Wheeled Mobility (Wheelchair) Service Delivery: Scope of the Evidence
Nancy Greer, PhD; Michelle Brasure, PhD, MSPH, MLIS; and Timothy J. Wilt, MD, MPH

Identifying the appropriate wheelchair for a person who needs one has implications for both disabled persons and society. For someone with severe locomotive problems, the right wheelchair can affect mobility and quality of life. However, policymakers are concerned about the increasing demand for unnecessarily elaborate chairs. The Office of Inspector General, U.S. Department of Health and Human Services, issued 4 reports between 2009 and 2011 detailing fraud and misapplication of Medicare funds for powered wheelchairs, more than a decade after similar concerns were first raised by 4 contractors who process claims for durable medical equipment. Subsequent concerns have arisen about whether some impaired persons who need wheeled mobility devices may now be inappropriately denied coverage. A transparent, evidence-based approach to wheeled mobility service delivery (the matching of mobility-impaired persons to appropriate devices and supporting services) might lessen these concerns.

This review describes the process of wheeled mobility service delivery for long-term wheelchair users with complex rehabilitation needs and presents findings from a survey of the literature (published and gray) and interviews with key informants. Recommended steps in the delivery process were identified in textbooks, guidelines, and published literature. Delivery processes shared many commonalities; however, no research supports the recommended approaches. A search of bibliographic databases through March 2011 identified 24 studies that evaluated aspects of wheeled mobility service delivery. Most were observational, exploratory studies designed to determine consumer use of and satisfaction with the process. The evidence base for the effectiveness of approaches to wheeled mobility service delivery is insufficient, and additional research is needed to develop standards and guidelines.


For author affiliations, see end of text.

METHODS
We gathered information from various sources and interviewed knowledgeable representatives from a broad range of relevant occupations and organizations. Our key informant group included 5 providers and assessors, 2 consumers, 2 payer representatives, 1 researcher, and 1 equipment supplier representative. Key informants were identi-
Evidence on the effectiveness of recommended steps for wheeled mobility service delivery is sparse. Available research consists primarily of studies with lower-quality designs, small sample sizes, heterogeneous populations, and inconsistent definitions and measurement of interventions and outcomes. Several issues complicate wheeled mobility service delivery and may limit the ability of persons with complex rehabilitation needs to obtain the best equipment to maximize their functional abilities. A consistent, transparent, and evidence-based approach to wheeled mobility service delivery is needed.

We searched the gray literature in July 2010 for descriptions of and critical issues related to the wheeled mobility service delivery process. Search terms included wheelchair or wheeled mobility and delivery, prescription, assessment, selection, or fit. Several databases were searched, including ProQuest Digital Dissertations, REHABDATA, the National Institute on Disability and Rehabilitation Research Program Directory, and the National Rehabilitation Information Center Knowledgebase. Payment policies were obtained by searching relevant online databases and by targeted requests for information. Library catalogs were searched to identify occupational and physical therapy textbooks and other reference materials. We also reviewed references identified by key informants and peer reviewers.

We searched MEDLINE, CINAHL, and ERIC from the earliest time permitted electronically through March 2011 for primary, English-language studies that focused on wheeled mobility service delivery and its relationship with a wheeled mobility outcome (such as use of or satisfaction with the device). Appendix Table 1 (available at www.annals.org) presents our MEDLINE search strategy. We included all publication types. Studies were excluded if they did not address components of the wheeled mobility service delivery process or their relationship to wheeled mobility outcomes; addressed aspects of wheeled mobility that were not relevant to service delivery questions (such as wheeled mobility used outside of routine activities, specific aspects of seating and mobility, outdated technology, or research and development on equipment that was not widely available); or addressed the creation or validation of or research on particular outcome measurement tools. From the selected studies, we abstracted and summarized the study purpose, population, study design, sample size, elements of service delivery studied, primary outcomes assessed, and user concerns with service delivery.

Role of the Funding Source
The Minnesota Evidence-based Practice Center prepared this technical brief with funding from the AHRQ Effective Health Care Program. The center collaborated with AHRQ to develop the protocol. The AHRQ reviewed the draft report but was not involved in study selection, data extraction, or drafting of the manuscript.

RESULTS
Recommended Approaches for Wheeled Mobility Service Delivery
The wheeled mobility service delivery process has been outlined by providers, organizations that represent patients, payers, suppliers, researchers, and health care agencies. Three of the 10 delivery models identified were developed for the broader area of assistive technology and 7 were specific to wheeled mobility service delivery, with 1 focused specifically on patients with spinal cord injury. Table 1 (16–25) provides an overview of these sources.
All 10 models called for determining the person’s goals and assessing his or her physical, cognitive, and functional ability as components of the evaluation. All but 1 model included an assessment of the person’s environment (home and workplace). The models also included product selection, delivery, and fitting as key elements. Only 6 models recommended that persons be allowed to try the selected and assembled equipment before purchasing, possibly because not all equipment is available in all settings and some reimbursement systems do not cover equipment trials. In addition, equipment trials may be difficult because of the high degree of customization often required for persons with complex rehabilitation needs.

All models included the postdelivery step of training on use of the mobility device and components, for the person and, if necessary, for family members or caregivers. Seven models included follow-up by the equipment provider or supplier, and 5 included outcome assessment (such as use and user satisfaction). Our key informants corroborated this finding; little follow-up is typically done after delivery, and formal assessments of outcomes are rare.

**Table 1. Recommended Elements of Wheeled Mobility Service Delivery**

<table>
<thead>
<tr>
<th>Study, Year (Reference), by Resource Type</th>
<th>Study Topic</th>
<th>Patient Evaluation</th>
<th>Equipment Selection and Delivery</th>
<th>After Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Goals Physical, Cognitive, or Functional Ability</td>
<td>Environment</td>
<td>Product Selection</td>
</tr>
<tr>
<td>Provider and patient resources</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paralyzed Veterans of America, 1997 (16)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cooper, 1998 (17)</td>
<td>Assistive technology in general</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Schmeler and Buning, 1999 (18)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Minkel, 2002 (19)</td>
<td>Assistive technology in general</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Clinician Task Force, 2004 (20)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Cook and Polgar, 2008 (21)</td>
<td>Assistive technology in general</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Armstrong et al, 2008 (22)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Taylor and Furumasu, 2009 (23)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Batavia, 2010 (24)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Peer-reviewed resource</td>
<td>Eggers et al, 2009 (25)</td>
<td>Wheeled mobility</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

The 24 studies varied in design and included 1 randomized, controlled trial; 1 quasi-randomized, controlled trial; 1 controlled trial; 1 case–control study; 3 retrospective cohort studies; 16 cross-sectional studies; and 1 case series. Sample sizes ranged from 3 to 318 and included persons of all ages, although most studies focused on adults.

The studies enrolled many types of consumers, including persons with spinal cord injuries, multiple sclerosis, spina bifida, cerebral palsy, rheumatoid arthritis, osteoarthritis, and stroke. Overall, 14 of the studies enrolled only persons with complex medical conditions and 5 included a mix of participants, some of whom had complex needs. Of the remaining 5 studies, 2 did not specify the participant population and 3 enrolled participants with noncomplex needs. Most of the included research took place in individual practice settings in the United States, the United Kingdom, Canada, Sweden, Holland, the Netherlands, and Australia.

The studies were primarily exploratory. Two studies (27, 46) identified factors important to persons when considering wheeled mobility options. Another 2 studies (37, 45) assessed caregivers’ and parents’ opinions about the wheeled mobility used by their child. Four studies (28, 36, 38, 48) that sought to determine user satisfaction with wheeled mobility devices and service delivery focused on a particular service or regional area to describe user satisfaction and opportunities for improvement. A fifth study (47) addressed similar questions with a more comprehensive data collection strategy.
Table 2 summarizes the outcomes. Five studies (30, 32, 35, 43, 47) reported mobility outcomes, but only 1 (32) related the overall delivery process to mobility. Similarly, of the 4 studies that focused on the outcome of goal achievement (26, 38, 46, 47), only 2 (38, 46) looked at the overall delivery process. Most studies reported on satisfaction; 16 (26–31, 33–37, 42, 44, 46–48) addressed satisfaction with the equipment, and 11 (26, 28, 29, 32, 36, 39, 42, 44, 45, 47, 48) addressed satisfaction with aspects of wheeled mobility service delivery. Five studies compared 2 approaches to wheeled mobility service delivery; 2 of these (26, 43) compared in-person assessments with those done via telehabilitation, whereas the other 3 compared either different types of treatment or different approaches to assessment. One of these studies (34) compared a multifactorial team approach with usual care, in which a physical or occupational therapy assistant, physical therapist, or occupational therapist provided a standard wheelchair at discharge. A second study (35) compared the provision of a motorized scooter with usual care in adults with arthritis of the knee. The third (30) compared outcomes of patients assessed at specialized assistive technology clinics with outcomes of those who were not assessed.

One study (41) analyzed outcomes for persons who visited a seating clinic and reported particular problems with their wheelchairs. Another (10) explored reasons for abandoning equipment. Five (10, 31–33, 47) reported patient concerns with various aspects of service delivery, including wait times for appointments and equipment, patient involvement in the process, and equipment repair.

### Issues and Research Gaps

Our review of the gray literature and discussions with key informants highlighted several issues related to wheeled mobility service delivery that future research should evaluate and quantify. Many of these issues could contribute to an inappropriate match between a mobility-impaired person and the wheeled mobility device.

Payer representatives noted the increasing demand for powered mobility devices. Their concerns focused on the role of health insurers when equipment is requested for non-health-related needs; current Medicare policies that restrict coverage to the needs of persons in their homes only and not beyond; and the basing of chair qualification and type on the diagnosis a person receives, not on their functional status.

Consumer representatives were concerned that many persons lack the necessary knowledge and awareness of the wheeled mobility delivery process and available resources. They noted that third-party payer networks may limit user options by specifying providers and suppliers, applying annual caps to durable medical equipment expenses, and restricting the use of private funds to upgrade equipment.

The key informants who were involved in wheeled mobility service delivery indicated that providers must often consider not only what they believe is right for the person but also what will be reimbursed. They also noted that the medical model, in which the physician is responsible for the prescription and the letter of medical necessity, may not be most appropriate for all persons or situations. The informants recommended involving a therapist in the prescription process.

Key informants from the equipment industry noted the limitations of the Current Procedural Terminology code system. Providers may not be adequately reimbursed for user assessments, user environment assessments, equipment trials, equipment adjustments, or training recipients in equipment use.

The research gaps identified in our review and corroborated by our key informants indicate a need for additional research to provide an evidence base for wheeled mobility service delivery. Future research could include persons with different physical and cognitive limitations, funding sources, needs or goals (such as home or vocational), and support systems. Further research could also evaluate different models of specialty seating and mobility clinics; telehabilitation for persons with no access to specialty clinics; evaluations performed by professionals from different fields and by teams of professionals; and various outcomes, such as functional abilities, comfort with and use of prescribed equipment, adverse effects, and equipment breakdowns. Conducting randomized, controlled trials in this area is...
challenging because of issues related to study design, population, environments, and equipment variations (35). High-quality observational studies would add value to this field. In addition, funding agencies need to be willing to allocate resources for research in this area.

DISCUSSION

Wheeled mobility service delivery is not a new concept or technology. However, dramatic changes have occurred in recent decades, including changes to funding, provider qualifications, consumer needs and desires, and advances in technology. Providers, payers, and consumers may therefore lack the necessary knowledge and awareness to ensure that persons with complex rehabilitation needs get the most appropriate seating and mobility services and equipment. Recent evidence of inappropriate prescribing and reimbursement, including in the Medicare system, may have resulted in inappropriate limitations on a person’s ability to get medically indicated equipment. Lack of access to (or underprescription of) necessary wheeled mobility equipment poses a substantial threat to quality of life for impaired persons with mobility needs. However, overprescription or inappropriate prescription could result in wasted resources or harms to the user.

Our literature searches and discussions with key informants revealed several elements of the wheeled mobility service delivery process that probably affect the quality of the match between the person and the wheeled mobility device. First, service delivery for persons with complex rehabilitation needs is probably best facilitated by a team of providers and professionals, which should include a physician, a physical or occupational therapist, a certified rehabilitation technology supplier, and a rehabilitation technician. However, rural areas often have fewer experienced providers and suppliers, and little is known about other factors that might limit access to high-quality providers. For persons with complex rehabilitation needs, the recommended setting for service delivery is a hospital seating clinic. Second, training and consumer education are important factors in reducing accidents (49), preserving limb function (50), increasing wheelchair skills (51), and increasing use of the wheeled mobility device (52, 53). Third, involving the person in the prescription process may reduce the risk that the device will be abandoned (9, 10, 54). Finally, active follow-up has reduced accidents (55) and allowed for adjustments to improve fit (54).

Our review underscores the lack of standardization across wheeled mobility delivery processes and the lack of research evaluating delivery approaches. Seating and mobility experts generally agree on how wheeled mobility service delivery should work; however, relatively little is known about how delivery processes work in practice. Evidence of effectiveness of delivery processes is lacking, as are clear, standard, validated models of wheeled mobility delivery. Thus, health care systems may not offer specialized seating and positioning clinics with teams of providers and ongoing services, and third-party payers may not realize the need to fund the recommended steps. Not all persons who need wheeled mobility devices require every step outlined for service delivery, nor will all such persons require or benefit from highly technical, customized equipment. A consistent, transparent, and valid approach is needed to best align wheeled mobility services with consumer needs.

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Current author addresses and author contributions are available at www.annals.org.

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9. Phillips B, Zhao H. Predictors of assistive technology abandonment. Assist...


49. Nitz JC. Evidence from a cohort of able bodied adults to support the need for driver training for motorized scooters before community participation. Patient Educ Couns. 2008;70:276-80. [PMID: 18065187]


Appendix Table 1. MEDLINE Search Strategy

1 *Wheelchairs
2 wheelchair$.tw.
3 scooter$.tw.
4 “power mobility device$”.
5 “wheel chair$”.tw.
6 “wheeled mobility”.tw.
7 powerchair$.tw.
8 “power chair$”.tw.
9 (“assistive technolog$” and “mobility”).mp. [mp=abstract, heading words, title]
10 “seating clinic”.tw.
11 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12 assess$.tw.
13 evalu$.tw.
14 select$.tw.
15 prescri$.tw.
16 match$.tw.
17 “service delivery”.tw.
18 provi$.tw.
19 acquir$.tw.
20 procur$.tw.
21 fit$.tw.
22 recommend$.tw.
23 purchase$.tw.
24 refer$.tw.
25 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24
26 or 11 and 25
27 (seating and mobility).mp. [mp=abstract, heading words, title]
28 26 or 27
29 limit 28 to (english language and humans)
30 limit 29 to (addresses or biography or case reports or dictionary or directory or in vitro or legal cases or news or newspaper article or portraits)
31 29 not 30

Appendix Figure. Summary of evidence search and selection.

References identified from database searches (n = 2169)
MEDLINE: 1824
CINAHL: 303
ERIC: 42

Excluded (n = 2151)
Did not address wheeled mobility service delivery and its relationship to wheeled mobility user outcomes
Addressed aspect of wheeled mobility not relevant to guiding questions
Addressed creation, validation, or research on particular outcome measurement instruments
Duplicate listing
Background study

Articles from database searches (n = 18)

Included articles (n = 24)

Additional articles from hand searches and review bibliographies (n = 6)
<table>
<thead>
<tr>
<th>Study, Year (Reference)</th>
<th>Study Purpose</th>
<th>Population</th>
<th>Study Design</th>
<th>Sample Size, n</th>
<th>Elements of Service Delivery Studied</th>
<th>Primary Outcomes Assessed (Assessment Tool)</th>
<th>Patient Concerns With Service Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barlow et al, 2009 (26)</td>
<td>To compare the effectiveness, client satisfaction, cost, and timeliness of wheelchair seating and positioning interventions provided through telerehabilitation and face-to-face</td>
<td>Cases included clients assessed by telerehabilitation by the GlenRose Seating Service (Edmonton, Alberta, Canada); 2 comparison groups (1 urban and 1 rural) were assessed face-to-face; comparisons were matched by age, diagnosis, and type of seating components received</td>
<td>Case-control</td>
<td>30 (10 per group)</td>
<td>Setting (telerehabilitation vs. face-to-face), travel costs, service provision time, wait times, and completion times</td>
<td>Satisfaction (QUEST 2.0) and achievement of seating intervention goals</td>
<td>Not reported</td>
</tr>
<tr>
<td>Batavia and Hammer, 1990 (27)</td>
<td>To identify and prioritize the factors that long-term AT users use to assess their devices</td>
<td>A panel of consumer experts with mobility impairments</td>
<td>Cross-sectional, qualitative</td>
<td>6</td>
<td>Identification of AT factors important to consumers</td>
<td>Consumer-defined satisfaction</td>
<td>Not reported</td>
</tr>
<tr>
<td>Beaumont-White and Ham, 1997 (28)</td>
<td>To identify problems with and possible areas for improvements to the practice of wheelchair issuance at a London wheelchair service</td>
<td>Experienced wheelchair users who used a London wheelchair service</td>
<td>Cross-sectional</td>
<td>27</td>
<td>Issue detail, therapy input before supply, general maintenance, written information offered and issued, use of the approved repairer service, wheelchair service support, additional needs unmet by the wheelchair service, and ideas for improvement</td>
<td>Current level of use and problems with wheelchair issuance</td>
<td>Not reported</td>
</tr>
<tr>
<td>Bergström and Samuelsson, 2006 (29)</td>
<td>To investigate how adults with SCI assess their satisfaction regarding several aspects of their manual wheelchair</td>
<td>Persons with SCI who used manual wheelchairs</td>
<td>Cross-sectional</td>
<td>124</td>
<td>Service delivery, repair service, professional service, and follow-up</td>
<td>User satisfaction with various aspects of the wheelchair and service (QUEST 2.0)</td>
<td>Not reported</td>
</tr>
<tr>
<td>Dicianno et al, 2009 (30)</td>
<td>To evaluate the association between the use of mobility devices and socialization</td>
<td>Adults with SB who attended a University of Pittsburgh-based clinic</td>
<td>Retrospective cohort</td>
<td>208</td>
<td>Setting (attainment of wheelchair at specialized AT clinic or not)</td>
<td>Physical and cognitive independence, mobility, social integration, economic self-sufficiency, occupation (CHA-RT-SF); depression, satisfaction with wheelchair, and wheelchair repair</td>
<td>Not reported</td>
</tr>
<tr>
<td>Evans et al, 2007 (31)</td>
<td>To qualitatively examine the satisfaction of older EPIOC users with their chair and service providers</td>
<td>Older adult EPIOC users with severe mobility disabilities, recruited through a specialist wheelchair service database</td>
<td>Cross-sectional, qualitative</td>
<td>15</td>
<td>Provision of safety training, waiting times for assessment and delivery, and repair services</td>
<td>Frequency and quality of chair activity, safety of and satisfaction with EPIOC-related services provided, and feelings of insecurity in the chair</td>
<td>Wait times for appointment and chain and disease progression while waiting for wheelchair delivery, adjustments, and repairs</td>
</tr>
<tr>
<td>Evans et al, 2007 (32)</td>
<td>To qualitatively examine the satisfaction of young EPIOC users with their chair and service providers</td>
<td>Young EPIOC users recruited through a specialist wheelchair service database</td>
<td>Cross-sectional, qualitative</td>
<td>18</td>
<td>Provision of safety training, waiting times for assessment and delivery, and repair services</td>
<td>Ability to function with the EPIOC, safety of the EPIOC, pain or discomfort, and satisfaction with service and support (EQ-5D)</td>
<td>Wait times for initial assessment and delivery and patient involvement in choice of product</td>
</tr>
</tbody>
</table>

Continued on following page
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Purpose</th>
<th>Population</th>
<th>Study Design</th>
<th>Sample Size, n</th>
<th>Elements of Service Delivery Studied</th>
<th>Primary Outcomes Assessed (Assessment Tool)</th>
<th>Patient Concerns With Service Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garber et al, 2002 (33)</td>
<td>To determine the extent to which wheelchairs prescribed during rehabilitation after a cerebrovascular incident are used and perceived as satisfactorily meeting individual mobility, functional, psychological, and social needs of veterans who have had a stroke</td>
<td>Veterans who were on the patient roster of the rehabilitation service at the Houston Veterans Affairs Medical Center; discharged with a primary diagnosis of stroke between 1989 and 1999; being followed for medical, mobility, or functional problems or stroke recurrence; living in the Houston metropolitan area; alive; not currently hospitalized; and provided wheelchair on discharge</td>
<td>Cross-sectional, qualitative</td>
<td>49</td>
<td>Receipt of written information about wheelchair, verbal instructions about use or maintenance of the wheelchair, contact information in case of problems with wheelchair, and verbal safety information</td>
<td>Use of and satisfaction with wheelchair</td>
<td>Wait time for equipment and equipment prescribed</td>
</tr>
<tr>
<td>Hoenig et al, 2005 (34)</td>
<td>To determine the effect of different methods of dispensing wheelchairs</td>
<td>Community-dwelling, cognitively intact patients prescribed a standard manual wheelchair</td>
<td>Quasi-randomized trial</td>
<td>84</td>
<td>Multifactorial intervention that consisted of a scripted evaluation by an expert physical or occupational therapist, which included a medical record review and self-reported and physical performance measures; individualization of the wheelchair and initiation of or orders for additional occupational or physical therapy, equipment, or home modifications as needed; multimodal patient education; and telephone follow-up at 3 and 6 wk vs. usual care</td>
<td>Amount of wheelchair use, with secondary outcomes of shoulder pain, wheelchair comfort or confidence, and home modifications</td>
<td>Not reported</td>
</tr>
<tr>
<td>Hoenig et al, 2007 (35)</td>
<td>To investigate the effects of providing a motorized scooter on physical performance and mobility</td>
<td>Ambulatory community-dwelling adults with no cardiac disease and stable rheumatic disease Mean age: 63 y White: 60% Men: 79% Included conditions: RA or osteoarthritis of the knee</td>
<td>Randomized, controlled trial</td>
<td>43</td>
<td>Provision of motorized scooter and lift vs. usual care</td>
<td>6-min walk distance, mobility, scooter accidents, and satisfaction</td>
<td>Not reported</td>
</tr>
<tr>
<td>Karmarkar et al, 2009 (36)</td>
<td>To describe the opinions of older adults about their satisfaction with wheelchair and service delivery</td>
<td>Convenience sample of 132 persons participating in the National Veterans Wheelchair Games in Omaha, Nebraska; participants were community-dwelling or from Veterans Affairs-affiliated nursing homes or private nursing homes</td>
<td>Cross-sectional</td>
<td>132</td>
<td>Service delivery, repair service, professional service, and follow-up</td>
<td>User satisfaction with various aspects of the wheelchair and service (QUEST 2.0)</td>
<td>Not reported</td>
</tr>
<tr>
<td>Kittel et al, 2002 (10)</td>
<td>To identify factors that influence persons with SCI to abandon their first wheelchair before 5 y of use</td>
<td>Persons who abandoned their first manual wheelchair before 5 y of use Ages: 26, 33, and 37 y Included conditions: SCI</td>
<td>Case series, qualitative</td>
<td>3</td>
<td>Reflections on wheelchair prescription experience</td>
<td>Abandonment</td>
<td>Patient knowledge of and involvement in process</td>
</tr>
</tbody>
</table>

Continued on following page
<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Purpose</th>
<th>Population</th>
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<th>Sample Size, n</th>
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<th>Patient Concerns With Service Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>McDonald et al, 2007 (37)</td>
<td>To investigate and compare the opinions of parents and therapists of children who use adaptive seating systems</td>
<td>Parents and local therapists matched and assessed regarding child ages not reported. Included conditions: severe CP</td>
<td>Cross-sectional, qualitative</td>
<td>30 matched parent-therapist pairs</td>
<td>Level of agreement between parent-therapist pairs about the child’s seating and mobility needs, abilities, and preferences</td>
<td>Use, comfort, and satisfaction</td>
<td>Not reported</td>
</tr>
<tr>
<td>Pimentel et al, 2008 (38)</td>
<td>To explore assessment practices for clients who require standard wheelchairs from 1 wheelchair service in the United Kingdom</td>
<td>Persons assessed for wheelchair during 4-mo period once new assessment practices were put in place. Mean age: 73 y. Age range: 12–102 y. Included conditions not reported</td>
<td>Cross-sectional, qualitative</td>
<td>35</td>
<td>Evaluation of new assessment practices that focused on soliciting goals from clients and using these as a framework for the prescription process</td>
<td>Achievement of goals</td>
<td>Not reported</td>
</tr>
<tr>
<td>Post et al, 1997 (39)</td>
<td>To examine the satisfaction of persons who have SCI with available services and service delivery procedures</td>
<td>Adults previously rehabilitated in a specialized center between 1986 and 1992 and currently living in the community. Mean age: 39.4 y. Included conditions: SCI</td>
<td>Cross-sectional, qualitative</td>
<td>318</td>
<td>Availability of services</td>
<td>Functional health status, life satisfaction, satisfaction with available services, and satisfaction with service delivery procedures</td>
<td>Not reported</td>
</tr>
<tr>
<td>Richardson and Frank, 2009 (40)</td>
<td>To identify areas of difficulty encountered by a regional wheelchair service in providing EPOCs to those with MD during the early years of their provision</td>
<td>EPOC users seen between April 1997 and March 2000 according to the departmental database of the EPOC clinic in Stanmore, United Kingdom. Mean age: 25 y. Included conditions: MD</td>
<td>Retrospective cohort</td>
<td>29</td>
<td>Medical chart documentation of outcomes at initial assessment, in the first 12 mo, and between 13 and 24 mo after the delivery of the chair</td>
<td>Weakness, pain or discomfort, deformities, or other medical issues; weight change; functional issues; posture; wheelchair driving skills; and other issues</td>
<td>Not reported</td>
</tr>
<tr>
<td>Samuelsson et al, 2001 (41)</td>
<td>To analyze whether an intervention to address wheelchair problems improved effectiveness from a consumer perspective</td>
<td>Active wheelchair users who consecutively visited the wheelchair department at the University Hospital in Linköping, Sweden, because of problems with seating. Mean age: 43 y. Included conditions: SCI, MS, stroke, CP, SB, and mental disability</td>
<td>Retrospective cohort</td>
<td>38</td>
<td>Visits to wheelchair seating department for problems with wheelchair</td>
<td>Wheelchair functionality, seating comfort, pain, occupational performance, and pressure distribution</td>
<td>Not reported</td>
</tr>
<tr>
<td>Samuelsson and Wressle, 2008 (42)</td>
<td>To compare and evaluate user satisfaction with and use of 2 types of mobility devices</td>
<td>Random sample of mobility assistive device users (rollators and manual wheelchairs) in Sweden. Mean age: 69.8 y. Included conditions not reported</td>
<td>Cross-sectional</td>
<td>262 (175 rollator and 87 wheelchair users)</td>
<td>Device type prescribed (rollator or manual wheelchair), service delivery, repairs and services, professional service, and follow-up</td>
<td>Use and satisfaction with device and services (QUEST 2.0)</td>
<td>Not reported</td>
</tr>
<tr>
<td>Schein et al, 2010 (43)</td>
<td>To evaluate the equivalence of wheeled mobility and seating assessments delivered in-person vs. those delivered by telerhabilitation</td>
<td>Adults who needed new wheeled mobility devices in western Pennsylvania. Mean age, 50.3 y (in-person) vs. 54.9 y (telerhabilitation). Included conditions: Progressive medical conditions; SCI; and orthopedic, cardiovascular, or CNS conditions</td>
<td>Controlled trial</td>
<td>98</td>
<td>Setting (in-person vs. telerhabilitation)</td>
<td>Functioning (FEW)</td>
<td>Not reported</td>
</tr>
<tr>
<td>Suzuki and Lockette, 2000 (44)</td>
<td>To explore client satisfaction and identify program areas needing improvement at the Rehabilitation Hospital of the Pacific’s Wheelchair Seating Clinic in Honolulu, Hawaii</td>
<td>Adults who received service from the formal seating clinic and had completed their initial interview and received their equipment by April 1999. Age and included conditions not reported</td>
<td>Cross-sectional</td>
<td>26</td>
<td>Assessment process and follow-up</td>
<td>Satisfaction</td>
<td>Not reported</td>
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</table>
### Appendix Table 2—Continued

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study Purpose</th>
<th>Population</th>
<th>Study Design</th>
<th>Sample Size, n</th>
<th>Elements of Service Delivery Studied</th>
<th>Primary Outcomes Assessed (Assessment Tool)</th>
<th>Patient Concerns With Service Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Telfer et al., 2010 (45)</td>
<td>To investigate the views of teaching staff members at special-needs schools and of the parents of children who attended these schools about the provision and current technology of seating systems</td>
<td>Teaching staff and parents of children in special-needs schools in central Scotland; teachers had worked with the children for ≥6 mo and parents had children who had used a piece of adaptive seating equipment for ≥6 mo; parents were encouraged to discuss the survey with their child</td>
<td>Cross-sectional, qualitative</td>
<td>33 teaching staff and 17 parents</td>
<td>Importance of different functions of seating system, satisfaction with speed at which new or replacement models were issued, and descriptions of completed repairs or adjustments</td>
<td>Time spent transferring child between, to, and from seating systems on an average day, satisfaction with how seating system accommodated growth, and other additional comments from participants</td>
<td>Not reported</td>
</tr>
<tr>
<td>Ward et al., 2010 (46)</td>
<td>To determine the most frequently selected features in a PWC, level of satisfaction with the selections, and how often the PWC features are used by patients with ALS or MND</td>
<td>Convenience sample of current patients at an ALS/Muscular Dystrophy Association center in Charlotte, North Carolina</td>
<td>Cross-sectional</td>
<td>32</td>
<td>Patterns of wheelchair selection and other aspects of decision-making processes that patients experienced before, during, and after acquiring a PWC</td>
<td>Initial and current satisfaction with and use of chair and specific features</td>
<td>Not reported</td>
</tr>
<tr>
<td>White and Lemmer, 1998 (47)</td>
<td>To identify and explore the key factors required for effectiveness in a wheelchair service</td>
<td>Investigators used a 4-stage data collection method to get information from wheelchair service providers, manual wheelchair users, PWC users, and specialty seating evaluations in England</td>
<td>Cross-sectional, qualitative</td>
<td>125 wheelchair therapists, 84 manual chair users, 27 PWC users, and 19 special seating users</td>
<td>Wheelchair therapists: referral procedures, assessment approaches, qualifications, and training needs Wheelchair users: assessment approach</td>
<td>Use, delivery times, knowledge of wheelchair service and repairs, satisfaction with service, level of need fulfillment, and chair preferences</td>
<td>Accuracy of information on referral form, training of wheelchair therapists, adequacy of assessment, and service delays</td>
</tr>
<tr>
<td>Wressle and Samuelsson, 2004 (48)</td>
<td>To follow up on user satisfaction with and use of manual wheelchairs</td>
<td>Adult users of mobility devices in Sweden</td>
<td>Cross-sectional</td>
<td>209</td>
<td>Service delivery, repair service, professional service, and follow-up</td>
<td>User satisfaction with various aspects of the wheelchair and service (QUEST 2.0)</td>
<td>Not reported</td>
</tr>
</tbody>
</table>

ALS = amyotrophic lateral sclerosis; AT = assistive technology; CHART-SF = Craig Handicap Assessment Reporting Technique-Short Form; CNS = central nervous system; CP = cerebral palsy; EPIOC = electric-powered indoor/outdoor wheelchair; EQ-5D = EuroQoL-5D; FEW = Functioning Everyday With a Wheelchair; MD = muscular dystrophy; MND = motor neuron disease; MS = multiple sclerosis; PWC = powered wheelchair; QUEST = Quebec User Evaluation Satisfaction With Assistive Technology; RA = rheumatoid arthritis; SB = spina bifida; SCI = spinal cord injury.