versions applicable
- Manual wheelchair: ✔ (skill #19)
- Powered wheelchair: ✔ (skill #20)

Description
- The subject moves the wheelchair a short distance on a soft surface.

Rationale
- There are many types of soft surfaces (e.g. carpet, dirt, grass, gravel, sand or snow) that a wheelchair user may encounter. Propulsion is more difficult on such surfaces (increased rolling resistance) because the wheels tend to sink into the surface, especially wheels that are narrow or of small diameter.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Behind the wheelchair, holding onto a spotter strap with one hand (if a manual wheelchair).
- Risks requiring spotter intervention:
  - Rear tip when accelerating.
  - Overuse injury due to the additional forces needed.

Equipment
- Pathway that includes a soft surface at least 2.5 m long and at least 1.5 m wide.
- There should be an additional 1.5 m of soft surface before the starting line and 1.5 m beyond the finish line.
- A gym mat (5 cm thick) is often used indoors as an example of a soft surface because it is readily available and easy to keep clean. Outdoor examples of soft surfaces include gravel, sand or grass.
- Note: Some sand and gravel pits have lips that make it difficult to get into and out of them. It is the 2 m of soft surface that is the focus of this skill, not the entry and exit.

Starting positions
- Wheelchair: Fully on the soft surface with the leading wheel axles behind the starting line. If the subject wishes to perform the skill in the backward direction, the tester may assist the subject in getting the wheelchair into position to do so.
Instructions to subject

- Optional screening questions: “Can you...?”
- “Move the wheelchair to the finish position (indicate it).”

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The leading wheel axles are moved beyond the finish line.
  - All techniques are permitted, such as forward or backward approaches.
  - During the course of any single attempt, a subject may use different approaches.
- “Partial pass”: As for the general scoring criteria.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations for manual wheelchairs

- The wheelchair user may use the feet.
- Examples of advanced technique include popping the casters slightly off the soft surface and moving the wheelchair well forward with each propulsion cycle. Alternatively, an advanced-pass score may be awarded if the subject performs the skill in the wheelie position.

Special considerations for powered wheelchairs

- The wheelchair user may use the wheelchair’s body positioning options (e.g. tilt, recline, leg-rest elevation) to reduce the weight on the smaller wheels.
5.22 GETS OVER OBSTACLE

Versions applicable
- Manual wheelchair: ✔ (skill #20)
- Powered wheelchair: ✔ (skill #21)

Description
- The subject moves the wheelchair over an obstacle.

Rationale
- Wheelchair users often encounter obstacles (e.g. door thresholds) of various sizes and shapes that they may not be able to simply roll over. Alternative strategies may be needed. For example, a manual wheelchair user might need to pop the casters over the obstacle whereas a powered wheelchair user might need to change the mode setting to one with more power.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If using a single spotter, he/she should be behind the wheelchair, holding onto a spotter strap with one hand (if a manual wheelchair) and holding the other hand in front of the wheelchair user’s shoulder.
  - If using two spotters (as is recommended), the second spotter should stand to one side of the level change.

  - Risks requiring spotter intervention:
    - Rear tip when accelerating to pop casters from the surface (if a manual wheelchair).
    - Forward tip or fall if the casters strike the obstacle.

Equipment
- Path on a smooth level surface that is at least 1.5 m wide, at least 3 m long before the obstacle (for subjects who use a moving approach) and at least 1.5 m after the obstacle.
- Obstacle 5 cm high, 10 cm across (in the line of progression) and at least 1.5 m wide, rectangular in cross-section (i.e. a vertical front face without a bevel).
- The obstacle should be secured to sufficiently withstand horizontal forces.
- The obstacle may be free-standing or braced across a doorway.

Starting positions
- Wheelchair: Facing the obstacle with the leading wheels at least 1.5 m from it.

Instructions to subject
- Optional screening questions: “Can you...?” If the subject answers “no”, the tester should repeat the question regarding an obstacle lower in height.

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- “Get your wheelchair over the obstacle.”

**Capacity scoring criteria**
- “Advanced pass”: As for the general scoring criteria.
  - A moving approach to the obstacle is used.
- “Pass”: As for the general scoring criteria.
  - All parts of the wheelchair must pass beyond the obstacle.
- “Partial pass”: As for the general scoring criteria.
  - At least the casters are over the 5-cm-high obstacle.
  - The subject is successful on a lower obstacle (e.g. 2.5 cm high), if one is available.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

**Special considerations for caregivers**
- A caregiver may request assistance from the wheelchair user during this skill, in the form of having the wheelchair user lean backward or forward at the caregiver’s direction, to facilitate the different stages of the skill.

**Special considerations for manual wheelchairs**
- The wheelchair user is permitted to use his/her feet or stand up to get over the obstacle.

**Special considerations for powered wheelchairs**
- The wheelchair user may use the wheelchair’s body positioning options (e.g. tilt, recline, leg-rest elevation) to reduce the weight on the smaller wheels or to clear the footrests.
- If the subject approaches the obstacle with excessive speed, leading to unnecessary jarring and potential loss of control, an advanced-pass score should not be awarded and a comment should be recorded.

**Special considerations for scooters**
- If the subject approaches the obstacle with excessive speed, leading to unnecessary jarring and potential loss of control, an advanced-pass score should not be awarded and a comment should be recorded.
5.23 GETS OVER GAP

Versions applicable

- Manual wheelchair: ✔ (skill #21)
- Powered wheelchair: ✔ (skill #22)

Description

- The subject moves the wheelchair over a gap across the line of progression.

Rationale

- A gap in surface support is a commonly encountered barrier (e.g. due to a rut in the road, a water channel or a space between a subway platform and a subway train). Gaps that only affect one wheel at a time are not usually major obstacles. In this section, only gaps that are as wide as the wheelchair will be considered. Small-diameter wheels (such as casters) can drop into such gaps, causing a sudden deceleration that can tip the wheelchair over forward or lead to the wheelchair user falling out of the wheelchair. Even if no tip or fall occurs, it can be difficult to get the wheelchair out of the gap.

Prerequisites

- None.

Spotter considerations

- Spotter starting position:
  - If using a single spotter, he/she should be behind the wheelchair, holding onto a spotter strap with one hand (if a manual wheelchair) and holding the other hand in front of the wheelchair user’s shoulder.
  - If using two spotters (as is recommended), the second spotter should stand to one side of the gap.
- Risks requiring spotter intervention:
  - Rear tip when accelerating to pop casters from surface (if a manual wheelchair).
  - Forward tip or fall if the casters drop into the gap.

Equipment

- Path on a smooth level surface that is at least 1.5 m wide, at least 3 m long before the gap (for subjects who use a moving approach) and at least 1.5 m after the gap.
- The gap should be ~5 cm deep, the full width of the path and 15 cm across (in the line of progression).
- If a gap is not readily available, one can be easily simulated. For instance, two folding tables (with the legs folded), two wooden platforms or two gym mats can be put close together.

Starting positions

- Wheelchair: Leading wheels at least 1.5 m in front of the gap.

Instructions to subject
• Optional screening questions: “Can you...?” If the subject answers “no”, the tester should repeat the question regarding a gap with smaller dimensions.

• “Get your wheelchair over the gap (indicate it).”

Capacity scoring criteria

• “Advanced pass”: As for the general scoring criteria.
  • A moving approach to the obstacle is used.

• “Pass”: As for the general scoring criteria.
  • The task is over when all components of the wheelchair are on the level surface beyond the gap.

• “Partial pass”: As for the general scoring criteria.
  • At least the casters get beyond the gap.
  • A partial-pass score may be awarded if the subject is successful over a gap with smaller dimensions (e.g. 7.5 cm in the line of progression or only 2.5 cm deep), if one is available.

• “Fail”: As for the general scoring criteria.

• “Not possible”: This score is not an option for this skill.

• “Testing error”: As for the general scoring criteria.

• Comments recorded: As for general scoring criteria.

Special considerations for caregivers

• As for “the gets over obstacle” skill.

Special considerations for manual wheelchairs

• As for “the gets over obstacle” skill.

Special considerations for powered wheelchairs

• As for “the gets over obstacle” skill.
5.24 ASCENDS LOW CURB

Versions applicable
- Manual wheelchair: ✔ (skill #22)
- Powered wheelchair: ✔ (skill #23)

Description
- The subject gets the wheelchair up a low curb.

Rationale
- Level changes (e.g. curbs, home entries, uneven sidewalk sections) are common obstacles in the natural and built environments. The ability to manage low curbs is useful but practice on low curbs also provides an opportunity to hone techniques that will be needed for higher curbs.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - For this and later curb-handling and stairs skills, a spotter strap is of little use if a sideways tip or fall occurs.
  - If using a single spotter, he/she should be behind the wheelchair, with both hands close to the push-handles (if any) or close to the backrest components to best guard against a sideways tip if one wheel goes up the curb before the other. If there are no push-handles, some other fixed portion of the wheelchair or the wheelchair user may be used.
  - If using two spotters (as is recommended), the second spotter should stand to one side of the level change.
  - Risks requiring spotter intervention:
    - Rear tip when accelerating to pop casters from surface (if a manual wheelchair).
    - Forward tip or fall if the casters strike the curb.
    - Sideways tip if one wheel gets up onto the upper level before the other.

Equipment
- Path on a smooth level surface that is at least 1.5 m wide and at least 3 m long before the curb (for subjects who use a moving approach). The pathway on the upper level leading away from the curb edge should be at least 1.5 m wide and at least 1.5 m long.
- The curb should be 5 cm high.
- The nosing of the curb should be gently rounded.
- Bracing a simulated curb (e.g. a wooden platform or folded table) against a solid object (e.g. a wall) or weighting it is usually needed to prevent it from moving when it is struck by the wheelchair.

Starting positions
• Wheelchair: All wheels are on the level surface below the curb, facing the curb and at least 1.5 m from it.

Instructions to subject
• Optional screening questions: “Can you...?”
• “Get the wheelchair up on the curb.”

Capacity scoring criteria
• “Advanced pass”: As for the general scoring criteria.
  • A moving approach to the obstacle is used.
• “Pass”: As for the general scoring criteria.
  • The task is complete when all wheels are on the upper surface, with the wheelchair user seated upright in the wheelchair.
  • The subject may remove the footrests and reposition the rear anti-tip devices but must do so independently.
  • The wheelchair user may get out of the wheelchair to accomplish the task.
  • Curb-climbing aids may be used if the wheelchair is equipped with these devices, but the subject must be able to activate and inactivate the aids independently.
• “Partial pass”: As for the general scoring criteria.
  • If moving forward, the subject gets the casters, but not the rear wheels, up onto the upper level.
  • If moving backward, the subject gets the rear wheels, but not the casters, up onto the upper level.
  • The subject successfully ascends a smaller level change (e.g. 2.5 cm high), if one is available.
• “Fail”: As for the general scoring criteria.
• “Not possible”: This score is not an option for this skill.
• “Testing error”: As for the general scoring criteria.
• Comments recorded: As for general scoring criteria.

Special considerations for caregivers
• As for the “gets over obstacle” skill.
• If a caregiver uses poor ergonomic technique (e.g. lifting rather than rolling the wheelchair up onto the upper level), no more than a pass score should be awarded.

Special considerations for manual wheelchairs
• As for the “gets over obstacle” skill.

Special considerations for powered wheelchairs
• As for the “gets over obstacle” skill.
5.25 DESCENDS LOW CURB

Versions applicable
- Manual wheelchair: ✓ (skill #23)
- Powered wheelchair: ✓ (skill #24)

Description
- The subject gets the wheelchair down a low curb.

Rationale
- As for the “ascends low curb” skill.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If the wheelchair user uses the forward direction, simply rolling off the low curb, the spotter may simply stand on the lower level close enough to intervene if the wheelchair tips forward or the wheelchair user falls from the wheelchair.
  - If the task is performed forward in the wheelie position, the spotter should be behind the wheelchair, with one hand close to each push-handle (if a manual wheelchair) to best avoid a sideways tip if one wheel descends before the other. If a second spotter is available, he/she should be on the lower level.
  - If the wheelchair user uses the backward technique, the spotter should be standing on the lower level with the hands positioned near the push-handles (if a manual wheelchair).
- Risks requiring spotter intervention:
  - Forward tip or fall from the wheelchair if the task is performed by rolling forward off the curb.
  - Rear tip if performed in the backward direction.
  - Rear tip if performed forward in the wheelie position.
  - Sideways tip if one wheel drops off the upper level before the other.

Equipment
- As for the “ascends low curb” skill except, because many subjects can descend level changes from a higher level than they can ascend, some alternative means (e.g. an incline) of getting to the upper level is recommended.

Starting positions
- Wheelchair: All wheels are on the level surface above the curb edge, facing the edge, with the leading wheels at least 0.5 m away from it.

Instructions to subject
- Optional screening questions: “Can you...?”
“Get the wheelchair down to the lower level.”

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
  - Descending forward in the wheelie position or using the moving transient-caster-pop technique generally warrant an advanced-pass score but these methods are not necessary for this score.
- “Pass”: As for the general scoring criteria.
  - The task is complete when all wheels are on the lower level, the wheelchair user is seated upright in the wheelchair and the wheelchair is free to roll away (i.e. not hung up on the footrests or rear anti-tip devices).
  - The wheelchair user may get out of the wheelchair to accomplish the task.
  - The subject may remove the footrests and reposition the rear anti-tip devices but must be able to do so independently.
- “Partial pass”: As for the general scoring criteria.
  - The subject successfully descends a smaller level change (e.g. 2.5 cm high), if one is available.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

**Special considerations for caregivers**

- A caregiver of a manual wheelchair user may request assistance from the wheelchair user during this skill if performed in the backward direction, in the form of having the wheelchair user lean forward then backward at the caregiver’s direction, to facilitate the different stages of the skill.
5.26 ASCENDS HIGH CURB

Versions applicable

- Manual wheelchair: ✓ (skill #24)
- Powered wheelchair: X

Description

- The subject ascends a high curb.

Rationale

- As for the “ascends low curb” skill. Although curb cuts (“pedestrian ramps”) are now commonplace in many parts of the world, curbs or large level changes are still commonly encountered. This skill is not applicable for most powered wheelchairs and scooters because of the difficulty and danger involved.

Prerequisites

- “Ascends low curb” skill.

Spotter considerations

- As for the “ascends low curb” skill.

Equipment

- As for the “ascends low curb” skill except the curb is 15 cm high.

Starting positions

- As for the “ascends low curb” skill.

Instructions to subject

- Optional screening questions: “Can you...?”
- “Get the wheelchair up on the curb.”

Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
  - As for the “ascends low curb” skill.
- “Pass”: As for the general scoring criteria.
  - As for the “ascends low curb” skill.
- “Partial pass”: As for the general scoring criteria.
  - As for the “ascends low curb” skill.
  - The subject successfully performs the skill using a 10 cm curb (if one is available).
- “Fail”: As for the general scoring criteria and the “ascends low curb” skill.
  - An automatic “fail” score should be awarded if the subject has failed the “ascends low curb” skill.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
• Comments recorded: As for general scoring criteria.

**Special considerations**

• As for the “ascends low curb” skill.
5.27 DESCENDS HIGH CURB

Versions applicable
- Manual wheelchair: ✔ (skill #25)
- Powered wheelchair: X

Description
- The subject gets the wheelchair down a high curb.

Rationale
- As for the “descends low curb” skill. The appropriate technique for a high curb differs in some respects from that used for a lower curb height. The high-curb skill is not applicable for most powered wheelchairs and scooters because of the difficulty and danger involved.

Prerequisites
- “Descends low curb” skill.

Spotter considerations
- Spotter starting position:
  - As for the “descends high curb” skill.
- Risks requiring spotter intervention:
  - As for the “descends high curb” skill.

Equipment
- As for “ascends high curb” skill.

Starting positions
- Wheelchair: The leading wheels at least 0.5 m from the curb edge.

Instructions to subject
- Optional screening questions: “Can you...?”, “How?” If a method is described that the tester has concerns about, from the perspective of being able to spot the skill in a manner that is safe for both the subject and test personnel, the tester may allow the subject to choose another method without penalty.
  - “Get the wheelchair down the curb.”

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
  - As for the “descends low curb” skill.
- “Pass”: As for the general scoring criteria.
  - As for the “descends low curb” skill.
- “Partial pass”: As for the general scoring criteria.
  - As for the “descends low curb” skill.
  - The subject successfully performs the skill using a 10 cm curb (if one is available).
• “Fail”: As for the general scoring criteria.
  • A “fail” score should be automatically awarded if the subject fails the “descends low curb” skill.
• “Not possible”: This score is not an option for this skill.
• “Testing error”: As for the general scoring criteria.
• Comments recorded: As for general scoring criteria.

Special considerations for caregivers
• Serious jarring can occur if a caregiver attempts to bring the wheelchair off the curb backward in the wheelie position. The tester or trainer should intervene and award a fail score.
5.28 PERFORMS WHEELCHAIR-GROUND TRANSFERS

Versions applicable
- Manual wheelchair: ✔ (skill #26)
- Powered wheelchair: ✔ (skill #25)

Description
- The wheelchair user gets from the wheelchair to the ground and back.

Rationale
- Getting to and from the ground is useful for an activity (e.g. gardening or playing with a child). Getting from the ground back into the wheelchair can also be helpful when recovering from a tip or fall.

Prerequisites
- “Performs level transfers” skill.

Spotter considerations
- Spotter starting position:
  - If there is a single spotter, he/she should be near the wheelchair, in a position to prevent the wheelchair from tipping over and to prevent the subject from falling to the ground.
  - If two spotters are used, one spotter should focus on the wheelchair user and the other spotter on preventing the wheelchair from sliding or rolling away. However, the second spotter should not touch the wheelchair unless it is necessary to intervene.
- Risks requiring spotter intervention:
  - Rear, forward or sideways tip or fall.

Equipment
- Smooth level surface. It is permissible to use a thin cushioned mat on the floor to protect the skin and to avoid soiling the clothes.

Starting positions
- Wheelchair user:
  - Seated in the wheelchair, facing the mat (if any).
  - Once on the ground, the subject may be seated in whatever position he/she chooses on completion of the initial transfer to the ground.

Instructions to subject
- Optional screening questions: “Can you...?”
- If the tester has doubts about the ability of the subject to perform this skill, he may wish to ensure that enough assistance or equipment is available to assist the subject back into the wheelchair.
  - “Get yourself onto the ground.”
  - “Now, get back into the wheelchair.”
Capacity scoring criteria

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - The transfer to the floor is complete when the subject is seated on the floor, on a mat (if provided) or on his/her own cushion if it has been removed.
  - The transfer back into the wheelchair is complete when the subject is on the wheelchair seat, ready to roll away. If the subject removes the seat cushion as part of his/her technique, it is required that the cushion be picked up but it is not necessary to get the cushion back under the buttocks. This is in recognition that the wheelchair user is usually able to go to another sitting surface and transfer out of the wheelchair to replace the cushion.
  - No external aids (e.g. the transfer bench, stairs or a lift) may be used.
- “Partial pass”: As for the general scoring criteria.
  - The subject can get to the ground, but not back into the wheelchair, or vice versa.
- “Fail”: As for the general scoring criteria.
  - An automatic fail score is awarded if the subject failed the “performs level transfers” skill.
  - The subject does not describe a safe and effective method.
- “Not possible”: This is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations for caregivers

- The caregiver may receive assistance from the wheelchair user in performing the skill. It is not a reasonable expectation that a single caregiver could carry out this skill alone.

Special considerations for powered wheelchairs

- If the powered wheelchair has positioning options (e.g. seat-height variation), they may be used.
5.29 PERFORMS STATIONARY WHEELIE

Versions applicable
- Manual wheelchair: ✔ (skill #27)
- Powered wheelchair: ✗

Description
- The subject achieves the wheelie position (balancing on the rear wheels), maintains it for a period of time and brings the casters back to the floor.

Rationale
- The stationary wheelie is a foundation skill for a number of functional skills that can be best performed in the wheelie position, skills such as descent of a steep incline or descent of a high curb. The stationary wheelie position can also be used to avoid postural problems that can cause neck strain from looking up. This skill is not applicable for most powered wheelchairs and scooters.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - Usually the spotter stands behind the wheelchair holding onto a spotter strap.
  - The skill can also be spotted from a sitting or crouching position in front of and to one side of the wheelchair, with a hand ready to apply a downward and backward force to the wheelchair user’s knee or a fixed part of the wheelchair.
- Risks requiring spotter intervention:
  - Rear tip if the subject overshoots on take-off or loses balance.

Equipment
- As for the “turns in place” skill.
- Means (e.g. a tape measure) of measuring distance.

Starting positions
- Wheelchair: As for the “turns in place” skill.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Get the wheelchair into the wheelie position and hold it until I tell you to stop. Keep the wheelchair as close to the starting position as possible (indicate the lines).”
- After 30s, "Come down now."

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
• The subject achieves the wheelie position and holds this position in a controlled manner for ≥ 30 seconds.

• After 30 s, a controlled return to the upright position is made. The subject must wait for the instruction to bring the casters back to the floor before doing so.

• It is permissible to use the feet to achieve the wheelie position but not to maintain it.

• “Partial pass”: As for the general scoring criteria.
  • The subject achieves the wheelie position and holds this position in a controlled manner for ≥ 15 seconds.
  • The subject performs an aided-wheelie (casters off the floor, balanced on rear anti-tip devices).

• “Fail”: As for the general scoring criteria.
  • The subject does not achieve the wheelie position.
  • The subject achieves the wheelie position but holds it for < 15 sec.

• “Not possible”: This score is not an option for this skill.

• “Testing error”: As for the general scoring criteria.

• Comments recorded: The direction and extent (if > 0.5 m) of any horizontal displacement between the starting point and the rear-wheel axles after landing from the wheelie position.

**Special considerations for caregivers**

• There is no need for a caregiver to maintain the wheelie for 30 s as long as the tester is satisfied that the caregiver has achieved the balance position correctly and is capable of maintaining it.
5.30 TURNS IN PLACE IN WHEELIE POSITION

Versions applicable
- Manual wheelchair: ✔ (skill #28)
- Powered wheelchair: X

Description
- In the wheelie position, the subject turns the wheelchair around to the left and right to face in the opposite direction, in as tight a space as possible.

Rationale
- As for the “turns in place” skill.
- Wheelchair users often encounter situations in which they need to perform a wheelie to make a tight turn. The area needed on the support surface (the “footprint”) is less in the wheelie position than when all wheels are on the surface.

Prerequisites
- “Performs stationary wheelie” skill.

Spotter considerations
- As for the “performs stationary wheelie” skill.

Equipment
- As for the “turns in place” skill.

Starting positions
- As for the “turns in place” skill.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Get the wheelchair into the wheelie position.”
- “Keeping the wheelchair in as tight a space as possible, turn the wheelchair around until you are facing in the opposite direction.”
- If necessary, the wheelchair is repositioned over the starting position.
- “Now turn the chair in the other direction (indicate it) until it is back where you started.”

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
- As for the “turns in place” skill.
- “Pass”: As for the general scoring criteria.
- As for the “turns in place” skill.
- The wheelchair must be kept in the wheelie position throughout the turn.
- The casters may be returned to the floor between the turns to the left and right.
- “Partial pass”: As for the general scoring criteria.
- As for the “turns in place” skill.
• “Fail”: As for the general scoring criteria.
  • As for the “turns in place” skill.
  • An automatic “fail” score is awarded if the subject fails the “performs stationary wheelie” skill.
• “Not possible”: This score is not an option for this skill.
• “Testing error”: As for the general scoring criteria.
• Comments recorded: As for the “turns in place” skill.

### Special considerations

- The caregiver’s feet should be considered equivalent to a wheel touching the ground for the purpose of measuring any dimensions.
5.31 ROLLS FORWARD AND BACKWARD IN WHEELIE POSITION

Versions applicable
- Manual wheelchair: ✓ (skill #29)
- Powered wheelchair: X

Description
- The wheelchair user achieves the wheelie position, and then moves the wheelchair forward (and later backward) a short distance in this position.

Rationale
- Moving forward in the wheelie position is useful when approaching obstacles for which it is advantageous to have the casters off the surface (e.g. for the descent of high curbs or the descent of steep inclines). Moving backward in the wheelie position is useful in tight spaces, where it is not possible to turn around, for instance to raise the casters over an obstacle (e.g. a stick on the ground or a towel on a bathroom floor). Also, the backward skill allows the wheelchair user to ease up to a wall or object against which he/she can lean (i.e. for the tilt-rest variation of the “relieves pressure from buttocks” skill).

Prerequisites
- The “performs stationary wheelie” skill.

Spotter considerations
- As for the “performs stationary wheelie” skill.

Equipment
- A smooth level surface, 2 m long and at least 1.5 m wide.
- Starting and finish lines at 0 and 2 m. The finish line for the forward component of the skill can function as the starting line for the backward component.
- Space at least 1.5 m before the starting line and beyond the finish line.
- Note: The floor markings for the “turns in place” skill can be used.

Starting positions
- Wheelchair: The wheelchair user is seated in the wheelchair with the leading wheels behind the starting line. The casters are the leading wheels for the forward component of the skill and the rear wheels are the leading wheels for the backward component.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Get into the wheelie position and push the wheelchair straight forward until I ask you to stop.” After crossing the finish line, “Stop.”
- After the subject completes the skill attempt in the forward direction, the tester repeats the test in the backward direction.

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
“Pass”: As for the general scoring criteria.
- The subject is required to achieve the wheelie position and travel 2 m in both directions.
- The subject should come to a stop at or beyond the finish line, at the tester’s command, before allowing the casters to touch the floor.
- The subject may bring the casters back to the floor between the forward and backward skills, but need not do so.

“Partial pass”: As for the general scoring criteria.
- The subject performs the skill successfully in one direction, but not the other.
- The subject can perform the skill in both directions for $\geq 1.0$ m.

“Fail”: As for the general scoring criteria.
- An automatic fail score should be awarded if the subject has failed the “stationary wheelie” skill.

“Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

Special considerations
- None.
5.32 DESCENDS HIGH CURB IN WHEELIE POSITION

Versions applicable
- Manual wheelchair: ✔ (skill #30)
- Powered wheelchair: X

Description
- In the wheelie position, the subject Descends a high curb in the forward direction.

Rationale
- Large level changes (e.g., curbs) are common obstacles for wheelchair users. Using a wheelie to descend a level change in the forward direction allows the wheelchair user to maintain forward movement and to see any dangers that lie ahead. Also, the wheelie position prevents the footrests from making contact with the lower level, which can decelerate the wheelchair and cause a forward tip or fall from the wheelchair.

Prerequisites
- “Performs stationary wheelie” skill.

Spotter considerations
- Spotter starting position:
  - For a single spotter behind the wheelchair, both of the spotter’s hands should be placed near the push-handles of the wheelchair.
  - If using two spotters, as is recommended, the spotter behind the wheelchair should have his/her hands near the push-handles and the second spotter should stand beside and below the curb.
- Risks requiring spotter intervention:
  - Rear tip.
  - Forward tip or fall.
  - Sideways tip if one wheel drops off the upper level before the other.

Equipment
- As for the “descends high curb” skill.

Starting positions
- As for the “descends high curb” skill.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Get your wheelchair into the wheelie position.”
- “Now, staying in the wheelie position, move forward down the curb under control.”

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
The subject achieves a controlled wheelie on the upper level, approaches the curb by moving forward in this position and then lowers the rear wheels to the lower level under control with the rear wheels striking the floor before the casters.

- “Partial pass”: As for the general scoring criteria.
- The subject performs the skill on a 10 cm curb, if one is available.
- “Fail”: As for the general scoring criteria.
  - An automatic fail score should be awarded if the subject has failed the “performs stationary wheelie” skill.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

**Special considerations**

- None.
5.33 DESCENDS STEEP INCLINE IN WHEELIE POSITION

Versions applicable
- Manual wheelchair: ✔ (skill #31)
- Powered wheelchair: X

Description
- In the wheelie position, the subject moves the wheelchair from a level surface down a steep incline to another level surface, stopping part way.

Rationale
- Descending a steep incline in the forward direction in the wheelie position lessens the problem of loss of traction (affecting braking and control) when the uphill wheels become unloaded. This technique also reduces the likelihood of forward tips or digging the footrests into the floor at the transition between the bottom of the incline and the level surface. For very steep inclines, this technique may be the only way to get down the incline without tipping over. Stopping part-way down the incline demonstrates control.

Prerequisites
- “Performs stationary wheelie” skill.

Spotter considerations
- As for “descends steep incline”.

Equipment
- As for “descends steep incline”.

Starting positions
- As for “descends steep incline”.

Instructions to subject
- Optional screening questions: “Can you...?”
- “Get your wheelchair into the wheelie position.”
- “Now, staying in the wheelie position, move the wheelchair down the ramp under control, stopping about half-way down.”
- After the stop: “Carry on to the bottom and and stop when you are off the ramp.”

Capacity scoring criteria
- “Advanced pass”: As for the general scoring criteria.
  - As for “descends steep incline” skill.
- “Pass”: As for the general scoring criteria.
  - The subject achieves the wheelie position on the platform above the incline, proceeds down the incline with the wheelchair under control.
  - The subject brings the wheelchair to a stop about half-way down the incline and at the bottom of the ramp. The casters may be brought to the surface as soon as
the rear wheels have reached the level surface at the bottom.

- “Partial pass”: As for the general scoring criteria.
  - The subject proceeds at least 2 m down the incline.
  - The subject successfully performs the skill on a slight incline (5°).
- “Fail”: As for the general scoring criteria.
  - An automatic “fail” score should be awarded if the subject fails the “performs stationary wheelie” skill.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

**Special considerations**

- None.
5.34 ASCENDS STAIRS

**Versions applicable**
- Manual wheelchair: ✅ (skill #32)
- Powered wheelchair: ✗

**Description**
- The wheelchair user and the wheelchair get from the bottom of a set of stairs to the top.

**Rationale**
- Although alternative means of getting from a lower to a higher level are often present (e.g. using a ramp or elevator), stairs may sometimes be the only option. Although exceptional manual wheelchair users can accomplish this skill alone while sitting in the wheelchair, this method is not recommended due to the ergonomic stresses on the arms involved. Getting out of the wheelchair or using caregivers to assist with stair ascent is a more reasonable approach. Stair ascent is not generally applicable to powered wheelchairs and scooters.

**Prerequisites**
- None.

**Spotter considerations**
- Spotter:
  - The spotter considerations vary depending upon the method used and the number of spotters available.
  - Regardless of the method used, at least one spotter should be below the wheelchair user on the stairs.
  - If the wheelchair user is in the wheelchair, the spotter below the wheelchair should use one or both hands near or holding a fixed part of the wheelchair. If holding a wheelchair part, it is important to avoid assisting or interfering with the performance of the task unless deliberately intervening.
  - If the wheelchair user is in the wheelchair and two spotters are available, one should be above (with the hands near the push-handles) and one below the wheelchair.

- Risks requiring spotter intervention:
  - Forward or rea tip or fall.
  - Runaway down the stairs.

**Equipment**
- In describing a set of stairs, one refers to the horizontal and vertical dimensions as the “run” and “rise” respectively.
- There should be at least 3 stairs, each with the following approximate dimensions – 18 cm rise, 28 cm run and width of at least 1.2 m. Although 3 stairs are not many, they are representative of the skills needed for a full flight of steps (10-11).
- Rails should be available on both sides, at a height above the steps of about 90 cm. The
rails should extend horizontally beyond the upper and lower stair boundaries by 30 cm or more.

- The set of stairs should end at the upper end on a level surface or platform that is at least 2 m². A lip around the open edges of the platform is recommended.
- No external aids (e.g. stair lift) may be used.

**Starting positions**

- Wheelchair: Facing the stairs at least 0.5 m from the bottom stair.

**Instructions to subject**

- Optional screening questions: “Can you...?”
- “Get yourself and the wheelchair up the stairs.”

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
- “Pass”: As for the general scoring criteria.
  - Any effective and safe technique is performed, as long as at least 3 stairs are completed with the wheelchair user and wheelchair coming to rest on the level surface above the stairs. If the subject uses the “out-of-wheelchair” method, he/she does not need to get back into the wheelchair because this is tested elsewhere (in the “performs wheelchair-ground transfers” skill).
- “Partial pass”: As for the general scoring criteria.
  - The subject successfully ascends ≥ 2 stairs.
  - The subject successfully ascends a set of stairs with longer runs and/or lower rises.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
- Comments recorded: As for general scoring criteria.

**Special considerations for caregivers**

- The caregiver may receive assistance from the wheelchair user in performing the skill.
5.35 DESCENDS STAIRS

Versions applicable
- Manual wheelchair: ✓ (skill #33)
- Powered wheelchair: X

Description
- The wheelchair user and the wheelchair get from the top of a set of stairs to the bottom.

Rationale
- As for the “ascends stairs” skill. Although there is still a potential for injury due to a fall, descent is much less strenuous than ascent. Many wheelchair users who cannot ascend stairs independently can descend them. The stair descent skill is not generally applicable to powered wheelchairs and scooters.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - As for the “ascends stairs” skill.
  - If the wheelchair user is proceeding independently down the stairs in the backward direction, the spotter should be behind the wheelchair with the hands near the push-handles.
  - If the wheelchair user is proceeding independently down the stairs in the forward direction in the wheelie position, at least two spotters should be involved. One or two spotters should be below the wheelchair with the hands near a fixed front part of the wheelchair to resist tipping or runaway. The uphill spotter should be above the wheelchair with the hands near the push-handles to react to forward, backward or sideways tips, or runaway.
- Risks requiring spotter intervention:
  - Forward, rear or sideways tip or fall.
  - Runaway down the stairs.

Equipment
- As for the “ascends stairs” skill.
- Because it is often possible to descend stairs that cannot be ascended, an alternative means (e.g. a ramp or lift) should be available to get the wheelchair and user to the top of the stairs.

Starting positions
- Wheelchair: Facing the top of the stairs, with the leading wheels at least 0.5 m from the edge of the top stair.

Instructions to subject
- Optional screening questions: “Can you...?”, “How?” The tester needs to know what method
the subject plans to use in order to approve the attempt and to position the spotter(s).

- “Get yourself and the wheelchair down the stairs.”

**Capacity scoring criteria**

- “Advanced pass”: As for the general scoring criteria.
  - As for the “ascends stairs” skill.
- “Pass”: As for the general scoring criteria.
  - As for the “ascends stairs” skill.
- “Partial pass”: As for the general scoring criteria.
  - As for the “ascends stairs” skill.
  - The subject successfully descends ≥ 2 stairs.
  - The subject successfully descends a set of stairs with longer runs and/or lower rises.
- “Fail”: As for the general scoring criteria.
- “Not possible”: This score is not an option for this skill.
- “Testing error”: As for the general scoring criteria.
  - If it is not possible to get the wheelchair to the top of the stairs.
- Comments recorded: As for general scoring criteria.

**Special considerations for caregivers**

- The caregiver may receive assistance from the wheelchair user in performing the skill.
The relationship between the WST and the WST-Q has been reported in the literature (see http://www.wheelchairskillsprogram.ca/eng/publications.php). The correlation between the total WST and WST-Q capacity scores has been found to be high, although the WST-Q scores tend to be slightly higher. The WST and WST-Q each have advantages and limitations, summarized in Table 6.1.

<table>
<thead>
<tr>
<th>Consideration</th>
<th>WST</th>
<th>WST-Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to administer</td>
<td>~30 minutes</td>
<td>~10 minutes</td>
</tr>
<tr>
<td>Obstacles needed</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Space needed</td>
<td>~1000 square feet</td>
<td>None</td>
</tr>
<tr>
<td>Induces a training effect</td>
<td>Probable (~5%)</td>
<td>None known</td>
</tr>
<tr>
<td>Can assess capacity (can do)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Can assess confidence</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Can assess performance (does do)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Simulated vs. real setting</td>
<td>Simulated usually</td>
<td>Real</td>
</tr>
<tr>
<td>Affected by missing test equipment</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Likelihood of lowered score due to a testing technicality</td>
<td>Occasional</td>
<td>None</td>
</tr>
<tr>
<td>Degree of specificity of settings</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Possibility of a testing error</td>
<td>Occasional</td>
<td>Rare</td>
</tr>
<tr>
<td>Can be administered by phone</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Can be administered by mailed questionnaire</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Can be administered on-line</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Can be completed by a proxy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Requires ability to follow instructions</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Requires ability to communicate</td>
<td>No</td>
<td>Yes (unless proxy)</td>
</tr>
<tr>
<td>Potential to misrepresent functional level</td>
<td>Low</td>
<td>Slightly greater</td>
</tr>
<tr>
<td>Provides detail about how the skills are performed</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Risk of injury</td>
<td>Minimal</td>
<td>None</td>
</tr>
<tr>
<td>Total scores</td>
<td>Slightly lower</td>
<td>Slightly higher</td>
</tr>
</tbody>
</table>

The advantages of the WST-Q include that it requires less time, equipment and space to perform, it does not appear to induce much of a training effect (like the WST may do), it avoids a training-to-the-test effect, it allows one to assess confidence and performance as well as capacity (in the terms of the International Classification of Functioning, Disability, and Health [ICF]), it is more realistic (relating as it does to the subject’s own setting), it is not subject to limitations due to missing test equipment (e.g. a 15 cm curb) at the time of testing, subjects are not likely to receive a lower score due to a testing technicality (e.g. a wheel slightly over a line), the settings are less specifically defined and the WST-Q may be the only option for situations in which objective testing is impractical or impossible (e.g. during
telephone interviews). The WST-Q can be administered by phone, postal questionnaire or online. It can be completed by a proxy. There is no risk of injury.

The limitations of the WST-Q are that the tester must rely on the subject’s ability to understand the questions and to communicate valid answers. This limitation can be offset by having a proxy (e.g. a caregiver) who knows the subject well or a translator assist in providing the answers. There is potential for the subject to overestimate or underestimate his/her capacity and performance. The WST-Q does not provide any detail about how the skills are performed, limiting its usefulness as a guide to intervention (e.g. by altering the wheelchair set-up or by training).

The complementary benefits of the WST and WST-Q can be captured by using them in combination. When doing so, the relevant WST-Q questions for each skill are asked first, then the subject demonstrates the skill (WST) before moving on to the next skill.

### 6.1 Indications

As for the WST, for clinical purposes, the WST-Q can be used early in the course of a rehabilitation program as a diagnostic measure, especially to determine which (if any) skills might be addressed during the rehabilitation process. By repeating the test on completion of the rehabilitation phase (or later during follow-up), the WST-Q can be used as an outcome measure. The WST-Q may also be used for program evaluation, to answer research questions and to assist in wheelchair design.

### 6.2 Contraindications

The WST-Q is only valid if the subject (or proxy) is able to communicate. As a screening procedure, the tester should ask the potential subject about information (e.g. date of birth, diagnosis, length of time using a wheelchair and time up in the wheelchair each day) that can be confirmed by chart review, the nursing staff or family members.

### 6.3 Time Limits

There is no upper time limit for the WST-Q. Rests are permitted but are usually unnecessary because the average time to complete the WST is only about 10 minutes. If the testing is conducted on more than one day, the tester should document the dates.

### 6.4 General Scoring Template for WST-Q Individual Skill Questions

For individual skills, the initial question is about capacity. The capacity question, answer options and definitions are summarized in Table 6.2. A score for this question is mandatory for each skill.
Table 6.2. Capacity Question, Answer Options and Definitions for Each Skill

<table>
<thead>
<tr>
<th>Capacity question: “Can you do it?”</th>
<th>Score</th>
<th>What this means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very well</td>
<td>3</td>
<td>Can do the skill safely and very well.</td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
<td>Can do the skill safely at a basic level.</td>
</tr>
<tr>
<td>Partially</td>
<td>1</td>
<td>Can do the skill in part.</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
<td>Have never done the skill or could not do it right now.</td>
</tr>
<tr>
<td>Not possible with this wheelchair</td>
<td>NP</td>
<td>The wheelchair does not have the parts to allow this skill. (This option is only presented for skills where such a score is a possibility.)</td>
</tr>
<tr>
<td>Testing error</td>
<td>TE</td>
<td>When answers have not been recorded (e.g. inadvertently or because the test subject did not understand the question).</td>
</tr>
</tbody>
</table>

The next question about each individual skill is about confidence. Confidence in one’s ability is an important determinant of the extent to which wheelchair skills are actually used in everyday life. A lack of confidence may be due to a fear of falling or other injury. The answer options and definitions are summarized in Table 6.3. The confidence questions are optional and may be skipped if an assessment of confidence is not one of the purposes of the questionnaire.

Table 6.3. Confidence Question, Answer Options and Definitions for Each Skill

<table>
<thead>
<tr>
<th>Confidence question: “How confident are you?”</th>
<th>Score</th>
<th>What this means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very</td>
<td>3</td>
<td>As of now, I am very confident that I can do this skill safely and consistently.</td>
</tr>
<tr>
<td>Moderately</td>
<td>2</td>
<td>As of now, I am moderately confident that I can do this skill safely and consistently.</td>
</tr>
<tr>
<td>Partly</td>
<td>1</td>
<td>As of now, I am only partly confident that I can do this skill safely and consistently.</td>
</tr>
<tr>
<td>Not at all</td>
<td>0</td>
<td>As of now, I am not at all confident that I can do this skill safely and consistently.</td>
</tr>
<tr>
<td>Not possible with this wheelchair</td>
<td>NP</td>
<td>As for capacity.</td>
</tr>
<tr>
<td>Testing error</td>
<td>TE</td>
<td>As for capacity.</td>
</tr>
</tbody>
</table>

If the answer to the capacity question for a skill is “no”, the score on the confidence question is automatically 0. If the score for capacity is NP, then NP is automatically the score for confidence.

The next question about each individual skill is about performance. The answer options and definitions are summarized in Table 6.4. The performance questions are optional and may be skipped if an assessment of performance is not one of the purposes of the questionnaire.
Table 6.4. Performance Question, Answer Options and Definitions for Each Skill

<table>
<thead>
<tr>
<th>Performance question: “How often do you do it?”</th>
<th>Answer</th>
<th>Score</th>
<th>What this means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td>3</td>
<td>Always when I need or want to do so.</td>
<td></td>
</tr>
<tr>
<td>Usually</td>
<td>2</td>
<td>Usually when I need or want to, but sometimes not.</td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>1</td>
<td>Occasionally when I need or want to, but often not.</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>0</td>
<td>Never or less often than once a year.</td>
<td></td>
</tr>
<tr>
<td>Not possible with this wheelchair</td>
<td>NP</td>
<td>As for capacity.</td>
<td></td>
</tr>
<tr>
<td>Testing error</td>
<td>TE</td>
<td>As for capacity.</td>
<td></td>
</tr>
</tbody>
</table>

WST-Q performance is related to WST-Q capacity, but is also related to personal factors (e.g. age, confidence) and the environment (e.g. weather, architectural barriers, opportunity). Additionally, some skills (e.g. folding/unfolding the wheelchair or transferring to and from the ground) may not need to be performed frequently. Total capacity percentage scores tend to exceed total performance percentage scores. The converse could occur – for instance, if a subject had a number of skills for which the capacity scores were 2 but these skills were always performed when necessary. Also, if a wheelchair user had an acute injury (e.g. a fractured wrist), he/she might be unable to perform a skill currently that he/she had always performed in the past. However, there is no guarantee in such a circumstance that the wheelchair user will ever get back to the earlier level of performance. Therefore, for the purposes of the WST-Q, if the capacity score for an individual skill is 0, the performance score for that skill is also automatically 0. If the score for capacity is NP, then NP is automatically the score for performance.

As for the WST, at the beginning of the WST-Q, if it is decided by the tester or subject that one purpose of the WST-Q is to identify potential training goals then, before the assessment of individual skills, the subject is asked if there are any specific wheelchair skills on which he/she would be interested in receiving training. After the capacity, confidence and performance questions have been answered (regardless of the scores recorded) and if an assessment of training goals is one of the purposes of the assessment, the final question for each skill is about training goals. The goal question, answer options and definitions are summarized in Table 6.5.

Table 6.5. Training Goal Question, Answer Options and Definitions for Each Skill

<table>
<thead>
<tr>
<th>Question: “Is this a training goal?”</th>
<th>Possible Answers</th>
<th>What This Means</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>I am interested in receiving training for this skill.</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>I am not interested in receiving training for this skill.</td>
<td></td>
</tr>
</tbody>
</table>

On completion of the assessment of individual skills, the subject is asked if there are any other skills on which he/she would be interested in receiving training.
6.5 Scoring Algorithm for Individual Skill Questions

The algorithm for the individual skill questions is shown in Figure 6.1.

![Scoring algorithm for individual skill questions.](image)

6.6 Calculated Scores

The total score for capacity that can be calculated from the WST-Q data is identical to that for the WST described earlier. Additionally, for the WST-Q, total confidence and performance scores can also be calculated as follows:

- Total Confidence Score = \frac{\text{sum of individual skill scores}}{\left(\text{number of possible skills} - \text{number of NP scores} - \text{number of TE scores}\right) \times 3} \times 100\%

Possible percentage scores range from 0-100%.
Total Performance Score = \( \frac{\text{sum of individual skill scores}}{([\text{number of possible skills} - \text{number of NP scores} - \text{number of TE scores}] \times 3)} \times 100\% \)

Possible percentage scores range from 0-100%.

As noted earlier, the calculated scores should not be used to predict the overall safety of using a wheelchair. Someone with a low total score may be very safe within his/her limits whereas someone with a high total score may be a risk-taker and more likely to get injured. However, the calculated scores can be helpful in comparing different time points (e.g. pre- vs. post-training), different wheelchairs or different populations (e.g. people with SCI vs. people with stroke).

### 6.7 Options for How the WST-Q May be Administered

There are a variety of acceptable ways in which the WST-Q can be administered and recorded. The WST-Q may be tester administered in-person or by telephone with the tester reading the questions and recording the answers. If a tester is involved, he/she may explain a question if it is not understood by the subject. The tester may also use follow-up questions to reassure him/herself about the validity of the answers provided (i.e. a semi-structured interview).

Alternatively the WST-Q may be self-administered (e.g. in a postal or on-line questionnaire) with the test subject or proxy reading the questions and recording the answers. For the paper version of the WST-Q, the person administering the questionnaire may record the answers either on the WST-Q script or on the WST-Q Report Form.

A computer-assisted version of the WST-Q for desk-top computers and tablets may become available (in development), links to which will be provided on the website. The tester or test subject records the answers on the computer or tablet. The advantages of this approach are that instances of missing data and transcription errors are minimized. Also, it requires less time to complete the WST-Q in this way because the computer uses the scoring algorithm automatically.

The WST-Q and WST can be administered together. As noted earlier, for each individual skill, the questions about capacity, confidence, performance and goals can be followed by a demonstration of that skill – “Can you do it? How confidently? How often? Show me how”.

Alternatively, the full WST can be administered after the full WST-Q is completed.

### 6.8 WST-Q Report Form

There is one WST-Q Report Form for each of the two versions of the WST-Q. The WST-Q Report Form may be completed by hand or be generated by software. The completed WST-Q Report Form includes identifying data, the scores for individual skills, the calculated score(s), comments and the skills (if any) for which the subject would be interested in receiving training.
CHAPTER 7. WHEELCHAIR SKILLS TRAINING

The WSTP represents our attempt to combine the best available evidence on motor skills learning (“process”) with the best available evidence on how to perform specific skills (“content”).

The optimum way to perform and teach each wheelchair skill may vary depending upon the characteristics of the learner, the wheelchair being used and the setting. However, the WSTP training protocol uses training methodology based on the literature. Research evidence regarding the safety and efficacy of WSTP training can be found at http://www.wheelchairskillsprogram.ca/eng/publications.php. Although much further study is needed, to date WSTP training has been found to be safe, practical and to result in significantly greater improvements in wheelchair skills than standard care. There is also research evidence in the literature for some of the specific skills (e.g. basic propulsion technique, transfers, inclines, curbs and wheelies), but not for all skills.

7.1 General Background on Motor Skills Learning

Education can address one or more of three domains – knowledge, skills and attitudes. All three are relevant to wheelchair skills training. However, in this chapter of the WSP Manual, the focus will be primarily on motor skills learning.

The issues presented in this chapter of the WSP Manual are based on the extensive motor-skills-learning literature (over 500 English-language papers published each year) and on the experience of the WSP team. This chapter is not intended to be a treatise for researchers. It is an attempt to synthesize the aspects of this literature that are most relevant to the learning of wheelchair skills. We have attempted to express these principles in language that the average educated, but not necessarily professional, trainer and learner might understand. Although there is a great deal of scientific evidence underlying these principles, the principles themselves are fairly simple. Trainers and/or learners who understand and apply the principles will be more effective than those who do not. In addition to the general principles summarized in this chapter, more specific “training tips” for individual skills or groups of skills later in Chapter 8.

7.2 What is a “Motor Skill”?

A motor skill is one that is voluntary, observable, has been learned and has a goal. Motor skills have been classified on the basis of the size of the muscle groups involved (gross vs. fine), on the basis of whether they are discrete tasks or more continuous ones, and on the basis of how stable the environment is (open vs. closed).

7.3 The Learning Process

In the course of learning a new motor skill, the learner progresses through stages. This is sometimes referred to as the “learning continuum”. Early in the process, success may be partial, inconsistent or only possible in a familiar setting. As learning progresses, preliminary
success is eventually achieved (skill acquisition), consistency within training sessions improves, success carries over into subsequent sessions (skill retention) and the learner is able to use the skill in more diverse settings (skill transfer). Ultimately, the skill may become autonomous, requiring little or no conscious effort. The time course of motor learning includes an initial period of rapid improvement, sometimes followed by a plateau that may be followed by additional gains. The shape of the motor-learning curve is not a straight line and may be punctuated by abrupt transitions from novice to skilled coordination patterns.

There is a distinction between aspects of the learning process that are in the form of facts and ideas (sometimes called the “declarative”, “cognitive” or “explicit” system) versus those that relate to the actual performance of the skill (sometimes called the “procedural”, “motor skill” or “implicit” system). Each can be acquired without the other. If both are acquired, this need not be in a fixed order. The two can assist or interfere with each other. Attempting to consciously control motor actions can disrupt optimal performance. Skills learned implicitly through a discovery approach appear to be more robust under pressure. Healthy learners can sometimes engage explicit (conscious) and implicit (automatic) motor control simultaneously without deterioration of control compared to either alone.

People who have acquired a high level of expertise in performing a motor skill have some characteristics in common. For instance, they have greater awareness of their situations and better ability to anticipate changes in the environment. They are better able to exclude intrusions on their attention and to remain focused on the task. Their motor performances are less affected by stress and fatigue.

### 7.4 Assessment of Wheelchair Skills

Periods of formal evaluation (e.g. using the WST and/or WST-Q before and after training, and at follow-up) can be useful. In addition to the assessment measures mentioned earlier in the General Assessment chapter, there are a variety of parameters that provide evidence of learning due to practice. Examples of such parameters are increased speed, improved consistency, improved adaptability to other settings, improved economy of movement and improved ability to detect and self-correct errors. Ongoing assessment by the trainer is important. What the trainer can do to facilitate the learning process varies continuously. A training log may be used by the trainer and/or learner to track the training process.

### 7.5 Goal Setting

From the baseline WST or WST-Q assessment, skills may be identified that are not performed as safely, effectively or efficiently as they might be. Generally, only 5-10 goals should be identified at the beginning of a series of training sessions. The goal may be from the WSP skill set – a full skill, a part of a skill, a variation of a skill – or any other skill that is important to the learner. Goal pursuit is related to the learner’s beliefs about him/herself and the task (confidence or self-efficacy). The learner may need help in coming to a decision about the goals of training because he/she may not initially recognize the functional benefits of acquiring a new skill. Additionally, a decision needs to be made as to whether it is feasible for the person to learn this skill. This is a judgment call and requires a good understanding of
the learner’s health and circumstances. If in doubt, it is recommended that the learner be given an opportunity to learn the skill. If progress is not being made, a learner can decide to abandon that skill. The trainer can assist the learner in coming to this decision.

Goals should be brief, specific, significant, achievable in the training time available and observable (i.e. a measureable action item). A broad participation-level goal (e.g. to go shopping) can be broken down into the constituent skills that make it up.

The following are examples of good WSTP goals:
- Roll 100 m in 2 minutes, using no more than 100 pushes.
- Get the wheelchair up a 2 cm curb.
- In the wheelie position, roll forward 10 m.
- Get from the wheelchair to the floor and back within 60 seconds.
- Come down a flight of 10 stairs backward, using one hand-rail.

The following are examples of poor goals from the perspective of WSTP training (and why):
- Go shopping at the mall (too broad, needs to be more specific).
- Reduce by 10% the number of pushes needed to roll 10 m (not significant).
- Complete a full marathon (may not be achievable in the training time available).
- Spend more time with my friends (not a wheelchair skill and not easily observable).
- Understand the importance of preventing pressure sores (not an action item).

Involving the learner in the goal-setting process can have a positive effect on motivation. However, the trainer has the right to refuse to provide training on any skill that he/she does not believe to be safe and feasible. The goals should be monitored and may be revised as training progresses. The goals may be formalized to allow a Goal Attainment Score (see earlier) to be calculated that can be used to track progress and quantify outcomes. A poster on Setting Goals is available at http://www.wheelchairskillsprogram.ca/eng/posters.php. It can be printed and posted in the training area.

7.6 Individualize the Training Process

Motor-learning principles generally apply almost equally well to elite athletes and to those who have severe disabilities. However, there is benefit to tailoring the training process to the learner. Learning-style preferences exist and should be respected whenever possible. Training can sometimes take the form of a problem-solving exercise, attempting to answer the question “For this learner, with this wheelchair, in this context, what would be the safest and most effective way to perform this task?” For another wheelchair user or another wheelchair, a different solution may be appropriate.

Inability to perform a skill may be due to a variety of limiting factors, alone or in combination. Limiting factors may be intrinsic (e.g. impairments such as cognitive limitations, weakness, deconditioning, pain, shortness of breath, limited range of motion, spasticity, poor coordination or movement disorders) or extrinsic (e.g. a faulty wheelchair part, poor seating support or poor lighting). The trainer should attempt to identify remediable limiting factors and seek to have them addressed.
Motor-skills learning can be affected by personal characteristics. A trainer who understands these differences will be able to reassure learners who might be progressing more slowly than others. For instance, males learn some skills faster than females. Although learning capacity is greater early in life and the young learn motor skills more rapidly and with less practice, elderly people can acquire new motor skills well. Very young children learn better by practicing parts of skills but whole-skill practice works better by about the age of 10 years. Children using scaled equipment (appropriate to their size and strength) acquire skills more quickly, perform them better and are more engaged. Motor learning may be affected by emotion or fatigue.

Neurological conditions may affect motor-skills learning. The learner’s impairments (e.g. motor weakness, spasticity, sensory loss, coordination, balance, perceptual problems) may affect how a skill should be optimally performed and the ease with which learning can occur.

Specific neurological disorders may also need to be taken into consideration, for instance:

- For people with stroke, the post-stroke brain has heightened sensitivity to rehabilitation early but this phenomenon declines somewhat with time. The extent of improvement is related to the intensity of training, but high doses of training may not be well tolerated early after the stroke. Explicit information disrupts skill acquisition even more than usual in people who have had strokes affecting the basal ganglia. For people with language impairments, it may be helpful to use nonverbal cues and feedback rather than verbal ones.
- People with multiple sclerosis may have greater susceptibility to high environmental temperatures and may fatigue more easily.
- People with Alzheimer’s disease can learn and retain new motor skills. Implicit-learning strategies and demonstration appear to be particularly useful for such people. Consistent practice conditions may work better than variable ones.
- For people with any form of dementia, there is some evidence of superior learning of problem-solving tasks with the aid of cues (errorless learning) versus trial-and-error learning.
- People with Parkinson’s disease can learn new motor skills although retention may be impaired and more practice may be needed. Rhythmic auditory cues can be helpful for them. Although less helpful for healthy people, paying conscious attention to motor tasks can be useful for people with Parkinson’s disease. Consistent practice conditions may work better than variable ones.
- Medicated patients with schizophrenia may have difficulties with the consolidation of skills.
- For children with cerebral palsy, a 100% feedback schedule is more effective than an intermittent one.

### 7.7 Structure of Training

There are a variety of ways in which the safety, effectiveness or efficiency of training can be enhanced. The motor learning principles in this chapter can be thought of as the trainer’s “instructional tool kit” with specific tools to be used as needed. Training can take place
anywhere (e.g. in the hospital, community or the learner’s environment). Training can take place in an ad-hoc format, seizing teaching opportunities as they present themselves (e.g. during community outings). Although this approach has much to commend it after the individual skills have been learned, it is unlikely that such challenges will present themselves in the order that would be most helpful to optimize learning. In the clinical setting, it can be helpful to provide more structure (e.g. scheduled sessions with lesson plans). At the beginning of a training session, a warm-up can have a number of benefits. The same is true of a cool-down at the end of a session. Sample lesson-plan templates for initial and subsequent sessions can be found in Appendix 2.

7.8 Training in Pairs or Groups

To permit an individualized approach, a ratio of trainers to learners of 1:1 or 1:2 is ideal, although much lower ratios (e.g. 1:20) can be successful. Training in pairs or groups is practical, cost-effective and has educational merit. The optimum group size depends on the goals but more than eight people in a group can lead to fewer interactions and lower satisfaction. Group training can permit group discussions and problem-solving. Learners can serve as models for each other, both for how and how not to perform a skill. Whenever possible, it is desirable to select groups on the basis of roughly similar skill level. Learners in groups should be reminded that skill capability is affected by a number of factors (e.g. age, sex, impairments and wheelchair type), so they should not compare their progress with that of others. For individuals with low self-efficacy, collaborative training with a more experienced partner aids skill acquisition. To function well, groups may need to reach agreement on the group process (e.g. arriving on time, avoiding the use of cell phones during the session) and consequences (e.g. singing a song) for breaking the group rules. Additional hints for organizing group training can be found in Appendix 3.

7.9 Motivation

Motor-skills learning is enhanced if the learner is motivated to learn. The trainer can help to motivate the learner by making the learning meaningful and rewarding. Game-based exercises can help to create and maintain interest. Children especially may learn best through play, rather than through formal training on a skill-by-skill basis. Working in either cooperation or competition with other learners can enhance motivation.

Whenever possible, the trainer should explain how the learner will benefit by learning a new skill. Training should be relevant to the learner and his/her context. In addition to the long-term benefits of training, there may be short-term benefits, such as the social interaction during the training sessions, the pleasure that some people get from challenging themselves or improving on a test. Without creating anxiety, the trainer should let the learner know that he/she will be assessed at the end of the training period, because this is known to have a positive effect on skill acquisition. Similarly, the expectation of having to teach another learner enhances motor learning. Encouragement and positive feedback from the trainer or fellow learners can be powerful incentives as well. Rewards significantly enhance the long-term retention of motor learning. The trainer should not be reluctant to challenge the learner to try ever more difficult but potentially achievable skills.
Learning, self-efficacy and affect are better when the learner perceives him/herself as having a choice (e.g. “do you want to start at that end of the line of pylons or at this end?”; “would you prefer to wheel across the yellow or the green mat?”). Autonomy is also important in deciding when and for how long to practice.

7.10 Demonstration

Demonstration (also called “observational learning”) is one of the most powerful tools for motor skills learning. The demonstrator may be the trainer, a model or a peer. Demonstration may be in-person or on a video. The Pictures and Videos section of the WSP website contains numerous video clips that can be used. The demonstrator should ideally be skilled, but this is not a necessity. One approach is to use an expert model to provide an accurate template of the movement, followed by less successful models. If the model is at a similar level to the learner (e.g. in a group setting), the learner can learn from the feedback provided to the model.

If the learner is unfamiliar with the skill to be practiced, the demonstration should occur before practice begins. The initial demonstration should be silent; then the demonstration is repeated while describing key elements of the skill. Otherwise, the demonstration can be used as part of the feedback provided to the learner. The demonstration may be repeated as often as needed. The trainer should briefly describe important elements of the skill or provide attention-directing cues, as part of the demonstration. The trainer should focus on what to do rather than what not to do, at least until the learner has had an opportunity to try the skill several times.

Observation alone can result in learning but has limits if not followed by physical practice. Demonstration is most effective for a novel task and less effective when refining a skill. When demonstrating a skill, the trainer should put equal emphasis on the movement and the outcome.

7.11 Verbal Instructions

Using the terminology of the motor learning literature, “instructions” are generally provided before practice, as distinct from “feedback” that is provided afterwards. Providing explicit instructions before task practice can be detrimental so instructions should be used with caution. Learners have a limited capacity to attend – the trainer should not overwhelm the learner with the quantity of information. Instructions are more likely to be of help for advanced learners (e.g. instructions regarding anticipation and decision making). The length of time between the instructions and actual practice should be minimized. Preferably, instructions should be given in combination with a demonstration. Learning is enhanced by instructions that portray the task as a learnable skill versus one that is based on inherent ability.

As for the content of instructions, some general examples follow:
• Speed and accuracy are inversely related. If both are desirable, the learner will do better to start with accuracy and build speed later. An instruction may be to “take your time, it’s not a race”.
• The trainer may provide instructions about what to look for in the environment that might affect performance. For instance “Pay attention to the lip at the bottom of the ramp”.
• The trainer may provide a framework, an organization or a way of thinking about a skill. An instruction may be “Think of the right rear wheel of your wheelchair as the face of a clock and start with your hands at 11:00 o’clock”.
• Analogy learning has been found to be helpful perhaps, at least in part, by reducing the informational volume. For instance, during the rolling forward skill, an instruction may be “Coast between pushes just as you would between strokes when paddling a canoe”.
• The trainer may provide verbal cues – short, precise words or phrases that direct attention or prompt movements. For instance, when attempting to get a manual wheelchair over an obstacle from a stationary start, the trainer may ask the learner to “pop” (popping the casters over the obstacle) then “lean” (leaning forward to help get the rear wheels over). The trainer should limit the number of cues to those that are most critical. It can be helpful to have the learner verbalize the cues prior to attempting the skill and during the attempt. As noted earlier, for people with dementia, there is some evidence of superior learning of problem-solving tasks with the help of cues versus trial-and-error learning.

7.12 Focus of Attention

Early in training, the trainer may need to have the learner focus on specific actions or processes (e.g. “lean forward”), if a crucial error has been identified. However, the research literature suggests that, when most individuals engaged in motor learning tasks concentrate on movements themselves, the conscious intervention in the control processes results in poor performance and learning. People with Parkinsonism may be an exception to this general rule.

As the skill becomes more automatic, more advanced learners tend to do better if they focus on the overall goal or outcome of the skill performance (e.g. “get up the incline onto the platform”). This phenomenon is better documented in adults than for children. Although automatic performance is ideal, even experts may find it necessary from time to time to focus attention on an aspect of a skill that requires it.

7.13 Imagery

There is evidence that imagery or mental practice can be helpful in the acquisition of motor skills. Imagery can be assigned as homework. Imagery can focus on what the learner would see during the performance of a skill, with internal or external perspectives (i.e. seeing through one’s own eyes vs. seeing oneself as though watching another person). Alternatively, imagery can focus on what the person might feel (e.g. limb position, external forces) during a skill performance. Most studies have used verbal live or recorded imagery instructions, have had the imagery performed with the eyes closed and have used an internal perspective with a kinesthetic focus. On average, participants in such studies practiced for about 15 minutes at a time, three times a week for a total of about three hours. Even a short nap after motor
Imagery aids consolidation.

Imagery can also be used for motivational purposes (e.g. visualizing performing with confidence and ease). Imagery can be used in advance, to prepare to perform a skill, or after the attempt, to reinforce a well-performed trial. Imagery is not as effective as physical practice but it is better than no practice. Used in combination with physical practice, imagery is almost as effective as physical practice alone, so it may be a useful strategy when there are factors that prevent physical practice (e.g. bad weather, lack of spotter availability, a sore shoulder). Imagery has a greater effect on closed skills (ones that are always the same) than open ones. Imagery is less useful for a novel task than a familiar one.

7.14 Feedback

Types of feedback. Implicit learning through intrinsic feedback (e.g. from what the learner can see, hear or feel) is useful and may be all that is needed. Feedback can be augmented in a variety of ways (e.g. by watching oneself in a mirror, by watching a video of one’s performance, by receiving biofeedback or by receiving feedback from a trainer). Augmented feedback is generally an effective tool for enhancing learning (e.g. by better participation, more rapid skill acquisition). However, augmented feedback is not always needed and it can hinder learning if the learner becomes dependent on it. The ultimate goal of skills learning is for the performer to be able to perform the skill without augmented feedback.

Feedback content. The trainer should be supportive and encouraging, even to the extent of slightly exaggerating how well the learner is doing in comparison with others at a similar stage of training. Such “bogus” positive feedback can have positive effects on skill acquisition, self-efficacy and affect. However, the trainer should be accurate with respect to feedback content. It is counterproductive to tell a learner that his/her performance was successful if it was not. Most people learn at least as well from their errors as from their successes.

When learning wheelchair skills, feedback from the trainer about the success or failure of an attempt at a skill (“knowledge of results”) is usually unnecessary, for two reasons. First, the result is usually self-evident. Second, if the learner is repeatedly unsuccessful, he/she may get discouraged by repeated statements about failure.

Another form of feedback is the provision of information about how the skill was performed (“knowledge of performance”). Ideally, such feedback should be directed at what the trainer suggests the learner should try differently (“prescriptive knowledge of performance”), in order to achieve a safer or more effective result. Before providing prescriptive knowledge of performance, it can be useful to ask the learner about his/her perceptions about the problem and intended solutions. The objective is to develop a learner who is an independent problem-solver. If the learner does not self-diagnose the problem correctly, the trainer should identify the most critical error and suggest what might be done to correct this problem.

Pointing out errors is more effective than noting what the learner is doing correctly (although the latter is important for motivation). It can be useful to have learners attempt skills in
inappropriate ways (e.g. rolling across a soft surface while leaning forward, causing the casters to sink into the surface), to help them better understand why a suggestion is being made. Qualitative feedback is fine early in training (e.g. “you need to pop your casters higher”). Later, quantitative feedback (e.g. “you need to pop your casters about 2 cm higher”) may be better. Feedback can be more effective if it directs the performer’s attention away from his or her own movements and to the effects of those movements. The perceived expertise of the trainer (e.g. as evidenced by a demonstration of the skill being learned) affects the perceived usefulness of the feedback provided.

Timing of feedback. The optimum frequency for knowledge of results feedback (if any is needed) is affected by the difficulties of the task – the more difficult the task, the higher the frequency of feedback can be without interfering with skill acquisition.

When providing knowledge of performance feedback, the trainer needs to exercise judgment and to be attuned to the chemistry of the training session. The trainer should offer feedback statements no more often than after every second attempt. This may be a difficult rule to follow in a group setting. Autonomy can be provided (“let me know when you would like some feedback”). An exception to this is if a learner performs in an unsafe manner and does not appear to be aware of it; the trainer should point this out as soon as possible. The trainer should let the learner know that the absence of feedback means that the performance was adequate for the current stage of learning. This gives the learner an opportunity to problem-solve on his/her own (i.e. intrinsic learning). It also decreases repetitive feedback statements, especially in the case of more advanced skills when it can take time for the learner to overcome a problem. A common error is for the trainer to spend too much time talking and not enough time allowing the learner to practice.

The feedback schedule is especially important for wheelchair users who have cognitive or behavioral impairments. A self-controlled feedback schedule (i.e. letting the learner ask for feedback) is generally preferable. More feedback is typically needed for a novel skill. The trainer should gradually reduce the frequency of feedback statements as time goes on. The feedback weaning schedule may need to be more gradual for children. As the fading process leads to less and less frequent feedback, the trainer should summarize a series of attempts rather than focusing only on the most recent attempt. This technique can also be used when working with a group, providing feedback that deals with a problem several of the group members are encountering.

Trainers should be aware of the principles of behavior modification, which have similarities to the principles of motor learning. Positive reinforcement (e.g. an encouraging remark) increases the likelihood of a behavior (or skill) being performed, whereas negative reinforcement (or no reinforcement) has the opposite effect. Initially, the trainer’s tolerance for the learner’s errors should be broad, but the “bandwidth” of acceptable performance is gradually narrowed as learning proceeds. Behaviorists refer to this as “shaping” a behavior. Intermittent positive reinforcement, at irregular intervals, is the ideal reinforcement schedule for sustaining behaviors.

Feedback can be provided during the skill attempt. This is more practical for continuous
skills (e.g. rolling a long distance), but there is a danger that this may interfere with the
learner’s attention to intrinsic feedback. Providing the feedback after the skill is usually
preferable. The trainer should wait a few seconds before providing feedback to allow
intrinsic processes to work first. Before beginning the next trial, the trainer should allow the
learner some time to plan the next attempt. Any augmented feedback should be followed by
an opportunity to practice.

Improvements in communication technology has made it possible for the learner and trainer
to interact when separated in space (“remotely”) and time (“asynchronously”). For instance, a
learner in one part of the world who is having difficulty with a skill can send a video-
recording of his/her technique to a trainer in another part of the world and receive feedback at
a later time that is convenient for the trainer. That feedback can be considered later, at a time
convenient to the learner. The learner is not limited to an interaction with a single trainer but
can seek input from anyone willing to provide it.

7.15 Specificity of Practice

If a learner wants to improve his/her ability to perform a task, the task itself should be
practiced. Cross-training may help to develop fitness, but is of limited use for the
development of motor skills. However, there is mounting evidence, for a broad range of
motor skills, that training in simulated situations can enhance skill performance in real-life
situations. Practice should be as specific as possible with respect to the task itself and the
context in which it is to be performed. If the skill consists of steps that need to be carried out
in a specific sequence, then that sequence should be used during practice. If the goal is for
the learner to be able to conduct the task in diverse settings, then that is what should be
practiced. If a wheelchair user has more than one wheelchair (e.g. powered and manual)
because different wheelchairs are used in different settings, he/she should be trained in the
use of both.

7.16 Amount of Practice

For motor skills to be learned well, they need to be practiced. If a learner is switching from
an old to a new coordination pattern, it may take 200 or more practice trials to achieve the
change. During the transition, there may be numerous errors, that the learner may find
frustrating and discouraging. The amount of practice needed may be much greater (up to 50-
fold) for people with injury or disease of the brain.

The “over-learning” strategy (a term that should not be confused with “too much learning”) has a positive effect on skill retention. Over-learning means continuing to practice (by 50-
200%) beyond the amount needed for initial success. This can be done right away or during
additional practice sessions later. However, more practice is not always better – as the saying goes “practice does not make perfect, perfect practice does”. Also, there may be a point of
diminishing returns. More than 4-6 hours of practice a day is unlikely to be productive. If
errors begin to occur due to fatigue or frustration, it is probably wise to take a break because
technique can break down with fatigue. Multiple short practice opportunities (one hour of
less) are preferable for retention.
For simple tasks, continued practice may actually cause performance to deteriorate. There is little point in practicing what has become easy and comfortable, it being preferable for the learner to continue to challenge him/herself. The literature on wheelchair-skills training suggests that substantial improvements can be made on a group of skills with as little as 2-3 hours of formal training spread over several sessions, but that the target for the clinical setting should probably be higher (e.g. 10-12 hours) if the situation allows. There is no strong evidence as yet regarding the optimum “dose” of wheelchair skills training.

Although it is not necessary to be an expert to perform a skill in a safe and useful manner, to achieve true expertise at a skill (as a professional athlete, musician or an assembly-line worker may exhibit) may require several hours of practice per day for periods of 10 years or more. There is some evidence to support that millions of repetitions and 10,000 hours of practice may be required for true expertise. Intervals of weeks or months between training are not barriers to learning. As little practice as 6 minutes a month has been shown to be effective. Self-control of the amount of practice and of the practice schedule has been shown to be superior to control by others.

7.17 Facilitate Retention

Although a learner may be able to “acquire” a skill during a practice session, it is not uncommon for the learner to fail to perform the skill adequately at the next session. This is a failure of skill “retention”. The objective of wheelchair-skills training is long-term retention (i.e. for months and years). For practical purposes, successful performance after such brief intervals as 3 days may need to be accepted as evidence of at least short-term retention, but long-term retention is the goal. The literature on the retention of wheelchair skills is limited but there is evidence to date that skills are retained for periods of a year or more.

There are conditions within and following a practice session that affect whether training on a new skill will be retained. To improve the likelihood of “consolidation”, the trainer (and other members of the rehabilitation team) should avoid the introduction of other new skills during the 4-6 hour period following practice. Newly acquired skills may be abolished by subsequent practice of a different novel skill within four hours (retrograde interference), especially if the competing task involves the same muscles and movement direction. Similarly, learning one skill can interfere with the subsequent learning of the second skill (antegrade interference). The extent of this interference is related to the duration of the earlier task learning. Performance saturation during training helps consolidation.

Ideally, the learner should sleep before the next training session. Although not always practical, a nap of as little as 40 minutes immediately post-training reduces susceptibility to interference and results in earlier consolidation, especially so for older learners. At the subsequent session, the learner may even perform better than at the previous session, without any intervening physical practice. This is sometimes referred to as “off-line learning”. Sleep affects some types of skills more than others (sequence-specific skills less so). Sleep is of most benefit to skills that were the most difficult before sleep. Learning by observation and mental imagery is also enhanced by sleep. Anticipated rewards can enhance off-line learning.
during sleep. Post-training deep alternative-nostril breathing has been shown to enhance retention.

Although it may seem to be inconsistent with the notion of a nap after a motor learning session, aerobic exercise (preferably high intensity, but also moderate intensity) has been shown to enhance retention. The gap between the motor-learning session and the bout of aerobic exercise may be as little as 20 minutes and as long as two hours.

Consolidation begins as a fragile state (one that is susceptible to interference) and progresses over time to a stabilized state. Off-line, a skill becomes less vulnerable to interference (stabilization) and improves in performance (enhancement). During subsequent practice, the consolidated memory can become unstable and susceptible to improvement (“reconsolidation”) or deterioration. Elderly adults have greater susceptibility to interference and less off-line gains in motor skills.

7.18 Variability of Practice

Variation in motor performance may be a feature of how the nervous system learns, with the variation serving as an exploration of boundaries and preferred approaches. Additionally, most wheelchair skills are of little use if they can only be performed in highly controlled settings. The purpose of wheelchair skills training is for the learner to use the skill in a variety of settings in his/her life (skill “transfer”). Once a skill is initially acquired and retained, the learner should practice it in different contexts to promote such skill transfer. Diversification may include alterations of the environment (e.g. surface, lighting conditions, time of day, ambient temperature), variations in how the skill is performed (e.g. faster, slower, while multi-tasking) or variations in the learner’s state (e.g. with fatigue, anxiety, altered focus of attention). Expanding the scope of training to include a few or many skills in combination (e.g. moving turns on soft surfaces) or in sequence (as might occur while playing a game or going on a community outing) can be very helpful.

To enhance skill retention and transfer, random practice of a group of skills that have already been acquired is generally better than consistent (“blocked” or “massed”) practice, especially for open versus closed skills. However, there will be more errors during random practice and learning may be slower. The two approaches are not mutually exclusive. For instance, it may be reasonable to begin with consistent practice and to progress to random practice of those skills. The approach may vary depending upon the personal characteristics of the learner (e.g. children and the elderly do better with less variability and fewer distractions).

The WSTP approach is to make sure that the learner can do each of the basic skills in at least one of the safe and effective methods available (e.g. performing moving turns by pushing harder on the outside hand-rim). To help with skill retention and transfer, trying suitable variations (e.g. performing moving turns while carrying a cup of water in one hand) is encouraged, as well as using the skill in combinations (e.g. performing moving turns while ascending an incline). Games can be used to help the learner use the skills in a more automatic fashion, as he/she focuses on the outcome of the game rather than on performing the individual skill.
After maximizing the ability of wheelchair users and caregivers to perform the representative set of individual skills that make up the WSP, these skills can be combined in the various combinations and permutations that make up real life. The WSP skills can be considered the building blocks whereas the real-life activities are the structures that can be built with these units. As part of any such community outings, the learner should be encouraged to plan the route that will be taken.

Real-life activities provide opportunities to identify challenges requiring intervention and opportunities to learn wheelchair skills as the challenges are encountered (“teachable moments”). However, the order in which such real-life challenges occur is random and inconsistent with a more structured approach in which the sequence of skills learned can be helpful.

7.19 Distribution of Practice

Practice may be condensed (“massed”) or spread over several sessions (“distributed”). In a rehabilitation center, practice may be organized as brief individual and/or group sessions at regular intervals (e.g. 30 minutes, 1-5 times a week for 2-4 weeks). Sessions might include a warm-up, some time on skills already acquired but requiring further practice, a period during which instruction is received on the principal new skill that is the focus of the session, and a cool-down activity.

When the learner has demonstrated the ability to do so safely, the trainer should encourage the learner to practice between formal sessions. Whenever feasible, it is recommended that wheelchair-skills training be spread over a series of brief sessions instead of one long one. Brief practice periods are less likely to conflict with other therapy sessions or to fatigue the learner. For wheelchair users who are elderly, who are unfit or who have a number of comorbidities, even a brief session can be fatiguing or cause overuse injury.

One alternative is to conduct training in and around the learner’s home. Another option for learners living in the community is to hold periodic group training courses (e.g. for 1-2 hours, weekly, for several weeks). Another alternative is a skill “camp” (e.g. all day for 1-5 days) in a central location or on a circuit basis. The single-training-session format is commonly used for workshops when training trainers. However, the use of such an approach can cause even highly motivated learners to lose focus and to become fatigued. In addition to such problems, this approach may lead to poor retention and consolidation.

The research literature suggests that, for the types of skills that wheelchair users and caregivers need, it is generally less effective to carry out a large amount of training in a condensed manner than it is to spread the training out over a longer period that permits rest and consolidation of what has been learned. However, too much time between practice sessions can allow the learning to decay if the skill has not yet been acquired and consolidated. Beyond this, there is little research evidence to suggest that one of the models noted above is vastly superior to another, so the choice of model(s) can be based on local considerations.
7.20 Whole versus Part Practice

For skills that consist of a sequence of sub-skills, initially it can be helpful to break the skill down into its components (segmented “motor chunks”). For instance, the stationary wheelie skill can be broken down into three phases – take-off (getting onto two wheels), maintaining balance on two wheels and landing (returning to the condition of having all four wheels on the ground). The goal, of course, is to build up to the point that the whole skill can be practiced as a unit.

There are some variations on this strategy. For instance, the learner can combine whole- and part-skill practice by focusing attention on different aspects of the skill even though performing the entire skill. If the skill is to be segmented, a progressive approach, from start to finish, is generally preferred because it eventually becomes whole-skill practice. However, the order in which the segments are practiced is not critical. “Chunking” is less often useful for the elderly. Chunking may impair motor skill acquisition, if learners could have taken advantage of cues related to an earlier chunk.

7.21 Simplification and Progression

For many wheelchair skills, it is possible to begin with a simpler and less difficult version of the skill. Reducing errors during initial practice attempts may encourage a more implicit method of learning. The learner can master the simpler task before progressing to the ultimate skill level that is the goal of training. For many wheelchair skills, the simpler version may be useful itself, even if the more difficult levels cannot be learned. For instance, getting the wheelchair up a low curb is a useful skill and also a step toward getting up a high curb. Another example is to learn the wheelie skill in a high-rolling-resistance setting before progressing to a low-rolling-resistance one. This strategy for learning the stationary wheelie has the advantage of reducing the amount of forward-backward movement of the rear wheels needed to maintain balance. This reduces demands on the learner’s attention. It also eliminates a degree of freedom (forward-backward movement of the rear wheels). Reducing the degrees of freedom is a strategy that has been observed to be used by beginners learning non-wheelchair skills.

Children do better with scaled equipment; they are more engaged, they are more confident, they perform better and they acquire skills more quickly. Other examples of progression are adding speed to a task, doing the task in a more challenging environment, adding a second task, reducing the amount of assistance provided by an assistant and reducing the proximity of the spotter. Specific examples of simplification and progression can be found later in the training-tips sections of Chapter 8. Some of these strategies are similar to those used to increase the variability of practice, with the goal of skill transfer.

In many cases, more difficult skills will build on methods learned in performing simpler but similar skills. For instance, the ability to get over an obstacle requires most of the techniques needed when later learning to get up a curb. The order of individual skills listed in Tables 1.1 and 1.2 reflects this. As noted earlier, this systematic approach may seem to be conceptually
incompatible with the community-outings approach whereby the learner and trainer make forays into the community (e.g. to the corner store) and learn about barriers as they are encountered. However, the two approaches can be used in a complementary fashion, using an initial community outing to help identify skills that require further training and to provide motivation, followed by a systematic process to improve upon those skills, followed by additional community outings to provide variety to the training experiences that encourage skill transfer.

Although a learner can perform a wheelchair skill with any safe and effective method, different methods may be more suitable for some individuals or some situations. For instance, for the “turns while moving forward” skill as performed by a user of a manual wheelchair who propels the wheelchair with two hands, the basic method is to push harder on the hand-rim of the rear wheel on the outside of the turn. However, for the wheelchair user with good arm function and a wall leading to an opening into which the person wishes to turn, the turn can be accomplished more readily, with less reduction in speed and with less demand on the shoulders if the wheelchair user performs a “drag turn”. To do so, the wheelchair user drags the arm along the wall to slow the wheelchair on one side and carry out the turn.

7.22 When the Caregiver is the Learner

A skill that may not be feasible or advisable for a wheelchair user to perform alone may be possible with the assistance of a caregiver (as previously defined). The training can be directed at the wheelchair user, the caregiver or the two functioning together. The relationship between a wheelchair user and a caregiver is important. The wheelchair user’s needs and preferences should take precedence whenever possible. The wheelchair user may need some help in learning how to ask for help, how to direct the nature of any assistance and how politely to decline offers of unwanted help.

There are some general considerations when caregivers are the learners. There are ways for caregivers to relate well to wheelchair users. For instance, the caregiver should be instructed to seek permission before taking any actions, to speak clearly, to address the wheelchair user from the front and at eye level whenever possible, and to consider the wheelchair itself as an item of the wheelchair user’s personal property. The caregiver should be cautioned to avoid applying excessive force to the wheelchair user and to avoid sudden movements. The caregiver should always provide the wheelchair user with cues concerning what he/she intends to do before attempting a skill. When the caregiver is successfully trained, the caregiver can serve as a spotter, so the caregiver should be instructed in how to perform in this capacity. The caregiver may also serve as a motivator and trainer (e.g. during practice by the wheelchair user between formal training sessions with the primary trainer). A caregiver can assist with powered wheelchairs in ways similar to manual wheelchairs, even though the powered wheelchair is heavier and bulkier. For instance, with a rear-wheel-drive wheelchair, a caregiver can push down on the back of the wheelchair to unload the casters or to add traction to spinning drive wheels. The caregiver can push a powered wheelchair forward, to assist with overcoming resistance. In addition to these general points, caregiver issues related to specific skills are dealt with later, when those skills are discussed.
CHAPTER 8. TRAINING OF INDIVIDUAL SKILLS OR GROUPS OF SKILLS

This chapter is organized by individual skills or groups of skills, in the order listed in Table 8.1. Note that, for training purposes, it has been possible to combine some of the skills from the WST. For instance, the WST skills “ascends slight incline” and “ascends steep incline” have been combined into a single skill group “ascends inclines”.

<table>
<thead>
<tr>
<th>#</th>
<th>WSP Skill Names</th>
<th>Manual</th>
<th>Powered</th>
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<td>Positions and operates controller</td>
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<tr>
<td>2.</td>
<td>Operates body positioning options</td>
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<td>25.</td>
<td>Performs wheelie-dependent skills</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

For each section in this chapter, the following headings are used (some of which are repeats on headings shown earlier in Chapter 5):

- **Versions applicable**: For which of the WSP versions (i.e. manual vs. powered wheelchairs) this skill is applicable.
- **WST/WST-Q skills**: The specific skills of the WST/WST-Q that are relevant for this section.
- **Description and rationale**: A brief general description of the skills and the reason why...
these skills have been included in the WSP skill set.

- **Prerequisites:** If the ability to perform an earlier skill is useful for these skills to be trained.

- **Spotter considerations:** If there are other than the general instructions regarding safety discussed earlier, these are mentioned here, in particular the starting position for the spotter and common risks requiring spotter intervention. These considerations are primarily for manual wheelchairs operated by their users but may be adapted for the powered-wheelchair version of the WSP.

- **Adjustment tips:** If there are adjustments to the wheelchair that would facilitate the training, these are mentioned here.

- **General training tips:** Tips that apply to most or all of the situations relevant for this skill.

- **Special considerations:** If the training tips up to this point for this skill require any special considerations, these are noted here. These might be related to the type of wheelchair being used or whether a caregiver’s assistance is being assessed.
8.1 POSITIONS AND OPERATES CONTROLLER

Versions applicable
- Manual wheelchair: X
- Powered wheelchair: √

WST/WST-Q skills
- “Positions and operates controller”.

Description and rationale
- The learner moves the controller (e.g. joystick) of a powered wheelchair or scooter away from its usual operating position and then returns it to its original position. Moving the controller away and back is useful when the controller is in the way for some activities (e.g. approaching a table, feeding, transferring).
- The learner turns the power of a powered wheelchair or scooter on and off. The functions of the powered wheelchair require power. However, when the wheelchair is not being used for position changes or mobility, the power should be turned off when sitting in the wheelchair doing other activities. Otherwise, an article of clothing (e.g. the cuff of a sleeve) can catch on the joystick and unintentionally drive the wheelchair into a person or object. Turning the power off also better maintains the battery charge.
- The learner operates the controller of a powered wheelchair or scooter to switch between drive modes, speeds and other functions (excluding those controlling body position that are dealt with in the next skill), then returns to the original setting. Most powered wheelchairs and some scooters provide an opportunity for the user to operate the wheelchair in different modes and speeds. The controller settings that are most appropriate for driving slowly in tight quarters are different from the settings that would work best when driving longer distances outdoors or when ascending low curbs. Some powered wheelchairs use the controller to activate and use other functions (e.g. communication aids).

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Beside the wheelchair, on the side of the controller in a position where it is possible to intervene.
- Risks requiring spotter intervention:
  - When moving the controller away and back, the mechanisms can pinch fingers or clothing.
  - Runaway if the learner activates the joystick unintentionally

Adjustment tips
- Moving the controller away/back:
  - Mounts can vary (e.g. midline flip up, swing away, permanent mounting).
  - When attempting to initiate the move-away portion of the skill, it is usually necessary to overcome some initial resistance. The amount of force needed can
sometimes be adjusted.

- Adding a loop to the controller may allow users with limited hand function to independently move the controller.

- Turning the power on/off:
  - A longer lever for the on/off switch will reduce the force required but increase the arc through which the lever must be moved.
  - The location of the on/off switch can vary greatly and may have an impact on independence.
  - Alternative switches can be used for on/off functions (e.g. toggle, depression switch, auxiliary switch).
  - Alternative locations (e.g. near the head or foot) can be used for the on/off switch to improve access.

- Changing speeds and modes:
  - The type of mode switch used will have an impact on success for some users.
  - In some wheelchairs, the mode and speed controls are separate.
  - A controller with the easiest access will be most appropriate for people with cognitive or physical limitations (e.g. three vs. five drive modes, toggle vs. dial for speed control).
  - Although the manufacturer may provide a representative set of mode settings, the dealer and/or therapist may adjust the settings with a programmer to make them as ideal as possible for the user. These settings can be altered later, as skill improves. For many powered wheelchairs, it is possible to independently select the maximum speed, acceleration and deceleration in different directions as well as the sensitivity to joystick deflections.
  - The order of drive modes (e.g. 1, 2, 3 and 4) may be varied. For instance, some users may prefer to have the order reflect progressively increasing speed whereas other users may wish to order the modes from the most often to the least often used. Through programming, the dealer and/or therapist can reduce the number of steps to get to the most commonly used drive modes or speeds.
  - The wheelchair user should be able to see or hear an indication of the mode and speed status.

**General training tips**

- Moving the controller away/back:
  - The controller should be moved sufficiently out of the way that it would not interfere with approach to a table or to another surface during a transfer.
  - The force applied to the controller may need to be applied in a specific location and direction. This location can be identified in a way that it can be better seen (e.g. with a piece of colored tape) or felt (e.g. with a piece of velcro).
  - When moving the controller out of the way, it should not be placed in a position that would make it impossible for the wheelchair user to restore it to
If the controller changes its orientation (e.g. by 90°) when it is moved out of the way, the wheelchair user needs to take this into consideration if activating the joystick in this position, to avoid driving in an unintended direction.

**Progression:**
- To avoid runaway, the power should be turned off while this skill is initially being practiced.
- Training should begin with moving the controller away then moving the controller back.
- The skill should eventually be used functionally, such as when approaching a table.

**Variations:**
- If the wheelchair user has poor hand control, he/she can use a gross motor movement to move the controller. Using the side of the arm or hand along with shoulder movement may allow the controller to be moved independently.
- The powered wheelchair can be slowly driven at an angle against a fixed external object (e.g. a desk top) to help indirectly push the controller out of the way.

**Turning the power on/off:**
- The joystick should be in a neutral position before the controller is turned on.
- Turning the controller off while the wheelchair is being operated will bring it to a sudden stop. This can be useful when a sudden stop is needed or if the wheelchair begins to behave erratically.

**Variations:**
- Rolling the hand onto and off the on/off switch may reduce the need for fine finger dexterity.
- Using larger movements and body parts may allow users to switch toggle levers on and off independently, if fine motor control is not available.
- On/off switches may be located on an attendant control unit that can be attached to the wheelchair or operated remotely. Depending on the control method used by the wheelchair user, it may be necessary to turn the controller on before the attendant control can be operated.
- The attendant control overrides that of the wheelchair user.

**Changing speeds and modes:**
- The user should be trained to select different mode and speed settings for different skills.
- The process of changing modes may be quite specific. For instance, a switch may need to be activated to make mode selection available, followed by movement of the joystick to the right to move from one mode to the next, followed by movement of the joystick forward to select or use that mode.
• Other features:
  • If the powered wheelchair has other operating features (e.g. horn, turn indicators, lights), the trainer should make sure that the user can operate them.

**Special considerations for scooters**

Moving the controller away/back:
• The controller for a scooter is usually in the midline, on top of the tiller, between the two handles.
• For many scooters, the tiller can be unlatched and tilted toward or away from the user, to ease transferring onto and off of the scooter.

Turning the power on/off:
• Turning the power on and off is usually done using a key that can be removed.
• Many scooter users leave the key in its receptacle when the power is off. However, to lessen the likelihood of theft when the scooter is left alone, the scooter user may wish to remove the key. If so, removing the key and reinserting it should be practiced.

Changing speeds and modes:
• Commonly, faster speeds are possible by turning the speed dial clockwise and slower speeds by turning the dial counter-clockwise. These may be graphically illustrated (e.g. with a turtle on the left and a rabbit on the right).
• If the scooter has other operating features (e.g. horn, turn indicators, lights) that are controlled on the “dashboard” of the tiller, the trainer should make sure that the user can operate them.
8.2 OPERATES BODY POSITIONING OPTIONS

Versions applicable
- Manual wheelchair: X
- Powered wheelchair: 

WST/WST-Q skills
- “Operates body positioning options”.

Description and rationale
- The learner changes body position (i.e. tilts, reclines, elevates the seat, elevates the legrests and/or uses the sit-to-stand feature) using the available options of a wheelchair and then restores the wheelchair to the original position. Powered wheelchairs capable of variable body positions or postures are used for a variety of reasons, including pressure redistribution, comfort, breathing, postural control, stability, transfers, obstacle negotiation, bladder management, tone and venous return from the legs. Not all powered wheelchairs have body-positioning options. Although some manual wheelchairs also have options for modifying body position, these will only be trained with the skills that require changes in body position (e.g. caregiver-assisted tilt as a means of relieving weight from the buttocks).

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Beside the wheelchair, in a position where it is possible to intervene.
- Risks requiring spotter intervention:
  - Runaway.
  - Tips.
  - Damage to body parts from the wheelchair mechanism or the external environment.

General training tips
- Before changing position or restoring the wheelchair to the original position, the learner should check that there is room behind the wheelchair and above the knees to change the position without damaging the environment, the wheelchair, the contents of a knapsack, the user or a bystander.
- For wheelchair users with limited trunk balance, to reduce the likelihood of falling forward, 5-10º of tilt or recline is usually adequate at rest or when driving.
- Depending upon the positioning mechanism, the extent of forward and rear stability may differ in the new position. This should be taken into consideration when in a situation where reduced stability could be unsafe (e.g. proceeding forward up an incline in the tilted position) or when it might be helpful to alter the weight distribution between the front and rear wheels (e.g. tilting toward the drive wheels to increase traction or reduce the tendency for smaller-diameter wheels to sink into a soft surface).
- If the wheelchair allows both tilt and recline, it is advisable to tilt first and then recline. When
returning to the upright position, it is advisable to reverse the order (i.e. return from the
recline position before recovering from the tilt position). This reduces the tendency for the
wheelchair user to slide forward on the cushion.

- For wheelchairs that have stand-up and recline features, reclining the wheelchair user before
standing him/her up may be preferable to standing up from the sitting position. In the other
direction, the order should be reversed (i.e. recover from standing before recovering from
reclining).

- For wheelchairs that have all three features, the order is tilt, then recline, then stand; the
converse is the recommended order when returning to upright sitting.

Progression:

- For the wheelchair user to adjust to a position change may involve starting with a
small position change and progressing to the full desired change.

Adjustment tips

- Programming by the dealer and/or therapist should be considered to allow the wheelchair
user to get into the desired position with as few steps as possible (e.g. using a preset position
of 45° of tilt).

- The wheelchair user needs to have access to the controller when in the altered position.

General training tips

- For safety, some powered wheelchairs will prevent the wheelchair from being driven while in
extreme positions. Powered wheelchairs may slow down or stop if the user attempts to
operate them in unsafe circumstances (e.g. driving up a steep incline forward with the seat
tilted fully back).

- Some seats can be turned to the side, allowing the powered wheelchair to be driven
“sideways”, such as along a table. The learner should be aware that joystick movement
directions may relate to the original seat orientation, not the sideways one.

- Some seats can be turned completely backward, essentially converting a rear-wheel-drive
wheelchair into a front-wheel-drive one and vice versa. The learner should be aware that
joystick movement directions may relate to the original seat orientation, not the reversed one.

- When reversing the direction of the positioning option (e.g. from tilt back to tilt forward), it
may be necessary to pause briefly with some controllers.

Progression:

- If the rate of position change can be programmed, it is advisable to begin with a slow rate
and progress to a faster one. This will provide more time in which to ensure that the
wheelchair user is adjusting to the new position and that there are no body parts that are at
risk of being injured.

Special considerations for scooters

- Some scooters allow the seat back to be reclined, slid forward and backward and/or rotated to
the side or back. If such options exist, they are usually carried out manually.
8.3 ROLLS FORWARD

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills
- “Rolls forward short distance”.
- “Rolls forward longer distance”.

Description and rationale
- The learner moves the wheelchair forward on a smooth level surface. Forward rolling is a skill used during many wheelchair activities. The short distance is intended to simulate moving about indoors or the distance involved when crossing a two-lane street. Most bouts of wheelchair use are relatively short but occur many times a day. The ability to manage longer distances allows wheelchair users to get around in the community (e.g. getting from a parking lot to an office or getting around inside a store). Learners who are able to move their wheelchairs short distances may not be able to roll longer distances due to the additional endurance or attention required.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If a manual wheelchair, the spotter should be behind the wheelchair, holding onto the spotter strap with one hand.
  - If a powered wheelchair, the spotter should be beside the wheelchair on the side of the controller.
- Risks requiring spotter intervention:
  - If a manual wheelchair, rear tip when accelerating (especially during the first push).
  - If a powered wheelchair, runaway or collision.
  - Because speeds are usually faster if the skill is being performed in a smooth open space, the higher momentum can cause greater injury or damage if there is a collision with a fixed or moving obstacle.

Adjustment tips
- The distribution of weight on the front and back wheels can be adjusted in some wheelchairs. This has effects on the stability of the wheelchair, traction and rolling resistance.
- If the wheelchair user experiences difficulties maintaining a straight direction, the problem may be due to a wheelchair part (e.g. a flat tire) or something rubbing on a wheel (e.g. a seat belt).
- Underinflated tires increase the rolling resistance.
- Solid tires roll better on smooth surfaces but are less comfortable than pneumatic tires on rough ground.

**General training tips**
- There are three segments of this skill: starting, rolling straight and stopping. Stopping will be dealt with separately, in section 9.5.
- When first attempting to move forward, the direction in which any swivel casters are trailing can lead to some initial resistance to movement or lateral deviation as movement begins. The learner should reposition the casters in the appropriate direction before setting out. Learning how to reposition the casters is a technique that is useful for a number of skills. To reposition the casters, the wheelchair should be moved short distances in a manner that causes the casters to swivel (e.g. forward, then left, than backward, then right).
- The learner should maintain attention in the direction of travel, avoiding distractions to either side but remaining alert to potential hazards.
- The wheelchair user should keep the wheelchair away from dangers like walls or drop-offs.
- The learner should also be alert to the moving environment. If a hallway is clear enough to permit it, it may be advisable to drive in the middle of the hallway, to avoid collisions with people unexpectedly coming around corners or out of doors.
- The learner should obey driving conventions (the “rules of the road”), with respect to altering course to one side (e.g. to the right in North America) when approaching others, use of horn or verbal warnings, overtaking and slowing down when approaching others or blind intersections.

**Progression:**
- Speed and accuracy are inversely related. It is advisable to begin movement skills with accuracy before increasing the speed.
- Start in a smooth level indoor space and progress to the outdoor setting.

**Variations:**
- The learner can experiment with different speeds.
- A strip of bubble wrap can be used for the wheelchair to straddle, providing audible feedback if a straight path is not followed.
- To work on directional control, the learner can follow a wall or sidewalk edge while trying to stay within an arm’s reach.

**Special considerations for manual wheelchairs**
- Each propulsion cycle includes propulsion and recovery phases.
- Endurance may be a limiting factor for longer distances if the wheelchair user is poorly conditioned.
- Two-hand-propulsion pattern:
  - **Adjustment tip:**
    - The wheelchair parts and their set-up can affect propulsion. For instance, the
rear-wheel axle should be directly under or slightly ahead of the acromion process of the shoulder when the wheelchair user is sitting upright at rest. The fingers should be able to touch the axle of the rear wheel. When the hands are on the hand-rims of the rear wheels at top dead center (12:00, using the clock analogy), the elbow should be flexed 60-70° from full extension. These adjustments will allow the wheelchair user to have the hands in contact with the hand-rims in a manner that permits optimal propulsion as described below. For instance, having the elbows slightly flexed at 12:00 means there is range to allow the elbows to extend at the beginning and end of the propulsion phase.

- The friction between the hands and the hand-rims can be increased by the use of gloves, high-friction covering on the hand-rims or surgical tubing wrapped in a spiral fashion around the hand-rims. However, too much friction can cause discomfort or blisters when slowing the wheelchair (e.g. while descending an incline).

**Starting:**
- When starting to roll forward, the wheelchair user should lean forward slightly and avoid overly vigorous accelerations that could cause the wheelchair to tip over backward. This is the first example of a skill that can benefit by leaning. Because the weight of most wheelchair users is large relative to the weight of the wheelchair, leaning can have a major effect on the relative weight on the different wheels. Leaning affects the stability of the wheelchair, traction and rolling resistance. Leaning is a strategy used often in the later skills.

**Propulsion phase:**
- Once up to speed, propulsion mechanics vary with the task and the characteristics of the wheelchair user. However, on smooth, level surfaces there are some general guidelines that should be considered the starting point.
- During the propulsion phase, the hands should initially match the speed of the moving wheels.
- The wheelchair user should avoid overly vigorous accelerations that could cause the wheelchair to tip over backward.
- To propel the wheelchair straight forward, the wheelchair user should grasp the hand-rims and push evenly with both hands. He/she should not wrap the thumbs around the hand-rims, but point them forward.
- The wrists should be in a roughly neutral orientation, avoiding the extremes of range.
- To improve friction, if necessary, the wheelchair user may rest the palms of the hands on the tires in addition to using the hand-rims. The disadvantage of this technique is that the palms pick up dirt from the tires.
- To minimize shoulder injury due to repetitive strain, it is generally accepted that the wheelchair user should try to push with long, slow strokes, allowing the wheelchair to coast between strokes where possible. However, this technique may actually increase the loads on the shoulders during each cycle (although it is generally assumed that the reduction in the number of cycles offsets this). As for walking, optimization of energy efficiency may be more
important than minimizing shoulder loads.

- As noted earlier, hand positions can be illustrated by having the wheelchair user imagine the right rear wheel as the face of a clock; the initial and final contact positions for the wheel might then be referred to as 11:00 and 2:00 o’clock. This “three-hour time period” corresponds to a contact angle of 90°.
- The wheelchair user should lean forward as the elbows are extended during the latter part of the propulsion phase, to get more contact time between the hands and the hand-rims and to reduce the chance of a rear tip.
- To maintain a straight direction during the coast between pushes, the wheelchair user may need to push harder on the side toward which the wheelchair is deviating or use the fingers on the hand-rim to apply friction on the other side. Although it is possible to coast for several meters from a single push, a cadence of about 1 push per second is commonly used, at least in part to maintain directional control. If the learner is having difficulties in achieving the desired cadence, the trainer can provide audible cues (e.g. by clapping).

- **Recovery phase:**
  - A recovery path for the hands below the hand-rims is usually recommended for wheelchair users propelling for any distance on smooth level surfaces. After releasing the hand-rims at the end of the propulsive phase, the arms can be allowed to swing in a relaxed pendular fashion below the hand-rims (the “semi-circular” recovery pattern) back toward where the propulsive phase will begin for the next cycle. (The hands need to move slightly outward as well as backward, to avoid contact with the rear wheels.) To reinforce the desired path of the hands, the trainer can ask the wheelchair user to touch the rear-wheel axles during each recovery phase (“like the drive shaft of a choo-choo train”). This allows the hands to make initial contact with the hand-rims while moving upward.
  - An additional reason to reach back during the recovery phase and to use long strokes is to exercise the shoulder retractor muscles and maintain shoulder retraction range. This may help to offset the tendency for manual wheelchair users to become round-shouldered due to muscle imbalance and loss of flexibility.
  - Wheelchair users with weak or insensitive hands may prefer to slide their hands back along the hand-rims (the “arc” recovery pattern), rather than letting go at the end of the propulsive phase, but any friction should be minimized to avoid braking. Short strokes with arc recoveries may be appropriate for propelling short distances in confined spaces when fine control is the priority.

- **Variations:**
  - The wheelchair user can see how far he/she can roll on a single push.
  - The wheelchair user can see how quickly he/she can cover a distance.
  - The wheelchair user can try propelling with one hand at a time (e.g. as when carrying a cup of coffee).
  - The wheelchair user can push an empty wheelchair with one hand, steering
with the empty wheelchair.

- The wheelchair user can try to straddle a strip of bubble wrap while coasting, without bursting any bubbles.

- The wheelchair user can try to *straddle objects* of various heights and widths (e.g. using a few bricks) to better understand the clearance between the wheels and under the wheelchair.

- The wheelchair user can pull another occupied wheelchair behind him/her (with the second wheelchair user holding onto the wheelchair in front) (another “choo-choo train” analogy).

- After weaving around objects, it is important to remember to return to the proper propulsion/recovery pattern. An easy, multi-task activity is to weave through cones (e.g. during the “turns while moving” skill) and then transition into a few pushes in a straight line before returning to the cones.

- **Hemiplegic-propulsion pattern:**
  - **Note:** Hemiplegia due to stroke is used as a representative example of a condition for which foot propulsion can be useful. Wheelchair users with other impairments may find foot propulsion useful as well.

- **Adjustment tip:**
  - While the wheelchair user is properly positioned on the seat, the height of the seat should be low enough to allow the full foot to be on the ground when it is directly below the knee but high enough to fully support the thigh.
  - The wheelchair user should wear shoes that do not fall off, that provide protection for the foot and that provide good traction.

- **Propulsion phase:**
  - If only the sound-side arm is used, the wheelchair will deviate to the weaker side.
  - The wheelchair user propels the wheelchair with the sound-side leg to both propel and steer the wheelchair, with or without the assistance of the sound-side arm.
  - There is no need to synchronize the cadence of the hand and foot. Indeed, once moving, some wheelchair users use only the foot to maintain forward movement.
  - The propulsion phase for the leg begins with the knee relatively *extended*, pushing down on the floor with the heel of the shoe, and then *flexing the knee* under the seat to pull the wheelchair forward.
  - The propulsion phase for the arm is the same as that described above for two-hand propulsion.
  - If wheelchair users are experiencing difficulties (e.g. due to low friction between the shoe and the ground), they may find it helpful to rock the trunk forward at the hips in time with each flexion of the knee.

- **Recovery phase:**
- At the end of the propulsion phase for the leg, the foot is lifted off the ground, and the knee is extended.
- The recovery phase for the arm is the same as that described above for two-hand propulsion.

**Special considerations for caregivers**

- For caregivers of people with hemiplegia, if there is only one footrest, because the wheelchair user uses one arm and one leg to self-propel the wheelchair, the unsupported foot can be crossed over the supported one.

**Special considerations for powered wheelchairs**

- **Adjustment tips:**
  - For this skill and later moving skills, when it is possible to program the wheelchair modes (e.g. with respect to speed, torque and deceleration), the trainer should use a mode that is safe without being ineffective when training begins.
  - When set in the slowest speed, there may be a time lag between when a joystick is moved and when the action occurs. This can lead to overcorrection while steering the wheelchair.
  - The learner should alter the controller mode and speed settings to the ones most appropriate for the task. For the mode used for longer distances, the controller setting can be adjusted by the therapist or dealer to one that permits more speed and less sensitivity.
  - Non-proportional drives (on/off) are just as dependent on proper programming as proportional drives, if not more so. The set-up of non-proportional drives can be graded to include less cognitive demand and physical load depending on the user’s needs and abilities.
  - If the wheelchair user’s hand slips off the joystick or control is poor, a different shape for the joystick may be appropriate (e.g. U-shape vs. ball-shape).
  - Powered wheelchairs may be rear-wheel, front-wheel or mid-wheel drive. The drive configuration will affect the path of the wheelchair and the ease with which the wheelchair can be kept moving in a straight line. For instance, a front-wheel-drive wheelchair tends to be more difficult to keep moving forward in a straight line; some wheelchairs have built-in compensation for this problem.

- This is the first powered wheelchair skill involving movement of the powered wheelchair in a drive mode. With powered wheelchairs, although there are a number of input devices that can be used to control the wheelchair, the term “joystick” has been used in the WSP Manual because it is the most common device used. Unless programmed otherwise for a wheelchair user with special needs, displacement of the joystick in a direction will cause the wheelchair to move in that direction. If the controller is of the proportional-control type, the farther the joystick is moved from its rest position, the faster the wheelchair will move in that direction. The user should move such a joystick forward gradually to achieve a smooth start. It may take some practice for the wheelchair user to use the joystick in a proportional way – an exercise may be for the wheelchair user to see how slowly he/she can move.
• If the wheelchair user is over-correcting for minor deviations from the intended path when driving, changing the contact point with the joystick (e.g. from finger tips to the web-space between the thumb and index fingers) and resting the forearm on the armrest may improve driving smoothness.

• **Progression:**
  - The learner can practice moving the joystick in an open space and progress to more enclosed ones.
  - The learner can begin at responsive but low torque settings and progress to different modes.

**Special considerations for caregivers**

- When a caregiver is first learning to handle a powered wheelchair, it is preferable to do so with the wheelchair unoccupied, to avoid injury to the wheelchair user.
- Some wheelchairs permit the wheelchair to be operated by a caregiver behind the wheelchair, which is the preferred position if the equipment allows.
- For this and other moving skills, the caregiver may operate the wheelchair by using the same joystick that the wheelchair user does. Where space permits, this should be done with the caregiver standing beside the wheelchair and facing forward. In some situations (e.g. going through a narrow opening), the caregiver may need to stand in front of the wheelchair. The caregiver in this situation should be careful not to drive the wheelchair over his/her own feet.
- Standing behind the wheelchair and leaning forward to reach the joystick is not generally recommended but may occasionally be necessary.
- Sitting on the wheelchair user’s lap to operate the joystick is not recommended for a number of self-evident reasons.
- **Disengaging the motors** allows the powered wheelchair to be pushed manually without power (e.g. if the battery is dead). To do so, the power should be turned off before the motors are disengaged. The wheelchair may be harder to push if the power is on, even if the motors are disengaged. The caregiver can confirm that the motors have been disengaged, by pushing on it to see that the wheelchair can be rolled a short distance. Depending on the type of wheelchair, rolling the wheelchair slightly when disengaging the motors may ease the lever into the disengaged position. Various makes and models of powered wheelchairs and scooters have different methods of disengaging the motors. For most powered wheelchairs, there are two motors that need to be separately disengaged and engaged. For caregivers, good ergonomic principles should be used when engaging and disengaging the motors. The caregiver’s knees should be bent and the back kept straight. In many cases, a foot can be used to perform the task but this should be gently done to avoid damaging the mechanism.

**Special considerations for scooters**

- The handles on the tiller control the orientation of the front wheel for steering purposes.
- **Lever mechanisms** on the handles usually control forward versus backward direction and moment-to-moment speed.
- A dial on the tiller controls the general speed setting (high vs. low) depending upon the circumstances.
• The scooter user can set the speed control so that he/she can proceed at the desired speed with the lever fully pushed or pushed part-way depending upon the user’s preference.

• The stiff suspension of most scooters can lead to some bouncing over rough surfaces such as sidewalk cracks.
8.4 ROLLS BACKWARD

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills
- “Rolls backward short distance”.
- “Rolls longer distance”.

Description and rationale
- The learner moves the wheelchair backward on a smooth level surface. Backward rolling is a skill used during many wheelchair activities. However, a short distance is usually all that is necessary, unless overcoming high rolling resistance (e.g. on a soft surface or ascending an incline using foot propulsion).

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - For a manual wheelchair the spotter should be behind the wheelchair, holding a spotter strap (if a manual wheelchair) or beside the wheelchair near the front in position to push downward on a knee or wheelchair part.
  - Risks requiring spotter intervention:
    - Rear tip when stopping.
    - Collision with fixed or moving objects.

General training tips
- If backing up immediately follows rolling forward, then the casters will be trailing backward rather than forward as they will while moving backward. As the backing up begins, there may be some initial resistance and directional instability as the casters move into the forward-trailing position. The casters can easily be repositioned by moving them in a circular path.
- The learner should proceed slowly and look over both shoulders regularly to avoid obstacles and collisions. Using the analogy of backing up a motor vehicle may be helpful. Directional stability is more difficult to maintain when backing up a rear-wheel-drive wheelchair. This may lead to a sinuous path, with a series of deviations and over-corrections (“fish-tailing”). This may not be apparent when wheeling backward for a short distance like that used for the WST, so a longer distance should be used for training purposes. Slowing down will make it easier for the learner to steer.

Variations:
- **Bubble wrap** can be placed behind a moving rear wheel without the learner’s
knowledge to provide audible feedback that shoulder checks are needed.

Special considerations for manual wheelchairs

- In many ways, the technique is the opposite of what is used for rolling forward (as dealt with in the previous skill).

  - **Two-Hand-Propulsion Pattern:**
    - To propel the wheelchair straight backward, the wheelchair user should reach forward, grasp the hand-rims and pull backward evenly.
    - Some wheelchair users with very weak arms (e.g. people with tetraplegia) may find it more effective to make contact under the hand-rims with the palms up. Others may prefer to place both hands on the backs of the wheels (about 11:00 o’clock, using the clock analogy) with the arms straight and the shoulders shrugged. Then, the wheelchair user can lean back and use the body weight to push down on the wheels.
    - Unlike forward rolling, it is not easy to coast backward without deviating to one side or the other. Therefore, the length of the strokes is usually shorter when rolling backward.
    - Because the distances are usually short, there is no need to use long propulsion strokes or to recover the hands below the hand-rims.

  - **Variations:**
    - As for the “rolls forward” training section.

  - **Hemiplegic-propulsion pattern:**
    - As for “rolls forward” training, except the sequence for the leg is to first flex the leg, push down on the floor with the foot enough to ensure good traction, then push the wheelchair backward by straightening the leg.

Special considerations for caregivers

- The caregiver needs to do regular shoulder checks to avoid collisions or obstacles and will need to move to one side of the wheelchair if backing up to a fixed object (e.g. a wall).

Special considerations for powered wheelchairs

  - **Adjustment tip:**
    - The programming of a powered wheelchair is separate for the forward and backward directions. It is possible that a wheelchair that has not been programmed correctly could have difficulty backing up unless the speed control is adjusted upward.
    - If the wheelchair is fitted with a rear-view mirror, this lessens the need to turn around to see where the wheelchair is going for wheelchair users with limitations of neck range.

- To move backward, the wheelchair user ordinarily pulls the joystick backward.

Special considerations for scooters
As for “rolls forward” training, the handles on the tiller control the orientation of the front wheel for steering purposes, lever mechanisms on the handles control forward versus backward direction and moment-to-moment speed, and a dial on the tiller controls the general speed setting (high vs low).
8.5 STOPS

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills
- “Rolls forward short distance”.
- “Rolls forward longer distance”.
- “Rolls backward short distance”.
- “Stops on command”.
- “Turns while moving forward”.
- “Turns while moving backward”.

Description and rationale
- While the learner is moving the wheelchair forward or backward, he/she may intentionally come to a stop at a pre-determined location (e.g. next to a table or wall) or need to come to a sudden stop in reaction to an unexpected event (e.g. other wheelchairs or pedestrians moving into the path) to avoid injury to themselves or others.

Prerequisites
- “Rolls forward short distance” for the forward direction.
- “Rolls backward short distance” skill for the backward direction.

Spotter considerations
- Spotter: As for the appropriate shorter-distance skill (forward or backward).
- Risks requiring spotter intervention:
  - As for the appropriate shorter-distance skill (forward or backward).
  - Forward or sideways tip or fall due to a sudden stop or turn.
  - Because speeds are usually faster if the skill is being performed in a smooth open space, the higher momentum can cause greater injury or damage if there is a collision with a fixed or moving obstacle.

General training tips
- The learner should be alert to the fixed and moving environment while the wheelchair is moving.
- Sudden stops or changes of direction can lead to the wheelchair user falling forward or to the side in the wheelchair.
- When attempting to stop as close as possible to a target without contacting it, the learner may need help to understand what are the foremost and rearmost points of the occupied wheelchair (e.g. the toes, the footrests, a knapsack or rear anti-tip devices) because it may not be visible to the wheelchair user.

- Progression:
  - Start at a slow speed before stopping and increase as tolerated.
• Start in a smooth level indoor space and progress to the outdoor setting.
• Start on the level and progress to inclined surfaces.
• To practice the avoidance of moving obstacles, the learner should start with a single moving obstacle moving slowly at a consistent speed, seen well in advance, to obstacles moving more rapidly and unpredictably, with less warning (e.g. actual pedestrian traffic in a crowded setting).

• Variations:
  • The learner can practice stopping progressively closer to an obstacle, but without touching it. This can include progress from a tall obstacle that can be seen no matter how close the person is to it (e.g. a door), to one that is lost to sight as the user gets closer (e.g. a line on the floor). This requires good awareness of the most forward and rear-most aspects of the wheelchair. A mirror positioned to the side of the wheelchair can provide useful feedback.
  • The wheelchair user can see how quickly he/she can stop on command.
  • Different moving obstacles can be used (e.g. a rolled ball, a swinging pendulum).

Special considerations for caregivers
• For caregivers of manual wheelchair users, secure push handles (ones that will not pull off when a backward force is applied to them) are important for this skill.
• Sudden changes in speed or direction can cause the wheelchair user to fall forward or to the side. The caregiver should use good spotting techniques, reaching forward or to the side with a hand to stabilize the wheelchair user.

Special considerations for manual wheelchairs
• When there is ample space in which to stop, on a level surface the wheelchair will coast to a gradual stop due to frictional forces and rolling resistance when the wheelchair user stops pushing.
• If the wheelchair user wishes to stop more quickly, the rate of slowing can be controlled by how hard the hand-rims are gripped. The hand-rims should be allowed to run through the wheelchair user’s hands. While stopping, the hands should be ahead of top dead center (about 1:00 o’clock using the clock analogy).
• If the wheelchair user stops too quickly while moving forward, the wheelchair user may fall forward out of the wheelchair or tip over forward. To prevent this, the wheelchair user should lean back whenever he/she is required to stop quickly.
• Sudden stops while moving forward can transfer weight forward onto the casters, allowing the unloaded rear wheels to skid.
• When stopping while moving backward, to avoid tipping backward when stopping, the wheelchair user should avoid grabbing the wheels suddenly and should lean forward slightly.
• On a slope, the wheelchair will continue to roll (or even accelerate) unless stopping forces are applied. If the wheelchair starts to roll too quickly down an incline that is wide enough, instead of grasping both hand-rims to stop, the wheelchair user can grab one, turning across the slope.
• On a slope that is being descended in the wheelie position, when stopping part-way down
the incline, the learner may remain facing downhill or turn the wheelchair across the slope.

- For people using the hemiplegic-propulsion pattern, the wheelchair user may use the hand (as for two-hand propulsion) and friction between the foot and the floor to stop.

- Variations:
  - When moving forward, the wheelchair user can practice both quick stops (leaning back and grabbing both hand-rims firmly) and swerves (leaning toward the direction of turn and grabbing one hand-rim firmly).
  - See wheelie variation later.

Special considerations for powered wheelchairs

- Adjustment tips:
  - The setting for the deceleration distance may be increased so that a sudden stop does not cause the wheelchair user to fall or tip forward. However, the greater the deceleration distance, the more planning is required to avoid the obstacle.

- When stopping a powered wheelchair, the user should allow the joystick to return to the neutral position gradually for a smooth stop. Simply letting go of the joystick will bring the wheelchair to a stop at a rate that has been programmed. Some wheelchairs can be brought to a stop more rapidly if the power is turned off or the joystick is put into reverse.

Special considerations for scooters

- The high speed that is possible with some scooters, combined with the high center of gravity and narrow wheelbase can make the scooter vulnerable to sideways tips during sudden turns.
8.6 TURNS IN PLACE

Versions applicable
- Manual wheelchair: ✗
- Powered wheelchair: ✗

WST/WST-Q skills
- “Turns in place”.

Description and rationale
- The learner turns the wheelchair around to the left and right to face in the opposite direction, in as tight a space as possible. Turning around in tight spaces is a common challenge for wheelchair users. The type of wheelchair and its dimensions affect the ease with which this skill can be performed. The environment may be such that the preferred direction of turn is not possible, so the learner must be capable of turning in both directions.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Near the wheelchair or behind the wheelchair, holding onto the spotter strap if done in the wheelie position.
- Risks requiring spotter intervention: See WST risks.

Adjustment tips
- The ease of making a turn in a tight space depends on the overall length and width of the occupied wheelchair, the distance between the wheels and how free the casters or steering wheels are to swivel.
- The rear anti-tip devices for some wheelchairs increase the overall length of the wheelchairs. Adjusting or removing them may make it easier to turn around in confined spaces.
- The footrests of some wheelchairs also increase the overall length of the wheelchairs, so more turning space is required. Removing the footrests may make it easier to turn around in close quarters. If the footrests are removed, it is important to avoid injuring the feet by bumping them or running over them with a wheel. If elevated footrests are lowered, the space needed for turning will be reduced.
- If a wheelchair is in the tilted or reclined position, the turning space needed may be larger.

General training tips
- For most wheelchairs (but not scooters), the ability to turn is made easier by casters. Casters are wheels that are free to swivel around a vertical axis. The location of the casters (front vs. back) will affect the nature of the turn.
- It may be helpful for the learner to shuttle forward and backward (e.g. forward turn to the left, backward turn to the right, repeating as necessary) to minimize the space required,
turning part of the way with each cycle. The longer the chair, the more likely it is that this will be necessary.

- The trainer should help the learner clearly understand the difference between the size of the turning circle (that is affected by parts, such as footrests, that stick out above the ground) and the size of the turning footprint (that only includes the chair or body parts that touch the ground).
- The footrests can be moved out of the way in tight spaces to reduce the radius of the turning circle.

**Progression:**
- The wheelchair user should begin with small angular displacements and progress to larger ones.
- The learner should start with a larger space in which to turn and progress to smaller ones.
- The learner should start at a slow speed, focusing on accuracy and increase the speed as skill develops.
- The wheelchair user can practice on progressive smaller areas of support.
- The wheelchair user can practice on a soft surface.

**Variations:**
- Game: Ask the learner to pretend that his/her feet are the hour hand of a clock facing up from the floor and see how quickly and accurately he/she can respond to times that the trainer calls out (e.g. from a starting position of 12:00 o’clock, “turn to 3:00 o’clock”).

**Special considerations for manual wheelchairs**

**Two-hand-propulsion pattern:**
- To make the turn most tightly, the wheelchair user should pull back on one hand-rim, while pushing forward to an equivalent extent on the other. In such a case, the vertical axis of rotation for the turn is midway between the drive wheels. It may take a few cycles to complete the turn. If the arc moved through by one hand is less than that for the other hand, on completion of the turn, the wheelchair will come to rest closer to the hand that moves less. This can be an issue for the trainer to correct to achieve a tighter turning circle. Alternatively, this asymmetry of forces can be used as a strategy if the wheelchair user wishes to move in a direction as well as turning around.

**Progression:**
- Small displacements do not require that the hands be repositioned on the hand-rims.
- The wheelchair user should then progress to larger displacements that require the hands to be repositioned, using several steps to get all the way around to 180°.
- Some wheelchair users may be able to get all of the way around to 180° (or beyond) in a single movement (the so-called “snap turn”) by allowing the hand-rims to slide through the fingers. To prepare for a snap turn, the wheelchair user
places one hand as far forward as possible on one hand-rim and the other hand as far back as possible on the other hand-rim. Then, in a single uninterrupted motion, the wheelchair user “snaps” the wheelchair around, letting the hand-rims slide through the fingers until the wheelchair reaches the desired angle. Depending upon the rolling resistance of the surface, the wheelchair may continue to spin in a circle until wheel or hand-rim friction brings the wheelchair to a stop.

Variations:

- When turning around in confined spaces, it can be helpful for the wheelchair user to push or pull on external objects rather than using the hand-rims.
- See wheelie variation later.
- **Hemiplegic-propulsion pattern:**
  - To turn to the side away from the stronger hand, the wheelchair user should push forward on the hand-rim and push sideways toward the stronger side with the foot.
  - To turn toward the stronger hand the wheelchair user should pull back on the hand-rim and push sideways toward the weaker side with the foot.
  - The wheelchair user may reach across to the opposite wheel with the stronger hand.

**Special considerations for caregivers**

- To turn a manual wheelchair around in a tight space, the caregiver should pull back on one push-handle, while pushing forward on the other.
- The caregiver should stand close to the back of the wheelchair if space is limited. If a knapsack prevents this, it can be temporarily removed and placed in the wheelchair user’s lap.
- This skill can be performed in the caregiver-assisted wheelie position.

**Special considerations for powered wheelchairs**

- **Adjustment tips:**
  - Adjusting the speed, acceleration and deceleration for turning will affect turning.
  - The location of the drive wheels and seating configurations have impacts on the turning characteristics of the system.
  - The closer the drive wheels are to the loaded wheelchair’s center of gravity, the easier it is to turn in place by simply moving the joystick straight to the left or right. The vertical axis of rotation for such a turn is midway between the drive wheels.
  - If the drive wheels are well forward or back, the casters will swing more widely so that a series of to-and-fro motions may be needed to minimize the turning radius.

**Special considerations for scooters**

- Because the drive wheels are not independent and because of the limited angle through which the tiller can turn for most scooters, a scooter cannot turn in place in the same way that manual and powered wheelchairs can.
- The tightness of the turn is also affected by the length of the wheelbase.
• When maneuvering in tight spaces, the speed setting should be reduced.
8.7 TURNS WHILE MOVING

**Versions applicable**
- Manual wheelchair: ✔
- Powered wheelchair: ✔

**WST/WST-Q skills**
- “Turns while moving forward”.
- “Turns while moving backward”.

**Description and rationale**
- The learner turns the wheelchair to the left and right while moving forward or backward. Such moving turns are often necessary to avoid obstacles or to change direction. The amount of space needed for turning is affected by such factors as the type of wheelchair, the wheelbase (distance between the ground contact points for the front and back wheels), the overall length of the wheelchair and the freedom of the steering wheels to turn. For most wheelchair users, turns while moving backward are required less often in everyday life than moving turns in the forward direction.

**Prerequisites**
- None.

**Spotter considerations**
- As for the “rolls forward short distance” and “rolls backward short distance” skills, unless the learner has safely performed the appropriate skill, in which case the spotter needs only to be nearby.

**General training tips**
- The path of the wheelchair parts (e.g. footrests) will differ depending upon the characteristics of the wheelchair (i.e. whether the chair has rear-wheel, mid-wheel or front-wheel drive). As a general rule when turning, the vertical axis for the turn is midway between the drive wheels, so the farther away from this axis that a wheelchair part or body part is, the greater the circumference through which it will swing.
- When turning around an object (e.g. a pylon or a corner) that the wheelchair is close to, the wheelchair user should focus on ensuring that rear wheel, specifically the contact point between the wheel and the ground, clears the obstacle.
- When driving a rear-wheel-drive wheelchair toward a 90° turn into a narrow opening, when space is available the wheelchair user should stay as far as possible away from the wall on which the opening is found. This is analogous to parking a car between two other cars in a crowded parking lot.
- If the approach path is narrow but the opening is wide, approaching the corner close to the wall is preferable, watching closely that the axle of the near-side rear wheel is slightly beyond the corner before turning sharply.
- With a front-wheel-drive wheelchair, there is less of a problem steering a path close to the wall.
• If maneuvering around a series of fixed obstacles (such as the pylons used in the WST) that are widely spaced, a useful strategy is to use a path that takes the drive wheels close to the obstacles. If the obstacles are closer together, the wheelchair may need to be driven farther away from each obstacle to have sufficient room in which to complete the turn.

• The user should be especially careful not to catch the feet on an immovable external object – if the foot stops and the chair continues to turn, a serious injury can result.

Progression:
  • The learner should start with small changes of direction (e.g. around widely spaced pylons) and progress to more closely spaced ones.
  • When beginning training around full 90° corners, learners may find it easier to break a turn down into its segments – driving straight, turning, then driving straight again, rather than following a smooth curved path.

Variations:
  • Three-point turns (e.g. using an opening like a doorway to turn around and go back in the opposite direction) can be carried out by making the first turn into the opening while moving forward, followed by a backward turn in the opposite direction.
  • Alternatively, the initial turn into the opening can be backward (after rolling past the opening), followed by a forward turn in the opposite direction.
  • When using the moving-turns skill in real-life settings, the learner should obey the rules of the road at corners – he/she should slow down if the path around the corner cannot be seen, he/she should stay to the right or left (whichever is the convention in the country in which the training is taking place) and he/she should not cut the corner.

Special considerations for manual wheelchairs
  • Two-hand-propulsion pattern:
    • When ready to turn, the wheelchair user should slow down the inside wheel and/or push harder on the outside wheel. Slowing down the inside wheel results in a tighter turn, but causes the wheelchair to slow down. Pushing harder on the outside wheel causes the wheelchair to speed up. The decision on the relative speeds of the two wheels depends on how tight a turn is needed and safety considerations.

  Variations:
    • While coasting forward in a straight line, the wheelchair user can experiment with the effect on direction caused by rotating the outstretched arms from side to side – for instance, swinging the arms counterclockwise (as viewed from overhead) causes the wheelchair to turn clockwise.
    • The fixed environment can be used to assist with turning. Timing, intensity, direction and location of the forces applied to a fixed object such as a wall are important features of success. Using the environment minimizes the need to slow down.
      ▪ In the “drag” turn, the wheelchair user drags a hand, in a rear position, along the wall to turn toward the wall and around the
corner. If the learner is having difficulties, the skill can be simplified by segmenting the skill, for instance having the trainer push the wheelchair forward toward the corner while the wheelchair user has the wall-side hand in the ready position and the opposite hand on the lap.

- In the “push-off” turn, the wheelchair user uses a hand, in a forward position, to push away from the wall.

- See wheelie variation later.

- Hemiplegic-propulsion pattern:
  - The wheelchair user should use the foot to help steer.
  - It is easier to turn away from the sound (unaffected) side than toward it.

Special considerations for caregivers
- When turning while moving forward, the caregiver should push harder with the push-handle on the outside of the turn and pull back slightly on the inside handle. The opposite is the case when turning while moving backward.
- The caregiver should be careful to avoid having the wheelchair user’s hands or feet hit any barriers.
- The wheelie position can be used to turn in tight spaces.

Special considerations for powered wheelchairs
- The path of the wheelchair is affected by whether the wheelchair is rear-wheel, mid-wheel or front-wheel drive. The general rule of paying attention to the axle of the near-side drive wheel applies.
- If the leading wheels are the drive wheels (i.e. a front-wheel-drive wheelchair when moving forward), the trailing casters may swing wide of the path and may strike the wall on the far side, depending upon the radius of the turn.
- If the wheelchair is about to collide with the corner, the wheelchair user should not reach out to fend off with the hands or feet – this is ineffective and may cause injury. The body parts should be kept within the protective envelope of the wheelchair.
- Although operation of the joystick is fairly intuitive when performing turns while moving forward (e.g. if one wishes to turn to the right, the joystick is moved to the right), it can be difficult to get used to performing moving turns in the backward direction. It can be helpful to remember that the left-right direction in which the joystick should be displaced should be the direction in which the wheelchair user wishes his/her knees to move. For instance, when making a backward turn to the left, the knees will move to the right, so that is the direction toward which the joystick should be displaced.

Special considerations for scooters
- Some scooters have three wheels and some have four. All other things being equal, a three-wheeled scooter will corner better but will be more vulnerable to sideways tips.
- Unlike powered wheelchairs, the drive wheels do not operate independently. Steering the scooter is related to the orientation of the front wheel(s), controlled by the handles of the tiller.
- Because most scooters are rear-wheel-drive, turning is similar to driving a car, an analogy
that may be useful to the learner.

- Because most scooters have long wheelbases in comparison with other wheelchairs and because there are usually limits to how far the handles can be turned, scooters cannot turn as tightly as other wheelchairs.

- Having a mirror attached to a handle can be useful when driving straight backward but is of less use when turning – as one backs up and turns to the right, the mirror looks to the left.
8.8 MANEUVERS SIDEWAYS

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills
- “Maneuvers sideways”.

Description and rationale
- The learner maneuvers the wheelchair sideways to the left and right parallel to an object (e.g. a window, bed or table). Repositioning the wheelchair sideways in a tight space is commonly necessary to get closer to or farther away from objects.

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Near the wheelchair.
- Risks requiring spotter intervention: No common risks.

Adjustment tip
- The length of the wheelchair can sometimes be minimized through set up (e.g. by moving the axles forward) or positioning (e.g. tilt, recline, footrest elevation).

General training tips
- The learner needs to be aware of the widest and longest points of the wheelchair as well as the footprint created by the wheels on the floor.
- If the space available in a real-life situation is limited, the learner may need to shuttle the wheelchair forward and backward a number of times to get into the desired position, moving more to the side with each attempt.

- Progression:
  - The learner should start with ample forward-backward room in which to maneuver and gradually decrease the space.
  - The learner should start with small sideways steps and progress to larger ones.
  - The learner should start at a slow speed, focussing on accuracy (staying within any designated boundaries), increasing the speed within the limits of accuracy.

- Variations:
  - The learner may mimic parallel parking a car, pulling forward ahead of the target opening, then backing into the opening.

Special considerations for manual wheelchairs
- Two-hand-propulsion pattern:
Variations:

- An alternative for the wheelchair user with good upper-body strength and coordination is to use the “bunny-hop” method. To do so, the wheelchair user hops the rear wheels to the side by shifting the body weight in the desired direction and pulling up on the rear wheels to have them move in the same direction. Although there remains some controversy regarding this, it seems that the head should move initially in the direction intended, then in the opposite direction while moving the hips over (analogous to the head-vs.-hips method used in the sideways transfer discussed later in section 9.11). The wheels do not need to get fully off the ground to be successful. The bunny hop is most useful when space is very limited (e.g. when very close to a wall). Initially, the wheelchair user can get used to just hopping up and down, with no sideways movement. If the hands holding onto the hand-rims are not at the top dead center, the rear wheels will rotate when they become unloaded. This can be prevented by applying the wheel locks.

- A similar effect can be created by rocking the wheelchair from side to side, although the wheelchair may move forward as well as to the side. The wheelchair user should lean hard in the direction that he/she wishes to move and return more gently to the upright position.

- The learner may use the sideways-maneuvering technique to negotiate to the other side of two barriers with a space between them (e.g. two concrete bolsters in a parking lot) that is too narrow to drive straight through but is low enough from the ground to allow clearance between the wheels. It may be possible to move one pair of wheels through the gap at a time, transiently straddling the obstacles with one pair of wheels on either side of the obstacles and the wheelchair parallel with the obstacles before getting all wheels beyond the obstacle.

- See wheelie variation later.

Hemiplegic-propulsion pattern:

- No special considerations.

Special considerations for caregivers

- The caregiver should generally not attempt to lift the occupied wheelchair sideways. However, it may be possible to use the “wheelbarrow” approach. To do so, the wheelchair user leans forward to unload the rear wheels, being careful not to tip over or fall from the wheelchair. Then the caregiver may be able to slightly lift the rear wheels and move them sideways in small increments.

- The caregiver should be careful that the wheelchair user’s arm or hand is not caught between the lateral barrier and the rear wheel.

Special considerations for powered wheelchairs

- Adjustment tip:

  - A mirror attached to the wheelchair can be used to provide visual feedback on the position of the chair with respect to the rear barrier.
• The strategies for front-wheel-drive and rear-wheel-drive wheelchairs are somewhat different. For instance, when maneuvering away from a wall that is very close, it is helpful to move the casters away from the wall first.

Special considerations for scooters

• **Adjustment tip:**
  • A mirror attached to a tiller handle can be used to provide visual feedback on the position of the chair with respect to the rear barrier.

• Because of the long wheelbase of most scooters, it is often not possible to move sideways when the amount of space is very limited, but the skill should still be practiced in larger spaces.
8.9 PICKS OBJECTS FROM FLOOR

Versions applicable
- Manual wheelchair: ✓
- Powered wheelchair: ✓

WST/WST-Q skills
- "Picks objects from floor".

Description and rationale
- The learner picks objects up from the floor and passes them to the tester. Objects that need to be picked up from the floor or ground vary from those as small and light as a coin or a piece of paper to those as bulky and heavy as a young child. This is also an opportunity for the trainer to work on other reaching tasks (e.g. horizontally across a table or overhead as when removing an object from a shelf).

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Near the wheelchair, on the side toward which the learner leans (if any).
- Risks requiring spotter intervention:
  - Forward or sideways tip or fall when reaching, leaning or standing up.
  - Forward fall or tip due to standing on a footrest.

Adjustment tip
- Chair height and the overall length of the wheelchair can have impacts on the wheelchair user’s ability to reach objects, depending upon the method used.

General training tips
- Reaching and leaning reduce stability, putting the wheelchair user at risk of falling out of the wheelchair or, if in a manual wheelchair, tipping the wheelchair over.
- If the armrest on the side to which the wheelchair user wishes to reach is moved out of the way, it allows the wheelchair user to bend further sideways.
- To be safer if leaning or bending forward, the wheelchair user should move the footrests out of the way and place the feet on the floor.
- If the wheelchair user chooses to lean forward to accomplish the task, he/she should make sure the casters are trailing forward to decrease the likelihood of tipping forward. As noted earlier, when the casters are trailing forward, they lie ahead of the portion of the wheelchair frame to which they are attached, as is the case when the wheelchair is rolled backward. This is a good opportunity to review with the wheelchair user how to swivel the casters into different directions. Caster swivel control is a skill that will be useful for later skills. To swivel the casters 180° in a tight space requires that a combination of forward-backward and left-right forces be applied to the casters. As an exercise, the trainer can ask the learner to point the casters at targets or to pretend the caster is the hour
...hand on a clock ("Set your caster to 3:00 o’clock"). Alternatively the trainer can ask the learner to swivel the casters around an object (e.g. a coin) on the floor without touching it.

- The wheelchair user should use one hand on the wheelchair or thigh to help with balance and the other hand to pick up the object.
- For a wheelchair user with weak trunk muscles, to reach the ground he/she should move the arms to the thighs one at a time, and then to the feet, placing the chest on the thighs.
- Turning an object on its side may help to get a better grip.
- To make it easier to pick up an object, the wheelchair user may pull the object up against one of the wheels so that it does not move.
- If a wheelchair user has weak pinch strength, increasing the friction between the fingers and the object (e.g. by wearing gloves or wetting the fingers with saliva) can help to prevent dropping the object.
- When passing the object to someone or placing it on a table or shelf, the wheelchair should be positioned to take advantage of the learner’s reach, strength and balance.
- For a person with weak trunk muscles, to avoid falling in the direction that he/she is leaning, he/she may hook the non-reaching arm behind the push handle or hold onto the armrest or wheel.
- To help right him/herself in the chair after reaching for the object, the wheelchair user can pull on the opposite armrest or wheel.

- Variations:
  - If standing up and crouching, the wheelchair user should first apply the wheel locks and clear the footrests out of the way. If the wheelchair user stands up on the footrests, a forward tip is likely unless the footrests are behind the front wheels. If standing up and crouching, the wheelchair user should keep one hand on the wheelchair to keep from falling.
  - The wheelchair user needs to exercise caution when reaching across the body, especially when reaching for or picking up something (e.g. a heavy object on a high shelf, hot coffee, a knife) that could injure the user if it was spilled or dropped onto the lap. Also, bending and twisting at the same time can cause back injury.
  - If the wheelchair user is reaching for a light and unbreakable object from a high shelf, he/she can use an improvised reaching aid (e.g. a rolled up magazine or a cane) to help move the object off the shelf and catch it. In a store, when an object is out of reach, an object (e.g. a cereal box) on a lower shelf can be used to ease the desired object off the higher shelf so that it can be caught.
  - The learner may use a reaching aid, but should carry it with him/her.

- Progression:
  - The object can be picked up using different approaches (e.g. front vs. side).
  - Objects of different sizes and weights can be used.

Special considerations for caregivers

- For a caregiver, to pick a dropped object off the ground, the caregiver may maneuver the...
wheelchair so that he/she can keep one hand on the wheelchair, for balance and control.
Then, the caregiver can crouch and pick up the object with the other hand.

**Special considerations for manual wheelchairs**

- **Adjustment tip:**
  - Caster locks can be helpful to keep the casters oriented in the correct direction (trailing in the direction of lean).

- **Variations:**
  - A moving pick-up can be accomplished if the wheelchair user holds the object against the bottom of the rear wheel with one hand as the wheelchair rolls forward, then both hands can be used to grasp the object when it rotates to the top of the wheel.

**Special considerations for powered wheelchairs**

- If the wheelchair can be repositioned (e.g. with respect to tilt, recline or seat height), this may be helpful. For instance, if the wheelchair user’s balance is good and his/her feet can be placed on the floor, the wheelchair user can move to the front of the seat and obtain help in rising to reach upward by using the tilt mechanism.

- There is a danger of unintentionally rolling a wheel over the fingers or pinching the fingers between the drive wheel and fender. The safest approach is to first position the wheelchair, shut off the power, then pick up the object.

**Special considerations for scooters**

- Scooter users most often stand and get out of the scooter to pick up objects. This is safer than leaning from the seat, due to the high center of gravity and the possibility of a sideways tip.

- When getting out of the scooter, the scooter user should keep at least one hand on the scooter for balance.
8.10 RELIEVES WEIGHT FROM BUTTOCKS

Versions applicable

- Manual wheelchair: ✓
- Powered wheelchair: ✓

WST/WST-Q skills

- “Relieves weight from buttocks”.

Description and rationale

- The learner relieves weight from both buttocks, although not necessarily at the same time. Weight relief is important for comfort and the prevention of pressure sores.

Prerequisites

- None.

Spotter considerations

- Spotter starting position: Near the wheelchair, on the side toward which the learner leans (if any).
- Risks requiring spotter intervention: Forward or sideways tip or fall when leaning.

General training tips

- Partial unloading (30-90%) of each buttock for 15 seconds every 25 minutes and complete off-loading (90% or more) of both buttocks for at least 15 second every 2 hours is recommended. Frequent bouts of short-duration movement (“squirming”) are also recommended.
- Trainers should recognize that susceptibility to pressure ulceration varies among wheelchair users (e.g. due to such factors as variations in co-morbidities, sensation, local anatomy, blood supply, nutrition, moisture, nature of clothing worn), many of which are not affected by skills training. However, if the trainer notices any such correctable factors, these should be pointed out to the learner and/or an appropriate health-care provider.
- If using either of the recommended leaning methods (forward or sideways) (introduced earlier for the “picks objects from ground” skill) to relieve weight from the buttocks, the extent of weight relief is proportional to the extent of the lean.
- With the forward leaning method, the casters should be in the forward-trailing position to increase forward stability. The elbows can be rested on the thighs or a table. Further unloading can be achieved by resting the trunk on the thighs, grabbing the footrests and pulling on them. It may be socially inconvenient to use the full forward-leaning technique in some circumstances. A more moderate forward lean may be adequate. Getting back upright from the forward-bent position can be a challenge for some wheelchair users. The hands can be walked up the thighs until an armrest or the backrest can be reached to allow the person to pull him/herself the rest of the way.
- Side leaning or shifting the weight onto one buttock can also be effective, for those who cannot lean forward and recover, or in situations when the wheelchair user might find it inconvenient to lean forward. The armrests or rear wheels can be used to push or pull on.
As was the case for leaning forward, the wheelchair user can lean sideways on a table.

- **Variations:**
  - Transferring out of the wheelchair (e.g. onto a bed), where the wheelchair user can lie on his/her side or front is also effective.
  - Standing up is effective, but if it is done using a stand-up wheelchair feature, there may be new pressure areas to consider related to how the wheelchair user is supported in the upright position. Standing on the footrests is generally not recommended, although it can be safe if the footrests are not too far forward and/or the casters are oriented in the forward-trailing position. After a weight-relief maneuver, the wheelchair user’s buttocks should be gently repositioned on the seat rather than dropped back into place.
  - Bridging (lifting the weight off the buttocks by pushing down firmly on the feet) is effective but difficult to maintain for prolonged periods.
  - Tilt and recline are alternative methods that may be adequate for some wheelchair users, although neither can be expected to achieve the > 90% relief target. If tilt or recline are used, the greater the extent of tilt or recline the better, preferably at least 45°.
  - Reclining a wheelchair can cause shear forces between the backrest and trunk that can be compensated for by lifting the trunk away from the backrest after the reclining has taken place. Some wheelchairs provide built-in compensation for such shear forces, but the extent of such compensation may not exactly match the amount needed.
  - Push-ups are not recommended because of the high loads on the upper limbs (that may contribute to overuse symptoms) and because they cannot easily be sustained for long.

**Special considerations for manual wheelchairs**

- The leaning techniques can cause tips in the direction toward which the wheelchair user is leaning.

- **Variations:**
  - The tilt-rest position (with the wheel locks applied [or hands holding the hand-rims] and the wheelchair or wheelchair user leaning against a wall or curb) may permit sufficient rear tilt for partial unloading that can be sustained for many minutes. This position can be achieved in a variety of ways, for instance:
    - **Pull-back technique:** The wheelchair user positions the wheelchair close to the object (e.g. a sofa or wall) that he/she intends to lean against. Some trial and error may be needed to select the correct distance from the object; it is better to start too close to the object than too far from it. The wheel locks are applied and are checked to ensure that they are functioning. The wheelchair user then reaches back and pulls on the external object to tilt the wheelchair back just beyond the balance position, so that the wheelchair or wheelchair user rests against the object.
    - **Push-back technique:** As for the pull-back technique except that the wheelchair user pushes against an external object to create the tilt. This can include using the foot to push on the ground.
- See wheelie variation later.
- When returning from the tilt-rest to the upright position, the wheelchair user should leave the wheel locks on and tilt forward by leaning or by pushing against the object being leaned against.
- See wheelie variation later.
- Resting on the rear anti-tip devices may permit sufficient rear tilt but can result in a rear tip. With a spotter in place behind the wheelchair resting on the rear anti-tip devices, the wheelchair user can lean and rock backward to see if the wheelchair tips over; if so, this technique should not be used.

**Special considerations for caregivers**

- A caregiver can assist in a variety of ways, such as reminding the wheelchair user of the need to unload the buttocks or by assisting the wheelchair user in getting into or recovering from the unloaded position.
- A caregiver can sit behind the wheelchair and tilt the wheelchair backward to rest against the caregiver and provide pressure relief. To prevent the rear wheels from rolling forward, the wheel locks should be applied. This is a variation of the tilt-rest skill.
8.11 PERFORMS LEVEL TRANSFERS

Versions applicable

- Manual wheelchair: ✓
- Powered wheelchair: ✓

WST/WST-Q skills

- “Performs level transfers”.

Description and rationale

- The wheelchair user transfers from the wheelchair to another surface that is about the same height as the wheelchair seat and back again. A level transfer is a commonly used skill to move between the wheelchair and a chair, bed, tub, toilet, car or other surface. The average wheelchair user spends about 10 hours per day in the wheelchair and performs about 8 transfers a day but the range is high. A higher number of transfers per day increases the likelihood of overuse injury to the upper limbs. Proper technique is advisable as a means of reducing overuse and minimizing pain during transfers. The level wheelchair transfer should only be considered a representative transfer. More difficulty may be experienced when transferring to and from other surfaces or heights.

Prerequisites

- None.

Spotter considerations

- Spotter starting position:
  - Usually in front of the wheelchair and slightly to one side, close enough to catch the learner if he/she falls and to prevent the wheelchair from rolling or sliding away or tipping.
  - The spotter may ask the learner where it would be best to stand, given the learner’s previous experiences.

- Risks requiring spotter intervention:
  - Forward or sideways tip or fall when reaching or standing.
  - Rear tip when sitting back down in the wheelchair after a standing-pivot or crouching transfer.
  - Fall between the wheelchair and bench if the wheelchair rolls or slides away.
  - In the course of a standing pivot or crouching transfer, tripping over the footrests and falling.

General training tips

- There are a number of transfer techniques and surfaces to which a wheelchair user may wish to transfer. The methods described here are representative, but by no means comprehensive. Which type of transfer will be most suitable for a wheelchair user, with or without the assistance of a caregiver, will depend on a number of factors. An experienced clinician should make this determination. A thorough discussion of these
options is beyond the scope of the WSP Manual.

- Care should be taken to avoid catching the wheelchair user’s intravenous line, urinary catheter or other collection devices when transferring.
- The height of the starting and target surfaces should be adjusted, to the extent possible, such that the target surface is slightly lower.
- The path between the starting and finish surfaces should be cleared of any obstacles.
- The wheelchair should be positioned as close as possible to the target surface, with the casters trailing in a way that enhances stability in the direction of transfer.
- The footrests should be cleared away (if possible).
- The wheel locks (if any) should be applied.
- The wheel locks of any wheeled target surface (e.g. bed) should be applied.
- The comments below generally apply to the transfer out of or into the wheelchair, but will be described as though the transfer is out of the wheelchair. Transfer into the wheelchair is generally the same except that, once the wheelchair user is back in the wheelchair, he/she should restore the footrests fully and put the feet back on them. The wheelchair user should also make sure that any removed or repositioned wheelchair parts (e.g. armrests, footrests, cushion, seat belt) are in the same position that they were before he/she left the wheelchair.

- **Sideways transfer:**
  - This is sometimes called a “sliding” transfer but actual sliding is not recommended (to avoid shear forces or injury to the buttocks).
  - The wheelchair user should move the armrest (if any) out of the way on the bench side.
  - The wheelchair user should remove the wheel-lock extension (if any) on the side toward which the transfer will take place.
  - People using sideways transfers tend to lead with the weaker or more painful arm. However, if the arms are fairly symmetrical, alternating the leading and trailing arms allows them to share the stresses.
  - The feet should be stably supported on the floor if the footrests can be easily moved out of the way. If the footrests cannot be moved, it is acceptable to leave one or both feet on the footrests as long as forward tipping does not occur during the transfer. In addition to an actual tip, when the rear wheels become unloaded the wheel locks become ineffective and the rear wheels may move sideways due to caster swivel. A forward tip is less likely to cause a problem in wheelchairs that have the footrests behind the casters and will not happen if caster swivel locks (if any) are applied with the caster trailing in the appropriate direction. In considering where to place the feet, the wheelchair user should try to avoid situations in which the feet are not free to swivel when the buttocks are moved to the new surface – this could lead to a torsion injury of the lower leg.
  - The wheelchair user should move forward on the seat, to avoid such obstacles to sideways movement as the rear wheels.
  - To get the transfer board (if using one) under the buttock, the wheelchair user should lean away from it.
  - The wheelchair user should push down on the transfer board and wheelchair to
unload the buttocks.

- The wheelchair user should avoid fully extending the fingers and wrists, allowing the fingers to wrap around the edge of the target sitting surface. This avoids overstretching the joints and tendons, which may be of importance for people with tetraplegia who use a tenodesis grip (whereby active wrist extension causes passive finger flexion if the tendons are of appropriate length). Keeping the wrists in a neutral position also functionally lengthens the arms, making it easier to get the buttocks off the sitting surface.

- The wheelchair user should keep the leading hand just far enough away from the body to allow room for the buttocks to land on the target surface, but no farther. The trailing hand should be close to the body.

- The wheelchair user may shift sideways toward the target surface in a single large movement or several smaller ones.

- If possible, the wheelchair user should lean well forward (“nose over toes”). During the actual transfer from this position, the hips and the head move in opposite directions. For instance, if the wheelchair user wishes to move the buttocks up and to the left, the head should move down and to the right. This technique reduces the forces needed from the arms.

- Once the buttocks are fully supported by the target surface, the wheelchair user should sit up and remove the transfer board. The wheelchair user should lean away from it to do so.

- Note: It is not recommended that the wheelchair user place his/her feet on the bed or bench before independently attempting to move the buttocks sideways. Hamstring tightness will prevent the wheelchair user from being able to flex the hips adequately.

- **Standing pivot transfer:**

  - This is one of the most common types of transfer. The person stands fully upright from the wheelchair seat, pivots in place until his/her buttocks face the target surface, then sits down.

  - Wheelchair users with hemiplegia using standing-pivot transfers tend to transfer to their stronger sides.

  - The wheelchair user should leave the armrests in place.

  - The wheelchair user should move forward on the seat before beginning the transfer.

  - The wheelchair user should try to flex the knees to get the feet under the body, in preparation for the sit-to-stand phase of the transfer. During the transfer, the hips should be flexed.

  - To avoid the need for turning through a greater arc than necessary when pivoting, the wheelchair user should turn the back toward the bench rather than away from it (i.e. a 90° turn, not a 270° one).

  - The wheelchair user may use the armrest on the unaffected side to help maintain balance while transferring but this can lead to unequal weight-bearing during standing-pivot transfers. If the wheelchair user can manage it, the sound-side hand may be placed on the thigh during the sit-to-stand segment of the skill.

  - If a wheelchair user with hemiplegia can only transfer back into the wheelchair with the strong side leading, he/she or a caregiver will need to move the wheelchair to the
other side.

- **Variation:**  
  o The *crouch pivot transfer* is similar to the standing-pivot transfer, except that the knees and hips are not fully extended. The wheelchair user may need to move the armrest and the wheel lock extension (if any) out of the way on the bench side. The wheelchair user should stay low, and not try to stand up fully. However, the buttocks need to be high enough to clear any obstacles (e.g. the armrest or rear wheel). The hips and the head move in opposite directions as for the sideways transfer.

- **Forward transfer:**  
  - When transferring straight-on (e.g. for a person with amputations of both legs above the knees), the wheelchair user should pull the wheelchair as close as possible to the transfer bench and at right angles to it.
  - A transfer board may be used.
  - The armrests should be left in place. If the armrests are desk-length, in some wheelchair designs they may be reversed to provide better support as the wheelchair user moves from the wheelchair to the new surface.
  - Wheelchair users who have used the forward transfer method to transfer out of the wheelchair may be able to enter the wheelchair in the forward direction and then turn around, if the amputation residual limbs are short enough. Alternatively, the wheelchair user can back onto the wheelchair seat.

- **Progression:**  
  - Once the basic transfer is mastered, it should be practiced with different target surfaces, at different relative heights. The “performs wheelchair-ground transfers” skill discussed later is an example of an advanced transfer.

### Special considerations for caregivers

- **General**  
  - This section only deals with transfers for wheelchair users who require no more than moderate assistance to perform the final movement between the wheelchair and the bench. If the caregiver must perform the majority of the effort, or if a mechanical lift is needed, additional training by experienced rehabilitation professionals is needed. This is outside the scope of the WSP Manual.
  - The caregiver should be attentive to the position of the wheelchair user’s arms to avoid injuring them during the transfer.
  - The caregiver, if unfamiliar with the wheelchair, should inquire as to whether the wheelchair user has ever experienced falls during transfers and, if so, in which direction. This may help the caregiver to know how best to provide assistance.
  - Care should be paid to good back ergonomics by the caregiver:
    - The feet should be shoulder-width apart for balance.
    - The caregiver should avoid bending the back and twisting at the same time.
    - The caregiver should bend his/her knees and keep the rest of his/her
body straight to avoid injury to the back.

- The caregiver should keep the wheelchair user close to the caregiver (vs. arms straight).
- The caregiver should use aids (e.g. transfer belt, transfer board, mechanical lift) as needed.

- The caregiver should use the help of other people, if needed. One option is for one caregiver to be behind the wheelchair user, reaching under the upper arms to grasp the wheelchair user’s forearms that have been crossed in front of the body. The second caregiver is positioned in front of or to the side of the wheelchair and lifts the legs from behind the knees.

- The wheelchair user should not hold the caregiver around the neck.

- If the wheelchair user is falling, it may be necessary for the caregiver to lower him/her to the floor rather than risk injury to the caregiver.

- If it is necessary for the caregiver to move the unoccupied wheelchair to the other side, the caregiver may leave the wheel locks on. Using the push handles at the rear of the wheelchair, the caregiver should lift the rear wheels slightly off the floor and push or pull the wheelchair on the casters (the “wheelbarrow” method). This will save time, avoid strain on the back and ensure that the wheel locks are applied when the wheelchair user transfers back into the wheelchair. Because the only wheels on the floor are the casters, the wheelchair can be moved straight sideways.

- If a mechanical lift is being used by the caregiver, it can be helpful to put the seat in the tilted position to assist in ensuring that the wheelchair user is properly positioned in the sling.

- If a mechanical lift is being used by the caregiver, after the wheelchair user has been lifted sufficiently, it may be easier to drive the wheelchair backward out from under the wheelchair user rather than moving the lift.

- Sideways transfers:
  - It may be necessary to perform the transfer in steps.

- Standing pivot transfers:
  - To assist the wheelchair user in getting from sitting to standing, the caregiver should stand or sit in front of the wheelchair or stand to one side.
  - The caregiver should apply an assisting force to the wheelchair user’s body, near the hips. The caregiver should not pull on the wheelchair user’s arms.
  - The caregiver may use a transfer belt around the wheelchair user’s waist.
  - The caregiver may need to use his/her knees to keep the standing wheelchair user’s knees from buckling, by blocking them.
  - Once standing, the caregiver should ask the wheelchair user to pivot, turning the back, in the shortest possible route, toward the bench.

**Special considerations for manual wheelchairs**

**Wheel locks:**

- Prior to the actual transfer, the learner should apply the wheel locks (if any). If the rear wheel is able to turn with the wheel lock applied, the wheel lock may need to be adjusted...
or the tire may need to be pumped up, if it is pneumatic. If strength is a limiting factor to applying the wheel locks, the wheelchair user may use wheel-lock extensions.

- A wheelchair user with weak trunk muscles can avoid falling forward during wheel-lock handling, by hooking an arm around a push handle or holding onto an armrest or wheel.
- To apply a push-to-lock wheel lock, the wheelchair user grasps the handle of the wheel lock and pushes it toward the front of the wheelchair until it is firmly in place.
- To apply a pull-to-lock wheel lock, the wheelchair user pulls the handle backward until it is firmly in place.
- Retractable wheel locks are ones that can be positioned completely out of the way when they are not in use, so the wheelchair user does not scrape his/her hands on them during wheelchair propulsion. They are most often found on rigid-frame wheelchairs. To apply a retractable scissor wheel lock, the wheelchair user pulls or pushes the handle in the appropriate direction until it is firmly in place.
- To release wheel locks, the learner should reverse the action used to apply them. For a retractable scissor wheel lock, the learner should fold the wheel lock fully out of the way.

**Armrests:**

- Generally, it is easier to reposition the armrests than it is to remove them completely.
- To move the armrests away, any of the following options can be used, depending upon the armrest design:
  - For a flip-up armrest, the learner should unlock the front of the armrest from the receptacle and lift the front of the armrest so that it flips back out of the way.
  - For a swing-away armrest, the learner should lift the armrest up slightly to disengage it and then swing it horizontally out of the way.
  - To completely remove an armrest, the learner should unlock whatever locks are necessary. There may be ones at both the front and back of the armrest. The learner should lift the armrest straight up so that the armrest is detached from the chair. If the armrest is height-adjustable, the wheelchair user should be careful not to just remove the elevating arm pad.
  - For a wheelchair with a tray (e.g. for a person with hemiplegia), the learner should first flip the tray away or slide it forward to detach it.
  - To restore the armrests, with some armrest designs, it is easy to unintentionally reverse left and right. To avoid this, the learner should be encouraged to follow a routine with respect to where the armrests are placed when removed. The learner should reverse the process used when moving the armrests away. The learner should make sure the armrest posts are lined up with the receptacles before locking them. The learner should check to make sure the armrests are locked in place by pulling up on them.

**Footrests:**

- The learner should clear the footrests out of the way prior to a transfer, whenever possible. It may be easier to do so before moving the wheelchair into its final position.
- Before moving the footrests out of the way, the learner should first remove the feet from the footrests. A person with weak hands may need to use two hands or an extended wrist of one hand under the knee to lift the leg. If one leg is stronger, it may be used to assist in lifting the weaker leg. Later, after restoring the footrests, the learner should put the feet
back on the footrests.

- To move a swing-away footrest out of the way, the learner should unlock the footrest. Locking mechanisms vary from wheelchair to wheelchair. The learner should swing the footrest completely out of the way. Some footrests swing away to the side and others to the middle. To replace the footrest, the learner should push the footrest back toward the front of the wheelchair until it clicks into place. The learner should check that it is locked in place by pulling on it.

- To completely remove the footrests, the learner may need to first swing the footrest away. The learner should then pull up on the footrest. The learner should pay attention to how the footrest was attached to the chair to simplify restoring it later. To replace the footrest, the learner may need to start in the swung-out position, line up the post or pins with the hole(s) and put the footrest back in place. The learner should then swing the footrest back to the front.

- Some wheelchairs do not allow the footrests to be swung away or removed, but it may be possible to flip the foot-plates up. The learner should pull the foot-plates up until they are fully vertical. To do so on some wheelchairs, it may be necessary to push the heel loops (if any) forward. To replace the footrests, the learner should push the foot-plates down. The learner should push the heel loops back into place, if they were displaced earlier.

- To raise an elevating footrest on a manual wheelchair, the learner should grasp it near the end and lift it to the desired position. This requires less force if the leg is not on the leg-rest. To lower the footrest, the learner should support its weight, and hold the position lock open while lowering the footrest. The position lock is often located at the top of the leg-rest (near the knee).

- For a wheelchair user with weak trunk muscles, to reach the footrests, the arms can be moved to the thighs one at a time, and then to the feet, until the chest is resting on the thighs. To get back into the upright position, the stronger arm can be hooked over the push handle or armrest and the body pulled up through elbow flexion and wrist extension.

Casters:

- If possible, the learner should position the wheelchair so that the casters are trailing in the direction of the transfer to reduce the likelihood of the wheelchair tipping in that direction. To achieve this position, the learner should finish the wheelchair positioning with a slight movement away from the direction of the transfer.

- For wheelchairs that are equipped with them, caster swivel locks can be used to help maintain caster orientation.

Special considerations for powered wheelchairs

- Positioning (e.g. tilt, recline, seat height, seat swivel) may be useful while preparing the wheelchair for a transfer.

- The power should generally be turned off while the transfer is being performed.

- Although not the only consideration, if all other factors are equal, it will be easier to make a sideways transfer toward the non-controller side.

- The controller may need to be moved out of the way for a sideways transfer in that direction.
• If the wheelchair user is using a standing-pivot transfer, with the feet on the ground the tilt mechanism of the wheelchair can be used to assist in lifting the buttocks if the wheelchair user has moved well forward on the seat.

Special considerations for scooters

• The tiller handles can be an asset while transferring if the scooter user needs assistance for balance. However, the amount of force applied to them should be minimal because they may swivel into a different position.

• The handles can get in the way if the tiller is turned to the side toward which the scooter user is transferring. Conversely, turning the tiller in the opposite direction provides additional space for the transfer.
8.12 FOLDS AND UNFOLDS WHEELCHAIR

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: X

WST/WST-Q skills
- “Folds and unfolds wheelchair”.

Description and rationale
- The learner folds or takes apart the unoccupied wheelchair to make it as small as possible, and then restores it to its original condition.
- For transport or storage, the size or weight of the wheelchair may need to be reduced. This can be done by folding the wheelchair. Removal of the rear wheels or other parts is a useful way to further diminish the size and weight of the wheelchair. In everyday life, wheelchair users may not need to break their wheelchairs down completely and this should be taken into consideration when setting goals for training. For the purposes of the WSTP, this skill is considered “not applicable” for powered wheelchairs and scooters, even though some parts of some models may be readily foldable or removable.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - Near the learner, on the side toward which the learner leans (if any).
- Risks requiring spotter intervention:
  - Forward fall while reaching.
  - Pinching fingers between folding or rotating parts.
  - Injury to lower leg or foot due to dropping or rotating wheelchair parts.

General training tips
- There is no rigid sequence of step to be used, but the trainer may identify changes that would be of benefit to the learner.

- Fold wheelchair:
  - The learner should pay attention to each item as he/she removes or alters it, to ensure that he/she will be able to reassemble the chair later.
  - The learner should remove anything that may prevent folding (such as the cushion, rigid seat, backrest or knapsack).
  - To remove a rigid seat or backrest, the learner may need to release restraining devices.
  - For rear wheels that can be removed without tools, there is usually a release mechanism at the center of the axle, a button or lever that needs to be depressed. If the wheel does not come off easily, the learner should check to be sure the wheel
lock is not on and that the rear wheel is off the ground.

- To fold a cross-braced wheelchair (one that becomes narrower from side to side when folded), the learner should first clear the footrests (e.g. by flipping them up, swinging them away or removing them).

- To fold a cross-braced wheelchair more easily, the learner should position the wheelchair so that he/she is on one side of it. The learner should then tip the chair slightly toward him/herself so that the wheels on the side away from him/her are off the ground. This eliminates the friction between the far-side rear wheel and the ground and allows gravity to assist in folding the wheelchair. The learner should then pull the seat or seat rails upwards, with one or both hands, to fold the chair.

- For a rigid-frame wheelchair with a fold-down back, although the frame cannot be folded, the learner can often make the chair easier to transport by folding down the back. The learner may need to release any restraining devices before he/she can do so. After folding the wheelchair, if the wheelchair does not have a latch mechanism to prevent the wheelchair from opening while it is being lifted, it may be helpful to use a strap.

- When lifting a folded wheelchair for which the rear wheels cannot be removed, injury can occur if the unlocked rear wheels are grasped, because the frame will be free to rotate.

- It may be possible to reduce the weight and size of the wheelchair by removing the armrests and footrests.

- The push-handles of some wheelchairs can be folded to further reduce the wheelchair dimensions.

- **Unfold Wheelchair:**
  - Generally, the learner should reverse the steps used to fold the wheelchair and in roughly reverse order (e.g. starting by putting the rear wheels back on and finishing with putting the cushion back in place).

  - To replace the rear wheels it may be necessary to push the quick-release plunger to allow the axle to get into the housing. To check that the axle is fully seated, the plunger should be out and it should not be possible to pull the rear wheel off.

  - Some tires have a directional tread pattern (more rolling resistance in one direction than the other). If so, the left and right wheels should not be considered interchangeable.

  - The learner should be careful not to tangle the seatbelt (if any) under the seat.

  - To get the process of opening a cross-braced wheelchair started, the learner should use the push-handles to lift the rear wheels off the ground (thereby avoiding friction with the ground) and separate the push-handles.

  - The learner usually then needs to push the seat rails back down into the starting position. The learner should keep the fingers on top of the rails to prevent them from being pinched.

  - For wheelchairs with backrests that fold forward, the backrest may lock in the folded position, necessitating a release of the locking mechanism to unfold the backrest.

  - The learner should put the cushion back on the seat properly before transferring back into the chair.
• **Progression:**
  - Once the learner is able to fold and unfold the wheelchair, he/she can progress toward full use of this skill by putting the folded wheelchair up on the transfer bench and into his/her vehicle. Variations in the designs of the wheelchair and vehicle preclude a thorough discussion of this in the WSP Manual.

• **Variations:**
  - The advanced wheelchair user may be able to remove and replace rear wheels while seated in the wheelchair by leaning sideways (e.g. in a doorway). This can be useful if the wheelchair user wishes to change the wheels for ones more suitable for a new activity. Also, removing the rear wheels can be helpful in getting through narrow spaces if there are transport wheels or rear anti-tip devices that can be used for the purpose.

**Special considerations for powered wheelchairs and scooters**

• Although generally not applicable, some powered wheelchairs and scooters can be folded or reconfigured without tools for storage or transportation. If that is the case and doing so is a goal of the learner, training should be provided.
8.13 GETS THROUGH HINGED DOOR

**Versions applicable**
- Manual wheelchair: ✔
- Powered wheelchair: ✔

**WST/WST-Q skills**
- “Gets through hinged door”.

**Description and rationale**
- The learner opens, passes through and closes a hinged door that opens away from the learner, then repeats the task in the opposite direction (with the door opening toward the learner). Wheelchair users frequently encounter such hinged doors or gates. Although there are a variety of door types, this is considered a representative skill.

**Prerequisites**
- None.

**Spotter considerations**
- Spotter starting position: Near the wheelchair, on the side toward which the learner leans (if any).
- Risks requiring spotter intervention:
  - Rear, forward or sideways tip or fall due to reaching and pulling on the door handle.
  - Pinching the fingers between the door and the frame.
  - Scraping the hands between the door frame and the wheelchair.

**Adjustment tips**
- For doors in the wheelchair user’s own environment, attaching something (e.g. a handle or piece of rope) in the middle of the door can make closing easier.
- Having a roller on the outer corner of the wheelchair’s footrest can be useful when using the footrests to apply force to a door.

**General training tips**
- Although the footrests can be useful to help push doors open or closed, this method should not be used on glass doors that might break.
- The feet often extend beyond the footplates, so care needs to be taken to avoid injury.
- If using the footrests to apply a force to a door, it is best to approach the door at a slight angle toward the side that will open. This ensures that it is the outer corner of the footrest that contacts the door and not the feet.
- If there is a threshold in the doorway, the principles for dealing with such an obstacle can be found in the later section on the “gets over obstacles or gaps” skill.
- For a door that opens away from the wheelchair, the wheelchair user can begin the skill by positioning the wheelchair directly in front of the door.
- For a door that opens toward the wheelchair, if there is enough space, the wheelchair user...
should position the wheelchair to the side of the door to allow room for it to be swung open without striking the wheelchair or a body part.

- Once a self-closing door has been opened enough to allow the wheelchair to proceed through it, the widest part of the wheelchair can be used to prevent the door from closing.
  To avoid scraping the door, the wheelchair user can use his/her hand or elbow to push the door open briefly to allow progress.

- While moving past the door, the wheelchair user should be careful to avoid catching any clothing or body parts on the door handle or the surface of the door if it is rough.

- The wheelchair user may wish to move his/her hands from the hand-rims to the tires to avoid them being pinched between the hand-rims and the door or door frame.

- To close a door that opens toward the wheelchair, after passing through it, there are several options (if the door does not close by itself):
  - The wheelchair user may gently swing the door closed behind him/her, moving the wheelchair quickly through the door and out of the way.
  - The wheelchair user may turn around once through the doorway, reach forward and pull the door toward him/her while backing away.
  - The wheelchair user may go through the door backward, pulling the door with him/her.
  - The wheelchair user should not put his/her fingers between the door and door-frame for any longer than necessary (preferably not at all) because they may get pinched when the door closes.
  - Reaching over the back of the wheelchair to close the door is effective, but there is risk of a rear tip in a manual wheelchair.

- To close a door that opens away from the wheelchair after passing through it, there are several options (if the door does not close by itself):
  - The wheelchair user can swing the door closed.
  - The wheelchair user can turn the wheelchair around and push the door closed with the footrests.
  - The wheelchair user can back up to close the door using the rear wheel or other wheelchair part to push on the door.

- Progression:
  - Judging the width of doorways relative to wheelchair dimensions can require practice. To avoid damage to the hands, wheelchair or door frame, it can be useful to attempt getting through progressively more narrow openings using objects that are not firmly fixed (e.g. pylons). Bubble wrap can be used to provide audible feedback.
  - The learner should start with a door that does not close on its own and progress to one that does. The trainer can reduce or add resistance to door opening by applying forces with his/her hand.
  - The space available to the side of the door can be varied.

- Variations:
  - The learner can experiment with negotiating the door in the forward or backward directions.
- Game: There are many variations in the ways doors open and close, alone or in sequence with other doors. Also, a variety of door handles exist. A game that provides opportunities to practice these variations is to have a “door scavenger hunt”, seeing how many different combinations and permutations can be found and successfully managed in a period of time.

- Game: To get used to the relative widths of the wheelchair and doorways, the user can attempt to get between two obstacles that are lightweight and movable enough that injury is not a concern. The distance between the obstacles can be gradually narrowed (“lateral limbo”) and they can be approached at progressively greater speeds.

**Special considerations for caregivers**

- Before moving a wheelchair through any type of door or narrow space, the caregiver should make sure that the wheelchair user’s hands or elbows are not extending beyond the sides of the wheelchair where they could be injured.

- The caregiver should keep part of his/her body between the door and the wheelchair user.

- The skill can be accomplished by moving the wheelchair through the door forward or backward.

- For a narrow doorway, one option is for the caregiver of a manual wheelchair user to remove one rear wheel. With the wheelchair user leaning the other way and the caregiver supporting the push-handle, it may be possible to get through the door on three wheels.

- For a door that opens away from the wheelchair, the caregiver should open the door, grasp the push handles at the rear of the wheelchair and push or pull the wheelchair through the doorway. When the wheelchair and caregiver are completely out of the way, the caregiver should close the door.

- For a door that opens toward the wheelchair, if there is room the caregiver should angle the wheelchair away from the door on the side that will open.

**Special considerations for manual wheelchairs**

- Two-hand-propulsion pattern:

  - The door-frame can be used to help propel the wheelchair user through the door (the “slingshot” method). To do so, the wheelchair user reaches forward and places one hand on the door frame and the other on the door or the door frame on the other side. Then, by pulling with both hands, the wheelchair is moved through the opening. This has the advantage of keeping the hands from being injured by bumping or scraping them between the door frame and the wheelchair.

  - To open a door that opens away from the wheelchair more easily, the wheelchair user can turn sideways in front of it. This allows the wheelchair user to get closer to the door and to resist the tendency of the wheelchair to roll backward when the door is pushed. Alternatively, the wheelchair user can hold onto the door-frame with one hand, as the door is pushed with the other. This is more likely to be necessary if the door resists opening.

  - To open a door that opens toward the wheelchair, the wheelchair user should push on the door-frame with the hand farthest from the hinge to open the door more easily with the other hand. Turning the wheelchair sideways will also prevent the...
wheelchair being pulled forward as the wheelchair user pulls on the door.

- **Variations:**
  - If there is a threshold or level change in the door opening, after popping the casters over the threshold or up onto the higher level, it may be helpful to use the door frame to help provide the forces needed to proceed.
  - For a door that opens away from the wheelchair and that is latched with a bar mechanism that will open when a force is applied to it, the wheelchair user can approach the door without slowing down. At the last moment, the wheelchair user can lean and reach forward with one or both hands and use momentum to open the door. The feet should not strike the door. This should initially be practiced at slow speeds.
  - For a doorway that is too narrow for the wheelchair to pass through, an option is to remove both rear wheels and rest on the rear anti-tip devices or transport wheels to get through the door. For wheelchairs that fold from side to side, some wheelchair users can partially fold the wheelchair and sit on an armrest.

- **Hemiplegic-propulsion pattern:**
  - Using one hand to cross over from one wheel to the other can be helpful to keep the wheelchair straight while getting through a door.

**Special considerations for powered wheelchairs**

- When applying a force to open a door toward a powered wheelchair, it may be easier to simply grasp the door handle with the hand on the side away from the joystick and then back the wheelchair up, rather than doing all of the work with the arm.
- Unlike with a manual wheelchair, the force of a self-closing door does not require the user to brace himself/herself with the other hand on the door frame or to turn sideways to prevent the wheelchair from being moved unintentionally.
- For a person with hemiplegia, it is impossible for the sound arm to simultaneously hold the door lever and control the joystick. It may be necessary to complete the task in several small steps.
- Because of the risk of injury and because overcoming the force of a self-closing door mechanism is not a problem, it is not recommended that momentum be used to open doors with latch mechanisms.
- If the powered wheelchair is about to collide with the door or door frame, the wheelchair user should not reach out to fend off with the hands or feet – this is usually ineffective and may cause injury. The body parts should generally be kept within the protective envelope of the wheelchair.

**Special considerations for scooters**

- The width of some scooters may make it difficult to get them through narrow openings.
- The length of some scooters can make it difficult to reach door handles, making it necessary for the scooter user to get off the scooter. When getting off the scooter, the user should keep at least one hand on the scooter for balance. The scooter user should not operate the scooter while standing because the movement may cause a fall.
8.14 ASCENDS INCLINES

Versions applicable

- Manual wheelchair: 
- Powered wheelchair: 

WST/WST-Q skills

- “Ascends slight incline”.
- “Ascends steep incline”.

Description and rationale

- The learner moves the wheelchair up inclines of different slopes. Inclines with different
  slopes are encountered frequently in the natural and built environments. For instance, a 5°
  (~1:12) grade meets the current building codes for ramps in North America. Inclines with
  slopes greater than the standard recommended value are encountered frequently in the
  natural and built environments.

Prerequisites

- None.

Spotter considerations

- Spotter starting position: Behind the wheelchair, holding onto the spotter strap (if a
  manual wheelchair).
- Risks requiring spotter intervention if moving forward up the incline:
  - Rear tip when initially accelerating.
  - Forward tip or fall due to deceleration when striking the lower floor-incline
    transition.
  - Hyper-flexion injury of the lower limb at the lower floor-incline transition if the
    foot catches on the ground.
  - Rear tip while ascending the incline.

General training tips

- The steeper the incline, the greater is the likelihood of problems due to scraping the
  footrests or anti-tip devices at the transition between the floor and the lower end of the
  incline.
- If the drive wheels are uphill, they become relatively unloaded. This can cause loss of
  traction so that propulsion, braking and directional control become difficult. If traction is
  lost to the extent that the wheels spin or the wheelchair begins to slide, the wheelchair
  user should lean toward the affected wheels. If this is insufficient, then the wheelchair
  should be turned around so that the drive wheels are downhill. It is best to turn around on
  the level but, if that is not possible, the wheelchair user should lean uphill during the turn.
- Edges and drop-offs at the sides of the incline or at the sides of the platform at the top of
  the incline should be avoided to prevent injury.
- Momentum can be used to ascend short inclines by approaching at speed. However, if the
  wheelchair user strikes the floor-ramp transition too quickly, he/she may tip the
wheelchair forward or fall forward out of the wheelchair.

- **Progression:**
  - The learner should start with the wheelchair stationary at the lower end of the incline and progress to a moving approach.
  - The learner should start with a minimal incline and proceed to more extreme ones.
  - Although only 5° and 10° inclines are mentioned specifically in the WSP Manual, for learners and wheelchairs capable of handling steeper inclines, it is reasonable to attempt these under the supervision of a trainer, even if only to help the learner recognize the limits of what is possible for him/her with that wheelchair.

- **Variations:**
  - Inclines with different surfaces, such as grass, cobblestone or loose rock may be used.
  - Stopping and turning around on the incline should be practiced.

**Special considerations for caregivers**

- For a caregiver of a manual wheelchair user with hemiplegia, the caregiver can put the unsupported foot on the other footrest to avoid it getting caught on the transition.
- To push a manual wheelchair forward up an incline, the caregiver should bend his/her knees and lean toward the wheelchair. The caregiver should not use a knee to apply pressure to the backrest.
- If the wheelchair does not have a headrest and if the wheelchair user is having difficulty maintaining an upright head position while ascending an incline, the caregiver can support the head with a hand.
- For a caregiver of a powered wheelchair user, if the space is narrow and the caregiver must operate the wheelchair from in front, the caregiver should be careful not to run over his/her own toes.

**Special considerations for manual wheelchairs**

- **Adjustment tips:**
  - A heavy knapsack will reduce rear stability. It can be moved to the lap (although this may limit forward lean) or footrests.
  - At the lower transition, either ascending or descending, the clearance of footrests can create problems.
  - If the rear anti-tip devices are too low, this can cause rear-wheel “float” whereby the rear wheels are not in contact with the surface (because the wheelchair is suspended between the casters and anti-tip devices) and are thereby unable to be used for propulsion or braking.
  - “Grade aids” (or “hill holders”) may be used for the ascent of inclines. These are ratchet-like attachments that, when activated, allow the rear wheels to roll forward but not backward. These devices allow the wheelchair user to rest on the incline without rolling back. The wheelchair user should apply them before he/she starts up the incline.
  - Some wheelchairs have gears that permit inclines to be handled more easily.
Two-hand-propulsion pattern:

- When negotiating the incline-floor transition at the lower end, during either ascent or descent, the wheelchair user should be careful not to catch an unsupported foot, as this could lead to a hyper-flexion injury of the knee.
- When getting the casters onto the bottom of an incline, it may be necessary to transiently tip the wheelchair (“popping” the casters, as will be described later in section 9.18) if the footrests are low and to reduce the sudden braking that occurs at the transition.
- Some wheelchair users use a rocking action to get the casters over the initial lip.
- The wheelchair user should lean forward as he/she goes up the ramp to apply more force to the hand-rims and to avoid tipping backward. The need for forward lean increases as the slope increases. In addition to a consistent forward lean, it can be helpful to lean forward a little more with each push to apply greater forces to the hand-rims.
- If the wheel locks are not of the retractable type, forward leaning can result in injury to the backs of the thumbs.
- It may be necessary to use shorter propulsive strokes than on the level, to avoid rolling backward between strokes.
- The recovery path of the hands at the end of the propulsive stroke may be more like an arc (following the hand-rim) than a loop (below the hand-rim) for this skill.
- If the wheelchair user gets tired part of the way up the incline, he/she should turn the wheelchair to the side and rest. This can be done without applying the wheel locks. Although it may seem counter-intuitive, the static rear stability of an occupied wheelchair is significantly lower with the wheel locks applied than not.
- If the wheelchair starts to roll backward, instead of grasping both hand-rims (that might cause a rear tip), the wheelchair user can grab one. As the other wheel rolls backward, this will turn the wheelchair across the slope.
- As the steepness of the incline increases, the wheelchair user should lean farther forward and move the initial contact with the hand-rims forward. The propulsion contact angle diminishes (although the duration of the push phase remains similar) and the force increases. The recovery phase becomes faster and an arc recovery pattern (back along the hand-rims) may be used.

Variations:

- Alternating hands during propulsion may help to prevent roll-back.
- If the incline is wide enough, the learner can steer back and forth across the incline (“slalom” or “zig-zag”), to decrease the apparent slope. The more turns used, the lower is the effective slope (but the greater the distance travelled).

Although a slalom path up an incline will reduce the effective slope, it will introduce an element of side-slope (dealt with more specifically in section 9.16).
- If using a slalom path up the incline, the wheelchair user will generally turn uphill (e.g. 90°) at the end of each traverse to go back the other way. However, if this is not possible due to limitations of strength or stability, the turn may be downhill (e.g. 270°). Although a little height up the incline is lost, the additional speed during the turn provides momentum to assist in regaining the loss. For sailors, the
analogy of “jibing” rather than “tacking” to progress upwind may be useful.

- As a learning exercise, it may be helpful to have the wheelchair user try to ascend the incline (with a spotter) without leaning forward.
- The wheelchair user may use the ramp handrails if available.
- See wheelie variation later.

- **Hemiplegic-propulsion pattern:**
  - It is usually easier for a wheelchair user with hemiplegia (who propels the wheelchair with one arm and one leg) to go up inclines backward. Whenever rolling resistance is encountered (including when ascending inclines), foot propellers find it easier to push backward than to pull forward with the feet.

**Special considerations for powered wheelchairs**

- A small lip on the side of an incline may be sufficient to prevent a manual wheelchair from accidentally going over the edge, but a powered wheelchair can go over such a lip more easily.
- Most powered wheelchairs can handle 5° with ease, at least from the perspective of having enough power to manage the slope.
- Altering the position of the wheelchair seat (i.e. with respect to tilt, recline, seat height) may be helpful to improve stability or to alter the weight distribution on the wheels (e.g. for more traction).
- The tilt or leg-elevation functions can be used to avoid scraping the footrests at the lower incline transition.

- **Progression:**
  - The learner may begin training with the controller in a low setting but programming that provides more power and torque may be needed for success. The user may need to change to a different drive mode to get up the incline.

**Special considerations for scooters**

- Most scooters have adequate power to get up steep inclines.
- Scooters may have difficulty at the upper incline-level transition due to inadequate clearance (“break-under angle”) between the front and back wheels.
- Scooters may have difficulties at the lower incline-level transition if any rigid rear anti-tip devices cause the rear wheels to “float” off the surface. Approaching with a little extra speed may help, but the stiff suspension of many scooters may cause the scooter user to bounce off the seat causing a loss of control.
8.15 DESCRENDS INCLINES

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills
- “Descends slight incline”.
- “Descends steep incline”.

Description and rationale
- The learner moves the wheelchair down inclines of different slopes. The general rationale is as for “ascends inclines”.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If the wheelchair is to move forward down the incline, the spotter should be behind the wheelchair, holding onto the spotter strap (if a manual wheelchair) with one hand and with the other hand in front of the wheelchair user’s shoulder.
  - If using two spotters, one spotter should be behind the wheelchair, holding onto the spotter strap and the second spotter should be in front of and beside the wheelchair to resist a forward tip or fall.
  - A removable seat belt may be used if there is concern about the learner falling forward from the wheelchair.
- Risks requiring spotter intervention:
  - Forward tip or fall due to deceleration when striking the lower incline-floor transition.
  - Hyper-flexion injury of the lower limb at the lower incline-floor transition due to catching the foot on the ground.
  - Runaway leading to collision or tip-over.
  - Hand injuries to the wheelchair user due to friction burns or lacerations due to hand-rim irregularities if the wheelchair is allowed to descend too rapidly.
  - Thumb injury on the wheel locks if the wheelchair user grabs the hand-rims when they are rolling too quickly because the hands can get pulled forward into the wheel locks by the wheels.

General training tips
- A smooth controlled descent in the forward direction is the basic method for descending inclines.
- The learner should proceed slowly to maintain control and should be prepared to stop at any time. It is easier to maintain speed control than to regain it after it has been lost.
Special considerations for caregivers

- For caregivers of manual wheelchair users, the push-handles should be checked to ensure that they will not pull off.
- The basic method for caregivers of manual wheelchair users is in the forward direction with all four wheels on the incline.
- The caregiver of a manual wheelchair user holds the push-handles firmly and allows the wheelchair to roll down the ramp while controlling the speed and direction.
- The caregiver should avoid sudden stops and slow down as he/she reaches the bottom transition to level ground.
- The caregiver can put one hand on the wheelchair user’s shoulder to prevent a forward fall and also to steer the wheelchair as the wheelchair will tend to twist if only one push-handle is held.
- For caregivers of manual wheelchair users, forward descent can be performed in the wheelie position. This is useful on steep inclines, to prevent the wheelchair user from falling forward. Descending an incline forward in the wheelie position is comfortable for the wheelchair user with no risk of falling out of the wheelchair. Also, the caregiver has the advantage of being able to see where he/she is going. However, this method may require the caregiver to bend too far forward, which may strain his/her back.
- For caregivers of manual wheelchair users, another method is to descend backward. This ensures that the wheelchair does not run away from the caregiver and that the wheelchair user does not fall forward. The caregiver should look over his/her shoulder for obstacles.
- For caregivers of powered wheelchair users, if the space is narrow and the caregiver must operate the wheelchair from in front, the caregiver should be careful not to run over his/her own toes.

Special considerations for manual wheelchairs

- Two-hand-propulsion pattern:
  - **Adjustment tip:**
    - Appropriate friction between the hands and hand-rims is important to carrying out this skill safely and effectively. Gloves are helpful. The type of coating (if any) on the hand-rims affects friction, as do hand-rim size and shape. A quick and inexpensive way to increase the friction of a hand-rim is to spiral-wrap it with rubber tubing.

    - The wheelchair user should keep his/her weight back, to maintain good traction on the rear wheels and to avoid forward tips or falls.
    - To slow down or steer, the wheelchair user should hold the hands still in a position ahead of top dead center (at about the 1:00 o’clock position, using the clock analogy) and let the hand-rims slide through his/her fingers. It is generally better to provide continuous friction than to use a jerky grasp-and-release (“like milking a cow”) method. However, the grasp-and-release method may be useful to minimize the heat that builds up through friction, grasping either with both hands at the same time or alternating from one to the other.
    - The wheelchair user can slalom down the incline by letting the hand-rim of one wheel at a time slide through the fingers. By descending using the slalom method, the apparent slope of the incline is lessened. Also, this technique may prevent the hands
from overheating due to sustained friction. Downhill-turning tendency (see section 9.16) can be used to advantage when the wheelchair user wishes to turn downhill. Leaning forward will accentuate the tendency and ease the turn.

- As for ascending inclines, the wheelchair may be turned sideways on the incline to rest without applying the wheel locks.

- Variations:
  - Caution should be used when using the wheel locks as a means of controlling speed. This is not a commonly used method.
  - If the wheelchair user has weak trunk muscles and a tendency to fall forward when facing downhill on inclines, he/she may feel more comfortable descending the incline backward. The backward approach may also be used if, when descending forward on a steeper incline, the wheelchair user experiences loss of traction due to the unloading of the uphill wheels. When going downhill backward, the wheelchair user should lean uphill to reduce the likelihood of tipping over backward. As with any time the wheelchair is moving backward, it is important to proceed slowly with frequent shoulder checks and to avoid sudden stops that can cause rear tips.
  - The wheelchair user may use the handrails of the incline, if available.
  - See wheelie variation later.

- Hemiplegic-propulsion pattern:
  - The wheelchair user can proceed forward down the incline, using the foot to control the speed.
  - The wheelchair user needs to be cautious that the foot does not get caught under the chair at the lower incline-floor transition.

Special considerations for powered wheelchairs

- Altering the position of the wheelchair seat (i.e. with respect to tilt, recline, seat height) may be helpful to improve stability, alter the weight distribution on the wheels (e.g. for more traction) or ensure footrest clearance at the lower transition. However, some wheelchairs do not permit the wheelchair to be driven when the positioning options exceed a threshold.
- Training should begin with the controller in a low setting.
- In a powered wheelchair, unlike a two-hand-propelled manual one, only one hand is needed to control speed and direction. The other arm can be hooked around the backrest to prevent falling forward onto the lap.
8.16 ROLLS ACROSS SIDE-SLOPE

Versions applicable
- Manual wheelchair: ✓
- Powered wheelchair: ✓

WST/WST-Q skills
- “Rolls across side-slope”.

Description and rationale
- The learner moves the wheelchair across a slight side-slope without turning downhill or uphill significantly, then repeats the task in the opposite direction. Side-slopes (or cross-slopes) are frequently encountered in built and natural environments. Sidewalks, for instance, are usually sloped 2% (1:50) toward the street to allow water to run off. Steeper grades are also often found (e.g. where sidewalks cross driveways). The yaw axis of a wheelchair (i.e. the vertical axis around which the wheelchair turns toward the left or right) is between the drive wheels. If the combined center of gravity of the wheelchair and user is ahead of the drive wheels and more on the casters that are free to turn (as is usually the case with rear-wheel-drive wheelchairs), the wheelchair will tend to turn downhill on a side-slope (“downhill turning tendency”). If the combined center of gravity of the wheelchair and user is behind the drive wheels (as is usually the case with front-wheel-drive wheelchairs), the wheelchair will tend to turn uphill on a side-slope (“uphill turning tendency”).

Prerequisites
- None.

Spotter considerations
- Spotter starting position: Slightly behind and downhill from the wheelchair.
- Risks requiring spotter intervention: Sideways tip or fall downhill.

General training tips
- The extent of downhill- or uphill-turning tendency is directly proportional to how far the combined center of gravity of the wheelchair and occupant is in front of or behind the drive wheels. The person operating the wheelchair can take steps to minimize this distance by repositioning the center of gravity (e.g. by leaning, tilting or reclining).
- If there is room to do so on a path, the person operating the wheelchair should stay away from the downhill edge of a side-slope to avoid veering off the path.

- Variation:
  - Slowly turning the wheelchair 360° in place on a side-slope will provide a good sense of how downhill-turning tendency affects the wheelchair at different angles.

- Progression:
  - Although only a 5° side-slope is mentioned specifically in the WSP Manual, for learners and wheelchairs capable of handling steeper inclines, it is reasonable to
attempt these under the supervision of a trainer, even if only to help the learner recognize the limits of what is possible for him/her with that wheelchair.

Special considerations for caregivers
- If the wheelchair user is in a tilt-in-space or reclining wheelchair, tilting or reclining the wheelchair can be used to get the center of gravity farther back.
- For caregivers of manual wheelchair users, to resist the downhill-turning tendency while pushing the wheelchair across a side slope, the caregiver needs to push harder on the downhill push-handle and pull back on the uphill push-handle.
- For a steeper slope, the caregiver of a manual wheelchair user may choose to use the wheelie position.

Special considerations for manual wheelchairs
- Adjustment tip:
  - Moving the rear axles of a rear-wheel-drive wheelchair forward reduces the downhill-turning tendency.
- Side-slopes require significantly more energy to push across.
- The wheelchair user should lean backward to keep the weight away from the casters.
- Two-hand-propulsion pattern:
  - To avoid turning downhill, the wheelchair user should push harder on the downhill wheel.
  - Different push frequencies may be used for the two hands. For instance, when moving across a side-slope with the right side downhill, the right hand may push 2-3 times for every 1 push on the left.
  - When pushing longer distances, route planning can be used to avoid overuse on one side. For instance, part of the journey can be carried out on the right-hand sidewalk (where the left side is downhill) and part of the journey on the left-hand sidewalk.
  - In some cases, the uphill hand may be used exclusively for braking (to minimize downhill-turning tendency) rather than for assisting with propulsion.
  - Shorter stokes may need to be used to keep the wheelchair moving straight.
  - On steep cross-slopes, problems (e.g. loss of uphill-wheel traction, lateral tip-over, folding of the wheelchair) may arise due to the lack of weight on the uphill wheel. These problems can be minimized by leaning uphill.
  - As noted earlier, downhill-turning tendency can be used to advantage when the wheelchair user wishes to turn downhill. Leaning forward will accentuate the tendency and ease the turn.
- Variations:
  - A useful learning experience to demonstrate the downhill-turning tendency is to have the wheelchair user lean forward as he/she rolls forward, to illustrate how the downhill-turning tendency increases.
If there is an uphill wall that can be used, the wheelchair user can drag the uphill hand on the wall behind the rear axle to counteract the downhill-turning tendency. This is analogous to the drag turn discussed earlier.

- See wheelie variation later.

- **Hemiplegic-propulsion pattern:**
  - When learning the skill in the forward direction, it may be less frustrating to cross the side-slope with the sound side downhill first; this will tend to counteract rather than aggravate the downhill-turning tendency.
  - Some users may choose to go backward with the sound side downhill rather than forward with the sound side uphill, to help manage the downhill-turning tendency.

**Special considerations for powered wheelchairs**

- Although a rear-wheel-drive wheelchair will tend to turn downhill (analogous to a manual wheelchair), a front-wheel-drive wheelchair will tend to turn uphill.
- Many powered wheelchairs are equipped with automatic correction of downhill/uphill-turning tendency on side-slopes.
- If there is no automatic correction, the wheelchair user should aim slightly away from the expected deviation (i.e. aim uphill for a rear-wheel-drive wheelchair and downhill for a front-wheel-drive wheelchair).
- If the wheelchair user is in a tilt-in-space or reclining wheelchair, tilting or reclining the wheelchair can be used to get the center of gravity over the drive wheels.

**Special considerations for scooters**

- On steeper side-slopes, sideways tips are possible due to the relatively narrow base width and high center of gravity of some scooters.
8.17 ROLLS ON SOFT SURFACE

Versions applicable

- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills

- “Rolls on soft surface”.

Description and rationale

- The learner moves the wheelchair a short distance on a soft surface. There are many types of soft surfaces (e.g. carpet, dirt, grass, gravel, sand or snow) that a wheelchair user may encounter. Propulsion is more difficult on such surfaces (increased rolling resistance) because the wheels tend to sink into the surface, especially wheels that are narrow or of small diameter.

Prerequisites

- None.

Spotter considerations

- Spotter starting position: Behind the wheelchair, holding onto the spotter strap with one hand (if a manual wheelchair).
- Risks requiring spotter intervention:
  - Rear tip when accelerating.
  - Overuse injury due to the additional forces needed.

Adjustment tip

- The diameter, width and shape of the wheels and tires will affect the extent to which they sink into the soft surface.

General training tips

- When approaching a section of soft or irregular terrain, the wheelchair user should look ahead and plan a route that will minimize difficulties. When proceeding across a soft or rough surface, it is easiest to move forward in a straight line because, if the casters sink into the soft surface, they will be less free to swivel should the user wish to change direction.
- When moving from a smooth level surface onto a soft surface, the wheelchair will decelerate, so it may be necessary to slow down (or pop the casters, if in a manual wheelchair) when approaching such a transition.
- To minimize rolling resistance, reducing the weight on the small wheels (casters) and increasing the weight on the drive wheels is a helpful strategy.
- If one drive wheel is spinning, the wheelchair user should shift his/her weight in the direction of the slipping wheel to increase the traction.
- For rear-wheel-drive wheelchairs, it may be easier to lead with the larger wheels (i.e. in the backward direction). The larger-diameter wheels make it easier to get started. The casters will trail backward and the resulting longer wheelbase may help as well because
the casters will be farther from the center of gravity.

- Variations:
  - A variety of surfaces (e.g. sand, thick carpet, foam, a gym mat, gravel) provide similar, but not identical, experiences.
  - If the surface is too soft to proceed over, a mat or other materials can be laid down over it. If an assistant is available, long distances can be covered by using two mats, picking up the mat behind the wheelchair and moving it to the front, proceeding forward in a step-wise fashion.

Special considerations for caregivers
- For caregivers of manual wheelchair users, to proceed in the forward direction (which has the advantage of allowing the caregiver to see where he/she is going more easily), it may be necessary for the caregiver to lean forward to apply the extra force needed.
- The caregiver of a manual wheelchair user should not use his/her knee against the backrest of the wheelchair to apply more force because this may be uncomfortable for the wheelchair user (if the backrest is flexible) or dislodge a rigid removable backrest.
- For caregivers of powered wheelchairs with rear-wheel-drive, a caregiver can push down (or stand) on the back of the wheelchair to unload the casters and add traction to spinning wheels. The caregiver can also push forward, to assist with overcoming resistance.

- Variations:
  - The caregiver of a manual wheelchair user may find it easier to push or pull the wheelchair in the wheelie position, so that almost all of the weight is on the rear wheels. If there is very high rolling resistance, pulling may be more effective. This is the first of many skills for which it may be useful for the caregiver to be able to get the wheelchair into the wheelie position. The caregiver should always let the wheelchair user know before he/she tips the wheelchair backward. To tip the wheelchair backward, the caregiver should use one foot on a tipping lever (an extension of the wheelchair frame, to which the rear anti-tip device [if any] may be attached) while pulling backward with the hands on the push handles (if any). The caregiver should tip the wheelchair back far enough so that it is just beyond the balance position, with the weight of the wheelchair pushing down slightly on the caregiver’s hands. How far back the wheelchair needs to be tipped will vary depending on the wheelchair user and the wheelchair. To land after such an assisted wheelie, the caregiver should slowly allow the casters to return to the floor using a foot on the tipping lever to help slow the landing.

Special considerations for manual wheelchairs
- Adjustment tips:
  - This is the first of several skills for which it is of benefit to pop the casters off the surface either transiently or to perform a full wheelie. Any adjustment that lowers the rear stability of the wheelchair (e.g. moving the axles of the rear wheels forward) will make it easier to pop the casters.
  - It may be necessary to reposition the rear anti-tip devices to allow the wheelchair to be tipped backward sufficiently to pop the casters. To reposition most rear anti-tip devices,
the person doing so needs to press a button or release mechanism on the wheelchair frame that locks the anti-tip device in place. The position of the anti-tip devices should be noted, to simplify restoring them later. The anti-tip devices can either be repositioned or removed. To restore the anti-tip devices, the learner should simply reverse the steps. Note that whenever the rear anti-tip devices have been inactivated, the wheelchair user is at increased risk of a rear tip. The spotter should be vigilant to spot the wheelchair user closely until the wheelchair user becomes used to this new condition. Even if the rear anti-tip devices are left in place, the wheelchair user should not rely on them to prevent rear tipping because they might sink into a soft surface.

- If the wheelchair has elevating footrests, it will be easier to pop the casters if the footrests are lowered.

- **Two-hand-propulsion pattern:**
  - The forward approach to negotiating soft surfaces is preferred because the wheelchair user can see where he/she is going.
  - The wheelchair user should use long slow strokes to keep the wheels from slipping in loose surfaces.
  - Because there is more rolling resistance on soft surfaces, more force is required by the wheelchair user.
  - Leaning forward slightly may help the wheelchair user to apply more force to the hand-rims and to prevent the additional force from causing a rear tip. However, keeping as much weight as possible on the rear wheels (e.g. by leaning backward slightly) will improve traction and keep the front wheels from digging into the soft surface. The wheelchair user should experiment with the extent of trunk lean to find the optimum (the “sweet spot” between too much and too little). As a learning exercise, the wheelchair user should try the skill while leaning forward and backward to different extents, to find the optimum position for him/her.
  - Transient caster pops are a good option, lifting the casters off the surface during each push, but letting them touch the surface as the hands recover for the next push. During a caster pop, the longer the hands remain on the hand-rims, the farther forward the wheelchair will move with the casters off the surface. This can be thought of as analogous to taking a series of walking “steps” across the surface; a few long steps are preferable to many short steps.

- **Progression:**
  - For wheelchair users who are unfamiliar with caster pops, it can be a useful exercise to practice such pops on a smooth firm surface. The emphasis is on pushing the hand-rims forward but more forcefully than to simply roll forward but less forcefully than is needed to achieve a full wheelie position. For a learner who is having difficulty applying enough force, the trainer can hold out his/her palm and ask the learner to use his/her own hand first to simply push against the trainer’s palm (to illustrate the amount and timing of the force needed to roll forward) and then to slap the trainer’s palm (to illustrate the amount and timing of the force needed to pop the casters off the surface).

- **Variations:**

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• See wheelie variation later.

• **Hemiplegic-propulsion pattern:**
  • Rolling on soft surfaces with the hemiplegic-propulsion pattern (one arm and one leg) is easier in the backward direction, because there is less rolling resistance with the large rear wheels than the smaller casters. Also, when pushing backward with the foot, the casters become slightly unloaded which makes it easier to move them.

**Special considerations for powered wheelchairs**

• If possible and necessary, the wheelchair user should adjust the controller setting to one that provides more torque.

• Positional control (e.g. **tilt**, recline) can alter the weight distribution between the front and rear wheels. It is easier to proceed on a soft surface if more of the weight is on wheels with larger diameters. Clearance for the feet can also be affected by this change.

• On soft or irregular terrain, there is an optimal speed that is fast enough to maintain forward movement but not so fast that the motion is uncomfortable or leads to a loss of control.

• Maintaining a steady speed is preferable to a series of stops and starts.

• On a “bottomless” soft surface (e.g. sand, gravel or mud), if the drive wheels are allowed to spin, the wheelchair may dig itself into a hole that it can be difficult to get out of without assistance.
8.18 GETTING OVER OBSTACLES OR GAPS

Versions applicable

- Manual wheelchair: ✓
- Powered wheelchair: ✓

WST/WST-Q skills

- “Gets over obstacle”.
- “Gets over gap”.

Description and rationale

- The learner moves the wheelchair over an obstacle or a gap across the line of progression.
- Wheelchair users often encounter obstacles (e.g. door thresholds) of various sizes and shapes that they may not be able to simply roll over. Alternative strategies may be needed. For example, a manual wheelchair user might need to pop the casters over the obstacle whereas a powered wheelchair user might need to change the mode setting to one with more power. A gap in surface support is a commonly encountered barrier (e.g. due to a rut in the road, a water channel or a space between a subway platform and a subway train). Gaps that only affect one wheel at a time are not usually major obstacles. In this section, only gaps that are as wide as the wheelchair will be considered. Small-diameter wheels (such as casters) can drop into such gaps, causing a sudden deceleration that can tip the wheelchair over forward or lead to the wheelchair user falling out of the wheelchair. Even if no tip or fall occurs, it can be difficult to get the wheelchair out of the gap.

Prerequisites

- None.

Spotter considerations

- Spotter starting position:
  - If using a single spotter, he/she should be behind the wheelchair, holding onto a spotter strap with one hand (if a manual wheelchair) and the other hand in front of the wheelchair user’s shoulder.
  - If using two spotters (as is recommended), the second spotter should stand to one side of the obstacle or gap.
  - A removable seat belt can prevent the wheelchair user from falling from the wheelchair.
- Risks requiring spotter intervention:
  - Rear tip when accelerating to pop casters from the surface (if a manual wheelchair).
  - Forward tip or fall if the casters strike the obstacle or drop into the gap.

Adjustment tips

- Rear anti-tip devices may need to be repositioned or removed to permit caster pops (for manual wheelchairs).
- Rear anti-tip devices that are too low may cause the drive wheels to “float” when
overcoming obstacles (i.e. with the weight being distributed on the casters and the anti-tip devices, unloading the drive wheels).

- Footrests or anti-tip devices may contact the obstacle before the wheels do, making it impossible to negotiate the obstacle in that direction without repositioning the wheelchair parts concerned.
- A seat belt may be useful for higher obstacles to prevent falling out of the wheelchair while the rear wheels are on top of the obstacle and the seat is tilted forward.
- Wheelchairs with longer wheelbases are less likely to tip forward as the rear wheels surmount higher obstacles.
- Wheelchairs with large-diameter leading wheels are able to roll over higher obstacles than those with small-diameter wheels.
- The diameter of the wheels affects the size and depth of gaps that can be overcome. A large-diameter wheel will be able to roll over a small gap rather than dropping fully into it.

**General training tips**

- The best approach is to avoid obstacles or gaps, steering around them or straddling them.
- If the wheelchair gets hung up on an obstacle due to insufficient distance between the front and rear wheels (short wheelbase), the learner may be able to escape by backing up slightly; this will swing the casters from the rear-trailing position to the side- or forward-trailing one, where there is more space between the front and rear wheels.
- If the casters drop into the gap and they turn sideways (a common problem if the wheelchair is moved forward and backward repeatedly in an attempt to get the casters out of the gap), it can be very difficult or impossible to proceed without assistance.

**Progression:**

- Although the techniques used for getting over gaps and obstacles are very similar and the gap technique is easier, the gap can be more intimidating for learners so we usually teach the learner how to get over an obstacle before progressing to the gap.
- The learner should start with a slow speed and progress to faster ones.
- The learner should start with low obstacles and progress to higher ones. Obstacles with a height of 10 cm or greater are negotiable in the right wheelchair. Before attempting to negotiate a high obstacle, the learner should be aware of how much clearance exists between the wheels and under the frame or chassis of the wheelchair, to avoid getting hung up on the obstacle.
- The learner should start with small shallow gaps and progress to more challenging ones.

**Variations:**

- Leading with the larger-diameter wheels may be helpful.
- The oblique approach to a gap is often safer and more effective than the square-on approach. As long as three wheels are supported at any time, the wheelchair will usually remain upright. That being the case, an oblique approach to a gap (e.g. 30-45° from the line of progression so that only one wheel is unsupported at a time) is a useful strategy. The wheelchair user should keep his/her weight away from the
unsupported wheel.

**Special considerations for caregivers**

- A caregiver may request assistance from the wheelchair user during these skills, in the form of having the wheelchair user lean backward or forward at the caregiver’s direction, to facilitate the different stages of the skill.
- A caregiver of a manual wheelchair user may proceed in the forward direction over a gap, using the transient caster pop or full wheelie method. After the rear wheels are in the gap, the casters can be lowered to the surface beyond the gap. Then the wheelchair user is asked to lean forward and the wheelchair is rolled out of the gap.
- The backward direction for overcoming gaps may be easier for the caregiver of a manual wheelchair user. If this technique is used, the rear wheels of the wheelchair can be lowered into the pothole, then the wheelchair tipped into the wheelie position to be pulled out of the gap on the rear wheels.
- For caregivers of powered wheelchair users attempting to negotiate a gap, if the casters get stuck sideways in the gap, the caregiver may need to stand on the back of the wheelchair to tilt the chair enough to get the casters out of the gap. If the wheelchair user cannot operate the joystick enough to help, a second caregiver may be needed. The motors may need to be disengaged to allow the wheelchair to be pushed out of the gap.

**Special considerations for manual wheelchairs**

- This is the first of a series of skills for which the ability to pop the casters in a specific location and to move forward are very helpful.

- **Forward Approach, Stationary Method:**
  - The square-on forward approach is useful to include in training because the method used is part of a step-wise sequence leading toward the ascent of curbs.
  - The wheelchair user should approach the obstacle and stop with the casters 5-10 cm before reaching the obstacle, to avoid striking the casters on the vertical section of the obstacle while popping them.
  - The stationary method is comprised of two steps: “pop” and “lean”. These cues can be verbalized as the steps are performed.
  - The wheelchair user first briefly pops the casters from the floor, just high enough to clear the obstacle. To do so using the two-hand propulsion method, the wheelchair user applies forward forces of moderate intensity to the hand-rims (a “slap” vs. a “push”, as noted earlier). After the casters land beyond the obstacle and the rear wheels encounter resistance, the wheelchair user leans forward to help power the rear wheels over the obstacle and prevent rear tipping. Some rocking may be needed.
  - Once the rear wheels are on top of a high obstacle, the wheelchair user should lean back to decrease the likelihood of a forward tip or fall out of the wheelchair.
  - For a gap, the casters can be stopped at the edge of the gap. There is less need to pop the casters “high” than to pop them “long” to get across the gap. As for
the “rolls on soft surface” skill (section 9.17), a long “step” can be achieved by ensuring that the hands remain on the hand-rims for as long as possible (i.e. 11:00-2:00 o’clock, using the clock analogy).

- **Forward Approach, Momentum Method:**
  - This method is comprised of three phases: “approach”, “pop” and “lean”. As for the stationary method, the cues can be verbalized as they are performed.
  - In preparing to pop the casters while the wheelchair user moves forward during the approach, the wheelchair user may briefly coast to allow correct placement of the hands when he/she is at the proper distance from the obstacle. The trainer can demonstrate the reason for the coast by using the analogy of walking toward the obstacle, adjusting the step length rather than stopping before the obstacle and stepping over it.
  - The wheelchair user should initially approach at a slow speed, square to the obstacle or gap. It is simpler to pop the casters when moving slowly. Also, if the wheelchair user fails to pop the casters for long enough to clear the front edge of the obstacle or the back edge of the gap, the sudden stop will be less jarring at a slow speed.
  - The wheelchair user should not lean forward to look at the feet when he/she approaches the obstacle or gap, because that increases the weight on the casters. In timing the caster pop, the wheelchair user needs to understand where the casters are (often below the knees rather than under the feet). A mirror placed to the side of the obstacle or gap can be used to provide feedback.
  - The correct position of the hands at the beginning of the popping phase is when they are ready to grasp the hand-rims, behind top dead center (11:00 o’clock on the right wheel, using the clock analogy). Then, the wheelchair user should accelerate the chair even faster than it is coasting, by using a stroke of moderate force that is powerful enough to pop the casters from the surface high enough and long enough.
  - Once the casters have landed beyond the obstacle or gap and the rear wheels strike the obstacle or gap, the wheelchair user should lean forward and propel the rear wheels to bring the rear wheels over the obstacle or up out of the gap. If the obstacle is a high one, the wheelchair user should lean back once the rear wheels are on top of the obstacle.
  - When moving forward over an obstacle or gap, some advanced wheelchair users prefer to allow the rear wheels to reach the surface beyond the obstacle before having the casters land on the surface. However, when initially learning the skill, it is preferable that the casters land beyond the obstacle or gap before the rear wheels strike the obstacle. This will be especially useful when learning to ascend curbs, to avoid “caster slap”.

- **Progression:**
  - To practice getting the timing correct without the fear of having the casters strike the obstacle or gap, the wheelchair user may practice propelling the wheelchair forward and transiently popping the casters at...
a predetermined point on the floor. This can be a line on the floor or a strip of bubble wrap. The horizontal distance over which the casters need to be off the floor can be gradually increased.

- The learner should start with the stationary approach then progress to the momentum method.
- For learners experiencing difficulties in coordinating the sequence of the three phases of the skill (approach, pop and lean), it may be useful to practice them in segments before putting the segments together.

### Variations:

- The wheelchair user may use the external environment if available (e.g. door frame) to pull the rear wheels over the obstacle or gap.
- The hands-free version of the skill is useful because the wheels may be spinning too quickly for the hands to catch up with them (e.g. coming down a hill). However, this is an advanced skill that can be difficult to spot.
- As noted earlier for the “maneuvers sideways” skill, to get beyond a pair of obstacles (e.g. concrete parking bolsters) or gaps that are too close to wheel between, it may be possible to move one wheel (or pair of wheels) through the space at a time, transiently straddling the obstacles with one wheel (or pair of wheels) on either side of the obstacles or gaps and the wheelchair parallel with the obstacles or gaps.
- The wheelchair user should approach the obstacle or gap slowly, because a sudden stop can cause a rear tip. As the wheelchair user approaches the obstacle or gap in the **backward direction**, he/she should lean forward to unload the rear wheels and further reduce the likelihood of a rear tip. The wheelchair user pulls the wheelchair straight backward by applying equal force to both wheels. Otherwise, the casters may turn and catch sideways on the obstacle or in the gap. Once the rear wheels are over the obstacle or gap, the wheelchair user should **lean back** enough to unload the casters as they reach the obstacle or gap), but not so much as to cause a rear tip.
- When popping the casters over a long obstacle or gap (in the line of progression), the wheelchair user can use the full wheelie position or perform a transient pop with two pushes, the second push while the casters are still in the air.
- See wheelie variations later.

#### Hemiplegic-propulsion pattern:

- The backward approach (as described above) is useful whenever high rolling resistance (as the obstacle and gap represent) is encountered.

#### Variations:

- The obstacle or gap can be approached in the forward direction, using the foot/feet to pop the casters. While popping the casters, at the same time the wheelchair user should roll the wheelchair forward so that the casters land on the floor beyond the obstacle or gap.

### Special considerations for powered wheelchairs

#### Adjustment tip:
• If the casters are rounded on their sides (i.e. ball-shaped), they will better resist the tendency to get caught sideways.

• Leaning the body away from the casters will unload them and make it easier to get them over the obstacle or gap.

• Positional control (e.g. tilt, recline) can be used to alter the weight distribution of the wheelchair and to provide footrest clearance.

• Smooth continuous forward movement is often the most successful method of traversing an obstacle or gap.

• Depending upon the size of the obstacle or gap, it may be necessary to switch drive modes to have the necessary wheel torque.

• If the powered wheelchair has come to a stop with the casters against the obstacle or in the gap, as extra force is applied to the obstacle, the casters may suddenly pop up. The wheelchair user should not apply any more force than is needed and should reduce the force applied to the joystick as soon as possible.

• Getting the larger drive wheels over an obstacle or gap is usually easier than getting the smaller caster wheels over.

• If a gap cannot be managed in the oblique direction or avoided, but appears to be negotiable in the straight-forward direction, it is best to proceed at a slow speed but a steady pace because the momentum may help bounce the wheels over the gap.

Special considerations for scooters

• If there is insufficient ground clearance between the front and rear wheels, the scooter may get hung up on a high obstacle.

• Approaching the obstacle with a little extra speed may help. However, if the scooter user approaches the obstacle too quickly, the stiffness of the suspension may cause the scooter user to bounce off the seat and lose control of the scooter.
8.19 ASCENDS CURBS

**Versions applicable**
- Manual wheelchair: ✓
- Powered wheelchair: ✓

**WST/WST-Q skills**
- “Ascends low curb”.
- “Ascends high curb”.

**Description and rationale**
- The learner gets the wheelchair up curbs of various heights. Level changes (e.g. curbs, home entries, uneven sidewalk sections) are common obstacles in the natural and built environment. The ability to manage low curbs (~5 cm) is useful but practice on low curbs also provides an opportunity to hone techniques that will be needed for higher curbs (~15 cm). Although curb cuts (“pedestrian ramps”) are now commonplace in many parts of the world, curbs or large level changes are still commonly encountered.

**Prerequisites**
- None.

**Spotter considerations**
- Spotter starting position:
  - For this and later curb-handling and stairs skills, the spotter strap is of little use if a sideways tip or fall occurs.
  - If using a single spotter, he/she should be behind the wheelchair, with both hands close to the push-handles (if any) or to the backrest components.
  - If using two spotters (as is recommended), the second spotter should stand to one side of the level change.
  - A removable seat belt can prevent the wheelchair user from falling from the wheelchair.
- Risks requiring spotter intervention:
  - Rear tip when accelerating to pop casters from surface (if a manual wheelchair).
  - Forward tip or fall if the casters strike the curb.
  - Sideways tip if one wheel gets up onto the upper level before the other.

**General training tips**
- It may be necessary to reposition or remove the footrests or rear anti-tip devices.
- This skill is similar to and builds upon the previous ones, specifically the “rolls on soft surface” and “gets over obstacles or gaps” sections.
- Progression:
  - The learner should start with a minimal level change and progress to higher ones.
  - It is useful to have a variety of curb heights (e.g. 2.5, 5, 10 and 15 cm). If space is an issue, these can be stacked or nested.
For learners and wheelchairs capable of handling curbs higher than 15 cm, it is reasonable to attempt these under the supervision of a trainer, if it can be done safely.

Special considerations for caregivers

- For caregivers of manual wheelchair users, to ascend a level change in the forward direction, the caregiver should put the wheelchair into the full or partial wheelie position to get the casters onto the upper level. Then, the caregiver should roll the chair forward until the rear wheels press firmly against the vertical face of the level change. The caregiver should then ask the wheelchair user to lean forward to reduce the weight on the rear wheels. The caregiver then applies a forward and upward force on the push handles or some other rigid part of the wheelchair to help the rear wheels roll up onto the upper level. If the rear wheels do not turn, the caregiver is lifting rather than rolling them. Once the rear wheels are on the upper level, the wheelchair user sits upright again.

- Alternatively, for a small level change, the caregiver can bring a manual wheelchair up the curb in the backward direction. If the level change is large enough, the caregiver may need to tip the wheelchair into the full wheelie position (to avoid tipping the wheelchair user forward out of the wheelchair) and pull the wheelchair up onto the upper level. Once on the upper level, the caregiver should roll the wheelchair well away from the edge of the level change before lowering the casters. The caregiver should not use this technique for a large level change, because he/she would need to bend forward too far and might injure his/her back.

Special considerations for manual wheelchairs

- Two-hand-propulsion pattern:
  - This skill is similar to the “gets over obstacles or gaps” section in that the low curb can be approached with stationary and momentum methods, but the momentum method is usually necessary for high curbs.
  - It is slightly more challenging to deal with the rear wheels than for the preceding skills because the tilted position, due to having the casters on top of the curb, moves more weight to the back of the wheelchair. This shift of weight is present until the rear wheels are all the way up on the upper level.
  - In the stationary approach, if the wheelchair user has difficulty getting the rear wheels up onto the upper level, the wheelchair user should roll the wheelchair backward until the front wheels are almost off the edge of the curb. This has two effects. First, it reverses the caster trail, thereby reducing the extent of rear tip (because the caster stems are no longer vertical). This provides a greater safety margin between the resting position and the rear tip-over threshold, so the wheelchair user can push harder without tipping over. Second, because the rear wheels have been backed slightly away from the edge, a small amount of momentum can be used. Before backing the rear wheels away from the curb edge, the wheelchair user should lean forward and place his/her hands on the hand-rims in the position where the most force can be applied. The hands should remain on the hand-rims as the wheelchair user sits up and the rear wheels are backed away from the curb, ensuring that the hands and trunk will be optimally placed when moving forward again. When the rear wheels strike the curb, the wheelchair user
should lean forward and push the rear wheels up onto the upper level. The forward
lean should be timed to coincide with when the rear wheels contact the curb.

- As noted earlier, with the momentum method, the wheelchair user should ensure
  the casters are on the upper surface (rather than in the air) when the rear wheels
  strike the curb. If the casters are still in the air, the energy from the forward pitch
  caused by the collision of the rear wheels with the curb will be expended in noisily
  bringing the casters down onto the upper level (“caster slap”) rather than bringing
  the rear wheels up onto the upper level.

- Variations:
  - The wheelchair user might find it easier to ascend low curbs in the backward
direction.
  - The wheelchair user may use the external environment if available (e.g. door frame)
to pull the rear wheels up onto the upper level.

- Hemiplegic-propulsion pattern:
  - The wheelchair is backed up until the rear wheels contact the obstacle. Then, leaning
    forward to unload the rear wheels, the foot is used to push the rear wheels up the level
    change. Then the wheelchair user sits upright and uses the foot to push down on the
    floor or top of the curb to bring the casters up to the upper level.

**Special considerations for powered wheelchairs**

- Ascending high curbs is not applicable for most powered wheelchairs, because of the
difficulty and danger involved. However, low and medium curbs may be feasible.
- Positional control (i.e. tilt, recline) can be used to alter the weight distribution on the
  wheels and to provide footrest clearance.
- Getting the larger drive wheels up the curb is usually easier than getting the smaller
  caster wheels up. Leaning away from the casters will unload them and make it easier to
  get them up onto the upper level.
- Depending upon the height of the curb, it may be necessary to switch drive modes to
  have the necessary wheel torque.
- Smooth continuous forward movement is often the most successful method of ascending a
curb.
- If the powered wheelchair has come to a stop against the curb, the casters may suddenly
  pop up as extra force is applied to the curb. The wheelchair user should not apply any
  more force than is needed and should reduce the force applied to the joystick as soon as
  possible.

- Variation:
  - In some instances, especially with a rear-wheel-drive wheelchair, it may be easier
to ascend the level change in the backward direction.

**Special considerations for scooters**

- Ascending high curbs is not applicable for most powered wheelchairs, because of the
difficulty and danger involved. However, low and medium curbs may be feasible.
• If there is insufficient ground clearance between the front and rear wheels, the scooter may get hung up on the edge of the curb.

• Approaching the curb with a little extra speed may help to mount the curb. However, if the scooter user approaches the curb too quickly, the stiffness of the suspension may cause the scooter user to bounce off the seat and lose control of the scooter.
8.20 DESCENDS CURBS

Versions applicable
- Manual wheelchair: ✓
- Powered wheelchair: ✓

WST/WST-Q skills
- “Descends low curb”.
- “Descends high curb”.

Description and rationale
- The learner gets the wheelchair down curbs of various heights. The rationale is the same as that for the “ascends curbs” section (9.19). The appropriate technique for a high curb differs in some respects from that used for a lower curb height.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - If the wheelchair user uses the backward technique, the spotter should be standing on the lower level with the hands positioned near the push-handles (if a manual wheelchair).
  - For the task performed forward, this is discussed later, in the 9.20 section.
- Risks requiring spotter intervention:
  - Forward tip or fall from the wheelchair if the task is performed by rolling forward off the curb.
  - Rear tip if performed in the backward direction.
  - Sideways tip if one wheel drops off the upper level before the other.

General training tips
- The wheelchair may be able to simply roll forward off the upper level of a low curb. This is less of a problem for wheelchairs with long wheelbases. The forward roll-off approach for low curbs is convenient and allows the learner to watch for traffic. It may be as safe and effective to go off the lip at a moderate or full speed as it is to go slowly.

Special considerations for caregivers
- For caregivers of manual wheelchair users descending low curbs, the caregiver may slowly push the wheelchair off the upper level in the forward direction, allowing the casters to gently land on the lower level, followed by the rear wheels. However, it is often dangerous for the caregiver to use this technique for medium or large level changes – the wheelchair user may tip forward out of the wheelchair or the footrests may dig in and prevent a smooth descent.
- Another option, and the one that should be used for higher curbs, is to descend a level change in the backward direction. The caregiver should turn the wheelchair around so
that the rear wheels go off the edge first. The caregiver should stand on the lower level behind and close to the wheelchair. The caregiver should align the rear wheels so that they are both on the edge of the upper level. The caregiver then asks the wheelchair user to lean forward to reduce the weight on the rear wheels. Controlling the movement of the chair, the caregiver slowly and evenly rolls the rear wheels down onto the lower level, avoiding any jarring. Leaning the caregiver’s torso against the backrest is acceptable. Once the rear wheels are on the lower level, the wheelchair user sits upright. Then the caregiver may need to tip the wheelchair back into the wheelie position to avoid the footrests scraping on the upper level as the wheelchair is moved backward away from the curb. Alternatively, the caregiver can turn the wheelchair sideways to prevent the footrests from getting caught because the footrests will have cleared the curb edge by the time that the second caster rolls off the curb.

- Alternatively, the caregiver can tip the wheelchair back into the full wheelie position and lower the rear wheels to the lower level in the forward direction. The caregiver should be careful about the extent to which his/her back is flexed. However, this technique has the advantage of allowing continuous progression along a street, with the eyes facing any dangers in traffic.
- Note: The caregiver should not attempt to descend the level change backward with the wheelchair in the wheelie position because, at greater heights, this causes severe jarring of the wheelchair and its occupant.

**Special considerations for manual wheelchairs**

- **Two-hand-propulsion pattern:**
  - The **forward roll-off approach** for low curbs is convenient and allows the learner to watch for traffic.
  - For a high curb, the backward approach is simple and generally safe if the wheelchair has adequate rear stability and sufficient visibility is available to avoid oncoming traffic. However, even more so than for descending low curbs, it is important to keep the rear wheels moving backward to avoid a rear tip. Learning the backward approach on low curbs is helpful when advancing to higher curbs.
  - To perform the backward approach, the wheelchair user should line the rear wheels up with the edge of the curb. The wheelchair user should lean as far forward as possible (chest on lap, if necessary) and reach forward on the handrims. The wheelchair user should move backward very slowly and let the rear wheels roll evenly down off the upper level under control. Once the rear wheels are on the lower level, the wheelchair user can sit more upright if this is possible without tipping over backward. The wheelchair user should avoid braking suddenly when the rear wheels land on the lower level because this can induce a rear tip; keeping the wheelchair moving backward reduces the likelihood of this problem. If the wheelchair can be brought to a stop with the rear wheels on the lower level and the casters on the upper level, the wheelchair user can turn to the left or the right to get the casters off the upper level without scraping the footrests.

- **Variations:**
  - Approaching the curb edge in the forward direction, the wheelchair user can transiently pop the casters as they reach the curb edge. The wheelchair
user approaches the curb edge squarely with all four wheels on the surface and pops the casters as they reach the edge. This is similar to the technique used to pop the casters transiently for the “gets over obstacles or gaps” skill. The extent of the caster pop should be sufficient to allow the rear wheels to land on the lower level at about the same time or slightly before the casters land. This method requires good timing and skill, but is a natural way to maintain forward progression and to watch for traffic. It can be difficult to spot, so two spotters are recommended.

- See the wheelie variation later.

- **Hemiplegic-propulsion pattern:**
  - The wheelchair is moved forward to the edge of the curb. Then, leaning backward to avoid a forward tip or falling out of the wheelchair, the foot is placed on the surface below the curb. The wheelchair is moved slowly forward until the rear wheels are on the surface below the curb. This technique can also be safely used at higher curb heights.

**Special considerations for powered wheelchairs**
- Ascending high curbs is not applicable for most powered wheelchairs, because of the difficulty and danger involved. However, low and medium curbs may be feasible.

**Special considerations for scooters**
- Ascending high curbs is not applicable for most scooters, because of the difficulty and danger involved. However, low and medium curbs may be feasible.
- If there is insufficient ground clearance between the front and rear wheels, the scooter may get hung up on the edge of the curb.
8.21 PERFORMS WHEELCHAIR-GROUND TRANSFERS

Versions applicable
- Manual wheelchair: ✔
- Powered wheelchair: ✔

WST/WST-Q skills
- “Performs wheelchair-ground transfers”.

Description and rationale
- The wheelchair user gets from the wheelchair to the ground and back. Getting onto the ground is useful for an activity (e.g. gardening or playing with a child). Getting from the ground back into the wheelchair can also be helpful when recovering from a fall.

Prerequisites
- “Performs level transfers” skill.

Spotter considerations
- Spotter starting position:
  - If there is a single spotter, he/she should be near the wheelchair, in a position to prevent the wheelchair from tipping over or prevent the learner falling to the ground.
  - If two spotters are used, one spotter should focus on the wheelchair user and the other spotter on preventing the wheelchair from sliding or rolling away. However, the second spotter should not touch the wheelchair unless it is necessary to intervene.
- Risks requiring spotter intervention:
  - Rear, forward or sideways tip or fall.

General training tips
- There are a number of techniques that wheelchair users can use to get safely from their wheelchairs to the ground and back, the variations reflecting differences in the nature of the wheelchair user’s impairments and wheelchair characteristics. Only a few of the more commonly used techniques will be described. There is no available literature as yet supporting the superiority of one technique over the others. The trainer and wheelchair user may wish to try the variations before selecting the one that will be used in most circumstances.
- After a fall, if one has occurred, unless there is some immediate danger, the wheelchair user and/or caregiver should take time to assess whether there has been any injury or damage to the wheelchair user or wheelchair before getting back into the wheelchair.
- The technique for getting to the ground is similar to that for a level sideways transfer, the major exception being that the hand of the reaching arm should be positioned on the ground before any significant weight is transferred to it. The learner should not use a controlled fall due to the potential for injury to the hand or wrist. The non-reaching hand holds the seat rail or another non-removable wheelchair part.
- The technique for getting from the ground to the wheelchair is more variable and is described in more detail below under “Special considerations for manual wheelchairs”.

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Special considerations for caregivers

- The caregiver can assist the wheelchair user by helping to position and stabilize the wheelchair.
- The caregiver should try to avoid bending and twisting his/her back at the same time and should lift with bent knees.
- A single caregiver may have difficulty in getting a wheelchair user back into his/her wheelchair from the ground without the significant help of the wheelchair user and/or a second caregiver. A mechanical lift or a team of people are recommended when lifting from the floor.
- If the caregiver is large and strong and the wheelchair user is light, the caregiver may be able to safely lift the wheelchair user from the side, with one arm around the back and under the arms and the other arm under the bent knees.
- If there are two caregivers, they may pick up the wheelchair user together. This can be done in two ways.
  - One option is to have one caregiver behind the wheelchair user, holding the wheelchair user’s arms by reaching under the upper arms and grasping the folded forearms. The other caregiver lifts with his/her hands behind the wheelchair user’s knees.
  - The other option is for the two caregivers to be on opposite sides of the wheelchair user, each with one arm under one of the wheelchair user’s arms and around the back and the other arm under the wheelchair user’s bent knees.
- If a third caregiver is available, he/she can help with the legs or manage the wheelchair. In some circumstances, it may be practical to move the wheelchair under the lifted wheelchair user rather than moving the wheelchair user to the wheelchair.
- If a caregiver is restoring the occupied wheelchair to the upright position from the fully rear-tipped position (if a rear tip has accidentally occurred), applying the wheel locks or otherwise preventing the wheels from rolling forward will keep the wheelchair from rolling forward (submarining).

Special considerations for manual wheelchairs

- Fall practice:
  - Learning about “performs wheelchair-ground transfers” is an opportunity to practice and/or discuss how to fall as safely as possible.
  - Generally, regardless of the fall direction, the wheelchair user should not reach out toward the ground with an arm. Even an otherwise minor arm injury can have major functional consequences for a person who uses that arm for mobility and transfers. However, some wheelchair users with low backrests, long arms and good flexibility can prevent full rear or sideways tips with a gentle push on the ground.
  - Rear falls can be safely practiced. The trainer should first lower the wheelchair user backward from the assisted-wheelie position onto a gym mat that has been elevated to about the height of the rear-wheel axles. The rearmost part of the rear wheel should be far enough away from the mat (about 10 cm) to avoid having the mat block the rear tip. While being lowered onto the mat, the wheelchair user should flex his/her neck and pull firmly on the hand-rims. Failure to hold onto the hand-rims will result in the rear wheels of the wheelchair rolling rapidly forward (“submarining”). The wheelchair user can then progress to real falls onto the elevated mat, the height of
which can be progressively lowered. As described earlier, if a rear fall seems imminent the wheelchair user should flex his/her neck and pull backward as forcefully as possible on the hand-rims. In addition to preventing submaring, the rate of rear tip will be decreased and the arms will act as shock absorbers when the wheelchair strikes the floor. Immediately after hitting the ground, the wheelchair user can use the hands or forearms to prevent the knees from striking the face.

- There is no safe and practical way to practice forward or sideways falls. However, they should at least be discussed. During a forward fall, the wheelchair user should twist to one side and try to roll sideways after striking the ground, protecting the head with the hands. During a sideways fall, the wheelchair user should lean away from the direction of tip, pulling vigorously on the uphill armrest or hand-rim.

- If falling backward in a powered wheelchair, the wheelchair user should tuck the chin and pull himself/herself vigorously forward using the armrests or seat. After such a fall, the power should be turned off. Those involved should check to be sure that there is no spilled battery acid.

**Getting from the wheelchair to the ground:**

- The casters of the wheelchair should be oriented so that they are trailing forward, the wheel locks and caster locks (if any) should be applied and, unless they will be used as an intermediate sitting surface, the footrests should be moved out of the way if possible.

- If there is a removable seat cushion and the learner can remove it (either while seated in the wheelchair or after transferring to another surface), the cushion may be placed on the ground in the position that the buttocks will land. This provides a surface that will protect the buttocks from excessive pressure. Additionally, doing so lowers the effective seat height and raises the effective floor height. For instance, if the wheelchair has a seat height of 50 cm and a 5 cm-thick cushion on top of the seat, instead of transferring from 55 to 0 cm (a total change in height of 55 cm), by placing the cushion on the ground, the wheelchair user will transfer from 50 cm to 5 cm (a total change in height of 45 cm), a net reduction of 10 cm.

**Getting from the ground to the wheelchair:**

- As noted above, the wheelchair user can use the seat cushion to increase the starting height above the floor and to lower the height of the wheelchair seat.

- A commonly used technique is with the wheelchair user in the sitting position on top of the seat cushion facing sideways in front of the wheelchair as close to the seat as possible, with the hips and knees flexed as much as possible. The wheelchair user can lift the buttocks with one arm on the seat and one on the ground. This approach is similar to a sideways level transfer (discussed earlier). Moving the head in the direction opposite to the direction to the hips is useful (i.e. move the head down when moving the hips up).

- After getting up onto the wheelchair seat, the cushion can be placed back under the buttocks by rolling to a transfer surface that is the same height as the wheelchair seat and transferring out of the wheelchair. When replacing the cushion, the learner should ensure that the well area (if any) is at the back of seat and the cushion is oriented evenly between the seat rails. Although it is possible for some wheelchair
users to replace the cushion without getting out of the wheelchair, the methods for
doing so vary widely.

- **Variations:**
  - The technique described above can also be performed with the wheel locks off.
    As the wheelchair user lifts the buttocks off the floor, he/she can use the hand on
    the wheelchair to simultaneously pull the wheelchair under the buttocks.
  - The wheelchair user with his/her back facing the front of the wheelchair can lift
    the buttocks with both arms on the seat or front rigging. The footrests can be used
    as an intermediate level between the ground and the wheelchair seat, if they are
    wide enough and if sitting on them does not tip the wheelchair forward. Even if
    the footrests are not wide enough for both buttocks, by turning slightly to one
    side, if may be possible to support one buttock.
  - The wheelchair user can move progressively from the floor to a foot stool, a
    bench and finally to the wheelchair seat. The number of steps can be gradually
    reduced.
  - Some wheelchair users may find it easier to face the wheelchair, getting up onto
    the knees (which may be on top of the seat cushion) before moving up to the seat
    level and twisting into the forward-facing position. If one leg has adequate knee-
    extension strength, the wheelchair user can kneel on the knee of the weaker leg
    with the foot of the stronger leg on the ground.
  - If the wheelchair user has the use of both of his/her legs, he/she can use the
    wheelchair to help get up onto his/her feet, then pivot and sit down.
  - If there is another stable object nearby (e.g. a chair or low table), the wheelchair
    user can put one hand on the object and the other hand on the wheelchair seat.
  - Some wheelchair users are able to right themselves while remaining in the
    wheelchair. To train someone to perform this technique, the wheelchair user can
    start on a surface partway between seat height and the ground, with the
    wheelchair on its back (as would be the case after practicing a fall backward onto
    an elevated mat, as described above). The wheelchair user should first pull on the
    rear wheels to get the buttocks firmly against the wheelchair seat. The wheelchair
    user may let the knees bend over the front of the seat. The wheel lock should be
    applied on the side of the stronger arm. The wheelchair user turns the trunk to the
    other side and uses the forward (stronger) hand to grab the hand-rim of the rear
    wheel on the unlocked side, with the hand as far forward as possible. The
    wheelchair user then reaches with the other hand to the surface on which the
    backrest of the wheelchair rests. The wheelchair user simultaneously and
    vigorously pushes with the floor hand and pulls with the hand-rim hand. This step
    is repeated as necessary, moving the floor hand progressively forward on the
    surface until the wheelchair is upright.

**Special considerations for powered wheelchairs**

- The power should be off while “performs wheelchair-ground transfers” are being
  practiced, unless one of the positioning options (e.g. seat-height elevation or tilt) is being
  used.
8.22 ASCENDS STAIRS

Versions applicable
- Manual wheelchair: ✓
- Powered wheelchair: X

WST/WST-Q skills
- “Ascends stairs”.

Description and rationale
- The wheelchair user and the wheelchair get from the bottom of a set of stairs to the top. Although alternative means of getting from a lower to a higher level are often present (e.g. using a ramp or elevator), stairs may sometimes be the only option. This skill is not generally applicable to powered wheelchairs and scooters.

Prerequisites
- None.

Spotter considerations
- Spotter:
  - The spotter considerations vary depending upon the method used and the number of spotters available.
  - Regardless of the method used, at least one spotter should be below the wheelchair user on the stairs.
  - If the wheelchair user is in the wheelchair, the spotter below the wheelchair should use one or both hands near or holding a fixed part of the wheelchair. If holding a wheelchair part, it is important to avoid assisting or interfering with the performance of the task unless deliberately intervening.
  - If the wheelchair user is in the wheelchair and two spotters are available, one should be above and one below the wheelchair.
  - A removable seat belt may be used,
- Risks requiring spotter intervention:
  - Forward or rear tip or fall.
  - Runaway down the stairs.

General training tips
- Alternative routes (e.g. ramps or elevators) to get to the upper level should be sought wherever possible.
- With the exception of the initial preparation for the first step of a set of stairs and concluding the task after ascending the last step, the same technique is used for each step.
- Safety is of particular importance, given the consequences of a loss of control.
- If a stair lift or elevator is available in the learner’s home or workplace, the use of this technology should be practiced.
- There are a variety of methods, the choice of which depends upon the characteristics of the wheelchair user (e.g. strength, flexibility, ability to use the legs) and the stairs.
Getting out of the wheelchair and ascending in the seated position is probably the safest technique and the one most likely to be possible for the wheelchair user without assistance:

- A strapped-on buttocks protector is advisable.
- The wheelchair should be positioned next to the stairs, in a way similar to how the wheelchair would be positioned for the “performs level transfers” skill.
- The wheelchair user transfers from the wheelchair to a sitting position on the second or third step. The stair handrail may be used.
- The wheelchair may be brought up to the top of the stairs by the wheelchair user or by an assistant. If bringing the wheelchair up the stairs himself/herself, the wheelchair user should pull the wheelchair up by facing it downhill with the wheel locks off, and tipping it back fully. The wheelchair user should push straight down with one hand on the wheelchair’s push-handles that are resting on a step, to keep the wheelchair from rolling or sliding down the stairs.
- For the wheelchair user to move up each step, he/she should flex the neck and hips and push down with the arms and feet to bring the buttocks up and back onto the next higher step (another example of the hips-vs.-head strategy described in the “performs level transfers” skill). Then the hands, feet and wheelchair are moved up to the next step.
- At the top of the stairs, a stool is helpful as a half-way step to the wheelchair seat. Otherwise, this final phase is the same as for the getting from ground into wheelchair phase of the “performs wheelchair-ground transfers” skill.

Variations:

- Out of the wheelchair, on hands and knees:
  - As for the seated approach above, but facing up the stairs and using a crawling action, advancing one limb at a time. A caregiver is usually needed to bring the wheelchair up the stairs.

- In the wheelchair:
  - Although this technique is not recommended for wheelchair users acting alone, because of the long-term consequences of the stresses placed on the shoulders and the safety consequences of poor technique, the following tips are provided for the exceptional wheelchair user who wishes to acquire this skill for the unusual occasion when it would be helpful.
    - The rear anti-tip devices (if any) should be repositioned to allow the rear wheels to contact the first stair and to permit the wheelchair to tip backward sufficiently.
    - The starting position is with the wheelchair user in the wheelchair, with the seat belt (if any) on.
    - The wheelchair should be backed up to the lowest step, closest to the handrail on the side of the stronger arm.
    - The wheelchair user reaches back as far as he/she can with the stronger arm and grabs the handrail with the palm facing up.
• By pulling on the handrail, the wheelchair user tilts the wheelchair back but not beyond the wheelie balance point to avoid having the rear wheels roll forward (submarining).

• The wheelchair user uses the hand on the stair handrail to pull while using the other hand on the hand-rim (starting well forward) to roll the rail-side wheel up the step.

• Because both hands are acting on the same side of the wheelchair, the front of the wheelchair will tend to turn toward the stair rail. The wheelchair should be squared-up (i.e. bringing both rear wheels against the vertical face of the step) before each new stair is attempted.

• At the top of the stairs, the casters should not be brought down until there is surface to support them.

• Progression:
  - It is useful to have stairs with a variety of dimensions to permit gradual progression. The wheelchair user can use a curb first, if there is a rail beside it, as an example of a single step.
  - If the staircase is curved, there is more “run” on the outside of the curve, so it will be easier on the outside.
  - It is reasonable to start with the caregiver-assisted versions of this skill. Caregivers can apply upward rolling forces to one or both rear wheels to assist in getting up the stair and to prevent the rear wheel on the side away from the hand-rail from moving away from the stair rise.

• Escalators:
  - Escalators that are wide enough and are not excessively steep can be safely managed in a manual wheelchair. Permission should be obtained before practicing on escalators in public places. To ascend an escalator, the wheelchair user slowly approaches the lower end in the forward direction, grasps both or one moving hand-rails and allows the wheelchair to be pulled onto the escalator. The wheelchair will settle itself into a stable position with the casters on a stair above the rear wheels. The wheelchair user should lean forward until on the level at the top. The major difficulty comes at the top, where there is usually a lip that will stop the wheelchair or cause it to tip forward. To prevent this, the wheelchair user should lean well back without tipping the wheelchair over, still holding onto the hand-rails. A second spotter at the top can help to pop the casters over the lip until the wheelchair user has mastered this on his/her own.

Special considerations for caregivers

• Wheelchair user in the wheelchair:
  - If more than one caregiver is involved, as should usually be the case, the wheelchair user or one of the caregivers should by agreement take the lead in coordinating the timing (e.g. to the count of “ready, set, go” for each step).
  - The starting position is with the wheelchair user in the wheelchair, with the seat
belt (if any) on. It can be helpful to remove the footrests.

- The wheelchair should be backed up to the lowest step with the rear wheels firmly against the step rise.
- The wheelchair user may place his/her hands on the rear wheels or the stair handrails, assisting to the extent possible but keeping his/her hands out of the way of the caregiver’s hands.
- For most methods, the location of the combined center of gravity of the wheelchair user and the wheelchair is a key factor. If the center of gravity is behind the rear-wheel axles, the rear wheels will tend to subside (i.e. move away from the step rise) if not prevented by the wheelchair user’s or caregiver’s hands on the hand-rims. If the center of gravity is in front of the rear-wheel axles, the rear wheels will tend to move backward, toward the step rise (which is where they need to be to roll the rear wheels up the step).
- If the wheelchair user cannot physically assist much, ideally there should be three caregivers available. One caregiver positions him/herself above the wheelchair, pulling on the push-handles, but not too forcefully because the awkward positioning could lead to injury of the caregiver’s back. This uphill caregiver is turned slightly to one side, with one foot on the stair above the rear wheels and the other on the next higher stair. The primary role of the uphill caregiver is to control the degree of rear tilt, which should be ahead of the balance point as noted earlier. The uphill caregiver can tell where the center of gravity is relative to the balance point by whether the push-handles are pushing back (as they should not be) or pulling forward (as they should be). The two downhill caregivers are below the wheelchair. Each uses the inside hand (closest to the mid-line of the wheelchair) to hold the frame of the wheelchair, not a part (e.g. a footrest) that could come off. The outside hand is placed on the hand-rim of the rear wheel and is used to roll the wheel up onto the next step. The outside hand begins at about the horizontal position and moves up to the vertical position.

- **Variations:**
  - If only a single caregiver is available and the wheelchair user is able to assist, then the caregiver can provide some of the needed force from downhill (e.g. rolling the non-rail-side wheel up the step while the wheelchair user pulls on the stair handrail with one hand and the rail-side hand-rim with the other hand) as described below.
  - With two caregivers, one of the caregivers can be positioned uphill and pull on the push-handles while the other caregiver is below and pushes on the wheelchair frame.
  - Although not recommended because of the stresses involved, a single strong caregiver can help a light wheelchair user in a light wheelchair proceed up a set of stairs from behind (uphill), tipping the wheelchair back beyond the balance point and rolling it up one step at a time. This is similar to the “ascends high curb” skill performed in the same way.

**Wheelchair user out of the wheelchair:**

- The caregiver can assist by spotting and/or bringing the wheelchair up the stairs.
For the latter, the caregiver proceeds backward up the stairs with the tipped empty wheelchair facing downhill.

- **Variations:**
  - The caregiver can carry the wheelchair user “piggy-back” style, with the wheelchair user on the caregiver’s back. The wheelchair user holds onto the caregiver with his/her arms over the caregiver’s shoulders. The caregiver holds onto the wheelchair user’s bent knees.
  - A strong caregiver can carry the wheelchair user “fire-fighter” style with the wheelchair user facing the caregiver and the hips flexed over one of the caregiver’s shoulders. The caregiver secures the wheelchair user by wrapping his/her arm around the wheelchair user’s knees.
  - Two caregivers can share the load, either front and back or by creating a “seat” of their interlocked hands as described earlier in the “gets from ground into wheelchair” skill.

**Special considerations for powered wheelchairs**

- The “ascends stairs” skill is not generally applicable although the out-of-wheelchair method (as for manual wheelchairs but without the wheelchair) may be useful in an emergency (e.g. a house fire).
8.23 DESCENDS STAIRS

Versions applicable

- Manual wheelchair: ✔
- Powered wheelchair: X

WST/WST-Q skills

- “Descends stairs”.

Description and rationale

- The wheelchair user and the wheelchair get from the top of a set of stairs to the bottom. The rationale is as for the “ascends stairs” skill. Although there is still a potential for injury due to a fall, descent is much less strenuous than ascent. Many wheelchair users who cannot ascend stairs independently can descend them. This skill is not generally applicable to powered wheelchairs and scooters.

Prerequisites

- None.

Spotter considerations

- Spotter starting position:
  - As for the “ascends stairs” skill.
  - If the wheelchair user is proceeding independently down the stairs in the backward direction, the spotter should be behind the wheelchair with the hands near the push-handles.

- Risks requiring spotter intervention:
  - Forward or rear tip or fall.
  - Runaway down the stairs.

General training tips

- To descend with the wheelchair user out of the wheelchair in the seated position or on the hands and knees, the technique is the reverse of the “ascends stairs” skill.

Variations:

- Descending stairs with the user in the wheelchair is much safer and more feasible than ascending stairs in the wheelchair:
  - The wheelchair is initially positioned with the back of the wheelchair facing the stairs.
  - The wheelchair user grabs one or both stair rails, leans forward enough to keep the casters from lifting off, lowers the rear wheels down one stair, then slides the hands down the rail. The trainer should alert the wheelchair user that this method can be noisy, because the casters and/or footplates bang down each stair; this can be minimized by not leaning too far forward.
  - If the footrests interfere with smooth progression down the stairs and they can be removed, this may be done. The feet are unlikely to be injured as they slide gently
from step to step, especially if shoes are worn.

- A variation for the use of two hands on the same rail is for the wheelchair user to turn the trunk toward the rail and reach farther downhill with the rail-side arm. This reduces the load on the casters and helps to prevent the wheelchair from turning on the stair.

- Another option is to face up the stairs as above, but to use one hand on the stair hand-rail and the other hand on the hand-rim of the wheelchair. This technique can prevent the tendency of the non-rail-side wheel to roll away from the stair riser.

- Using a transient caster pop, the wheelchair user can descend forward continuously rather than stopping on each step. This method is similar to the previous one except that the wheelchair is moving forward as it reaches the edge of the top step. The wheelchair user pops the casters just before the casters reach the drop off. This technique is difficult to spot safely.

- Descending an escalator is similar to ascending an escalator as described above in the “ascends stairs” skill. The wheelchair user approaches the upper end of the escalator backward, grasps the hand-rails of the escalator and allows the wheelchair to be pulled onto the escalator. While descending, the wheelchair user leans forward enough to keep the casters from lifting off the stair. At the bottom, although there is a lip, it usually presents little difficulty because it is first struck by the rear wheels, the large diameter of which allows the relatively unloaded rear wheels to easily roll over.

- See wheelie variation later.

**Special considerations for caregivers**

- As for the “ascends stairs” skill, but in the reverse direction.

**Special considerations for powered wheelchairs**

- Not generally applicable although the out-of-wheelchair method (but without the wheelchair) may be useful in an emergency (e.g. a house fire).
8.24 PERFORMS WHEELIE

Versions applicable
- Manual wheelchair: ✓
- Powered wheelchair: X

WST/WST-Q skills
- “Performs stationary wheelie”.

Description and rationale
- The learner achieves the wheelie position (balancing on the rear wheels), maintains it for a period of time and brings the casters back to the floor. The stationary wheelie position can also be used to avoid postural problems that can cause neck strain from looking up. The stationary wheelie is also a foundation skill for a number of functional skills that can be best performed in the full wheelie position and that will be dealt with in the next section.

Prerequisites
- None.

Spotter considerations
- Spotter starting position:
  - Usually the spotter stands behind the wheelchair holding onto a spotter strap.
  - The skill can also be spotted from a position in front and to one side of the wheelchair, with a hand ready to apply a downward and backward force to the wheelchair user’s knee or a fixed part of the wheelchair.
- Risks requiring spotter intervention:
  - Rear tip if the learner overshoots on take-off or loses balance.

Adjustment tips
- As was noted earlier with respect to adjustments that make it easier for the wheelchair casters to be transiently popped from the surface, the wheelchair type and set-up influence the ease with which the wheelchair can be tipped backward into the full wheelie position. It is easier to achieve the wheelie position in a wheelchair that is less stable to begin with; this can be achieved by moving the rear axle position forward.
- If rear anti-tip devices do not allow the wheelchair to be tipped back far enough, they need to be adjusted out of the way or removed. Even for rear anti-tip devices that do permit a wheelie to be performed, they may not be sufficiently stable to prevent a full rear tip.

General training tips
- The description that follows is for people using two hands for propulsion, but people who only have the use of one arm can perform wheelies in a similar way.
- To avoid frustration and manage expectations, the trainer may wish to inform the learner that most people require a total of 45-60 minutes of practice, spread over 2-3 sessions, to acquire and retain this skill.
• The sequence of phases trained is not critical but the more natural sequence (and one that is supported by the general motor skills literature) is described below.

• Take-off phase:
  • The learner will already have learned how to transiently pop the casters from the surface in earlier skills. It may be useful to review transient caster popping before proceeding to the full wheelie take-off.
  • It may be useful to use simulation, having the trainer tip the wheelchair back into the balance position, to give the wheelchair user a sense of how much tilt will be needed.
  • If properly timed and the wheelchair is appropriately set up, the wheelchair user should require little force to achieve take-off.
  • For the wheelie take-off, many wheelchair users roll backward slowly, then quickly forward. This method is very effective and is to be preferred when the wheelchair user wishes to perform a wheelie in the same position in which he/she started (e.g. during the WST). If using this method, the wheelchair user should start with the hands just ahead of the top center of the wheel (i.e., ~1:00 o’clock, using the clock analogy). The wheelchair user should try not to pause between rolling back and pushing quickly forward, otherwise he/she may not tip backward as easily.
  • However, the method of only rolling the wheels forward is preferred when the available space is not an issue because the forward-only method can be used while the wheelchair is moving forward (as is occasionally necessary). The hands will need to start farther back on the wheels (i.e., ~11 o’clock, using the clock analogy) and slightly more force will be needed by the wheelchair user than for the backward-then-forward method.
  • The forward motion that is common to both methods can be thought of as an action to get the base of support (the rear wheels) under the center of gravity (located near the lap of the wheelchair user).
  • Some wheelchair users may find it easier if they lean back into the backrest to cause or help with the initial rear tip. However, skilled wheelie performers can achieve the wheelie position while maintaining an upright body position. Leaning forward is a natural tendency to prevent rear tip-over but this makes it more difficult to achieve take-off.
  • Whichever method is used, the wheelchair user should progressively pop the casters higher and higher until he/she can tip backward far enough to reach and slightly overshoot the wheelie balance point. Once past the balance point, the wheelchair user should then pull back on the hand-rims to prevent tipping too far and to return to the balance point.
  • If the wheelchair user is having difficulty getting tipped far enough backward to reach the balance point, he/she should push forward more forcefully. An alternative is to start the take-off with the casters uphill or on a small level change although there needs to be room for the rear wheels to roll forward if using the forward-only method.
  • If a learner is having difficulties due to fear of tipping over backward, the wheelchair user can pop back onto the spotter then progress to a self-save (flexing the neck and trunk while pulling back vigorously on the hand-rims, as has been dealt with earlier during rear-falling practice, to bring the casters back to the floor). Once the learner is able to tip backward far enough to be caught by the spotter, in subsequent attempts
he/she should gradually reduce the amount of overshoot until it is possible to self-save without the spotter’s assistance.

- Although take-off can usually be achieved with a single push, if the wheelchair has not been tilted back far enough with the first push, a second push before the casters return to the floor may be successful.

- Once the learner can consistently perform the wheelie take-off, attention should be shifted to the balance phase.

- **Balance phase:**
  - The wheelchair user does not need to use much force to maintain balance. It is preferable for the wheelchair user to keep a light grip on the wheels (“avoid the grip of death!”). It should be possible for the wheelchair user to slide his/her hands forward and backward on the hand-rims.
  - During the early learning stage, some wheelchair users find it useful to isolate the variations of pitch from those of rear-wheel displacement (i.e. using the motor-learning principle of “reducing the degrees of freedom”). This can be done by reducing the extent to which the rear wheels can move (e.g. by using obstacles such as bricks or pieces of wood in front of and behind the rear wheels). If the wheelchair is well set up and the wheelchair user has adequate strength, he/she may be able to push forward hard enough to tilt the wheelchair into the balance position with the rear wheels blocked. Otherwise, the trainer can tip the wheelchair back to the balance point while the wheelchair user rests his/her hands in the lap. For a wheelchair that is difficult for the trainer to tip backward (e.g. due to a low backrest, absence of push-handles, absence of tipping levers or excessive stability), the trainer can alternatively lift a forward section of the wheelchair frame. The trainer then turns over control to the wheelchair user by having the wheelchair user grasp the hand-rims. The trainer should then take his/her hands off the wheelchair – it can be confusing to have two people attempt to maintain balance at the same time – and let the learner know (“It’s all you now”).

- Once the wheelchair user is in control with the rear wheels blocked, learning exercises can include any or all of the following:
  - Having the wheelchair user experiment with the extent of tip (more and less than the ideal balance point, where the force to maintain position is minimal).
  - Leaning forward (which increases the amount of tip needed to be at the ideal balance point).
  - Using only two fingers and a thumb of each hand on the hand-rims.
  - Sliding the hands backward and forward on the hand-rims to find the ideal position.
  - Holding on with only one hand while waving the other.
  - Closing the eyes and focusing on the feel of the balance position.

- Once these variations are mastered at the high rolling-resistance level (i.e. with the wheels fully blocked), the barriers in front of the rear wheels can be moved a few cm away while the wheelchair leans against the rear barrier. This allows a small amount of forward and backward movement of the rear wheels. At either extreme of movement, the wheelchair user can lean the rear wheel against the front or rear barriers. This stage can be considered analogous to having “training wheels” like
those used by children learning to ride bicycles. Once the wheelchair user is familiar with this, the barriers can be moved progressively farther away and removed.

- When the wheelchair user has become comfortable with not spending too much time leaning on the barriers, the wheelchair can be moved to a surface with medium rolling resistance (e.g. on a gym mat). Here the take-off and balance phases can be combined. The soft surface allows the learner to perform a “slow-motion” wheelie.
- Once this is mastered, the wheelchair can be moved to a low rolling-resistance surface (e.g. a tile floor).
- When a basic wheelie can be performed on a low rolling-resistance surface, the learner can refine his/her skill by becoming familiar with and practicing the two balance strategies that have been reported in the scientific literature:
  - Proactive balance strategy: In this strategy, analogous to balancing a meter stick on a finger, the wheelchair user keeps the wheels moving forward and backward over a small area. The wheelchair user should try to move the hands only between the 12:00 and 1:00 o’clock positions, using the clock analogy. This will allow a safety margin, so that the wheelchair user can react to a loss of balance in either direction. If the wheelchair user wants the wheels to move farther than the intermediate hand position permits, the hand-rims can be allowed to slide through the grip. It may be helpful to time the movement of the rear wheels to the breathing pattern while using the proactive balance strategy.
  - Reactive balance strategy: The reactive balance strategy is analogous to the step strategy used in standing balance – if a standing person is pushed forward or backward hard enough that he/she would otherwise fall, the person steps forward or backward to bring the base of support under the displaced center of gravity. If the wheelchair user begins to tip too far forward, he/she should roll the rear wheels forward to return to the balance point (“when you fall forward, push forward”). If the wheelchair user imbalances backward, he/she should roll the rear wheels backward to re-establish balance (“when you fall back, pull back”). The strategy to prevent a rear fall or to minimize its consequences was dealt with earlier in the rear-falling practice section of the “performs wheelchair-ground transfers” skill.

- Landing Phase:
  - To land from the balance position, the wheelchair user pulls back on the wheels, or leans forward to gently bring the front wheels to the ground.

- Progression:
  - Once the full wheelie can be performed with the spotter nearby, the wheelchair user can practice performing the stationary wheelie with variations (e.g. with the spotter progressively farther away, with low lighting, while multi-tasking).

- Variations:
  - During the balance phase, the wheelchair user can lean forward or place a knapsack
on the lap or footrests to increase the caster height needed for the wheelie position. The wheelchair user can practice this by placing the casters on different height targets (e.g. pylons, steps).

- See other wheelie variations in the next section.

**Special considerations for caregivers**

- As noted earlier in the “rolls on soft surface” skill, to achieve a caregiver-induced wheelie, the caregiver should pull back on the push-handles, with one foot pushing down on a tipping lever, to tip the wheelchair back to the balance point.

- Once in the wheelie balance position, only minimal force is needed by the caregiver to maintain balance.

- When moving the wheelchair forward or backward in the wheelie position, the caregiver should allow the wheelchair to tip back far enough so that it is just beyond the balance position pushing down slightly on the hands.

- To lower the wheelchair to the horizontal position, the caregiver should put one foot on the tipping lever at the back of the wheelchair to keep the wheelchair from pitching forward too abruptly.
8.25 PERFORMS WHEELIE-DEPENDENT SKILLS

Versions applicable
- Manual wheelchair: ✓
- Powered wheelchair: X

WST/WST-Q skills
- “Rolls forward and backward in wheelie position”
- “Relieves weight from buttocks”
- “Rolls on soft surface”
- “Turns in place in wheelie position”
- “Turns while moving forward”
- “Turns while moving backward”
- “Maneuvers sideways”
- “Descends low curb”
- “Descends high curb”
- “Descends high curb in wheelie position”
- “Descends slight incline”
- “Descends steep incline”
- “Descends steep incline in wheelie position”
- “Rolls across side-slope”
- “Descends stairs”

Description and rationale
- The learner performs a variety of previously discussed skills for which non-wheelie methods are available, but that can be performed (and sometimes need to be performed) in the wheelie position. Once the learner has mastered the stationary wheelie, the learner should return to these earlier skills and attempt to learn them using the wheelie technique.
- Caregiver-aided wheelies are dealt with in the previous sections because of their relative simplicity in comparison with wheelies performed by wheelchair users.

Prerequisites
- The “performs stationary wheelie” skill.

Spotter considerations
- Spotter starting positions:
  - Unless otherwise noted below, as for the “performs stationary wheelie” skill and for the specific skill being learned.
- Risks requiring spotter intervention:
  - Unless otherwise noted below, as for the “performs stationary wheelie” skill and for the specific skill being learned.

Adjustment tips
- As for the “performs stationary wheelie” skill.
General training tips

- The training tips for the skills in this section build upon the tips presented earlier where the non-wheelie methods were described. Only aspects specific to the wheelie method will be presented here.

- Rolls forward and backward in the wheelie position
  - Rolling forward in the wheelie position is useful when approaching obstacles for which it is advantageous to have the casters off the surface (e.g. for the descent of high curbs). Moving backward in the wheelie position is useful in tight spaces, where it is not possible to turn around, for instance to raise the casters over an obstacle (e.g. a stick on the ground or a towel on a bathroom floor). Also, the backward skill allows the wheelchair user to ease up to a wall or object against which he/she can lean (i.e. for the tilt-rest variation of the “relieves pressure from buttocks” skill).
  - Moving the wheelchair forward and backward in the wheelie position utilizes the reactive balance strategy noted in the previous section. The wheelchair user should allow the wheelchair to begin to fall (dip) slightly in the direction in which he/she wishes to move and then roll the rear wheels in the same direction to catch up. To initiate the dip, the wheelchair user can move the head or lean slightly in the direction he/she wishes to move. Alternatively, the wheelchair user can initiate the dip by pushing the wheels slightly in the opposite direction. The wheelchair user should be encouraged to take his/her time to achieve control and to move slowly. The wheelchair user should grip the wheels lightly, giving a light push and letting the hand-rims slide through the fingers. In catching up to the center of gravity after the first dip, there is no need for the wheelchair user to catch up completely. By undershooting slightly, the wheelchair user can initiate the next dip. Some wheelchair users may find it easier to move forward or backward with one hand at a time. It is easier to begin with short steps then proceed to longer ones. The forward and backward “dip-and-roll” processes can be practiced against resistance (e.g. on a soft surface, up an incline, over an obstacle or up a 5 cm curb). The dip needs to be accentuated in such circumstances.

- Stops
  - Some highly skilled wheelchair users can induce a controlled wheelie by throwing the trunk backward while coasting quickly forward. The goal is to overshoot the balance point and then grasp the hand-rims firmly to stop the wheelchair and prevent a rear tip. With a different amount of force applied to the two hand-rims, a rapid turn can be made.

- Relieves weight from buttocks
  - A wheelie can be used to achieve tilt but the extent of tilt (rarely more than 25°) means that no more than partial unloading can be achieved.
  - A wheelie can be used to achieve the tilt-rest position discussed earlier, that permits a greater degree of tilt but still not enough to achieve complete unloading. To get into the tilt-rest position using the wheelie, the wheelchair user achieves the wheelie position with the back of the wheelchair facing the object that will be leaned against.
The wheelchair is then rolled back in the wheelie position until the rear wheel or backrest of the wheelchair or back of the wheelchair user (for low and high objects respectively) contacts the object. Then the wheelchair is allowed to tilt back slightly further and the wheel locks are applied one at a time (or the hand-rims are held with the hands). The wheelchair user must not let go of both wheels at the same time or the rear wheels will roll rapidly forward ("submarining") and a rear tip will occur.

- **Rolls on soft surface**
  - If using the full wheelie position to move on a soft surface, the wheelchair user needs a strong forward dip to get going as was discussed earlier. If the casters touch the surface during the dip, the wheelchair user can lean forward slightly. This allows the casters to lift off further during the wheelie and provides better clearance during the dip.

- **Turns in place**
  - Wheelchair users often encounter situations in which they need to perform a wheelie to make a tight turn. The area needed on the support surface (the “turning footprint”) is less in the wheelie position than when all wheels are on the surface. The learner should be careful not to let the elevated feet hit any external object.

- **Turns while moving forward and backward**
  - These skills are similar to moving straight forward and backward in the wheelie position except that, in correcting for the initial dip, the rear wheels are rolled forward or backward to different degrees.
  - Alternatively, this skill can be broken into two components performed sequentially (e.g. rolling straight forward to a slight extent, then turning in place to a slight extent, repeating these steps) rather than simultaneously.

- **Maneuvers sideways**
  - In tight spaces, the wheelie allows the wheelchair to be moved sideways by a series on forward and backwards turns.

- **Descends curbs**
  - Using a wheelie to descend a curb in the forward direction allows the wheelchair user to maintain forward movement and to see any dangers that lie ahead. Also, the wheelie position prevents the footrests from making contact with the lower level, which can decelerate the wheelchair and cause a forward tip or fall from the wheelchair.
  - If the wheelchair user descends a curb in the wheelie position, a single spotter should stand on the upper level with both hands near the push-handles to react to rear, forward or sideways tips. A removable seat belt can prevent the wheelchair user from falling forward from the wheelchair. If using two spotters, as is recommended for the wheelie forward descent, the spotter behind the wheelchair should have his/her hands near the push-handles and the second spotter should stand beside and below the curb.
The forward full-wheelie method is an excellent method for the descent of a large level change. The wheelchair user should get into the wheelie position slightly away from the edge of the level change. The wheelchair user should roll forward to the edge of the curb in the wheelie position, staying square to the edge. The “Rolls forward and backward in wheelie position” skill will have prepared the learner to approach the curb edge under control. After initiating the forward dip to move the rear wheels over the edge of the curb, the wheelchair user should quickly slide the hands backward from just ahead to just behind top dead center of the hand-rims, so that he/she can firmly grip the hand-rims and resist the descent. The wheelchair user should let the rear wheels hit the lower level before the casters. As soon as the rear wheels touch the ground, the momentum should bring the casters down to the surface, but the wheelchair user should lean forward as well. The skill should be practiced first on a low curb, increasing the height of the curb as skill and confidence allow.

As a variation, the wheelchair user can land on the lower level and maintain the wheelie position rather than allowing the casters to land, either maintaining balance or leaning back against the curb rise. This is useful where there is little space for the casters to land, such as on a series of widely spaced stairs.

Descends inclines

For the ascent of very steep inclines, some wheelchair users will go up backward. The uphill movement is initiated by allowing the wheelchair to dip backward, followed by a strong pull backward on the hand-rims to re-achieve balance a short distance up the slope.

Descends inclines

Descending a steep incline in the forward direction in the wheelie position lessens the problem of loss of traction (affecting braking and control) when the uphill wheels become unloaded. This technique also reduces the likelihood of forward tips or digging the footrests into the floor at the transition between the bottom of the incline and the level surface. For very steep inclines, this technique may be the only way to get down the incline without tipping over.

The wheelchair user usually achieves the wheelie position on the level at the top of the incline. Then he/she moves forward onto the incline. Moving forward and backward in the wheelie position will already have been practiced. When initially moving onto the incline, the wheelchair user may be startled to feel as though the wheelchair is tilting farther backward. When stopped facing downhill in the wheelie position, the sensation is similar to that felt while leaning back on a barrier, as when learning the balance phase of the “performs stationary wheelie”. Once on the incline, facing downhill, the wheelchair user should let the hand-rims run smoothly through the hands to control the wheelchair’s speed, direction and pitch angle. Letting the hand-rims run more quickly through the hands will allow the wheelchair to pitch (tilt) farther back. Slowing the rate at which the hand-rims slide through the fingers will cause the wheelchair to pitch forward. The learner should have the casters touch down shortly after the rear wheels reach the level surface at the bottom of the incline.
• A variation is for the learner to achieve wheelie take-off while on the incline and facing downhill. This is useful when an unexpected obstacle is encountered. If the wheelchair user is facing downhill, more force is needed for take-off (because the wheelchair is pre-tilted in the wrong direction) and the wheelchair may accelerate rapidly downhill.

• On steep or slippery inclines, or if the wheelchair has too much rear stability, there may not be enough rear-wheel traction to allow wheelie take-off while facing downhill. In such situations, the wheelchair can be turned so that it is facing across the hill or even uphill. This will place more weight on the rear wheels and avoid runaway. Once in the wheelie position, a wheelie turn-in-place will allow the wheelchair user to proceed down the incline.

• **Rolls across side-slope**

  • In the wheelie position facing across a slope, there is no downhill-turning tendency, because the center of gravity is between the rear wheels.

• **Descends stairs**

  • In the full wheelie position, the wheelchair user can descend forward, one step at a time. This is possible if there is an adequate horizontal distance (“run”) on each step.

  • At least two spotters should be involved. One or two spotters should be below the wheelchair with the hands near a fixed front part of the wheelchair to resist tipping or runaway. The uphill spotter should be above the wheelchair with the hands near the push-handles to react to backward, forward or sideways tips, or runaway.

  • The wheelchair user drops down one step at a time as for the “descends curbs” skill. The difference is that the casters cannot land after the rear wheels do. The wheelchair user instead balances on the rear wheels or, more simply, allows the wheelchair to tilt back after the rear wheels land on the step such that the rear wheels push against the step rise (analogous to the “tilt rest” version of the “relieves weight from buttocks” skill) before proceeding to the next step. This should be practiced on a single curb first.

  • In the full wheelie position, the wheelchair user can descend forward continuously rather than stopping on each step. However, this method is difficult to spot. It is only recommended for a short flight of stairs and when no handrails are available. If the wheelchair user is going to fall, it is better to fall backward than forward.
CHAPTER 9. GAMES

In Chapter 9 on the training of individual skills or skill groups, some variations and activities are described that can be used as means of encouraging varied practice and providing motivation for people learning wheelchair skills. In the chapter that follows, more detail is provided on some structured games that are suitable for individuals or small groups. Although the importance of organized sports is recognized, descriptions of structured wheelchair sports (e.g. wheelchair basketball, wheelchair rugby, track and field) have not provided because that would be beyond the scope of this Manual. Depending upon the skill of the participants and the game, spotters may be needed. Note that some of the games or their variations are based around competition and may not be of interest to all participants.
### 9.1 Line Game

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
</tbody>
</table>
| Equipment and set-up               | • Line grid on floor. Many gyms already have court lines outlined on the floor for participants to follow but, if not, a grid can be easily made using tape.  
• Name tags. |
| Instructions                       | • Participants propel along the lines on the floor. When participants meet each other on a line they must turn around and propel in the opposite direction. |
| Skills reinforced                  | • Rolling forward and backward, moving turns, turns in place, spatial awareness. |
| Variations                         | • As an ice-breaker, have participants introduce themselves when they meet, give each other high fives, shake hands or wave.  
• Participants are each given a bingo style sheet with questions in each block such as ‘brown eyes’, or ‘birthday in April’ or ‘likes to play basketball’, etc. When participants meet they must match their new partner with one of the ‘bingo’ blocks and cross it off. The first person to get five blocks in a row wins.  
• When participants meet, instead of turning around, they propel backward away from their partner until they can turn off down another line, at which point they can propel forward again. |
### 9.2 Traffic Lights

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• 3 colored balloons or signs (green, yellow, red)</td>
</tr>
<tr>
<td>Instructions</td>
<td>• Participants propel wherever they wish in the space provided. At intervals, a volunteer or trainer holds up one of the three balloons/signs. Each balloon/sign represents a different instruction. For example red = stop immediately, yellow = Go slowly and green = Go quickly around the room. When the sign is held up participants must immediately follow the new instructions.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Rolling forward, moving turns (all directions), spatial awareness and stopping.</td>
</tr>
</tbody>
</table>
| Variations                          | • Trainer shouts out instructions or uses a whistle.  
• Ask participants to propel backward.  
• The last person to stop is disqualified.  
• Use music and encourage participants to go quickly or slowly depending on the speed of the music. When the music stops, so must the participants. |
### 9.3 Gears

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
</tbody>
</table>
| Equipment and set-up                | • Line markings or pylons.  
|                                     | • Mark off the room into three different areas or zones. |
| Instructions                        | • Participants are instructed to move as slowly as possible through the first area, at a medium speed through the second area and as quickly as possible in the final area. |
| Skills reinforced                   | • Rolling forward, speed control and braking. |
| Variations                          | • The same game, but in the backward direction. |
## 9.4 What time is it Mr. Wolf?

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• None.</td>
</tr>
<tr>
<td>Instructions</td>
<td>• The participants are lined up beside each other at the baseline on one side of the room and Mr. Wolf is on the other side of the room, facing away from the participants.</td>
</tr>
<tr>
<td></td>
<td>• The participants together shout ‘What time is it Mr. Wolf?’</td>
</tr>
<tr>
<td></td>
<td>• Mr. Wolf’s response corresponds to how many pushes they can give in an attempt to catch the wolf while his/her back is turned. (For instance, if Mr. Wolf says that it is 3 o’clock each participant can move as far as they are able with 3 pushes.)</td>
</tr>
<tr>
<td></td>
<td>• If Mr. Wolf says that “It’s dinner time!” all participants must turn around and propel to the opposite side of the gym without being caught by Mr. Wolf.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Rolling forward, stopping, turns in place and avoiding moving obstacles.</td>
</tr>
<tr>
<td>Variations</td>
<td>• See next game (8.5)</td>
</tr>
</tbody>
</table>
### 9.5 Red Light, Green Light

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• None.</td>
</tr>
</tbody>
</table>
| Instructions                        | • Participants line up at one end of the gym.  
• One participant is chosen as “it” and waits at the opposite end of the gym.  
• “It” turns his/her back to the rest of the group and calls “green light”, at which point all participants begin to propel forward.  
• “It” can then call “red light” at any point and turn around quickly. When red light is called all participants must freeze.  
• If “it” catches anyone moving when he/she turns around that person has to go back to the other end of the gym and start again.  
• The goal is to tag “it” while his/her back is turned to become the new “it”. |
| Skills reinforced                   | • Rolling forward, stopping and turns in place. |
| Variations                          | • When “it” calls red light and turns around all participants must turn around to face the opposite direction and then freeze.  
• For more advanced players, when “it” calls red light all participants must perform a wheelie. The first person to be unable to sustain the wheelie is “out” (disqualified). The last person “out” becomes the new “it” |

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Current edition: August 17, 2018
### 9.6 Follow the Leader

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• None.</td>
</tr>
<tr>
<td>Instructions</td>
<td>• A leader is chosen who is responsible for leading the group around the space provided (indoor or outdoor). This leader can perform different skills that the rest of the group tries to copy.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Potential to cover all skill groups, depending on the leader.</td>
</tr>
<tr>
<td>Variations</td>
<td>• Having more than one group going at once is a good way to group participants by skill level.</td>
</tr>
</tbody>
</table>
## 9.7 Trains

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• Flags or equivalent.</td>
</tr>
<tr>
<td>Instructions</td>
<td>• Participants form at least two ‘trains’ of three or more people and move around the room with each wheelchair as close as possible to the wheelchair in front of it. Different trainers stand around the room with a flag or other sign. When a flag is raised by a trainer, the trains must propel toward the person holding the flag. The first train to reach the ‘station’ wins that round and the wheelchairs change order.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Rolling forward, speed control, spatial awareness, stopping and moving turns.</td>
</tr>
</tbody>
</table>
| Variations                         | • For manual wheelchairs, the first wheelchair in each train pulls the wheelchairs behind it, with the occupant of the wheelchair behind holding onto the push-handle of the wheelchair in front.  
• If there is a mixture of manual and powered wheelchairs in the group, the powered wheelchairs can pull the manual wheelchairs. |
### 9.8 Slalom

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
</tbody>
</table>
| Equipment and set-up               | • Start and finish lines 5-10 m apart.  
                                         • Lines and/or walls about 1.5 m apart on each side to limit how widely the wheelchair can go on either side of the slalom course.  
                                         • Obstacles – at least 4 items to turn around, such as pylons, chairs, paper cups or stones – set up in a line with 1.2-2 m between them. |
| Instructions                       | • Participant(s) must propel around the obstacles beginning in a prescribed direction (e.g. to the left of the first obstacle) as quickly as possible without touching or displacing the obstacles. |
| Skills reinforced                  | • Rolling forward, stopping, spatial awareness and moving turns. |
| Variations                         | • Try different positions for the obstacles for example closer together, closer to one wall or line, following a curved path.  
                                         • Make the course more competitive by counting the number of obstacles displaced and/or measuring the time from the start to the finish line.  
                                         • Try the course backward.  
                                         • The same game, but on an incline – up, down or across. |
### 9.9 Orienteering

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheelchair type</strong></td>
<td>• Manual or powered</td>
</tr>
</tbody>
</table>
| **Equipment and set-up**          | • Plan a route outdoors. The route could include obstacles such as different surfaces, cross slopes, curbs, pot holes, inclines and level changes, depending on the skill level of the group.  
• Photo clue book.  
• A congratulations sign is placed at each landmark, along with instructions to look at the next photo clue in the book. |
| **Instructions**                  | • In small groups, participants use photo clues to navigate the route. Each photo shows a landmark that the participants can find (e.g. a tree, a bench). |
| **Skills reinforced**             | • Depending on the route used, any combination of skills could be reinforced. |
| **Variations**                    | • When each new clue is found, participants can collect objects or cards that can be put together at the end.  
• Organize different skill level courses so that different routes can be assigned depending on the varying abilities of the groups.  
• To make this activity more competitive or to be able to assess improvement in ability and skill, performance through the course can be timed. |
### 9.10 Go Fish

<table>
<thead>
<tr>
<th><strong>Suggested minimum number of players</strong></th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheelchair type</strong></td>
<td>• Manual or powered</td>
</tr>
</tbody>
</table>
| **Equipment and set-up**               | • Various small objects – for instance, pens, magazines, paper clips, coins, coffee cups, peanuts.  
• Container for each participant to hold the objects after they are picked up.  
• Surfaces on which to place the objects – chairs, tables, shelves, floor.  
• Objects are placed on the surfaces around the room. |
| **Instructions**                       | • The participant moves around the room picking up the objects and placing them in the container on his/her lap. When completed, the participant brings the container to the finish point. |
| **Skills reinforced**                  | • Rolling, turning, sideways maneuvering and reaching. |
| **Variations**                         | • Have participants pick up objects in a certain order. For example picking up the highest objects first or the lowest objects first. Alternatively, pick up objects only of a certain color or shape.  
• Hide peanuts or a similar sized object around the room, split participants into teams. The team with the most peanuts at the end of a time period wins. |
<table>
<thead>
<tr>
<th><strong>9.11 Circle Game</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suggested minimum number of players</strong></td>
<td>7</td>
</tr>
<tr>
<td><strong>Wheelchair type</strong></td>
<td>• Manual or powered</td>
</tr>
</tbody>
</table>
| **Equipment and set-up** | • Space about 5 m square.  
• Participants form a circle, facing the center. |
| **Instructions** | • When a participant’s name is called by the trainer, he or she moves clockwise around the outside of the circle until returning to his/her place. |
| **Skills reinforced** | • Rolling forward, stopping, spatial awareness, speed control and moving turns. |
| **Variations** | • Cat and Mouse: One participant (the cat) propels around the outside of the circle. As the cat does so, he/she tags another participant (the mouse) in the circle and the two race in opposite directions around the circle. The last person to return to the original spot is now the cat. |
## 9.12 Relay Race

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suggested minimum number of players</strong></td>
<td>10</td>
</tr>
<tr>
<td><strong>Wheelchair type</strong></td>
<td>• Manual or powered</td>
</tr>
<tr>
<td><strong>Equipment and set-up</strong></td>
<td>• Batons (any object will do).</td>
</tr>
<tr>
<td></td>
<td>• Cones (or equivalent obstacle to turn around).</td>
</tr>
<tr>
<td><strong>Instructions</strong></td>
<td>• Divide participants into groups. Each group lines up at one end of the room. When the trainer shouts ‘go’ the first participant in each group races to the other end of the hall, makes a turn around a cone and returns to his/her group, passing the baton to the next participant. The first group that finishes wins.</td>
</tr>
<tr>
<td><strong>Skills reinforced</strong></td>
<td>• Rolling forward, moving turns and reaching.</td>
</tr>
<tr>
<td><strong>Variations</strong></td>
<td>• Instead of going around a cone, have participants perform a skill (e.g. wheelie, 360-degree turn in place, circling the cone twice) once they reach the opposite end of the room.</td>
</tr>
<tr>
<td></td>
<td>• Instead of returning to the back of the group when a participant finishes the relay, he/she passes the baton to the next person and then follows behind him/her (as in follow the leader). This continues until the whole group is led by the final participant around the course.</td>
</tr>
<tr>
<td></td>
<td>• A series of stations can be spread out at each of which a task must be performed (e.g. picking an object off the floor and placing it on a chair, doing a weight shift for 3 seconds, pouring a cup of water).</td>
</tr>
</tbody>
</table>
### 9.13 Shrinking Space

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• Cones (or equivalent obstacles)</td>
</tr>
<tr>
<td>Instructions</td>
<td>• A line of cones is placed close to a wall. Each participant attempts to pass between the cones and the wall without touching either. Each time a participant completes this successfully, the cones are moved closer to the wall.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Rolling forward or backward, and spatial awareness (a good way for participants to learn exactly what gap they can manage in their wheelchair).</td>
</tr>
<tr>
<td>Variations</td>
<td>• Do it in the backward direction.</td>
</tr>
<tr>
<td></td>
<td>• See how quickly participants can get through the space by timing them.</td>
</tr>
</tbody>
</table>
### 9.14 What’s Your Clearance?

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• Objects that can be used to create barriers of increasing widths and heights, for instance by placing them side by side or stacking them. Pieces of wood or bricks are examples. To start the game, a low and narrow obstacle is set up.</td>
</tr>
<tr>
<td>Instructions</td>
<td>• Each participant attempts to pass over the obstacle with the object passing between the wheels without the wheels or footrests touching the object. Each time a participant completes this successfully, the width and/or the height of the obstacle is increased.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Rolling forward or backward, and spatial awareness (a good way for participants to learn exactly what clearance they have under their wheelchairs).</td>
</tr>
</tbody>
</table>
| Variations                          | • Sheets of bubble wrap as obstacles are useful to provide audible feedback that a wheel has gone over the obstacle.  
• Do it in the backward direction.  
• For manual wheelchairs, permit the wheelchair user to use a transient or full wheelie to eliminate the front wheels or footrests from consideration.  
• To add an element of competition, participants can be “out” (disqualified) if they are unable to get over the obstacle without touching it. |
### 9.15 Case Open and Shut

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Suggested minimum number of players</strong></td>
<td>1</td>
</tr>
<tr>
<td><strong>Wheelchair type</strong></td>
<td>• Manual or powered</td>
</tr>
<tr>
<td><strong>Equipment and set-up</strong></td>
<td>• A building or structure with different types and styles of doors.</td>
</tr>
<tr>
<td></td>
<td>• A route description.</td>
</tr>
<tr>
<td><strong>Instructions</strong></td>
<td>• Participants are given a route to a series of different doors, returning to the starting point when finished.</td>
</tr>
<tr>
<td><strong>Skills reinforced</strong></td>
<td>• Opening and closing a variety of doors.</td>
</tr>
<tr>
<td><strong>Variations</strong></td>
<td>• To avoid crowding and delays, teams of 2-3 participants can be routed to the doors in different orders or at intervals (staggered start).</td>
</tr>
<tr>
<td></td>
<td>• This game can be turned into an orienteering exercise by providing only directions to the next door, where the next set of directions will be posted.</td>
</tr>
</tbody>
</table>
### 9.16 Stormy Seas

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• None.</td>
</tr>
</tbody>
</table>

**Instructions**

- Each participant is given membership to a category of fish (e.g. starfish, shark or octopus).
- Participants line up against a wall at one end of the room.
- One participant (the fisherman) positions himself/herself in the middle of the room and yells out one of the above categories. When their category is called, the participants must try to get across the room to the other wall without being caught by the fisherman. If tagged, a participant must stop where he/she was caught and he/she becomes seaweed. The seaweed’s job is similar to the fisherman’s except seaweed cannot move.
- If the fisherman yells “stormy seas”, all participants try to get to the other side of the room regardless of their category.

**Skills reinforced**

- Rolling forward, moving turns, stopping and spatial awareness.

**Variations**

- When a participant is caught, he/she becomes an ‘island’ in the sea (rather than seaweed), creating a passive obstacle for the remaining participants to negotiate.
### 9.17 Simon Says

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• None.</td>
</tr>
</tbody>
</table>

**Instructions**

- A leader is chosen who instructs the group to perform certain skills. The participants should only perform the skill when the leader says “Simon Says” before the instruction. If a participant performs a skill when the leader has not said “Simon Says”, that participant is ‘out’. The last participant in the game wins.

**Skills reinforced**

- Potential to cover all skill groups.

**Variations**

- Simon Says Mix-Up: Participants must do the opposite of what ‘Simon’ instructs. For example, if Simon says “turn to the right” participants must turn to the left. If they do what Simon says, rather than the opposite, they are ‘out’.
### 9.18 Reverse Limbo

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• Obstacles of various heights.</td>
</tr>
</tbody>
</table>
| Instructions                        | • Participants take turns getting over the obstacle until everyone has completed the task.  
|                                     | • The obstacle is then replaced with a higher obstacle.  
|                                     | • Participants are eliminated when they can no longer get over the obstacle, and the game continues until only one participant is left. |
| Skills reinforced                   | • Getting over obstacles of various heights. |
| Variations                          | • Regular limbo: having an obstacle like a broom handle or rope that can be progressively lowered from an initial position about head-high. |
### 9.19 Garbage-Can Basketball

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wheelchair type</strong></td>
<td>• Manual or powered</td>
</tr>
<tr>
<td><strong>Equipment and set-up</strong></td>
<td>• Ball (any size).</td>
</tr>
<tr>
<td></td>
<td>• Basket (can be a garbage can or waste basket on a chair).</td>
</tr>
<tr>
<td><strong>Instructions</strong></td>
<td>• To begin create two teams, each with an equal number of participants.</td>
</tr>
<tr>
<td></td>
<td>• Participants are only permitted to carry the basketball for the time it takes them to complete two pushes (if using a manual wheelchair, or equivalent time if using a powered wheelchair) at which point they must either pass the ball to a team member or bounce it on the ground.</td>
</tr>
<tr>
<td></td>
<td>• Points are scored by getting the ball in the garbage can.</td>
</tr>
<tr>
<td><strong>Skills reinforced</strong></td>
<td>• Rolling forward, moving turns, turns in place, spatial awareness and speed control.</td>
</tr>
<tr>
<td><strong>Variations</strong></td>
<td>• Break the game down into its components. Have participants practice bouncing and throwing the ball with a partner. Or practice how to carry the ball for two pushes and then quickly bounce it. Add a quick turn on the end (i.e. push, bounce, fast turn).</td>
</tr>
<tr>
<td></td>
<td>• Practicing throwing skills by sitting in a circle and passing the ball around. Each time that the ball is passed around the circle without dropping on the floor get the participants to make the circle bigger by giving one push backward. Then try again.</td>
</tr>
<tr>
<td></td>
<td>• Practice shooting. Change the height of the net, increasing the height as the participant’s skill improves.</td>
</tr>
</tbody>
</table>
### 9.20 Beach Ball Chaos

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• Beach balls.</td>
</tr>
<tr>
<td>Instructions</td>
<td>• A variation on dodge ball, this game can be played as a team or individually. Place one or more balls on the floor and have participants hit the balls with their hands toward members on the other team. Participants must maneuver around balls or block the ball with their hands to avoid the wheelchair getting hit. If the wheelchair is hit by the ball, the participant is frozen until another member of their team high-fives them.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Moving turns and reaching.</td>
</tr>
<tr>
<td>Variations</td>
<td>• Once a participant is tagged, he/she can be required to come to the back of the court and perform a designated wheelchair skill.</td>
</tr>
<tr>
<td></td>
<td>• Place two pylons at each end of the room about 2 m apart to create goals. The team that scores the greatest number of goals wins.</td>
</tr>
</tbody>
</table>
### 9.21 Horse

<table>
<thead>
<tr>
<th>Suggested minimum number of players</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wheelchair type</td>
<td>• Manual or powered</td>
</tr>
<tr>
<td>Equipment and set-up</td>
<td>• None.</td>
</tr>
<tr>
<td>Instructions</td>
<td>Players are numbered and remain in order. Player #1 performs a skill that he/she thinks is possible but that others might find difficult. Starting with Player #2, each player must successfully complete that same skill. If a player is not able to complete the skill, that player is given sequential letters from the word ‘HORSE’. Once a player has all the letters to spell HORSE, he/she is disqualified. Once everyone has tried Player #1’s skill, Player #2 presents a different skill and the game continues in the same fashion until there is only one player remaining.</td>
</tr>
<tr>
<td>Skills reinforced</td>
<td>• Any combination of skills.</td>
</tr>
<tr>
<td>Variations</td>
<td>• Words that are longer (e.g. WHEELCHAIR) or shorter (e.g. PIG) can be used.</td>
</tr>
<tr>
<td></td>
<td>• Player #1 describes a situation without demonstrating it (e.g. “get your wheelchair through the door with your eyes closed”), to avoid providing clues as to how the skill is accomplished.</td>
</tr>
</tbody>
</table>
APPENDIX 1: OPTIONAL WST SKILL ORDER

The order of skills shown below in Table A1.1 reflect an efficient ordering of the skill tests that requires the least movement among locations, assuming that most of the floor markings and obstacles are set up in the same room, except for the “rolls longer distance” skill that can be accessed through a hinged door.

<table>
<thead>
<tr>
<th>Manual WST Skill #*</th>
<th>WST Skill Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rolls forward short distance</td>
</tr>
<tr>
<td>2</td>
<td>Rolls backward short distance</td>
</tr>
<tr>
<td>3</td>
<td>Stops on command</td>
</tr>
<tr>
<td>4</td>
<td>Turns in place</td>
</tr>
<tr>
<td>27</td>
<td>Performs stationary wheelie</td>
</tr>
<tr>
<td>28</td>
<td>Turns in place in wheelie position</td>
</tr>
<tr>
<td>29</td>
<td>Rolls forward and backward in wheelie position</td>
</tr>
<tr>
<td>5</td>
<td>Turns while moving forward</td>
</tr>
<tr>
<td>6</td>
<td>Turns while moving backward</td>
</tr>
<tr>
<td>7</td>
<td>Maneuvers sideways</td>
</tr>
<tr>
<td>8</td>
<td>Picks objects from floor</td>
</tr>
<tr>
<td>9</td>
<td>Relieves weight from buttocks</td>
</tr>
<tr>
<td>10</td>
<td>Performs level transfers</td>
</tr>
<tr>
<td>11</td>
<td>Folds and unfolds wheelchair</td>
</tr>
<tr>
<td>26</td>
<td>Performs wheelchair-ground transfers</td>
</tr>
<tr>
<td>12</td>
<td>Gets through hinged door</td>
</tr>
<tr>
<td>13</td>
<td>Rolls longer distance</td>
</tr>
<tr>
<td>14</td>
<td>Ascends slight incline</td>
</tr>
<tr>
<td>15</td>
<td>Descends slight incline</td>
</tr>
<tr>
<td>16</td>
<td>Ascends steep incline</td>
</tr>
<tr>
<td>17</td>
<td>Descends steep incline</td>
</tr>
<tr>
<td>31</td>
<td>Descends steep incline in wheelie position</td>
</tr>
<tr>
<td>18</td>
<td>Rolls across side-slope</td>
</tr>
<tr>
<td>19</td>
<td>Rolls on soft surface</td>
</tr>
<tr>
<td>20</td>
<td>Gets over obstacle</td>
</tr>
<tr>
<td>21</td>
<td>Gets over gap</td>
</tr>
<tr>
<td>22</td>
<td>Ascends low curb</td>
</tr>
<tr>
<td>23</td>
<td>Descends low curb</td>
</tr>
<tr>
<td>24</td>
<td>Ascends high curb</td>
</tr>
<tr>
<td>25</td>
<td>Descends high curb</td>
</tr>
<tr>
<td>30</td>
<td>Descends high curb in wheelie position</td>
</tr>
<tr>
<td>32</td>
<td>Ascends stairs</td>
</tr>
<tr>
<td>33</td>
<td>Descends stairs</td>
</tr>
</tbody>
</table>

* According to Table 4.3.
APPENDIX 2: LESSON PLANS

Before each WSTP session, the trainer should have a plan for how each session will be conducted as well as a plan for the series of sessions. The lesson plans will be affected by whether the training will be 1-on-1 or in a group, by the group size, by the group makeup (diagnoses accounting for wheelchair use, skill level), by session specifics (e.g. the number, frequency and duration of sessions), by the training facilities and by the number of trainers and spotters available. This sample outline is intended to be used in combination with other materials found earlier in this Manual and on the WSP website.

The sample lesson plans below are general templates for one-on-one training in sessions scheduled for 30 minutes following an intake session of 40 minutes.

Advance preparation by the trainer for any session:

- Confirm that the space has been booked, if necessary.
- Ensure that the participant and any other training personnel know the session date, time and location. (It is a good idea to remind the participant and training personnel of the upcoming session if it will be more than a week since the previous session.)
- Obtain, prepare or review materials needed for every session:
  - Participant’s contact information.
  - Attendance sheet.
  - Documentation of intake data for participant.
  - Clip-board and pen or pencil for participant.
  - List of goals for participant.
  - Name tags for training personnel.
  - Whistle or other noise maker for calling attention.
  - Air pump for tires.
  - Tool kit for urgent repairs or adjustments.
- Obtain, prepare or review any materials needed for this specific session:
  - If necessary, review the appropriate chapters of the WSP Manual on-line.
  - If necessary, review on-line videos of the skills to be covered.
  - If the session being prepared for is the 1st session:
    - Signage directing participants to the arrival area.
  - If the session being prepared for is the final session:
    - Evaluation form for the participant to complete.
    - Report card.
    - Certificate.

Intake Session (40 minutes)*

A. Welcome (2 minutes)
  - Explain the purpose of this and subsequent sessions.
  - Obtain consent to proceed.

B. Perform an intake assessment (25 minutes)
- Record contact information (phone numbers, email address, next-of-kin).
- Document demographic, clinical and wheelchair-experience data.
- Identify any contraindications for testing or training.
- Document wheelchair specifications.
- Wheelchair skills assessment (WST-Q and/or WST).

C. Goal setting (5 minutes)
- From the intake assessment and discussion with the learner, identify and record a set of relevant and potentially achievable training goals.

D. Begin training (5 minutes)
- Begin work on an initial goal so that the learner goes away with at least one skill to practice before the next session.

E. Closing (3 minutes)
- Describe the nature of subsequent sessions.
- Schedule the next session.
- Assign homework.
- Answer any questions that the learner may have.
- Provide strong encouragement.
- Complete any final documentation of the session.

* Times are rough guidelines only

**Subsequent Sessions (30 minutes)**

A. Welcome and Warm-Up (5 minutes)
- Check status: *Any new health concerns since the last session? Any after-effects from the last session? Any practice since the last session? Any wheelchair changes?*
- Review the goals and planned activities for the current session.
- Questions and answers.
- Warm-up activity.

B. Practice skills that have already been acquired but that need work (10 minutes)
- Random order, but begin with less stressful ones until the learner is warmed up.
- Variety of settings.
- Trainer role: provide structure, safety, minimal feedback.
- This portion of the session can also serve to provide conditioning, if the sessions are scheduled often enough to serve in that capacity (i.e. at least 3 times a week).
- Games can be a fun way to carry out this stage of the session.

C. Practice a skill that has not been acquired yet (10 minutes)
- Trainer role: provide structure, safety, instructions, demonstration and feedback.

D. Closing (5 minutes)
• Questions and answers.
• Plan next session content.
• Assign homework.
• Schedule next session.
  o Complete any final documentation of the session.
• If it is the final session in a series:
  o Review any arrangements for obtaining a post-training assessment of wheelchair skills (e.g. using the WST-Q or WST), preferably a minimum of 3 days after the final training session
  o Congratulate the participant on his/her participation and achievements
  o Have the participant complete an evaluation of the training sessions; a simple list of aspects of the sessions that he/she liked most and least is adequate.
  o Distribute a report card and certificate.
  o Thank the training personnel for their efforts.
  o Let the participant know how he/she can access training again at a later date should he/she need or wish to do so.
A 2.1 Small groups

This sample outline is intended to assist trainers working with groups of 5-10 participants, all of whom are using two-hand wheelchair propulsion. The syllabus has been structured to be used over a period of 6 sessions, each lasting one hour. A general template begins on the next page.

The content should be adjusted depending upon the skill level of the participants and the local setting. This sample outline is intended to be used in combination with other materials found earlier in this Manual and on the WSP website.

Prior to any training sessions, for the purposes of this example, it is assumed that each participant has already been seen individually to perform an intake assessment.

It is also possible to obtain most of this intake information in a group setting. However, if the WST is to be used as an outcome measure, the WST should not be performed as a group because witnessing others may affect the participant's technique.

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**General Session Template that Applies to All Sessions Unless Otherwise Specified**

**Advance Preparation by the Trainer**

- Confirm that the space has been booked, if necessary.
- Ensure that participants and training personnel know the session date, time and location. (It is a good idea to remind participants and training personnel of the upcoming session if it will be more than a week since the previous session.)
- Obtain, prepare or review materials needed for every session:
  - List of participants and their contact information.
  - Attendance sheet.
  - Documentation of intake data for each participant.
  - Clip-board and pen or pencil for each participant.
  - List of goals for each participant.
  - Name tags for participants and training personnel.
  - Whistle or other noise maker for calling attention.
  - Air pump for tires.
  - Tool kit for urgent repairs or adjustments.
- Obtain, prepare or review any materials needed for this specific session:
  - Decide which “old” and “new” skills will be the focus of this session (see Table A.2.1 as an example).
  - If necessary, review the appropriate chapters of the WSP Manual on-line.
  - If necessary, review on-line videos of the skills to be covered.
  - If the session being prepared for is the 1st session:
    - Signage directing participants to the arrival area.
  - If the session being prepared for is the final session:
    - Evaluation forms for the participants to complete.
    - Report cards.
The Actual Training Session

A. Arrival of participants (5 minutes)
- Greet participants as they arrive
- If this is the 1st session:
  - Direct participants to where they should hang up their coats and knapsacks.
  - Let participants know that an air pump and tools are available for urgent maintenance.
  - Each participant picks up his/her name tag, clipboard with goal list attached and pen or pencil.

B. Session Opening (10 minutes)
- Call to order: Form a circle (“huddle”).
- Introductions (mostly at 1st session but at subsequent sessions if there are any new people in attendance).
- Record attendance.
- At 1st session, achieve consensus on rules and post them on the wall for reference purposes, for instance:
  - Make every reasonable effort to attend all sessions.
  - If unable to attend a session, notify the trainer (provide trainer contact information to enable this).
  - Be on time for sessions.
  - Turn off cell phones during sessions.
  - During huddles or explanations, only one person should be talking at a time.
  - Do not attempt any skill that you are not sure that you can do safely without a spotter.
  - Agree on a penalty for rule violation. Pick something fun (e.g. sing a song or do a dance) rather than punitive.
- Check for any participant status changes since the last session (the intake session, in the case of the 1st session):
  - Any after-effects from the last session (for sessions #2-6)?
  - Any practice carried out (encourage this)?
  - Any wheelchair changes?
  - Any new health concerns? (Invite participants to speak to you privately, before beginning the warm-up activity.)
- Review the general purpose of the training sessions – to improve specific wheelchair skills in order to prevent injury and overcome environmental barriers.
- Have each participant independently review his/her overall goals for the series of training sessions, revising them if appropriate.
- Explain the planned activities for the current session.
- Warm-up activity:
  - An activity designed to warm up the muscles, heart and lungs.
  - The activity should include some skills that have already been learned or, if the 1st
session, skills that the trainer knows from the intake assessments that all participants can perform.

- A game (see Games chapter of the WSP Manual) can be a fun way to carry out this activity.

C. Practice “Old” Skills (15 minutes)

- Explain or remind participants of the rationale for practicing skills that have already been learned – need practice to refine them, build efficiency, explore alternative ways to perform them and generalize them to different settings.
- Generally, using a random order for practicing the old skills is ideal, but it is acceptable to begin with less stressful ones before proceeding to more difficult ones.
- Practice old skills in a variety of settings and using a variety of methods.
- For the old-skill practice, the trainer provides structure and safety, keeping feedback to a minimum.
- Individualize the difficulty level to the extent possible.

D. Practice “New” Skills (ones that have yet to be acquired or perfected) (15 minutes)

- This section of the session may carry over from one session to the next.
- The trainer should focus on a single skill or series of a few related skills.
- When introducing a new skill, the trainer should explain the rationale for the skill, demonstrate how it is done, then ask each participant to attempt the skill (either all at the same time or sequentially, depending upon the skill and the setting).
- Trainer role: provide structure, safety, instructions, demonstration and feedback.

E. Warm-Down Activity (10 minutes) (Optional if pressed for time)

- An activity designed to reduce any tension or frustration from working on the new skills.
- As for the warm-up activity, the activity should include some skills that have already been learned.
- A game can be a fun way to carry out this activity.
- Moving outside the regular training area (e.g. outdoors) can be useful.

F. Closing (5 minutes)

- Form a circle (“huddle”).
- Answer any questions that the learners may have.
- Summarize the key points about the “new” skills covered earlier in the session.
- If it is not the final session:
  - Have each participant review his/her training goals, revising them if appropriate.
  - Remind participants and training personnel of the date, time and location for the next session.
  - Strongly encourage participants to practice their skills (with a spotter if needed) before the next session.
- If it is the final session in a series:
  - Review any arrangements for obtaining a post-training assessment of wheelchair skills (e.g. using the WST-Q or WST), preferably a minimum of 3 days after the final training session.
o Congratulate the participants on their participation and achievements.
 o Have the participants complete an evaluation of the training sessions.
 o Distribute report cards and certificates.
 o Award prizes – preferably some small trinket for each participant with a humorous reason (e.g. “For the best spotter scare”, “For the best uphill slalom”, “For the fastest downhill sprint”, “For the wobbliest wheelie without falling”).
 o Thank training personnel for their efforts.
 o Let the participants know how they can access training again at a later date should they need or wish to do so.
• Retrieve materials (name tags, clip-boards, pens or pencils) from the participants.
• Complete any final documentation of the session.
**Table A.2.1. Example schedule of “old” and “new” skill coverage**

<table>
<thead>
<tr>
<th>Individual Skills</th>
<th>Session #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Rolls forward short distance</td>
<td>New</td>
</tr>
<tr>
<td>2. Rolls backward short distance</td>
<td>New</td>
</tr>
<tr>
<td>3. Turns in place</td>
<td>New</td>
</tr>
<tr>
<td>4. Turns while moving forward</td>
<td>New</td>
</tr>
<tr>
<td>5. Turns while moving backward</td>
<td>New</td>
</tr>
<tr>
<td>6. Maneuvers sideways</td>
<td>New</td>
</tr>
<tr>
<td>7. Reaches high object</td>
<td>New</td>
</tr>
<tr>
<td>8. Picks object from floor</td>
<td>New</td>
</tr>
<tr>
<td>9. Relieves weight from buttocks</td>
<td>New</td>
</tr>
<tr>
<td>10. Operates body positioning options</td>
<td>New</td>
</tr>
<tr>
<td>11. Level transfer</td>
<td>New</td>
</tr>
<tr>
<td>12. Folds and unfolds wheelchair</td>
<td>New</td>
</tr>
<tr>
<td>13. Gets through hinged door</td>
<td>New</td>
</tr>
<tr>
<td>14. Rolls longer distance</td>
<td>New</td>
</tr>
<tr>
<td>15. Avoids moving obstacles</td>
<td>New</td>
</tr>
<tr>
<td>16. Ascends slight incline</td>
<td>New</td>
</tr>
<tr>
<td>17. Descends slight incline</td>
<td>New</td>
</tr>
<tr>
<td>18. Ascends steep incline</td>
<td>New</td>
</tr>
<tr>
<td>19. Descends steep incline</td>
<td>New</td>
</tr>
<tr>
<td>20. Rolls across side-slope</td>
<td>New</td>
</tr>
<tr>
<td>21. Rolls on soft surface</td>
<td>New</td>
</tr>
<tr>
<td>22. Gets over obstacle</td>
<td>New</td>
</tr>
<tr>
<td>23. Gets over gap</td>
<td>New</td>
</tr>
<tr>
<td>24. Ascends low curb</td>
<td>New</td>
</tr>
<tr>
<td>25. Descends low curb</td>
<td>New</td>
</tr>
<tr>
<td>26. Ascends high curb</td>
<td>New</td>
</tr>
<tr>
<td>27. Descends high curb</td>
<td>New</td>
</tr>
<tr>
<td>28. Performs stationary wheelie</td>
<td>New</td>
</tr>
<tr>
<td>29. Turns in place in wheelie position</td>
<td>New</td>
</tr>
<tr>
<td>30. Descends high curb in wheelie position</td>
<td>New</td>
</tr>
<tr>
<td>31. Descends steep incline in wheelie position</td>
<td>New</td>
</tr>
<tr>
<td>32. Gets from ground into wheelchair</td>
<td>New</td>
</tr>
<tr>
<td>33. Ascends stairs</td>
<td>New</td>
</tr>
<tr>
<td>34. Descends stairs</td>
<td>New</td>
</tr>
</tbody>
</table>
A2.2 Large groups

Group of up to 20 learners can be managed by 1-2 trainers for workshops lasting 1-8 hours on a single day. Typically for a group of 20, if the whole group will work together on the same skills (e.g., “rolls forward short distance”), a “conga line” can be used (each learner following the other by a few meters). For other skills (e.g., “maneuvers sideways”), a “chorus line” can be used (all learners performing the same skill at the same time).

Groups of more than 20 learners can be divided into smaller groups and managed on different days. Alternatively, stations can be used. For instance, a group of 24 therapy students undergoing a 90-minute workshop on wheelchair skills in a 2-hour period of time can be divided in 6 group of 4 student with each group starting at a different station (“shotgun” start). At each station, one trainer deals with a different set of skills for 15 minutes, then the students move to the next station.

If there is more flexibility with respect to the starting and finishing time (e.g., a 4-hour time period even though each student will only receive 90 minutes of training), it is preferable to use a “staggered” start, with each group beginning at Station 1 and progressing every 15 minutes in order to Station 6. This has the advantage over the shotgun start of allowing each student to learn about the skills in the preferred sequence.

When working with large groups of able-bodies learner (e.g., student in the health professions), the number of available wheelchairs can be a limiting factor. For a group of 20 able-bodies learners, 10 wheelchairs of different sizes are ideal with 10 students in the wheelchairs and the other 10 acting as spotters at any time. If there are more students or fewer wheelchairs, then the students can be divided into group sizes that are a multiple of the number of wheelchairs. For each skill, Group 1 students would begin in the wheelchairs, Group 2 would be spotters and Group 3 student would be observers. After each student in Group 1 has attempted the skill, the Group 2 students get into the wheelchairs and the Group 3 student act as spotters. This rotation continues until every student has attempted every skill.