WHEELCHAIR SKILLS PROGRAM (WSP)©
VERSION 4.1

WHEELCHAIR SKILLS TRAINING PROGRAM (WSTP)© MANUAL

This manual and related materials can be downloaded from:
www.wheelchairskillsprogram.ca

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Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

Editorial Committee

This Manual, like the other materials in the Wheelchair Skills Program, has resulted from the work of many people. Those who have had the greatest involvement in this latest version constitute the Editorial Committee. They are listed below:

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1. INTRODUCTION TO THE WSTP

A General Introduction to the Wheelchair Skills Program (WSP) can be found in a separate document, posted on the web-site. The WSP includes the Wheelchair Skills Test (WST), the Wheelchair Skills Training Program (WSTP) and related materials. This Manual focuses on the WSTP.

The WSTP is a standardized training method that addresses a set of representative wheelchair skills. Research evidence regarding the safety and efficacy of the WSTP in general (as well as some specific skills) can be found in the Evidence and Publications sections on the web-site. There are also some excellent resources available in manuals, textbooks and websites about various ways to perform specific wheelchair skills. Examples include work by P. Axelson, I. Denison, L. Harvey and M.F. Somers. Some on-line resources can be found on the Related Sites page of our WSP website. However, despite good progress, there has been relatively little scientific study to date on the optimum methods of either performing or teaching most wheelchair skills.

Nevertheless, based on the evidence that does exist, we strongly hold two convictions about wheelchair skills training that are the basis for the WSTP. First, for any motor skill being attempted by a specific person in a specific setting, there is a better and worse way of performing the skill. Second, when learning to perform a motor skill or to perform it better, there is a better and worse way to do so.

The goals of the WSP are to increase the likelihood that a wheelchair user or caregiver who needs and wants to improve his/her ability to safely and effectively use a wheelchair will have an opportunity to do so, to provide an evidence-based means for wheelchair skills training to occur and to provide learning resources to those who wish to use them.

Wheelchair skills are not only ends in and of themselves, they are also means to an end. In terms of the World Health Organization's International Classification of Function (2001), wheelchair skills are "activities". The ability to perform them 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 ("participation"). Other potential benefits of wheelchair-skills training for wheelchair users and caregivers include fewer acute and overuse injuries, an improved sense of wellbeing (through self-esteem, self-efficacy, confidence and personal control, the sense of becoming newly abled, empowerment 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 is not a feasible one, the most

appropriate strategy may be to assist the learner in adjusting his/her expectations to a more realistic level.

Regardless of whether the wheelchair is a manual or a powered one, the characteristics of the wheelchair – its features, fit and setup – can have major effects on skill performance. The process of wheelchair provision includes a number of components (e.g. prescription, fitting and set-up, training and follow-up). These components need not be sequential. For instance, following training, it may be possible to revise the prescription and set-up. However, a thorough discussion of how to optimize the wheelchair for the user goes beyond the scope of this Manual. We will focus on the skills-training component of the process. Even within the skills-training component, there are aspects (e.g. maintenance skills) that are outside the scope of this Manual.

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2. GENERAL BACKGROUND ON MOTOR SKILLS LEARNING

Education can include one or more of three domains – knowledge, skills and attitudes. All three are relevant to wheelchair skills training. However, in this Manual, we will focus primarily on motor skills. 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 versus 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 versus closed).

In the context of the WSP, there are three components of the education process – objectives, curriculum and evaluation. These are conceptually linked in the "circle of education". Evaluation provides a baseline and a means of identifying goals and objectives. The curriculum is used to accomplish the objectives. This is followed by re-evaluation, to determine if the objectives have been fully met. If not, the objectives are reviewed and, if appropriate, the cycle continues.

The issues presented in Section 3 are based on the extensive motor-skills-learning literature and on our own experience with the WSP. The motor skills literature is extensive, with over 500 English-language papers published per year. Section 3 is not intended to be a treatise for researchers. It is our 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. For those seeking a more scholarly and thorough source, we suggest Richard A. Magill's excellent textbook (Motor Learning and Control: Concepts and Applications. 9th Edition. McGraw-Hill, New York, 2011). Although there is a great deal of scientific evidence underlying these principles, the principles themselves are fairly simple. We strongly believe that trainers and/or learners who understand and apply the principles summarized in Section 3 will be more effective than those who do not.

In addition to the general principles summarized in Section 3, more specific "training tips" are included with the individual skills later in Section 7. These have been derived from a number of excellent sources in the rehabilitation and wheelchair literature, as well as from our own experience.

3. SPECIFIC ISSUES OF IMPORTANCE FOR MOTOR SKILLS LEARNING

3.1. The Learning Process

In the course of learning a new motor skill, the learner progresses through stages. 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 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.

3.2. Safety

Wheelchair users and caregivers are at risk of acute or chronic injuries, for instance due to tip-over accidents or poor ergonomic technique. The trainer should provide feedback to a learner if the learner uses potentially unsafe methods. Indeed, if concerned about the possibility of acute injury, the trainer should interrupt a skill attempt. 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 trainer needs to be particularly attentive to the risk of a rear tip-over. At the end of the session, the trainer should restore the rear anti-tip devices to their original positions, unless the learner has progressed to the stage where they can be abandoned.

The goal of wheelchair skills training is for the learner to be able to perform skills safely and

effectively. 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 safe to use a wheelchair independently.

3.3. Spotters

We strongly recommend careful attention to spotting during practice sessions. Any person serving as a spotter during training should meet the criteria described in the Spotter Manual and position him/herself as indicated in the individual skill sections of that Manual.

3.4. Trainers

It is possible to learn the skills by self-training. However, a good trainer can be an important element in learning wheelchair skills. The trainer should be knowledgeable about wheelchair skills and how to teach them. The personal characteristics of the trainer are also important.The trainer should be credible, friendly, supportive, non-judgemental, interested and honest. The trainer should be familiar with the structure and operation of the specific wheelchair used by the learner.

The trainer may be a rehabilitation clinician (e.g. an occupational therapist or physical therapist) who is regularly involved in wheelchair prescription and training, or someone specifically trained for the purpose. 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.

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 trainers. The trainer should be as familiar as possible with relevant elements of the WSTP, including the general principles and the specific elements. The trainer should feel free to refer to the WSTP Manual whenever necessary. Those interested in becoming WSTP trainers should study the WSTP Manual and related materials and observe how a skilled trainer performs. Ideally, the WSTP should only be used by trainers who have been trained in its administration. However, good results should be possible by careful attention to the WSTP Manual, because it has been designed to be reasonably self-explanatory and to reflect normal clinical practices.

3.5. Assessment of Wheelchair Skills

As noted earlier, evaluation is part of the circle of education. Periods of formal evaluation (e.g. using the WST before and after training, and at follow-up) can be useful. However, predicting future performance on the basis of early attempts is of limited use. The trainer should not prejudge the outcome of training. Ongoing assessment by the trainer is also important. What the trainer can do to facilitate the learning process varies continuously.

There are a variety of parameters that provide evidence of learning due to practice or experience. The WST represents only one intermediate level of assessment. Other, more detailed, parameters include increased speed, improved consistency, improved adaptability to other settings, improved economy of movement and improved ability to detect and self-correct errors. Instrumented wheels can be used to record additional detail (e.g. force profiles). Examples of parameters at a level less detailed than the WST are hours per day of wheelchair use (e.g. using a questionnaire) and distance covered per day (e.g. using dataloggers). We suggest that a training log be used by the trainer and/or learner to track the training process.

3.6. Set Achievable Goals

From the baseline WST assessment (questionnaire and/or objective versions), skills may be identified that are not performed as safely and/or as effectively as they might be. For each of these identified skills, a decision needs to be made about whether improvement in the skill is a goal of the learner. Goal pursuit and performance are related to the learner's beliefs about him/herself and the task (self-efficacy). The learner may need some help in coming to this decision, 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 judgement call and requires a good understanding of the learner's health and circumstances. If in doubt, we recommend that the person 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. 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 in a Goal Attainment Scale (see WST Manual) that can be used to track progress and quantify outcomes.

3.7. 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 usually 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?"

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, 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 limiting factors and seek to have any remediable limiting factors addressed.

Motor-skills learning can be affected by personal characteristics, such as sex, age and health conditions. A trainer who understands these differences will be able to reassure learners who might be progressing more slowly than others. The training process may need to be adapted to the individual. With respect to sex, males learn some skills faster than females. With respect to age, although learning capacity is greater early in life and the young learn motor skills more rapidly and with less practice, aged people can acquire new motor skills well. Motor learning is affected by client factors (e.g. emotion, fatigue).

Neurological conditions may affect motor-skills learning, for instance:

- For people with stroke, the post-stroke brain has heightened sensitivity to rehabilitation early but this phenomenon declines somewhat with time. Rehabilitation training, whether early or late, improves functional outcomes. The extent of improvement is related to the intensity of training. 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 Alzheimer's disease can learn and retain new motor skills. Implicit-learning strategies and demonstration appear to be particularly useful in this setting. Consistent practice conditions may work better than variable ones.
- For people with dementia, there is some evidence of superior learning of problem-solving tasks with the help of cues (errorless learning) vs trial-and-error learning.
- People with Parkinson's disease can also learn new motor skills but do not retain them as well as people with Alzheimer's disease. Rhythmic auditory cues can be helpful for them. Although less helpful for people with normal brains, paying conscious attention to motor tasks can be useful for people with Parkinson's disease. Consistent practice conditions may work better than variable ones.
- People with early Huntington's disease can use either implicit or explicit control well, but not in parallel.
- Medicated patients with schizophrenia may have difficulties with consolidation.

3.8. Determine Who the Learner(s) Will Be

A skill that may not be feasible for a wheelchair user to perform alone may be possible with the

assistance of a bystander or caregiver. The training can be directed at the wheelchair user, the caregiver or the two functioning together. Other types of learners are clinicians or others serving as spotters, testers or trainers.

The relationship between a wheelchair user and a helper (whether a regular caregiver or a stranger) is important. The wheelchair user's needs and preferences should take precedence whenever possible. The wheelchair user may need some help in learning how best to ask for help, how to direct the nature of any assistance and how to politely decline offers of unwanted help. There are ways for caregivers to relate well to wheelchair users. For instance, the caregiver should seek permission before taking any actions, should speak clearly, should address the wheelchair user from the front and at eye level whenever possible, and should treat the wheelchair as an item of the wheelchair user's personal property.

There are some general considerations for caregivers as the targets of training. 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 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 unweight the casters or to add traction to spinning wheels. The caregiver can push 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.

3.9. Structure of Training

The essential elements for learning are only that there be a learner and a task that has yet to be mastered. Beyond these basic requirements, there are a variety of ways in which the safety, effectiveness or efficiency of training can be enhanced. The topics 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 own environment). Training can take place in an ad-hoc format, seizing teaching opportunities as they present themselves (e.g. during community outings). However, in the clinical setting, it can be helpful to provide more structure (e.g. scheduled sessions with lesson plans). Sample lesson-plan templates for initial and subsequent sessions can be found in Section 4 of the Manual.

3.10. Training in Pairs or Groups

To permit an individualized approach, we recommend that the ratio of trainers to learners be 1:1 or

1:2, although larger groups have also been successfully trained. Training in pairs or groups is practical, cost-effective and has educational merit. Such 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 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.

3.11. 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 maintain interest. Working in either cooperation or competition with other learners can enhance motivation. Children especially may learn best through play, rather than through formal training on a skill-by-skill basis.

Helping the learner to understand the skill can be helpful, such as by the use of memory aids (e.g. relating hand placement on the wheelchair hand-rims to the hands of a clock), providing verbal labels for segments of a skill and organizing a way of thinking about the components of the skill. Learning is enhanced by instructions that portray the task as a learnable skill versus one that is based on inherent ability. Perceived good-luck superstitions can enhance performance via improved perceptions of self-efficacy.

Whenever possible, the trainer should explain how the learner will benefit (e.g. improved safety, improved participation and quality of life) 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 has a known positive effect on skill acquisition. Encouragement and positive feedback from the trainer or fellow learners can be powerful incentives as well. Rewards significantly enhance long-term retention of motor learning.

3.12. Demonstration

Demonstration is one of the most powerful instructional methods in motor skills learning. The demonstrator may be the trainer, a model or a peer. It 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. The demonstration should occur before practice begins. It 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 effects. If there is a right-handed and a left-handed way of performing the skill, it is more helpful if the person demonstrating the skill performs it in the same way that the learner will.

3.13. Verbal Instructions

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.

As to 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. The trainer may provide a framework, an organization or a way of thinking about a skill (e.g. segments of a skill, or use of the hands of a clock to refer to the position of the hands on the rear wheel). The trainer may provide instructions about what to look for in the environment that might affect performance (e.g. a lip at the bottom of a ramp). Analogy learning has been found to be helpful (e.g. during the rolling forward skill, comparing the coasts between pushes to the coasts between strokes when paddling a canoe).

The trainer may provide verbal cues – short, precise words or phrases that direct attention or prompt movements. Preferably, these should be given in combination with a demonstration. 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. For instance, when using the momentum method to ascend a curb (see later, in skills section), the cues that we use are “push, coast, pop and lean”. As noted earlier, for people with dementia, there is some evidence of superior learning of problem-solving tasks with the help of cues (errorless learning) vs trial-and-error learning.

3.14. Focus of Attention

Intention interferes with performance at all skill levels. 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 has suggested 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 aspects of the task that require it.

3.15. 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 versus 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 instructions, have been 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, 3 times a week for a total of about three hours. Even a short nap after motor imagery helps.

Imagery can 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.

3.16. 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, faster 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.

3.17. Feedback Content

The trainer should be supportive and encouraging, even to the extent of slightly exaggerating how well the learner is doing. 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. People learn at least as well from their failures 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" [KR]) is usually unnecessary, for two reasons. First, the result is usually self-evident. Second, if the learner is failing repeatedly, he/she may get discouraged by repeated statements about failure. However, if a learner performs in an unsafe manner and does not appear to be aware of it, the trainer should point this out.

Another form of feedback is the provision of information about *how* the skill was performed ("knowledge of performance" [KP]). Ideally, such feedback should be directed at what the trainer suggests the learner should try differently ("prescriptive KP"), in order to achieve a safer or more effective result. The trainer should identify the most critical error and suggest what might be done to correct this problem. Pointing our 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 through gravel while leaning forward, causing the casters to sink into the gravel), to help them better understand why a suggestion is being made. Qualitative feedback is fine early (e.g. "you need to pop your casters higher"). Later, quantitative feedback (e.g. "you need to pop your casters about 2cm 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. As part of the feedback process, 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.

3.18. Timing of Feedback

The optimum frequency for KR feedback 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 KP 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. 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. 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 having the learner 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. The trainer should gradually reduce the frequency of feedback statements as time goes on. The weaning of the feedback 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 attending 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.

3.19. 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. There is mounting evidence, for a broad range of motor skills, that training in simulated situations can enhance skill performance in real-life situations. However, practice should be as specific as possible with respect to the task itself and the context in which it is to be performed. During practice, the learner should match the desired final setting. However, if the goal is for the learner to be able to conduct the task in diverse settings, then that is what should be practiced.

3.20. 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, which 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 has a positive effect on skill retention. This involves 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 – "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. For simple tasks, continued practice may cause performance to diminish. 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 per day of deliberate practice for periods of 10 or more years. 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 as 6 minutes, once 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.

3.21. 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. 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 target. 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 learning of a different 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 the susceptibility to interference and results in earlier consolidation. 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.

Consolidation is a process with different components that are processed differently. Memory progresses over time from a fragile state, one that is susceptible to interference, 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.

3.22. Variability of Practice

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 his/her life (skill transfer). Once a skill is initially acquired and retained, the learner should practice it in different contexts to promote transfer to everyday situations. 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, focus of attention).

To enhance skill retention and transfer, random practice of a group of skills that have already been acquired is generally better than consistent ("blocked") practice. However, there will be more errors during random practice. The two approaches are not mutually exclusive. For instance, it may be reasonable to begin with consistent practice and to progress to serial practice of a few skills followed by 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).

3.23. Distribution of Practice

Practice may be condensed ("massed") or spread over several sessions ("distributed"). Our experience at a rehabilitation centre is primarily with brief individual and/or group sessions at regular intervals (e.g. 15-30 minutes, 1-5 times a week for 2-4 weeks), with practice encouraged between sessions. One alternative model is to conduct training in and around the learner's home. Another model 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 become fatigued. In addition to such problems, this approach may lead to poor retention and consolidation. Each of these models has advantages and disadvantages.

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.

Whenever feasible, we recommend 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 learners. For wheelchair users who are elderly, who are unfit or who have a number of co-morbidities, even a brief session can be fatiguing or cause overuse injury. We have found it practical to use sessions of 15-30 minutes in duration. Such sessions 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. Depending upon the setting (e.g. inpatient vs community), sessions can be scheduled at intervals of 1-7 days. When the learner has demonstrated the ability to do so safely, the trainer should encourage the learner to practice between formal sessions.

3.24. 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 ("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.

3.25. 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 5cm level change is a useful skill and also a step toward getting up a full 15cm curb. Another example is to learn the wheelie balance phase 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 attentional demand. 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.

Other examples of simplification and 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 for individual skills. 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 a threshold requires most of the techniques needed when later learning to get up a curb. The order of individual skills listed in Tables 5-8 reflects this.

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 moving-turns skills 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.

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

4. LESSON PLANS

Before each WSTP session, the trainer should have a plan for how the session will be conducted. Below we provide two sample lesson plans. This is not intended to be restrictive.

4.1. Intake Session (40 minutes)*

A. Welcome (2 minutes)

- Explain purpose of this and subsequent sessions
- Obtain informed consent to proceed

B. Perform an intake assessment (25 minutes)

- Document demographic, clinical and wheelchair-experience data
- Identify any contraindications for testing or training
- Document wheelchair specifications
- Wheelchair skills assessment (questionnaire version of the WST and segments of the objective 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 (2 minutes)

- Describe the nature of subsequent sessions
- Schedule the next session
- Assign homework
- Answer any questions that the learner may have
- Provide strong encouragement

F. Documentation (1 minute)

- Complete any final documentation of the session

* Times are rough guidelines only

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4.2. Subsequent Sessions (25 minutes)

A. Welcome (2 minutes)

- Check status: Any new health concerns since the last session? Any after-effects from the last session? Any practice since the last session?
- Review the goals and planned activities for the current session
- Questions and answers

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 (2 minutes)

- Questions and answers
- Plan next session content
- Assign homework
- Schedule next session

E. Documentation (1 minute)

- Complete any final documentation of the session

5.0 SKILL GROUPS

There are a great many individual skills that a wheelchair user and caregiver may be required to carry out during everyday activities. A broad (but not all-inclusive) set of such skills will be described in more detail in the later sections. Most of these skills can be grouped, as described below, although some of these groupings only apply to manual wheelchairs.

5.1. 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 delivered with user manuals. Wheelchair users and caregivers can learn about special features of the wheelchair 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).

5.2. Understanding the dimensions of the wheelchair

The dimensions of the occupied wheelchair are important to be familiar with, for instance when judging the width of an opening or how much space is needed in which to turn around.

5.3. Getting into, out of and repositioning oneself with respect to the wheelchair

This includes transferring between the wheelchair and various other surfaces, unweighting pressure-sensitive body parts and changing position in the wheelchair.

5.4. 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 propel the wheelchair forwards and backwards, 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).

5.5. Using the environment

Although the environment is often a barrier to activities, there are times when it can be an asset. For example, when turning a manual wheelchair around a solid object, placing a hand on the object can allow the wheelchair to swing around the object without slowing down, rather than the usual approach of slowing down and turning using the hand-rims. Other examples are when the wheelchair user uses the hand rails on a ramp to pull himself or herself up the ramp or uses a doorframe to guide

passage through a door.

5.6. 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 users trunk and upper body contribute a considerable proportion of the combined center of gravity of the wheelchair and wheelchair user. This 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 backwards. To prevent this, the wheelchair user should lean forwards 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 primarily on the rear wheels. When crossing side slopes, the tendency for the wheelchair to turn downhill can be reduced by leaning away from the swivel casters.

Leaning towards 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.

5.7. Skills that require popping the front wheels briefly off the surface

As a natural extension of 5.6, there are some obstacles that require that the smaller (usually front) wheels clear the obstacle. These skills are most appropriate for manual wheelchairs. Examples include negotiating gravel, potholes, vertical obstacles (e.g. door thresholds) and getting up level changes (e.g. curbs).

5.8. Skills for which balancing on the rear wheels is necessary

The full wheelie position (balancing on the rear wheels) can be used to deal with situations like those described in sections 5.6 and 5.7 that require the front wheels to be unweighted. However, there are some desirable skills that cannot be carried out without the ability to keep the front wheels off the surface. These skills include the stationary wheelie (e.g. to reduce sitting pressures and improve neck comfort), turning around in a tight space, the forward descent of steep inclines and the forward descent of large level changes (e.g. a 15cm curb). These skills require the ability to perform a stationary wheelie, to turn around in the wheelie position, and to move forward or backwards in the wheelie position. These skills are impossible in most powered wheelchairs.

5.9. Working with a helper

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 helper.

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. The helper may be a regular one (e.g. friend or family member) or a passerby who can be recruited to help under the wheelchair user's direction.

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

6.0. TABLES OF INDIVIDUAL SKILLS

In this section, tables are shown of the skills included in each of the four versions of the WSP, based on whether the learner is a wheelchair user or a caregiver and whether the wheelchair is manual or powered. Following Table 4 (the Master list), are tables reflecting a suggested order of training for each of the four circumstances. These can be modified to reflect local settings. In addition to these core sets of skills, many other skills exist but these are beyond the scope of this Manual.

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

Table 4: WST 4.1 Master List of Individual Skills

#	Skill Level	Individual Skills	Manual WC		Powered WC	
			WCU	CG	WCU	CG
1.	Indoor	Moves controller away and back	X	X	✔	✔
2.	Indoor	Turns controller on and off	X	X	✔	✔
3.	Community	Selects drive modes and speeds	X	X	✔	✔
4.	Indoor	Controls tilt function	X	✔	✔	✔
5.	Indoor	Controls recline function	X	✔	✔	✔
6.	Indoor	Disengages and engages motors	X	X	✔	✔
7.	Indoor	Operates battery charger	X	X	✔	✔
8.	Indoor	Rolls forward 10m	✔	✔	✔	✔
9.	Community	Rolls forward 10m in 30s	✔	✔	✔	✔
10.	Indoor	Rolls backward 5m	✔	✔	✔	✔
11.	Indoor	Turns 90° while moving forward	✔	✔	✔	✔
12.	Indoor	Turns 90° while moving backward	✔	✔	✔	✔
13.	Indoor	Turns 180°in place	✔	✔	✔	✔
14.	Indoor	Maneuvers sideways	✔	✔	✔	✔
15.	Indoor	Gets through hinged door in both directions	✔	✔	✔	✔
16.	Indoor	Reaches 1.5m high object	✔	X	✔	X
17.	Indoor	Picks object from floor	✔	X	✔	X
18.	Indoor	Relieves weight from buttocks	✔	X	✔	X
19.	Indoor	Transfers from WC to bench and back	✔	✔	✔	✔
20.	Community	Folds and unfolds wheelchair	✔	✔	X	X
21.	Community	Rolls 100m	✔	✔	✔	✔
22.	Community	Avoids moving obstacles	✔	✔	✔	✔
23.	Community	Ascends 5° incline	✔	✔	✔	✔
24.	Community	Descends 5° incline	✔	✔	✔	✔
25.	Advanced	Ascends 10° incline	✔	✔	✔	✔
26.	Advanced	Descends 10° incline	✔	✔	✔	✔
27.	Community	Rolls 2m across 5° side-slope	✔	✔	✔	✔
28.	Community	Rolls 2m on soft surface	✔	✔	✔	✔
29.	Community	Gets over 15cm pot-hole	✔	✔	✔	✔
30.	Community	Gets over 2cm threshold	✔	✔	✔	✔
31.	Community	Ascends 5cm level change	✔	✔	✔	✔
32.	Community	Descends 5cm level change	✔	✔	✔	✔
33.	Advanced	Ascends 15cm curb	✔	✔	X	X

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34.	Advanced	Descends 15cm curb	✔	✔	X	X
35.	Advanced	Performs 30s stationary wheelie	✔	✔	X	X
36.	Advanced	Turns 180° in place in wheelie position	✔	✔	X	X
37.	Advanced	Gets from ground into wheelchair	✔	✔	✔	✔
38.	Advanced	Ascends stairs	✔	✔	X	X
39.	Advanced	Descends stairs	✔	✔	X	X

Abbreviations and symbols: WC = wheelchair, WCU = wheelchair user, CG = caregiver, ✔ = included, X = not included

Table 5. WSTP-M/WCU: Individual Skills for Manual Wheelchairs Operated by Wheelchair Users – Suggested Order of Training.

Order	Individual Skills
1.	Rolls forward
2.	Rolls backward
3.	Turns in place
4.	Turns while moving forward
5.	Turns while moving backward
6.	Maneuvers sideways
7.	Relieves weight from buttocks
8.	Picks object from floor
9.	Reaches high object
10.	Transfers
11.	Folds and unfolds wheelchair
12.	Doors
13.	Rolls 100m
14.	Avoids moving obstacles
15.	Inclines
16.	Side-slope
17.	Soft surface
18.	Pot-holes
19.	Threshold
20.	5cm level change
21.	15cm curb ascent and backwards descent
22.	Stationary wheelie
23.	Wheelie turns in place
24.	Wheelie forward/back
25.	Wheelie moving turns forward/back – variation no-hands rest
26.	Wheelie on soft surface forward
27.	Wheelie incline descent
28.	Wheelie curb descent
29.	Gets from ground into wheelchair – including falls
30.	Descends stairs
31.	Ascends stairs

Table 6. WSTP-M/CG: Individual Skills for Manual Wheelchairs Operated by Caregivers – Suggested Order of Training.

#	Individual Skills
1.	Controls tilt function
2.	Controls recline function
3.	Rolls forward
4.	Rolls backward
5.	Turns in place
6.	Turns while moving forward
7.	Turns while moving backward
8.	Maneuvers sideways
9.	Transfers
10.	Folds and unfolds wheelchair
11.	Doors
12.	Rolls 100m
13.	Avoids moving obstacles
14.	Inclines
15.	Side-slope
16.	Soft surface
17.	Pot-holes
18.	Threshold
19.	5cm level change
20.	15cm curb ascent and backwards descent
21.	Stationary wheelie
22.	Wheelie turns in place
23.	Wheelie forward/back
24.	Wheelie moving turns forward/back – variation no-hands rest
25.	Wheelie on soft surface forward
26.	Wheelie incline descent
27.	Wheelie curb descent
28.	Gets from ground into wheelchair – including falls
29.	Descends stairs
30.	Ascends stairs

Table 7. WSTP-P/WCU: Individual Skills for Powered Wheelchairs Operated by Wheelchair Users– Suggested Order of Training .

#	Individual Skills
1.	Moves controller away and back
2.	Turns controller on and off
3.	Selects drive modes and speeds
4.	Controls tilt function
5.	Controls recline function
6.	Disengages and engages motors
7.	Operates battery charger
8.	Rolls forward
9.	Rolls backward
10.	Turns in place
11.	Turns while moving forward
12.	Turns while moving backward
13.	Maneuvers sideways
14.	Relieves weight from buttocks
15.	Picks object from floor
16.	Reaches 1.5m high object
17.	Transfers
18.	Doors
19.	Rolls 100m
20.	Avoids moving obstacles
21.	Inclines
22.	Side-slope
23.	Soft surface
24.	Pot-holes
25.	Threshold
26.	Ascends/descends 5cm level change
27.	Gets from ground into wheelchair

Table 8. WSTP-P/CG: Individual Skills for Powered Wheelchairs Operated by Caregivers – Suggested Order of Training.

#	Individual Skills
1.	Moves controller away and back
2.	Turns controller on and off
3.	Selects drive modes and speeds
4.	Controls tilt function
5.	Controls recline function
6.	Disengages and engages motors
7.	Operates battery charger
8.	Rolls forward
9.	Rolls backward
10.	Turns in place
11.	Turns while moving forward
12.	Turns while moving backward
13.	Maneuvers sideways
14.	Transfers
15.	Doors
16.	Rolls 100m
17.	Avoids moving obstacles
18.	Inclines
19.	Side-slope
20.	Soft surface
21.	Pot-holes
22.	Threshold
23.	Ascends/descends 5cm level change
24.	Gets from ground into wheelchair

7. INDIVIDUAL SKILLS

This section is organized by individual skills. For a description of any suggested equipment and set-up, the starting position for the subject, spotter position, evaluation criteria and special considerations, see the corresponding individual-skill section of the Spotter Manual and WST Manual. In the WSTP Manual, only a brief description of the skill and rationale for its inclusion will be provided. The emphasis is instead on training tips. The training tips are based on a number of excellent textbook chapters, manuals and on-line sources, as well as papers from the scientific literature and our own experiences. There is considerable variability among wheelchairs, both with respect to their components and ways in which they may be modified for individual users. The training tips may need to be altered in light of these differences. The order of skills discussed reflects that of the Master Table (Table 4).

For each skill, the following headings are used:

- Versions applicable: For which of the four versions of the WSP (Table 4) this skill is applicable.
- Description: A brief general description of the skill.
- Rationale: The reason why this skill has been included.
- Training tips:
    - General training tips that apply to most or all of the subsequent sections.
    - Training tips for manual wheelchairs operated by wheelchair users. Wherever appropriate, this section includes separate tips for wheelchair users using two-hand propulsion and those more appropriate for people using one hand and one leg ("hemiplegic" propulsion), recognizing that other methods may also be used by some people.
    - Training tips for manual wheelchairs operated by caregivers
    - Training tips for powered wheelchairs operated by wheelchair users
    - Training tips for powered wheelchairs operated by caregivers

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7.1 Moves controller away and back	
Versions applicable	• WST-M/WCU **X** WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject moves the controller (e.g. joystick) away from its usual operating position and then returns it to its original position.
Rationale	• This skill is useful when the controller is in the way for some activities (e.g. approaching a table, feeding, transfers). Some wheelchair users may need to move the controller in order to change the modes or speed.

General training tips	• Adjustment tips:
	  • When attempting to initiate the move away, 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.
	• Variations: mounts can vary (e.g. midline flip up, swing away, permanent mounting).

Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• Not applicable.

Training tips for powered wheelchairs operated by wheelchair users	•
	• 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.
	• When moving the controller out of the way, it should not be placed in a position that would make it impossible for that wheelchair user to restore it to its original position.
	• Many units have scissor-like mechanisms that can pinch fingers or clothing.
	• Progression:
	  o The power should be turned off while this skill is initially being practiced.
	  o Start with moving the controller away then moving the

	controller back. o Then use the skill functionally, such as moving the controller out of the way to allow closer approach to a table. • Variations: o If the wheelchair user has poor hand control, he/she can use a large, 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. o The powered wheelchair can be slowly driven against a fixed external object (e.g. a desk top) to help push the controller out of the way.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.2 Turns controller on and off	
Versions applicable	• WST-M/WCU **X** WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject turns the controller on and off.
Rationale	• The functions of the powered wheelchair require power.

General training tips	• It is important to turn the power 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.
	• Adjustment tips:
	  • A longer lever for the on/off switch will reduce the force required.
	  • 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. head, foot, thigh) can be used for the on/off switch to improve access.

Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• Not applicable.

Training tips for powered wheelchairs operated by wheelchair users	• The joystick should be in a neutral position before the controller is turned on.
	• When the wheelchair is not being used for position changes or mobility, the power should be turned off. This is for safety reasons and to better maintain the battery charge.
	• 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:
	  o Rolling the hand onto and off of the on/off switch may reduce the need for fine finger dexterity.
	  o Using larger movements and body parts may allow users

	to switch toggle levers on and off independently, if fine motor control is not available.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users. • On/off switches may be located on an attendant control unit. 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 will override that of the wheelchair user.

7.3 Selects drive modes and speeds	
Versions applicable	• WST-M/WCU **X** WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject operates the controller to switch between drive modes and/or speeds.
Rationale	• Powered wheelchairs vary, but most allow the user to select different performance parameters for different environments. • Most powered wheelchairs provide an opportunity for the user to operate the wheelchair in different modes and speeds. User-adjustable settings include mode, speed, direction and whether cruise control is on or off. The controller settings that are most appropriate for driving slowly in tight quarters are different from the settings that would work best when ascending inclines or curbs.
General training tips	• Adjustment tips: The type of mode switch used will have an impact on success for some users. • Select a controller with the easiest access for people with cognitive or physical limitations (e.g. three vs. five drive modes, toggle vs. dial for speed control). • In some wheelchairs, the mode and speed controls are separate. • Although the manufacturer may provide a representative set of modes, the dealer and/or therapist may adjust the settings 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, 4) may be different from one wheelchair to the next. For instance, some users may prefer to have the order reflect progressively increasing speed whereas other users may wish to order the modes to those from the most to 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. •

Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• Not applicable.
Training tips for powered wheelchairs operated by wheelchair users	• Turn the power on. • The wheelchair user should be able to see or hear an indication of the mode and speed status. • The user may select different mode and speed settings for different skills. • Progression: The user should also learn to use other wheelchair functions (e.g. the horn).
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.4 Controls tilt function	
Versions applicable	• WST-M/WCU **X** WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject tilts the wheelchair back from the upright position and then restores the wheelchair to the upright position. In a tilt, the angle between the wheelchair seat and back remain the same, but the angle from the horizon changes.
Rationale	• Wheelchairs capable of variable rear tilt are used for a variety of reasons, including pressure relief, comfort, to enhance breathing, postural control, stability (e.g. to prevent falling forward from the wheelchair when striking an obstacle), to enhance transfers, facilitate bladder management, reduce spasticity or reduce edema. • Tilt of 35 degrees or more may be needed to increase circulation over the ischial tuberosities, but lesser degrees of tilt can be effective if combined with recline.
General training tips	• Adjustment tip: o Not all wheelchairs have a tilt function. o Programming by the dealer and/or therapist should be considered to allow the wheelchair user to get into a tilted position with as few steps as possible (e.g. using a preset position of 45º of tilt). o Be careful to ensure that the wheelchair user has access to the controller when in the tilted position. • Before tilting the seat back or restoring it to the upright position, the person performing the tilt should be sure that there is room behind the wheelchair and above the knees to change the tilt without damaging the environment, the wheelchair, the user or a bystander. • For the purpose of pressure redistribution, the greater the extent of tilt the better. • For wheelchair users with limited trunk balance, to reduce the likelihood of falling forward, 5-10º of tilt is usually adequate at rest or when driving. • Depending upon the tilting mechanism, the extent of forward and rear stability may differ with the wheelchair upright vs. tilted back. 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. to increase traction or reduce the tendency for smaller-diameter wheels to sink into a soft surface). • When reversing direction (from tilt back to tilt forward or vice versa), it may be necessary to pause briefly. • For safety, some powered wheelchairs will prevent the wheelchair from being driven while tilted past a set amount. 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 fully tilted back). • If the wheelchair allows both tilt and recline, it is advisable to recover to the upright from the recline position before recovering from the tilt position. This reduces the tendency to slide forward on the cushion. • Progression: o For the wheelchair user to adjust to tilt may involve starting at a small amount and progressing to full tilt. o If the rate of tilt 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.
Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• When first tilting a chair, the caregiver should be aware of the force that may be required to 'catch' the person. The set-up and mechanics of the tilt influence the amount of weight supported by the caregiver.
Training tips for Training tips for powered wheelchairs operated by wheelchair users	• As for general tips.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.5 Controls recline function	
Versions applicable	• WST-M/WCU **X** WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject reclines the wheelchair from the upright position and then restores the wheelchair to the upright position. Recline occurs when the seat-to-back angle increases as the back of the seating system moves away from the seat.
Rationale	• Wheelchairs capable of variable recline are used for a variety of reasons, including pressure relief, comfort, to enhance breathing, postural control, stability (e.g. to prevent falling forward from the wheelchair when striking an obstacle), to enhance transfers, facilitate bladder management, reduce spasticity or reduce edema.
General training tips	• Adjustment tip: o Not all wheelchairs have a recline function. o Programming should be considered to allow the wheelchair user to get into a reclined position with as few steps as possible (e.g. using a preset position of 15º of recline). • Be careful to ensure that the wheelchair user has access to the controller when in the reclined position. • Before reclining the seat or restoring it to the upright position, the person performing the recline should be sure that there is room to change the recline angle without damaging the environment, the wheelchair, the user or a bystander. • In many wheelchairs, moving from an upright to a reclined position may cause shear forces between the wheelchair user and the backrest. • For the purpose of pressure redistribution, the greater the extent of recline the better. • Recline and tilt may be used in combination. • Depending upon the reclining mechanism, the extent of forward and rear stability may differ with the wheelchair upright vs. reclined. 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 reclined position) or when it might be helpful to alter the weight distribution between the front and rear wheels (e.g. to increase traction or reduce the tendency for smaller-diameter wheels to sink into a soft surface).

	• 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 fully reclined). • If the wheelchair allows both tilt and recline, it is advisable to recover to the upright from the recline position before recovering from the tilt position. This reduces the tendency to slide forward on the cushion. • Progression: o Adjusting to recline may involve starting at a small amount and progressing to full recline. o If the rate of recline 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 there are no body parts that are at risk of being injured.
Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• When first reclining a wheelchair, the caregiver should be aware of the force that may be required to 'catch' the person. The set-up and mechanics of the recline influence the amount of weight supported by the caregiver.
Training tips for powered wheelchairs operated by wheelchair users	• As for General tips.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.6 Disengages and engages motors	
Versions applicable	• WST-M/WCU **X** WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner disengages and engages the motors.
Rationale	• Disengaging the motors allows the wheelchair to be pushed manually without power (e.g. by a caregiver if the battery is dead).
General training tips	• 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. • For most powered wheelchairs, there are two motors that need to be separately disengaged and engaged. • Ensure that the lever is being moved along the appropriate plane. • Depending on the type of chair, rolling the chair slightly when disengaging the motors may ease the lever into the disengaged position. Some chairs will be more difficult than others to push when disengaged. • Variations: Various makes and models have different methods of disengaging the motors.
Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• Not applicable.
Training tips for powered wheelchairs operated by wheelchair users	• The wheelchair user may transfer out of the wheelchair onto the transfer surface to allow him/her to perform this skill. • It may be possible to perform this task while seated in the wheelchair if the armrests are removed or a reaching aid is used.
Training tips for powered wheelchairs operated by caregivers	• Good ergonomic principles should be used when engaging and disengaging the motors. The caregiver's knees should be bent and the back straight. In many cases, a foot can be used to perform the task.

7.7 Operates battery charger	
Versions applicable	• WST-M/WCU **X** WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject operates the battery charger.
Rationale	• Powered wheelchairs utilize battery power. The battery needs to be charged regularly, as often as daily.
General training tips	• Adjustment tips: The user manual should be consulted for wheelchair-specific elements of this skill. • Only use a battery charger that has been specified for the wheelchair. Failure to do so could cause damage to the battery. • Generally, the skill includes checking that the charger is plugged into the power source (e.g. a wall socket), switching it on and plugging the wheelchair into the charger.The battery charger is usually a separate equipment item, left where the wheelchair is stored overnight. • Some powered wheelchairs have on-board chargers that allow greater flexibility to users when they are working properly but leave the user without a chair if the charger needs to go to the supplier for repairs. • The charger port is usually near the controller or under the seat. • To avoid electrical shocks, avoid using the battery charger in a wet environment or where liquids may be spilled on it. • Both the wheelchair and charger should be turned off when being connected to each other and the power source. Then the power on the charger (if not automatic) should be turned on. • The length of time required to charge a battery can vary due to the type of charger and nature of the battery. • If the battery charger is capable of charging different batteries (e.g. 6 and 12 volts), ensure that the appropriate setting is used. • A battery with a slightly low charge may function reasonably well on smooth level surfaces but may be insufficient to get the wheelchair over obstacles. • If the battery needs to be changed, it should be replaced with an approved model. The type of battery needed to start a combustion engine is different from the slow-discharge type needed for a powered wheelchair. Sealed gel batteries are preferable to those

	with liquid acid that can leak if the battery or wheelchair is tipped over.
Training tips for manual wheelchairs operated by wheelchair users	• Not applicable.
Training tips for manual wheelchairs operated by caregivers	• Not applicable.
Training tips for powered wheelchairs operated by wheelchair users	• Manufacturers recommend that the battery not be charged in a room with people present, because there is a risk of explosion with some batteries. This recommendation is difficult to comply with for a wheelchair user acting alone, unless the wheelchair user has a second means of mobility.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.8 Rolls forward 10m	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject moves the wheelchair 10m forwards on a smooth level surface.
Rationale	• Forward rolling is a skill used during many wheelchair activities. The forward propulsion distance (10m) is intended to simulate moving about indoors or the crossing of a two-lane street.
General training tips	• Adjustment tip: o The position of axle and weight over drive wheel have a great impact because rolling resistance is lower when the wheel diameter is greater. o 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. • When first attempting to move forward, the direction in which any swivel casters are pointing can lead to some initial resistance or lateral deviations. The person handling the wheelchair can reposition the casters in the appropriate direction before setting out. To do so, 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. • Stopping is an important part of this skill. It should be possible to stop the wheelchair at will, on command and in response to obstacles. • Progression: o Remember that speed and accuracy are inversely related. It is advisable to begin movement skills with adequate accuracy before increasing the speed. o Stop progressively closer to an obstacle, but without touching it. Progress from a tall obstacle that can be seen no matter how close the person is to it (e.g. a wall), to one that is lost to sight as the user gets closer (e.g. a line on

	the floor). • Variations: o Experiment with different speeds. o Experiment with how gradually or rapidly the wheelchair can be brought to a stop.
Training tips for manual wheelchairs operated by wheelchair users	• Two-Hand-Propulsion Pattern • To propel the wheelchair straight forwards, 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 wheelchair user should lean forward as the arms are extended, to get more contact time between the hands and the hand-rims and to reduce the chance of a rear tip. • The wheelchair user should avoid jerky accelerations that could cause him/her to tip over backwards. • Strokes should be smooth, with the hands comfortably grasping the hand-rims, initially matching the speed of the moving wheels. • 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. To do so, the wall should be contacted well ahead of the rear wheels. • To minimize shoulder strain and be mechanically efficient, the wheelchair user should try to push with long, slow strokes, allowing the wheelchair to coast where possible. 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. An additional reason to reach back and 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. • A recovery path for the hands below the hand-rims is commonly recommended for wheelchair users propelling on smooth level surfaces. To reinforce this, the trainer can ask the wheelchair user to touch the axles (center of the rear

	wheel) during each recovery phase. This allows the hands to make initial contact with the hand-rims while moving upward, reducing any impact. Wheelchair users with weak and insensitive hands may prefer to slide the hands back along the hand-rims, rather than letting go at the end of the propulsive stroke, but this may cause some braking to occur.
	• To maintain a straight direction during the coast, the wheelchair user may need to push harder on the side towards which the wheelchair is deviating or use the fingers on the hand-rim on the other side, but without gripping tightly.
	• To stop, the rate of slowing can be controlled by how hard the hand-rims are gripped. The hand-rims should run through the wheelchair user's hands. During the coast and stop, the hands are in the 1:00 o'clock position. If the wheelchair user stops too quickly, he/she may fall forward out of the wheelchair or tip over forwards. To prevent this, the wheelchair user should lean back whenever he/she is required to stop quickly.
	• Variations:
	  • As a game, the wheelchair user can see how far he/she can coast after 1-2 pushes. The purpose of this learning exercise is to get the learner familiar with hand position, and with letting the hand-rims slide through the fingers. Use single thrusts only, of progressively increasing vigor. The distance can be extended if the wheelchair user keeps his/her weight back on the rear wheels, or if he/she swings the outstretched arms to either side.
	  • One hand propels at a time.
	
	• A person With Hemiplegia
	  • The wheelchair user should propel the wheelchair with the sound-side arm and leg.
	  • To avoid moving to the weaker side, the wheelchair user should use the sound-side foot to help steer the wheelchair.
	  • The wheelchair user should use the foot to help stop.

	• 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. • The wheelchair user should wear shoes that provide both protection for the foot and good traction. • To use the foot to propel forward, the wheelchair user should straighten the leg, push down on the floor with the heel, and then pull the wheelchair forward with the foot.
Training tips for manual wheelchairs operated by caregivers	• The caregiver should keep the wheelchair close to his/her body. • The caregiver should avoid starting or stopping suddenly, because this may startle the wheelchair user or cause him/her to lose trunk balance. • 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.
Training tips for powered wheelchairs operated by wheelchair users	• Adjustment tips: o 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 may wish to use a mode that is safest and most likely to be effective when training begins. o 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. This illustrates the importance of proper programming. Non-proportional drives are just as dependent on proper programming as proportional drives, if not more so. Set-up of non-proportional drives can be graded to include more or less cognitive and physical loads depending on the user's needs and abilities. • This is the first powered wheelchair skill involving movement of the wheelchair in a drive mode. With powered wheelchairs, although there are a number of input devices that can be used to control the wheelchair, we have used the term "joystick" because it is the most common device used. Displacing the joystick will cause the wheelchair to move in that direction. The farther the joystick is moved from its rest position, the faster the wheelchair will move, if

	the controller is of the proportional-control type. If the joystick is of the proportional-control type, the user should move it forwards gradually to achieve a smooth start. • If the wheelchair user is over-correcting when driving, changing the contact point with the joystick (e.g. from finger tips to web-space between the thumb and index fingers) may improve the smoothness of the driving. • When driving quickly, if there is difficulty with directional control due to the apparent sensitivity of the joystick in that mode, the joystick can be dampened by resting the palm of the hand on the base of the joystick. • 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 versus ball-shape). • Powered wheelchairs may be rear-, front- or mid/center-wheel-drive. The 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. • Stops: When stopping, 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. For a rapid stop, the power can be turned off or the joystick can be put into reverse. • Progression: o Practice moving the joystick in wide open spaces and progress to more enclosed ones. o Begin at responsive but low torque settings and progress to different modes.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users. • Some wheelchairs permit the wheelchair to be operated from behind the wheelchair, which is the preferred position. • 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 recommended. • When the 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.

7.9 Rolls forward 10m in 30s	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject propels the wheelchair 10 meters forwards on a smooth level surface within 30 seconds. • Note: this skill is usually dealt with together with the "rolls forward 10m" skill one (#7.8).
Rationale	• As for "rolls forward 10m" skill (#5.8). • 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 30s for a full cycle.
General training tips	• As for skill #7.8. • Variations: real street crossing. 1st example of community application of skills. • Planning the crossing, by looking ahead to the various obstacles that lie en route to the safe area on the other side. • Understand traffic signals, cautions at road crossings, the importance of looking both ways. • Avoid crossing at unmarked areas or coming into traffic from between parked cars that prevent oncoming traffic from seeing you. • Cross with a standing person or a group, so as to be better seen.
Training tips for manual wheelchairs operated by wheelchair users	• As for skill #7.8.
Training tips for manual wheelchairs operated by caregivers	• As for skill #7.8.
Training tips for powered wheelchairs operated by wheelchair users	• As for skill #7.8. • Adjustment tip: It may be necessary to adjust the drive mode and speed of the wheelchair to meet the time requirement.
Training tips for powered wheelchairs	• As for powered wheelchairs operated by wheelchair users.

operated by caregivers	

7.10 Rolls backward 5m	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject moves the wheelchair 5 m backwards on a smooth level surface.
Rationale	• Backward rolling is a skill used during many wheelchair activities.
General training tips	• If backing up immediately follows rolling forward, then the casters will be trailing backwards. 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 the shoulder to avoid obstacles and collisions. • Slowing down will also make it easier for the subject to steer. 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.

Training tips for manual wheelchairs operated by wheelchair users	• Two-Hand-Propulsion Pattern
	  • To propel the wheelchair straight backward, the wheelchair user should grasp the hand-rims and pull evenly.
	  • Unlike forward rolling, it is not easy to coast backwards without deviating to one side or the other. Therefore, the length of the strokes is usually shorter when rolling backward.
	  • To avoid tipping over backwards when stopping, the wheelchair user should avoid grabbing the wheels suddenly and should lean forward slightly.
	  • Variations:
	  o One hand at a time → both hands.
	  o For a person with weak arm muscles, the wheelchair user can 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 use the body weight to push down on the wheels.
	• A Person with Hemiplegia
	  • As for rolling forward (#7.8), except the sequence is to first flex the leg, push down on the floor with the foot enough to ensure

	good traction, then push the wheelchair backwards by straightening the leg.
Training tips for manual wheelchairs operated by caregivers	• As for 7.8.
Training tips for powered wheelchairs operated by wheelchair users	• Adjustment tip: The programming of a powered wheelchair is separate for the forward and backwards 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. • Pull the joystick backwards. • If the wheelchair is fitted with a rear-view mirror, this eliminates the need to turn around to see where the wheelchair is going. •
Training tips for powered wheelchairs operated by caregivers	• As for general tips.

7.11 Turns 90° while moving forward	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject turns the wheelchair 90^{o} to the left and right while moving forwards.
Rationale	• Moving turns are often necessary to avoid obstacles or to change direction.
General training tips	• The learner should 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 turning footprint (that only includes the chair or body parts that touch the ground). • For most wheelchairs, the ability to turn is made possible 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. This skill is a good opportunity for the learner to understand how casters swivel and how to control the extent and direction of the swivel. The direction of caster trail can be utilized to ensure a smooth start or to enhance stability. • 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-, mid/center-, 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 arc through which it will swing. • When driving a rear-wheel-drive wheelchair toward a 90° turn into a narrow pathway, the wheelchair user should stay as far as possible away from the wall on which the opening is found. With a front-wheel drive wheelchair, there is less problem steering a path close to the wall. • When turning around an object (e.g. a corner wall) that the wheelchair is close to, the turn should not begin until the axles of the drive wheels (whether rear, mid or front) have reached the object. • If the leading wheels are the drive wheels, the trailing

	(castered) wheels will swing wide of the path and may strike the wall on the far side. • 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. • The footrests can be moved out of the way in tight spaces to reduce the radius of the turning circle. • Progression: o Start with small changes of direction (e.g. around widely spaced pylons) and progress to more closely spaced ones. o Start with loose (large-radius) turns and progress to tight (small radius) ones. o When beginning training around full 90° corners, learners may find it easier to break a turn down into its parts – driving straight, turning, then driving straight again, rather than following a smooth curved path. • Variations: o 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. o When using this skill in real settings, the learner should obey the rules of the road at corners – slow down if the path around the corner cannot be seen, stay to the right (if that is the convention in the country in which the training is taking place) and do not cut the corner.
Training tips for manual wheelchairs operated by wheelchair users	• Two-Hand-Propulsion Method • When ready to turn, the wheelchair user should slow down the inside wheel and/or push harder on the outside wheel. • Variations: • While coasting in a straight line, experiment with the effect that rotating the outstretched arms from side to side has on direction – swinging the arms

	to one side causes the wheelchair to turn in the other side. • The fixed environment can be used to assist with turning. In the "drag" turn, the wheelchair user drags a hand, in a rear position, along the wall to turn toward the wall and around a corner. In the "push-off" turn, the wheelchair user uses a hand, in a forward position, to push away from the wall. Timing, intensity, direction and hand position of the forces applied to the wall are important features of success. Using the environment minimizes the need to slow down. • The skill may be performed in the wheelie position. • A Person with Hemiplegia • The wheelchair user should use the foot to help steer. • It is easier to turn away from the sound side than toward it.
Training tips for manual wheelchairs operated by caregivers	• The caregiver should push harder with the push-handle on the outside of the turn and pull back slightly on the inside handle. • 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.
Training tips for powered wheelchairs operated by wheelchair users	• See general training tips.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.12 Turns 90° while moving backward	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner turns the wheelchair 90^{o} to the left and right while moving backwards.
Rationale	• Moving turns are often necessary to avoid obstacles or to change direction.
General training tips	• As for skill #7.11.
Training tips for manual wheelchairs operated by wheelchair users	• As for skill #7.11.
Training tips for manual wheelchairs operated by caregivers	• As for skill #7.11.
Training tips for powered wheelchairs operated by wheelchair users	• As for skill #7.11.
Training tips for powered wheelchairs operated by caregivers	• As for skill #7.11.

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7.13 Turns 180° in place	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner turns the wheelchair around to face in the opposite direction, while remaining within a square space with 1.5 meter sides. This is done towards the left and the right.
Rationale	• Turning around in tight spaces is a common challenge for wheelchair users.
General training tips	• It may be helpful for the learner to shuttle forwards and backwards to stay inside the designated space, turning part of the way with each cycle. The longer the chair, the more likely it is that this will be necessary. • The footrests for most wheelchairs increase the overall length of the wheelchairs, so a larger turning circle is required. Removing one or both footrests may make it easier to turn around in close quarters. If only one footrest is removed, the unsupported foot can be crossed over the supported one. If both footrests are removed, it is important to avoid injuring the feet by bumping them or running over them with a wheel. • Progression: o Start with small angular changes of the wheelchair and progress to larger ones. o Start at a slow speed, focussing on accuracy (staying within the designated boundaries). Increase the speed within the limits of accuracy.
Training tips for manual wheelchairs operated by wheelchair users	• Two-Hand-Propulsion Method • To make the turn more tightly, the wheelchair user should pull back on one wheel, while pushing forward 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 180° turn. • Progression: o Begin with small arcs of the hands on the wheels and progress to larger ones. o The “snap turn” is a more advanced version of the turn in place. To perform it, the wheelchair user positions one hand well forward and the other well

	back. 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:
	  • The skill may be performed in the wheelie position. This minimizes the footprint and the corresponding size of the support surface needed, even though the above-ground space needed (i.e. the turning circle) will not diminish to the same extent.
	  • 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.
	
	• A Person with Hemiplegia
	  • To turn to the side away from the stronger hand, the wheelchair user should push forward on the hand-rim.
	  • To turn toward the stronger hand the wheelchair user should pull back on the hand-rim.
	  • The wheelchair user may use the feet.
	  • The wheelchair user may reach across to the opposite wheel with the stronger hand.

Training tips for manual wheelchairs operated by caregivers	• To turn 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 removed and placed in the wheelchair user's lap. • This skill can be performed in the wheelie position.

Training tips for powered wheelchairs operated by wheelchair users	• Adjustment tip:
	  o Adjusting the speed, acceleration and deceleration for turning will affect the overall turning of the chair.
	  o The drive wheel and seating configurations have an impact on the turning radius 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 farther forward or back, the casters will swing more widely so that a series of to-and-fro motions may be needed to stay within the designated boundaries.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.14 Maneuvers sideways	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject maneuvers the wheelchair sideways parallel to an object (e.g. bed or wall). The skill is performed towards both the left and right sides.
Rationale	• Positioning oneself in a tight space involves maneuvering of the wheelchair, to move the wheelchair closer to or farther away from objects.
General training tips	• The user needs to be aware of the widest and longest points of the chair. The length can sometimes be minimized through set up (e.g. moving the axles forward). Mirrors can be used to provide visual feedback on the size of the chair. • The trainer may use the analogy of parking a car, if the subject has had such experience. • It may be helpful for the trainer to break the task into segments – for instance, a moving turn of about 30 degrees backwards to the right, followed by a moving turn backwards to the left, followed by a moving turn forward to the right, followed by a moving forward to the left will have moved the wheelchair to one side. With a front-wheel-drive wheelchair, the starting position will be behind the target position. • If the space available is limited, the subject may need to shuttle the wheelchair forward and backward to get into the desired position, moving more to one side with each attempt. • Progression: o Start with ample fore-aft room in which to maneuver and gradually decrease the space available. o Start with small sideways steps and progress to larger ones. o Start at a slow speed, focussing on accuracy (staying within the designated boundaries). Increase the speed within the limits of accuracy. • Variations: o Begin facing the target position, at right angles to it, rather than parallel to it.
Training tips for manual wheelchairs operated by	• Two-handed propulsion • As for the general tips above.

wheelchair users	• Variations: o An alternative for the wheelchair user with good upper-body strength and co-ordination is to use the "bunny-hop" method. To do so, the wheelchair user hops to the side by pulling up on the rear wheels and shifting the body weight in the desired direction. This is most useful when space is very limited. Initially, the wheelchair user can get used to just hopping up and down, with no sideways movement. • A Person With Hemiplegia • The wheelchair user should use the sound-side foot to steer and the sound-side arm to provide the power.
Training tips for manual wheelchairs operated by caregivers	• The caregiver should generally not try 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 unweight 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 barrier and the rear wheel.
Training tips for powered wheelchairs operated by wheelchair users	• As for general tips.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.15 Gets through hinged door in both directions	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• 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).
Rationale	• Wheelchair users frequently encounter such hinged doors or gates.
General training tips	• Adjustment tips: o Having a roller on the outer corner of the footrest can be useful when using them to apply force to a door. o For doors in the wheelchair users' own environments, attaching something (e.g. a handle or piece of rope) in the middle of the door can make closing easier. • If there is a threshold in the doorway, the principles for dealing with such an obstacle are dealt with in a separate section (#7.30). • Judging the width of doorways relative to wheelchair dimensions can require practice. • 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. Also, the feet often extend out beyond the footplates, so care needs to be taken to avoid injury to the toes. 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. • For a door that opens towards the wheelchair, 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. • To close the door 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 and reach forward and pull the door towards him/her using the other hand to push on the door-frame or otherwise back away.

	• The wheelchair user may go through the door backwards, pulling the door with him/her. • The wheelchair user can back up to close the door using the rear wheel to push on the door. • Reaching over the back of the wheelchair is effective, but there is the risk of a rear tip in a manual wheelchair. o The learner should not put his/her fingers between the door and door-frame on the hinged side because they may get pinched when the door closes. • Progression: o 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 through his/her hand. • Variations: o 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 successfully managed in a period of time. o For doors that close themselves, the rear wheel can be positioned in a way that prevents the door closing. o The learner can experiment with negotiating the door in the forward or backwards direction.
Training tips for manual wheelchairs operated by wheelchair users	• Two-handed propulsion: o 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. Then, by pulling with both hands, the wheelchair is moved through the opening. This has the advantage of keeping the hands from being injured. It is common for a wheelchair user to injure the backs of his/her hands by bumping or scraping them between the door frame and the wheelchair. A person with hemiplegia: • 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.
	
	• Door that Opens Away From the Wheelchair
	  • To open the door 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.
	  • 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.
	  o For a door that opens away from the wheelchair and that is latched with a 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 reach forward with one or both hands and use momentum to open the door. The feet should not strike the door. This should be practiced at slow speeds initially.
	
	• Door that Opens Towards the Wheelchair
	  • The wheelchair user should push on the door-frame with one hand (farthest from the hinge) to open the door more easily with the other (closest to the hinge).
	  • The wheelchair user may keep one hand on the door handle and use the other to push both wheels, one at a time.
	
	• Variations:
	  • If there is a threshold or level change in the door opening, it may be helpful to use the door frame to help provide the forces needed to proceed.
	  • For a doorway that is too narrow for the wheelchair to pass through it, an option is for the wheelchair user to transfer from the wheelchair on one side to a regular chair on the other, fold the wheelchair to get it through the door and then transfer back into it. Other alternatives include removing both rear wheels and resting 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.

Training tips for manual wheelchairs operated by caregivers	• General:
	  • Before pushing 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.
	  • For a narrow doorway, one option is for the caregiver 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 3 wheels.
	
	• Door that opens away:
	  • 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.
	  • The caregiver should use his/her body to prevent the door from closing on the wheelchair.
	  • When the wheelchair and caregiver are completely out of the way, the caregiver should close the door.
	
	• Door that opens toward:
	  • If there is room, the caregiver should angle the wheelchair away from the door on the side that will open.

Training tips for powered wheelchairs operated by wheelchair users	• With a powered wheelchair, when applying a force to open the door toward you, 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. • For a person with hemiplegia, it can be difficult to use the one functional arm to both hold the door lever and to 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.
Training tips for powered wheelchairs operated by caregivers	• As for manual wheelchairs operated by caregivers. • This can be an awkward task, because the caregiver's position is dictated by both the need to have access to the joystick and the door.

7.16 Reaches 1.5m high object	
Versions applicable	• WST-M/WCU ✔ WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG **X**
Description	• The subject reaches up to touch an object 1.5m above the floor.
Rationale	• A combination of upward and sideways or forward reaching is often needed when reaching for a light switch, elevator button or cupboard. This skill is not applicable for caregivers, because it is not a challenge for most caregivers.
General training tips	• Adjustment tip: o Chair height and the length of the wheel base have an impact on the wheelchair user's ability to reach objects. • The wheelchair should be positioned to take advantage of the subject's reach, strength and balance. • Reaching and leaning reduce stability, putting the wheelchair user at risk of falling out of the wheelchair or, if a manual wheelchair, tipping the wheelchair over. • The learner may use a reaching aid, but should carry it with him/her. • To be safer when leaning or bending forwards, the wheelchair user can move the footrests out of the way and place the feet on the floor. • If standing up, the wheelchair user should first apply the brakes and clear the footrests out of the way. If the wheelchair user stands up on the footrests, a forward tip is likely. The wheelchair user should keep one hand on the wheelchair to keep from falling. • For a person with weak trunk muscles, to avoid falling in the direction that he/she is leaning toward, he/she should hook the opposite 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. • 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. 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 were spilled or dropped onto the lap. Also, bending and twisting at the same time

	can cause back injury. • Variations: o If the wheelchair user is reaching for an 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 to 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 shelf so it can be caught. •
Training tips for manual wheelchairs operated by wheelchair users	• It is sometimes easier to approach the target backwards, but the wheelchair user needs to be careful not to reach too far and tip the wheelchair over. • 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 forwards. When the casters are trailing forwards, they lie ahead of the portion of the wheelchair frame to which they are attached, as is the case when the wheelchair is rolled backwards. • Adjustment tip: o Caster locks can be helpful to keep the caster oriented in the correct direction.
Training tips for manual wheelchairs operated by caregivers	• Not applicable.
Training tips for powered wheelchairs operated by wheelchair users	• As for general tips. • 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 from the tilt mechanism.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.

7.17 Picks object from floor	
Versions applicable	• WST-M/WCU ✔ WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG **X**
Description	• The learner picks a small object up from the floor.
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. This skill is not applicable for caregivers, because it is not a challenge for most caregivers.
General training tips	• See some of the general training tips for the Reaches-1.5m-high-object skill (#7.16), which will not be repeated here. • The wheelchair user should use one hand on the chair 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 the object on its side may help, to get a better grip. • To make it easier to pick up the 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.
Training tips for manual wheelchairs operated by wheelchair users	• Variations: o If the wheelchair user holds the object against the wheel and rolls the wheel forward, both hands can be used to grasp the object when it rotates to the top of the wheel. This can be done on the move.
Training tips for manual wheelchairs operated by caregivers	• 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.
Training tips for powered wheelchairs operated by wheelchair users	• If the wheelchair can be repositioned (e.g. with respect to tilt, recline or seat height), this may be helpful. • There is a danger of unintentionally rolling the drive 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.
Training tips for powered wheelchairs operated by caregivers	• As for manual wheelchairs operated by caregivers.

7.18 Relieves weight from buttocks	
Versions applicable	• WST-M/WCU ✔ WST-M/CG **X** • WST-P/WCU ✔ WST-P/CG **X**
Description	• The learner relieves weight from both buttocks, although not necessarily at the same time.
Rationale	• Pressure relief is important for the prevention of pressure sores. Ideally, pressure relief should be performed often and for prolonged periods of time.

General training tips	• It is generally suggested that a wheelchair user relieve pressure from the buttocks every 15-20 minutes and for prolonged periods (i.e. at least 2 minutes). However, many wheelchair users have remained free of pressure ulcers with far less stringent regimens.
	•
	• With the forward leaning method, the trunk can be rested on the thighs. Further unweighting can be achieved by grabbing the footrests and pulling on them. 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. Leaning on a table is a strategy that may be helpful for wheelchair users who have difficulty in getting back to the upright position after leaning forward onto the thighs. It may be socially inconvenient to use the forward-leaning technique in some circumstances.
	• 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.Variations:
	  • The push-up method, applying forces to the armrests or seat to lift the buttocks straight up, requires more force than some of the alternative methods.
	  • Bridging, tilt and recline are alternative methods that may be adequate for some wheelchair users, but these methods are not as effective in relieving pressure as the options mentioned earlier.
	  • The more tilt or recline the better, but getting the trunk backwards

	by 30 degrees or more may be needed to increase circulation over the ischial tuberosities and sacrum.
Training tips for manual wheelchairs operated by wheelchair users	• The leaning techniques can cause tips in the direction towards which the wheelchair user is leaning. • If leaning forward, the casters should be in the forward trailing position to increase forward stability. • A wheelie can be used to achieve tilt. It can be sustained by balance, by using the no-hands wheelie rest (with brakes locked and leaning against a wall or curb) or by resting on the rear anti-tip devices if they permit sufficient rear tilt.
Training tips for manual wheelchairs operated by caregivers	• A caregiver can assist in a variety of ways, such as reminding the wheelchair user of the need to unweight the buttocks or by assisting the wheelchair user in getting into or recovering from the unweighted position. • A caregiver can sit behind the wheelchair and tilt the wheelchair backwards to provide pressure relief. To prevent them from rolling forwards, the rear wheels should have the brakes (wheel locks) applied.
Training tips for powered wheelchairs operated by wheelchair users	• See general tips.
Training tips for powered wheelchairs operated by caregivers	• As for manual wheelchairs operated by caregivers.

7.19 Transfers from wheelchair to bench and back	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The wheelchair user transfers from the wheelchair to another surface and back again. The subject positions the wheelchair, removes and restores wheelchair components as necessary to complete the transfer.
Rationale	• A transfer is a commonly used skill to move between the wheelchair and a chair, bed, tub, toilet, car or other surface. This skill, as part of the WSTP, should only be considered a representative transfer.

General training tips	• There are a number 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 and/or 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.
	• The learner should be careful to avoid catching his/her catheter or other collection devices when transferring.
	• Adjust the height of the starting and target surfaces, to the extent possible, such that the target surface is slightly lower.
	• Clear the path between the starting and finishing surfaces.
	• Get the wheelchair close to the other surface.
	• Ensure the wheelchair brakes are on and the footrests are cleared away (if possible).
	• Apply the brakes of any other wheeled surface (e.g. bed).
	• Transfer Out of Wheelchair
	  • Standing Pivot Transfer
	  • This is one of the most common types of transfer to or from a wheelchair. The person stands fully upright from the original surface, 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 angle the chair with its

	near side about 30° from the bench. • The wheelchair user should leave the armrests in place. • The wheelchair user should try to flex the knees and the feet under the body, in preparation for the sit-to-stand phase of the transfer. During the transfer, the hips should be flexed. • If the wheelchair user is having trouble getting started, he/she should try to move forward on the seat before beginning the transfer with the feet under the body. • To avoid the need for turning through a greater arc than necessary when pivoting, the wheelchair user should turn the back towards the bench rather than away from it. • The wheelchair user should use the armrest to help maintain balance while transferring. • Crouching Transfer • This transfer is like the standing-pivot transfer, except that the knees and hips are not fully extended. • The wheelchair user may need to move the armrest out of the way on the bench side. • The wheelchair user may need to remove the brake extension (if any) on the bench side. • The wheelchair user should stay low, and not try to stand all the way up. However, the buttocks need to be high enough to clear any obstacles (e.g. the rear wheel). • The hips and the head move in opposite directions. • Sideways Transfer • The distance between the wheelchair and the target surface should be less than 3", generally with the wheelchair at an angle of 20-45 degrees from the target surface. • People using sideways transfers tend to lead with their weaker or more painful arms. However, if the

	arms are fairly symmetrical, alternating the leading and trailing arms allows them to share the stresses. • The wheelchair user should move the armrest out of the way on the bench side. • The wheelchair user should remove the brake extension (if any) on the bench side. • The feet should be supported on the footrests (if not easily removed) or the floor. • The wheelchair user should move forwards on the seat, to avoid such obstacles as the rear wheels. • To get the transfer board (if using one) under the body, the wheelchair user should lean away from it. • The wheelchair user should push down on the transfer board and wheelchair to unweight the buttocks. • The wheelchair user should avoid fully extending the fingers and wrists. This avoids overstretching the joints and tendons, which may be of importance for people with spinal cord injury who use a tenodesis effect (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 far enough away from the body to allow room for the body to move. The trailing hand may be close to the body. • The wheelchair user should shift sideways, in a single large movement or several smaller ones, towards the target surface. • 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. This technique reduces the forces needed from the arms. • Once fully supported by the target surface, the

	wheelchair user should remove the transfer board. The wheelchair user should lean away from it to do so. Forward Transfer • When transferring straight-on (e.g. for a person with amputations of both legs), the wheelchair user should pull the wheelchair as close as possible to the transfer bench. • A transfer board may be used. • Transfer Into Wheelchair •General • This is the same as the transfer out of wheelchair except as noted below. • Once the wheelchair user is back in the wheelchair, the subject should restore the footrests fully and put the feet back on them. • The wheelchair user should make sure that 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. • 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 they have short enough amputation stumps. • Persons with Hemiplegia • If the wheelchair user must transfer back into the wheelchair with the strong side leading, he/she will need to move the wheelchair to the other side. • Progression: • Once the basic transfer is mastered, it should be practiced with different target surfaces, at different relative heights.
Training tips for manual wheelchairs operated by wheelchair users	Brakes: • Prior to the actual transfer, the subject should apply the brakes (if any).

	• Adjustment tip: If the rear wheel moves with the brake locked, the brake may need to be adjusted or the tire may need to be pumped up, if it is pneumatic. A wheelchair user with weak trunk muscles can avoid falling forward during brake handling, by hooking an arm around a push handle or holding onto an armrest or wheel.
	• If strength is a limiting factor, the wheelchair user may use brake extensions.
	• To apply a push-to-lock brake, the wheelchair user grasps the handle of the brake and pushes it towards the front of the wheelchair until firmly in place.
	• To apply a pull-to-lock brake, the wheelchair user pulls the handle backward until firmly in place.
	• Retractable brakes 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 ultralight wheelchairs. To apply a retractable scissor brake, the wheelchair user pulls or pushes the handle in the appropriate direction until firmly in place.
	• To release brakes, the subject should reverse the action used to apply them. For a retractable scissor brake, the subject should fold the brake 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 subject should unlock the front of the armrest from the receptacle and lift the front of the armrest so that it flips behind the chair back.
	  • For a swing-away armrest, the subject should lift the armrest up slightly to disengage it and then swing it to the rear far enough to clear the backrest posts.
	  • To completely remove an armrest, the subject should unlock whatever locks are necessary. There may be ones at both the front and back of the armrest. The subject

	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 subject should first flip the tray away or slide it forwards to detach it. • To restore the armrests: • It is easy, with some armrest designs, 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 wheelchair user should reverse the process for moving the armrests away. • The wheelchair user should make sure the armrest posts are lined up with the receptacles before locking them. • The subject should check to make sure the armrests are locked in place by pulling up on them. Footrests: • People who need to propel their wheelchairs with their feet are effectively restrained if they cannot move the footrests out of the way. • The wheelchair user should clear the footrests 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 wheelchair user should first remove the feet from the footrests. A person with weak hands may need to use both hands or an extended wrist 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 wheelchair user should put the feet back on the footrests. • To move a swing-away footrest out of the way, the wheelchair user should unlock the footrest. Locking mechanisms vary from wheelchair to wheelchair. The

	wheelchair user 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 wheelchair user should push the footrest back towards the front of the wheelchair until it clicks into place. The wheelchair user should check that it is locked in place by pulling on it. • To completely remove the footrests, the wheelchair user may need to first swing the footrest away. The wheelchair user should then pull up on the footrest. The wheelchair user should pay attention to how the footrest was attached to the chair to simplify restoring it later. To replace the footrest, the wheelchair user 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 wheelchair user 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 wheelchair user 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 wheelchair user should push the foot-plates down. The wheelchair user should push the heel loops back into place, if they were displaced earlier. • To raise an elevating footrest, the wheelchair user 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 wheelchair user 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. • 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 subject should finish the wheelchair positioning with a slight movement away from the direction of the transfer. •
Training tips for manual wheelchairs operated by caregivers	• General • This section only deals with transfers for wheelchair users who require minimal 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 this Manual. • The caregiver should be attentive to the position of the wheelchair user's arms to avoid injuring them during the transfer. • If the wheelchair user is able to give direction then the caregiver should assist in ways such as off loading weight or guiding the trunk. • The caregiver should inquire as to whether the wheelchair user has ever experienced falls 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 for the caregiver: ▪ Feet shoulder width apart. ▪ Avoid bending 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. ▪ ▪ Keep the wheelchair user close to the caregiver (vs arms straight). ▪ Get the wheelchair user involved as much as possible. ▪ Use aids (e.g. transfer belt, sliding board, and mechanical lift) as needed. ▪ Use two people, if help is needed. Coordinate your efforts with the wheelchair user and any

	other caregiver (e.g. "on the count of 3…"). ▪ The wheelchair user should not hold the caregiver around the neck. ▪ If the wheelchair user is falling, it may be necessary to lower him/her to the floor rather than risk injury to the caregiver. • Standing Pivot and Crouching 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 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, towards the bench. • Sideways transfers: • May be necessary to do in steps. • Transfer into the wheelchair: • The caregiver may simply reverse whatever procedure was used to get the wheelchair user out of the wheelchair. • Alternatively, the caregiver may move the wheelchair to the other side, if this is necessary and if there is room. To move the wheelchair away from the bench and reposition it, the caregiver may leave the brakes 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 brakes 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.
Training tips for powered wheelchairs operated by wheelchair users	• See general tips. • Positioning (i.e. tilt, recline, seat height) may be useful while preparing the wheelchair for the 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-joystick side. • The controller may need to be moved out of the way.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users. • If a mechanical lift is being used, 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, after the wheelchair user has been lifted sufficiently, it may be easier to drive the wheelchair out from under the wheelchair user rather than moving the lift.

7.20 Folds and unfolds wheelchair	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• The learner folds the unoccupied wheelchair, and then unfolds it. This includes removal of the rear wheels, if they can be removed without tools. • Note: This skill is usually dealt with in combination with the transfer skill, while the wheelchair user is seated on the transfer bench.
Rationale	• For transport or storage, the size 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.
General training tips	• The learner user 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.

Training tips for manual wheelchairs operated by wheelchair users	• Fold Wheelchair
	  • The wheelchair user should remove anything that may prevent folding (such as the cushion, rigid seat, backrest or knapsack).
	  • To lift the seat out, the wheelchair user may need to release any restraining devices.
	  • If the rear wheels can be removed without tools, they should be. Usually, there is 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, check to be sure the brake 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 wheelchair user should first clear the footrests (e.g. by flipping them up, swinging them away or removing them).
	  • To close the chair more easily, the wheelchair user should position the wheelchair so that he/she is on one side of it. The wheelchair user should then tip the chair slightly towards him/herself so that the rear wheel on the side away from him/her is off the ground. This eliminates the friction of the far-side rear wheel on the ground and allows gravity to

	assist in folding the wheelchair. The wheelchair user should then pull the seat or seat rails upwards, with one or both hands, to fold the chair. For a person with hemiplegia, to fold the chair, the wheelchair user should put the stronger arm under the middle of the seat and lift up. • For a rigid-frame wheelchair with a fold-down back, although the wheelchair cannot be completely folded, the wheelchair user can make the chair easier to transport by folding down the back. The subject may need to release any restraining devices before he/she can do so. • Unfold Wheelchair • The wheelchair user should be careful not to tangle the seatbelt under the seat. • To get the process started, the wheelchair user can lift the rear wheels off the ground and separate the push-handles. • The wheelchair user usually needs to push the seat rails back down into the starting position. The wheelchair user should keep the fingers on top of the rail to prevent them from being pinched. • The wheelchair user should remember to put the cushion back on the seat properly before transferring back into the chair. • Progression: put folded wheelchair up on the transfer bench → into vehicle. • Variations: • Remove and replace rear wheels by leaning sideways (e.g. in a doorway) or forwards (tipping the wheelchair onto the footrests).
Training tips for manual wheelchairs operated by caregivers	• As for manual wheelchair operated by wheelchair users.
Training tips for powered wheelchairs operated by wheelchair users	• Not applicable.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.

7.21 Rolls 100m	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner moves the wheelchair 100m on a smooth level surface.
Rationale	• The ability to propel for distances of this magnitude allows wheelchair users to get around to a limited extent in the community (e.g. getting from a parking lot an office or getting around inside a store).
General training tips	• As for skill #7.8 (rolls forward 10m). • Progression: o Start at a slow speed and increase as tolerated. o Start in a smooth level indoor space and progress to the outdoor setting. • Variations: To work on directional control, the learner can follow a wall or sidewalk edge while trying to stay within an arm's reach.
Training tips for manual wheelchairs operated by wheelchair users	• As for skill #7.8. • Endurance may be a limiting factor if the wheelchair user is deconditioned. • Variations: o If the wheelchair user prefers to do so, he/she can perform this skill in the backwards direction.
Training tips for manual wheelchairs operated by caregivers	• As for skill #7.8.
Training tips for powered wheelchairs operated by wheelchair users	• As for skill #7.8 and general tips. • For longer distances, the controller mode and speed settings can be adjusted to ones that permit more speed and less sensitivity. Also, the deceleration distance should be increased so that a sudden stop does not cause the wheelchair user to fall or tip forward. • Because speeds are usually faster, at least if the path is 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. o
Training tips for powered wheelchairs operated by caregivers	• As for skill #5.8. • As for powered wheelchairs operated by wheelchair users.

5.22 Avoids moving obstacles	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• While moving, the learner avoids obstacles approaching from different directions.
Rationale	• In addition to stationary obstacles, wheelchair users must avoid moving obstacles (e.g. other wheelchair users, pedestrians).
General training tips	• This skill builds on the earlier skills of stopping (#7.8) and turning (#7.11). • The person operating the wheelchair should be alert to the moving environment while the wheelchair is moving. • If a hallway is clear, 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 ("etiquette" or the "rules of the road"), with respect to altering course to one side (the right in North America) when approaching others, use of horn or verbal warnings, overtaking and slowing down when approaching others or blind intersections. • Sudden stops or changes of direction can lead to the user falling forward or to the side in the wheelchair. • Progression: o Start with a single moving obstacle moving slowly at a consistent speed, seen well in advance, to ones moving more rapidly and unpredictably, with less warning (e.g. actual pedestrian traffic in a crowded setting). o Start with obstacles approaching from right angles and progress to ones coming from different angles, including overtaking and being overtaken. o Start slowly and progressively increase the speed of propulsion. • Variations: o Different moving obstacles can be used (e.g. a rolled ball, a swinging pendulum).
Training tips for manual wheelchairs operated by wheelchair users	• 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).

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

Training tips for manual wheelchairs operated by caregivers	• Adjustment tip: secure push handles are important for this skill and the similar skill of stopping part way down a steep grade. • Sudden changes in speed or direction can cause the wheelchair occupant 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 occupant.
Training tips for powered wheelchairs operated by wheelchair users	• Adjusting the deceleration settings at top speeds is important for this skill. However, the higher the deceleration distance, the more planning is required to avoid the obstacle.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.23 Ascends 5° incline	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner moves the wheelchair up a 5° incline.
Rationale	• Inclines are encountered frequently in the natural and built environments. The 5° (~1:12) grade meets the current building codes for ramps in North America.
General training tips	• Some of these tips apply to incline descent and to inclines of different degrees. • The steeper the incline, the greater is the likelihood of problems due to scraping the footrests or anti-tip devices at the lower incline-level transition, loss of traction, and tip-overs. • On inclines, if the drive wheels are uphill, they become relatively unweighted. This can cause loss of traction, so that propulsion, braking and directional control may become problems. 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 should be avoided to prevent tip-over accidents. • Momentum can be used to ascend short inclines by approaching at speed, but the initial lip needs to be taken into consideration. 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. This can be prevented by popping the casters over the lip. • If a ramp is wide enough, the wheelchair user can cut back and forth across the incline (slalom), to decrease the apparent slope. This may allow the wheelchair user to carry items on his/her lap or allow for successful completion when the user is unable to lean forward to prevent tipping. Pylons can be set up to provide a path for the wheelchair user to follow. • Although a slalom path up a steep incline will reduce the effective slope, it will introduce an element of cross-slope (dealt with later in

	the 7.27 section). • Progression: o Start with the wheelchair stationary at the lower end of the incline and progress to a moving approach. o Start with a minimal incline and proceed to more extreme ones. • Variations: o Grassy inclines, cobblestone or loose rock. o Stopping and steering on the incline.
Training tips for manual wheelchairs operated by wheelchair users	• Adjustment tips: o A heavy knapsack will reduce rear stability. It can be moved to the lap. o At the lower transition, either ascending or descending, the clearance of footrests can create problems. o The learner may need to adjust the height of the rear anti-tip devices so they do not catch during the transition. If they do, this can cause rear-wheel "float" whereby the rear wheels are not in contact with the surface and thereby unable to be used for propulsion or braking. o The wheelchair may be equipped with "grade aids" (or "hill holders"). These are attachments that, when activated, allow the rear wheels to roll forward but not backwards. The wheelchair user may apply them before he/she starts up the incline. This will allow the wheelchair user to rest on the incline without rolling back. o Some wheelchairs have gears that permit inclines to be handled more easily. • Two-hand propulsion • When negotiating the lower incline-floor transition, during either ascent or descent, the wheelchair user should be careful not to catch the unsupported feet, 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 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 backwards. The need for forward lean increases as the slope increases. • Shorter propulsive strokes are used than on the level, both because the wheelchair user is leaning forward and to avoid rolling backwards between strokes. If the brakes are not of the retractable type, the backs of the thumbs can be injured if the wheelchair user is not careful. The recovery path of the hands at the end of the propulsive stroke may be more like an arc than a loop for this skill. • If the wheelchair user gets tired part of the way up the incline, he/she should put on the brakes or, if there is sufficient room to do so, turn the wheelchair to the side and rest. • If the wheelchair starts to roll backward, instead of grasping both hand-rims (which 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. • Variations: o As a learning exercise, it may be helpful to have the wheelchair user try to ascend the incline (with a spotter) without leaning forwards. o Use the ramp hand rails if available. o For very steep inclines, some wheelchair users will go up backwards in the wheelie position. This requires a lot of skill and strength. • A Person With Hemiplegia • It is usually easier for a wheelchair user with hemiplegia who propels the wheelchair with one arm and one leg to go up the ramp backwards. Whenever rolling resistance is encountered (including when ascending inclines), foot propellers find it easier to push backwards than to pull forward with the feet.
Training tips for manual wheelchairs operated by caregivers	• As for manual wheelchairs operated by wheelchair users. • If the wheelchair user has hemiplegia, the caregiver can put the weak foot on the other footrest to avoid it getting caught on the

	transition. • To push the wheelchair forwards up an incline, the caregiver should bend the knees and lean towards the wheelchair. The caregiver should not use the knee to apply pressure to the backrest.
Training tips for powered wheelchairs operated by wheelchair users	• A small lip on the edge of an incline may be sufficient to prevent a manual wheelchair from going over the edge, but a powered wheelchair can go over such a lip more easily. • Most powered wheelchairs can handle 5 degrees with ease, at least from the perspective of having enough power to manage the slope. Depending upon the wheelchair's characteristics (front, mid/center or rear-wheel drive, acceleration settings, etc) and the user characteristics (poor trunk control, low self-effficacy), even the 5 degree incline can be challenging. • Altering the position of the wheelchair seat (i.e. with respect to tilt, recline, seat height) may be helpful to improve stability or 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: Begin training with the controller in a low setting but ensure that the programming provides adequate power and torque for success. The user may need to change to a different drive mode to accomplish this task.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by 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. • 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 provide support for the head with a hand.

7.24 Descends 5° incline	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner gets the wheelchair down a 5° incline.
Rationale	• As for the "ascends 5° incline" skill (#5.23).
General training tips	• Some similarities to incline ascent (see 7.23 above). • Smooth straight control down the incline is the basic method. • Drive slowly to maintain control. • Dangers include wheelchair runaway and, if the wheelchair strikes the lower ramp-floor transition too quickly, the wheelchair user may tip the wheelchair forward or fall forward out of the wheelchair. • Variations: o Starting and stopping on the incline. o Steering (slalom), using pylons to steer around.
Training tips for manual wheelchairs operated by wheelchair users	• Two-hand propulsion • Forwards • The wheelchair user should keep his/her weight back, to maintain good traction on the rear wheels. • The wheelchair user should not go too quickly, should stay in control and should be prepared to stop at anytime. • To slow down or steer, the wheelchair user should hold the hands still at the 1:00 o'clock position and let the hand-rims slide through his/her grip. It is better to provide continuous friction than to use a jerky grasp-and-release method (like milking a cow). If the wheelchair is allowed to descend too rapidly, the hands of the wheelchair user may get injured due to friction burns or lacerations due to hand-rim irregularities. Gloves help. • There is the potential for thumb injury on the brakes if the wheelchair user grabs the wheels when moving too quickly because the hands can get pulled forward. • If the wheelchair starts to roll too quickly and the incline is wide enough, instead of grasping both

	hand-rims to stop, the wheelchair user can grab one, turning across the slope. • Variations: o Slalom. If a ramp is wide enough, the wheelchair user can slalom down it 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. o Partially applied brakes. Caution should be used when using wheel locks as moving brakes. Equal and graded pressure should be used. This is not a commonly recommended method but some users do use it effectively. o Use the handrails, if available. o Wheelie method (see section 7.26 for details). o Perform 360° turns using only friction and downhill turning tendency to effect the turns. • Backwards • If the wheelchair user has weak trunk muscles and a tendency to fall forwards when facing downhill on inclines, he/she may feel more comfortable descending the incline backwards. • The backwards approach may also be used if, when descending forwards on a steeper incline, the wheelchair user experiences loss of traction due to the unweighting of the uphill wheels. • When going downhill backwards, the wheelchair user should lean uphill to reduce the likelihood of tipping over backwards. • As with any time the wheelchair is moving backwards, it is important to proceed slowly with frequent shoulder checks and to avoid stopping suddenly to prevent rear tips. • Hemiplegia • The wheelchair user can proceed forward down the incline,

	using the foot to slow down. • Caution that the foot does not get caught under the chair at the lower incline-floor transition.
Training tips for manual wheelchairs operated by caregivers	• The basic method is in the forward direction with all four wheels on the incline. The caregiver holds the push-handles firmly and allows the wheelchair to roll down the ramp while controlling the speed. The caregiver avoids sudden stops and slows down as he/she reaches the bottom transition to level ground. • Coming down an incline, the caregiver can put one hand on the wheelchair user's shoulder to prevent forward fall and also to steer the wheelchair as the wheelchair will tend to twist if only held by one hand. • Variations: • The forward descent can be performed in the wheelie position. This is useful on steep inclines, to prevent the wheelchair user from falling forwards. However, this method may require the caregiver to bend too far forwards, which may strain the back. • Another method is to descend backwards. 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 the shoulder for obstacles. • As a combined wheelchair-user and caregiver method, the wheelchair user can descend forwards, holding onto a hand-rim with one hand and putting the other hand on the low back of the caregiver walking beside the wheelchair.
Training tips for powered wheelchairs operated by wheelchair users	• 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. • Begin training 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 or push-handle to prevent falling forward onto the lap.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by 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.

7.25 Ascends 10° incline	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner gets the wheelchair up a 10° incline.
Rationale	• Inclines with slopes greater than the standard recommended value are encountered frequently in the natural and built environments.
General training tips	• As for skill #7.23.
Training tips for manual wheelchairs operated by wheelchair users	• As for skill #7.23.
Training tips for manual wheelchairs operated by caregivers	• As for skill #7.23.
Training tips for powered wheelchairs operated by wheelchair users	• As for skill #7.23.
Training tips for powered wheelchairs operated by caregivers	• As for skill #7.23.

7.26 Descends 10° incline	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner gets the wheelchair down a 10° incline.
Rationale	• As for the "ascends 10° incline" skill (#7.25). • The appropriate technique for a steep incline often differs from that used for a lesser slope (e.g. descending a moderate or steep incline in the forward wheelie position has a number of benefits).
General training tips	• As for skill #7.24.

Training tips for manual wheelchairs operated by wheelchair users	• As for skill #7.24.
	
	• Wheelie Descent
	  • This is the preferred method for the descent of a steep incline.
	  • Achieve the wheelie position on the level at the top of the incline, as described in section 7.35.
	  • Then move forward onto the incline. To move forward on the level above the incline in the wheelie position, 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. This is like the reactive balance strategy described in the stationary wheelie skill, but the imbalance is intentional.
	  • 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 on the wheels and letting the hand-rims slide through the fingers.
	  • In catching up to the center of gravity after the dip, there is no need for the wheelchair user to catch up completely. By undershooting slightly, the wheelchair user can initiate the next dip.
	  • Once on the incline, facing downhill, the wheelchair user

	should let the hand-rims run smoothly through the hands to control the speed, direction and the wheelchair pitch angle. Letting the hand-rims run more quickly through the hands will allow the wheelchair to pitch farther back. Slowing the rate at which the hand-rims slide through the fingers will cause the wheelchair to pitch forward. • The subject should have the casters touch down shortly after the rear wheels reach the level surface. • Variations: • Wheelie down the incline, stop half way, perform a 360° turn in the wheelie position, then continue down. • An advanced exercise is for the wheelchair user to practice achieving wheelie take-off while on the incline. This is useful when an unexpected obstacle is encountered. If the wheelchair user is facing downhill, more force is needed for takeoff 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. 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.
Training tips for manual wheelchairs operated by caregivers	• As for skill #7.24.
Training tips for powered wheelchairs operated by wheelchair users	• As for skill #7.24. • When stopping while descending a steep incline, moving the joystick into reverse may work better than simply bringing the joystick to the resting neutral position.
Training tips for powered wheelchairs operated by caregivers	• As for skill #7.24.

7.27 Rolls 2m across 5° side-slope	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The subject propels the wheelchair across a side-slope without turning downhill significantly.
Rationale	• Side (or cross) slopes are frequently encountered in man-made and natural environments. Sidewalks, for instance, are usually sloped ~2% (1:50) toward the street to allow water to run off, although steeper grades are often found (e.g. where sidewalks cross driveways).
General training tips	• Downhill-turning tendency will tend to pull the caster wheels downhill. • The extent of downhill-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 to avoid veering off the path.
Training tips for manual wheelchairs operated by wheelchair users	• Side-slopes require significantly more energy to push across. • The wheelchair user should lean backwards to keep the weight away from the casters. • Two-hand propulsion o To avoid turning downhill, the wheelchair user should push harder on the downhill wheel. o In some cases, the uphill hand may be used exclusively for braking (to minimize downhill-turning tendency) rather than for assisting with propulsion. o 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. o Variations: ▪ A useful learning experience to demonstrate the

	downhill-turning tendency is to have the wheelchair user lean forward, to illustrate how the downhill-turning tendency increases. ▪ In the wheelie position facing across a slope, there is no downhill-turning tendency, because the center of gravity is between the rear wheels. • Person with hemiplegia o When learning the skill it may be less frustrating to cross the side-slope with the sound side downhill first due to the downhill-turning tendency. Some users may choose to go backwards with the sound side downhill rather than forwards with the sound side uphill, to help manage the downhill-turning tendency.
Training tips for manual wheelchairs operated by caregivers	• 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 may choose to use the wheelie position. • 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.
Training tips for powered wheelchairs operated by wheelchair users	• Although a rear-wheel-drive wheelchair will tend to turn downhill, a front-wheel-drive wheelchair will tend to turn uphill. • Many chairs are now equipped with automatic correction of downhill-turning tendency on side-slopes. • If there is no automatic correction, the wheelchair user should aim slightly away from the 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.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.28 Rolls 2m on soft surface	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner propels the wheelchair 2m on a soft surface.
Rationale	• There are many soft surfaces (e.g. carpet, dirt, grass, gravel, sand or snow) with increased rolling resistance. Propulsion is more difficult on such surfaces and the wheels tend to sink into the surface.
General training tips	• Adjustment tip: o The diameter, width and shape of the wheels will affect the extent to which they sink into the soft surface. • When approaching a section of soft or irregular terrain, the wheelchair user should look ahead and plan a route that will minimize difficulties. • When moving from a smooth level surface onto a soft surface, the wheelchair will decelerate, so it is wise to slow down when approaching such a transition. • Because rolling resistance is the challenge here, reducing the weight on the small wheels (casters) and increasing the weight on the drive wheels is the focus. • When proceeding across a soft or rough surface, it is easiest to move forward in a straight line, as the casters will be less free to swivel should the user wish to change direction or back up. • If one drive wheel is spinning, the wheelchair user should shift the 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 backwards direction). • Variations: o A variety of surfaces (e.g. sand, thick carpet, foam, a gym mat, gravel) provide similar, but not identical experiences. o 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 picking up the mat behind the wheelchair and moving it to the front, proceeding forward in a step-wise fashion.
Training tips for manual wheelchairs operated by wheelchair users	• Adjustment tips: • This is the first of several skills during which it may be necessary to reposition the rear anti-tip devices to allow the

	wheelchair to be tipped backwards sufficiently to perform a partial or full wheelie. To reposition most rear anti-tip devices, the learner will need to press the button or release mechanism on the wheelchair frame that locks the anti-tip device in place. The learner should note the position of the anti-tip devices, so that he/she will be able to restore them later. Then, the learner can either reposition the anti-tip devices so that they face upwards or remove them altogether. To restore the anti-tip devices, the learner should simply reverse the steps.
	Note: 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 he/she becomes used to this new condition. Even if left in place, the wheelchair user should not rely on the rear anti-tip devices to prevent rear tipping because they might sink into a soft surface.
	
	• Forwards approach
	  • Because there is more rolling resistance, more force is required by the wheelchair user. There is a risk of overuse injury.
	  • Although leaning forward slightly may help the wheelchair user to apply more force, and to prevent the additional force from causing a rear tip, keeping the weight on the rear wheels will improve traction and keep the front wheels from digging in. 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 and the wheelchair.
	  • The forward approach 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.
	  • This is the first in a series of skills for which transient wheelies are useful or necessary. Partial wheelies are a good option for the wheelchair user, lifting the casters off the surface during each push, but letting them touch down as the hands recover for the next push.
	  • Variations:

	• If using the full wheelie position (a good option, but one that requires more skill), the wheelchair user needs a strong forward 'dip' to get going. 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'. • In some circumstances, it may prove easier to use both hands on the same wheel to move one wheel at a time. • Person with hemiplegia • It is easier in the backwards direction, because there is less rolling resistance with the large rear wheels than the smaller casters. • When pushing backwards with the foot, the casters become slightly unweighted which makes it easier to move them.
Training tips for manual wheelchairs operated by caregivers	• It may be necessary for the caregiver to lean forward to apply the extra force needed. • The caregiver should not use the 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. • Variations: • The caregiver may find it easier to pull the wheelchair backward. • The caregiver may find it easier to tip the wheelchair back into the full wheelie position, so that all of the weight is on the rear wheels. The caregiver should be sure to find the wheelie balance point before starting. The caregiver may need to reposition the rear anti-tip devices or remove them. The wheelchair can be pushed forward or pulled backwards.
Training tips for powered wheelchairs operated by wheelchair users	• 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 wheels. It is easier to proceed on a soft surface if more of the weight is on wheels with larger diameter. Clearance for feet can also be positively 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.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users. • With a rear-wheel-drive wheelchair, a caregiver can push down on the back of the wheelchair to unweight the casters or to add traction to spinning wheels. The caregiver can push forward, to assist with overcoming resistance. Alternatively, the front of the wheelchair can be lifted or pulled on.

7.29 Gets over 15cm pot-hole	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner gets the wheelchair over a pot-hole that is 15cm across (in the line of progression) and at least as wide as the wheelchair.
Rationale	• Such loss of surface support is a commonly encountered barrier. Gaps at elevator doors and sewer grates are similar challenges.
General training tips	• Small pot-holes, that only affect one wheel at a time, may be jarring but are not usually major obstacles. In this section, we will be considering only pot-holes that are as wide as the wheelchair. • If a pot-hole is not readily available, one can be easily simulated. For instance, two gym mats can be put close together, with whatever space between them the trainer wishes. • The best approach is to avoid pot-holes, steering around them or straddling them. • If the pot-hole cannot be avoided but appears to be negotiable, it is best to proceed at a slow speed but a steady pace. Avoid stopping, if possible. • The wheelchair user should approach the pot-hole as squarely as possible. • If the casters drop into the pot-hole and turn sideways (a common problem if the wheelchair is moved forwards and backwards repeatedly in an attempt to get the casters out of the pothole), it can be very difficult to proceed. • Rear anti-tip devices may cause the drive wheels to "float" (i.e. with the weight being distributed on the casters and the anti-tip devices, unweighting the drive wheels. • Progression: o Start slow and add speed. o Start with small pot-holes and progress to larger ones. • Variations: o As long as 3 wheels are supported at any time, the wheelchair will remain upright. That being the case, an oblique approach to a pothole, so that only one wheel is unsupported at a time, may be a useful strategy. The wheelchair user should keep his/her weight away from the unsupported wheel.

Training tips for manual wheelchairs operated by wheelchair users	• The risks occur in sequence. When the wheelchair user pops the casters from the surface, there is the risk of a rear tip. If the casters drop into the pot-hole, there is the risk of a forward tip or fall.
	
	• Forward Approach, Stationary Method
	  • The wheelchair user should approach the obstacle and stop with the casters near it.
	  • This method is comprised of two steps: "pop" and "lean". They can be verbalized as they are performed, as cues.
	  • The wheelchair user first briefly pops the casters from the floor, just high enough to clear the pot-hole. To do so, the wheelchair user can push quickly forward on the hand-rims. Alternatively, the wheelchair user can use his/her 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 back on the floor beyond the pot-hole.
	  • After the rear wheels drop into the pot-hole, the wheelchair user should lean forward and power the rear wheels out of the pot-hole.
	
	• Forward Approach, Momentum Method
	  • This method is comprised of four steps: "push", "coast", "pop" and "lean". As before, they can be verbalized as they are performed.
	  • The wheelchair user should initially approach at a slow speed. 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 pot-hole, the sudden stop will be less jarring.
	  • The wheelchair user should not lean forward to look at the feet when he/she approaches the obstacle, because that will increase the weight on the casters. In timing the 'pop', the wheelchair user should understand where the casters are (often below the knees, not under the feet). A mirror can be used to provide augmented feedback.
	  • In preparation to pop the front wheels while the

	wheelchair user moves forward, the wheelchair user briefly coasts and place the hands in the power-stroke-ready position, to be in the right position when he/she is at the proper distance from the pot-hole. The power-stroke-ready position is when the hands are ready to grasp the hand-rims, behind top dead centre (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 powerful enough to pop the casters. • Once the casters have cleared the pot-hole and the rear wheels drop into it, the wheelchair user should lean forward and propel the rear wheels to bring the rear wheels over the pot-hole. • Progression: • Segmentation: Progress through the skill starting with the stationary approach then moving to the momentum method. • To practice getting the timing correct without the fear of having the casters drop into the pot-hole, the wheelchair user may practice propelling the wheelchair forward and transiently popping the casters at a predetermined point on the floor. The horizontal distance over which the casters need to be off the floor can be gradually increased. • Variations: • The wheelchair user can use a full wheelie for the entire skill or only until the rear wheels are in the pot-hole. Momentum can be used to carry the rear wheels out of the pot-hole, but this may be jarring to the wheelchair user. If the wheelchair user moves forward more slowly, this will allow the rear-wheel drop to occur with minimal jarring. To get the rear wheels out of the pot-hole, the wheelchair user should lean forward and power out of it. Some rocking may be needed. • The hands-free version of the skill (achieving caster lift-off by backwards trunk movement) is useful because the wheels may be spinning too quickly for the hands to catch up with (e.g. coming down a hill). However, this is an advanced skill. The

	wheelchair user can flex the hips, keeping the body upright. Although leaning back into the backrest will also pop the casters off the ground, there is an increased risk of the wheelchair user tipping over backwards and the body will not be well positioned for the forward lean needed during the second half of this skill. This variation can be difficult to spot.
Training tips for manual wheelchairs operated by caregivers	• The caregiver may proceed in the forward direction, using the transient caster pop or full wheelie method. • The caregiver should always let the wheelchair user know before he/she tips the wheelchair backwards. • To tip the wheelchair backwards, the caregiver should use one foot on a tipping lever (an extension of the wheelchair frame, to which the rear anti-tip device may be attached) while pulling backwards with the hands on the push handles. • For the full wheelie position, the caregiver should tip the wheelchair back far enough so that it is balanced over the rear wheels. How far back the chair needs to be tipped will vary depending on the wheelchair user and the wheelchair. If the wheelchair has elevating footrests, it will be easier to tip the wheelchair backward if they are lowered. To land after the 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. • In either case, after the rear wheels are in the pot-hole, the casters can be lowered to the surface beyond the pot-hole. Then the wheelchair user is asked to lean forward and the wheelchair is rolled out of the pot-hole. • Variations: • The backward direction may be easier for the caregiver. If this technique is used, the rear wheels of the wheelchair can be lowered into the pothole, then the wheelchair tipped into a wheelie position to be pulled out of the pothole on the rear wheels.
Training tips for powered wheelchairs operated by wheelchair users	• Positional control (e.g. tilt, recline) can be used to get the weight over the drive wheels and improve traction. • Smooth continuous forward movement is often the most successful method of traversing a pot-hole. • If the casters are rounded on their sides (i.e. ball-shaped), they will

	better resist the tendency to get caught sideways or to drop into gaps.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.30 Gets over 2cm threshold	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner propels the wheelchair over a 2cm-high threshold.
Rationale	• Wheelchair users often encounter low obstacles (e.g. door thresholds) or higher ones (e.g. sticks, uneven sidewalk sections) that they cannot get over by merely rolling over them.

General training tips	• As for 7.29 in many respects.
	• Adjustment tips:
	  • Footrests or anti-tip devices may contact the threshold before the wheels do, making it impossible to negotiate the threshold without repositioning the wheelchair parts concerned.
	  • Footrests or anti-tip devices may cause the wheelchair to get hung-up on the threshold, unable to proceed because the drive wheels are not in contact with the surface ("float").
	• Before attempting to negotiate a high obstacle, the learner should be aware of how much vertical and horizontal clearance exists between the casters and the rear wheels, to avoid getting hung up on the obstacle. If the wheelchair does get hung up due to insufficient horizontal clearance (wheelbase), the learner may be able to escape by backing up slightly (which swings the casters from the rear-trailing position to the side- or forward-trailing one, where there is more space).
	• Getting the larger drive wheels over the threshold is usually easier than getting the smaller caster wheels over. Leaning away from the casters will unweight them and make it easier to get them over.
	• Progression:
	  • Start with low thresholds and progress to higher ones. Obstacles of 10cm high or greater are negotiable in the right wheelchair.
	• Variations:
	  • Leading with the larger-diameter wheels may be helpful.

Training tips for manual wheelchairs operated by wheelchair users	• See skill 7.29 re the stationary and momentum approaches. The only differences from the pot-hole skill are as follows: • A bit more of everything is needed (speed, extent of caster pop and extent of forward lean after the rear wheels hit the obstacle).

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

	• The wheelchair user should pop the casters about 10-15cm before reaching the threshold, to avoid striking them on the vertical section. • Once the rear wheels are on top of the obstacle, the wheelchair user should lean back to decrease the likelihood of a forward tip or falling forward out of the wheelchair. • Backwards Approach • The wheelchair user may find it easier to back over a low obstacle. • The wheelchair user should approach the obstacle slowly, because a sudden stop can cause a rear tip. • As the wheelchair user approaches the obstacle backwards, he/she may find it easier if he/she leans forward to slightly unweight the rear wheels. • Using the foot on the floor might give the wheelchair user additional power to get over the obstacle. • The wheelchair user should pull the wheelchair straight backward by applying equal force to both wheels. Otherwise, the casters may turn and catch sideways on the obstacle. • Once the rear wheels are over the low obstacle, the wheelchair user should lean back enough to unweight the casters as they reach the obstacle, but not so much as to cause a rear tip. • Variations: o To get beyond a pair of bolsters that are too close to wheel between, it may be possible to move one wheel (or pair of wheels) through the gap at a time, especially in the wheelie position. o Using two hands on one wheel to get one wheel over at a time may be helpful.
Training tips for manual wheelchairs operated by caregivers	• As for 7.29.
Training tips for powered wheelchairs operated by	• Positional control (e.g. tilt, recline) can be used to alter the weight distribution and traction of the chair.

wheelchair users	• Smooth continuous forward movement is often the most successful method of traversing the threshold. • Depending upon the size of the threshold, it may be necessary to switch drive modes to have the necessary wheel torque. • If the powered wheelchair has come to a stop against the threshold, as extra force is applied to the threshold, 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.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.31 Ascends 5cm level change	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner gets the wheelchair up a 5cm level change.
Rationale	• Level changes (e.g. curbs, steps) are common obstacles in the natural and man-made environments.
General training tips	• As for the threshold skill, the footrests, anti-tip devices and clearance between the wheels may affect the ability to negotiate level changes. • This skill is similar to and builds on the previous ones, specifically the soft surface, pot-hole and threshold skills. • To ascend or descend level changes, it may be necessary to reposition or remove the rear anti-tip devices. • Progression: o Start with a minimal level change and progress to higher ones.
Training tips for manual wheelchairs operated by wheelchair users	• Two-hand propulsion • This skill is similar to the pot-hole and threshold skills in that it can be approached with stationary and momentum methods. • It is slightly more challenging because the pre-tilted position of having the casters on top of the curb moves more weight to the back of the chair. 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 backwards until the front wheels are almost off the edge of the level change. 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. Then, 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 obstacle. A rocking motion may be needed. • With the momentum method, the wheelchair user should shift his/her weight forward as or before the rear wheels hit the lip of the level change to ensure the casters are on the upper surface. If this does not happen, the energy from the forward pitch caused by the collision of the rear wheels with the obstacle will be expended in crashing the casters down on the upper level rather than bringing the rear wheels up onto the upper level. • Common errors are popping the casters too soon, not popping high enough and popping too high. • Backwards • The wheelchair user might find it easier to attempt to ascend the 5cm-high level change backwards. • Variations: • Use the external environment if available (e.g. door frame or street pole). • Person with hemiplegia • The wheelchair is backed up until the rear wheels contact the obstacle. Then, leaning forward to slightly unweight the rear wheels, the foot is used to push the rear wheels up the level change. Then the wheelchair user sits upright and pushes down on the foot on the floor or top of the level change to bring the casters up to the upper level.
Training tips for manual wheelchairs operated by caregivers	• To ascend a level change forwards, 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 forwards until the rear wheels touch the edge of the level change. After the casters are on the upper level, the caregiver should ask the wheelchair user to lean or shift forward to reduce the weight on the rear wheels. Then, the caregiver should apply a forward and upward force to help the rear wheels roll up onto the upper level. The caregiver should not lift the wheels clear of the surface. The caregiver should stand close to the wheelchair, but he/she should

	not use the knee against the backrest.
	
	• Variations:
	  • For a small level change, the caregiver can ascend backwards, if preferred. 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. The caregiver should step 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.
	  • Caregiver in front, with casters up the curb. Shake hands with the wheelchair user and pull him/her up the level change. The wheelchair user uses his/her free hand to push on the hand-rim. This technique looks more natural than pushing from behind.

Training tips for powered wheelchairs operated by wheelchair users	• The user may need to change to a drive mode with higher torque to accomplish this task. • Positional control (i.e. tilt, recline) can be used to alter the weight distribution on the wheels. • Variation: • In some instances, especially with a rear-wheel-drive wheelchair, it may be easier to ascend the level change in the reverse direction.
Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.32 Descends 5cm level change	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The learner gets the wheelchair down a 5cm level change.
Rationale	• As for "ascends 5cm level change" skill (#5.31).
General training tips	• On a small level change such as this, forward or backwards are both appropriate approaches to take. Learning the backwards approach will be helpful when advancing to higher level changes. • The wheelchair may be able to simply roll forward off the upper level. It may be as safe and effective to go off the lip at a moderate or full speed rather than slowly.
Training tips for manual wheelchairs operated by wheelchair users	• Two-hand propulsion o Variations: ▪ If the footrests catch on the ground or there is the danger of a forward tip or fall from the wheelchair, the wheelchair user can use the backwards approach. The wheelchair user should line the rear wheels up with the edge of the level change. The wheelchair user should lean as far forward as possible (chest on lap), and reach forward on the hand-rims. The wheelchair user should move backwards very slowly and let the rear wheels roll evenly down off the upper level under control. Resisting the descent will reduce the impact shock. Once the rear wheels are on the lower level, the wheelchair user can sit more upright if this is possible without tipping over backwards. If necessary, the wheelchair user can turn to the left or the right to get the casters off the upper level without scraping the footrests – by the time the second caster rolls off the edge, the footrests are beyond the edge. Alternatively, the wheelchair user can use the full-wheelie position to move away from the curb. ▪ Full wheelie method (see 7.34).

	• Person with hemiplegia • Reverse of 7.31.

Training tips for manual wheelchairs operated by caregivers	• The caregiver should not attempt to descend the level change backwards with the wheelchair in the wheelie position because, at greater heights, this causes severe jarring of the wheelchair and its occupant.
	• To descend a level change, the caregiver may alternatively do this in the forward direction. The caregiver should slowly push the wheelchair off the upper level, allowing the casters to gently land on the lower level, followed by the rear wheels. It is 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.
	
	• Variations:
	  • Approaching in the forward direction, the caregiver can tip the wheelchair back into the full wheelie position and lower the wheelchair to the lower level. 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.
	  • To descend a level change backwards, the caregiver should turn the wheelchair around so that the rear wheels go off the edge first. The caregiver should stand close behind the wheelchair and on the lower level. 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 should slowly and evenly roll the rear wheels down onto the lower level, avoiding any jarring. Once the rear wheels are on the lower level, the caregiver may need to tip the wheelchair back into the wheelie position to avoid the footrests from scraping on the upper level. Alternatively, the caregiver can turn the chair sideways to prevent the footrests from getting caught.

Training tips for powered wheelchairs operated by wheelchair users	• As for 7.31 in many respects. See general tips. •

Training tips for powered wheelchairs operated by caregivers	• As for powered wheelchairs operated by wheelchair users.

7.33 Ascends 15cm curb	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• The learner ascends a 15cm curb in the wheelchair
Rationale	• As for "ascends 5cm level change" skill (#5.31). • This skill is not generally applicable for powered wheelchairs because of the difficulty and danger involved.
General training tips	• As for 7.31. • The risks of tipping occur in sequence. A rear tip may occur when the casters are popped from the surface. A forward tip or fall can occur if the casters strike the curb. A sideways tip can occur if one wheel ascends the curb but the other does not. • Progression: o Begin with the stationary method and a small level change, then gradually increase the height of the level change until it becomes difficult. Then change to the momentum with a small level change and gradually increase the height.
Training tips for manual wheelchairs operated by wheelchair users	• As for 7.31, for both two-hand and hemiplegic propulsion patterns.
Training tips for manual wheelchairs operated by caregivers	• As for 7.31.
Training tips for powered wheelchairs operated by wheelchair users	• Not generally applicable although some powered wheelchairs are capable of climbing full-height curbs.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.

7.34 Descends 15cm curb	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• The learner gets the wheelchair down a 15cm curb.
Rationale	• As for "descends 5cm level change" skill (#5.32). • Also, the appropriate technique for a high curb may differ from that used for a lesser level change. • This skill is not generally applicable for powered wheelchairs because of the difficulty and danger involved.
General training tips	• As for 7.32.

Training tips for manual wheelchairs operated by wheelchair users	• Two-hand propulsion
	  • The forward full-wheelie method is the preferred method for the descent of a large level change, but it requires good wheelie skills. The wheelchair user should get into the wheelie position away from the edge of the level change. The wheelchair user should roll forward, in the wheelie position to the edge, staying as square as possible to the edge. The wheelchair user should place the hands in the 11 o'clock position (clock analogy), so that he/she can firmly grip the hand-rims until the rear wheels drop to the lower level. As slowly as possible, the wheelchair user should lower the rear wheels from the upper to the lower level, pulling backwards to slow 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, but the wheelchair user should lean forward as a precaution.
	
	  • Variations:
	  • The backwards approach (see 7.32) is simple and generally safe if the wheelchair has adequate rear stability. For this skill, it is especially important to practice with a spotter until it has been mastered.
	  • The forward, transient-wheelie method is an advanced skill. The wheelchair user approaches the curb edge squarely with all four wheels on the surface and pops the casters as they reach the edge. The extent of the caster pop should be

	sufficient to allow the rear wheels to have landed on the lower level by the time 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. • Person with hemiplegia • As for 7.32.
Training tips for manual wheelchairs operated by caregivers	• As for 7.32.
Training tips for powered wheelchairs operated by wheelchair users	• Not applicable.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.

7.35 Performs 30s stationary wheelie	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• The learner achieves the wheelie position, maintains it for 30 seconds and brings the casters back to the floor.
Rationale	• The stationary wheelie position can be used to avoid postural problems that can cause neck strain from looking up or to decrease the likelihood of pressure sores on the ischial tuberosities. The stationary wheelie is also a foundation skill for a number of functional skills (e.g. curb descent, steep incline descent) that can be best performed in the full wheelie position. • This skill is not applicable for powered wheelchairs because of the difficulty and danger involved.
General training tips	• Adjustment tips: o The wheelchair type and set-up influence the ease with which the wheelchair can be tipped backward into the wheelie position. It is easier to achieve wheelie take-off in a wheelchair that is less stable to begin with – e.g. removing the footrests and allowing the feet to dangle, moving the rear axle position forward, raising the rear axle position or switching to a less stable wheelchair. o Rear anti-tip devices usually need to be removed.
Training tips for manual wheelchairs operated by wheelchair users	• The description that follows is for people using two hands for propulsion, but people have only the use of one arm can perform wheelies in a similar way. • When learning the wheelie, the main risks are of injury due to a backward tip and striking the head on the floor or injuring an outstretched arm. This skill should not be practiced without a spotter or a rear anti-tip device that permits enough rear tip to achieve the wheelie balance point but prevents a full rear tip. • Most people require a total of 45-60 minutes of practice, spread over 2-3 sessions, to acquire this skill. • Take-Off Phase • It may be useful to use simulation. For instance, the trainer may tip the wheelchair back into the balance position, to give the wheelchair user a sense of how far back this is.

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

	• If properly timed, 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. If using this method, the wheelchair user should start with the hands near the top centre of the wheel (i.e., ~12:00 or 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 lose momentum and will not tip backwards as easily. • The method of only rolling the wheels forward is preferred because it can be used while the wheelchair is moving forwards (as is often the case), but the hands will need to start farther back on the wheels (i.e., 10-11 o'clock) and more force will be needed by the wheelchair user than for the backward-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 centre of gravity (located near the lap). It can be helpful for the wheelchair user to focus on this than on getting the centre of gravity back. • 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 (or even forward-leaning) body position. • Whichever method is used, the wheelchair user should try to tip backwards far enough to reach and slightly overshoot the wheelie balance point. Once past the balance point, the wheelchair user then should pull back on the wheels to prevent tipping too far and return to the balance point. • If the wheelchair user is overshooting the balance point too vigorously, a learning exercise is for him/her to practice popping the casters up onto a small object (~5cm high). • If the wheelchair user is having difficulty getting tipped far enough backward to reach the balance point, he/she should push forward more forcefully to pop the casters higher. Steps (noted earlier) can be taken to reduce the rear stability of the wheelchair. An additional strategy is to start the take-off with

	the casters uphill or on a small level change. If the problem is fear of tipping over backwards, the wheelchair user can pop back onto the spotter then progress to a self-save.
	
	• Balance Phase
	  • The wheelchair user does not need to use a lot of force to maintain balance. It is preferable for the wheelchair user to keep a light grip on the wheels.
	  • The wheelchair user should try to relax and remember to breathe.
	  • 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. obstacles such as bricks in front of and behind the rear wheels and foam under the rear wheels). The trainer tips the wheelchair back to the balance point. In this situation, learning exercises include: i) 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), ii) leaning forward (which increases the amount of tip to be at the ideal balance point), iii) using only two fingers and a thumb of each hand, iv) sliding the hands backwards and forwards on the hand-rims to find the ideal position, v) holding on with only one hand and vi) closing the eyes. Once these are mastered at the high rolling-resistance level, the sequence can be repeated with medium rolling resistance (e.g. gravel or 10cm of foam), then low resistance (e.g. tile floor).
	  • Two balance strategies have been reported, the proactive and reactive.
	
	• Proactive balance strategy:
	  • In this strategy, the wheelchair user keeps the wheels moving forwards and backwards over a small area. The wheelchair user should try to move the hands only between the 12:00 and 1:00 o'clock positions. 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, because breathing has a subtle effect on wheelchair stability.
	
	• Reactive balance strategy:
	  • 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"). The worst that can happen in this direction is that the wheelchair lands prematurely.
	  • If the wheelchair user imbalances backwards, he/she should roll the rear wheels backwards to re-establish balance ("when you fall back, pull back"). Even if past the point of no return, the preferred strategy to minimize injury due to striking the back of the head on the ground is for the wheelchair user to pull back hard on the rear wheels and flex the neck until the back hits the ground. Falls will be practiced later, under skill 7.37.
	
	• Landing Phase:
	  • To land, the wheelchair user pulls back on the wheels, or leans forward to gently bring the front wheels to the ground.
	
	• The description above can be summarized in the form of criterion-referenced steps:
	  • Step #1: Review relevant earlier wheelchair control work (pushing on level, hand position, letting hand-rims slide through fingers).
	  • Step #2: Transient tip (forward-only push), as used for the soft surface, pot-hole, threshold and level-change ascent skills.
	  • Step #3: Self-save (pull back on hand-rims, lean forward) from a trainer-induced tip into the wheelie position.
	  • Step #4: Full take-off (progressive degrees of tip, until overshoot + self-save).

	• Step #5: Balance strategies in high rolling resistance (RR) setting with trainer-induced initial tip into the balance position. • Step #6: Balance strategies in medium RR (e.g. foam, grass, sand). • Step #7: Balance strategies in low RR (tile). • Step #8: Add the take-off phase and perform the balance phase thereafter. May need to return to the medium-RR setting for this. • Step #9: Exercises (change body position, fingertips only, one hand only, eyes closed, reduced spotter proximity). • Step #10: Start wheelie-related skills (roll forward/back).
Training tips for manual wheelchairs operated by caregivers	• 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. • 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.
Training tips for powered wheelchairs operated by wheelchair users	• Not applicable.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.

7.36 Turns 180° in place in wheelie position	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• In the wheelie position, the learner turns the chair 180^{o} in place, both to the left and right.
Rationale	• As for "performs 30s stationary wheelie" skill (#7.35). • 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 is less than that at a higher level. • This skill is not applicable for powered wheelchairs because of the difficulty and danger involved.
General training tips	• This skill is a combination of skills 7.13 and7.35.
Training tips for manual wheelchairs operated by wheelchair users	• As for skills 7.13 and7.35.
Training tips for manual wheelchairs operated by caregivers	• As for skills 7.13 and7.35. • The caregiver should be careful not to let the wheelchair user's elevated feet hit anything.
Training tips for powered wheelchairs operated by wheelchair users	• Not applicable.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.

7.37 Gets from ground into wheelchair	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU ✔ WST-P/CG ✔
Description	• The wheelchair user gets from the ground into the wheelchair.
Rationale	• This skill is useful when recovering from a fall or from an occasion when the wheelchair user is on the ground for another reason.
General training tips	• After a fall, 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 or occupant before getting back into the wheelchair.

Training tips for manual wheelchairs operated by wheelchair users	• Getting from the wheelchair onto the ground is an opportunity to practice safe falls (onto a mat):
	  • Generally, the wheelchair user should not reach out towards the ground with an arm, unless he/she has exceptional flexibility and can prevent the tip/fall with a gentle push on the ground.
	  • Rear falls: the trainer should first lower the wheelchair user onto an elevated mat, with the wheelchair user's neck flexed and hands pulling on the hand-rims. Failure to hold onto the hand-rims will result in the rear wheels of the wheelchair rolling rapidly forward ("submarining"). Progress to real falls onto an elevated mat. Gradually lower the height of the mat. Immediately after hitting the ground, the wheelchair user can use the hands or forearms to prevent the knees from striking the face.
	  • Forward falls: the wheelchair user should twist to one side and try to roll sideways after striking the ground, protecting the head with the hands..
	  • Sideways falls: the wheelchair user should lean away from the direction of tip, pulling vigorously on the uphill armrest.
	• Out-of-wheelchair approach for getting up from the ground:
	  • Right the wheelchair, lock the brakes and transfer back into it from the front.
	  • If the wheelchair user is sitting in front of the chair then he/she can reach back to the frame to pull himself/herself back onto the seat.
	  • If the person sits beside the wheelchair with the wheel locks off,

	he/she can put one hand on top of the cushion and the other on the floor. Then, lifting the buttocks off the floor, he/she can pull the wheelchair under the buttocks. • Many-step approach: Floor to foot stool to bench to wheelchair seat. Reduce the number of steps with progression. • One can use the seat cushion to increase the height of the floor and to lower the height of the wheelchair seat. • One can approach from a 90-deg angle or straight in front of the wheelchair. Flex the hips and knees fully before starting. Can do in 2 steps, lifting the buttocks onto the footrests first. • Can lift with both arms on the seat at the same time or with one arm on the seat and one on the ground. • If the wheelchair user has the use of the legs, he/she can use the wheelchair to help get up onto his/her feet, then pivot and sit down. • Stay-in-wheelchair approach for getting up from the ground: • Some wheelchair users are able to right themselves while remaining in the wheelchair. • Start on a surface partway between seat height and ground, with the wheelchair on its back (as would be the case after practicing a fall backwards onto an elevated mat). • Pull on rear wheels to get buttocks firmly against the wheelchair seat. • Let the knees bend over the front of the seat. • Lock one brake. • Turn to other side. • Use the forward hand to grab the hand-rim of the rear wheel on the unlocked side as far forward as possible. • Reach the rearmost hand to the floor. • Push firmly with the floor hand and pull with the hand-rim hand. • Push and pull repeatedly, moving the floor-hand hand forward on the floor and the hand-rim hand forward on the hand-rim in a step-wise fashion with each rock until upright.
Training tips for manual wheelchairs operated by 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 at the same time and should lift with bent knees. • If tipping the wheelchair upright from the fully rear-tipped position, locking the brakes will prevent the wheelchair from rolling forward. • A single caregiver may have difficulty in performing this skill without the 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. Without a mechanical lift, maintaining proper ergonomics is challenging. • If the caregiver is large and strong and the wheelchair user is light, the caregiver may be able to safely lift the wheelchair user, with one arm around the back and under the arms and one under the bent knees. • If there are two caregivers, they may pick up the wheelchair user together. This can be done in two ways. o 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. o 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.
Training tips for powered wheelchairs operated by wheelchair users	• As for the general tips and, in some respects, tips for manual wheelchairs above. • If falling backwards, the wheelchair user should tuck the chin and pull himself/herself vigorously forward using the armrests or seat. • After a fall, the power should be turned off. Watch out for spilled battery acid. • The power should be turned off while the getting-up skill is being practiced.
Training tips for powered wheelchairs operated by caregivers	• As for manual wheelchairs operated by caregivers. • As for powered wheelchairs operated by wheelchair users.

Originally approved for distribution and use: March 14, 2008
Current edition: WSTP Version 4.1.49, April 11, 2012.

7.38 Ascends stairs	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• The wheelchair user and the wheelchair get from the bottom to the top of a set of stairs.
Rationale	• Although alternative means of getting from a lower to a higher level are often present, the use of stairs is frequently the only option. Although 3-5 stairs are not many, they are representative of the skills needed for a full flight of steps. • This skill is not applicable for most powered wheelchairs because of the difficulty and danger involved.
General training tips	• Regardless of method, this is a challenging skill. There is a risk of injury due to falling or due to straining the arms. Stairs should be avoided whenever possible. • When providing training, proper spotting is important.

Training tips for manual wheelchairs operated by wheelchair users	• 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.
	• Out of wheelchair, on buttocks:
	  • Position the wheelchair next to the stairs, in a way similar to how the wheelchair would be positioned for any transfer. Lock the brakes. Clear the footrests.
	  • The wheelchair user transfers from the wheelchair to the 2nd or 3rd step, usually using a standing-pivot or a crouch-pivot method. The stair handrail may be used.
	  • A buttocks protector is a good idea.
	  • The wheelchair may be brought up the stairs by the wheelchair user or by an assistant. If bringing it himself/herself, he/she should pull the folded wheelchair up by facing it downhill, and tipping it back fully. The wheelchair user should push straight down with one hand on the wheelchair's push-handles to keep the wheelchair from rolling or sliding down the stairs.
	  • As the wheelchair user moves 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. Then the hands and feet 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. • Out of wheelchair, on hands and knees: o As for on buttocks above, but facing up the stairs and using a crawling action. • In wheelchair: • Reposition the rear anti-tip devices to allow the rear wheels to approach the first stair and to later permit the wheelchair to tip backwards into the wheelie position. • The starting position is with the wheelchair user in the wheelchair, with the seat belt (if any) on. • Back up to the lowest step, closest to the handrail on the side of the stronger arm. • The wheelchair user reachs 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 past the balance point, using the other hand on the same-side rear wheel to prevent it from rolling forward. • The wheelchair user uses the hand on the handrail to pull while using the other hand to roll the rail-side wheel up the step. • Proceed up one stair at a time. • Progression: • In describing a set of stairs, one refers to the horizontal and vertical dimensions as the “run” and “rise” respectively. • Ideally, for training it is useful to have stairs with a variety of runs (start big, gradually get smaller) and rises (start small and get gradually bigger). Can use a curb first, as an example of a single step. • Variations: • If the staircase is curved, there is more “run” on the outside of the curve, so it will be easier on the outside.

	Make sure the rear wheels are square to each step.

Training tips for manual wheelchairs operated by caregivers	• Wheelchair user out of the wheelchair:
	  • The caregiver can assist by merely spotting and/or bringing the wheelchair up the stairs. For the latter, the caregiver proceeds backwards up the stairs with the tipped wheelchair downhill.
	  • Variations:
	  • Piggy-back style.
	  • Fire-fighter's over-the-shoulder carry, with one strong person.
	  • Two-man carry, either front and back or by creating a "seat" of their interlocked hands.
	
	• Wheelchair user in the wheelchair:
	  • The starting position is with the wheelchair user in the wheelchair, with the seat belt (if any) on.
	  • Back up to the lowest step, closest to the handrail on the side of the stronger arm.
	  • Wheelchair user with the hands on wheels or handrails, assisting to the extent possible.
	  • To ascend, tip the wheelchair back and roll (not lift) the wheelchair up one step at a time.
	  • 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 (e.g. rolling the non-rail-side wheel up the step while the wheelchair user pulls on the handrail with one or both hands).
	  • With two caregivers and a wheelchair user who is able to assist, one of the caregivers can be positioned uphill and pull on the push-handles while the other caregiver is below and wheelchair user functions as described above. The wheelchair user or one caregiver should take the lead in coordinating the timing (e.g. to the count of "ready, set, go" for each step).
	  o If the wheelchair user cannot physically assist much, ideally there should be three caregivers available. One caregiver positions him/herself above, pulling on the push-handles, but not too hard because of the awkward positioning that could injure the back. This caregiver is turned slightly to one side, with one foot on the stair above the wheel and the

	other on the next higher stair. Two caregivers below. Each uses the inside hand to hold the frame of the wheelchair, not a part that could come off (e.g. footrests). The footrests can be removed for easier access to the frame. The outside hand is used to roll the wheel up onto the next step. It begins at about the 3:00 o'clock position and moves up to the 1:00 o'clock position.
Training tips for powered wheelchairs operated by wheelchair users	• Not generally applicable.
Training tips for powered wheelchairs operated by caregivers	• Not generally applicable.

7.39 Descends stairs	
Versions applicable	• WST-M/WCU ✔ WST-M/CG ✔ • WST-P/WCU **X** WST-P/CG **X**
Description	• The wheelchair user and the wheelchair get from the top to the bottom of a set of stairs.
Rationale	• As for "ascends stairs" skill (#7.38).
General training tips	• As for 7.38, but in the reverse direction. • 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.

Training tips for manual wheelchairs operated by wheelchair users	• Out of the wheelchair, on the buttocks or on hands and knees:
	  • Reverse of ascent procedure (7.38).
	
	• In the wheelchair:
	  • The safest method is facing up the stairs. The wheelchair user grabs one or both rails with both hands, leans well forward, 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, as the casters and/or footplates bang down each stair.
	  • Variations:
	  • Backwards, as above, but using one hand, with the other hand on the non-rail-side hand-rim.
	  • In wheelie, forward, one step at a time. This is possible if there is an adequate horizontal distance (run) on each step. The run needs to be greater than the radius of the rear wheel to permit this technique. The wheelchair user drops down one step at a time, like doing a wheelie down a curb, pulling back to bring the rear wheels against the step before proceeding to the next step. This should be practiced on a single curb first.
	  • In wheelie, forward continuous method: This method is difficult to spot. It is only recommended for a short flight of stairs and when no handrails are available. The wheelchair user approaches the top step at a comfortable speed and pops the casters just before the casters reach the drop off. In this technique, the wheelchair user treats

	the stairs like an incline, with the rear wheels skimming the edges of the steps. If the wheelchair user is going to fall, it is best to fall backwards, not forwards. Learn the method on curbs before attempting it on stairs. The trick is in popping the casters enough but not too much.
Training tips for manual wheelchairs operated by caregivers	• As for 7.38, but in the reverse direction.
Training tips for powered wheelchairs operated by wheelchair users	• Not applicable.
Training tips for powered wheelchairs operated by caregivers	• Not applicable.