Understanding the Provision of Assistive Mobility and Daily Living Devices and Service Delivery to Veterans After Stroke

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MeSH TERMS

- health services research
- mobility limitation
- self-help devices
- stroke
- utilization review

OBJECTIVE. The objective of this study was to determine whether facility-level, structural factors affect the provision of assistive devices and services.

DESIGN. A retrospective design was used. Activities of daily living and mobility-related devices were categorized into 11 types. Logistic regression models were performed for each type of device, controlling for patient-level and facility-level covariates.

RESULTS. Non-veteran-level factors significantly affect the provision of assistive devices, even after covariate adjustment. Increased rehabilitation clinician staffing by 1 full-time equivalent position was associated with increased provision odds of 1%–5% for 5 of 11 types of devices. Lower facility complexity was significantly associated with increased provision odds of 35%–59% for 3 types of devices and with decreased provision odds of 16%–69% for 3 types of devices.

CONCLUSION. System-level factors, in addition to patient need, significantly affect the provision of assistive devices. Provision guidelines could assist clinicians in making decisions about device provision.

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Loss of the ability to walk and drive has been described as an “inconvenient truth of aging” (Gill, Gahbauer, Murphy, Han, & Allore, 2012). Loss of ambulation increases disability, morbidity, health care use and costs, institutionalization, and death risk (Corti, Guralnik, Salive, & Sorkin, 1994; Fried & Guralnik, 1997; Gill et al., 2012; Hardy, Kang, Studenski, & Degenholtz, 2011; Iezzoni, 2003; Newman et al., 2006). More than 50% of people age 70 yr and older lose the ability to walk and drive within 10 yr (Gill et al., 2012), and more than 30% have difficulty with bathing (Gill, Han, & Allore, 2007; Naik, Concato, & Gill, 2004).

Even though bathing disability is a strong predictor of long-term nursing home admission (Gill, Allore, & Han, 2006), assistive devices are used by only 50% of people with bathing disability (Naik & Gill, 2005). Assistive technology is used to increase independence and decrease burden of care; however, an equitable system for providing assistive devices is lacking (Greer, Brasure, & Wilt, 2012). An equitable system for providing assistive devices would address the needs of people with a given disability, provide prescribing clinicians with a structure that facilitates identification of appropriate technology, and could be supported by policymakers determining reimbursement criteria. This much-needed system would have important implications for both individuals and society (Greer et al., 2012).

Ideally, assistive devices should be provided on the basis of patient need. However, their provision, as well as health care in general, varies regionally (Ashton et al., 1999; Wennberg & Gittelsohn, 1973). The purpose of this study was to try

to understand the variation in assistive device provision that was not attributed to patient need by using Donabedian's (1980) Structure–Process–Outcome Model. More specifically, for a given assistive device type, this study investigated the relationship between a veteran poststroke receiving at least one device and facility factors: complexity of the Veterans Health Administration (VHA) facility type, Commission on Accreditation of Rehabilitation Facilities (CARF) accreditation, and rehabilitation clinician staffing levels.

Method

This study was approved by the University of Florida and the Miami Veterans Affairs Healthcare System institutional review boards as well as the North Florida/South Georgia Veterans Health System and the Miami Veterans Affairs Human Subjects and Research and Development Committees. A data use and data transfer agreement was approved by the U.S. Department of Veterans Affairs (VA) Office of Patient Care Services.

Participants and Data

Using a population-based, retrospective design, we identified all veterans who received acute care for a stroke from a VA facility during fiscal year (FY) 2007–2008 from two VA administrative databases—the Functional Status Outcomes Database and the VA Medical SAS datasets (Murphy, Cowper, Seppala, Stroupe, & Hynes, 2002; Reker et al., 2005)—by using algorithms developed by Reker, Hamilton, Duncan, Yeh, and Rosen (2001), yielding 13,041 unique veterans. Once the veteran population was identified, we created a dataset with both veteran- and facility-level data with one observation for each unique veteran (Hubbard Winkler et al., 2012). In addition, the VHA Administrative and Data Management Office provided veteran-level FY2007–2009 National Prosthetics Patient Database (NPPD; Downs, 2000) data for veterans who had received treatment for a stroke at a VA facility during FY2007–2008. Veteran-level demographic and clinical data were acquired from the VA Medical SAS datasets and the Functional Status Outcomes Database, and assistive device provision data were acquired from the NPPD.

There were 57,914 assistive devices provided to the 13,041 unique veterans in FY2007–2009. To ensure the study included devices for veterans whose stroke was toward the end of FY2008, we factored in assistive devices provided in FY2009. Eleven assistive device types were categorized as follows: (1) standard manual wheelchair,

(2) rehabilitation (lightweight) manual wheelchair, (3) power wheelchair, (4) scooter, (5) ankle foot orthotic/knee foot orthotic (AFO/KFO), (6) walker, (7) cane, (8) patient lift, (9) bed, (10) toilet device, and (11) bathing device.

CARF (<http://www.carf.org/About/WhoWeAre/>) is an independent, nonprofit accreditor of health and human services in many areas, including aging services and rehabilitation and durable medical equipment, prosthetics, orthotics, and supplies. The VHA Physical and Medicine and Rehabilitation Service (recently reorganized and named the Rehabilitation and Prosthetics Service; <http://www.prosthetics.va.gov/factsheet/PMRS-FactSheet.pdf>) provided us with a list of CARF-accredited VHA facilities. We created a CARF variable in the dataset to indicate whether CARF accreditation affected assistive device provision.

Another facility variable of interest is facility complexity. Facility complexity data were acquired from the VA Allocation Resource Center Unit Cost Reports. Facility complexity levels were assessed by the VHA Automated Records Center to account for the variation in cases treated at VA Medical Centers (Rugs et al., 2013). Seven facility factors were considered in determining complexity level: (1) volume and patient case mix, (2) clinical services provided, (3) patient risk calculated from VA patient diagnosis, (4) total resident slots, (5) index of multiple residency programs at a single facility, (6) total amount of research dollars, and (7) number of specialized clinical services. The following facility complexity levels were used:

- Level 1 (high complexity/high patient risk): High levels of teaching, research, or both; high volume and patient risk; largest number and breadth of physician specialists; Level 3 and 4 intensive care units
- Level 2 (medium complexity): Medium levels of teaching, research, or both; medium patient risk; Level 4 intensive care units
- Level 3 (low complexity): Little or no teaching or research; low levels of patient complexity; lowest number of physician specialists per prorated person; Level 1 and 2 intensive care units.

In addition, facility-level staffing data used in this study include the total rehabilitation full-time equivalent (FTE) positions per providing facility (for occupational therapy, physical therapy, and kinesiotherapy) averaged over FY2007–2008. These data were acquired from VHA online ProClarity data cubes managed by the VHA Service Support Center.

For each veteran, one observation was made for each of the following variables: demographic data (age, gender,

Table 1. Cohort Demographic and Clinical Characteristics (N = 13,041)

Demographic and Clinical Characteristics	Assistive Devices Provided, <i>n</i> (%) or <i>M</i> (<i>SD</i>)			
	Total Cohort	None, <i>n</i> = 4,659 (36)	One, <i>n</i> = 1,646 (13)	More Than One, <i>n</i> = 6,736 (52)
Age at index stroke, yr	67.9 (11.8)	67.3 (11.8)	67.5 (11.9)	68.4 (11.8)
Race/ethnicity ^a				
White	8,017 (61)	2,862 (61)	1,038 (63)	4,117 (61)
Black	3,037 (23)	989 (21)	406 (25)	1,642 (24)
Hispanic	732 (6)	171 (4)	46 (3)	515 (8)
Other	1,248 (10)	633 (14)	155 (9)	460 (7)
Marital status				
Married	5,742 (44)	1,971 (42)	674 (41)	3,097 (46)
Not married	7,299 (56)	2,688 (58)	972 (59)	3,639 (54)
Comorbid conditions	5.9 (2.8)	4.9 (2.5)	5.8 (2.6)	6.6 (2.8)
Recurrent strokes	0.1 (0.3)	0.1 (0.2)	0.1 (0.3)	0.1 (0.4)
Distance to facility, mi	32.0 (35.9)	32.9 (36.5)	30.5 (33.8)	31.8 (36.0)
Severity of disability				
Total Motor FIM score	50.6 (26.4)	56.5 (29.7)	55.2 (26.8)	46.3 (23.5)
Total Cognitive FIM score	25.1 (10.2)	24.9 (11.4)	26.2 (10.1)	25.0 (9.5)

Note. *M* = mean; *SD* = standard deviation. FIM missingness rate = 27%.

^aData on race/ethnicity were missing for 7 veterans.

race or ethnicity, marital status, distance from the veteran's home to the nearest VA rehabilitation facility), clinical data (severity of disability, number of comorbid conditions, recurrent strokes), devices provided (yes or no for each of the 11 types), facility CARF accreditation status (yes or no), facility complexity level, and total rehabilitation FTE positions per facility. The demographic and clinical characteristics for the full cohort are provided in Table 1, and these variables are described in more detail in the next section. In cases in which no devices from this study's categories were provided (36%), the discharge facility was used as the facility of record. In addition, because only 7% of the veteran cohort was provided with devices from more than one facility, which are insufficient data to be analyzed separately, these veterans were excluded from this facility-based analysis. Therefore, the study included 12,094 unique veterans in the analysis.

Analysis

The primary aim of this study is to determine the relationship between the probability that a veteran post-stroke is provided a specific type of assistive device and VHA facility complexity, CARF accreditation, and FTE rehabilitation staffing. Therefore, primary predictors were included as factors using separate multivariate logistic regression models, with the outcomes being provision of specific assistive device types. The study protocol called for separate analyses for each primary factor and outcome device to explore the predictors and covariates individually for each device type. The five primary structure predictor variables were at the facility level: (1) facility complexity (Level 1 is most complex and Level 3 least

complex); (2) CARF accreditation (yes or no); and total FTE rehabilitation staff positions per facility for (3) occupational therapy (OT FTE), (4) physical therapy (PT FTE), and (5) physical therapy and kinesiotherapy (PT+KT FTE). Because of the small sample size for kinesiotherapy, it was not examined separately.

The 11 outcome variables were the provision of each of the assistive devices described previously. The adjustment covariates were age, race or ethnicity, marital status, distance from veteran's home zip code to nearest VA rehabilitation facility, severity of disability measured by the FIMTM (Uniform Data System for Medical Rehabilitation, 1997) Cognitive and Motor scores at admission (higher scores indicate greater function), number of comorbid conditions (Elixhauser, Steiner, Harris, & Coffey, 1998), recurrent strokes, and facility budget restraints. The FIM admission score (rather than FIM discharge score) was used to measure disability severity because it provided a more complete assessment (e.g., no missing values) than measurement at discharge. In addition, because of the structure of the NPPD database, there is no meaningful relationship between FIM scores at discharge and when the device was prescribed to the veteran. Budget restraint was a continuous factor measuring the extent to which facility funds were used to fund assistive devices. In the VA system, the Prosthetics and Sensory Aids Service provides each facility with a separate budget for assistive devices. Only if this separate budget is exhausted will facility dollars be used to fund the provision of devices. This variable is defined as $(A - B)/A$, in which *A* is the total money budgeted and *B* is the total money spent on assistive devices. Negative

values reflect facility money being used to pay for assistive devices.

Fifty-five modeling scenarios were examined: one multivariate logistic regression analysis for each of the 11 outcome variables (11 types of devices) times each of the five primary predictor variables: facility complexity, CARF accreditation, OT FTE, PT FTE, and PT+KT FTE. For each device type, the models yielded adjusted odds ratio estimates for the predictors of interest. For CARF accreditation, the odds ratio is a comparison of the odds of a veteran receiving 1 or more of a device type between a CARF-accredited facility and an unaccredited facility, with adjustment for the control covariates. In the case of FTE positions, the odds ratio measures the odds of device provision associated with an increase of 1 FTE position. The main quantitative objective was estimation of facility-level effects and confidence intervals on the adjusted odds of device provision for each of the device types. Factors are significant for p values less than .05 without consideration of the multiple models used.

Results

As seen in Table 1, 36% of the cohort received no assistive devices, 13% received one assistive device type, and 52% received more than one assistive device type. Veterans who received more than one assistive device type tended to be older and had more comorbid conditions. In addition, a higher proportion of these veterans were Hispanic, were married, and had poorer physical functioning. Approximately 27% of the cohort did not have FIM scores and were excluded from the multivariate model analyses. Of the 11 categories of assistive devices examined, (1) 15% of veterans received standard manual wheelchairs; (2) 11%, rehabilitation (lightweight) manual wheelchairs; (3) 3%, power wheelchairs; (4) 2%, scooters; (5) 7%, AFO/KFOs; (6) 29%, walkers; (7) 21%, canes; (8) 3%, patient lifts; (9) 7%, beds; (10) 21%, toileting devices; and (11) 29%, bathing devices (Table 2).

Facility Complexity

Facility complexity overall was a significant predictor for 5 of the 11 categories of devices after controlling for the covariates. Veterans had 59% higher odds of receiving a power wheelchair from Level 2 than from Level 1 facilities; 16% lower odds of receiving a toileting device from Level 2 than from Level 1 facilities; 55% higher odds of receiving a cane from Level 3 than from Level 1 facilities; and 69%, 46%, and 31% lower odds of receiving a scooter, toileting, and bathing device, respectively, from Level 3 than from Level 1 facilities. Significance for facility complexity was

not found for manual wheelchairs, walkers, patient lifts, or beds (see Table 2).

CARF Accreditation

CARF accreditation was a significant predictor for 3 of the 11 categories of devices after controlling for the covariates. Veterans had 19% higher odds of receiving a standard manual wheelchair, 22% higher odds of receiving a walker, and 14% lower odds of receiving a cane from facilities with CARF accreditation than from those without CARF accreditation.

Staffing

Veterans had higher odds of receiving a manual wheelchair (standard or rehabilitation), walker, bed, toileting device, or bathing device from facilities with higher rehabilitation staffing after controlling for the covariates. The increased odds for an increase of 1 FTE position were generally 1%–3% and occasionally 3%–5% for occupational therapists, who tend to work more with activities of daily living (ADL) devices than physical therapists and kinesiotherapists.

Covariates

Overall, older veterans were more likely to receive standard manual wheelchairs, walkers, beds, and toileting devices; younger veterans were more likely to receive rehabilitation (lightweight) manual and power wheelchairs, canes, and bathing devices. Age was not significantly associated with provision of scooters. Compared with White veterans, Black and Hispanic veterans were more likely to receive standard manual wheelchairs, canes, patient lifts, beds, and toileting devices and less likely to receive rehabilitation (lightweight) manual wheelchairs. Veterans who were married were more likely to receive walkers, patient lifts, beds, and toileting and bathing devices.

The number of comorbid conditions was significantly associated with provision of all categories of devices. Veterans with lower physical function were more likely to receive all categories of devices; veterans with higher cognitive function were more likely to receive all categories of devices except beds. Recurrent strokes were significantly associated with provision of all categories of devices except power mobility (power wheelchairs and scooters) and beds. Veterans who lived farther from a specialized VA rehabilitation unit were more likely to receive wheelchairs, toileting and bathing devices, walkers, and beds, whereas veterans living closer to these facilities tended to be more likely to receive more AFO/KFO devices. Veterans at facilities that stayed within their allocated prosthetics budget had slightly greater odds of being provided bathing devices than those at facilities that exceeded their

Table 2. Adjusted Odds Ratios for Receiving a Specific Device (*N* = 8,513)

Assistive Device Type	Device User, <i>n</i> (%)	Overall χ^2	Facility Complexity ^a			OR [95% CI]				
			Level 2	Level 3	CARF Accreditation ^b	FTE Staffing ^c				PT + KT
						OT	PT			
Standard manual wheelchair	1,238 (15)	0.33	1.05 [0.87, 1.27]	0.98 [0.73, 1.31]	1.19* [1.02, 1.40]	1.02*** [1.01, 1.04]	1.02*** [1.01, 1.03]	1.01 [1.00, 1.01]		
Rehabilitation manual wheelchair	911 (11)	5.98	1.18 [0.96, 1.44]	0.79 [0.58, 1.09]	1.07 [0.89, 1.27]	1.04*** [1.02, 1.05]	1.02*** [1.01, 1.03]	1.02*** [1.01, 1.02]		
Power wheelchair	240 (3)	6.68*	1.59* [1.12, 2.25]	1.14 [0.64, 2.02]	1.29 [0.94, 1.79]	1.01 [0.98, 1.04]	1.01 [0.99, 1.03]	1.01 [1.00, 1.03]		
Scooter	168 (2)	5.06	0.99 [0.65, 1.51]	0.31*	1.04 [0.71, 1.53]	1.01 [0.98, 1.05]	1.01 [0.99, 1.04]	1.01 [0.99, 1.03]		
AFO/KFO	638 (7)	6.31*	1.35* [1.05, 1.72]	0.94 [0.64, 1.39]	1.08 [0.88, 1.33]	1.02 [1.00, 1.03]	1.01 [0.99, 1.02]	1.00 [0.99, 1.01]		
Walker	2,437 (29)	2.58	1.06 [0.92, 1.22]	0.87 [0.70, 1.09]	1.22** [1.08, 1.38]	1.02** [1.01, 1.03]	1.02*** [1.01, 1.03]	1.01*** [1.01, 1.02]		
Cane	1,749 (21)	13.63**	1.15 [0.98, 1.36]	1.55*** [1.22, 1.96]	0.86* [0.75, 0.98]	1.01 [0.99, 1.02]	1.01 [1.00, 1.02]	1.00 [0.99, 1.00]		
Patient lift	216 (3)	2.66	1.40 [0.93, 2.09]	1.09 [0.57, 2.07]	0.91 [0.64, 1.31]	1.02 [0.99, 1.05]	1.01 [0.99, 1.03]	1.00 [0.99, 1.02]		
Bed	576 (7)	2.54	1.02 [0.77, 1.34]	1.35 [0.93, 1.97]	1.07 [0.85, 1.34]	1.05*** [1.03, 1.07]	1.03*** [1.02, 1.05]	1.02*** [1.01, 1.03]		
Toileting device	1,825 (21)	20.34***	0.84* [0.71, 0.99]	0.54*** [0.40, 0.71]	1.03 [0.90, 1.18]	1.04*** [1.03, 1.05]	1.02*** [1.01, 1.03]	1.01** [1.00, 1.02]		
Bathing device	2,489 (29)	10.22**	1.02 [0.88, 1.18]	0.69** [0.54, 0.88]	1.02 [0.90, 1.15]	1.03*** [1.02, 1.04]	1.02*** [1.01, 1.03]	1.01 [1.00, 1.01]		

Note. All models adjusted for the following covariates: age, race/ethnicity, marital status, comorbidities, recurrent strokes, distance to rehab facility, facility budget restraints, and severity of disability (motor and cognitive). AFO/KFO = ankle foot orthotic/knee foot orthotic; CARF = Commission on Accreditation of Rehabilitation Facilities; CI = confidence interval; FTE = full-time equivalent; KT = kinesiotherapy; OR = odds ratio; OT = occupational therapy; PT = physical therapy.

^aLevel 1 is reference group for OR; OR compares difference in odds of device type provision between Level 1 and Levels 2 and 3; χ^2 distribution has 2 degrees of freedom and tests for difference in OR among the three levels. ^bOR compares accredited and unaccredited facilities. ^cOR compares the odds for 1 additional FTE position.

* $p < .05$. ** $p < .01$. *** $p < .001$.

prosthetics budget. Because of the large amount of data, covariate results are not discussed here but are available upon request.

Discussion

Rehabilitation clinicians receive specialized training in the selection of assistive devices at both the preservice and the postservice levels. An earlier study performed by part of this research team (Hubbard et al., 2006) found significant racial and ethnic disparity in the provision of wheelchairs to veterans in the VHA when considering only patient-level factors. The study found that White patients were more likely to receive power wheelchairs, whereas minorities were more likely to receive manual wheelchairs. A successive study additionally examined severity of disability and geographic location in relation to racial and ethnic disparity (Hubbard Winkler et al., 2010). The results showed that when geographic location was included as a predictor, racial and ethnic disparity became nonsignificant.

The purpose of our study was to investigate system-level factors that could help explain variation in assistive device provision while controlling for veteran-level factors. It is important that clinicians consider facility and individual biases in addition to client-level needs when recommending mobility-related and ADL devices. We hope that this study facilitates the future establishment of clear device provision guidelines to assist clinicians in making device provision decisions.

Facility Complexity

Facility complexity was a significant system-level predictor for nearly half of the device categories. Consistent with the expectation of specialized rehabilitation care, odds were higher for receiving scooters and bathing and toileting devices from a high-complexity facility. Although the specific reasons for this finding are not known, a contributing factor could be related to the higher number of occupational therapy practitioners in high-complexity facilities. Not intuitive was the more than 50% higher odds of receiving a power wheelchair at a medium-complexity facility than at a high-complexity facility. We would expect the high-complexity facilities to serve people with more severe stroke cases and thus have higher power wheelchair provision rates.

Full-Time Equivalent Staffing

Rehabilitation staffing measured by total OT, PT, and PT+KT FTE per facility was a significant system-level predictor for nearly half of the device categories. The

large VHA databases used in this study provided data on VHA facilities but did not provide information on the training of individual clinicians. Therefore, the rehabilitation staffing variable was selected as a proxy for clinician training on the basis of the volume-outcome effect (Gaynor, Seider, & Vogt, 2005; Kizer, 2003) and the following assumptions: Facilities with rehabilitation clinicians will have specialized training in seating and mobility and availability of assistive devices, and facilities that provide more rehabilitation services (i.e., have higher total FTE positions) will have more experience in seating and mobility and provision of assistive devices, gained through practice and interaction with peers.

Intuitive and consistent with specialized rehabilitation were the positive, significant relationship between higher FTE rehabilitation staffing and higher odds of receiving a bed, toileting device, and bathing device. Less intuitive was that this relationship held true for manual wheelchairs but not for power wheelchairs or scooters. The findings are consistent; however, the low number of power wheelchairs and scooters provided makes statistical findings inconclusive. Thus, for power wheelchair and scooter provision, the findings do not support the volume-outcome effect (Gaynor, Seider, & Vogt, 2005; Kizer, 2003). Although we assumed higher provision rates would occur for more expensive power devices at facilities with higher FTE rehabilitation staffing, where seating and mobility specialists are more likely located, our findings suggest this may not be the case.

CARF

CARF accreditation was not as strong a predictor of device provision as was facility complexity. Statistically, CARF accreditation was associated only with increased provision of standard manual wheelchairs and walkers and decreased provision of canes. However, because only small numbers of some devices were provided (e.g., power wheelchairs), potentially clinically significant relationships between accreditation and device type may be masked. More research is needed to better parse out the specific effects of CARF accreditation on assistive device provision; however, an important finding of our research is that CARF accreditation does not seem to be a reliable predictor for device provision in the VHA system.

Summary

Understanding variation in device provision can lead to more effective and efficient utilization of limited health care resources. Sources of the variation can be at the patient or system levels. Previous findings (Hubbard Winkler et al., 2010) suggested that geographic region

accounts for as much variation as veteran-level clinical and demographic factors in VHA-provided assistive devices to veterans poststroke. Geographic region effects, known as *small area variation*, are attributed to regional differences in clinicians' opinions of the best approach to health care. Small area variation is not explained by illness, patient preference, or the dictates of evidence-based medicine (Wennberg, 2004) but rather is based on where the patient lives or receives care (Baicker, Chandra, & Skinner, 2005). Additionally, a wheelchair delivery model proposed by Eggers et al. (2009) includes payer (not applicable in the VA), clinician, and supplier factors in addition to client factors as sources of variation. Findings by Greer et al. (2012) agree on the lack of standardization in the wheelchair delivery process. The authors suggested that overprescription wastes resources and compromises safety and that underprescription threatens quality of life and function. An important finding of the current study is that non-veteran-level factors such as facility complexity (including case mix and resources available) and rehabilitation staffing significantly affect the provision of assistive devices.

The VHA is the second largest supplier of wheelchairs and aids to daily living devices in the United States (behind Medicare). The VA NPPD provides a unique opportunity to explore the provision of assistive devices in this setting and is adequately valid for this purpose (Hubbard Winkler et al., 2012; Winkler et al., 2010). This study is the only known study that has examined system-level predictors of assistive device provision per assistive device category in the VHA system; however, other studies have examined other organizational aspects of provision. At least one study has looked at the relationship between health plan and provision of assistive devices (Scheerer, 2003). Wolff, Agree, and Kasper (2005) investigated the relationship between level of care and device provision for Medicare beneficiaries: inpatient hospitalization and home health use were predictors of cane, crutch, and walker and wheelchair acquisition. A qualitative study of power wheelchair provision in Canada (Mortenson, Clarke, & Best, 2013) found that fears for patient safety and lack of time for training in use of the power wheelchair affected clinicians' decisions to provide simpler devices (e.g., manual wheelchairs).

Although it is important not to dictate to clinicians how to make clinical decisions, assisted device provision standardization in the form of practice guidelines can compensate for variation in clinician values and experiences, clinical education training, and the extent to which clinicians rely on vendors or facility inventory in decision making. Decision making without updated guidelines is

further complicated by the rapid growth in technology, especially in the more expensive powered, computerized, and lightweight devices. The occupational therapy profession is ideally positioned to support the development of clinical practice guidelines because assistive technology has been one of the fundamental domains of occupational therapy and because occupational therapy practitioners are trained in integrating the client with the environment.

The results of this study reinforce the need for clinical practice guidelines (Gray, 2009) that not only support clients but also consider facility- and clinician-level factors in assistive device provision decision making. In the absence of practice guidelines, clinicians must be cognizant of both client-level and system-related factors that affect their assistive device provision choices. Clinician bias and values and facility-related practices, which may also affect device provision, were not assessed in this study. We recommend that facilities track assistive device provision as a program outcome to aid evaluation and add to the evidence pool.

Study Limitations

As with any research performed using administrative data, this study has limitations. First, we attempted to analyze and present a workload structure predictor, that is, the average number of clinic encounters or visits per facility per 2-yr study period, calculated for occupational therapy, physical therapy, and physical therapy and kinesiotherapy. We found, however, that only outpatient workload data were available in the VA Medical SAS datasets and that the device data (from the NPPD) did not specify whether the device was provided at an inpatient or outpatient visit. Therefore, the results of this process-level analysis were spurious and not reported. Although the VA Medical SAS datasets now include inpatient workload data, the validity of repeating our failed analysis would depend on the accuracy of the procedural coding entered by clinicians.

Second, although we controlled for stroke severity at an individual level (based on FIM scores), we did not examine the extent to which stroke case severity varied among facility types. Third, relatively few power devices were provided to our study cohort; only 3% received a power wheelchair. This limitation decreased our ability to statistically detect differences in odds of power wheelchair provision (e.g., CARF accreditation had an odds ratio estimate of 1.29, reflecting 29% increased odds for power wheelchair provision, which was not statistically significant). Fourth, in the current results, we analyzed provision of each device as a separate outcome variable; however, each could be considered a dependent variable because

provision of one device may influence the provision of other devices. For example, wheelchair provision may affect the chances of getting toileting or bathing devices, or cane provision may affect walker provision. The decision to conduct separate analyses was made during the planning of the VA-funded research project as a result of the desire to examine the odds and explanatory variables for each outcome separately. Finally, the study population consisted of veterans poststroke, and results cannot be generalized to other conditions.

Directions for Future Research

The findings and limitations of this research both lead to potential avenues for future research. Research into other potential areas of provision variation such as clinician bias and values and facility-related practices would help paint a more complete picture of device provision and help in guideline development. In addition, although we describe associations between device provision and predictor factors, we can only speculate about the causality. Interesting research would delve into the reasons behind the nonintuitive findings such as why power wheelchair provision seems higher at medium-complexity than at high-complexity facilities.

Because of the preliminary nature of this study (i.e., the first known study of system-level variables) and the limitations of using administrative data, follow-up prospective studies are needed to interpret the meaning of the reported findings. Another important research question for future studies would be to compare prescription patterns of rehabilitation and nonrehabilitation clinicians across the device categories. However, such studies would be challenging because the NPPD provides the device prescription text but not the service or department that prescribed the device (e.g., rehabilitation, prosthetics, nursing, primary care). Subsequent planned research with the collected data will further analyze the complex relationships between device outcomes by using multivariate modeling techniques to explore their interrelatedness.

Implications for Occupational Therapy Practice

The results of this study have the following implications for occupational therapy practice:

- System-level factors, in addition to patient need, significantly affect the provision of ADL and mobility-related devices.
- Variance in the provision of assistive devices that is not related to individual patient needs can be addressed by clinician training.

- Although rehabilitation clinicians typically receive training in the provision of assistive devices, not all devices are prescribed by rehabilitation therapists; therefore, occupational therapy practitioners may need to provide training for other clinicians.
- Assistive device prescription should be standardized at the facility and geographic area levels, that is, for patients with identical clinical and functional needs and resources, device provision should be the same regardless of where they receive their care.

Conclusion

System-level factors, in addition to patient need, significantly affect the provision of assistive devices in VHA facilities. Although we cannot control for patient need for assistive devices, non-patient-level variances can be addressed through clinician training and standardization at the system level by implementing clinical guidelines. ▲

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