CHAPTER 10

第十章

Technologies That Enable Mobility支持移动性的技术

CHAPTER OUTLINE

Activity Component 活动组件

Human Component 人类组件

Disorders Resulting in Mobility Impairments 疾病导致移动性障碍

Mobility Issues Across the Lifespan 跨寿命的移动性问题

Mobility and Obesity 流动性和肥胖

Context Components 背景组件

Physical Context 物理背景

Social Context 社会背景

Cultural Context 文化语境

Institutional Context 制度背景

Assessment for Wheeled Mobility 轮式移动性评估

Needs Assessment 需求评估

Assessment of the Human Factors 人的因素的评估

Assessment of the Context 背景的评估

Assistive Technology 辅助技术

Supporting Structure 支撑结构

LEARNING OBJECTIVES 学习目标

On completing this chapter, you will be able to: 完成本章后，您将能够：

Frame Types 框架类型

Propelling Structure: Manual 推进结构：手动

Propelling Structure: Powered 推进结构：动力

Specialized Bases for Manual Wheelchairs 手动轮椅专用基座

Specialized Bases for Powered Wheelchairs 电动轮椅专用基座

Smart Wheelchairs 智能轮椅

Wheelchair Standards 轮椅标准

Implementation and Training for Manual and Powered Mobility Fitting of Mobility Systems

手动和动力配合的移动系统的实施和培训

Maintenance and Repair of Personal Mobility Systems 个人移动系统的维护和修理

Developing Mobility Skills for Manual and Powered Systems Outcome Evaluation 开发手动和动力系统的移动技能结果评估

Outcome Evaluation Instruments 结果评价仪器

Outcomes of Wheeled Mobility Device Use 轮式移动设备使用的结果概要

Summary 总结

1. Identity the activity, human, and contextual influences 识别活动，人类和情境影响。
2. Describe the assessment of the consumer for a mobility of the wheelchair on the function of the wheelchair 描述消费者在轮椅功能系统中轮椅的移动性的评估
3. Describe the two primary structures of wheelchairs 描述轮椅的两个主要结构
4. Identify the major characteristics of manual wheelchairs确定手动轮椅的主要特点

5.Describe the classifications of powered mobility systems use of wheeled mobility devices and their characteristics 描述使用轮式移动设备的动力移动系统的分类及其特征

6.Understand the influence of the relationship between on the use of wheeled mobility the center of gravity of the user and the center of mass system 理解使用轮式移动和用户重心、质心之间关系的影响

8.Describe the key elements of implementation and training for the use of wheeled mobility devices 描述在执行和训练轮式移动装置关键要素

9. Identify standardized assessments that are specifc to 识别特定的标准化评估及其特点

KEY TERMS 关键条款

Alignment对准

Anti-Tip Devices 防尖端设备

Armrests 扶手

Bariatrics 肥胖病

Bariatric Chair 减肥椅

Camber 弯曲

Center of Mass 质心

Center of Gravity 重心

Dependent Mobility Footplate 依赖移动性脚踏

Front Rigging 前面的索具

Independent Manual Mobility 独立手动移动

Independent Powered Mobility 独立电动移动

Legrest 腿部

Lightweight Wheelchair 轻便轮椅

Lightweight High-Strength Wheelchair 轻量高强度轮椅

Low-Shear Systems Manual Wheelchair Nonproportional Control Powered Wheelchair Propelling Structure Proportional Control Push Handles

Recline 低剪切系统手动轮椅非比例控制电动轮椅推进结构比例控制推手柄

横卧

Rigid Sport Ultralightweight Wheelchair Scooter Shear 刚性运动超轻型轮椅滑板车剪

Smart Wheelchair 智能轮椅

Standard Wheelchair 标准轮椅

Standing Frame 常设框架

Standing Wheelchair 常设轮椅

Supporting Structure 支撑结构

Tilt 倾斜

Ultralightweight Wheelchair超轻轮椅

Wheel Lock 车轮锁

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CHAPTER 10

Technologies That Enable Mobility

第10章启用移动性的技术

Mobility is fundamental to each individual’s quality of life and is necessary for functioning in each of the performance areas: self-care, work or school, and play or lei- sure. As we have described for other activity outputs, limitations to functional mobility can be either augmented or replaced with assisitive technologies. Te activity output of ambulation can be augmented with low-tech aids such as canes, walkers, or crutches or replaced by wheeled mobility systems of various types. In addition to the functional gain of increased independence in mobility, other goals such as positive self-image, social interaction, and health maintenance are achieved. In this chapter we focus on manual and powered wheelchair systems to enhance an individual’s mobility. Our emphasis is on the total process of delivering these systems to those who need them, from initial need and goal setting, through assessment and recommendation, to implementation and training.

移动性是每个人生活质量的根本，并且在每个性能领域的运作是必要的：自理，工作或学校，以及游戏或放松。正如我们已经描述的其他活动输出，功能移动性的限制可以扩充或替换为辅助技术。移动的活动输出可以用低技术辅助设备（例如手杖，助行器或拐杖）来增加，或者由各种类型的轮式移动系统代替。除了提高对移动独立性的功能获得外，还实现了其他目标，如积极的自我形象，社会互动和健康保障。在本章中，我们专注于手动和电动轮椅系统，以提高个人的移动性。我们的重点是将这些系统交付给所需之人的整个过程，从初始需求和目标设定，到评估和建议，到实施和培训。

ACTIVITY COMPONENT 行动部分

This chapter discusses personal mobility (i.e., the ability to move oneself from one place to another) within a building, around and outside a building, or between buildings. Personal mobility is distinguished from mobility achieved through the use of any form of transportation, private or public (see Chapter 11). Te World Health Organization’s Classification of Functioning identifies mobility as an activity, rather than an impairment of a body structure or function (WHO, 2001). Only one sub-classifcation, moving around using equipment, specifically refers to the use of mobility devices. When using the ICF for its intended purpose of classification of factors that influence a health condition, the other categories of the mobility classification exclude anyone who uses a mobility device to get around. However, for the purposes of this discussion, relevant mobility classifications will be identified to illustrate different aspects of mobility.

本章讨论了在建筑物内，建筑物周围和外部或建筑物之间的个人移动性（即，将自己从一个地方移动到另一个地方的能力）。 个人移动性与通过使用任何形式的私人或公共交通（见第11章）实现的移动性不同。 世界卫生组织的功能分类识别移动性是一种活动，而不是身体结构或功能的损害（WHO，2001）。 只有一个子分类，使用设备移动，具体指的是使用移动设备。 当使用ICF用于分类导致健康状况的因素的预期目的时，移动性分类的其他类别排除任何使用移动设备来绕行的人。 然而，为了本讨论的目的，相关的移动性分类将被识别以示出移动性的不同方面。

The ICF describes moving around inside different types of buildings, including the home and community. Moving inside a building involves getting in and out of a building, moving to different locations, moving between floors, and moving outside and around a building. Te ICF mobility chapter also describes moving between buildings (i.e., leav- ing one building and traveling to another one).

ICF描述了在不同类型的建筑物内移动，包括家庭和社区。 在建筑物内移动涉及进入和离开建筑物，移动到不同的位置，在楼层之间移动，以及移动到建筑物外部和周围。 ICF移动性章节还描述了在建筑物之间移动（即，离开一个建筑物并行进到另一个建筑物）。

Use of transportation to move around is also included in the ICF mobility chapter, including traveling as a passenger or as the driver. This classification explicitly excludes the use of mobility devices, for the purposes of the ICF. However, for our purposes, we think about a wheelchair used as a seat in some form of vehicle and the requirements to lift a mobility device in and out of a vehicle.

使用交通工具移动也包括在ICF移动性章节中，包括作为乘客或驾驶员旅行。 为了ICF的目的，这种分类明确排除了移动设备的使用。 然而，为了我们的目的，我们考虑在某种形式的车辆中用作座椅的轮椅以及将移动装置提升到车辆内和外部的要求。

Mobility is a foundational activity for many other skills and activities. It enables a person to move to or about a location where the activity will be completed, whether that is within a building or in the community and beyond. Several authors describe the lack of access to mobility devices (Buck, 2009; Mortensen et al., 2005) as a limitation to full participation in society.

移动性是许多其他技能和活动的基础活动。 它使一个人能够移动到或将围绕活动将要完成的地点，无论是在建筑物内还是在社区内和之外。 一些作者的描述因为全方位参与社会的限制而缺少使用移动设备（Buck，2009; Mortensen等人，2005）。

Mobility using a wheelchair is an activity itself that has received considerable attention to describe the skills that are required for competence. Measures such as the Wheelchair Skills Test (Kirby et  al., 2002; Kirby et  al., 2004) identify different wheelchair skills that range from basic use of the wheelchair, such as engaging and disengaging the brakes, basic maneuvers such as moving the wheelchair forward a short distance, and complex maneuvers such as climbing a curb or popping a wheelie. These skills are important when understanding the activity of mobility when using a wheelchair.

使用轮椅的移动性是一种活动本身，其已经受到相当大的关注以描述能力所需的技能。 诸如轮椅技能测试（Kirby等人，2002; Kirby等人，2004）的措施识别不同轮椅技能，其范围从轮椅的基本使用，例如接合和分离制动器，基本操纵例如移动轮椅 前进一段短距离，以及复杂的动作，例如攀爬路缘石或弹出自行车。 这些技能在理解使用轮椅时的活动中都非常重要。

The wheelchair assessment identifies the occupations in which the individual will engage while using a wheelchair. Because the wheelchair and seating components are a unit, the occupations identified include both those for which seated support is of primary importance and those for which mobility is required. For example, in the workplace, seated support is of primary importance when considering work occupations that are completed at a desk. Mobility becomes important when the individual moves about the building to access different locations or to enter and exit. Both types of occupations influence the recommendations derived from the results of the wheelchair assessment.

轮椅评估将识别使用轮椅的个体职业。 因为轮椅和座椅部件是一个单元，所以识别的职业包括最重要的座位支持和移动需求。 例如，在工作场所，在考虑到在办公桌完成的工作职业时，座位支持是至关重要的。 当个体围绕建筑物移动以访问不同的位置或者进入和离开时，移动变得重要。 这两种类型的工作都影响了从轮椅评估结果中得出的建议

The frequency of use of the wheelchair is another activity consideration. Some clients require use of their chair for most of their waking hours, perhaps transferring to another seat in the evening when they are relaxing, but otherwise using the wheelchair on a full-time basis. Alternatively, some clients may only need a wheelchair when the need for mobility over an extended time arises and fatigue or some other condition interferes. For example, some clients may use a wheelchair on a part-time basis when they go out into the community for extended times or for moving around large sites such as an airport. In other situations, such as moving about the home, a wheelchair is not required because their mobility abilities enable them to move safely in another way.

使用轮椅的频率是另一个活动的考虑因素。 一些客户需要在大多数清醒时间使用他们的椅子，也许当他们晚上放松时转移到另一个座位，否则会在全天使用轮椅。 或者，一些客户可能在长时间移动、疲劳或者有其他干扰时需要一个轮椅。例如，一些客户可能在部分时间使用轮椅，当他们需要长时间出入社区或在大型站点（例如机场）周围移动时。 在其他情况下，例如在家中移动，就不需要轮椅，因为他们的移动能力能够保证以另一种方式安全地移动。

Understanding the activity of mobility also requires knowledge of how the wheelchair is used—is the client independent in all wheelchair skills or are there some instances when assistance is needed? For example, a client who uses a wheelchair on a part-time basis may not have developed sufficient skills to maneuver it safely, and so requires assistance from other persons. Another client who is developing wheel- chair skills or who is unable to learn advanced skills like a wheelie, may only require assistance for specific skills. A competent wheelchair user, who uses it on a full-time basis, likely requires assistance rarely, in unusual circumstances (e.g., moving the chair across sand or snow).

了解移动活动也需要知道客户如何独立用技巧来使用轮椅或在某些需要协助的情况下。例如，一个客户在部分时间使用轮椅的话，不可能提高技能来保证其安全性，所以需要其他人的帮助。另一个客户提高轮椅的技能或无法达到高技能像杂技，可能只需要援助的具体技巧。一个经常使用轮椅的人，在不寻常的情况下（例如，轮椅对面有沙子或者雪），可能很少需要帮助。

Mobility, the ability to move around in and among loca- tions, is both an activity on its own and one that supports other activities. When considering the activity component of wheelchair mobility, the clinician seeks to understand the frequency with which the wheelchair is used, the assistance required and the circumstances under which that assistance is needed, the wheelchair skills available and needed, when and how the wheelchair will be transported, and other occu- pations that are conducted while seated in the wheelchair.

移动性（地点之间移动的能力）是活动本身，也是可以支持其他活动。 当考虑轮椅移动性的活动部分时，临床医生试图理解使用轮椅的频率，需要的帮助和需要该帮助的情况，可用和需要的轮椅技能，轮椅何时以及将如何运输和其他需要轮椅的职业。

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HUMAN COMPONENT 人为成分

A significant increase in the number of individuals using mobility systems, across many countries, is related to three trends: (1) the increasing proportion of older adults in many countries (WHO, 2011), (2) the rising rates of obesity (WHO, 2008, 2011), and (3) accessibility legislation. The population of most developing countries is aging, with the proportion of older individuals (65 years and older) rang- ing from a low of 10% in South Africa to a high of ≈40% in Japan by 2050, for OECD countries reporting these projections (Ministry of Industry, 2010). Te projection for the United States is that 20.2% of the population will be over 65 years of age. Te Canadian estimate is 22.1% (Ministry of Industry, 2010). Te proportion of individuals reporting a disability increases substantially with age (Ministry of Industry, 2010). Age-related physical changes such as arthritis result in mobility impairments that require the use of mobility devices (Ministry of Industry, 2010).

在许多国家，使用移动系统的个人数量的显着增加与三个趋势有关：（1）许多国家老年人比例增加（世卫组织，2011年），（2）肥胖率上升，2008，2011），以及（3）可达性立法。大多数发展中国家的人口正在老龄化，到2050年，老年人（65岁及以上）的比例从南非的10％低到日本的高达40％，对于报告这些问题的经合组织国家（工业部，2010年）。美国的预测是，20.2％的人口将超过65岁。加拿大的估计是22.1％（工业部，2010）。报告残疾的个人的比例随年龄增长显着增加（工业部，2010年）。年龄相关的身体变化，如关节炎，导致需要使用移动设备的行动障碍（工业部，2010年）。

The proportion of morbidly obese individuals is rising, particularly in North America, which has resulted in the development of mobility devices specifically designed to support the increased size and weight of these individuals (WHO, 2008). Bariatric chairs are now available for these individuals whose mobility is impaired by obesity and related chronic diseases.

病态肥胖个体的比例正在上升，特别是在北美，导致开发了专门用于支持这些个体的体型和体重增加的移动设备（WHO，2008）。减肥椅现在可用于这些个人，其行动受到肥胖症和相关慢性疾病的损害。

Accessibility legislation in many countries has reduced physical and institutional barriers to community participation of individuals with disabilities, with the result that more people are using mobility devices for instrumental activities of daily living. This type of legislation affects the incidence of wheelchair use in two ways: mandating construction of physical environments that are accessible to individuals who use a wheelchair and defining funding mechanisms to sup - port the acquisition of mobility devices. Relevant legislation is discussed in Chapter 3 .

许多国家的无障碍立法减少了社区残疾人参与的物理和制度障碍，结果是更多的人使用移动设备进行日常生活的工具活动。 这种类型的立法以两种方式完善轮椅使用的发生：授权建造使用轮椅的个人可以使用的物理环境，以及定义资助机制以支持移动设备的获取。 相关立法在第3章讨论。

Data collected in the 2000 U.S. census indicate that 20.9 million U.S. families have at least one individual with a disability living in their household ( Wang, 2005 ). Of these, 16.6% report a physical disability that results in a functional limitation. The Profle of Disability in Canada indicates that 13.7% of the Canadian population reports a mobility impairment ( Cossette, 2002 ).

在2000年美国人口普查中收集的数据表明，2090万美国家庭至少有一个残疾人生活在家里（Wang，2005）。其中，16.6％报告了导致功能受限的身体残疾。加拿大的残疾人士表示，13.7％的加拿大人口报告了行动障碍（Cossette，2002）。

Kaye, Kang, and LePlante (2002) provide information on the number of Americans who use mobility devices. These data are derived from the 1994–1995 National Health Interview Survey on Disability (NHIS-D). The survey indicated that 1.6 million Americans who live outside of an institutional setting use a mobility device.

Kaye，Kang和LePlante（2002）提供了关于使用移动设备的美国人数量的信息。 这些数据来自1994 - 1995年国家残疾问题卫生面试调查（NHIS-D）。 调查表明，160万美国人在公共场所之外使用移动设备。

The vast majority of these individuals (1.5 million) use a manual wheel - chair ( Kaye et al., 2002 ). Elderly individuals (65 years of age or older) have the highest rate of mobility use, accounting for 57.5% of manual wheelchair users and 69.7% of power wheelchair users ( Kaye et al., 2002 ). Te WHO report on the Guidelines on the Provision of Manual Wheelchairs in Less-Resourced Countries ( WHO, 2008 ) estimates 1% of the population in developing countries requires a wheelchair.

这些巨大个体（150万）主要使用手动轮椅（Kaye等人，2002）。老年人（65岁或以上）移动使用率最高，占手动轮椅使用者的57.5％和电动轮椅使用者的69.7％（Kaye等，2002）。世卫组织关于在资源贫乏国家提供手动轮椅的准则的报告（世卫组织，2008年）估计，发展中国家1％的人口需要轮椅。

CHAPTER 10

Technologies That Enable Mobility231

Disorders Resulting in Mobility Impairments There are many causes of mobility impairment. Disorders that result in mobility impairment may be neurological, musculoskeletal, or cognitive in nature. Bear in mind that not all individuals with a given diagnosis experience a similar impairment in mobility. Te onset of the disorder, whether it was acquired or congenital, also affects the individual’s mobility needs.

导致移动性障碍的疾病是许多移动性障碍的原因。导致运动障碍的障碍可以是神经学，肌肉骨骼或认知性的。记住，并非所有具有给定诊断的个体在移动性方面都经历类似的损伤。无论是获得性还是先天性疾病的发作，都会影响个体的移动性需求。

Kaye et al. (2002) present the top 10 conditions in the United States that result in use of a wheelchair or scooter. Individuals who have had a stroke are the leading group of mobility device users (11.1%) ( Kaye at al., 2002 ). Additional neurological disorders that may result in mobility impairment include cerebral palsy, Guillain-Barré syndrome, Hun tingtons chorea, traumatic brain injury, muscular dystrophy, Parkinson’s disease, poliomyelitis, spinal cord injury, spina bifda, and multiple sclerosis. Symptoms commonly seen in these neurological disorders are muscle weakness or paralysis, sensory defcits, and abnormal muscle tone. All these disorders can lead to limitations with joint range of motion, postural control, and mobility. Te individual may also have cognitive and sensory impairments as a result of the disorder.

Kayeetal（2002）提出了在美国导致使用轮椅或踏板车的前10个条件。已经发生中风的个人是移动设备用户的领先群体（11.1％）（Kaye等人，2002）。可能导致移动性障碍的其它神经障碍包括大脑性麻痹，格林 - 巴雷综合征，亨廷顿氏舞蹈病，创伤性脑损伤，肌营养不良，帕金森病，脊髓灰质炎，脊髓损伤，脊柱裂和多发性硬化。在这些神经疾病中常见的症状是肌肉无力或平滑肌症，感觉缺陷和异常肌张力。所有这些疾病可导致关节活动范围，姿势控制和移动性的限制。个体也可能由于该病症而具有认知和感觉损伤。

Orthopedic and rheumatological conditions account for another large group of mobility device users ( Kaye et  al., 2002 ). Some of the symptoms commonly seen in individuals with arthritis include painful, swollen, and stiff joints (particularly in hand and wrist); muscle weakness, muscle wasting around the affected joints, complaints of feeling fatigued, and, in later stages, joint contractures resulting in range-of-motion limitations. Other disorders that affect the musculoskeletal system and may result in mobility impairments include ankylosing spondylitis, osteogenesis imperfecta, osteoporosis, Paget’s disease, and scoliosis. Individuals with a lower extremity amputation, acquired or congenital, may also use a mobility device.

矫形和风湿病是另一大群移动设备用户（Kayeetal 2002）。 在患有关节炎的个体中常见的一些症状包括疼痛，肿胀和僵硬关节（特别是在手和手腕中）; 肌肉无力，受感染关节周围的肌肉萎缩，感觉疲劳的投诉，以及在后期阶段，导致运动范围限制的关节挛缩。 影响肌肉骨骼系统并可能导致运动功能障碍的其他病症包括强直性脊柱炎，成骨不全症，骨质疏松症，佩吉特氏病和脊柱侧凸。 具有下肢截肢，获得性或先天性的个体也可以使用移动装置。

Diabetes, cardiorespiratory conditions, and obesity are chronic conditions that may require the use of a mobility device. Frequently, fatigue or restrictions related to energy expenditure are the reasons for use of a mobility device with this population. Amputations resulting from complications due to diabetes may also lead to the use of a mobility device.

糖尿病，心脏呼吸病症和肥胖症是可能需要使用移动性装置的慢性病症。通常，与能量消耗有关的疲劳或限制是使用这种人群的移动设备的原因。由于糖尿病引起的并发症引起的截肢也可导致使用移动设备。

Disorders that affect an individual’s cognitive functioning and ability to learn, such as Alzheimer’s disease and cognitive impairment, can also be associated with mobility impairments. In the first instance, dementia, the adult wheelchair user may require special consideration of safety measures if the user has limited memory or insight concerning safe mobility ( Mortenson et al., 2005 ). For example, as the cognitive impairment progresses, judgment can become impaired. A client at this stage may not recognize unsafe situations such as a stairwell and attempt to propel the chair down stairs or may not be able to control anger and use the wheelchair as a weapon and propel it into another person. In situations where cognitive impairment limits safe mobility, modifcations are required to wheelchair skills training to simplify instructions and give additional way finding cues in familiar environments; measures such as use of seatbelts may be used for safety; and considerations given to the ability of the caregiver to push, lift, and stow the chair when this assistance is required. A wheelchair seatbelt may be considered a restraint in some jurisdictions. A summary of best practices for use of restraints is provided in Chapter 9.

影响个体的认知功能和学习能力的疾病，例如阿尔茨海默氏病和认知损伤，也可以与运动障碍相关。在第一种情况下，如果用户对安全移动性具有有限的记忆或洞察力，则成年轮椅使用者可能需要特别考虑安全措施（Mortenson等人，2005）。例如，随着认知障碍的进展，判断可能受损。在这个阶段的客户可能不认识不安全的情况，例如楼梯间和尝试推动椅子下来楼梯或者可能不能控制愤怒和使用轮椅作为武器并且推进到另一个人。在认知障碍限制安全移动的情况下，需要进行修改以轮椅技能训练，以简化指令并在熟悉的环境中给出额外的寻找线索;可以使用诸如使用安全带的措施来确保安全;以及在需要该辅助时护理者推动，提起和收起椅子的能力的考虑。轮椅安全带在某些管辖区可能被视为限制。第9章提供了使用约束的最佳做法的摘要。

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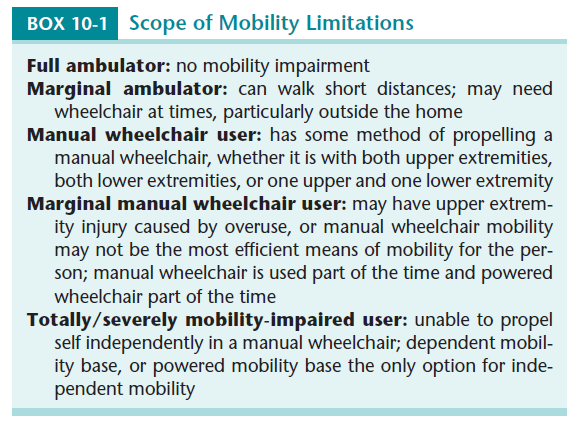
CHAPTER 10 Technologies That Enable Mobility

Warren (1990) proposes a classification system that is useful to understand ambulation needs. Te degree of limitation in mobility varies across a broad scope, as shown in Box 10-1. At one end of the range are individuals who are considered marginal ambulators. At the opposite end of the range are those individuals who have severe mobility limitations and are dependent in manual mobility, with powered mobility being their only option for independence.

Warren（1990）提出了一种分类系统，用于了解移动的需要。 移动性的限制程度在很宽的范围内变化，如框10-1所示。 在范围的一端是被认为是边缘行动者的个体。 在范围的另一端是那些具有严重的移动性限制并且依赖于手动移动性的个体，其中动力移动是他们独立的唯一选择。

Warren (1990) describes marginal ambulators as able to move independently in their environment but functional only at a slow rate or for short distances. Persons who have marginal ambulating skills can benefit from part-time use of a powered mobility device such as a scooter, which allows them to walk inside the home using a walker or cane and use a powered device within the home to augment ambu- lation. Next are individuals who are exclusive users of manual wheelchairs. They may rely on a caregiver to propel the wheelchair or they propel a manual wheelchair using one of three methods: (1) using both upper extremities, (2) using both lower extremities, or (3) using an upper and lower extremity on the same side of the body (e.g., a person who has had a stroke). Marginal manual wheelchair users are able to propel a wheelchair manually but have upper body weakness, respiratory problems, or postural asymmetry as a result of pushing that limits their ability to propel a manual chair for a prolonged time (Warren, 1990). Marginal manual wheelchair users may also include individuals who formerly used a manual wheelchair for their mobility needs and have sustained an overuse injury from propelling the chair. Propelling a wheelchair for any length of time depletes the energy of these individuals and compromises their productivity in other areas of life. Marginal manual wheelchair users can benefit from powered mobility on a full-time or part-time basis.

沃伦（1990）描述了腿脚不方便的患者能够在他们的环境中独立移动，但只能以缓慢的速度或短距离运行。具有边界行走技能的人可以受益于部分时间使用动力移动设备，例如滑板车，这允许他们使用步行者或拐杖走在家里，并使用家庭内的动力设备增加了救护。接下来是手动轮椅的独立用户。他们可以依靠护理人员推动轮椅，或者他们使用三种方法之一推进手动轮椅：（1）使用两个上肢，（2）使用两个下肢，或（3）使用上肢和下肢在身体的同一侧（例如，已经中风的人）。边缘手动轮椅使用者能够手动推动轮椅，但是具有上身弱，呼吸问题或由于推动而导致的姿势不对称性，这限制了他们长时间推进手动椅子的能力（Warren，1990）。边界手动轮椅使用者还可以包括以前为了他们的移动需要使用手动轮椅并且由于推动椅子而遭受过度使用伤害的个人。不管推动轮椅的时间长短，都会耗尽这些人的能量，并损害他们在生活的其他领域的生产力。边缘手动轮椅使用者可以受益于全职或兼职的动力移动。



BOX 10-1 Scope of Mobility Limitations

Full ambulator: no mobility impairment

Marginal ambulator: can walk short distances; may need

wheelchair at times, particularly outside the home

Manual wheelchair user: has some method of propelling a

manual wheelchair, whether it is with both upper extremities,

both lower extremities, or one upper and one lower extremity Marginal manual wheelchair user: may have upper extremity injury caused by overuse, or manual wheelchair mobility

may not be the most efficient means of mobility for the per-

son; manual wheelchair is used part of the time and powered

wheelchair part of the time

Totally/severely mobility-impaired user: unable to propel self independently in a manual wheelchair; dependent mobility base, or powered mobility base the only option for independent mobility

BOX 10-1移动性限制的范围

充分行动：没有运动障碍

边缘行动者：可以行走短距离; 可能需要轮椅，特别是在家庭外

手动轮椅使用者：具有推动手动轮椅的某种方法，无论是上肢，两个下肢，还是一个上肢和一个下肢。边缘手动轮椅使用者：可能由过度使用造成的上肢损伤，或手动轮椅移动 可能不是人的最有效的流动手段; 手动轮椅使用部分时间和电动轮椅部分时间

完全/严重的流动性受损的用户：无法在手动轮椅中自主推进; 依赖移动性基础或动力移动性基础是独立移动性的唯一选择

Mobility Issues Across the Lifespan

跨寿命的移动性问题

Mobility needs differ across the lifespan. In this section, we focus on two issues that warrant special attention: (1) powered mobility for young children, and (2) mobility for older adults.

移动性需求在整个生命周期中不同。 在本节中，我们关注两个值得特别注意的问题：（1）年轻儿童的机动性，（2）老年人的移动性。

The use of powered mobility by young children is an area that has received a great deal of attention in the last decade. In the past, powered mobility was deemed inappropriate for young children for a number of reasons. These concerns were related to the ability of children to operate a powered wheelchair safely, the initial cost of the wheelchair and cost of replacing it as the child grows, and possible detrimental effects on physical development if the child depends on a powered system instead of self-locomotion (Kermoian, 1998). Recent literature supports the provision of powered mobility to young children (Rosen et al., 2009; Furumasu, Guerette, & Teft, 2004; Kangas, 2010).

在过去十年中，年轻儿童使用机动移动是一个受到极大关注的领域。 在过去，动力运动被认为不适合幼儿，原因有很多。 这些关注涉及儿童安全操作电动轮椅的能力，轮椅的初始成本和随着儿童成长而更换它的成本，以及如果儿童依靠动力系统而不是自行车，可能对身体发育造成不利影响（Kermoian，1998）。 最近的文献支持向年幼儿童提供动力移动（Rosen等人，2009; Furumasu，Guerette，＆Teft，2004; Kangas，2010）。

Opportunities for early mobility have widespread benefits to the child, not only physically, but cognitively and socially (Deitz, Swinth, & White, 2002; Jones, McEwen, & Neas, 2012; Rosen et al., 2009). Children who are able to move independently in their environment can initiate interactions with others; they don’t need to wait for another person to take them where they want to go.

早期移动的机会不仅在身体上，而且在认知上和社会上对儿童具有广泛的利益（Deitz，Swinth，＆White，2002; Jones，McEwen，＆Neas，2012; Rosen等人，2009）。 能够在环境中独立移动的儿童可以启动与他人的互动; 他们不需要等待其他人把他们带到他们想去的地方。

Most current literature suggests that affording the opportunity for mobility should occur at an appropriate develop- mental time. Te goal of such mobility is not to learn how to control a chair, but to experience movement within the environment and to engage in relevant functional tasks, sup- ported by mobility. As with any young child, it is the responsibility of the parent, caregiver, or clinician to ensure a safe environment in which the child can explore and experience mobility (Kangas, 2010; Rosen et al., 2009).

大多数现有文献表明，提供机动性的机会应该在适当的发展时间发生。 这种移动性的目标不是学习如何控制椅子，而是体验在环境中的运动，以及从事由移动性支持的相关功能性任务。与任何幼儿一样，父母，照顾者或临床医生负责确保儿童可以探索和体验移动的安全环境（Kangas，2010; Rosen等，2009）。

Some needs that are specific to the older adult wheelchair user have been identified in the literature. Comfort, safety, increased function, and a feeling of security when moving in their environment have been identified as important needs related to seating and mobility for residents of long-term care facilities (Mendoza et al., 2003; Mortenson et al., 2005; Mortenson et al., 2006). Te older adult wheelchair user may depend on another person to push the wheelchair. Terefore a mobility device that can be used easily by an attendant is important (Buck, 2009; Ham, Aldersea, & Porter, 1998). Safety and security are deemed important for the user of the wheelchair, as well as for the care provider. For instance, it is important that the care provider be able to transfer a person in and out of the wheelchair safely. Both the user and the care provider will be more inclined to use a wheelchair that is comfortable, safe, secure, and easy to use.

在文献中已经识别出对于较老的成年轮椅使用者特定的一些需求。 舒适，安全，功能增强和在环境中移动时的安全感已被认为是与长期护理设施的居民的就座和移动有关的重要需求（Mendoza等人，2003; Mortenson等人，2005 ; Mortenson等，2006）。 老年人轮椅使用者可以依靠另一个人推动轮椅。 因此，可以由服务人员容易使用的移动设备是重要的（Buck，2009; Ham，Aldersea，＆Porter，1998）。 安全和牢固对于轮椅的使用者以及护理者来说被认为是重要的。 例如，重要的是护理提供者能够安全地使用轮椅。 用户和护理提供者将更倾向于使用舒适，安全，牢固且易于使用的轮椅。

Mobility and Obesity

移动性和肥胖

Wheelchairs that target the bariatric client are a recent development in wheelchair design. Bariatrics is a term that describes the practice of medicine concerning individuals who are significantly overweight. It is derived from the Greek “baros” meaning weight and “iatrics” meaning medical treatment. In some situations, the client’s obesity is the cause of the mobility impairment. Obesity has become a major health problem in North America. The Center for Disease Control data (CDC, 2006) report a growing trend in the prevalence of obesity (generally defned as a BMI of 30 or over). In 1995, the prevalence of obesity was less than 20% in all states. In 2000, 28% of states reported obesity prevalence of less than 20%, but by 2005 this incidence had dropped to only 4 states. Te 2005 fgures further indicate that 17 states report a prevalence of obesity of equal to or greater than 25% and 3 report a prevalence rate of equal to or greater than 30% (CDC, 2006).

针对减肥客户的轮椅是轮椅设计的最新发展。 减肥症是描述关于显着超重的个体的医学实践的术语。 它源自希腊语“baros”意为体重，“iatrics”意为医疗。 在一些情况下，客户的肥胖是移动性障碍的原因。 肥胖已成为北美的主要健康问题。 疾病控制中心数据（CDC，2006）报告了肥胖患病率（通常被定义为30或更高的BMI）的增长趋势。 1995年，所有州的肥胖率低于20％。 在2000年，28％的国家报告的肥胖患病率低于20％，但到2005年，这一发病率下降到只有4个州。 2005年的数据进一步表明，17个州报告的肥胖患病率等于或大于25％，3个报告的患病率等于或大于30％（CDC，2006）。

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Diabetes is a serious chronic health condition that is asso- ciated with obesity. Mobility in this population is restricted by the excessive weight, low physical endurance, cardiorespiratory complications, and complications arising from diabetes including vision impairment, circulatory and sensory impairments, and amputation. Typical wheelchairs have standard weight limits up to 300 pounds. Chairs for bariatric clients are capable of supporting weights up to 600 pounds and in some cases up to 1000 pounds. Examples of these chairs will be described later in this chapter. Clients who are morbidly obese present specific challenges when measuring for a wheelchair, as will be discussed later.

糖尿病是与肥胖有关的严重慢性健康状况。 在这种人群中的移动性受到体重过重，身体耐力低，心脏呼吸道并发症和由糖尿病引起的并发症（包括视力障碍，循环和感觉损伤和截肢）的限制。 典型的轮椅标准重量限制高达300磅。 肥胖客户的椅子能够支撑重量高达600磅，在某些情况下高达1000磅。 这些椅子的例子将在本章后面描述。 病态肥胖的患者在测量轮椅时存在特定的挑战，这将在后面讨论。

CONTEXT COMPONENTS

背景成分

Physical Context

物理背景

The physical contexts in which the mobility device is used influence the client’s ability to use the chair and the type of chair recommended as a result of the wheelchair assessment. Some key considerations include: Will the device be used both indoors and outdoors? How accessible are these environments? Width of doorways, floor surfaces, bathroom layout, and access to the structure (e.g., ramp, stairs) all need to be considered. On what type of surfaces will the consumer travel when using the device outdoors? Does the user expect or need to transport the device between different locations such as home, school, or work? How will the user and the mobility device travel (e.g., will he or she use a private vehicle or public transportation)? Does the user access other modes of transportation such as trains or airplanes or school bus?

使用移动设备的物理环境影响了客户使用椅子的能力以及由于轮椅评估而推荐的椅子类型。 一些关键的注意事项包括：设备将在室内还是室外使用？ 该如何接近这些环境？ 门口的宽度，前表面，浴室布局以及通向结构的通道（例如，坡道，楼梯）都需要考虑。 消费者在户外使用设备时，会看到什么类型的表面？ 用户是否期望或需要在不同地点（如家庭，学校或工作地点）之间运输设备？ 用户和移动设备将如何旅行（例如，他或她将使用私人车辆还是公共交通工具）？ 用户是否访问其他交通工具，如火车或飞机或校车？

The ability to use the chair and the type of chair recommended vary if the client only uses it indoors versus when both indoor and outdoor use are required. Exclusive indoor use often means the client propels the chair on two types of surfaces—hard floors such as wood, ceramic, or linoleum or softer surfaces such as carpeting. The width of doorways and hall- ways and the travel space around furniture may be restricted in the home, office, or school environment. In contrast, when the client uses the chair both indoors and outdoors, different considerations for the travel surface and the type of travel are made. Outdoor surfaces vary in terms of terrain (e.g., sand, gravel, grass, concrete), and presence of slopes and potholes and other obstructions. These obstacles affect the choice of tire and the ability to maneuver both a manual and power wheel- chair. Distances traveled are a factor here, affecting both the individual’s endurance level and battery charge time.

如果客户端只在室内使用，而不需要室内和室外使用，则使用椅子和椅子类型的能力会有所不同。 独特的室内使用通常意味着客户推动椅子在两种类型的表面硬质材料如木材，陶瓷或油毡或更软的表面如地毯。 门口和走廊的宽度以及家具周围的旅行空间可能在家庭，办公室或学校环境中受到限制。 相反，当客户在室内和室外使用椅子时，要对行进表面和行进类型的有不同考虑。 户外表面在地形（例如，沙子，砾石，草，混凝土）方面不同，并且存在斜坡和坑洼以及其他障碍物。 这些障碍影响轮胎的选择以及操纵手动和电动轮椅的能力。 行驶距离是一个因素，影响个人的耐力水平和电池充电时间。

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Just as the climate was a factor in the recommendation concerning a seating system, it also influences the recommendation of a mobility device. A different recommendation for device may be made if the consumer lives in a climate where snow is a typical part of winter and he or she expects to use the device outdoors versus a consumer who lives in a climate where snow and cold temperatures are not a routine expectation. Additionally, when the wheelchair is used out- doors, the travel surface will be affected by rain (e.g., softening natural surfaces such as grass or creating puddles). Rain and snow also affect the durability of the wheelchair and the performance of electronic components.

正如气候是关于座位系统的建议的一个因素，它也影响了移动设备的建议。 如果消费者生活在冬天会经常下雪的地区，并且他或她期望在户外使用该设备而不是生活在不经常下雪或低温地区的消费者，则可以对设备进行不同的推荐 。 此外，当轮椅在户外使用时，行驶表面将受到雨的影响（例如，软化自然表面，例如草或形成水坑）。 雨雪也影响轮椅的耐用性和电子部件的性能。

Clients who live in rural or remote locations face different conditions than those who live in urban conditions. In the first instance, clients may need to travel longer distances, may have less access to accessible buildings or sidewalks, and few opportunities for accessible public transportation. These clients may not have ready access to clinicians or technicians when problems arise related to their use of the wheelchair.

居住在农村或偏远地区的客户与居住在城市的客户面临不同的情况。 在第一个例子中，客户可能需要旅行更长的距离，可能无法进入无障碍建筑或人行道，几乎没有机会进行无障碍公共交通。 当出现与使用轮椅有关的问题时，客户可能无法随时访问临床医生或技术人员。

Social Context

社会背景

Family members, peers, and others in the social environment can influence the choice and use of a mobility device. Peers with experience with various mobility devices can be a great source of information and share their knowledge of what works and what does not. Conversely, peers and families may exert pressure in the choice of a manual versus a power wheelchair. Te individual may prefer to use a power chair because it allows him or her to conserve energy for other occupations but may be viewed as lazy by others for choosing this technology. Te willingness or ability of decision makers in the school, workplace, and other community environments to accommodate various types of mobility devices also needs to be considered. Lack of knowledge of necessary accommodations by an employer may result in a work environment that is not physically accessible to the client. In this instance, it is the employer’s lack of information that is limiting rather than the actual physical barriers.

家庭成员，同伴和社会环境中的其他人可以影响移动设备的选择和使用。使用过各种移动设备的同行的经验可以是一个伟大的信息来源，并且分享他们知道的什么可以做、什么不可以做。相反，同行和家庭可能在选择手动或者电动轮椅时施加压力。个人可以更喜欢使用电动椅，因为它允许他或她为其他活动节省能量，但是选择电动轮椅可以被其他人看作是懒惰的。学校，工作场所和其他社区环境中决策者的意愿或能力，以适应各种类型的移动设备也需要考虑。雇主缺乏必要的住宿知识可能会导致客户无法在实际工作环境中使用。在这种情况下，雇主缺乏限制性信息，而不是实际障碍。

Cultural Context

文化背景

The cultural context affects wheelchair use and recommendation in three ways: values related to cultural and societal inclusivity, availability of technology, and access to technology. A culture that values inclusivity seeks to implement strategies and programs that enable full societal and community participation by all citizens. Te United Nations Convention on the Rights of Persons with Disabilities (UN, 2006) declares the rights of all persons, regardless of abilities, to full participation and identifies elements that comprise full participation. Signatories of this convention commit to establishing ways of meeting all of the goals identified in the articles that make up this convention.

文化背景以三种方式影响轮椅使用和推荐：文化和社会包容性的价值，技术可用性和技术获取。 一种重视包容性的文化力图实施能够使所有公民充分参与社会和社区活动的战略和方案。 “联合国残疾人权利公约”（联合国，2006年）宣布，所有人不论其能力如何，都有权充分参与，并确定充分参与的因素。 本公约的签署国致力于建立满足构成本公约的条款中所确定的所有目标的方法。

Availability of technology means all residents of a given country can acquire the necessary devices. Te WHO World Report on Disability (2011) indicates that provision of assisitive technology must suit the environment and the user and provide adequate follow-up. Such provision requires the technology to fit the intended user and support the user’s needs as well as be useful in his or her environment. For example, a client who lives in a remote area that does not have paved roads will have a difficult time maneuvering a wheelchair that has smooth tires over dirt paths.

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技术的可用性意味着特定国家的所有居民都可以获得必要的设备。世卫组织“世界残疾报告”（2011年）指出，提供辅助技术必须适合环境和用户，并提供充分的后续行动。这样的规定要求技术使预期的用户成功，并且支持用户的需要，并且在他或她的环境中是有用的。例如，居住在没有铺设道路的偏远地区的客户将具有操纵轮椅的困难时间，轮椅在污垢路径上具有光滑的轮胎。

The WHO document Guidelines on the Provision of Manual Wheelchairs in Less-Resourced Countries ( WHO, 2008) lists further principles relevant to the provision of these devices. These principles include: (1) the device is accept- able to the users and others in the environment, (2) users are able to access these devices, (3) the device is adaptable to the needs of the user and the context in which it will be used, (4) devices are affordable, (5) available, and (6) the device is of high quality (WHO, 2008).

世卫组织文件“在资源贫乏国家提供手动轮椅的准则”（世卫组织，2008年）列出了与提供这些装置有关的进一步原则。这些原则包括：（1）设备对于环境中的用户和其他人是可接受的，（2）用户能够访问这些设备，（3）设备适应用户的需要和其中将被使用，（4）设备可靠，（5）可用，和（6）设备是高质量的（WHO，2008）。

When inclusion of all citizens is valued and technology is available, the last aspect is that technology is accessible. Legislation, policy, and other programs that assist clients to acquire technology are also important components of the cultural context. Cultures that recognize the rights of all citizens take steps to establish funding mechanisms to ensure some reasonable access to technology, in this case mobility technology, to support full participation.

当包含所有的公民的价值和技术是可用的，最后一个方面是，技术是可访问的。立法、政策和其他帮助客户获得技术的过程也是文化环境的重要组成部分。文化，认识到所有公民的权利采取步骤建立资金机制，以确保一些合理的访问技术，在这种情况下的流动性技术，以支持充分参与。

Institutional Context

制度背景

Institutional regulations and policies influence the recommendation of a mobility device. The clinician must be aware of the criteria for funding these devices in his or her jurisdiction, including who is eligible for funding, requirements for stability of client condition, restrictions on where the device must be used, and the requirements of client performance (e.g., the ability to propel a wheelchair a specific distance without assistance). Te clinician considers the client’s future needs and the implications that a current recommendation will have on the ability to access an appropriate mobility device in the future. For example, some funding programs have a specified time during which replacement of an existing system is not funded. Further, some stipulate that if a person receives one type of mobility device (e.g., manual or powered wheelchair), a second mobility device will not be funded for a specified length of time.

制度规章和政策影响了移动设备的建议。临床医生必须了解在其管辖范围内为这些设备提供资金的标准，包括谁有资格获得资金，对客户条件稳定性的要求，对设备必须使用位置的限制以及客户绩效的要求（例如，在没有辅助的情况下将轮椅推进特定距离的能力）。临床医生考虑了客户的未来需求以及当前建议对于将来访问适当移动设备的能力的影响。例如，一些资助计划有一个规定的时间，在这期间，一个现有系统的替换不被资助。此外，一些规定如果人接收一种类型的移动设备（例如，手动或电动轮椅），则第二移动设备将不被供应指定时间长度的资金

As mentioned previously, legislation such as the Americans with Disabilities Act (ADA, 1990) defines access to environments and technology. These types of legislation define the different types of environmental accessibility features required and the conditions under which they must be implemented (e.g., new construction, renovations of buildings of a certain age). They further identify who has the responsibility to fund the construction of accessibility features. In addition, such legislation identifes conditions of employment, access to public facilities, and education that affect access to mobility devices.

如前所述，诸如“美国残疾人法案”（ADA，1990）等立法禁止获取环境和技术。 这些类型的立法规定了所需的不同类型的环境无障碍特征以及必须实施的条件（例如，新建筑，某一年龄的建筑物的翻修）。 他们进一步确定谁有资金建设无障碍功能的责任。 此外，这种立法确定了就业条件，获得公共设施的机会和教育，这些条件影响到行动设备的使用。

Individual institutions, such as long-term care or skilled nursing facilities, frequently have policies that affect wheel- chair use. Some of these policies limit the resident’s ability to use a wheelchair if the resident has repeatedly demonstrated use of the chair that threatens the safety of themselves or others in the environment (Mendoza et  al., 2003). Some institutions will not allow residents access to power wheel- chairs due to concerns regarding maintenance and safety. Other policies establish responsibilities for daily and long- term maintenance of the chair and transportation when the user takes it between locations.

个人机构，如长期护理或专业护理设施，经常有影响轮椅使用的政策。 如果居民已经反复使用威胁自己或环境中其他人安全的椅子，其中一些政策限制了居民使用轮椅的能力（Mendoza et al。，2003）。 由于对维护和安全的考虑，一些机构不允许居民接触电动轮椅。 其他政策规定了用户在不同地点之间进行日常和长期维护和运输轮椅的责任。

ASSESSMENT FOR WHEELED MOBILITY Commonly, the assessment described in Chapter 9 to deter- mine the most appropriate seating components is the same assessment that determines the wheeled mobility base. Consequently, the discussion of the assessment that was presented in Chapter 9 will not be repeated here.

轮式机动性评估通常，第9章中描述的用于确定最合适的座椅部件的评估是确定轮式机动基础的相同评估。 因此，第9章中对评估的讨论将不再重复。

Needs Assessment 需求评估

Te goal of wheeled mobility intervention is to support the user’s ability to move in the environment (i.e., the mobility output of the activity component of the HAAT model). Consistent with the HAAT model described in Chapters 1 and 3, the evaluation to determine the most appropriate wheeled mobility base starts with an assessment of the activities in which the individual wishes to engage while using mobility technology.

轮式移动性干预的目的是支持用户在环境中移动的能力（即，HAAT模型的活动组件的移动性输出）。 与第1章和第3章描述的HAAT模型一致，用于确定最合适的轮式移动基础的评估决定于评估个人在使用移动技术时参与的活动的意愿。 Will the mobility device be used primarily to move from one place to another in the community or will the individual use it as the primary means of mobility and consequently perform most activities (e.g., ADL, work, and leisure occupations) while seated in the device? Te clinician determines which activities are important and necessary for the user to complete as well as those in which the user wishes to engage.

移动设备将主要用于在社区中从一个地方移动到另一个地方，或者个人将其用作移动性的主要手段，并且因此坐在移动设备上完成大多数活动（例如，ADL，工作和休闲职业） ？ 临床医生确定哪些活动对于用户完成以及用户希望参与的活动是重要和必要的。

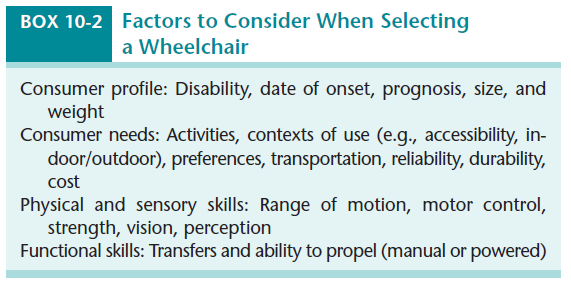
Further, the level of assistance the user requires to complete these activities is determined. As mentioned earlier, the client may complete these activities independently, with the assistance of another person, or with the use of other technology. In the latter case, it is necessary to consider the interface between the wheelchair and other technology, such as a communication device, that will be used.

此外，确定用户完成这些活动所需的帮助水平。 如前所述，客户可以在另一个人的帮助下或者使用其他技术独立完成这些活动。 在后一种情况下，需要考虑轮椅与将使用的其它技术（例如通信装置）之间的接口。

Assessment of the Human Factors 评估中的人为因素

Box 10-2 identifies the factors that should be considered when selecting a mobility base for a consumer. Some of this information is available through the client’s chart or background information. Examples of this background information include client living situation (alone, with others, and type of accommodation), diagnosis (including length of time since onset), existing technology, and age.

框10-2确定了为消费者选择移动基础时应考虑的因素。 有些信息可通过客户的图表或背景信息获得。 这种背景信息的例子包括客户生活状况（独居，合租和住宿类型），诊断（包括发病后的时间长度），现有技术和年龄。



BOX 10-2 Factors to Consider When Selecting

a Wheelchair 选择轮椅时要考虑的因素

Consumer profile: Disability, date of onset, prognosis, size, and weight

Consumer needs: Activities, contexts of use (e.g., accessibility, indoor/outdoor), preferences, transportation, reliability, durability, cost

Physical and sensory skills: Range of motion, motor control,strength, vision, perception

Functional skills: Transfers and ability to propel (manual or powered)

消费者简介：残疾，发病日期，预后，大小和体重

消费者需求：活动，使用环境（例如，可达性，室内/室外），偏好，交通，可靠性，耐久性，成本

物理和感觉技能：运动范围，运动控制，力量，视力，感知

功能技能：转移和推进（手动或动力）

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CHAPTER 10

A client who has a progressive impairment such as amyotrophic lateral sclerosis (ALS) will lose function over time, so the clinician should be alert to signs that the wheel- chair is no longer meeting the client’s needs.

具有进行性损伤例如肌萎缩性侧索硬化（ALS）的客户将随时间丧失功能，因此临床医生应警惕轮椅不再满足客户需要的现象。

For example, a client whose motor function is declining may show fatigue when propelling a manual wheelchair over a distance that was easy for her or him to travel earlier. Alternatively, a client who uses a joystick to control a power wheelchair may show loss of ability to reliably stop the chair or control its speed

例如，其运动功能下降的客户可能在推动手动轮椅超过他们以前行进距离时显示疲劳。 或者，使用操纵杆来控制电动轮椅的客户可能会明显失去停止椅子或控制其速度的可靠能力。. Clients whose cognitive abilities are declining may become lost in familiar surroundings, use their chairs inappropriately to intentionally run into people or objects, or forget how to control the chair.

认知能力正在下降的客户可能在熟悉的环境中迷失，使用椅子不适当地靠近人或物体，或忘记如何控制椅子。

Noting changes in a client’s weight or posture will also provide clues that the wheeled mobility device (and seating system) is no longer adequate.

客户的体重或姿势的任何变化也将为轮式移动设备（和座椅系统）提供不再足够的线索。Te individual’s physical and sensory skills are evaluated for range of motion, strength, motor control, skin integrity, vision, and perception.

评估个人的身体和感觉技能的运动范围，力量，运动控制，皮肤完整性，视觉和感知。This assessment also includes determining the user’s optimal control site and interface for propelling the wheelchair. 该评估还包括确定用户推动轮椅的最佳控制位置和接口。

Information on the person’s weight and size is gathered to determine the size and capacity of the wheelchair. Measurements of the person’s leg length, thigh length, back height to base of scapula, back height to top of shoulder, and hip breadth are taken while the person is sitting (refer to the discussion in Chapter 9).

收集关于人的重量和尺寸的信息以确定轮椅的尺寸和容量。 在人坐着时，测量人的腿长，大腿长度，背部高度到肩胛骨底部，背部高度到肩部顶部和臀部宽度（参见第9章中的讨论）。

An obese person will need a bariatric wheelchair. Clients who are obese should be measured while sitting because adipose tissue spreads when they lie down, resulting in inaccurate measurements (Daus, 2003). If the consumer is a child and is expected to grow, that expected change needs to be reflected in the decision making as well. 肥胖的人需要一个肥胖的轮椅。 肥胖的客户应该在坐着时测量，因为当他们躺下时脂肪组织扩散，导致不准确的测量（Daus，2003）。 如果消费者是一个孩子而且预计会长大，预计的变化需求也应该在决定中体现出来The person’s functional abilities are also evaluated. Two elements are important. The first is evaluation of different ADLs and IADLs. In addition to identifying in which occupations the individual wishes to engage, this evaluation will determine how they complete those activities. 该人的功能能力也被评估。 两个要素很重要。 第一个是评估不同的ADL和IADL。 除了确定个人希望参与的职业外，本评价还将决定他们如何完成这些活动。The second element involves evaluation of wheelchair skills. The Wheel-chair Skills Test (WST)1 ( Kirby et  al., 2002; Kirby et  al., 2004) is a well-developed, standardized measure of various wheelchair skills.第二个要素包括评估轮椅技能。 轮椅技能测试（WST）1（Kirby等人，2002; Kirby等人，2004）是各种轮椅技能的良好开发的标准化测量。

This test assesses the individual’s ability to perform basic wheelchair skills such as removal of an arm- rest and application of the brakes to more complex, advanced skills such as performing a wheelie to negotiate a curb. This test is one of the few that has had extensive research in all phases of its development. In addition to the evaluation, a training program has also been developed and evaluated. Information about this test and the training program are available at www.wheelchairskillsprogram.ca.

该测试评估个人执行基本轮椅技能的能力，例如移除扶手并将刹车应用于更复杂的高级技能，例如执行车轮离地车以停在路边。 这个测试是在其发展的所有阶段进行广泛研究的少数几个。 除了评价外，还制订和评价了一个培训方案。 有关此测试和培训计划的信息，请访问www.wheelchairskillsprogram.ca。

Technologies That Enable Mobility235

启用移动的技术235

When an individual has a severe mobility limitation, powered mobility may be the best option to gain functional mobility. These individuals often have a manual wheelchair, propelled by a caregiver, as a back-up chair. Powered mobility devices have the potential to enable the user’s participation in school, work, leisure, and other community-based activities. The control interfaces (see Chapter 7) available today make it possible for someone with only one or two movements, for example lateral flexion of the head or shoulder rotation, to operate a powered wheelchair; how- ever, perceptual, cognitive, and behavioral impairments may prevent individuals from using a powered wheelchair even if they have the necessary motor skills. For example, a client with a visual-spatial impairment may have difficulty navigating a cluttered environment if she or he cannot maintain a safe distance from people or objects in the environment. When the individual also uses an augmentative communication system or an adapted van, integration of all of these devices is considered at the time of selection of the most appropriate mobility device. All mobility device users will require a system to support their seating needs (see Chapter 9). 由护理人员推动，作为后备椅。动力移动设备具有使用户能够参与学校，工作，休闲和其他基于社区的活动的潜力。现在可用的控制接口（参见第7章）使得只有一个或两个运动（例如头部或肩部旋转的侧向力）的人能够操作电动轮椅;然而，感知，认知和行为障碍可以防止个人使用电动轮椅，即使他们有必要的运动技能。例如，如果她或他不能与环境中的人或物体保持安全距离，则具有视觉空间损伤的客户可能具有导航混乱环境的不同。当个人还使用增强通信系统或适应的货车时，在选择最适当的移动设备时综合考虑所有这些设备的。所有移动设备用户将需要一个系统来支持他们的座椅需求（见第9章）

Assessment of the Context 背景的评估

Physical Context 物理背景

The previous discussion on the physical context identifed several questions about the context in which the wheelchair will be used that influence the recommendation. 先前关于物理背景的讨论确定了关于将使用影响推荐轮椅的几个问题。Where possible, the clinician should visit the client’s home to determine any limitations this environment poses for use of the chair. 在可能的情况下，临床医生应访去客户家里看看，以确定环境对椅子使用的任何限制。 Often it is not possible to visit other relevant environments, such as the work or school environment (although the latter may be possible). 通常不可能访问其他相关环境，例如工作或学校环境（尽管后者是有可能的）。In this situation, the clinician uses the interview to understand the issues related to wheelchair use across environments. 在这种情况下，临床医生使用走访来了解轮椅在环境中使用的相关问题。Similarly, the clinician asks about transportation to determine the ft between wheelchair and mode of transportation. 类似地，临床医生询问运输情况以确定轮椅和运输模式之间的适合性。

Social Context 社会背景

As described earlier, the clinician determines who is in the environments in which the wheelchair will be used and their influence on its use. 如前所述，临床医生确定谁在使用轮椅的环境中以及它们对其使用的影响。Where appropriate, the clinician identifies who the caregiver is and the issues that may affect his or her ability to support wheelchair use. 在适当的情况下，临床医生认为护理者可能影响他或她支持轮椅使用的能力的问题。For example, the clinician determines if the caregiver is able to assist with transfers, propelling the wheelchair when needed, lifting and moving the wheelchair (e.g., into and out of a vehicle), securing it in a vehicle, and providing routine care and maintenance. 例如，临床医生确定护理者是否能够辅助转移，在需要时推动轮椅，提升和移动轮椅（例如，进入和离开车辆），将其固定在车辆中，以及提供日常护理和维护 。If multiple caregivers will assist the individual, as sometimes is the case with home care providers, the clinician and the client should identify potential aspects of the use of the wheelchair that might prove a challenge for a caregiver unfamiliar with the client and the technology.如果多个护理人员将帮助个人，如家庭护理提供者的情况，临床医生和客户应该识别轮椅使用的潜在方面，这可能证明对于不熟悉客户端和技术的护理人员是一个挑战。 In this case, strategies for educating each caregiver are developed. 在这种情况下，教育每一个护理者的策略就会有所发展。

The influence of others in the environment, such as employers and school personnel, is also considered.还考虑了其他人在环境中的影响，例如雇主和学校人员。 In the work environment, the clinician determines whether any policies exist that might limit the client’s ability to function in the environment with a wheelchair, for example, access to

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CHAPTER 10 Technologies That Enable Mobility 支持移动性的技术

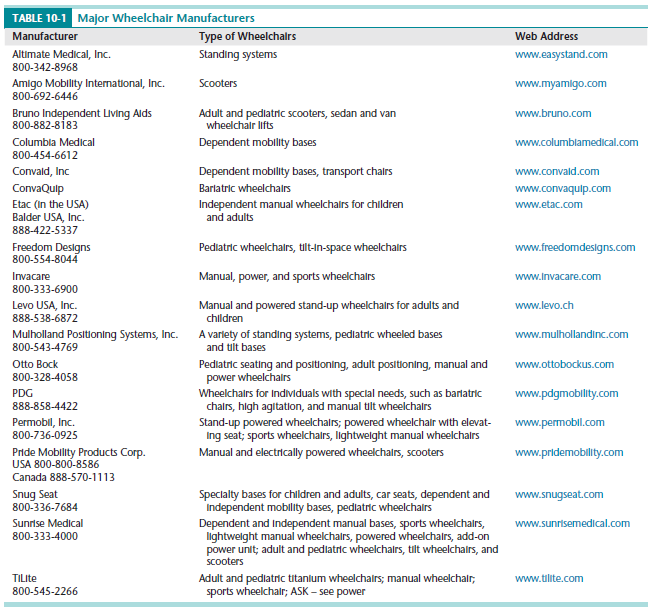
accessible washrooms or a height adjustable desk that will accommodate the chair.

在工作环境中，临床医生确定是否存在可能限制客户在轮椅环境中运行的能力的任何策略，例如，访问可接近的洗手间或可容纳椅子的高度可调的书桌。

Similar considerations are made in the school environment related to the knowledge and attitudes of school personnel related to accommodation of a person using a wheelchair. 在学校环境中进行类似的考虑，涉及学校人员与使用轮椅的人在学校住宿方面相关的知识和态度。

Institutional Context 制度背景

Policies, legislation, and regulations related to funding, access, and wheelchair use were identified in an earlier section of this chapter. The clinician has the responsibility to become familiar with all of the institutional elements, particularly policies and practices that will affect acquisition and use of the wheelchair, before making a recommendation and providing the supporting documentation for funding. 在本章前面的章节中，确定了与资金，通道和轮椅使用相关的政策，法律和法规。 临床医生有责任熟悉所有的机构因素，特别是那些会影响轮椅采购和使用的政策和做法，然后再提出建议并提供资金支持。



Adult and pediatric scooters, sedan and van

Dependent mobility bases, transport chairs

Independent manual wheelchairs for children

Pediatric wheelchairs, tilt-in-space wheelchairs

Manual, power, and sports wheelchairs

Manual and powered stand-up wheelchairs for adults and

A variety of standing systems, pediatric wheeled bases

Pediatric seating and positioning, adult positioning, manual and

Wheelchairs for individuals with special needs, such as bariatric chairs, high agitation, and manual tilt wheelchairs

Stand-up powered wheelchairs; powered wheelchair with elevating seat; sports wheelchairs, lightweight manual wheelchairs Manual and electrically powered wheelchairs, scooters

ASSISTIVE TECHNOLOGY 辅助技术

In this section we discuss the major characteristics of manual and powered mobility systems. Table 10-1 lists the major manufacturers of personal mobility systems. Modern mobility systems are more fexible and capable of being adapted to a variety of functional tasks. These adaptations may include height adjustment, tilt, recline, axle position adjustment, and combinations of all of these.

在本节中，我们将讨论手动和动力移动系统的主要特性。 表10-1列出了个人移动系统的主要制造商。 现代移动系统更加灵活，能够适应各种功能任务。 这些适应可以包括高度调节，倾斜，倾斜，轴位置调节，以及所有这些的组合。

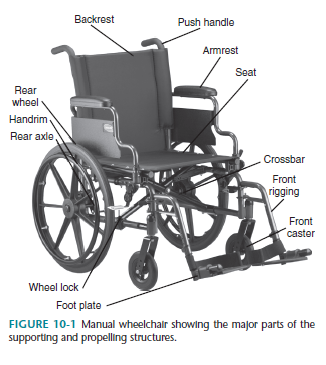
The selection of a wheelchair is based on the evaluation discussed in the previous section and is a process of matching characteristics to the consumer’s needs and skills (Scherer, 2002). To meet the varied needs of individuals with mobility impairments, there are three broad categories of wheeled mobility systems:

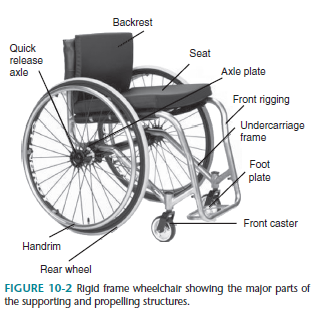
轮椅的选择基于上一节中讨论的评估，是将特征与消费者的需求和技能相匹配的过程（Scherer，2002）。 为了满足具有行动障碍的个人的不同需求，有三种类型的轮式移动系统：dependent mobility, independent manual mobility, and independent powered mobility.依赖移动性，独立手动移动性和独立供电移动性。

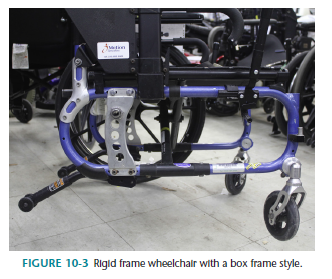
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Dependent mobility systems are propelled by an attendant and include strollers and transport chairs, as well as a manual chair that is propelled by an attendant. 依赖移动系统由服务员推动，包括手推车和运输椅，以及由服务员推动的手动椅。A dependent mobility system is chosen when (1) the individual is not at all capable of independently propelling a wheelchair or (2) a secondary system is needed that is lightweight and easily transported. 选择依赖移动系统需要满足（1）个体不能独立地推动轮椅，（2）需要轻质且容易运输的次级系统时。 An independent manual mobility system is for those individuals who have the ability to propel a wheelchair manually. 独立的手动移动系统适用于那些有能力手动推动轮椅的人。These bases have two large wheels in the back and two smaller front wheels that allow the user to propel independently. Independent powered mobility systems are required when the user has diffculty propelling a manual wheelchair. These are powered wheelchairs that are driven by the user. 这些底座在后部具有两个大轮子，并且两个较小的前轮允许使用者独立地推进。 当用户有困难推动手动轮椅时，需要独立的动力移动系统。 这些是由用户驱动的动力轮椅。

Within each of these categories there are many commercial options available to meet the needs of the individual user.在这些类别中每一个，都存在许多可用于满足个体用户需求的商业选择。 In this section we discuss the characteristics of mobility systems, starting with the wheelchair’s two basic structures: a supporting structure and a propelling structure. Figure 10-1 shows the anatomy of a folding manual wheelchair. 在本节中，我们讨论移动系统的特点，从轮椅的两个基本结构开始：支撑结构和推进结构。 图10-1显示了折叠手动轮椅的解剖图。Figure 10-2 shows the anatomy of a rigid frame manual wheelchair. 图10-2示出了刚性框架手动轮椅的解剖结构。







Supporting Structure 支持结构

The supporting structure of the wheelchair consists of the frame and attachments to it. Specialized seating and positioning (see Chapter 9) is often considered part of the sup- porting structure. Accessories to the frame (e.g., armrests,footrests) are also a part of the supporting structure. In some wheelchairs these accessories are manufactured as part of the frame. Some supporting structures are unique in that they are adjustable to allow for changes in the orientation of the user in space, including systems that provide tilt or support in a standing position. 轮椅的支撑结构包括框架及其附件。 专业的座椅和位置（见第9章）通常被认为是支撑结构的一部分。 对框架的附件（例如，扶手，脚踏板）也是支撑结构的一部分。 在一些轮椅中，这些附件被制造为框架的一部分。 一些支撑结构是独特的，因为它们是可调节的以允许用户在空间中的方向的变化，包括在站立位置提供倾斜或支撑的系统。

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Frame Types 框架类型

Tree underlying factors will be discussed before describing different classifications of manual wheelchairs: type of frame (rigid or folding), adjustability of the position of the axle of the rear wheel and material used to construct the wheelchair frame. 在描述手动轮椅的不同分类之前将讨论三个基本因素：框架类型（刚性或折叠），后轮的轴的位置的可调节性以及用于构造轮椅框架的材料。

Frames may be either folding or rigid, and there are three common frame styles (Cooper, 1998). Rigid frames are available in a box, cantilever, and T or I frame style. Typically the box frame construction (Figure 10-3) has a rectangular shape that provides a strong and durable base to which the seat and wheels are attached.框架可以是折叠的或刚性的，并且有三种常见的框架样式（Cooper，1998）。 刚性框架有盒子，悬臂和T或I框架样式。 通常，箱式框架结构（图10-3）具有矩形形状，其提供牢固且耐用的底座，座椅和车轮附接到该底座。 Lighter weight designs are accomplished by replacing the box with a single bar extending between the wheels, forming a cantilever structure. Upright tubes from this main support are used to attach the seat and back. The footrests are extensions of the seat rails. The T construction uses a bar similar to the cantilever design but has a single bar attached to the center of the cantilever that connects to a single front caster.通过用在轮之间延伸的单个杆来替换箱形成悬臂结构来实现轻重量设计。 来自该主支撑的直立管用于附接座椅和靠背。 搁脚板是座椅轨道的延伸部。 T构造使用类似于悬臂设计的杆，但是具有附接到连接到单个前脚轮的悬臂的中心的单个杆。

This configuration forms a T shape under the seat. If two front casters are used, then the T becomes an I shape. For transportation, the wheels on all these chairs are removed, and in some cases the back folds down. The choice between rigid or box frame and folding frame styles involves a number of factors, including the consumer’s needs, functional ability, method of transfer, and level of activity (Cooper, 1998). 这种配置在座位下形成T形。 如果使用两个前脚轮，则T变为I形。 为了运输，所有这些椅子上的轮子被移除，并且在一些情况下，后部折叠下来。 刚性或箱形框架和折叠框架样式之间的选择涉及许多因素，包括消费者的需要，功能能力，转移方法和活动水平（Cooper，1998）。

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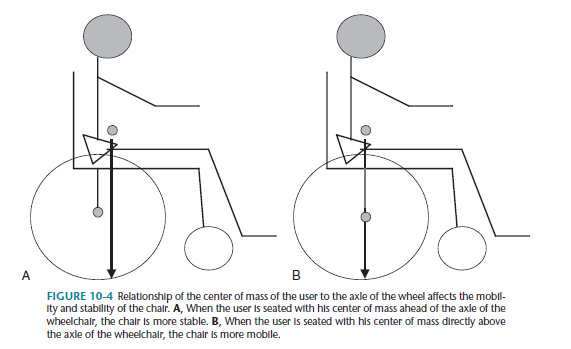


FIGURE 10-4 Relationship of the center of mass of the user to the axle of the wheel affects the mobility and stability of the chair. A, When the user is seated with his center of mass ahead of the axle of the wheelchair, the chair is more stable. B, When the user is seated with his center of mass directly above the axle of the wheelchair, the chair is more mobile. 图10-4用户的质心与车轮轴的关系影响椅子的移动性和稳定性。 A，当使用者的质心坐在轮椅的轴之前时，椅子更稳定。 B，当使用者的质心坐在轮椅的轮轴上方时，椅子更具移动性。

The position of the axle of the drive wheel relative to the user’s center of gravity affects the stability and maneuverability of the wheelchair. Figure 10-4 shows this relationship. The center of mass of an empty wheelchair is located under the seat, in front of the drive wheels (Engstrom, 2002). When the user is seated in the wheelchair, the center of mass moves above the seat and forward and backward depending on the seated position of the individual and the drive wheels. 驱动轮的轴相对于使用者的重心的位置影响了轮椅的稳定性和可操作性。 图10-4显示了这种关系。 空轮椅的质量中心位于座椅下方，在驱动轮前面（Engstrom，2002）。 当使用者坐在轮椅上时，质量块根据个人和驱动轮的就座位置在座椅上方向前和向后移动。

When the center of mass is forward of the axis of the drive wheels, more weight is placed on the castors, making it more difficult to lift them (Engstrom, 2002). Te chair is more stable but less maneuverable in this configuration. As the center of mass moves backward, closer to the axis of the drive wheel or even slightly behind it, stability decreases and maneuverability increases. 当质心位于驱动轮轴线的前方时，脚轮上的重量更大，使其更难以提升它们（Engstrom，2002）。 椅子更稳定，但在这个配置操作性变差。 当质心向后移动，更接近驱动轮的轴线或甚至稍微后移时，稳定性降低并且机动性增加。

Understanding this relationship is important when set- ting up the chair. An active user will want a configuration that is easily maneuverable and allows him or her to perform a wheelie (i.e., lift the castors up) to clear curbs and other barriers. A less confident wheelchair user will be most comfortable with a chair that does not tip backward easily, allowing him or her to feel secure in the chair. 了解这种关系在设置椅子时很重要。 活动用户将需要易于操纵的配置，并允许他或她执行车轮离地（即，提升脚轮）以清除路缘和其他障碍物。 不太自信的轮椅使用者将使用不容易向后倾倒的椅子，这样他或她在椅子上会有安全感。

A recent advancement in the wheelchair industry is the material used to form the chair frame. Much of the advancement in materials comes from the cycling industry. 轮椅工业中的最近的进步在于椅子框架的材料。 材料的大部分进步来自于自行车行业。

Wheelchair frames are made from many materials, including steel, aluminum, steel/aluminum alloy, titanium, and carbon fiber composites. These materials vary in their weight, strength, cost, how they conduct vibration, method of attaching components together, and how they are formed. 轮椅框架由许多材料制成，包括钢，铝，钢/铝合金，钛和碳纤维复合材料。 这些材料在重量，强度，成本，它们如何传导振动，将部件附接在一起的方法以及它们如何形成等方面都不同。Wheelchairs are classified according to a number of parameters including weight, adjustability, and available options. Standard wheelchairs are generally useful for very short-term use such as rentals at an airport or shopping mall (Schmeler & Bunning, 1999). They are folding chairs, with very limited adjustment; in particular, the axle of the rear wheel is fixed. Features such as footrests and armrests may be fixed or detachable. There is limited choice of seat width and depth. They are the heaviest of the manual wheelchairs and therefore are not useful for long-term because as they require a great deal of energy to propel on a regular basis. 轮椅根据多个参数进行分类，包括重量，可调性和可用选项。 标准轮椅通常用于非常短期的使用，例如在机场或商场租赁（Schmeler＆Bunning，1999）。 他们是折叠椅，调整非常有限; 特别地，后轮的轴是固定的。 诸如脚踏板和扶手的特征可以是固定的或可拆卸的。 座椅宽度和深度的选择有限。 它们是最重的手动轮椅，因此长期不是有用的，因为它们需要大量的能量来定期推进。

Lightweight and lightweight high strength wheelchairs (Schmeler & Bunning, 1999) weigh less than the standard chair, as their name would suggest. Otherwise, they tend to have similar features. These chairs offer more flexibility in choice of seat width and adjustment of back height. Both the standard and lightweight chairs are available with a lower seat-to-floor height that allows the user to propel with the feet. 顾名思义,轻型和轻质的高强度轮椅（Schmeler＆Bunning，1999）的重量肯定小于标准椅子。 否则，它们都具有类似的特征。 椅子的座椅宽度选择和背部高度的调整更加灵活。 标准和轻便的椅子都具有较低的座椅到靠背高度，允许使用者用脚推动。

An ultralightweight wheelchair is substantially lighter than the standard chair. Schmeler & Bunning (1999) suggest that the chairs in the standard and lightweight categories are not suitable for use over the long term. The ultralightweight chair is one they consider useful for an individual who uses a manual wheelchair as the primary means of mobility. It retains the folding frame and is available with a lower seat- to-floor height for individuals who propel with their feet. Te axle of the rear wheel is adjustable relative to the center of gravity of the user.

超轻型轮椅比标准椅子轻得多。 Schmeler和Bunning（1999）认为，标准和轻量级椅子不适合长期使用。 超轻型椅子是他们认为对于使用手动轮椅作为主要移动手段的人有用的椅子。 它保持折叠框架，并且对于用脚推动的个人具有较低的座椅到身高。 后轮的轮轴相对于用户的重心是可调节的。

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Rigid sport ultralightweight wheelchairs ( Schmeler & Bunning, 1999) are a huge growth area for the wheelchair industry. The primary difference between these and the previous categories is the rigid frame. These chairs have quick release rear wheels and the back of most folds down to facilitate transfer and storage of the chair in a vehicle. Te axle of the rear wheel of these chairs can be adjusted relative to the center of gravity of the user. 刚性运动超轻型轮椅（Schmeler＆Bunning，1999）是轮椅行业的一个巨大的发展领域。 这些和以前的类别之间的主要区别是刚性框架。 这些椅子具有快速释放后轮和可以大部分折叠的后部，以便于椅子在车辆中的移动和存储。 这些椅子后轮的轴可相对于使用者的重心调整。

A final comment will be made about the seat-to-floor height of the chair. This dimension is important for two reasons: (1) access to tables, counters, and other structures and (2) access to the floor for users who propel the chair with their feet. In the first instance, the height of the chair should allow the user to roll the chair to a table or desk, permitting the user’s knees to be under the table or desk. In the second instance, the seat is lowered to provide a seat-to-floor height that allows the person to “walk” his or her feet on the floor, thus propelling the chair. 将对椅子的座椅到靠背的高度进行最终讨论。 这个维度是重要的，有两个原因：（1）访问桌子，柜台和其他结构;（2）用户脚着地推动轮椅向前。 在第一种情况下，椅子的高度应该允许用户将椅子滚动到桌子下面，允许用户的膝盖在桌子下面。 在第二种情况下，座椅被降低以提供座位到地板的高度，其允许人们用脚在地板上“走动”，从而推动椅子。

Accessories 配件

Armrests on conventional wheelchairs may be manufactured as a fixed part of the frame, flip back out of the way, or be completely removable. Nonremovable armrests decrease the width of the wheelchair slightly, and do not get lost because they cannot be removed. In general it is advantageous to have armrests that flip back or are removable to facilitate transfers and other activities. Two lengths of armrests are available. Desk-length armrests are shorter in the front to allow the consumer to move close to a desk or table. Full-length arm- rests, which provide more support, extend to the front of the seat rails. Armrests may be fixed or adjustable in height. 常规轮椅上的扶手可制造为框架的固定部分，可以向后翻转或完全可移除。 不可移动的扶手略微减少了轮椅的宽度，因为它们不能被移除，所以不会丢失。 通常，具有向后翻转或可移除的扶手是有优势的，以便于移动和其它活动。 提供两段扶手。 桌面扶手在前部较短，以允许消费者移动靠近桌子或台子。 全长扶手，提供更多的支撑，延伸到座椅导轨的前面。 扶手可以是固定的或可调节的高度。

Armrests that are height adjustable can be moved up or down to accommodate the length of the user’s trunk and provide the proper amount of support for the arms. A clothing guard on the armrests prevents clothing and body parts from rubbing against the wheels. 高度可调的扶手可以向上或向下移动以适应使用者躯干的长度并且为扶手提供适当的支撑量。 扶手上的防护罩可防止衣服和身体部位摩擦轮子。

Legrests and footplates support the legs and feet. Taken together, these two components are often called the front rigging of the wheelchair. Angle options are often available for the legrests with either 90° or 70° hangers. These options increase the comfort of the user by accommodating his or her preferred knee flexion angle but they can also add to the turning radius, which may be a factor for mobility in some environments. Legrests may be fixed (built into the frame) or removable (swing away). Styles that swing away make it easier to transfer in and out of the wheelchair. Footplates are attached to the leg rests and are available as a single plate to support both feet or as two separate units, with individual height adjustment. Te height of the footplate should sup- port the desired position of the lower extremities.

脚凳和脚踏板支撑腿和脚。 总之，这两个部件通常被称为轮椅的前索具。 角度选项通常适用于带90°或70°悬挂器的搁脚凳。 这些选项通过适应他或她的优选膝屈曲角度来增加用户的舒适度，但是它们也可以增加转向半径，这可能是在一些环境中的移动性的因素。 脚踏板可以固定（内置在框架中）也可以拆卸（摆动）。 摆动的样式使其更容易转入和转出轮椅。 踏板连接到搁脚板，可作为单个板支撑两个脚或作为两个单独的单元，具有单独的高度调节。 足板的高度应该调节到可以支撑下肢的所期望位置。The angle of the footplate can also be adjusted to accommodate ankle flexion or extension. Heel loops can be attached to the back of the footplate to prevent the foot from sliding backward (see Figure 10-1). 足板的角度也可以调节以适应脚踝弯曲或伸展。 鞋圈可以连接到踏板的背面，以防止脚向后滑动（见图10-1）。

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Wheel locks are the devices that prevent the wheels from moving during transfers and other stationary activities. They are available in a number of configurations such as push or pull to lock, with lever extensions for individuals with limited reach, under the seat mounts, hill holders (device that “holds” the wheelchair on an incline, preventing it from rolling downhill) and attendant controlled. Figure 10-5 shows some of the various brake styles.车轮锁是防止车轮在运送和其他固定活动期间移动的装置。 它们具有多种结构，例如推或者拉来锁定，具有控制杆扩展是为了限制个人，在座位安装件下方，山支架（将轮椅“保持”在斜坡上，防止其向下滚动的装置） 和服务员控制。 图10-5显示了一些不同的制动方式。 The client’s preferred method of transfer, ability to access the wheel lock, the most reliable method available to manipulate the wheel lock, and the ability of the user or caregiver to maintain this component influence the selection of this component. As with the brakes of a motor vehicle, proper maintenance of the wheel locks is an important safety consideration. Wheel locks that are improperly maintained may not be in secure contact with the tire, causing instability, particularly during transfers or when holding the chair on an incline/decline. 客户喜欢的传输方法，使用轮锁的能力，操纵轮锁的最可靠的方法以及用户或护理者使用该部件的能力影响该部件的选择。 与机动车辆的制动器一样，车轮锁的适当维护是重要的安全考虑。 不正确地保持的车轮锁可能不与轮胎紧密接触，导致不稳定性，特别是在转移期间或当将椅子保持在倾斜/下降时。

Anti-tip devices are small wheels attached to a rod and mounted at the back of the chair. These devices prevent the chair from tipping backwards. When the drive wheels are located forward on the chair, anti-tip devices are recommended, particularly when the individual cannot safely per- form a wheelie. Since these devices limit backward tipping of the chair, they can interfere with travel over some obstacles such as curbs. Anti-tip devices can be removed or rotated so they do not interfere with such travel when an attendant is pushing the chair. However, they should be returned to their original position when the user resumes propelling the chair (Engstrom, 2002). Anti-tipping devices can be seen on the back of the chair in the Figure 10-10, which shows a com- posite mag wheel. 防倾倒装置是附接到杆并安装在椅子后部的小轮。 这些装置防止椅子向后倾斜。 当驱动轮位于椅子的前方时，推荐使用防倾斜装置，特别是当个人不能安全地执行车轮离地时。 由于这些装置限制椅子的向后倾斜，它们可以干扰在诸如路缘石的一些障碍物上的行进。 防倾倒装置可以被移除或旋转，使得当服务员推动椅子时，它们不干扰这种行程。 然而，当使用者恢复推动椅子时，它们应当返回到它们的原始位置（Engstrom，2002）。 在图10-10的椅子背面可以看到防倾翻装置，它显示了一个复合磁轮。

Push handles are another option on a manual chair. These are the handles used by an attendant or caregiver to maneuver the chair. Some of these are height adjustable to accommodate the different heights of individuals who push the chair. Extended handles are available for pediatric chairs to avoid low-back strain for the individual pushing the chair. Push handles have different shapes and are of different mate- rials to assist with grip and handling in difficult situations such as inclement weather or traveling up or down a hill. 推手柄是手动椅上的另一种选择。 这些是由服务员或护理人员用来操纵椅子的把手。 其中一些是高度可调节以适应推动椅子的个人的不同的高度。 扩展的手柄可用于儿科椅子，以避免个人推椅子的低背应力。 推手柄具有不同的形状，并且具有不同的材料，以在困难的情况下帮助抓握和处理，例如恶劣的天气或在山上上下行驶。

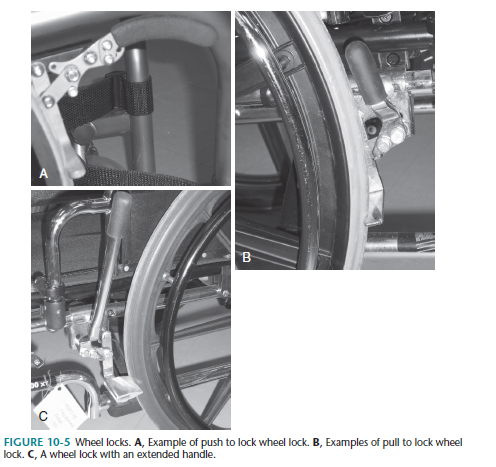
The upholstery of most wheelchairs intended for regular, long-term use is designed to be used with a seating system. The option exists for most chairs to remove the upholstery completely and replace with a back or seat that is attached directly to the frame of the chair. Generally, only those chairs that are for occasional use come with hammock style upholstery attached to the frame.常规长期使用的大多数轮椅的内饰设计与座位系统是一起使用。 对于大多数椅子来说，存在这样的选择：完全移除内饰，并且用直接附接到椅子的框架上的靠背或座椅来替换。 通常，只有那些偶尔使用的椅子带有吊床式内饰，连接到框架上。

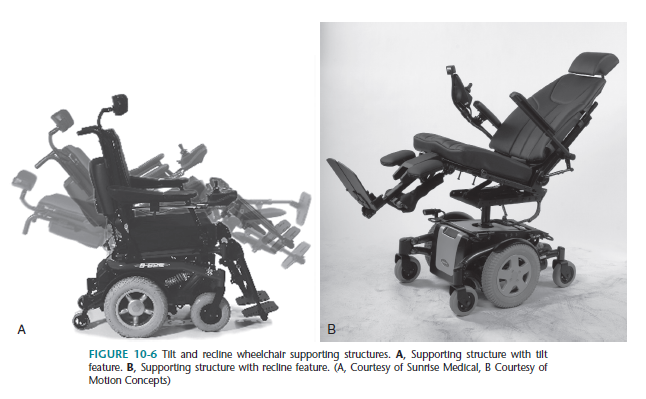
Frames for Tilt and Recline 侧翻与倾斜的框架

Tilt and recline features are available on both manual frames and power bases. Figure 10-6 A and B shows examples of these systems. These features recognize that sit- ting is not a static activity and that we need to provide the opportunity to change position for individuals who cannot do so independently. Tilt refers to the ability to rotate a specific seating position around a fixed axis, thus changing the orientation in space. Recline refers changing the seat- to-back angle, resulting in a seat-to-back angle greater than 90° (Lange, 2000). Te seat-to-back angle typically ranges from upright to nearly horizontal.

手动框架和电源底座都有侧翻和倾斜功能。 图10-6 A和B显示了这些系统的示例。 这些特征意识到，座位不是一个静态的活动，我们需要提供机会来改变不能独立完成的个人的位置。 侧翻是指围绕固定轴旋转特定座位位置，从而改变空间方向的能力。 倾斜指改变座椅到背部角度，导致座椅到背部角度大于90°（Lange，2000）。 座椅到背部角度通常在从直立到接近水平的范围内。Tilt and recline have some common benefits to the user. Both provide a change of position and improved circulation, thus bringing pressure relief and greater comfort (Lange, 2000; Wilson & Miller Polgar, 2005; Smith, 2004). They have the potential to improve head and postural control, providing an improved functional position and influence muscle tone (Engstrom, 2002; Kreutz, 1997; Lange, 2000; Smith, 2004). 侧翻和倾斜给用户带来共同的好处。 两者提供位置的改变和改善的循环，从而带来压力缓解和更大的舒适感（Lange，2000; Wilson＆Miller Polgar，2005; Smith，2004）。 他们有改善头部和姿势控制的潜力，提供改善的功能位置和影响肌肉紧张（Engstrom，2002; Kreutz，1997; Lange，2000; Smith，2004）。

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Clients with neurological problems may have difficulty maintaining postural control (see Chapter 9) in an upright position. Moderate tilt and recline positions may reduce the effects of gravity, allowing a more upright posture, thus aiding function. They have the potential to improve respiratory function, provide a better visual field, regulate blood pressure, ease transfers, and allow rest during the day (Kreutz, 1997; Lange, 2000). Recline or tilt can be used to achieve a more typical spinal alignment, for example, to reduce a thoracic kyphosis (Engstrom, 2002). 有神经问题的客户可能难以保持立姿的姿势控制（见第9章）。 适度的侧躺和倾斜位置可以减少重力的影响，允许更直立的姿势，从而辅助这些功能。 他们有改善呼吸功能，提供更好的视野，调节血压，舒缓转移，并允许白天休息（Kreutz，1997年;兰格，2000年）的潜力。 侧躺或倾斜可以用于实现更典型的脊柱对齐，例如，以减少胸椎后凸（Engstrom，2002）。

Recline is also useful for individuals who become fatigued when sitting upright for a length of time. A chair with a recline feature allows rest without the need to transfer to bed. Clients with a hip deformity that limits their ability to flex the hip will benefit from recline to achieve a comfort- able seating position. It can alleviate orthostatic hypotension (Kreutz, 1997; Lange, 2000) and improve bowel and bladder function. Recline may be preferred to tilt in a work or social environment since it is considered to be less obtrusive by the user (Lange, 2000). Recline does not raise the knees during the position change, which allows the use of this position while continuing to work at a desk or table. 斜倚还对于在一段时间内直立坐在座椅上而变得疲劳的个人也是有用的。 具有斜倚功能的椅子可以不用去床上就可以休息。 具有限制其弯曲髋关节的能力的髋部畸形的客户将受益于倾斜以实现舒适的就座位置。 它可以缓解直立性低血压（Kreutz，1997; Lange，2000），并改善肠和膀胱功能。 倾斜可能倾向于倾斜在工作或社会环境中，因为它被认为是较不引人注意的用户（Lange，2000）。 斜倚在位置改变期间不会抬起膝盖，这允许继续在桌子上工作的同时使用该位置。

Recline is not a good option for some consumers. Opening the hip angle will cause excessive extensor tone in some individuals, particularly children with cerebral palsy or individuals who have sustained a head injury. Obviously, it is not useful when the user has limited hip extension range of motion. Individuals who use a custom contoured seating system should not use a recline system due to the shear forces that are inevitably present when changing the seat-to- back angle.对某些消费者来说，斜倚不是一个好的选择。 打开髋关节角将在一些个体中引起过度的伸展音，特别是患有脑瘫的儿童或持续头部受伤的个体。 显然，当用户具有有限的髋部伸展运动范围时，这是无用的。 使用定制轮廓座椅系统的个人不应使用倾斜系统，因为当改变座椅背靠角度时不可避免地存在剪切力。

Shear is of concern when changing the seat-to-back angle. Recall from Chapter 9 that shear is defined as the friction that occurs when two surfaces slide across each other. Shear has the potential to tear skin, which can lead to a pressure ulcer. Most recline systems are designed to minimize shear, referred to as low-shear systems. These systems follow the user as the system reclines, resulting in a reduction of shear but not its elimination ( Smith, 2004). Low-shear systems are available in both manual and power options. 当改变座椅到背部角度时，剪切是关注的。 回想起第9章，剪切被定义为当两个表面彼此滑动时发生的摩擦。 剪切有可能撕裂皮肤，这可能导致压力性溃疡。 大多数斜倚系统被设计成使剪切最小化，称为低剪切系统。 当系统倾斜时，这些系统跟随用户，导致剪切的减少，但不是消除剪切力（Smith，2004）。 低剪切系统有手动和电动两种选择。

Tilt systems are recommended when it is desirable to maintain the seating position for function or for control of other devices mounted to the wheelchair, such as augmentative and alternative communication devices (Lange, 2000). Because the whole seat pivots around an axis, shear is not as significant a concern as it is with a recline system. In addition to rearward tilt, some systems also provide lateral tilt, which again maintains the seating position but tilts the user in the saggital plane. The combination of anterior-posterior and lateral tilt gives the user control to change position as he or she wishes. 当希望保持座位位置以用于控制安装到轮椅上的其它装置（例如增强型和替代通信装置）时，推荐倾斜系统（Lange，2000）。 因为整个座椅围绕轴线枢转，所以剪切不像关于斜倚系统那样重要。 除了向后倾斜之外，一些系统还提供横向倾斜，其再次保持就座位置，但是在矢状面中使用户倾斜。 前后和侧向倾斜的组合使得用户能够根据他或她的愿望改变位置。

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Tilt systems do pose disadvantages that recline systems do not. Most systems increase the seat-to-floor height. Further, when the user is in the tilt position, the knees are raised, sometimes higher than the level of the head.倾躺系统确实存在倾斜系统没有的缺点。 大多数系统增加了座椅到地板的高度。 此外，当用户处于倾躺位置时，膝盖抬起，有时高于头部的水平。 Te seat-to- floor height and position may interfere with the ability to work at a table or desk and poses a risk for injury if the user attempts to move into a tilt position while seated at a desk or table. As the seat tilts and the knees are raised, the lower extremity may be impinged between a desk and the system (Lange, 2000). 座椅到地板的高度和位置可能干扰在台子或桌子处工作的能力，并且如果用户在坐在台子子或桌子处试图移动到倾躺位置时有可能会受伤。 当座位倾躺并且膝盖抬起时，下肢可能碰撞在桌子和轮椅之间（Lange，2000）。Since tilt maintains the hip angle (typically 90°), bladder constriction may occur, causing problems with fully emptying the bladder (Kreutz, 1997). Extreme degrees of tilt may cause the user to feel posturally insecure, which has the potential to increase muscle contraction, thus defeating the purpose of alleviating fatigue. Finally, tilt may interfere with the use of a tray: objects will slide of a tray when in tilt. 由于倾躺保持髋关节角度（通常为90°），膀胱收缩可能发生，导致完全排空膀胱的问题（Kreutz，1997）。 极度倾躺可能导致使用者感觉到体位不安全，这有可能增加肌肉收缩，从而破坏减轻疲劳的目的。 最后，倾斜可能会干扰托盘的使用：当倾斜时，物体将滑动托盘。

Center of mass shifts are a consideration when evaluating a wheelchair that incorporates a tilt-in-space option. Te relationship of the center of mass of the seat to the center of mass of the base must be considered. The center of mass moves posteriorly as the seat tilts on some systems. This movement can cause rearward instability if the center of mass of the seat is shifted too far back with respect to the center of mass of the base. Most current wheelchair designs compensate for this concern with mechanisms that maintain the center of mass of the seat over the center of mass of the base. 在评估包含空间倾斜选项的轮椅时，质心偏移是一个考虑因素。 必须考虑座椅的质心与基座的质心的关系。 当座椅在某些系统上倾斜时，质心向后移动。 如果座椅的质心相对于基座的质心向后移动得太远，则这种运动可能导致向后不稳定性。 大多数当前的轮椅设计通过将座椅的质心保持在基座的质量中心上的机构来弥补这一问题。

Consumers who use either a tilt-in-space or a recline system frequently also have other assistive technology, and use of that technology must be integrated with these positioning options, specifically, control of a power wheel- chair with a head array, use of a ventilator and/or use of an adapted van. 使用倾斜空间或倾斜系统的消费者经常也使用其他辅助技术，并且该技术的使用必须与这些定位选项相结合，具体地，控制具有头部阵列的电动轮椅，使用 呼吸机或使用适配的厢式货车。Head array controls should be turned of when the user is in the tilt or recline position so that she or he can fully rest the head. When a ventilator is mounted on the wheelchair, care must be taken to ensure that the tilt or recline mechanism does not impinge on the unit and that the ventilator retains its proper position (Lange, 2000).当用户处于倾斜或倾斜位置时，应当转动头部控制器，使得她或他可以完全休息头部。 当将呼吸机安装在轮椅上时，必须注意确保倾斜或倾斜机构不会碰撞到本机上，并且呼吸机保持其正确的位置（Lange，2000）。 Finally, evaluation of the user’s method of transportation must be considered when tilt and recline options are used. Tilt increases the seat-to-floor height, which may prevent the user from transferring into an adapted van. Both have the potential to increase the overall length of the system, which may limit the maneuverability of the user and chair once in a van (Lange, 2000; Phillips, Fisher & Miller Pol- gar, 2005). Integration of wheelchairs with adapted vans will be considered in Chapter 11 when transportation is discussed. 最后，当使用倾斜和倾斜选项时，必须考虑用户的交通方式的评估。 倾斜增加了座椅到地板的高度，这可防止用户转移到适应的厢式货车中。 两者都有可能增加系统的总长度，这可能限制用户和椅子在货车中的可操作性（Lange，2000; Phillips，Fisher＆Miller Pol-gar，2005）。 在讨论交通运输时，第11章将考虑将轮椅与改装车辆集成。

Frames for Standing

We normally think of mobility in terms of wheelchairs; that is, the user is seated. There are, however, many advantages to placing an individual in a standing position (Eng et al., 2001; Eng, 2004; Mogul-Rotman & Fisher, 2002). Among the positive effects of standing are physiological improvement in bladder and bowel function, alleviation of orthostatic hypo- tension, prevention of pressure ulcers (see Chapter 9), reduction in muscle contractures and osteoporosis, and improved circulation. In addition, there are psychological benefits from being able to interact face to face with other people. For example, the height differential between someone seated and someone standing may imply an adult–child relation- ship, whereas standing and interacting face to face implies a relationship among peers. Standing frames and standing wheelchairs are two types of supporting structures that allow the individual to stand. 我们通常认为轮椅的移动性; 即，用户就座。 然而，将个体置于站立位置存在许多优点（Eng等人，2001; Eng，2004; Mogul-Rotman＆Fisher，2002）。 站立的积极效果是膀胱和肠功能的生理改善，正位静息张力减轻，预防压疮（见第9章），减少肌肉挛缩和骨质疏松症，改善循环。 此外，能够与其他人进行面对面交流还有心理上的好处。 例如，坐着的人和站立的人之间的高度差可能意味着成人 - 儿童的关系，而站立和互动的面对面意味着同伴之间的关系。 立式框架和立式轮椅是允许个体站立的两种类型的支撑结构。

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FIGURE 10-7 Large prone stander. (Courtesy of Rifton)

Standing frames are categorized as prone standers, supine standers, upright standers, and mobile standers (Mogul- Rotman & Fisher, 2002). Prone standers, such as the one shown in Figure 10-7, are the most common type. They provide support on the anterior side of the body. Weight bearing on the long bones and lower extremity joints is a major benefit. Weight bearing strengthens bones and can limit advancement of osteoporosis (loss of bone density) that results from prolonged immobility and lack of weight bearing. Often a lap tray is added to the stander, which serves two purposes. 站立框架被分类为俯卧撑，仰卧位，直立式和移动式支架（Mogul-Rotman＆Fisher，2002）。 如图10-7所示的支架是最常见的类型。 它们在身体的前侧提供支撑。 长骨和下肢关节的承重是一个主要的好处。 承重加强骨骼，并且可以限制由于长时间不动和缺乏承重而导致的骨质疏松症的进展（骨密度的丧失）。 通常，托盘被添加到托盘，其用于两个目的。 First, it provides a supportive surface for the upper extremities as the user leans on it. Second, it provides a work surface for activities such as writing, playing with toys, or using a communication device. Prone standers are generally tilted forward to use gravity to assist maintenance of an upright position in the stander. Some types have fixed angles and others are adjustable. Adjustment for growth is incorporated into some designs. This type of standing frame does not give the individual the option of moving into a seated position, as does the stand-up wheelchair discussed below. 首先，当使用者倾斜时，它为上肢提供支撑表面。 第二，它为诸如写作，玩玩具或使用通信设备的活动提供工作表面。 倾斜支架通常向前倾斜以使用重力来辅助维持支架中的直立位置。 一些类型有固定角度，其他类型可调。 生长调整被纳入一些设计。 这种类型的站立框架不给予个人选择移动到就坐位置，如下面讨论的立式轮椅。

Supine standers are less common, and there are fewer options. This type of stander provides support for the posterior surfaces of the body. Because the user is leaning back, it is more difficult to use his or her hands. Line of sight will also be affected. This type of stander is useful for persons who do not have good head control, since the stander sup- ports the head and neck. Upright standers provide for complete weight bearing on the lower extremities. People who have good upper body strength can use stationary models. Mobile versions are often sit-to-stand wheelchairs that allow changes in position from sitting to standing throughout the day. Te change from sitting to standing and vice versa can be either powered or manual. When in a vertical position, these units generally function like a prone stander. 仰卧起坐不太常见，而且选择较少。 这种类型的支架为身体的后表面提供支撑。 因为用户向后倾斜，所以使用他或她的手更加困难。 视线也会受到影响。 这种类型的支架对于没有良好的头部控制的人是有用的，因为支架支撑头部和颈部。 直立式支架在下肢提供完全承重。 具有良好的上半身强度的人可以使用固定模型。 移动版本通常是坐到站立的轮椅，允许位置一整天的变化。 从坐姿到站姿的变化可以是电动的或者手动的。 当处于垂直位置时，这些单元通常起到类似于倾斜的支架的作用。



FIGURE 10-8 Stand-up wheelchair. (Courtesy of Levo AG)

Standing wheelchairs have both functional and social benefits. Many tasks of daily living, such as cooking, are simplifed with the use of a standing wheelchair. Additionally, the use of a standing wheelchair may make it possible to avoid modifications to a home or work setting. For example, a person cooking dinner while using a standing wheelchair is able to reach items in upper cabinets and reach the surface of cabinets and stoves without requiring modifications. Individuals who use a standing wheelchair report positive psychological benefits when they are at the same level as others (Eng, 2004). 站立式轮椅具有功能和社会效益。 使用常设轮椅简化了日常生活的许多任务，例如烹饪。 另外，使用立式轮椅可以避免对家庭或工作环境的改变。 例如，在使用站立轮椅的同时烹饪晚餐的人能够到达橱柜上部中的物品并且到达橱柜和炉灶的表面，而不需要改变。 使用站立轮椅的个人在与其他人相同的水平时报告积极的心理效益（Eng，2004）。

Standing wheelchairs (Figure 10-8) are available in three basic configurations: manual driven with a manual lifting mechanism, manual driven with a power lifting mechanism, and power driven with a power lifting mechanism. Standing wheelchairs with manual lifting mechanisms consist of a hydraulic system that uses either a pump or a lever to raise the person to the standing position. 常备轮椅（图10-8）有三种基本配置：手动提升机构手动驱动，动力提升机构手动驱动，动力提升机构动力驱动。 具有手动提升机构的常规轮椅包括液压系统，该液压系统使用泵或杠杆将人抬高到站立位置。With a powered system,

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the person activates a button to move into the upright position. When standing, the person is supported by padded bars at the knees and torso. Stability in the upright position is a concern with standing wheelchairs since movement into the standing position moves the client’s center of gravity for- ward in the chair, ahead of the center of mass of the base. For this reason not all standing wheelchairs are mobile while in the upright position. Those that are designed to be mobile in the standing positioning have a wider-than-normal base of support or adjust the center of mass of the user so that it remains over the center of the drive wheels. Typically, those chairs that are not meant to be mobile in the standing position have a drive lockout. 使用动力系统，人按动按钮变成直立位置。 站立时，该人由膝盖和躯干上的填充条支撑。 在直立位置的稳定性是站立轮椅的重点，因为运动到站立位置使得客户的重心向前移动超过基座的质量中心。 由于这个原因，不是所有的站立轮椅在直立位置是可以移动的。 被设计成站立位置可移动的那些轮椅，具有比正常的更宽的支撑来调节用户的质心，使得其保持在驱动轮的中心上方。 通常，那些在站立位置移动的椅子具有驱动锁定。

Frames That Provide Variable Seat Height 提供可变座椅高度的框架

Another available option on powered wheelchair frames is an elevating seat. The person remains in a seated position, and when the mechanism is activated, the wheelchair seat raises and lowers within a given range. A seat that lowers near the floor is particularly useful for small children. Being at floor level allows the child to play on the floor and interact at a level with children of the same age. 电动轮椅框架上的另一个可用选项是升降座椅。 人员保持在就座位置，并且当机关被启动时，轮椅座椅在给定范围内升高和降低。 可以降低到接近地面的座椅对小孩子特别有用。 允许儿童在地面上玩，并与同龄的儿童在一个水平上进行交流。

There are also benefits to raising the height of a seat. As with a standing wheelchair, a seat elevator can make it easier for the individual to participate in certain self-care, work, and educational activities by reducing the need for environmental accommodations. As with standing wheelchairs and tilt-in-space and recline systems, the location of the center of mass has implications to safety. Some systems have a power lockout that prevents the chair from moving when the seat is raised to a certain height. Stability when traveling around corners may be compromised if the center of mass is too high relative to the footprint of the chair. 还有益于提高座椅的高度。 与普通轮椅一样，座位的升降可以减少需要环境调节的几率，而使个人更容易参与某些自我照顾，工作和教育活动。 与站立式轮椅，空间倾躺和倾斜系统一样，质心的位置对安全也有影响。 一些系统具有动力锁定，其在座椅被提升到一定高度时防止椅子移动。 如果质心相对于椅子太高的话，则在拐角处行驶时的稳定性可能会降低。

Frames That Accommodate Growth 适应增长的框架

A major requirement of the supporting structure of the wheelchairs for children is that they accommodate growth. Two approaches are commonly used to accommodate growth (including clients with weight gain). The first of these is to design the supporting structure so that it can be adjusted directly. Kits are provided in the second option that allow replacement of various tubes on the frame increasing seat width and length, seat-to-floor height, and access to the wheels. Wheelchairs that are adjustable are now more common. 儿童轮椅的支撑结构的主要是适应儿童生长的需求。 通常使用两种方法来适应生长（包括具有体重增加的客户）。 第一个是设计支撑结构，使其可以直接调整。 在第二选项中提供了配件，其允许更换框架上的各种管，从而增加座椅宽度和长度，座椅到地面的高度以及进入车轮。 可调节的轮椅现在更常见。

Access to the drive wheels is another consideration when recommending pediatric chairs. One strategy to improve this access is to set the drive wheels in slight camber. A second approach, for very young children, is to reverse the configuration of the drive wheels, placing them at the front of the chair with the casters at the back. Stability of the chair, rearward, must be carefully assessed with this configuration. 访问驱动轮是推荐儿童轮椅时的另一个考虑因素。 改善这种接近的一个策略是将驱动轮设置在轻微的弯度。 第二种方法，对于很小的孩子，是扭转驱动轮的配置，将它们放在椅子的前面，脚轮在后面。 使用此配置必须仔细评估椅子后部的稳定性。

Push handles are a final consideration for a pediatric frame. Extended handles are available so that the caregiver does not need to lean or bend forward to grasp the push handles. This configuration greatly reduces the load placed on the caregiver’s lower back by allowing an upright position during this activity.推动手柄是儿童轮椅的最终考虑因素。 延长的手柄是可用的，使得护理者不需要倾斜或向前弯曲以抓握推动手柄。 这种构造通过在该活动期间允许直立位置而大大减小了放置在护理者的下背上的负载。

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Propelling Structure: Manual

For manual wheelchairs, the propelling structure consists of two main parts: (1) wheels (including tires and casters) and (2) an interface that the consumer uses to move the wheel- chair (Ragnarsson, 1990). We discuss each of these components in this section.

推进结构：手动

对于手动轮椅，推进结构包括两个主要部分：（1）轮（包括轮胎和脚轮）（2）消费者用来移动轮椅的接口（Ragnarsson，1990）。 我们在本节讨论这些组件。

Tires 轮胎

There are three main types of wheelchair tires: solid, semi- pneumatic, and pneumatic (Robson, 2005). Solid tires require less maintenance than other types but are the least versatile. They generally perform well on smooth indoor surfaces but are less efficient when used on carpeted surfaces or other rough, uneven terrain. Solid tires typically have a smooth surface. 轮椅轮胎有三种主要类型：固体，半气动和气动（Robson，2005）。实心轮胎比其他类型的轮胎需要更少的维护，但是最不通用。 它们通常在光滑的室内表面上表现良好，但是当在地毯表面或其它粗糙，不平坦的地形上使用时效率较低。 实心轮胎通常具有平滑表面。

Pneumatic tires may have an inner tube or a fat-free insert. Although they are useful over more varied terrain than solid tires, they require maintenance to maintain proper tire pressure and can be punctured, resulting in a fat. Sawatsky et al. (2005) found that rolling resistance and energy expenditure were significantly decreased when tires were inflated to 50% of their recommended pressure. They report clinical evidence that wheelchair tires are commonly found to be inflated to only 25% of their recommended pressure. In addition to maintaining tire pressure, the user should inspect the tires regularly for any cracks or imperfections that may lead to a fat. These tires are available with different tread depths; deeper treads are useful on rough terrain but create more rolling resistance when used on smoother surfaces. 充气轮胎可以具有内管或无脂插入物。 虽然它们在比实心轮胎更多变化的地形上是有用的，但它们需要保持适当的轮胎压力并且可以被刺穿。 Sawatsky et al（2005）发现，当轮胎充气到其推荐压力的50％时，滚动阻力和能量消耗显着降低。 他们报告临床证据，轮椅轮胎通常被发现只能膨胀到推荐压力的25％。 除了保持轮胎压力，用户应定期检查轮胎是否有任何可能导致车带的裂纹或缺陷。 这些轮胎有不同的胎面深度; 较深的胎面在粗糙的地面上是有用的，但是当在更平滑的表面上使用时产生更大的滚动阻力。

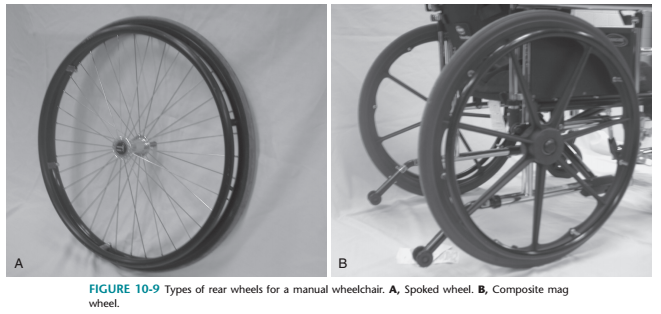
Wheels 车轮

Rear wheels are of two basic types: composite or spoke, shown in Figure 10-9 ( Robson, 2005). Composite wheels tend to be more economical than spoke wheels and require less maintenance. 后轮有两种基本类型：复合轮或辐条轮，如图10-9所示（Robson，2005）。 复合轮比辐条轮更经济，并且需要较少的维护。There is less risk of the user getting a hand caught in the wheel. These wheels tend to be more rigid than spoke wheels and thus may make for a more uncomfortable ride (Robson, 2005). Spoke wheels typically require maintenance because it is more difficult to clean them and the spokes should be readjusted. 使用者将手抓在车轮中的风险较小。 复合轮子比辐条轮子更刚性，因此可能造成不舒服的乘坐感受（Robson，2005）。 辐条通常需要维护，因为它们更难清理，并且轮辐应当重新调整。These wheels tend to transmit less vibration from the surface to the user than do more rigid composite wheels (Robson, 2005). They are lighter in weight than composite wheels. High-performance wheels (such as the Spinergy wheel) are available for active users such as individuals who use their chairs to travel long distances regularly, use a wheelie to change heights as in climbing a curb, or who use their chairs most of the day, moving about their environment. These wheels use lightweight materials that provide better strength and greater shock absorption. Wheels range in size from 18 to 26 inches in diameter. Powered wheelchairs typically have 18-inch wheels and conventional manual types have 24-inch wheels. 与较硬的复合轮相比，高性能轮倾向于将更少的振动从表面传递给用户（Robson，2005）。 它们的重量比复合轮轻。 高性能轮（例如Spinergy轮）可用于活跃用户，例如使用他们的椅子定期长距离旅行的人，在攀爬路边时使用轮椅的改变高度功能，或者在大部分时间使用他们的椅子在他们的环境中移动。 这些轮子使用轻质材料，提供更好的强度和避震。 车轮直径从18到26英寸不等。 电动轮椅通常有18英寸轮子，常规手动型轮子有24英寸轮子。

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 FIGURE 10-9 Types of rear wheels for a manual wheelchair.

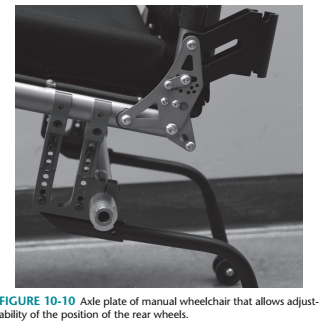


FIGURE 10-10 Axle plate of manual wheelchair that allows adjust- ability of the position of the rear wheels.

Many wheelchairs allow adjustment of the location of the drive wheels forward or rearward on the chair. Figure 10-10 shows a mounting plate that allows adjustments of the position of the drive wheels. The location of the wheels relative to the center of gravity of the user affects the mobility and stability of the chair. When the axle of the wheel is located either directly under the user’s center of gravity or anterior to it, the result is a more maneuverable, responsive chair—one that is desired by the active user. More novice wheelchair users or those with less control will feel most comfortable with the axis of the wheel located slightly behind their center of gravity, resulting in a more stable chair (Engstrom, 2002). Wheel camber affects the responsiveness of the chair. Camber refers to the degree to which the wheel is mounted of vertical, usually 1 to 4 degrees. Camber tips the wheel so the top is closer to the user’s body. When the wheels are set this way the wheel- chair becomes more stable and propulsion is more efficient.

许多轮椅允许在椅子上向前或向后调整驱动轮的位置。图10-10显示了一个可以调整驱动轮位置的安装板。轮子相对于用户的重心的位置影响椅子的移动性和稳定性。当车轮的轴线位于用户的重心下方或其前方时，结果是活动用户期望的更灵活，更灵敏的椅子。更多的新手轮椅使用者或较少控制的人将感觉最舒适的车轮轴位于稍微在其重心后面，是更稳定的椅子（Engstrom，2002）。车轮外倾影响椅子的响应性。凸度是指车轮安装的垂直度，通常为1到4度。凸轮提示轮子，使得顶部更靠近用户的身体。当轮子以这种方式设置时，轮椅变得更稳定并且推进更有效。

There is greater access to the wheels. Camber increases the overall width of the chair and lowers the rear seat-to-floor height (Robson, 2005). Wheel alignment also affects the ease with which the chair can be propelled. Alignment refers to the degree to which the two wheels are parallel to each other. If they are not parallel and at equal distance from each other, there is greater rolling resistance for the wheelchair. 有更多的访问车轮。 弯度增加了椅子的整体宽度，并降低了后座椅到地板的高度（Robson，2005）。 车轮定位也影响了椅子可以被推动的容易程度。 对准是指两个轮彼此平行的程度。 如果它们不平行并且彼此距离相等，则对于轮椅存在更大的滚动阻力。

Casters 脚轮

The front wheels on wheelchairs are referred to as casters. They range in diameter from 2¾ to 8¼ inches ( Buck, 2009). Larger casters give a smoother ride but are less responsive and can interfere with foot placement (Robson, 2005). Smaller casters are more responsive, contribute to more efficient propulsion, and allow more flexibility in the position of the feet, but these benefits are compromised by a rougher ride (Engstrom, 2002; Robson, 2005). Solid, semipneumatic casters are available. The relationship of the user’s center of gravity to the chair’s center of mass is important here. If the user is seated too far forward in the chair, excess weight is placed on the casters (i.e., front loading the casters), making it more difficult to propel as the force required to overcome inertia is greater (Engstrom, 2002). This situation may also result in loss of forward stability with an added risk of the chair tipping forward.

轮椅上的前轮被称为脚轮。 它们的直径范围从2¾到8¼英寸（Buck，2009）。 较大的脚轮给予更平滑的骑行，但反应较慢，并可能干扰脚放置（Robson，2005）。 较小的脚轮响应更快，有助于更有效的推进，并允许在脚的位置更多的灵活性，但这些好处受到了更粗糙的旅行（Engstrom，2002年; Robson，2005年）。 提供固体，半气动脚轮。 在此，用户的重心与椅子的质心的关系是重要的。 如果使用者在椅子上坐得太靠前，则多余的重量被放置在脚轮上（即，前部装载脚轮），使得它更难以推进，因为克服惯性所需的力更大（Engstrom，2002）。 这种情况还可能导致前向稳定性的损失，并且椅子倾斜向前的风险增加。

Attention to the function of the casters is important because they contribute to the overall function of the chair. Shimmy is one of the major problems with casters (Buck, 2009). This term refers to the rapid vibration that is often experienced when pushing a shopping cart. Smaller casters tend to have less shimmy than larger ones. Shimmy can result from the position of the caster fork and stem, uneven wear of the caster wheel, and the tension in the caster axle and swivel mechanism where they attach to the frame. Caster float occurs when one of the casters does not touch the floor when the wheelchair is on level ground (Cooper, 1998), which can

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result in reduced stability and performance. If caster shimmy is observed, it is an indication that maintenance of the chair is needed. Excessive wear on one caster or unequal camber in the rear wheels will bring about caster foat. Replacing the caster, adjusting the rear wheel camber, or lowering the caster that foats with a spacer can eliminate the problem (Cooper, 1998).

注意脚轮的功能是重要的，因为它们有助于椅子的整体功能。 振动是脚轮的主要问题之一（Buck，2009）。这个术语是指推动购物车时经常遇到的快速振动。较小的脚轮倾向于比较大的脚轮更少的摆动。垫片可能由脚轮叉和杆的位置，脚轮的不均匀磨损以及脚轮轴和旋转机构中的张力导致，其中它们附接到框架。当轮椅在水平地面时，当其中一个脚轮不接触地面时，脚轮漂浮发生（Cooper，1998），这可能导致稳定性和性能降低。如果观察到脚轮振摆，则表明需要维护椅子。一个脚轮过度磨损或后轮不平的外倾会带来脚轮浮起。更换脚轮，调整后轮外倾角或降低带有间隔件的脚轮可以消除这个问题（Cooper，1998）。

Hand Rims手边缘

The human/technology interface for a manual wheelchair is most commonly a ring attached to the wheel, called a hand rim. Hand rims are made from a variety of materials including titanium, aluminum, and stainless steel. They may have a vinyl coating. Ergonomically designed hand rims use a material that spans the space between the wheel rim and the hand rim, thus allowing a natural fit with the user’s palm (Figure 10-11). If an individual has the use of only one arm and hand for propelling the wheelchair, two hand rims are put on the intact side and a linkage is attached between the inner hand rim and the opposite wheel (Buck, 2009). By grasping both hand rims, the user can move forward. Turning is possible using one hand rim at a time. Often the person who uses this hand rim configuration will also use at least one leg to propel the chair.

手动轮椅的人/技术接口最常见的是附接到轮的环，称为手边缘。 手边缘由各种材料制成，包括钛，铝和不锈钢。 它们可以具有乙烯基涂层。 人体工程学设计的手边缘使用跨越轮缘和手边缘之间的空间的材料，从而允许与使用者的手掌自然贴合（图10-11）。 如果个人仅使用一个手臂和手来推动轮椅，则在完整侧上放置两个手边缘，并且在内手边缘和相对的轮子之间连接连杆（Buck，2009）。 通过抓握两个手边缘，用户可以向前移动。 每次可以使用单手轮圈进行车削。 通常，使用这种手边缘构造的人还将使用至少一条腿来推动椅子。

Propelling Structure: Powered推进结构：动力

The propelling structure of powered wheelchairs has more variability than do manual systems. The major components are a wheeled mobility base with a power drive to the wheels, a control interface that the consumer uses to direct the movement of the wheelchair, an electronic controller, and powered accessories (e.g., recline, tilt). Tis section discusses current approaches. 动力轮椅的推进结构比手动系统具有更多的变化性。 主要部件是具有到车轮的动力驱动器的轮式移动基座，消费者用于引导轮椅运动的控制接口，电子控制器和动力配件（例如，斜倚，倾斜）。 本节讨论当前的方法。

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FIGURE 10-12 Powered wheelchair with midwheel drive system. (Courtesy of Pride Mobility Products Corporation)

Drive Wheels驱动轮

Powered wheelchairs have undergone a tremendous change in the last decade. The development of microprocessing capabilities enables developers of powered mobility technology to include a wide range of functions in these devices. One of the most significant developments is the change in the location of the drive wheels. Power is delivered to one pair of wheels in mobility technology with additional sets of wheels providing stability. Direct drive systems also often provide dynamic or active braking of the wheelchair by providing a voltage that stops the motor. This action offers more control than the common situation of letting the chair coast to a stop after the voltage is turned of to the motor. Powered wheelchairs are generally classified as rear-, mid-, or front- wheel drive depending on the location of the wheels that propel the chair. Rear- and mid-wheel drive chairs are the most common. In addition to castors, anti-tipping devices may also be present on a power chair. Figure 10-12 shows a mid-wheel drive powered wheelchair, with the housing for the motor and batteries located underneath the seat. 电动轮椅在过去十年中经历了巨大的变化。微处理能力的发展使得电动移动技术的开发者能够在这些设备中包括广泛的功能。最重要的发展之一是驱动轮的位置的变化。动力传递到一对车轮的移动技术，附加的车轮提供稳定性。直接驱动系统还通常通过提供停止电动机的电压来提供轮椅的动态或主动制动。这种动作提供了比在电压转向电动机之后使椅子滑行停止的常见情况更多的控制。根据推动椅子的轮子的位置，电动轮椅通常被分类为后轮驱动轮，中间轮或前轮驱动轮。后轮和中轮驱动椅是最常见的。除了脚轮，防倾翻装置也可以存在于电动椅上。图10-12显示了一个中轮驱动电动轮椅，其中电机外壳和电池位于座椅下方。

Denison and Gayton (2002) proposed an additional drive classification based on the relationship of the drive wheel to the center of gravity of the user as well as the ratio of weight on the drive wheels to that on the castors. The drive wheels of a rear-wheel drive chair are located behind the center of gravity of the user. These are well behind the center of gravity in a low-ratio rear-wheel drive. The front wheels are castors and anti-tipping wheels may or may not be present. The drive wheels of a high-ratio rear wheel drive are closer to the user’s center of gravity. In addition to front castors, anti-tipping wheels are located behind the drive wheels. The drive wheels of a mid-wheel drive chair are located directly under the users center of gravity. Castors are located both in front of and behind the drive wheels. Denison和Gayton（2002）基于驱动轮与用户重心的关系以及驱动轮上的重量与脚轮重量的比率提出了附加的驱动器分类。 后轮驱动椅的驱动轮位于用户的重心后面。 这些都落在低比率后轮驱动中的重心后面。 前轮是脚轮，并且防倾翻轮可以存在或可以不存在。 高比率后轮驱动的驱动轮更接近使用者的重心。 除了前脚轮，防倾翻轮位于驱动轮后面。 中轮驱动椅的驱动轮直接位于用户的重心下方。 脚轮位于驱动轮前面和后面。

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These castors are intended to be in contact with the surface when the chair is in motion. The drive wheels of a front-wheel drive chair are located ahead of the user’s center of gravity, with the high- ratio front-wheel drive wheels being closer to the center of gravity than the low-ratio. The location of the drive wheels affects the performance of the chair, making it an important consideration when recommending a chair to a client. 这些脚轮意在当椅子运动时与表面接触。 前轮驱动椅的驱动轮位于用户重心的前方，高比率前轮驱动轮比低速比更接近重心。 驱动轮的位置影响椅子的性能，使得在向客户推荐椅子时是重要的考虑因素。

Evaluation of the clients physical and cognitive abilities and examination of their mobility needs are important steps in determining which type of powered wheelchair is most suited to their needs and lifestyle. There is limited literature that evaluates the function of powered wheelchairs to assist the client and clinician in making a power mobility decision. Rentschler and colleagues from the Rehabilitation Engineering Research Center on Wheeled Mobility at the University of Pittsburgh used the ANSI/RESNA standards to evaluate five powered wheelchairs that were commonly recommended for clients in the Veterans Affairs Healthcare system (Rentschler et al., 2004). They examined two rear- wheel drive chairs, two mid-wheel drive chairs, and one front-wheel drive. While their results did not point conclusively to the benefits of one chair over another, they do give a good initial foundation with which to compare a chair’s performance to the consumer’s needs. 对客户身体和认知能力的评估以及对他们的移动性需求的检查是确定哪种类型的电动轮椅最适合他们的需求和生活方式的重要步骤。 有限的文献评估动力轮椅的功能以帮助客户和临床医生做出动力移动性决定。 Rentschler和匹兹堡大学轮动车辆康复工程研究中心的同事们使用ANSI / RESNA标准来评估五个电动轮椅，这些轮椅通常被推荐给退伍军人事务医疗系统的客户（Rentschler et al。，2004）。 他们检查了两个后轮驱动椅，两个中轮驱动椅和一个前轮驱动。 虽然他们的结果并不能确定一个椅子对另一个椅子的好处，他们确实提供了一个良好的初步基础，用来比较椅子的性能与消费者的需要。

Control Interfaces for Powered Mobility Systems电动移动系统的控制接口

There are a number of ways in which a powered wheelchair can be controlled. Two control distinctions need to be made before discussing the various technologies: proportional versus nonproportional control. Proportional control with 360-degree directionality means that the chair moves in whichever direction the joystick is displaced. The greater the displacement, the faster the chair moves (Lange, 2005). The joystick controls fewer degrees of movement with nonpro- portional control. Regardless of the displacement, the chair travels at a preselected speed. If the user wishes to change direction she or he must release the joystick in one direction and activate it in the direction of the change (Lange, 2005). 有多种方式可以控制电动轮椅。 在讨论各种技术之前，需要进行两种控制区分：比例控制和非比例控制。 具有360度方向性的比例控制意味着椅子沿着操纵杆移位的任何方向移动。 位移越大，椅子移动得越快（Lange，2005）。 操纵杆通过非临时控制控制较小的移动度。 不管位移，椅子以预选的速度行进。 如果用户希望改变方向，她或他必须沿一个方向释放操纵杆并且沿变化的方向激活它（Lange，2005）。

Many options exist that provide access to powered wheel- chair controls. The initial assessment by the clinician includes the determination of movements that the client is able to make reliably. A similar process can be used to determine the most appropriate method of access, as was described in Chapters 6, 7 and 8 regarding computer and AAC access. An important difference between assessment for computer access versus powered wheelchair control is that the clinician needs to determine that the movement of the control interface used to control the powered wheelchair is safe as well as reliable (i.e., the user must be able to initiate or cease a movement as required because they are controlling a moving vehicle). 存在许多选项提供访问动力轮椅控制。 临床医生的初始评估包括客户能够可靠地进行的运动的确定。 可以使用类似的过程来确定最合适的访问方法，如关于计算机和AAC访问的第6,7和8章中所述。 计算机访问的评估与电动轮椅控制的评估之间的重要区别在于，临床医生需要确定用于控制电动轮椅的控制接口的移动是安全的以及可靠的（即，用户必须能够启动或停止 由于它们正在控制移动车辆而需要的运动）。

Many of the types of switches described in Chapter 8 are also useful for powered mobility control. These switches can be mechanical or electronic (Lange, 2005). Mechanical switches must be physically activated to initiate a control command. For example, they must be moved, depressed, touched, or released. Capacitive switches do not require physical contact from the user. Proximity switches activate when the user is close to the switch, but not necessarily touching it. Fiberoptic switches emit an invisible beam that initiates an action when interrupted (Lange, 2005). 第8章中描述的许多类型的交换机也可用于电源移动性控制。 这些开关可以是机械的或电子的（Lange，2005）。 机械开关必须被物理激活以启动控制命令。 例如，他们必须移动，按压，触摸或释放。 电容开关不需要用户的物理接触。 当用户靠近开关时，接近开关激活，但不一定接触开关。 光纤开关发射不可见光束，当中断时启动动作（Lange，2005）。

The most common method of control of a powered wheel- chair is direct selection through the use of a four-direction joystick. Typically, a joystick can be positioned on either side of the chair or in midline to be controlled with the hand or forearm. It can also be fixed or mounted on a swing-away plate that facilitates transfers. It can be positioned to be used with the chin, foot, leg, or head. When a chin joystick is used, an additional switch (often activated by a shoulder shrug) can be used to control a powered arm that moves the joystick into position for use and swings it out of the way for eating, talking, or mouthstick use.

最常见的控制电动轮椅的方法是通过使用四向操纵杆进行直接选择。 通常，操纵杆可以定位在椅子的任一侧或中间，以用手或前臂控制。 它也可以固定或安装在便于转移的摆动板上。 它可以定位以与下巴，脚，腿或头一起使用。 当使用下巴操纵杆时，可以使用附加的开关（通常由肩耸肩激活）来控制动力臂，该动力臂将操纵杆移动到使用位置，并且摆动它用于吃饭，说话或口腔使用。

Most joysticks have a ball on top. However, many types of handles are available for users with different grasping abilities (Lange, 2005). For example, a U-shaped cuf that sup- ports the person’s hand on the sides may enhance control of the joystick. Other variations include smaller or larger balls, a T-bar (shown in Figure 10-15), and an extended joy- stick. A new product, Touch Drive 2,2 uses a touch screen in place of a joystick. This unit allows the client to use different access methods to control it. Movement up, down, right, or left results in corresponding movements of the chair. Speed is determined by the speed of movement on the touch pad. Maintaining contact with the touch pad in the desired direction keeps the chair moving in that direction.

大多数操纵杆在顶部有一个球。 然而，许多类型的手柄可用于具有不同抓握能力的用户（Lange，2005）。 例如，支撑人的手在侧面的U形形状可以增强对操纵杆的控制。 其他变化包括更小或更大的球，T形杆（如图10-15所示）和扩展的操纵杆。 新产品Touch Drive 2,2使用触摸屏代替操纵杆。 该单元允许客户端使用不同的访问方法来控制它。 向上，向下，向右或向左的运动导致椅子的相应运动。 速度由触摸板上的移动速度确定。 在期望的方向上保持与触摸板的接触保持椅子在该方向上移动。

Sip-and-puff switches are a common control interface for individuals with a high spinal cord lesion. A small tube is placed in close proximity to the person’s mouth. The user controls the switch with either a puff (blowing air out of the mouth) or sip (sucking air into the mouth). A hard puff causes the chair to move forward while a hard sip causes it to move in reverse. A soft puff turns the chair right; a soft sip turns it left. The forward direction is latched (i.e., once the user activates forward movement, the chair will continue to travel in that direction until reverse is activated). Good oral motor control is required to use a sip-and-puff system. Figure 10-13 shows a sip-and-puff system for controlling a wheelchair. sip-and-puff开关是具有高脊髓损伤的个体的常见控制界面。 将小管放置在人的嘴附近。 用户用吹气（吹出口中的空气）或吸气（将空气吸入口中）来控制开关。 硬吸力使椅子向前移动，而硬的吸力使其反向移动。 一个软的吹把椅子转动; 软啜饮把它左转。 向前方向被锁定（即，一旦用户激活向前移动，椅子将继续沿该方向行进，直到反向被激活）。 需要良好的口服电机控制以使用sip-and-puff系统。 图10-13显示了用于控制轮椅sip-and-puff系统。

Various head control systems are available and are arranged in a head array in a headrest. Figure 10-14 shows an example of this type of control interface. These are electronic, not mechanical, switches. Typically the user has access to three switches: moving the head backwards causes the chair to move forward, tilting it to the right moves the chair right, and the opposite initiates travel to the left. Tilting the head forward stops the chair (Lange, 2005). Control can be either proportional or nonproportional, depending on the head control of the user. Individuals who tend to move into extension when their neck is extended may not be good candidates for this type of system because they may not be able to reliably stop or reverse the chair if extensor tone inhibits forward flexion of the neck. 各种头部控制系统是可用的并且以头部阵列布置在头枕中。 图10-14显示了这种类型的控制接口的示例。 这些是电子的，而不是机械的开关。 通常，用户可以使用三个开关：向后移动头部使得椅子向前移动，向右倾斜使椅子向右移动，并且相反启动向左移动。 向前倾斜头部阻止椅子（Lange，2005）。 根据用户的头部控制，控制可以是比例或非比例的。 当颈部伸展时倾向于伸展的个体可能不是这种类型的系统的良好候选者，因为如果伸展者的嗓音抑制颈部的向前屈曲，则他们可能不能可靠地停止或倒转椅子。

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FIGURE 10-13 Sip-and-puff controller. (Courtesy of Adaptive Switch Laboratories)

FIGURE 10-14 Head array, power wheelchair controller. (Courtesy of Adaptive Switch Laboratories)

Indirect selection using scanning is also available for consumers who can only use a single switch. In this case there are four lights, one for each direction, arranged in a cross pattern. The lights scan around the pattern until the user presses a switch. The wheelchair then moves in the direction selected. Other functions are also scanned. Single-switch scanning is time-consuming, as well as cognitively demanding, and is typically considered only after other options have been excluded. Another major issue with this approach is the tendency of the chair to wander from a straight line of travel, necessitating the inclusion of steering switches that make small corrections to the direction of travel.

使用扫描的间接选择也可用于只能使用单个开关的消费者。 在这种情况下，存在四个灯，每个方向一个，以十字图案布置。 灯光在模式周围扫描，直到用户按下开关。 然后轮椅沿所选方向移动。 还扫描其他功能。 单次切换扫描是耗时的，以及认知上的要求，并且通常仅在排除其它选项之后才被考虑。 这种方法的另一个主要问题是椅子从直线行驶的倾向，需要包括对行驶方向进行小修正的转向开关。

Controllers控制器

A powered wheelchair controller connects the control inter- face to the drive system. This component is the processor in the assistive technology component of our Human Activity Assistive Technology (HAAT) model. Figure 10-15 A and B shows a typical wheelchair controller. In a proportional drive system, the controller determines the amount of voltage supplied to the motor by the amount of defection in the joystick. This voltage is directly related to motor speed. Tis type of proportionality is not obtained from a switched control interface. To allow the wheelchair to accelerate gradually (as the user with a proportional control would do), the controller provides a gradual acceleration when any direction is selected. In most controllers, the rate of acceleration can be adjusted to meet the consumer’s needs. For example, an expert powered wheelchair user could have the acceleration set on the high end so that the chair is highly responsive, whereas a novice user could set the rate of acceleration slower to allow for a slower start. The rate of deceleration (braking) can also be adjusted. Deceleration is the swiftness with which the wheelchair comes to a stop once the control interface is deactivated. With these two features on a controller, it is possible to set one rate for acceleration and a different rate for braking. 电动轮椅控制器将控制接口连接到驱动系统。这个组件是我们的人类活动辅助技术（HAAT）模型的辅助技术组件中的处理器。图10-15 A和B显示了一个典型的轮椅控制器。在比例驱动系统中，控制器通过操纵杆中的偏离量来确定供应给马达的电压量。该电压与电机速度直接相关。不从开关控制接口获得该类型的比例。为了允许轮椅逐渐加速（当用户使用比例控制时），当选择任何方向时，控制器提供逐渐的加速度。在大多数控制器中，加速度的速率可以调整以满足消费者的需要。例如，专家动力轮椅使用者可以在高端设置加速度，使得椅子高度响应，而新手用户可以将加速率设置得更慢以允许更慢的起动。也可以调整减速度（制动）。减速是一旦控制接口被停用，轮椅就停止的快速性。利用控制器上的这两个特征，可以设置一个加速率和不同的制动率。

Controllers also provide either momentary or latched switch control. In momentary control, the motors are activated only while the switch is pressed, which provides the greatest control for the user. Some consumers are unable to maintain switch activation, but they can press and release quickly. In this case, latched control is used. In this mode, when the switch is pressed once, the motors turn on and remain on. When the switch is pressed again, the motors turn of. It is important that the consumer be able to activate the switch reliably and rapidly when it is in the latched mode, so as to stop quickly when necessary. This feature is often used with sip-and-puff switches. It allows the user to give a hard puff once to latch the control for the wheelchair to move either forward or backward and then use soft sips and puffs to turn left or right (Taylor & Kreutz, 1997). 控制器还提供瞬时或锁存开关控制。 在瞬时控制中，电机仅在按下开关时被激活，这为用户提供了最大的控制。 一些消费者无法保持开关激活，但他们可以快速按下和释放。 在这种情况下，使用锁存控制。 在此模式下，当按下开关一次时，电机打开并保持打开。 再次按下开关时，电机转动。 重要的是，消费者能够在其处于锁定模式时可靠且快速地激活开关，以便在必要时快速停止。 此功能通常用于sip-and-puff开关。 它允许用户给予一次硬的扑一次以锁定轮椅的控制，向前或向后移动，然后使用软的水槽和抽吸向左或向右转动（Taylor＆Kreutz，1997）。

Most powered wheelchair controllers are programmable by the user to some extent, which gives them much more flexibility and adjustability. The clinician completes the initial programming when the chair is set up, based on his or her assessment. Forward and reverse maximal speeds can be independently adjusted. On some devices the ratio of for- ward to reverse speed is adjustable. It is more difficult to control the wheelchair when turning than when going straight, and the controller feature that allows turning speed to be set independently of (or as a function of) forward speed is useful. 大多数电动轮椅控制器可由用户在一定程度上编程，这给予他们更大的灵活性和可调性。 当椅子被设置时，临床医生基于他或她的评估完成初始编程。 正向和反向最大速度可以独立调节。 在某些设备上，前进与倒车速度的比率是可调的。 在转弯时比在直线时控制轮椅更加困难，并且允许独立于前进速度（或作为前进速度的函数）设定转动速度的控制器特征是有用的。

Some consumers have difficulty controlling their movements because of tremor, which can make the use of a joystick or other wheelchair control interface difficult. To accommodate for tremor, an averaging feature is incorporated into some controllers. The averaging system effectively damps out the tremor by ignoring small rapid movements and responding to larger, slower ones (Aylor et al., 1979). The disadvantage of this approach is that the system can become sluggish, resulting in reduced capability to respond to obstacles quickly. This feature is sometimes referred to as the sensitivity or tremor dampening of the controller. 一些消费者由于震颤而难以控制它们的运动，这可能使得使用操纵杆或其他轮椅控制界面变得困难。 为了适应震颤，一些控制器中集成了平均功能。 平均系统通过忽略小的快速运动并响应更大，更慢的运动而有效地抑制震颤（Aylor等人，1979）。 这种方法的缺点是系统可能变得迟缓，导致快速响应障碍的能力降低。 此功能有时称为控制器的灵敏度或震颤抑制。

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Another adjustment allowed by the controller is the ability to alter the degree of range of motion required for an individual to operate a control interface. This feature is called the short throw adjustment and is most commonly used with joysticks. It is useful for consumers who have limited range of motion at the control site that is being used. Many controller models have an LED display that visually represents the different functions and the results of adjustments as they are made (Figure 10-15 A). 控制器允许的另一调整是改变个体操作控制接口所需的运动范围的程度的能力。 此功能称为短掷调整，最常用于操纵杆。 它对于在正在使用的控制位点处具有有限运动范围的消费者是有用的。 许多控制器型号具有LED显示器，其在视觉上表示不同功能和调整的结果（图10-15A）。

Computer-based controllers allow the storage of a set of values for parameters like those described earlier. These parameters can then be recalled for use in a particular situation (e.g., outdoors on a hill or indoors on a smooth floor). A therapist working with a consumer to gradually develop driving skills can also store the setups and recall them when needed. Different configurations can be stored for each consumer in training or assessment settings where several consumers may use one powered wheelchair. Most powered wheelchair controllers also have provision for the attachment of an “attendant control,” which is very useful for training. This control can override the user’s control interface in an emergency situation or training. 基于计算机的控制器允许存储用于如前所述的参数的一组值。 然后可以调用这些参数以用于特定情况（例如，在山上的户外或在光滑地板上的室内）。 与消费者合作逐渐发展驾驶技术的治疗师也可以存储设置并在需要时回忆。 在训练或评估设置中，可以为每个消费者存储不同的配置，其中多个消费者可以使用一个电动轮椅。 大多数电动轮椅控制器还具有附加的“乘务员控制”，这对于训练是非常有用的。 该控制可以在紧急情况或训练中超越用户的控制界面。

Another feature of many controllers is the ability to operate different functions of the wheelchair or other devices with the same control interface. Generally an output from the controller is connected to the external device (e.g., an augmentative communication system or electronic aid to daily living [EADL]). Using a switch, the user is able to transfer the output of the controller from the motors to the external device. The control interface is then able to control the external device directly. A visual display identifies which function is being used. For example, if a joystick were being used for mobility, switching to communication auxiliary mode would allow directed scanning (see Chapter 7) to be used for selections on an augmentative communication device. A switch allows the user to change between these two operations. 许多控制器的另一个特征是能够操作轮椅或具有相同控制接口的其他设备的不同功能。 通常，来自控制器的输出连接到外部设备（例如，增强通信系统或日常生活的电子助手（EADL））。 使用开关，用户能够将控制器的输出从电动机传送到外部设备。 控制接口然后能够直接控制外部设备。 视觉显示识别正在使用的功能。 例如，如果操纵杆被用于移动性，切换到通信辅助模式将允许定向扫描（参见第7章）用于在增强型通信设备上的选择。 开关允许用户在这两个操作之间切换。

Batteries电池

The power for a powered wheelchair is supplied by a pair of batteries mounted under the seat of the chair. The batteries used are rechargeable lead-acid types. Batteries differ in several ways. Automobile batteries require a high cur- rent for a short period to start the car. Wheelchair batteries, on the other hand, require smaller amounts of current for a longer time. This difference is reflected in the use of deep-cycle lead-acid batteries for power wheelchairs. These have thicker plates, which allow them to provide current for longer periods. Te chemicals inside the battery may be in a liquid form, called a wet cell, or in a semisolid form, called a gel. Wet-cell batteries are less expensive and last longer; however, they are more hazardous and require more maintenance than gel batteries, so are less commonly used for powered wheelchairs. The fluid in wet-cell batteries is subject to spilling and evaporation. Replacement of the fluid with distilled water is required at regular intervals.

电池

电动轮椅的电源由安装在椅子座椅下的一对电池提供。使用的电池是可充电铅酸型。电池有几种不同的方法。汽车电池需要高电流短时间启动汽车。另一方面，轮椅电池需要较少量的电流较长时间。这种差异反映在用于动力轮椅的深循环铅酸蓄电池的使用中。这些具有较厚的板，允许它们提供更长时间的电流。电池内的化学品可以是称为湿细胞的液体形式，或称为凝胶的半固体形式。湿电池电池更便宜，持续时间更长;然而，它们比凝胶电池更危险并且需要更多的维护，因此不常用于电动轮椅。湿电池电池中的流体易于溢出和蒸发。需要用蒸馏水定期更换流体。Gel (often called sealed) batteries will not spill, which makes them more desirable for transportation. They do not require any maintenance other than keeping them charged.

凝胶（通常称为密封）电池不会溢出，这使得它们更适合运输。 他们不需要任何维护，除了保持他们充电。

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These batteries are typically allowed on public transportation systems where the wet-cell batteries often are not. They do not need to be fully discharged before they require recharging. They do not have a “memory,” which means that the battery capacity is not limited by previous recharges. Battery power between charges is determined by the capacity measured in ampere-hours. At room temperature, wheelchair batteries commonly have 30 to 90 ampere-hours capacity at 12 volts (Cooper, 1998). The type of motors, environmental conditions (e.g., extremes of temperature), and amount of regular maintenance can all affect battery life and performance. Different batteries require different types of chargers, and it is imperative that the correct battery charger be used. The technology for wheelchair batteries has changed very little over the years. Smaller, lighter-weight batteries with an increase in capacity would help to decrease the weight of powered wheelchairs and increase the distance that the user can travel on one charge. 这些电池通常允许在湿电池通常不在的公共交通系统上。在需要充电之前，他们不需要完全放电。它们没有“存储器”，这意味着电池容量不受先前的充电限制。充电之间的电池功率由以安培每小时为单位测量的容量决定。在室温下，轮椅电池通常在12伏时具有30至90安培每小时的容量（Cooper，1998）。电机的类型，环境条件（例如，温度的极端值）和常规维护的量都可以影响电池寿命和性能。不同的电池需要不同类型的充电器，并且必须使用正确的电池充电器。多年来，轮椅电池的技术几乎没有变化。更小，更轻的电池，其容量增加将有助于减少动力轮椅的重量，并增加用户在一次充电时可行驶的距离。

ANSI/RESNA standards identify a test method for determining the capacity of wheelchair batteries on a single charge. Tis test requires the chair to be driven at maximum speed around a 54.5 m track 10 times in each direction. Amperes per hour are measured and the theoretical maxi- mum distance is calculated from this measurement (ANSI/ RESNA, 1998). Rentscher et al. (2004) indicate that this test does not take into account the varying draw on battery power when the user travels up hill, in different weather conditions, or across different terrains, for example. Information on the theoretical distance of a battery is vital information since serious injury or death could result from a power wheelchair user who is stranded by a dead battery. ANSI / RESNA标准确定了用于确定单次充电时轮椅电池容量的测试方法。 该测试要求椅子在每个方向上以54.5米轨道的最大速度驱动10次。 测量每小时的安培数，并根据该测量计算理论最大距离（ANSI / RESNA，1998）。 Rentscher et al。 （2004）指出，该测试不考虑例如当用户在山上，在不同的天气条件下或在不同的地形上行进时对电池功率的变化牵引。 关于电池的理论距离的信息是重要的信息，因为严重的伤害或死亡可能由电量耗尽的电池搁置的动力轮椅使用者导致。

Ventilators呼吸机

Consideration must be given to the placement and movement of a ventilator when the powered wheelchair user is dependent for respiratory support. Like many other products, ventilators have become much more compact and streamlined in recent years, yet they still affect the overall length, weight, and center of mass of the chair. Ventilators can be mounted low on the base of the chair or on a frame that is attached to the vertical uprights of the back. Mounts for ventilators can be fixed or articulating. The orientation of the ventilator is congruent with that of the wheelchair seat in a fixed mount. An articulating mount is required with a wheelchair frame that tilts or reclines. Tis option maintains the vertical orientation of the ventilator as the seat moves in tilt or recline modes. Further, it keeps the ventilator out of the way of the chair batteries.

当电动轮椅使用者依赖呼吸支持时，必须考虑呼吸机的放置和移动。 像许多其他产品一样，呼吸机近年来变得更加紧凑和流线型，但它们仍然影响椅子的总长度，重量和质心。 通风器可以低安装在椅子的基座上或安装在靠背的垂直立柱上的框架上。 通风机支架可以是固定的或铰接的。 通风机的定向与固定安装座中的轮椅座椅的定向一致。 需要具有倾斜或倾斜的轮椅框架的铰接安装。 此选项在座椅在倾斜或倾斜模式下移动时保持通气机的垂直方向。 此外，它保持呼吸机脱离椅子电池的方式。

Specialized Bases for Manual Wheelchairs手动轮椅专用基座

Having described the major wheelchair characteristics, we can now look at dependent mobility bases that have unique structural and propelling characteristics. Because an attendant or care provider is responsible for pushing the consumer in a dependent-mobility wheelchair, special attention is given to biomechanics of the caregiver during this activity. Items normally required for independent manual mobility (e.g., large rear wheels with hand rims) are often omitted in these systems. Bases for dependent mobility are commonly lighter weight and lower priced than wheelchairs for independent manual mobility (Buck, 2009).

  描述了主要的轮椅特性，我们现在可以看看具有独特的结构和推进特性的依赖移动基础。 因为护理人员或护理人员负责推动依赖移动性轮椅中的消费者，所以在该活动期间特别注意护理人员的生物力学。 在这些系统中通常省略通常用于独立手动移动性所需的物品（例如，具有手边缘的大后轮）。 依赖移动性的基础通常比独立手动移动的轮椅重量更轻，价格更低（Buck，2009）。

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FIGURE 10-16 Firm stroller base.

Stroller Bases婴儿车

Strollers, similar to those used for transporting very young children, are typically of two types: (1) umbrella folding with a sling seat and (2) full-sized units with solid seats (Buck, 2009). Although originally designed for children, there are now strollers that accommodate consumers who weigh up to 200 pounds. The umbrella type generally does not provide good sitting support, but it folds easily for storage in a vehicle. Consumers who use strollers should not be trans- ported in the stroller unless it has been crash tested (Kemper, 1993). In North America, stroller bases that have met crash testing standards will be listed in the WC19 category, which lists all mobility devices that have been tested and are com- pliant with standards related to the ability to withstand a vehicle crash. These devices have attachment sites that are an integral part of the frame. A list of wheelchairs and seating products that are WC19 compliant can be found at http:// www.rercwts.org/RERC\_WTS2\_KT/RERC\_WTS2\_KT\_ Stand/RERC\_WTS2\_19\_Chart.html .

婴儿车类似于用于运输非常幼小的儿童，通常有两种类型：（1）带有吊带座椅的伞折叠和（2）具有实心座椅的全尺寸单元（Buck，2009）。虽然最初是为儿童设计的，现在有婴儿车，适应消费者重达200磅。伞类型通常不提供良好的坐姿支撑，但是它容易折叠以存储在车辆中。使用婴儿车的消费者不应该在婴儿车中运输，除非它已经过碰撞测试（Kemper，1993）。在北美，符合碰撞测试标准的婴儿车底座将列入WC19类别，其中列出了所有已经测试并符合与承受车辆碰撞能力的标准相关的移动设备。这些装置具有作为框架的组成部分的附接部位。有关符合WC19标准的轮椅和座椅产品清单，请访问http：// www.rercwts.org/RERC\_WTS2\_KT/RERC\_WTS2\_KT\_Stand/RERC\_WTS2\_19\_Chart.html。

An attraction of stroller bases is that they resemble standard strollers in appearance, which can be appealing to parents. One feature that appeals to parents is the ease with which they can be transported. The small wheels and short wheelbase of most strollers make them easily maneuverable by an attendant. One disadvantage of the stroller is that the child or adult is often in a reclined position, which may limit his or her ability to carry out functional tasks. Strollers are sometimes purchased as a second wheelchair to facilitate transportation, with a standard wheelchair used for functional tasks. Figure 10-16 shows an example of a solid stroller base. 婴儿车底座的吸引力在于它们在外观上类似于标准婴儿车，这可能对父母很有吸引力。 吸引父母的一个特征是易于运输。 大多数婴儿车的小轮和短轴距使得他们很容易由服务员操纵。 婴儿车的一个缺点是儿童或成人通常处于斜倚位置，这可能限制他或她执行功能性任务的能力。 有时购买手推车作为第二个轮椅，以方便交通，标准轮椅用于功能任务。 图10-16显示了固定婴儿车底座的示例。

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Transport Wheelchairs运输轮椅

Transport wheelchairs are designed for occasional use, often available for transporting patients in hospitals or in short- term situations such as traversing an airport or shopping mall. They typically have upholstery seating and four small wheels. They do not have any adjustability nor is it anticipated that seating systems will be used. They are lightweight, durable, and relatively maintenance-free. These chairs provide a short-term, dependent mobility option and are not intended to provide seating and positioning in the long term.

运输轮椅设计用于偶尔使用，通常用于在医院运输患者或在短期情况下（例如穿过机场或商场）。 他们通常有装饰座椅和四个小轮子。 他们没有任何可调整性，也没有预期将使用座位系统。 它们重量轻，耐用，相对免维护。 这些椅子提供了一个短期的，依赖移动的选择，并且不打算提供长期的座位和定位。

Wheelchairs for Use by Older Clients轮椅由老客户使用

The setup of a manual wheelchair for regular use by an older client is different from that of a younger, more active user. Age-related disabilities such as arthritis, osteoporosis (loss of bone density), and sarcopenia (loss of muscle fiber) con- tribute to reduced muscle strength and range of motion. Further, older clients may feel less secure in their movements. Age-related visual changes, including disorders such as age- related macular degeneration and glaucoma, are further con- siderations for setup of a chair for use by an older client. Care should be taken to ensure that the center of gravity ratio of the client to the axis of the drive wheel provides an optimal stability and mobility balance. Access to the drive wheels and hand rims relative to range of motion and strength in the upper extremities needs to be considered along with rolling resistance. Effects of visual-perceptual changes resulting from a cerebral vascular accident will affect the user’s ability to navigate in the environment and will need to be considered when providing training in wheelchair skills.

较旧的客户端常规使用的手动轮椅的设置与较年轻，更活跃的用户的设置不同。年龄相关的残疾，如关节炎，骨质疏松症（骨密度丧失）和肌肉减少（肌肉纤维损失）有助于减少肌肉力量和运动范围。此外，老年客户可能感觉不太安全的移动。年龄相关的视觉变化，包括年龄相关性黄斑变性和青光眼等疾病，是老年人使用的椅子设置的进一步考虑。应注意确保客户端与驱动轮轴线的重心比提供最佳的稳定性和流动性平衡。需要考虑到相对于上肢运动范围和强度的驱动轮和手边缘的接近以及滚动阻力。由脑血管意外引起的视觉感知变化的影响将影响用户在环境中导航的能力，并且当提供轮椅技能的训练时将需要考虑。

Some manufacturers are producing chairs that have a rocking feature. Often these chairs have a tilt feature as well. A mechanism on the chair allows the user to rock the seat of the chair. Tis mechanism can be disengaged in some situations, such as transportation, when it is not desired. This feature is recommended for clients who become agitated, with the view that the rocking motion is calming for the client. 一些制造商正在生产具有摇摆特征的椅子。 通常这些椅子也有倾斜功能。 椅子上的机构允许用户摇动椅子的座位。 在不希望的情况下，这种机构可以在一些情况下脱离，例如运输。 这个功能推荐给那些变得激动的客户，因为摇摆运动对客户来说是平静的。

Wheelchairs for Bariatric Clients 减肥客户的轮椅

Bariatric clients, those individuals with a BMI (Body Mass Index) of 30 or greater, are a population with an increasing prevalence in North America. These individuals require frames that are designed to accommodate their weight and their larger size. Most typical wheelchairs have a maximum weight capacity of 300 pounds. Chairs for bariatric clients accommodate a maximum weight of 600 pounds with some manufacturers offering chairs that will accommodate up to 1000 pounds (Daus, 2003). The location of the mechanics of electrically powered wheelchairs beneath the seat allows the use of a larger seat while still maintaining as narrow a width as possible. Some chairs provide user adjustable seat depth and width. Tilt is also an option that can be provided for the bariatric client. The Eclipse (Figure 10-17) is an example of a chair designed for bariatric clients

减重的客户，具有30或更高的BMI（身体质量指数），这些人都是在北美的患病率增加人口。 这些个体需要被设计成适应其重量和其较大尺寸的框架。 最典型的轮椅的最大重量容量为300磅。对于减肥的客户椅子容纳600磅的最大重量与一些制造商提供座椅，可容纳高达1000英镑（DAUS，2003）。座位下方的电动轮椅力学的位置允许使用更大的座位，同时仍保持窄的宽度成为可能。 一些椅子提供用户可调节的座椅深度和宽度。 倾斜也是可以为减肥客户提供的一个选项。 Eclipse（图10-17）是为肥胖客户设计的椅子的一个例子



FIGURE 10-17 Eclipse wheelchair for bariatric client. (Courtesy of PDG Mobility)

Fitting a wheelchair for a bariatric client has special considerations since soft tissue distribution and accumulation vary, resulting in different body sizes and shapes (Daus, 2003). Measurement should be done in the seated position and on a from surface. If there is significant soft tissue accumulation around the buttocks, the configuration of the seat back must be considered, since the buttocks may protrude further than the shoulders, requiring the individual to lean back if his upper back is to be in contact with the seat back. Some manufacturers produce a back that provides support along the entire back surface. A change in the width of the back from hip to shoulder to accommodate a different shape is another accommodation made by some manufacturers. 因为软组织分布和积聚不同，导致不同的身体尺寸和形状（Daus，2003），所以为减肥客户端安装轮椅具有特殊的考虑。 测量应在坐姿和从表面进行。 如果在臀部周围存在显着的软组织，则必须考虑座椅靠背的构造，因为臀部可以比肩部更突出，如果他的上背部要与座椅靠背接触，则需要个人后仰 。 一些制造商生产的背部提供沿整个后表面的支撑。 背部的宽度从臀部到肩部的变化以适应不同的形状是由一些制造商进行的另一种调节。

Specialized Bases for Powered Wheelchairs Customized Powered Wheelchairs 电动轮椅专用底座定制电动轮椅

The range and combinations of features available on powered wheelchairs is rapidly increasing. Some of these features, such as tilt, recline, elevating seats, and footrests, have been mentioned already. The Attitude™ (Figure 10-18 A) and the Latitude™ (Figure 10-18 B) systems both provide power options to enable independent transfers. The Attitude™ has a foot platform that lowers to the ground and then rises up to seat height, allowing an individual to transfer independently. To transfer into the chair, the foot platform is lowered to the floor; the user transfers onto the foot platform, raises it to seat height, and then transfers on to the seat. Te Latitude system is similar, but in this case the entire seat moves forward and down to the floor.4 动力轮椅上可用的特征的范围和组合正在快速增加。 已经提到了这些特征中的一些，例如倾斜，倾斜，升高座位和脚踏板。 Attitude™（图10-18 A）和Latitude™（图10-18 B）系统都提供电源选项，以实现独立传输。 Attitude™有一个脚踏平台，降低到地面，然后上升到座椅高度，允许个人独立转移。 为了转移到椅子中，脚平台降低到地板; 使用者转移到足部平台上，将其提升到座位高度，然后转移到座位上。 Te纬度系统是类似的，但在这种情况下，整个座位向前和向下移动到地板

Scooters 滑板车

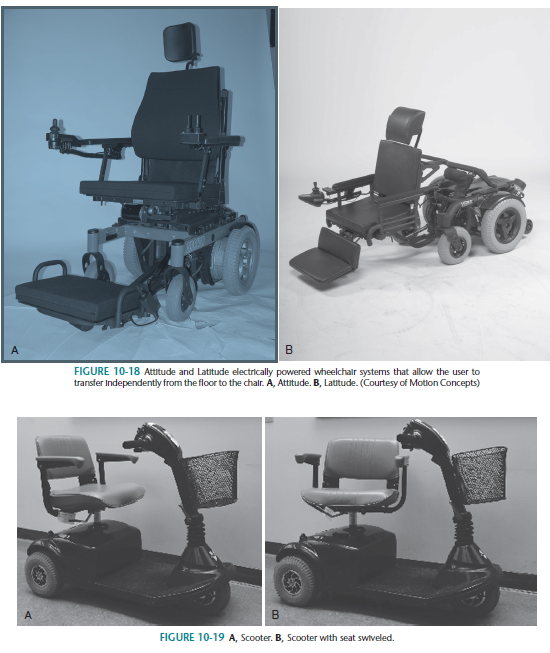
Scooters ( Figure 10-19 A) comprise a large proportion of the powered system market. Individuals who are marginal

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ambulators and need mobility to conserve energy most often use the scooter. For this reason, it is most commonly used by the consumer outside the home. Grocery stores and shop- ping malls often provide scooters for customers who may need them. Te propelling structure of the scooter includes the drive train, the tires, the tiller, and the battery. There are a number of models available in either three- or four-wheel versions with front-wheel drive or rear-wheel drive. Scooters

with front-wheel drive do better on level terrain and are more maneuverable. For this reason, they perform better in small spaces. In rear-wheel drive scooters, the rider’s weight is positioned over the motor so there is better traction and more power. Te bases of rear-wheel drive scooters are wider and longer than the other powered chairs. These scooters are better able to handle inclines and uneven or rough terrain and therefore are preferable for outdoor use.

踏板车（图10-19A）占动力系统市场的很大一部分。作为边缘行动者并且需要移动以节约能量的个人最常使用滑板车。因此，它最常用于家庭以外的消费者。杂货店和购物中心通常为可能需要它们的客户提供踏板车。踏板车的推进结构包括传动系，轮胎，舵杆和电池。有三种或四轮车型可选，有前轮驱动或后轮驱动。前轮驱动的滑板车在水平地形上做得更好，更容易操作。因此，它们在小空间中表现更好。在后轮驱动踏板车中，骑车者的重量位于马达上方，因此具有更好的牵引力和更大的动力。后轮驱动滑板车的基座比其他电动椅子更宽更长。这些踏板车能够更好地处理坡度和不平坦或不平的地形，因此优选用于户外使用。

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A tiller-type control is used to steer the wheelchair and acceleration is accomplished by either grasping a lever on the tiller with the fingers or pressing with the thumb. When the accelerator is released, the scooter eases to a stop. On some scooters the height and angle of the tiller is adjustable. Depending on the model, scooters can have either proportional (variable-speed) control or switched (constant-speed) control. There is a separate control setting for adjusting the speed of the scooter. Some scooters have a dial that provides a range of settings, whereas others have a toggle switch for high and low. 舵柄式控制器用于转向轮椅，并且通过用手指抓住操纵杆上的杆或用拇指按压来实现加速。 当加速器释放时，滑板车轻松停止。 在一些踏板车上，舵柄的高度和角度是可调的。 根据型号，踏板车可以具有比例（可变速度）控制或切换（恒定速度）控制。 有一个单独的控制设置，用于调节滑板车的速度。 一些踏板车有一个拨盘提供一系列的设置，而其他有一个拨动开关的高和低。

The seat of the scooter is mounted to a single post coming up from the base. Typically the seat is a bucket type that has few options for seat width, depth, or back height (Buck, 2009). Te seats come in padded or unpadded versions and several types of armrest styles (fixed, flip-up, or none) are available. Most scooters have a mechanism that releases the seat so it can swivel to the side and then lock in place. This feature is helpful for transfers in and out of the seat and for accessing a table surface. Figure 10-19 B shows a scooter with a swivel seat.

滑板车的座位安装到从基座上升的单个柱上。 通常，座椅是座椅宽度，深度或靠背高度具有较少选项的桶型（Buck，2009）。 座椅采用填充或未填充版本，有几种类型的扶手样式（固定，翻转或无）。 大多数踏板车具有释放座椅的机构，因此其可以旋转到侧面，然后锁定就位。 此功能有助于进出座椅和进入工作台面。 图10-19 B显示了带有旋转座的滑板车。

Some of the advantages of scooters are that they are lighter in weight, can be disassembled for transportation in a car, are easy to maneuver, are less costly than other powered wheelchairs, and are more acceptable than other types of powered wheelchairs. Te primary disadvantage of scooters is that they do not provide flexibility in control interfaces. Te consumer needs to have a fair amount of trunk and upper extremity control to operate the tiller of the scooter. Scooters also have very little flexibility in terms of speed, braking, or turning control. Finally, the seat of a scooter typically does not provide adequate postural support, and many types of seating systems needed by individuals with postural control problems cannot be interfaced to a scooter. 踏板车的一些优点是它们重量更轻，可以拆卸用于在汽车中运输，易于操纵，比其他动力轮椅成本更低，并且比其他类型的动力轮椅更可接受。 踏板车的主要缺点是它们不提供控制接口的灵活性。 消费者需要具有相当数量的躯干和上肢控制来操作滑板车的舵手。 踏板车在速度，制动或转向控制方面也具有很小的灵活性。 最后，踏板车的座椅通常不提供足够的姿势支撑，并且具有姿势控制问题的个人所需的许多类型的座椅系统不能与踏板车接口。



Power-Assist Mechanisms 电源辅助机制

Considerable attention has been given to the shoulder injuries that result from prolonged propulsion of a manual wheel- chair (for example, see Boninger et al., 2002, 2005; Cooper et al., 1997b; Sawatsky et al., 2005; Veeger et al., 2002). One option for individuals with shoulder pain that limits the ability to propel a manual wheelchair but for whom a powered wheelchair is not desirable is push rim–activated power- assist wheels. These wheels are interchanged with those of a manual wheelchair. A motor is located in the hub of the rear wheels that is linked to the hand rims (Algood et al., 2005). These units supply power to the manual wheelchair as needed by the user. When the user applies force above a preset level to the hand rims, such as when going up an incline, the motors engage and help to propel the wheelchair. Propulsion and braking assistance are provided for both forward and rearward motion. Te unit can also be turned of, which allows the manual wheelchair to function in the usual manner. These units add considerable weight to a manual chair, which is a consideration in their selection. Giesbrecht and colleagues (2009) found that participation in daily activities and psychosocial aspects of device use were similar across



FIGURE 10-21 MagicWheels™ multigear wheels for manual wheelchair. (Courtesy of Magic Wheels, Inc.)

power-assist wheels and a powered wheelchair, suggesting that the former are alternatives to a powered chair in some situations. Figure 10-20 shows an example of a power-assist product.

已经对由于手动轮椅的长时间推进而产生的肩部损伤给予了相当多的关注（例如，参见Boninger等人，2002,2005; Cooper等人，1997b; Sawatsky等人，2005; Veeger等人et al。，2002）。肩部疼痛的个体的一个选择是推动轮辋激活的动力辅助轮，所述个体限制推进手动轮椅的能力，但对于不想要动力轮椅的人而言。这些轮子与手动轮椅的轮子互换。马达位于后轮的轮毂中，其连接到手轮缘（Algood等人，2005）。这些单元根据用户的需要向手动轮椅供电。当使用者向手边缘施加超过预设水平的力时，例如当上坡时，马达接合并帮助推动轮椅。提供用于向前和向后运动的推进和制动辅助。该单元也可以翻转，这允许手动轮椅以通常的方式起作用。这些单元对手动椅增加了相当大的重量，这是它们的选择的考虑。 Giesbrecht和他的同事（2009）发现，参与日常活动和心理社会方面的设备使用是相似的跨动力辅助轮和一个电动轮椅，表明前者是替代电动椅子在某些情况下。图10-20显示了助力产品的示例。

Another product on the market with a similar purpose is Magicwheels™, which provides geared technology for manual wheelchairs (Figure 10-21).5 Magicwheels™ gives the user a selection of two gears, similar to the concept of bicycle gears, with the second gear providing a 2:1 mechanical advantage. Te user selects the second gear by moving the housing of the gear, located on the hub of the wheel. Changing gears does not require grip or substantial strength. Magicwheels™ are most useful on inclines, where they provide assistance propelling upwards and braking when traveling down. Finley et al (2006) completed a pilot study of the

5From Magic Wheels Inc.: www.magicwheels.com.

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effect of Magicwheels™ use on shoulder pain, length of time the user was able to sustain uphill travel, and perceived exertion during this task. An A-B-A design was used, with base- line being use of consumer’s typical wheels. After 4 months of use, shoulder pain was stable or reduced and users were able to travel uphill for a longer time with no change in perceived exertion. Howarth and colleagues (2010) investigated muscle effort of healthy volunteers when ascending ramps of various grades, using Magicwheels™ and with a nongeared wheel. Trunk muscle effort was lower with Magicwheels™ as the ramp grade increased, as was shoulder flexion. Over- all, use of Magicwheels™ required more sustained muscle effort because of the longer time taken to ascend the ramp. Because this study used healthy volunteers, it needs to be repeated with wheelchair users to further investigate the effects of Magicwheels™ on propulsive efforts when ascending a ramp. 市场上另一个具有类似目的的产品是Magicwheels™，其为手动轮椅提供齿轮传动技术（图10-21）.5 Magicwheels™为用户提供了两种齿轮的选择，类似于自行车齿轮的概念，第二种齿轮提供2：1的机械优势。用户通过移动位于轮毂上的齿轮的壳体来选择第二齿轮。更换齿轮不需要抓地力或实质性的强度。 Magicwheels™在斜坡上最有用，它们在向下行驶时提供向上推进和制动的辅助。 Finley等人（2006）完成了对Magicwheels TM对肩部疼痛的使用的影响的试验性研究，用户能够承受上坡旅行的时间长度，以及在该任务期间感觉到的运动。使用A-B-A设计，基线是使用消费者的典型轮子。使用4个月后，肩部疼痛稳定或减少，并且使用者能够在上行更长时间，而没有感觉到的运动改变。 Howarth和同事（2010）调查了健康志愿者在各种等级上升坡道时的肌肉力量，使用Magicwheels™和非轮胎轮。 Trunk肌肉力量下降与Magicwheels™随着斜坡坡度增加，肩部屈曲。总而言之，使用Magicwheel™需要更持久的肌肉力量，因为上坡时间较长。因为本研究使用健康的志愿者，需要与轮椅使用者重复，以进一步调查Magicwheels™在上坡时对推进力的影响。

SMART WHEELCHAIRS 智能轮椅

Smart technology is being incorporated into wheelchairs to provide additional options for individuals who are unable to control a wheelchair in other ways. Smart wheelchairs are defined as “either a standard power wheelchair to which a computer and a collection of sensors have been added or a mobile robot base to which a seat has been attached” (Simpson, 2005, p. 424). These technologies are useful for wheel- chair users who have low vision or severely restricted visual field, motor impairments such as excessive tone or tremor, or cognitive impairments that limit the ability to navigate a wheelchair safely. Smart technologies can be integrated into available power systems or built as an add-on feature (Simpson, 2005). 智能技术正被纳入轮椅，为无法以其他方式控制轮椅的个人提供更多选择。 智能轮椅被定义为“添加了计算机和传感器集合的标准动力轮椅或已经附着座椅的移动机器人基座”（Simpson，2005，第424页）。 这些技术对于具有低视力或严重受限的视野，运动损伤（例如过度的音调或震颤）或认知损伤（其限制安全地导航轮椅的能力）的轮椅使用者是有用的。 智能技术可以集成到可用的电力系统中或作为附加功能构建（Simpson，2005）。

Smart wheelchairs typically provide two functions: collision avoidance and navigation, either along a path or through obstacles (Mitchell et  al., 2014; Simpson, 2005; Wang et al., 2013). In the first instance, sensors detect an obstacle in the path of the wheelchair and will slow or stop the chair or provide some form of warning if the user doesn’t perform a maneuver to avoid it (Wang et al., 2013). In the latter instance, the sensors guide the chair along a pathway that is programmed into the chair’s control system or that follows an environmental path, or sensors can also guide the chair through a feature such as a doorway. 智能轮椅通常提供两个功能：碰撞避免和导航，沿着路径或穿过障碍物（Mitchell等人，2014; Simpson，2005; Wang等人，2013）。 在第一种情况下，传感器检测到轮椅路径中的障碍物，如果用户不能手动来避免它，则会减慢或停止椅子或提供某种形式的警告（Wang等人，2013）。 在后一种情况下，传感器沿着被编程到椅子的控制系统中或者遵循环境路径的路径引导椅子，或者传感器也可以引导椅子通过诸如门口的特征。

Mitchell et al. (2014) describe a shared control system, in which control of the wheelchair is shared between the user and the onboard computer. This method of control may be more acceptable to users because they retain some control and do not experience the sensation of the chair moving without their guidance. An autonomous control system is one in which the onboard computer assumes full control of the chair (Wang et al., 2013). Mitchell et al。 （2014）描述了一种共享控制系统，其中轮椅的控制在用户和车载计算机之间共享。 这种控制方法对于用户是更加可以接受的，因为它们保持一些控制并且没有经历椅子在没有他们的引导的情况下移动的感觉。 自主控制系统是车载计算机完全控制椅子的系统（Wang et al。，2013）。

Four main types of sensors are used to guide the chair: infrared (see Chapter 12 for a further explanation of this type of sensor), sonar (sound wave technology), laser range finders, and computer vision (Simpson, 2005). Sensors are also categorized as contact, requiring physical contact before action is taken, or proximity, which require objects to be close to each other but not in direct contact (Wang et al., 2013). 四种主要类型的传感器用于引导椅子：红外线（关于这种类型的传感器的进一步解释，参见第12章），声纳（声波技术），激光测距仪和计算机视觉（Simpson，2005）。 传感器也被分类为接触，在采取行动之前需要物理接触或接近，这需要物体彼此接近但不直接接触（Wang等人，2013）。

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Wang et  al. (2013) conducted a qualitative study with potential users of smart wheelchairs, caregivers, and prescribers, investigating their perceptions of collision avoidance technology. Their findings were grouped into three themes: (1) potential uses of the technology, (2) concerns about the technology design, and (3) potential users of the technology. Many functions were identified that had the potential to be aided by smart technology, including maneuvering in confined spaces, backing up, avoiding moving obstacles, as an aid to learning to drive a power chair, and managing physical outdoor barriers such as curbs, pot- holes, and uneven or sloped surfaces. Concerns about the design included lack of confidence if full control was held by the wheelchair, recognition of the user’s intentions and the immediate environment by the chair, discrimination among objects, reliability of the device (e.g., avoiding an obstacle when needed), properties of the human technology interface, and situations where the smart technology would prevent the user’s intention, such as pulling up to a table or desk. Safety concerns were identified, in particular safety of others in the environment. Most participants expressed the opinion that this type of technology would be most useful for clients with visual impairments and less so for clients with cognitive impairments (Wang, 2013). Wang et al。 （2013）与智能轮椅，护理人员和处方者的潜在用户进行了定性研究，调查了他们对碰撞避免技术的看法。他们的研究结果分为三个主题：（1）技术的潜在用途，（2）技术设计的关注，（3）技术的潜在用户。许多功能被确定为有潜力由智能技术辅助，包括在狭窄的空间操纵，备份，避免移动障碍，作为一个辅助学习驱动电动椅，以及管理物理户外障碍，如路缘石，孔，以及不平坦或倾斜的表面。对完全由轮椅控制的设计关注包括：用户的意图和椅子的直接环境的识别，对象之间的辨别，设备的可靠性（例如，当需要时避免障碍）的性质，人类技术接口以及智能技术将阻止用户的意图（例如拉到桌子或桌子）的情况。确定了安全关注，特别是环境中其他人的安全。大多数参与者表示，这种类型的技术对于具有视觉障碍的客户最有用，对于具有认知障碍的客户则更少（Wang，2013）。

As might be anticipated, the cost of these systems is extremely high, although available “plug and play” technology is likely to reduce this cost in the near future (Mihailidis, personal communication, October, 2013). Smart technology for wheelchairs is not available on the commercial market, existing only in research settings. However, research continues to make this technology more accessible, reliable, and safe. We introduced the functions of smart wheelchairs here in anticipation that some of this technology will be available for clients in the near future. 可以预见，这些系统的成本非常高，尽管在即将来临的“即插即用”技术可能降低这种成本（Mihailidis，个人通信，2013年10月）。 在商业市场上不存在用于轮椅的智能技术，仅存在于研究环境中。 然而，研究继续使这项技术更容易获得，可靠和安全。 我们介绍了智能轮椅的功能，预计这些技术将在不久的将来面向客户。

WHEELCHAIR STANDARDS 轮椅标准

Standards can be used to provide manufacturing guidance to ensure product quality. One area of assistive technologies in which standards have been developed is for wheelchairs. Both the International Standards Organization (ISO) and the American National Standards Institute (ANSI) and RESNA have published standards for manual and power wheelchairs, seating systems, and wheelchair use during transportation. There is considerable overlap in these standards. A comparison of the ISO and ANSI/RESNA standards is in Box 10-3. 标准可用于提供制造指导以确保产品质量。 已经开发出标准的辅助技术的一个领域是用于轮椅。 国际标准组织（ISO）和美国国家标准协会（ANSI）和RESNA已经出版了手动和电动轮椅，座椅系统和轮椅在运输过程中使用的标准。 这些标准有很大的重叠。 ISO和ANSI / RESNA标准的比较在框10-3中。

Although these standards are voluntary, there are strong motivations for manufacturers to adhere to them. For example, the Department of Veterans Affairs (VA) has purchasing requirements for wheelchairs. As the largest purchaser of wheelchairs in the United States, the VA could significantly impact compliance with the standards shown in Box 10-3 by adopting them by reference rather than developing their own standards. Some published studies exist that have

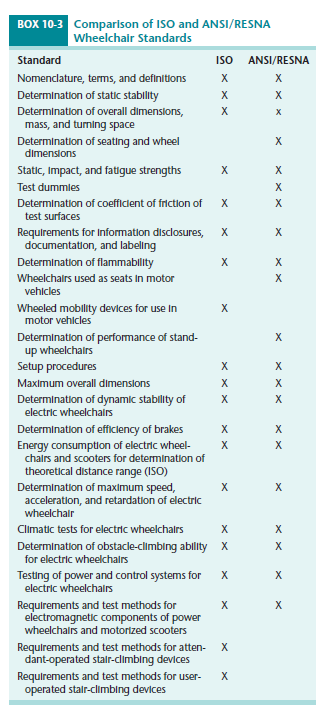
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BOX 10-3 Comparison of ISO and ANSI/RESNA

Wheelchair Standards



BOX 10-3 ISO和ANSI / RESNA的比较

轮椅标准ISOANSI / RESNA

标准 ISO ANSI / RESNA

命名，术语和定义 X X

静态稳定性的测定 X X

确定总体尺寸，质量和车削空间 X X

座椅和车轮尺寸的确定 X

静态，冲击和疲劳强度 X X

测试虚拟 X

测试表面摩擦系数的确定 X X

信息披露，文件和标签的要求 X X

测定可燃性 X X

轮椅用作机动车辆的座椅 X

用于机动车辆的轮式运动装置 X

立式轮椅的性能测定 X

安装程序 X X

最大总尺寸 X X

电动轮椅动态稳定性的确定 X X

制动效率的确定 X X

电动轮椅和踏板车的能量消耗用于

确定理论距离范围（ISO） X X

 确定电动轮椅的最大速度，加速度和减速度 X X

电动轮椅气候试验 X X

电动轮椅和踏板车的能量消耗用于

确定理论距离范围（ISO） X X

确定电动轮椅的最大速度，加速度和减速度 X X

电动轮椅气候试验 X X

电动轮椅爬坡能力的确定 X X

电动轮椅的功率和控制系统测试 X X

动力轮椅和电动滑板车的电磁部件的要求和测试方法 X X

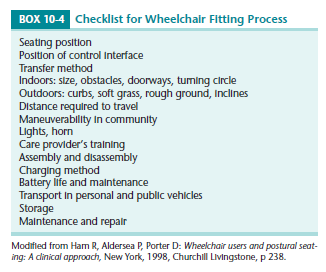
附属操作爬楼梯装置的要求和测试方法 X

用户操作爬楼梯装置的要求和测试方法 X

applied these standards to manual and powered wheelchairs and seating cushions (for example, see Cooper et al., 1997a, 1999; Fass et al., 2004; Pearlman et al., 2005; Rentschler et al., 2004; Sprigle & Press, 2003). 虽然这些标准是自愿的，但是制造商有强烈的动机来坚持它们。 例如，退伍军人部（VA）有轮椅的购买要求。 作为美国最大的轮椅购买者，VA可能会通过引用而不是制定自己的标准，显着地影响符合框10-3所示的标准。 一些已发表的研究已经将这些标准应用于手动和电动轮椅和座垫（例如，参见Cooper等人，1997a，1999; Fass等人，2004; Pearlman等人，2005; Rentschler等人， 2004; Sprigle＆Press，2003）。

IMPLEMENTATION AND TRAINING FOR MANUAL AND POWERED MOBILITY 实施和培训手动和动力的机动性

As we have emphasized throughout this text, the assistive technology system includes much more than a piece of equipment. For the consumer to be satisfied and successful with an assistive device, proper implementation and training need to be part of the system. Te same holds true to maximize the performance of consumers who use mobility systems.正如我们在本文中强调的，辅助技术系统包括的不仅仅是一件设备。 为了使消费者对辅助装置感到满意和成功，适当的实施和培训需要是系统的一部分。 这同样适用于使使用移动系统的消费者的性能最大化。



BOX 10-4 Checklist for Wheelchair Fitting Process

Seating position

Position of control interface

Transfer method

Indoors: size, obstacles, doorways, turning circle Outdoors: curbs, soft grass, rough ground, inclines Distance required to travel

Maneuverability in community

Lights, horn

Care provider’s training

Assembly and disassembly

Charging method

Battery life and maintenance

Transport in personal and public vehicles Storage

Maintenance and repair

BOX 10-4轮椅安装过程检查表

座位

控制接口的位置

转移方法

室内：大小，障碍，门道，转弯圈户外：路缘，软草，粗糙的地面，坡度旅行所需的距离

机动性在社区

灯，喇叭

护理提供者的培训

装配和拆卸

充电方法

电池寿命和维护

在个人和公共车辆运输存储

维护和修理

Modifed from Ham R, Aldersea P, Porter D: Wheelchair users and postural seat- ing: A clinical approach, New York, 1998, Churchill Livingstone, p 238.

改编自Ham R，Aldersea P，Porter D：Wheelchair users and postural seating：A clinical approach，New York，1998，Churchill Livingstone，第238页。

Fitting of Mobility Systems 移动系统配件

It is advisable that a fitting appointment be held with the consumer and caregiver. Te purpose of this appointment is to make any adjustments needed to the wheelchair and to try the chair and determine whether it meets the original objectives outlined during the assessment. During the initial fitting, time should also be spent demonstrating to the user and the caregiver important features of the chair and going through instructions for maintenance. Box 10-4 shows a checklist of items to be covered during the fitting process for either a manual or powered wheelchair. Depending on the complexity of the wheelchair and whether seating components are involved, more than one fitting appointment may be necessary. 建议与消费者和护理人员进行合适的预约。 这项任命的目的是对轮椅进行任何调整，并尝试椅子，并确定是否符合评估期间概述的原始目标。 在初始贴合期间，还应该花费时间向用户和护理人员展示椅子的重要特征以及维护说明。 框10-4显示了在手动或电动轮椅的安装过程中要涵盖的项目的清单。 根据轮椅的复杂性以及是否涉及座椅部件，可能需要多个配合预约。

Because today’s wheelchairs are often multifunctional, a number of components on the wheelchair are adjustable. Some adjustments and settings are made in the factory before shipping, but typically the provider of the wheelchair will need to make modifications to ft the chair to the user once it arrives from the factory. Adjustments to the wheelchair that can make a difference in user comfort, safety, and performance include axle position, wheel camber, and wheel alignment. Appropriate adjustment of the seat angle, back height and angle, and height and angle of leg rests and footrests is also critical to user performance. Any adjustments to the chair should be made carefully and with the user’s safety in mind. After adjustments are made, the user should be cautious in trying out the wheel- chair until he or she gets acclimated to the changes. 因为今天的轮椅通常是多功能的，轮椅上的多个部件是可调节的。 一些调整和设置在出厂之前在工厂进行，但是通常，轮椅的提供商将需要对来自工厂的椅子进行修改以使其到达用户。 对轮椅的调整可以改变用户的舒适性，安全性和性能，包括车轴位置，车轮外倾角和车轮定位。 适当调整座椅角度，靠背高度和角度以及搁脚板和搁脚板的高度和角度对于用户性能也是至关重要的。 对椅子的任何调整都应该仔细考虑并考虑用户的安全。 在进行调整之后，用户应该小心地尝试轮椅，直到他或她适应变化。

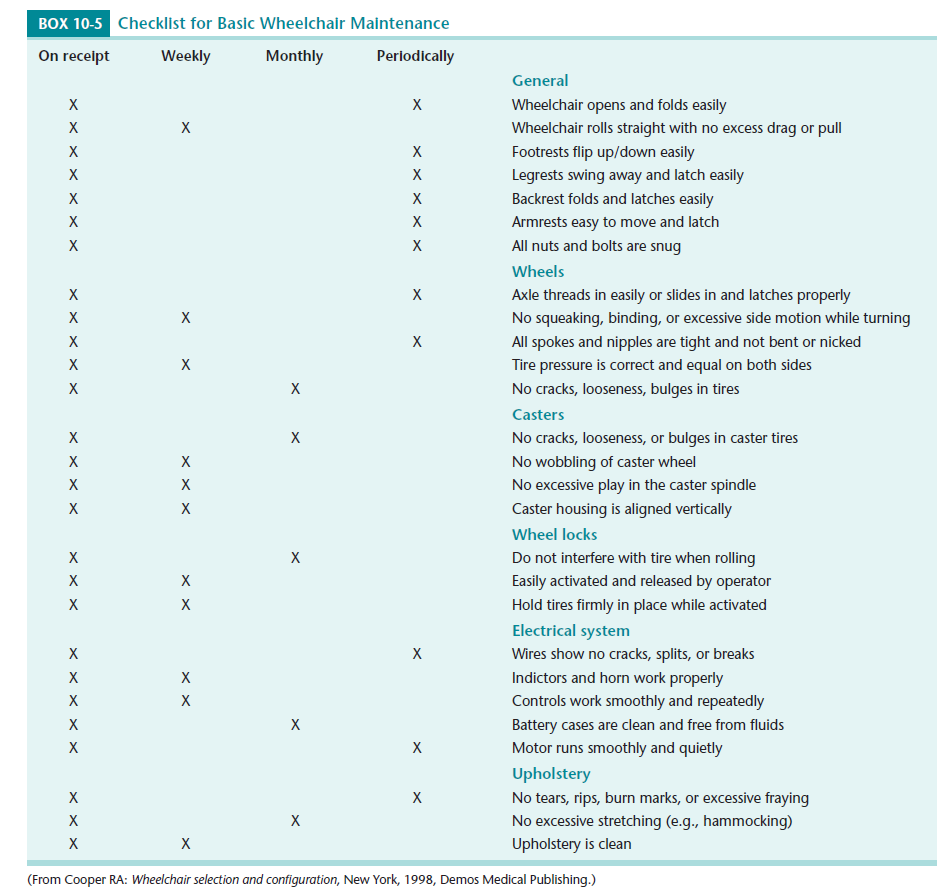
Maintenance and Repair of Personal

Mobility Systems

个人移动系统的维护和修理

Wheelchairs are designed to be low maintenance and there are few items on a wheelchair, particularly a manual wheel - chair, that require maintenance by the user ( Cooper, 1998).

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BOX 10-5 Checklist for Basic Wheelchair Maintenance

BOX 10-5基本轮椅维护清单

On receipt Weekly Monthly Periodically

一般

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

X X

一般

轮椅打开和折叠容易

轮椅直接卷起，没有多余的阻力或拉力脚踏板容易上下翻转

搁脚板摆动并轻松锁定

靠背折叠和闩锁很容易

扶手易于移动和闩锁

所有螺母和螺栓紧贴

车轮

轴线易​​于插入或插入并正确闩锁在转弯时没有吱吱声，束缚或过度的侧向运动所有轮辐和接头都紧固，不弯曲或有缺口轮胎压力正确，两侧相等

轮胎无裂纹，松动，膨胀

脚轮

轮胎轮胎无裂纹，松动或隆起

没有摆轮的轮子

在脚轮主轴上没有过多的游隙

脚轮外壳垂直对齐

轮锁

滚动时不要干涉轮胎

操作员轻松激活和释放

在激活时将轮胎保持在适当位置

电子系统

电线没有裂纹，裂纹或断裂

指示灯和喇叭正常工作

控制工作顺利，重复

电池盒是干净的，免费的

电机运行平稳，安静

室内装潢

没有眼泪，裂口，烧伤痕迹或过度磨损

没有过度拉伸（例如，吊床）

内饰是干净的

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General

Wheelchair opens and folds easily

Wheelchair rolls straight with no excess drag or pull Footrests fip up/down easily

Legrests swing away and latch easily

Backrest folds and latches easily

Armrests easy to move and latch

All nuts and bolts are snug

Wheels

Axle threads in easily or slides in and latches properly No squeaking, binding, or excessive side motion while turning All spokes and nipples are tight and not bent or nicked Tire pressure is correct and equal on both sides

No cracks, looseness, bulges in tires

Casters

No cracks, looseness, or bulges in caster tires

No wobbling of caster wheel

No excessive play in the caster spindle

Caster housing is aligned vertically

Wheel locks

Do not interfere with tire when rolling

Easily activated and released by operator

Hold tires frmly in place while activated

Electrical system

Wires show no cracks, splits, or breaks

Indictors and horn work properly

Controls work smoothly and repeatedly

Battery cases are clean and free from fuids

Motor runs smoothly and quietly

Upholstery

No tears, rips, burn marks, or excessive fraying

No excessive stretching (e.g., hammocking)

Upholstery is clean

(From Cooper RA: Wheelchair selection and confguration, New York, 1998, Demos Medical Publishing.)

The user is responsible for keeping the chair clean, the tires properly inflated, the brakes properly adjusted, and seeing that the wheelchair is inspected on a regular basis. Te user of a powered wheelchair needs to ensure that the correct battery for the wheelchair is used and that it is properly charged. A checklist of items that wheelchair users should monitor or have monitored regularly is shown in Box 10-5. Te user manual for the wheelchair will also specify a schedule for periodic inspection and maintenance. 用户负责保持椅子清洁，轮胎适当地充气，制动器被适当地调整，并且看到轮椅被定期检查。 电动轮椅的使用者需要确保使用用于轮椅的正确电池并且其被适当充电。 附件10-5显示了轮椅使用者应该监测或定期监测的项目清单。 轮椅的用户手册还将指定定期检查和维护的计划表。

Developing Mobility Skills for Manual

and Powered Systems 开发手动和动力系统的移动技能

Training in mobility skills can occur before and after the delivery of the final chair to the consumer. In situations where it is undetermined which chair is most suitable for the consumer or if the consumer will be able to operate the wheelchair, a trial period takes place. During the trial period the person is loaned or leased a wheelchair, either manual or powered, which allows the consumer to test the chair and determine if it is appropriate to meet his or her needs. Often, particularly with powered mobility, this trial involves a period of training to determine if the person can develop the skills to use the wheelchair. For example, powered mobility may be identified as a goal but the individual may not yet have the skills required to control a powered wheelchair safely. If there is any question, it is best to delay making an expensive equipment purchase and risking the safety of the user and others. It is important that the potential user develop these skills through a training program before permanently acquiring the device. Implementation should not always end with the consumer’s acquisition of the device. In many cases, further training sessions are necessary. When developing either manual or powered mobility skills, it is important to set specific, measurable objectives for training.

移动技能的培训可以在消费者买卖前后进行。在不确定哪个椅子最适合于消费者的情况下，或者如果消费者能够操作轮椅，则进行体验期。在体验期间，该人借用或租用手动或动力的轮椅，这允许消费者测试椅子并且确定是否适合满足他或她的需要。通常，特别是对于动力移动，该体验涉及一段时间的训练，以确定该人是否能够使用轮椅的技能。例如，动力移动性可以被识别为目标，但是个人可能还没有安全地控制电动轮椅所需的技能。如果有任何问题，最好是推迟购买设备，保护用户和其他人的安全。重要的是，潜在用户在永久采集设备之前通过培训计划开发这些技能。不应该总是以消费者获取设备为结束。在许多情况下，还需要进一步的培训。当开发手动或动力移动技能时，重要的是设置具体的，可衡量的培训目标。

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For manual mobility, basic skills include maneuvering the wheelchair indoors on a level surface, in and around tight spaces, and over surfaces such as carpet, tile, or linoleum. For the active user of a manual wheelchair, preparation in advanced wheelchair mobility skills is suggested. These skills include the ability to negotiate rough, uneven terrain; propel up and down ramps and curbs independently; and execute wheelies. 对于手动移动，基本技能包括在室内的水平表面上，在狭窄空间中和周围以及在诸如地毯，瓷砖或油毡的表面上操纵轮椅。 对于手动轮椅的主动使用者，建议高级轮椅移动技能的准备。 这些技能包括越过粗糙，不平坦的地形的能力; 独立推进上坡和下坡; 并推动车轮。

One well-researched training program is the Wheelchair Skills Program (Kirby, 2005).6 This program was developed in conjunction with the Wheelchair Skills Test (Kirby et al., 2002,2004). Te program teaches wheelchair users basic use of the wheelchair, such as applying and releasing the brakes, removing footrests, and folding the chair. It teaches basic propulsion such as rolling forwards and backwards, turning, and maneuvering through doorways. More advanced skills include propulsion on an incline, level changes, performance of a wheelie, and various wheelie skills. Skills are classified as indoor, community, or advanced (Kirby, 2005). A version for powered mobility devices is also available, which requires users to demonstrate use of different features of the chair such as the controller, battery charger, and other functions. 一个研究良好的培训计划是轮椅技能计划（Kirby，2005）.6该计划与轮椅技能测试（Kirby等人，2002,2004）一起开发。 该程序教轮椅使用者基本使用轮椅，例如施加和释放制动器，移除脚踏板和折叠椅子。 它教导基本的推进，例如向前滚动和向后滚动，转动和通过门口操纵。 更高级的技能包括在倾斜上的推进，水平变化,前轮离地平衡的表现和各钟平衡技能。 技能分为室内，社区或高级（Kirby，2005）。 还提供了用于动力移动设备的版本，其要求用户演示使用椅子的不同特征，例如控制器，电池充电器和其他功能。

Enabling development of the ability to use a powered wheelchair for mobility in young children is different than that for adults. Te great majority of adults who start to use a powered wheelchair have experience with mobility and likely experience in driving a vehicle as well. Many young children do not. Rather than teaching the child how to use the chair, the goal of powered wheelchair provision is to enable the experience of movement (Kangas, 2010; Livingstone, 2010; Rosen et al., 2009). Current practice regarding use of powered mobility by young children suggests that the only prerequisite to use is motivation on the part of the child to be mobile, rather than requiring a certain level of cognitive ability. A young child who is learning to walk is not aware of dangerous situations, so it is the responsibility of the parents or caregivers to ensure that the environment is a safe one in which the child can learn. Similarly, children learning to use power mobility need to learn in a safe environment. It is the responsibility of the clinician, parents, or caregivers to shape the environment to provide a safe place for exploration of the control of a power wheelchair (Kangas, 2010; Rosen et al., 2009). 使儿童使用电动轮椅进行机动性的能力发展与成年人不同。大多数开始使用电动轮椅的成年人都具有移动性的经验以及在驾驶车辆方面的经验。许多幼儿没有。而不是教孩子如何使用椅子，提供动力轮椅的目标是提高运动的经验（Kangas，2010; Livingstone，2010; Rosen et al。，2009）。目前关于儿童的动力移动的实践表明，使用的唯一先决条件是儿童的动机是移动的，而不是需要一定水平的认知能力。一个正在学习走路的幼儿不知道危险的情况，所以父母或看护者有责任确保环境是一个孩子可以学习的安全的环境。同样，学习使用动力运动的儿童需要在安全的环境中学习。临床医生，父母或护理人员有责任塑造环境，为探索电动轮椅的控制提供安全的地方（Kangas，2010; Rosen et al。，2009）。

Three phases of powered wheelchair use by children have been described in the literature: (1) exploration, (2) use of the wheelchair functions, and (3) use of the wheelchair for functional activities (Kangas, 2010). Current practice guide- lines recommend that children who can benefit from powered mobility be given this opportunity as soon as they show an interest in movement. Te exploration stage allows the child the opportunity to explore movement and to learn

about moving about the environment. Play is the primary means of facilitating this exploration. Kangas (2010) recommends providing the child with a wheelchair in his or her own environment. Wherever possible, let them move as they wish rather than directing the child to go right, left, start, or stop (which requires understanding of these concepts). She stresses that the adult is responsible for the child’s safety. As the child becomes more confident with movement, the child is able to control the chair more directly, handling the joy- stick and appreciating the cause/effect relationship between his or her actions on the joystick and the movement of the chair. Ultimately, the control of the chair becomes a subskill (Bruner, 1973) that enables the child to complete daily activities while moving about the environment at will.文献中描述了儿童使用电动轮椅的三个阶段：（1）探索，（2）使用轮椅功能，（3）使用轮椅进行功能活动（Kangas，2010）。目前的实践指南建议，只要孩子对运动有兴趣，就可以获得机会。探索阶段允许孩子有机会探索运动和学习

关于环境的移动。游戏是促进这种探索的主要手段。 Kangas（2010）建议在自己的环境中为孩子提供轮椅。只要有可能，让他们随意移动，而不是指示孩子向右，向左，开始或停止（这需要理解这些概念）。她强调，成年人对孩子的安全负责。当孩子对运动更有信心时，孩子能够更直接地控制椅子，处理操纵杆并且欣赏他或她在操纵杆上的动作与椅子的运动之间的因果关系。最终，椅子控制变成了一个次要项目（Bruner，1973），使儿童能够在随意移动环境的同时完成日常活动。

OUTCOME EVALUATION 成果评价

Outcome Evaluation Instruments 结果评价仪器

Several instruments are available to evaluate the outcome of wheeled mobility intervention. Table 10-2 provides information on several of these instruments. Some of these instruments are useful in a clinical setting, including the Assistive Technology Outcomes Profle-Mobility, the Functional Mobility Assessment, the Functioning Everyday in a Wheel- chair Instrument, and the Wheelchair Outcome Measure. Te Nordic outcome measure and the Wheelchair Use Confidence Measure are fairly new instruments for which ongoing research and development continues. These instruments will become more useful to clinicians in the short term. 有几种仪器可用于评估轮式移动干预的结果。 表10-2提供了有关这些仪器的信息。 这些仪器中的一些在临床设置中是有用的，包括辅助技术成果，移动性，功能性移动性评估，轮椅仪器中每天的功能以及轮椅结果测量。 北欧结果测量和轮椅使用信心测量是相当新的工具，并且在持续的研究和开发。 这些仪器将在短期内对临床医生更有用。

The Participation and Activity Measurement System requires the use of sensors and a GIS system attached to the user’s wheelchair. This system provides a significant amount of data about the individual’s activities when using a wheelchair, as well as context for this use obtained through an interview. Te technology required to collect the objective data will likely limit this system’s use for research purposes, at least in the short term. Other researchers (Cooper et al., 2011; Moghaddam et al., 2011) have used data loggers and sensors to

measure aspects of mobility of individuals who use wheelchairs. This quantitative data, when paired with qualitative information to provide context to the individual’s movement, is facilitating a better understanding of where individuals travel with their chairs, what they are doing, and the length of time spent using their chairs during the day (Harris et al., 2010). 参与和活动测量系统需要使用传感器和连接到用户轮椅的GIS系统。 该系统提供了大量关于使用轮椅时个人活动的数据，以及通过面谈获得的这种使用的环境。 至少在短期内，收集客观数据所需的技术可能会限制该系统用于研究目的。 其他研究者（Cooper等人，2011; Moghaddam等人，2011）使用数据记录器和传感器来测量使用轮椅的个人的移动性的方面。 该定量数据与定性信息配合以提供个人运动的背景时，有助于更好地理解个人与他们的椅子一起旅行的位置，他们正在做什么以及在白天使用他们的椅子花费的时间长度（Harris et al。 et al。，2010）。

Outcomes of Wheeled Mobility Device Use A significant body of research exists that evaluates different aspects of wheelchair use, such as different propulsion techniques, effect of wheelchair setup, and wheelchair training programs. This research will not be reviewed here, although some of this work is presented in earlier sections of this

chapter. In this section, we consider research that explores the effect of wheelchair use on participation, in the home and in the community. Most of this research has been conducted with adults who use wheelchairs; however, we will start with the work exploring the relationship between wheelchair use and participation in children. 轮式移动装置使用的结果存在大量的研究来评估轮椅使用的不同方面，例如不同的推进技术，轮椅设置的效果和轮椅训练计划。 这项研究不会在这里进行审查，虽然其中一些工作在本章前面的章节中介绍。 在本节中，我们考虑研究轮椅使用对参与，家庭和社区的影响。 大多数这项研究是与使用轮椅的成年人进行; 然而，我们将开始探讨轮椅使用和参与儿童之间的关系。

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TABLE 10-2 Mobility Device–Specifc Outcome Measures Title Reference Purpose Assistive Technol- Hammel J, Southall K, Measures the ogy Outcomes Jutai J, Finlayson M,

Profle-Mobility

Kashindi G, Fok D:

and participation

outcomes of mobility Evaluating use and

technology: a multiple

stakeholder analysis.

Disabil Rehabil: Assist

Technol, 8:294-304, 2013

impact of mobility devices on activity

Functioning Everyday in a Wheelchair Seating- Mobility Outcomes Measure

Mills T, Holm MB, Trefer E, Schmeler M, Fitzgerald S, Bonninger M: Develop- ment and consumer vali- dation of the Functioning Everyday in a Wheelchair (FEW) instrument. Disabil Rehabil, 24:38-46, 2002. Holm M, Mills T, Schmeler M, Trefer E.

From www.Few.Pitt.edu Kumar, A, Schmeler M, Karmarker AM, Collins DM, Cooper R, Cooper RA, Shin H, Holm MB: Test-retest reliability of the functional mobility assess- ment (FMA): A pilot study, Disabil Rehabil: Assist Technol, 8:213-219, 2-13.

Provides a profle of

function, as per-

ceived by the user of a wheelchair or

scooter

Functional Mobility Assessment

Self-report measure

of functional outcomes of mo-

bility intervention,

including seating and wheelchair intervention

Nordic Mobility- Related Participation Outcome Evaluation of Assistive Device Intervention Participation and Activity Measurement System

Brandt A, Iwarsson S: Development of an instrument for assess- ment of mobility-related participation outcomes, the NOMO 1.0, Technol Disabil, 24:293-301, 2012 Harris F, Sprigle S, Sonen- blum SE, Maurer CL: The participation and activity measurement system: An example application among people who use wheeled mobility devices, Disabil Rehabil: Assist Technol, 5:48-57, 2010.

Measure of partici- pation outcomes related to use of mobility devices

Measure of health, activity, and par-

ticipation of adults

who use mobility devices

Wheelchair Use Confdence Scale

Rushton PW, Miller WC, Kirby RL, Eng JJ, Yip J: Development and evalu- ation of the wheelchair use confdence scale: A mixed-methods study, Disabil Rehabil: Assist Technol, 6:57-66, 2011.

Measures the confdence of wheelchair users when performing different activities

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Intended Population Adults who use mobility devices as primary means of mobility

Adults with progressive or nonprogressive conditions who use a wheelchair as their primary means of mobility

Measurement Structure 68-item instrument measuring ac- tivity (physical performance and ADL) and participation (social role performance and discretion- ary social participaton). Computer adaptive testing methods used to administer only relevant items.

Responses range from ability to perform without any diffculty to unable to do.

Two scores: (1) mobility level with device and (2) capability without device

Instrument consists of 10 items evaluating aspects of the wheelchair, its operation, ADL performance, transfers, mobility, and transportation while using the chair.

Items are scored on a 6-point Likert scale with 1 = completely dis- agree and 6 = completely agree.

Adults who use any form of mobil- ity device, including manual and power wheelchairs

Adult users of mobility devices; instrument available in Danish, Swedish, Icelandic, and Norwegian

Instrument consists of 10 items, measuring a range of functional activities, e.g., completing daily routine, reaching and transfer- ring objects, personal and public transportation, indoor and out- door mobility.

Scored on a 7-point Likert scale from completely disagree to completely agree.

Two parts: (1) diffculty and depen- dence in use of mobility device in different environments and (2) frequency, ease of participa- tion, and number of activities performed.

Adult users of mobility devices

Adult manual wheel- chair users from inpatient rehabilita- tion to community reintegration

Consists of two parts:

(1) objective measurement, using GIS and sensors to record mobil- ity factors such as time spent in wheelchair, use of features (tilt, recline, standing), distance traveled, destinations, time spent outside of home, and (2) prompted recall interview that provides context for the objective data acquired. Six different scales:

Negotiating the physical environ- ment, Activities performed using manual wheelchair, Knowledge and problem solving, Manag- ing social situations, Advocacy, Managing emotions

Continued

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TABLE 10-2 Mobility Device–Specifc Outcome Measures—cont’d

Title

Wheelchair Out- come Measures (WhOM)

Reference

Mortenson B, Miller W, Miller Polgar J: Measur- ing wheelchair interven- tion: Development of the Wheelchair Outcome Measure (WhOM). Disabil and Rehabil: Assist Tech- nol. 2007; 2: 275-285. Miller WC, Garden J, Mortenson WB: Measure- ment properties of the wheelchair outcome mea- sure in individuals with spinal cord injury. Spinal Cord, 49:995-1000, 2011.

Purpose A user-centered measure of the functional and

physical outcomes

of wheelchair service delivery



Rodby-Bousquet and Hagglund (2010) described the use of manual and/or power wheelchairs in children with cerebral palsy living in Sweden. A sample of 562 children living in south Sweden was surveyed to provide this description. The researchers found that wheelchair use increased with the age of the child and with the severity of the cerebral palsy. Children with a Gross Motor Function Classification Score of IV or V were more likely to use a power wheelchair. Te researchers explored wheelchair use indoors and outdoors. Wheelchairs were used indoors by 165 children: 104 of these children were pushed by an attendant, 32 used a manual wheelchair exclusively, 12 used a power wheelchair exclusively, and 17 used both manual and power chairs. A larger number of children used wheelchairs for outdoor mobility; 228 used mobility devices for this purpose. Of this group, 66 were independent when propelling their chair (18 manual wheelchair, 36 power chair, and 12 both) (Rodby-Bousquet Hagglund, 2010). A significant proportion (162 of 228 children) were pushed when traveling outside (Rodby-Bousquet Hagglund, 2010). These numbers give some indication of the level of independence of this sample of children when using their chairs, as well as the effect of indoor versus outdoor mobility. Rodby-Bousquet和Hagglund（2010）描述了在瑞典生活的大脑性瘫痪儿童使用手动和/或动力轮椅。对住在瑞典南部的562个儿童的样本进行了调查，以提供这种描述。研究人员发现，轮椅使用随着儿童的年龄和大脑性麻痹的严重程度而增加。具有IV或V的总运动功能分级得分的儿童更可能使用电动轮椅。研究人员探讨了轮椅在室内和室外使用。 165名儿童在室内使用轮椅：其中104名儿童由服务员推动，32名使用手动轮椅，12名仅使用电动轮椅，17名使用手动和电动椅。大量儿童使用轮椅进行户外活动; 228名用于此目的的移动设备。在这组中，66人在推动他们的椅子（18手动轮椅，36电动椅，和12两者）时是独立的（Rodby-Bousquet Hagglund，2010）。大部分（228名儿童中的162名）在外出时被推动（Rodby-Bousquet Hagglund，2010）。这些数字给出了这个样本儿童在使用椅子时的独立程度，以及室内和室外移动的影响。

The RESNA position paper (Rosen et al., 2009) on provision of powered mobility for children cites numerous benefits of powered mobility use by young children. These benefits include greater likelihood of initiating movement, enhanced exploration, independence and curiosity, more interactions with peers, and greater participation in educational programs (Rosen et al., 2009). 关于为儿童提供动力移动的RESNA立场文件（Rosen等人，2009年）介绍了儿童使用动力轮椅的许多好处。 这些好处包括更有可能启动运动，增强探索，独立性和好奇心，与同伴的更多互动，以及更多参与的教育计划（Rosen等，2009）。

The influence of powered mobility on function of children with motor impairments was further investigated by Bottos et al. (2001) and Jones et al. (2012). Jones et al. investigated the effect of the provision of powered mobility in a small sample of children (N = 28) with severe motor impairments, aged 14 to 30 months to determine its influence on their development and function, comparing the performance of children who received a power wheelchair with that of children who did not. Their findings suggested that receptive communication, mobility, need for caregiver assistance, and caregiver self-care change scores of the experimental group were significantly different from those of the control group. Bottos et al. (2001) found little change in gross motor function, cognition, and impact of childhood illness on parents in young children with cerebral palsy 6 months following acquisition of a powered mobility device. They did find a significant difference for the level of independence. These two studies have promising findings; however, combined with the literature included in the RESNA position paper on pediatric powered mobility (Rosen et al., 2009), they demonstrate the limited evidence base to support clinical practice in this area. 动力运动对运动障碍儿童功能的影响由Bottos等进一步研究。 （2001）和Jones et al。 （2012）。 Jones et al。研究了在14至30个月的严重运动障碍的小样本儿童（N = 28）中提供动力移动的影响，以确定其对其发育和功能的影响，比较接受动力轮椅的儿童的表现与没有的孩子的。他们的研究结果表明接受沟通，流动性，照顾者援助的需要和照顾者自我护理变化分数的实验组与对照组的显着不同。 Bottos et al。 （2001）发现，在获得动力移动装置6个月后，儿童疾病对大脑性麻痹儿童的父母的大运动功能，认知和影响几乎没有变化。他们发现独立性水平有显着差异。这两项研究有希望的发现;然而，结合RESNA关于儿童动力移动的立场文件（Rosen等，2009）中的文献，他们证明了在这一领域支持临床实践的有限证据基础。

More attention has been given to adults who use wheel- chairs. Here we focus on work that has investigated the influence of mobility device use on participation. The following review is not intended to be an exhaustive review of studies of the effect of wheelchair use on participation. However, the range of client populations studied and the convergence of findings across the papers enabled the identification of key themes that are reflected in our application of the HAAT model to mobility device service delivery and use. Studies were conducted with older adults (Evans et al., 2007; Lofqvist et al., 2012); adults who have sustained a stroke (Barker et al., 2006; Pettersson et al., 2006, 2007); adults with multiple sclerosis (Boss & Finlayson, 2006); and adults with spinal cord injury (Chaves et al., 2004, Cooper et al., 2011, de Groot et al., 2011; Kilkens et al., 2005). 更多的注意力应该放在使用轮椅的成年人。 在这里，我们专注于研究移动设备在活动参与中的影响作用。 以下评论并不是对移动设备在活动参与中的影响的研究的详尽回顾。 然而，研究的客户群体的范围和研究结果的融合使得我们能够确定在HAAT模型应用于移动设备服务提供和使用中反映的关键主题。 对老年人进行研究（Evans et al。，2007; Lofqvist et al。，2012）; 已经持续中风的成人（Barker等人，2006; Pettersson等人，2006,2007）; 成人与多发性硬化（Boss＆Finlayson，2006）; 和脊髓损伤的成人（Chaves等人，2004，Cooper等人，2011，de Groot等人，2011; Kilkens等人，2005）。

Several themes recur in these studies. Participants experienced freedom, independence, and autonomy with acquisition of a wheelchair, either manual or powered (Barker et al., 2006; Evans et al., 2007; Pettersson et al., 2006; Rosseau- Harrison et al., 2012). Participants in several studies reported they felt less of a burden on family members (Barker et al., 2006; Boss et al., 2006). 这些研究中重复出现了几个主题。 参与者通过获得手动或动力的轮椅经历了自由，独立和自主。（Barker等人，2006; Evans等人，2007; Pettersson等人，2006; Rosseau-Harrison等人，2012） 几项研究的参与者指出他们对家庭成员的负担减轻（Barker等人，2006; Boss等人，2006）。

Enhanced quality of life is another positive outcome of mobility device acquisition (Pettersson et al., 2007). In contrast to the perception of self as an independent, autonomous person, some participants reported experiencing stigma and a self-perception of greater disability, particularly following acquisition of a powered wheelchair. One study reported that participants self-limited their community mobility because

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of concern that they looked disabled (Evans et  al., 2007). Individuals who reported greater satisfaction with their device and greater comfort when using it were more likely to have higher rates of participation (deGroot et al., 2010). Further, individuals with stronger wheelchair skills had higher levels of function (Kilkens et al., 2005).

提高生活质量是移动设备获取的另一个积极结果（Pettersson等人，2007）。 与自己作为一个独立的，自主的人的感觉相反，一些参与者报告经历了耻辱和更强的残疾的感觉，特别是在获得电动轮椅之后。 一项研究报告说，参与者自我限制他们的社区流动性，因为他们担心他们看起来残疾（Evans等人，2007）。 报告对其装置更高满意度和使用时更舒适的个人更有可能具有更高的参与度（deGroot等人，2010）。 此外，具有更强的轮椅技能的个人具有更高的功能水平（Kilkens等人，2005）。

Power mobility devices afforded greater community mobility than did manual devices, which were found to enhance occupations in the home to a greater extent than in the community (Rosseau-Harrison et al., 2012). While many studies reported that users of power mobility devices were able to do more in the community (Barker et  al., 2006; Blach Rossen et al., 2012; Cooper et al., 2011; Evans et al., 2007; Lofqvist et al., 2012; Pettersson et al., 2006), barriers were also experi- enced that limited the choice of venues visited (Barker et al., 2006). Power mobility devices enabled individuals to travel in the community to perform necessary and desired occupations such as going for a walk or shopping and enhanced social interactions (Barker et  al., 2006; Blach Rossen et  al., 2012; Evans et al., 2007; Lofqvist et al., 2012; Pettersson et al., 2006), providing their destinations were accessible (Barker et  al., 2006; Boss et al., 2006; Chaves et al., 2004; Evans et al., 2007; Pettersson et al., 2006). Powered mobility devices themselves hindered participation due to lack of ft with various forms of transportation (Chaves et al., 2004).

与手动装置相比，动力移动装置提供了更大的社区流动性，这被发现在家庭中比在社区中更大程度地增强职业（Rosseau-Harrison等人，2012）。虽然许多研究报告说，动力移动设备的用户能够在社区做更多（Barker等人，2006; Blach Rossen等人，2012; Cooper等人，2011; Evans等人，2007; Lofqvist等人2012年; Pettersson等，2006），障碍也经历了限制访问场所的选择（Barker等人，2006）。动力移动设备使个人能够在社区中旅行，以执行必要的和期望的职业，例如散步或购物和增强社会交往（Barker等人，2006; Blach Rossen等人，2012; Evans等人，2007 ; Lofqvist等人，2012; Pettersson等人，2006），提供他们的目的地是可访问的（Barker等人，2006; Boss等人，2006; Chaves等人，2004; Evans等人，2007; Pettersson等人，2006）。动力移动设备本身由于缺乏与各种交通工具的配合而阻碍了参与（Chaves等人，2004）。

These studies demonstrate the positive benefits of mobility device use, particularly powered mobility device use, for participation of adults with mobility impairments. How- ever, they also point out environmental accessibility issues, including transportation, that limit community participation of adults who use powered devices. Te research further highlights the meaning that use of a mobility device holds for an individual, and how that influences participation. These three key findings—enhanced participation, effect on self-perception, and accessibility issues—are elements of all phases of the service delivery process and support the human-activity-context foundation that we applied in this chapter. 这些研究证明了移动设备使用，特别是动力移动设备使用，对于具有移动性障碍的成年人的参与的积极好处。 然而，他们还指出了环境无障碍问题，包括交通，限制了使用有源设备的成年人的社区参与。 研究进一步突出了移动设备的使用对个人的意义，以及如何影响参与。 这三个主要发现是增强了参与，增强了对自我感知和无障碍问题的影响，这些发现是服务提供过程所有阶段的要素，并支持我们在本章中应用的人类活动背景基础。

SUMMARY 总结

Mobility is very important for participation in self-care, home, work, school, and leisure activities. Mobility needs for individuals with disabilities vary depending on the age and the disability status of the user. Te ability to move about one’s environment at will has physical, psychological, and social benefits. In this chapter we describe the general characteristics of personal mobility systems and the various types of mobility devices available to meet individual needs of the user. Personal mobility devices fall under the categories of independent manual, dependent manual, and powered mobility. Both manual and powered wheelchair options were described.

移动性对于参与自我照顾，家庭，工作，学校和休闲活动非常重要。 残疾人的移动性需求根据用户的年龄和残疾状况而变化。 随意移动环境的能力将具有身体，心理和社会效益。 在本章中，我们描述个人移动系统和各种类型的移动设备的一般特性，以满足用户的个性化需求。 个人移动设备属于独立手册，相关手册和动力移动的类别。 手动和电动轮椅选项被描述。

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CASE STUDY 12-1

Change from Manual Wheelchair to Power

Ted is a 53-year-old man who sustained a T12 incomplete spinal cord injury in a car crash 15 years ago. Ted is a business man who commutes to work regularly using adapted public transit. His work and home are both fully accessible to support use of a manual wheelchair. Ted enjoys an active lifestyle, particularly get- ting out to visit friends, using his chair to travel on outdoor paths, and traveling with his wife. Ted has had increasing shoulder pain, resulting from many years of propelling his manual chair. For the past year he has found himself unable to do as much activity as he wishes because of the pain in his shoulder. He also finds that he becomes fatigued more easily when propelling his chair. Ted was recently admitted to a rehabilitation facility for a urinary tract infection. While in the facility, his wheelchair prescription is being reviewed. The seating and mobility team, with Ted, will decide if he should change to power-assist wheels or a power wheelchair. You are a clinician in the facility. Your assessment will assist with this decision.

Questions

What observations would you make during your interactions

with Ted that would contribute to this decision?

What factors or observations would indicate that power-assist

wheels are the best option?

What factors or observations would indicate that a powered

wheelchair is the best option?

案例研究12-1

从手动轮椅更改为电源

特德是一名53岁的男子，在15年前的车祸中维持了T12不完全脊髓损伤。 特德是一个商人，通勤使用适合的公共交通工作。他的工作和家庭都是完全理解和支他持使用手动轮椅。 特德喜欢积极的生活方式，特别是去看朋友，用椅子在室外的路上行走，和妻子一起旅行。由于多年推动他的手动椅，特德已经开始肩痛。在过去的一年里，他发现自己无法做他想要的事情，因为他的肩膀疼痛。他还发现，当他推动椅子时，他更容易疲劳。 特德最近被允许进入尿路感染的康复设施。在设施，他的轮椅处方正在审查。座椅和移动团队，与特德将决定是否应该更改为动力辅助轮或电动轮椅。您是该设施的临床医生。您的评估将有助于做出这一决定。

问题

在你的互动中你会做什么观察

与Ted，将有助于这个决定？

什么因素或观察将指示助力

轮子是最好的选择？

什么因素或观察将指示有电

轮椅是最好的选择？

CASE STUDY 12-2

Wheelchair Safety in a Long-Term Care Facility

Maude is an 83-year-old woman who lives in a long-term care facility. She has a diagnosis of mid-stage Alzheimer’s disease. Two years ago she sustained a stroke, followed immediately by a myocardial infarction. This combination of conditions resulted in the use of a powered wheelchair, following the initial recovery from the stroke. In the past 6 months, staff and residents in the long- term-care facility have expressed concerns about Maude’s safe use of her powered wheelchair. She has had many collisions with doorframes and walls when traveling in the facility and several times has come close to colliding with staff or other residents. Last week Maude ran over the foot of one of the staff members. A family meeting will be held in two days to discuss these safety concerns and the plan to change to use of a manual chair. The staff members expect that the family will express concerns that this change will limit Maude’s independence. You are a clinician in the long-term-care facility and will participate in the family meeting because you interact with Maude on a regular basis. Questions

What information is important to provide in each of the following areas?

Physical abilities

Cognitive abilities

Emotional state

Environmental aspects

What is the context in which incidents of unsafe use of the chair

occur?

What features of a manual wheelchair do you think will be

important to include to minimize the effect this change will have on her mobility?

案例研究12-2

长期护理设施中的轮椅安全

莫德是一名83岁的女性，住在一家长期护理机构。她是一名中期阿尔茨海默病的患者。两年前，她持续中风，随后立即发生心肌梗死。这两种病导致在初始恢复之后使用动力轮椅。在过去6个月中，长期护理机构的工作人员和居民对莫德安全使用电动轮椅表示了关注。她在设施内行动时与门框和墙壁发生许多碰撞，并且几次差点和工作人员或其他居民发生碰撞。上周莫德辗过了一名职员的脚。家庭会议将在两天内举行，讨论这些安全问题和改变使用手动椅子的计划。工作人员认为家人会表示担心，这种变化将限制莫德的独立性。您是长期护理机构的临床医生，将参加家庭会议，因为您定期与莫德交流。问题

在以下每个领域中提供哪些信息很重要？

身体能力

认知能力

情绪状态

环境方面

发生不安全使用椅子的事件的背景是什么？

你认为手动轮椅的什么特点

重要的是要包括以减少这种变化对她的流动性的影响？

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CASE STUDY 12-3 Pediatric Wheelchair Training

案例研究12-3儿童轮椅训练

Matthew is a 4-year-old boy who just started preschool. He has

severe cerebral palsy, affecting upper and lower extremities, trunk,and head control. At rest his tone is low. When excited or when completing an activity, his tone increases. His head control is fair.He is unable to sit independently. He has a slight startle reflex to loud noises. Matthew has some right hand function, as evidenced by his ability to play computer games using a four-position switch array. Matthew is nonverbal and communicates with facial expressions,gestures, sounds, yes/no signals, and a picture board. His communication is purposeful. He is able to express his needs and engage in a limited conversation with his picture board. His vocabulary

is increasing rapidly now that he has some means to communicate.

His functional vision appears to be intact.

Matthew’s parents have used a solid based stroller for mobility.They did not want to obtain a wheelchair as they wanted Matthew to walk. However, recently they realized that Matthew wants to be able to move about his environment independently and agreed to the purchase of a powered wheelchair. He recently received his powered wheelchair, with a four-position switch array embedded into the laptray as a controller. You are the clinician who is responsible for conducting his powered wheelchair training. 马修是一个4岁的男孩，刚刚开始学龄前。他有

严重脑性麻痹，影响上肢和下肢，躯干和头部控制。休息时他的语气很低。当兴奋或完成一个活动，他的语气增加。他的头部控制是公平的。他不能独立地坐。他对大声噪音有一个轻微的惊吓反射。马修有一些右手功能，这证明了他使用四位置开关阵列玩电脑游戏的能力。马修是非语言的，是用面部表情，手势，声音，是或否和画板进行通信。他的沟通是有目的的。他能够表达自己的需求，并与他的画板进行有限的对话。他的词汇正在快速增长，因为他有一些手段来沟通。他的功能性视觉似乎是完整的。

马修的父母已经使用一个坚实的婴儿车来移动。他们不想得到轮椅，因为他们希望马修走路。然而，最近他们意识到，马修想要能够独立地移动，并同意购买一个电动轮椅。他最近收到了他的电动轮椅，一个四位开关阵列嵌入到laptray作为控制器。你是负责进行电动轮椅训练的临床医生。

Questions 问题

Describe three stages in the training in use of a powered mobility device and give an example of an activity that you think would be beneficial at each stage.

描述使用动力移动设备的训练中的三个阶段，并给出您认为在每个阶段都有益的活动的示例。

How would you arrange the environment for Matthew in the initial

stages of powered wheelchair training?

在电动轮椅训练的初始阶段，您如何为Matthew安排训练环境？

What opportunities would you use to help Matthew learn to control the chair, while at the same time ensuring his safety in the environment?

你将使用什么机会帮助马修学会控制椅子，同时确保他在训练环境中的安全？

What skills do you think Matthew should demonstrate consistently before he uses his powered wheelchair in an environment with other children?

你认为马修在和其他儿童一起的环境中使用电动轮椅之前，应该始终如一的展示什么技能？

STUDY QUESTIONS 研究问题

1. Describe the three broad categories of wheeled mobility systems.

1.描述轮式移动系统的三大类。

2. Describe one aspect of a resident’s cognitive, physical, and

affective behavior or skill that a clinician may observe that

provides useful information for a wheelchair assessment.

描述临床医生可能观察到的为轮椅评估提供有用信息的居民的认知，身体和情感行为或技能的一个方面。

3. Describe one aspect of each of the physical, social, and

institutional contexts that has the potential to affect a

client’s ability to use a manual wheelchair. 描述每一个物理，社会和有可能影响客户使用手动轮椅的能力的制度环境。

4. Describe three situations or behaviors that a clinician

might observe that would suggest that a client should

change from a manual to a power wheelchair.描述临床医生的三种情况或行为可能会观察到，客户应该从手动轮椅变成电动轮椅。

5. What are the two major structures of a wheelchair? 轮椅的两个主要结构是什么？

6. Describe and contrast the advantages and disadvan-

tages of tilt versus recline systems. What are the indica-

tions for the recommendation of each? 描述和对比倾斜系统和斜倚系统的优点和缺点。 每个建议的指征是什么？

7. Discuss the relationship of the center of mass of the

user to the center of mass of the wheelchair as it was

described in this chapter. What are the implications of

this relationship to function? 讨论用户的质心与轮椅质量的关系，如本章所述。 这种关系对功能的影响是什么？

8. What are the ways in which pediatric wheelchairs can

accommodate growth? 儿童轮椅可以适应生长的方式是什么？

9. List the four types of standing systems and give an advantage and disadvantage of each. What are the major benefts of these systems? 列出四种类型的站立系统，并给出每个的优势和劣势。 这些系统的主要优点是什么？

10. Define bariatrics and discuss the implications of wheel-chair confguration and use for this population.定义肥胖病学和讨论轮椅配置和对这个人群的作用。

11. Discuss the considerations of wheelchair use and configuration for elderly clients 讨论轮椅使用和配置的老年客户的考虑

12. Identify the different locations of the drive wheels of an electrically powered wheelchair and describe how each affects the function of the chair. 识别电动轮椅的驱动轮的不同位置，并描述它们如何影响椅子的功能。

13. What types of control interfaces are typically used for

powered wheelchairs? 什么类型的控制接口通常用于电动轮椅？

1. What types of batteries are used in powered wheel-chairs? How do they differ from automobile batteries? What is the difference between wet-cell and gel batteries? 电动轮椅使用什么类型的电池？ 它们与汽车电池有什么不同？ 湿电池和凝胶电池有什么区别？

REFERENCES 参考文献

Blach Rossen C, et al.: Everyday life for users of electric wheelchairs:

A qualitative interview study, Dis Rehabil: Assist Technol 7:399–407,

2012, http://dx.doi.org/10.3109/17483107.2012.665976. Boninger M, et al.: Propulsion patterns and pushrim biomechan-

ics in manual wheelchair propulsion, Arch Phys Med Rehabil

83(5):718–723, 2002.

Boninger M, et al.: Pushrim biomechanics and injury prevention

in spinal cord injury: Recommendations based on CULP-SCI

investigations, J Rehabil Res Dev 42(3):9–20, 2005 .

Boss T, Finlayson M: Responses to the acquisition and use of

power mobility by individuals who have multiple sclerosis and

their families, Am J Occup Ter 60:348–358, 2006 .

Bottos M, et al.: Powered wheelchairs and independence in young

children with tetraplegia, Dev Med Child Neuro 43:769–777,

2001.

========267========

Bruner JS: Organization of early skilled action, Child Dev

44:1–11, 1973.

Buck S: More than 4 wheels: Applying clinical practice to seating,

mobility and assistive technology, Milton, ON: Terapy Now!

Inc, 2009.

Center for Disease Control: State-specifc prevalence of obesity

among adults—United States, 2005, Morbidity and Mortality

Weekly 55(36):985–988, 2006 .

Chaves ES, et al.: Assessing the infuence of wheelchair tech-

nology on perception of participation in spinal cord injury,

Arch Phys Med Rehabil 85:1854–1858, 2004. http://dx.doi

.org/10.1016/j.apmr.2004.03003.

Cooper RA: Wheelchair selection and confguration, New York, 1998,

Demos Medical Publishing .

Cooper R A, Boninger M L, Rentschler A : Evaluation of selected

manual wheelchairs using ANSI/RESNA standards, Arch Phys

Med Rehabil 80:462–467, 1999 .

Cooper R A, et al.: Te relationship between wheelchair mobil -

ity patterns and community participation among individuals

with spinal cord injury, Assist Technol 23:177–183, 2011. http://

dx.doi.org/ 10.1080/10400435.2011.588991 .

Cooper R A, et al.: Performance of selected lightweight wheel -

chairs on ANSI/RESNA tests, Arch Phys Med Rehabil

78:1138–1144, 1997a .

Cooper R A, et al.: Methods for determining three-dimensional

wheelchair pushrim forces and moment—A technical note,

J Rehabil Res Dev 38(1):41–55, 1997b .

Cossette L : A profle of disability in Canada, 2001, Ottawa, ON,

2002, Ministry of Industry .

Daus C: Te right ft, Rehab Manag, Available online. Downloaded

October 31, 2006. http://www.rehabpub.com/features/

892003/4.asp , 2003.

deGroot S , et al.: Is manual wheelchair satisfaction related to

active lifestyle and participation in people with spinal cord in -

jury? Spinal Cord 49:560–565, 2011, http://dx.doi.org/ 10.1038/

sc.2010.150 .

Deitz J , Swinth Y , White O : Power mobility and preschool -

ers with complex developmental delays, Am Jl of Occup Ter

56:86–96, 2002 .

Denison I , Gayton D : Power wheelchairs selection. Downloaded

October 28, 2006 http://www.assistive-technology.ca/newdef2

.htm, 2002.

Eng JJ, Levins S M, Townson A F: Use of prolonged standing for

individuals with spinal cord injury, Phys Ter 81:1392–1399,

2001.

Eng JJ: Getting up goals, Rehab Manag. Downloaded October 28,

2006. http://rehabpub.com/features/1022004/5.asp , 2004. Engstrom B : Ergonomic seating: A true challenge, Sweden, 2002,

Posturalis Books .

Evans S , et al.: Older adults’ use of and satisfaction with electric

powered indoor/outdoor wheelchairs, Age Ageing 36:431–435,

2007, http://dx.doi.org/ 10.1093/ageing/afm034 .

Fass MV, et al.: Durability, value and reliability of selected electric

powered wheelchairs, Arch Phys Med Rehabil 85:805–814,

2004.

Finley MA, et al.: Efect of 2-speed manual wheelchair wheel on

shoulder pain in wheelchair users: Preliminary fndings. In Proc

22nd International Seating Symposium , British Columbia, 2006,

Vancouver.

Furumasu J, Guerette P, Teft D: Relevance of the pediatric pow-

ered wheelchair screeing test for children with cerebral palsy,

Dev Med Child Neuro 46:468–472, 2004 .

CHAPTER 10

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Giesbrecht EM, et al.: Participation in community-based activities

of daily living: Comparision of a pushrim-activated, power

assist wheelchair and a power wheelchair, Disabil & Rehabil:

Assist Tec 4(3):198–207, 2009 .

Ham R, Aldersea P, Porter D: Wheelchair users and postural seating:

A clinical approach, New York, 1998, Churchill Livingstone . Harris F , et al.: Te participation and activity measurement sys -

tem: An example application among people who use wheeled

mobility devices, Dis Rehabil: Assist Technol 5:48–57, 2010.

http://dx.doi.org/ 10.3109/17483100903100293 .

Howarth S, et al.: Use of a geared wheelchair wheel to reduce pro-

pulsive muscular demand during ramp ascent: Analysis of muscle

activation and kinematics, Clinical Biomechanic 25:21–28, 2010 . Howarth SJ, et al.: Trunk muscle activity during wheelchair ramp

ascent and the infuence of a geared wheel on the demands of

postural control, Arch of Phys Med Rehabil 91:436–442, 2010 . Jones MA, McEwen IR, Neas BR: Efects of power wheelchair on

the development and function of young children with severe

mobility impairments, Pediat Phys Ter 24:131–140, 2012.

http://dx.doi.org/10.1097/PEP.0b013e31824c5fdc. Kangas K: Powered mobility does not require any prerequisites, except

the need to be independently mobile, Orlando, 2010, ATIA.

December 13, 2010.

Kaye S, Kang T, LaPlante MP: Wheelchair use in the United

States, Disability Statistics Abstract 23, 2002 .

Kemper K: Strollers: A growing alternative, Team Rehabil Rep

4(2):15–19, 1993.

Kermoian R: Locomotor experience facilitates psychological

functioning: Implications for assistive mobility for young children. In Gray DB, Quatrano LA, Lieberman ML, editors: Designing

and using assistive technology, Baltimore, 1998, Paul H Brookes. Kilkens OJE, et al.: Relationship between manual wheelchair skill

performance and participation of persons with spinal cord

injury 1 year after discharge from inpatient rehabilitation,

J Rehab Res Dev 42:65–74, 2005. http://dx.doi.org/10.1682/

JRRD. 2004.08.0093.

Kirby RL: Wheelchair Skills Program v. 3.2. Available from

www.wheelchairskillsprogram.ca , 2005.

Kirby R L, Swuste J , Dupuis D J, Mcleod D A: Munro, R: Te

wheelchair skills test: A pilot study of a new outcome measure,

Arch Phys Med Rehabil 83:1298–1305, 2002 .

Kirby R L, Dupuis D J, MacPhee A H, et al.: Te Wheelchair Skills

Test (version 2.4): Measurement properties, Arch Phys Med

Rehabil 85:41–50, 2004 .

Kreutz D : Power tilt, recline or both, Team Rehab Rep 29–32,

March 1997 .

Lange M : Tilt in space versus recline: New trends in an old de -

bate, Tech Spec Int Sec Quart 10:1–3, 2000 .

Lange M : Power wheelchair access: Assessment and alternative

access methods, Proc 21st Int Seat Symp , 87–88, January,

2005.

Livingstone R : A critical review of power mobility assessment

and training for young children, Disabil and Rehabil: Assist Tech

5(6):392–400, 2010 .

Lofqvist C , Pettersson C , Iwarsson C , Brandt A : Mobility and

mobility-related participation outcomes of power wheelchair

and scooter interventions after 4 months and 1 year, Dis Reha-

bil: Assist Tech 7:211–218, 2012. http://dx.doi.org/ 10.3109/174

83107.2011.6194244 .

Mendoza R J, Pittenger D J, Savage F S, Weinstein C S: A protocol

for assessment of risk in wheelchair driving within a healthcare

facility, Dis Rehabil 25:520–526, 2003 .

========268========

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CHAPTER 10 Technologies That Enable Mobility

Ministry of Industry: Physical Activity and Limitation Survey,

2006: Tables (Part IV), Statistics Canada, 2010, Ottawa. Publi-

cation No: 86-628-X. Accessed February 10, 2014.

Mitchell IM, Viswanathan P, Adhikari B, Rothfels E, Mackworth

AK: Shared control policies for safe wheelchair navigation of

elderly adults with cognitive and mobility impairments: De-

signing a Wizard of Oz study, Am Control Conf, 2014. pre-print. Mogul-Rotman B, Fisher K: Stand up and function, Available

online Rehab Manag, 2002. Downloaded October 28, 2006,

http://www.rehabpub.com/features/892002/3.asp.

Moghaddam AR, Pineau, J, Frank J, Archambault P, Routhier F,

Audet T, Polgar J, Michaud F, Boissey P: Mobility profle

and wheelchair driving skills of powered wheelchair users:

Sensor-based event recognition using a support vector machine

classifer, Proceedings of the Annual International Conference

IEEE Engineering in Medicine and Biology Society, EMBS,

art no. 6091711, 7336–7339, 2011.

Mortenson B, et al.: Perceptions of power mobility use and safety

within residential facilities, Can J Occup Ter 72(3):142–152,

2005.

Mortenson B, et al.: Overarching principles and salient fndings

for inclusion in guidelines for power mobility use within resi-

dential care facilities, J Rehab Res Dev 43(2):199–208, 2006 . Pearlman JL, Cooper RA, Karnawat J, Cooper R, Boninger ML:

Evaluation of the safety and durability of low-cost non-

programmable electric powered wheelchairs, Arch Phys Med

Rehabil 86:2361–2370, 2005 .

Pettersson I, Ahlström G, Törnquist K: Te value of an outdoor

powered wheelchair with regard to the quality of life of persons

with stroke: A follow-up study, Assist Tech 19:143–153, 2007 . Pettersson I, Törnquist K, Ahlström G: Te efect of outdoor

power wheelchair on activity and participation in users with

stroke, Dis Rehabil: Assist Tech 1:235–243, 2006. http://dx.doi

.org/10.1080/17483100600757841.

Phillips K, Fisher K, Miller Polgar J: Tinking beyond the wheel-

chair. Proc 21st Int Seat Symp, 2005, pp 97–98.

Ragnarsson KT: Prescription considerations and a comparison of

conventional and lightweight wheelchairs, J Rehabil Res Dev

Clin Suppl (2)8–16, 1990 .

Rentscher, et al.: Evaluation of select electric-powered wheelchairs

using the ANSI/RESNA standards, Arch Phys Med Rehabil

85:611–619, 2004.

Rodby-Bousquet E, Hagglund G: Use of manual and power

wheelchair in children with cerebral palsy: A cross-sectional

study, BMC Pediatr 10:59–66, 2010. http://dx.doi

.org/10.1186/1471-2431-10-59.

Robson M: 25 Choices: Manual wheelchair confguration and

new technology. In Proc 20th Can Seat Mob Conf, 2005, p 113. Rosen L, Ava J, Furumasu J, Harris M, Lange ML, McCarthy E,

et al.: RESNA Position paper on the application of power

wheelchairs for pediatric users, Assist Tech 21:218–225, 2009 .

Rosseau-Harrison K, Rochette A, Routhier F, Dessureault D,

Tibault F, Cote O: Perceived impacts of frst wheelchair on

social participation, Dis Rehabil: Assist Tech 7:37–44, 2012.

http://dx.doi.org/10.3109/17483107.2011.562957. Sawatsky BJ, Denison I, Kim WO: Rolling, rolling, rolling, Rehab

Manage, 2005. downloaded October 29, 2006. http://www

.rehabpub.com/features/892002/7.asp.

Sawatsky BJ, et al.: Prevalence of shoulder pain in adult- versus

childhood-onset wheelchair users: A pilot study, J Rehabil Res

Dev 42(3):1–8, 2005 .

Scherer M: Introduction. In Scherer MJ, editor: Assistive technology:

Matching device and consumer for successful rehabilitation, Washing-

ton, DC, 2002, American Psychological Association, pp. 3–13. Schmeler M, Bunning MJ: Manual wheelchairs: Set-up and propul-

sion biomechanics. Downloaded September 8, 2006 http://www

.wheelchairnet.org/wcn\_wcu/SlideLectures/MS/5WCBiomech

.pdf, 1999.

Simpson R: Smart wheelchairs: A literature review, J Rehab Res

Dev 42:423–435, 2005 .

Smith ME: Te applications of tilt and recline. Downloaded Octo -

ber 28, 2006. http://www.wheelchairjunkie.com/tiltandrecline

.html, 2004.

Sprigle S , Press L : Reliability of the ISO wheelchair cushion test

for loaded contour depth, Assist Tecnol 15:145–150, 2003 . Taylor S J, Kreutz D : Powered and manual wheelchair mobility. In

Angelo J , editor: Assistive technology for rehabilitation therapists,

Philadelphia, 1997, FA Davis.

United Nations: Convention on the rights of persons with dis-

abilities, New York: UN, 2006. Available from: www.un.org/

disabilities/convention/conventionfull.shtml.

Veeger HEJ, Roxendaal LA, van der Helm FCT: Load on the

shoulder in low intensity wheelchair propulsion, Clin Biomech

17:211–218, 2002.

Wang Q: Disability and American families: 2000, Washington,

2005, US Census Bureau .

Wang RH, et al.: Power mobility with collision avoidance for

older adults: User, caregiver and prescriber perspectives, J Rehab

Res Dev 50:1287–1300, 2013. http://dx.doi.org/ 10.1682/

JRRD. 2012.10.0181.

Warren CG: Powered mobility and its implications, J Rehabil Res

Dev Clin Suppl (2)74–85, 1990 .

Wilson K, Miller Polgar J: Te efects of wheelchair seat tilt on

seated pressure distribution in adults without physical disabili-

ties. In Proceedings of the 21st International Seating Symposium,

Orlando, FL, 2005, pp 115–116.

World Health Organization: International classifcation of function-

ing, disability and health, Geneva, 2001, WHO.

World Health Organization: Guidelines on the provision of manual

wheelchairs in less-resourced countries, Geneva, 2008, WHO. World Health Organization: World report on disability, Malta,

2011, WHO.

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