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Wheelchair utilization and satisfaction following cerebral vascular accident

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Abstract—The purpose of this cross-sectional descriptive study was to determine the extent to which wheelchairs prescribed during rehabilitation are used and perceived as satisfactorily meeting individual mobility, functional, psychological and social needs of veterans who have had a stroke. Forty-nine veterans were interviewed during a one-time visit to the Veterans Affairs Medical Center. Questionnaires on demographics, medical status, functional independence, cognition, social integration, depression, health status and well-being, and wheelchair use and satisfaction were administered. Fifteen participants (31%) no longer used their wheelchairs. Primary reasons included improved physical function (93%) and use of alternative mobility aids (87%). Use by continued wheelchair users ranged from less than 1 hour each day (29%) to more than 8 hours each day (3%). Participants who retained use of the wheelchair were satisfied with its performance. Continued use was associated with impaired mobility, physical dysfunction, and physical dependence. Participants who no longer used their wheelchairs had used them an average of 13 weeks. Medical and psychosocial problems unrelated to wheelchair use were common. Almost 45% of the participants had impaired socialization, 80% had severely compromised occupations, and 41 percent displayed mild to severe depression. Although wheelchair use declined for 31% of the participants, primarily as a result of improved physical function, it is evident that a number of wheelchairs were issued at great expense that were no longer needed. This finding, as well as the reporting of problems unrelated to wheelchair use, suggests the need for reevaluation of mobility and psychosocial needs during the years following rehabilitation for a stroke.

Key words: *follow-up, stroke, wheelchairs.*

INTRODUCTION

Changes in mobility following a stroke affect functional independence and quality of life [1]. Persons who have had a stroke often rely on devices to facilitate mobility at home and in the community. Additionally, many individuals who have had a stroke are elderly and may have other physical conditions associated with age and limited mobility. Concomitant issues such as decreased cognition, emotional liability, and economic factors affect the overall quality of life of the person with a stroke and the individuals who administer care [2]. Rehabilitation professionals often provide the interventions that enhance function, reduce anxiety, and identify alternative solutions to meet the individual's needs.

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Wheelchairs and the Elderly

The literature is replete with references pertaining to the wheelchair needs of persons with spinal cord injury (SCI), traumatic brain injury, and cerebral palsy [3,4]. However, there is a paucity of information on the mobility, seating, and positioning needs of elderly persons with a stroke or other neuromuscular or musculoskeletal problems. Formal evaluations of the elderly for mobility devices are reported rarely in the scientific literature [5–7]. Often, the wheelchair that is provided for the elderly is the wrong size, is in poor repair, is unsafe, has fixed armrests and footrests, and has no pressure-reducing or positioning components [8,9]. These factors may result in poor posture, pain and discomfort, decreased sitting tolerance and function, decreased mobility, and pressure ulcers [8,10]. Psychological factors associated with inadequate or inappropriate mobility devices may include loss of self-esteem, depression, diminished quality of life, and social isolation [8]. In long-term care facilities, the primary reported reason for the use of inadequate equipment is the lack of funds. A more serious problem is the failure of many clinicians and administrators to recognize the relation of posture and comfort to functional independence [5]. Furthermore, little attention has been directed toward understanding the issues that might have an impact on the use of and satisfaction with wheelchairs once the person has returned to the community.

Over time, changes in a person's medical status may alter mobility skills. The wheelchair may not be compatible with the person's mobility needs in his or her own environment. The inability to ambulate, propel, or move oneself may influence further the person's physical and psychological health. Modifications may be necessary to the wheelchair and/or the environment of persons who have had a stroke. These modifications include raising or lowering the seat to allow the person to propel himself or herself with one arm and one leg, adding cushions to ensure comfort and protection of the skin, or finding an alternative means of mobility such as an electric wheelchair or scooter. Environmental changes may include removing carpeting from the floor to make propelling easier, widening doorways if new wheelchairs are larger than the original mobility devices, and adding ramps. Financial resources often are not available for modifications or replacement of mobility devices. Improvement in strength, range of motion, stamina, and energy may reduce the frequency of wheelchair use or eliminate it altogether.

Use of Assistive Technology

The cost of a wheelchair can range from several hundreds to several thousands of dollars, depending on its type, i.e., manual, electric, and scooter. In the current climate of medical economics, clinicians are challenged to provide quality and cost-effective care, including the prescription of essential equipment. Assistive devices for mobility or for the enhancement of functional independence constitute expensive components of rehabilitation. Garber and Gregorio reported that only 35 percent of all devices prescribed during the rehabilitation of persons with tetraplegia were still in use at the end of 2 years [11]. Similar studies were conducted with regard to other technology. Forbes and colleagues studied elderly persons with various impairments who did not use assistive devices [12]. They found that not using assistive devices was consistently and strongly correlated in women isolated socially, having less education, and living in rural areas. Page and Geiger reported that of the assistive devices given to patients during a rehabilitation hospitalization, approximately 50 percent were abandoned after discharge [13,14]. Conversely, Bynum and Rogers reported that the rate of assistive device use was 82 percent for their sample of older adults receiving care at home [15]. Haworth reported that 18 percent of toilet devices, 19 percent of walking devices, 26 percent of dressing devices, and 36 percent of bathing devices had been discarded 2 weeks after discharge by patients who had total hip replacements [16]. These data indicate that although many assistive devices are used, some are never used or are discarded shortly after they are received. The use of and satisfaction with wheelchairs by persons who have had a stroke have not been studied.

Psychological Concomitants of Stroke

Psychological and social outcomes of stroke have been reported in the literature. Feibel and Springer studied depression and failure to resume social activities after stroke [17]. They found that although depression after stroke was not significantly related to age, sex, marital or cognitive status, ambulation, independence in activities of daily living, or side of brain involvement, it was significantly correlated with failure to resume premorbid social activities. In a study by Labi et al., three parameters of social function—socialization in the home, socialization outside the home, and hobbies and interests—were analyzed to determine social reintegration of long-term stroke survivors who had reached satisfactory levels

of physical function [2]. Their findings suggest that social, environmental, emotional, and organic brain dysfunction factors contribute to social isolation even after functional independence has been achieved. Angeleri et al. studied the influence of depression, social activity, and family stress on functional outcome after stroke [18]. They reported that depression, social activity, and stress caused to relatives were highly correlated in all study participants. Kelly-Hayes and Paige stressed the importance of assessing for psychosocial conditions as well as for neurologic disabilities because of the prevalence of depression that affects rehabilitation and recovery following stroke [19]. Shimoda and Robinson studied the effect of social functioning and depression on recovery from stroke [20]. They found that both depression and impaired social function have independent negative effects on physical recovery from stroke. Bethoux et al. studied changes in the quality of life of stroke patients over time [21]. Their results suggested that although disability level is unchanged, quality of life might deteriorate over time. They suggest further that studies of this nature need to be replicated with larger samples of stroke survivors. The objectives of this study were to determine the use of and satisfaction with prescribed wheelchairs and to describe factors that contribute to continued use or nonuse of a wheelchair following a stroke.

METHODS

Sample

A cross-sectional descriptive study design was used to understand the use of and satisfaction with wheelchairs prescribed to veterans during their rehabilitation following a stroke. The sampling frame consisted of 375 veterans currently on the patient roster of the Rehabilitation Service at the Houston Veterans Affairs Medical Center (VAMC). These individuals had been discharged with a primary diagnosis of stroke from the comprehensive inpatient rehabilitation program at the Houston VAMC between 1989 and 1999 and were being followed for medical, mobility, or functional problems, or the recurrence of a stroke. The sample was screened by a computer database to determine if each veteran was (1) living in the Houston metropolitan area, (2) not deceased, or (3) not currently hospitalized. Once screened, the 141 potential participants who met these criteria were contacted to determine if they had received a wheelchair upon discharge from their rehabilitation hospitalization following their stroke. Individuals who did not receive a wheelchair were not included in the sample. Of the 141 people contacted, 97 (69 percent) had received a wheelchair and 52 (54 percent) agreed to participate in the study. The remainder declined because of failing health, lack of transportation, lack of desire to participate, or a combination of reasons. The functional status of the individuals who declined to participate is not known. Persons who declined might include a number of continued users of wheelchairs and/or individuals who no longer used their wheelchair because of a severe decline in function resulting in confinement to bed. Of the 52 persons who agreed to participate, 3 were unable to complete the study questionnaires primarily because of cognitive deficits. Therefore, 49 persons comprised the study population.

PROCEDURE

Participants were scheduled for a one-time individual interview at the Houston VAMC; at which time, we obtained informed consent. They were requested to respond to questions on demographics, medical status, cognition, dimensions of handicap, depression, health status, well-being, and use of and satisfaction with the wheelchair prescribed during their rehabilitation hospitalization. A spouse or significant other accompanied 37 participants (75 percent) and remained with the participant during the interview. Occasionally, the spouse or significant other would contribute additional information to clarify the participant's responses or to help in recall of relevant information. The interview time ranged from 90 to 120 minutes, and participants were financially compensated for their transportation and time.

Measures

Demographic Information

Demographic data were obtained from the participants and their medical records. Characteristics described included gender, age, ethnicity, marital status, level of education achieved, and time since onset of the stroke.

Use of and Satisfaction with Wheelchair

In this study, wheelchair use was defined as any use of a wheelchair regardless of number of hours used each day. The survey used to obtain these data is a modified

version of a structured questionnaire with both forced choice and open-ended questions [11]. Participants were asked if they were using a wheelchair. If they were, they were asked to determine the number of hours of use each day and to describe the environments in which it was used (in the home or community). They then were asked to rate six wheelchair characteristics on a 5-point Likert scale in which 1 = poor and 5 = excellent. The six factors were appearance, function, mechanical performance, maintenance, safety, and overall impression. The average of the six scores represents the overall level of satisfaction. If the wheelchair prescribed during their rehabilitation hospitalization was no longer in use, participants were asked to describe the reasons they no longer used it and how long they had used it before discarding it. The use of and satisfaction with the wheelchair were the primary outcome measures of this study.

Comorbid Conditions

Pain, spasticity, contractures, and medical or neurological changes were assessed because of their potential effect on wheelchair use and functional independence. The Visual Analogue Scale (VAS), a self-report Likert scale, scored from 0 to 10, was used to assess pain [22]. Absence of pain is indicated by a "0," whereas extreme pain is indicated by "10." According to Huskisson, results of visual analogue scales correlate well with other methods of measuring pain and are sensitive and reproducible methods of expressing pain severity [23]. Spasticity, like pain, may interfere with a person's ability to propel or sit comfortably in the wheelchair [24]. In this study, the Ashworth Scale was used to assess the degree of spasticity. It is scored from 0 to 4, with normal tone scored "0" and rigid muscle tone scored "4" [25]. Bohannon and Smith tested the interrater reliability of the Ashworth Scale and agreed on 86.7 percent of their readings resulting in a Kendall's tau correlation between their grades of 0.847 ($p < 0.001$) [25]. In the current study, the investigator assessed the degree of tone by taking the joints of the upper (shoulder, elbow, wrist, and fingers) and lower (hip, knee, and ankle) limbs through range of motion. In addition, participants were asked to report on the degree to which spasticity interfered with their ability to propel or sit comfortably in their wheelchair.

Contractures are persistent or chronic loss of joint range of motion caused by pathologic shortening of the soft connective tissue structures in or around the joint [26]. They interfere with mobility and the ability to perform basic activities of daily living and they may be painful; all of which may hinder wheelchair sitting time or functional independence. The investigator assessed for the presence of contractures by passively ranging the joints of the participant's upper and lower limbs. All major joints were passively ranged and examined for limitations of joint motion.

A number of health issues may interfere with mobility and independence once persons with a stroke return to their home and community. The Health Outcomes Institute Stroke Form—Later Outcomes lists conditions that may have occurred during the months since discharge from the hospital [27]. These conditions include a new stroke, pneumonia requiring hospitalization, myocardial infarction, heart failure, pressure ulcers, deep-vein thrombosis, pulmonary embolism, and urinary tract infections. Participants were requested to check off the conditions that pertained to them.

Functional Status

The Functional Independence Measure (FIM) is a measure of disability and assesses function in six domains: self-care, sphincter control, mobility, locomotion, communication, and social cognition [28]. The FIM is administered on admission to, on discharge from, and at intervals throughout the rehabilitation hospitalization. In this study, the FONE FIM, the self-report version of the original FIM, was used to determine the level of functional independence [29]. It is a structured interview consisting of 18 items, each of which is scored from 1 (total assistance) to 7 (complete independence). Total scores ranged from 18 to 126, with higher scores indicating greater functional independence. Functional categories are—

1. Self-care, including bathing, toileting, grooming, dressing upper and lower limbs, and eating (six items).
2. Sphincter control of bowel and bladder (two items).
3. Transfers (mobility) to bed, toilet, and tub/shower (three items).
4. Locomotion, including walking, using a wheelchair, and climbing stairs (two items).
5. Communication, including comprehension and expression (two items).
6. Social cognition, including social integration, problem solving, and memory (three items) [28–30].

Cognition

The Mini-Mental State Examination was used to screen each participant's cognition. This test is a brief practical method for assessing cognitive function [31]. It contains 11 items in two sections: (1) orientation, memory, and attention and (2) reading and writing, ability to name, following verbal and written commands, writing a sentence, and copying a polygon. Questions are scored by summing the assigned points of successfully completed tasks. Scores range from 0 to 30. Cutoff points have been variable. The most commonly used cutoff point indicating cognitive impairment deserving further investigation is 23/24. However, cutoff points of 17/18 (regarded as optimal for persons with less education), 20/21 (for individuals with 8 or 9 years of schooling), and 22/23 (for individuals with 10 to 12 years of schooling) have been reported [32].

Depression

The Geriatric Depression Scale (GDS) Short Form is a screening test for depression in elderly people [33]. Originally a 30-item scale, it has been modified and validated to include 15 items that are answered as "yes" or "no" [34]. Scores range from 0 to 15 and items answered "yes" are summed.

Dimensions of Handicap

The Craig Handicap Assessment and Reporting Technique (CHART) is a 32-item self-report instrument that assesses the extent of handicap across five dimensions: independence, mobility, occupation, social integration, and economic self-sufficiency [35]. It was originally developed for use with persons with SCI. The authors of this measure are currently pursuing validation of it for populations other than SCI, including the stroke population. In this study, the economic self-sufficiency domain (two questions) was not assessed because of participants' reluctance to reveal financial information.

Health Status and Well-Being

The Health Status Questionnaire (HSQ 2.0) is a measure of overall functional status and well-being. It yields a profile of eight health scores grouped under three major health dimensions: (1) overall evaluation of health (general health perception), (2) functional status (physical functioning, social functioning, role limitations attributed to physical problems/emotional problems, and bodily pain), and (3) well-being (pain, mental health, and energy/fatigue) [36,37].

Major Life Events Scale

This scale is a checklist of significant events in a person's life. The person checks off and describes any of the events that have occurred within the last year. These events include changes in health, finances, and relationships [38]. In this study, the questionnaire was modified and included eight items from the original instrument. These items included serious illness, accident, or injury; financial crisis or change; death of a person close to the participant; divorce or separation; marriage or new relationship; loss of caregiver; change in employment or educational status; and change in residence.

Analysis

Descriptive statistics were obtained for all study variables. Frequency tables were constructed for all categorical variables (gender, ethnicity, marital status, level of education, and the presence or absence of pain, spasticity, contractures, and neurological and medical problems). Means, standard deviations (SDs), and ranges were calculated for all continuous variables (age, time since onset of the stroke, length of hospital stay, cognition, and scores on the FIM, HSQ, and CHART). When one variable was continuous and one was categorical, a t-test was used. When both variables were categorical, a Chi-square analysis was performed. The Fisher's exact test was used for small numbers. For statistical significance, $p < 0.05$ was adopted in all analyses.

RESULTS

Characteristics of Population Studied

The study population, consisting of 49 persons who had had a stroke and hospital-based rehabilitation, is described in **Tables 1** and **2**. Males made up the majority of participants. Mean age was 65 years. Almost half were African American and 45 percent were Caucasian; more than half were married and nearly two-thirds had at least a high school education. The mean time since the onset of the cerebral vascular accident (CVA) was 2 1/2 years. Slightly more than one-third had their stroke within 24 months of their participation. The mean length of hospital stay for rehabilitation was 73 days. The mean time from hospital discharge to the time of enrollment into the study was

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Table 1.
Means, standard deviations, and ranges of continuous study variables.

Variable	Mean	SD	Range
Age in years (n = 49)	64.71	9.25	39–82
Time in Months Since Onset of CVA (n = 49)	29.40	25.96	4–120
Time in Months Since Hospital Discharge (n = 49)	27.37	26.08	1–119
Length of Hospital Stay, in Days (n = 49)	73.48	103.77	6–350
Wheelchair Use in Weeks Before Discarding (n = 15)	13.26	17.31	1–60
Daily Hours of Wheelchair Use By Users (n = 34)	2.01	2.28	1–9
Satisfaction with Wheelchair* (n = 34)	4.53	0.64	2–5
CHART (Craig Handicap Assessment)†			
Independence	73.00	33.79	4–100
Mobility	77.00	22.29	8–100
Occupation	31.34	33.62	0–100
Social integration	68.46	29.65	15–100
HSQ (Health Status Questionnaire)‡			
Physical health	31.83	27.38	0–90
Role physical health	31.63	34.14	0–100
Role emotional health	62.57	42.87	0–100
Social	61.97	32.94	0–100
Mental health	73.63	22.04	0–100
Pain	66.38	30.07	0–100
Energy	46.73	28.10	0–100
FIM (Functional Independence Measure)§			
Self-care	36.24	8.29	11–42
Sphincter control	12.69	2.32	2–14
Mobility/transfers	17.69	4.35	3–21
Locomotion	10.59	3.54	2–14
Communication	12.32	1.31	8–14
Social cognition	18.79	2.92	7–21
GDS (Geriatric Depression Scale)¶	4.65	3.58	0–13
Mini-Mental State Examination**	27.12	3.32	14–30
Major Life Events Scale††	1.12	0.99	0–4

*Scoring is 1–5.
†Scoring is 0–100 points.
‡Scoring is 0–100 points.
§Scoring is 1–7 for each of 18 items categorized as:
Self-Care (6 items) 6–42
Sphincter control (2 items) 2–14
Mobility/transfers (3 items) 3–21
Locomotion (2 items) 2–14
Communication (2 items) 2–14
Social cognition (3 items) 3–21
¶Scoring is 0–15.
**Scoring is 0–30.
††Scoring is 0–8.

Table 2.
Frequencies and percentages of categorical study variables (n = 49).

Variable	Number	Percent
Gender		
Male	45	91.8
Female	4	8.2
Race/Ethnicity		
Caucasian	22	44.8
African American	24	48.9
Hispanic	3	6.1
Marital Status		
Never married	4	8.1
Married	26	53.0
Widowed	8	16.3
Divorced	10	20.4
Separated	1	2.0
Educational Status		
Less than high school graduate	17	34.6
High school graduate or GED	10	20.4
Some college	17	34.6
Bachelor's degree	4	8.1
Graduate school	1	2.0
Persons Reporting Pain	16	32.6
Persons with Spasticity	25	51.0
Contractures (Persons with Contractures)	6	12.2
Persons Who Had Falls Within Last Year	30	61.2
Persons with Pressure Ulcers Within Last Year	4	8.1
Persons Reporting Neurological or Medical Changes Within Last Year	11	22.4
Persons Reporting Major Life Events		
Death of person close to you	17	34.7
Illness, accident, or injury	16	32.7
Financial crisis or change	9	18.4
Change in employment or education	6	12.2
Change in residence	5	10.2
Marriage or new relationship	1	2.0
Loss of caregiver	1	2.0
Divorce or separation	0	0.0
Reasons for Nonuse of Wheelchairs (n = 15)		
Improved physical function	14	28.6
Alternative solutions	13	26.5
Did not want to utilize wheelchair	5	10.2
Broken wheelchair	2	4.1

27 months. Pain was reported by one-third of the participants and spasticity by just over half. Almost one-quarter of the participants reported the occurrence of neurological or medical problems within the year preceding the study.

Wheelchair Use and Satisfaction

The primary outcome variable studied was the use or nonuse of the wheelchair prescribed during rehabilitation following a stroke. All wheelchairs had been individually

prescribed for each person during his or her rehabilitation hospitalization. At the time they participated in the study, fifteen (30.6 percent) participants had totally stopped using their wheelchair, all of which were manual wheelchairs. On average, these participants used their wheelchairs for 13 weeks before discontinuing use. Each of the 15 participants who had stopped using the wheelchair gave multiple reasons (**Table 2**). The most frequently cited reasons included "improved physical function" and "use of alternative mobility devices" such as walkers or canes.

Continued wheelchair use for the remaining 34 (69 percent) participants varied greatly from less than 1 hour a day to more than 8 hours a day. Of the participants who still used their wheelchairs, 30 used manual wheelchairs, 2 used motorized wheelchairs, and 2 used scooters. Overall, the mean satisfaction score (average of six wheelchair characteristics) was 4.53 out of a possible 5.0 (**Table 1**), indicating a high level of satisfaction with the wheelchair still in use. However, 33 (67 percent) reported that they had received no written information about their wheelchair, 26 (53 percent) reported that they had received no verbal instructions about the use or maintenance of the wheelchair, and 22 (45 percent) reported that they did not know whom to contact if they had problems with the wheelchair. However, 46 (94 percent) reported that they did receive some verbal safety information.

Relationship of Wheelchair Use with Other Factors

Demographics and Comorbid Conditions

We found no significant differences between wheelchair users and nonusers with respect to age, ethnicity, marital status, level of education achieved, time since onset of the stroke, length of hospital stay for rehabilitation, or time since discharge from the rehabilitation hospitalization. Furthermore, we found no significant differences between continued users of wheelchairs and nonusers with respect to cognition, pain, spasticity, contractures or the occurrence of other neurological or medical problems. Although 41 percent of the participants displayed mild to severe depression (as measured by the GDS), no significant difference was found between wheelchair users and nonusers. Thirty participants (61.2 percent) reported falls within the last year and four participants (8.1 percent) reported a pressure ulcer within the last year (**Table 2**). However, there were no significant differences between wheelchair users and nonusers with respect to the occurrence of falls or pressure ulcers.

Functional Status

A significant difference was found between wheelchair users and nonusers in the FIM transfers/mobility score (users: mean = 16.61, SD = 4.80; nonusers: mean = 20.13, SD = 1.12, t = 4.02, df [degrees of freedom] = 40.25, p = 0.001). However, no significant differences were found between continued wheelchair users and nonusers with respect to the other functional parameters of the FIM (self-care, sphincter control, or locomotion).

Dimensions of Handicap

We found a significant difference between wheelchair users and nonusers in the CHART physical independence score (users: mean = 64.02, SD = 36.67; nonusers: mean = 93.33, SD = 10.24, t = 4.29, df = 42.56, p = 0.001). However, there were no significant differences between wheelchair users and nonusers with respect to mobility, occupation, and social integration domains of the CHART. Participants who still used their wheelchairs were significantly more dependent than those who did not. Overall, regardless of sustained wheelchair use, almost 45 percent of the participants had a marked decrease in socialization (mean = 68.46, SD = 29.65) and 80 percent had severely compromised occupations (mean = 31.34, SD = 33.61).

Health Status and Well-Being

Participants who continued to use their wheelchair were in poorer physical health than nonusers as measured by the HSQ (users: mean = 24.55, SD = 23.20; nonusers: mean = 48.33, SD = 29.68, t = –3.03, df = 47 p = 0.004). However, there were no significant differences between wheelchair users and nonusers with respect to general health perception, social functioning, role limitations (physical or emotional problems and bodily pain), and mental health and energy.

Major Life Events

Thirty-four (69 percent) of the study participants reported at least one major life event occurrence within the last year and thirteen (26 percent) reported two or more. The most frequently reported event was illness, affecting one-third of the participants. However, there was no difference between wheelchair users and nonusers with respect to the total number of reported life events.

Secondary Results

A number of issues that were unrelated to the primary research question emerged while we were addressing the use or nonuse of wheelchairs by individuals who had had a stroke. The participants spontaneously shared this information with the investigator. Neither the participant nor any person accompanying him or her was prompted or cued to provide information. Thirty-nine participants reported a total of 49 problems in at least one of the following four areas: (1) equipment needs, (2) referral needs, (3) caregiver problems, and/or (4) psychosocial problems. More than half (56 percent) of the reported problems were with referral needs. Participants did not seem to know whom to contact for assistance from their primary care physician, social worker, or equipment provider. Furthermore, they did not know whom to contact if they believed they needed more occupational or physical therapy. The second most common problem reported was depression (28 percent). Although a thorough investigation of the causes of the participants' depression was beyond the scope of this project, the investigators suggested options that included contacting either their social worker, primary care physician, or the psychologist assigned to the Rehabilitation Unit. In some cases, the investigator made the contacts for the participants or their families.

Four participants were waiting for equipment that had been ordered but never delivered. This included a pressure-reducing mattress overlay, wheelchair cushions, and scooters. Two participants received equipment that they were unable to use. This included a standing frame that needed to be assembled and bathroom equipment that did not fit in the participant's home bathroom. Two participants reported neglect or abuse by their family or caregiver. Financial problems and the need to clarify VA (Veterans Affairs) and Social Security benefits also were reported. The investigators referred all of the veterans or family members to appropriate resources for problem resolution whenever possible. Examples of the specific problems and their solutions are presented in **Table 3**.

DISCUSSION

Assistive technology is defined as "any device or product system that increases the physical functioning or independence of persons with disabilities" [39]. Since the

Table 3.
Reported secondary problems.

Secondary Problem	Equipment Needs	Referral Needs	Caregiver Problems	Psychosocial Problems
Example A	**Not received**	**Basic information**	**Caregiver assistance**	**Depression**
	Patient had been waiting 6 months for his scooter. Investigator discovered it just needed to be delivered.	Patients did not know whom to call when equipment broke down. They were referred to the appropriate departments.	Many caregivers are frail, older females physically unable to meet the needs of their spouses. The social worker and the Benefits Office were contacted to determine if the caregiver could receive assistance.	Several patients reported being depressed. They were referred to the VA Psychiatry Evaluation Assessment Clinic (PEAC) or their primary care physician for follow up.
Example B	**Not useable**	**Rehabilitation services**	**Neglect**	**Social isolation**
	Patient received shower chair and grab bars for toilet, but bathroom was too narrow for wheelchair and patient needed maximum assistance. Patient was referred to the social worker to determine if the VA would pay for renovations.	Patient indicated an interest in vocational counseling. He was referred to the appropriate personnel in the Vocational Rehabilitation Program.	Patient stated that wife is verbally abusive and unresponsive to his needs for affection. Wife did not deny it. A referral was made for them both to receive counseling at the VA PEAC.	Patients reported that they felt isolated and frequently confined to their homes. They were referred to a stroke support group where they can talk about their feelings and receive peer support.
Total No. Problems	5	21	12	11

1970s, technology has expanded every aspect of care for persons with disabilities. Its principal purpose is to assist the person with physical limitations to achieve his or her highest level of personal autonomy. Although follow-up on consumer use and satisfaction with assistive technology has been reported in the literature, many of these studies have been retrospective and focused on assistive devices for activities of daily living. In most cases, the prescribed devices were still in use at various follow-up intervals. Ninety-two percent of Brabyn's study subjects were still using the prototype vocational aids for blind persons [40]; Caudrey and Seeger found that 86 percent of various devices was still in use 16 weeks after device delivery [41]. The populations studied in these investigations had a variety of impairments and disabilities.

Follow-up data on use of and satisfaction with wheelchairs prescribed for persons with a stroke have not been reported despite the expense of this equipment. Therefore, this study was undertaken to determine the use of and satisfaction with wheelchairs prescribed for persons who have had a stroke and to describe factors associated with use or nonuse. The principal findings of this investigation included—

- Of 49 participants, 15 (31 percent) discontinued using their wheelchairs after discharge from their rehabilitation hospitalization.
- No significant differences were found between users and nonusers of wheelchairs with respect to demographics, comorbid conditions, function, or psychological and social status.
- As expected, participants who continued to use their wheelchairs were more disabled and handicapped as evidenced by the mobility scores on the FIM, the physical independence scores on the CHART, and the physical functioning scores on the HSQ.

These data are consistent with those of Osberg and colleagues who found that wheelchair users were more likely to have poorer functional outcomes than ambulatory patients were at a 12-month follow-up assessment [42]. Kohn et al. reported that 21 percent of their clients who received assistive devices reported problems with their devices [43]. Kohn et al. reported that 57 percent of all devices delivered required repairs at 7 months and 86 percent of the power wheelchairs required repairs in the same period [44]. However, in the current study, there was a high degree of satisfaction with the mechanical and performance characteristics of the wheelchair still used by the participants.

The psychological consequences of stroke include depression; lower quality of life; reduction in social, sexual, and leisure activities; and social isolation [45,46]. In this study, a number of these issues emerged from the interviews with the participants. Overall, regardless of wheelchair use, 20 of the participants in this study were mildly to severely depressed, 22 had marked decrease in social integration, and 39 had severely compromised occupations (routine, daily activities). In a study by King, depression was the strongest predictor of overall psychological health and quality of life of stroke patients 1 to 3 years following rehabilitation [45]. It has been estimated that poststroke depression prevalence rates range from 20 to 79 percent [46,47]. In a study by Kauhanen and colleagues, depression was the most important reason for impaired quality of life [48]. These investigators suggest that clinicians should identify patients and their spouses or primary caregivers who need supportive psychological or social services and develop individualized, multifaceted rehabilitative approaches and support services for patients and spouses in need of these interventions. In a study of stroke survivors 1 year after stroke, 38 percent scored in the depressed range [49]. Depression was associated with inability to work because of disability and diminished social activity. These investigators concluded that functional status and depression were significant predictors of a person's quality of life. These data are consistent with the findings from the current study in which 41 percent of the participants were found to have mild to severe depression. Corr and Bayer reported a decline in functional independence among their sample of 49 persons 6 to 12 months postrehabilitation [50]. They found that there was considerable need for continued support and intervention after rehabilitation hospitalization in view of the decline in functional and social activities of patients at follow-up.

Participants who reported continued use of their wheelchair were more likely to have impaired mobility, decreased physical functioning, and greater dependence than individuals who no longer used the wheelchair. However, regardless of their wheelchair use, participants in this study reported a number of perceived unmet mobility, functional, and psychosocial needs. These needs have implications for stroke rehabilitation in government and nongovernment facilities. In their study of disabled persons in New Zealand, Caradoc-Davies and Hawker found that the main factors affecting service delivery were, among other issues, lack of information

and needs not assessed [51]. These two problems also emerged as concerns for the participants in the study reported here. In current practice at the government facility where this study was conducted, scheduled follow-up visits by persons who have had a stroke and hospital-based rehabilitation focus on physical, medical, and functional status with little attention to the psychological and social problems that often are overlooked or go unreported. Rarely are the psychological and social concerns of the person or his primary caregiver explored unless the person reports a problem.

Among the limitations of this study are—

1. Small sample size (46 percent of potential participants declined to participate).
2. Select population (mostly male and all veterans).
3. Extent of interviews (multiple questionnaires).
4. Time spent to complete interviews (90 to 120 minutes).
5. Unknown functional status of persons who declined to participate.
6. The wide variation in time since onset of the stroke (4 to 120 months).

The results of this study may not be generalizable to other persons who have had a stroke. Therefore, replicating the study with larger samples both in government healthcare facilities and in the private sector is recommended. The specific characteristics of the people who declined to participate are not known and constitute another limitation of the study. Neither were the functional status of these individuals assessed nor were any persons identified who had used a wheelchair but no longer were using it because their function had declined and they were confined to bed. This would be an important factor to explore in future studies. Another important consideration is the time since the onset of the stroke. Replication of the study, with participants whose time since onset of stroke was more homogeneous, is warranted to obtain valid and reliable data on wheelchair use as well as on the physical, psychological, and social issues of concern to persons with a stroke and their caregivers.

CONCLUSIONS

Approximately one-third of the participants in this study stopped using their wheelchairs at some point after discharge from rehabilitation. The reasons most likely are multifactorial, but this sample consistently cited improved physical functioning or use of alternative mobility devices as reasons for discontinuing use of the wheelchair. Despite each veteran's level of physical function, other problems emerged during the interview. In most cases, these problems were psychological or social in nature. This suggests that patients, at this facility, who are undergoing rehabilitation following a stroke may benefit from counseling during hospitalization and follow-up clinic visits that address these additional problems. Currently, the follow-up protocol for stroke patients at the VAMC where this study took place consists of a 6-week postdischarge assessment of the veteran and other visits planned for 3 and 6 months later. At the time of the 6-week follow-up, the physician evaluates the veteran's medical and physical status and another rehabilitation team member administers the FIM. If the physician believes the veteran will benefit from additional therapy or equipment, he or she will refer the veteran to the appropriate departments. If no referral is needed at that time, the patient then is discharged from the rehabilitation service. Although the 3 and 6 months appointments may be scheduled, no data describes the number of return visits that actually occur. Future changes in medical status are handled on an as-needed basis.

A comprehensive assessment of the person who has experienced a stroke in terms of daily routines, roles, future goals, personal perspectives, skills and accomplishments, and social support is recommended. Such an assessment may result in a broader and more effective evaluation of the person's postdischarge status and provide a means to identify problems early that could greatly interfere with community reintegration and quality of life [52]. Future efforts might focus on studying the outcomes (physical, social, psychological) of such a structured follow-up protocol compared to the standard protocol in current practice.

Both the stroke survivor and caregiver could benefit from additional education during rehabilitation and exposure to stroke support groups after discharge from the hospital [53]. The VAMCs have a number of programs for individuals returning to the community after a stroke. Stroke support groups, psychological counseling, adaptive equipment for mobility and functional independence, and vocational rehabilitation are available to enhance the veteran's vocational and avocational needs. However, the participants in this study seemed mostly unaware that these resources exist; therefore, the study participants

underused the services. An increased awareness of these options and empowering the patient to take advantage of them may also help to reduce the number or severity of psychological and social problems in the future.

During this study, many participants acknowledged that they had problems unrelated to their mobility or physical status and had not shared them with other people. Awareness of these issues and providing an environment in which they can be explored may reduce morbidity and prevent secondary complications. Despite the best efforts of rehabilitation specialists to maintain a person's quality of life after the onset of stroke, the restoration of physical function alone appears to be insufficient to prevent psychological problems, such as depression, decreased levels of activity, and social isolation. Persons who have had a stroke and their caregivers should be encouraged to communicate their needs and seek psychological support and adjustment training after the stroke. Structured follow-up protocols may provide the essential information that facilitates realistic self-evaluations of poststroke capabilities and enhances the veteran's quality of life.

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REFERENCES

1. Adkins ER. Quality of life after a stroke: exposing a gap in nursing literature. Rehabil Nurs 1993;18:144–47.
2. Labi MLC, Phillips TF, Gresham GE. Psychosocial disability in physically restored long-term stroke survivors. Arch Phys Med Rehabil 1980;61:561–65.
3. Garber SL. Wheelchair cushions for spinal cord injured individuals. Am J Occup Ther 1985;39:722–25.
4. Trefler E, Hobson D, Taylor S, Monahan L, Shaw G. Seating and mobility for persons with physical disabilities. Tucson (AZ): Therapy Skill Builders; 1993.
5. Redford JB. Seating and wheeled mobility in the disabled elderly population. Arch Phys Med Rehabil 1993;74:877–85.
6. Herzberg SR. Positioning the nursing home resident: an issue of quality of life. Am J Occup Ther 1993;47:75–77.
7. Ferni GR. CAD/CAM approaches to the development of seating and mobility aids for the elderly. Can J Public Health 1986;77 Suppl 1:114–18.
8. Shaw G, Taylor SJ. A survey of seating problems of the institutionalized elderly. Assist Technol 1991;3:5–10.
9. Sadler C. Wheelchair comfort. Community Outlook. 1989 Nov. p. 5–8.
10. Epstein CF. Wheelchair management: developing a system for long term care facilities. J Long Term Care Admin 1990; 8:1–12.
11. Garber SL, Gregorio TL. Upper extremity assistive devices: assessment of use by spinal cord-injured patients with quadriplegia. Am J Occup Ther 1990;44:126–31.
12. Forbes WF, Hayward LM, Agwani N. Factors associated with self-reported use and nonuse of assistive devices among impaired elderly residing in the community. Can J Public Health 1993;84:53–57.
13. Page M. The problems of the selection, provision, and use of aids. In: Bray J, Wright S, editors. The use of technology in the care of the elderly and the disabled. Westport (CT): Greenwood; 1980.
14. Geiger CM. The utilization of assistive devices by patients discharged from an acute rehabilitation setting. Phys Occup Ther Geriatr 1990;9:3–25.
15. Bynum HS, Rogers JD. The use and effectiveness of assistive devices possessed by patients seen in home care. Occup Ther J Res 1987;7:181–91.
16. Haworth RJ. Use of aids during the first three months after total hip replacement. Br J Rheumatol 1983;22:29–35.
17. Feibel JH, Springer CJ. Depression and failure to resume social activities after stroke. Arch Phys Med Rehabil 1982; 63:276–78.
18. Angeleri F, Angeleri VA, Foschi N, Giaquinto S, Nolfe G. The influence of depression, social activity, and family stress on functional outcome after stroke. Stroke 1993;24: 1478–83.
19. Kelly-Hayes M, Paige C. Assessment and psychologic factors in stroke rehabilitation. Neurology 1995;45(2 Suppl 1): S29–32.
20. Shimoda K, Robinson RG. The relationship between social impairment and recovery from stroke. Psychiatry 1998; 6:101–11.
21. Bethoux F, Calmels P, Gautheron V. Changes in the quality of life of hemiplegic stroke patients with time: a preliminary report. Am J Phys Med Rehabil 1999;78:19–23.
22. Jenssen MP, Karloy P, Braver S. The measurement of clinical pain intensity: a comparison of six methods. Pain 1986;27:117–26.
23. Huskisson EC. Measurement of pain. J Rheumatol 1982; 9:768–69.
24. Little JW, Massagli TL. Spasticity and associated abnormalities of muscle tone. In: DeLisa JA, Gans BM, Currie D, editors. Rehabilitation medicine: principles and practice. 2nd ed. Philadelphia: Lippincott; 1993. p. 666–80.
25. Bohannon RW, Smith MB. Interrater reliability of a modified Ashworth Scale of muscle spasticity. Phys Ther 1987;67:206–7.
26. Means KM. Rehabilitation of joint contractures. In: Grabois M, Garrison SJ, Hart KA, Lehmkuhl LD, editors. Physical medicine and rehabilitation, the complete

approach. Malden (MA): Blackwell Science, Inc.; 2000. p. 859–70.
27. Health Outcomes Institute. Stroke Form 11.4, Later Outcomes. 1994.
28. Granger CV, Hamilton BB, Keith RA, Zielizny M, Sherwin FS. Advances in functional assessment for medical rehabilitation. Top Geriatr Rehabil 1986;1:59–74.
29. Smith P, Hamilton BB, Granger CV. Functional independence measure decision tree: the FONE FIM. Buffalo (NY): Research Foundation of the State University of New York; 1989.
30. Hamilton BB, Granger CV, Sherwin FS, Zielezny M, Tashman JS. A uniform national data system for medical rehabilitation. In: Fuhrer MJ, editor. Rehabilitation outcomes: analysis and measurement. Baltimore: Brookes; 1987. p. 137–47.
31. Folstein MF, Folstein SE, McHugh PR. Mini-Mental State: a practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189–98.
32. Uhlmann RF, Larson EB. Effect of education on the mini-mental state examination as a screening test for dementia. J Am Geriatr Soc 1991;39:876–80.
33. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, Leirer VO. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res 1982–83;17:37–49.
34. Lesher EL, Berryhill JS. Validation of the Geriatric Depression Scale—Short Form among inpatients. J Clin Psychol 1994;50:256–60.
35. Whiteneck GG, Charlifue SW, Gerhart KA, Overholser JD, Richardson GN. Quantifying handicap: a new measure of long-term rehabilitation outcomes. Arch Phys Med Rehabil 1992;73:519–26.
36. Health Outcomes Institute. Health Status Questionnaire 2.0. 1993.
37. Ware JE, Kosinski M, Bayliss MS, McHorney CA, Rogers WH, Raczek A. Comparison of methods for the scoring and statistical analysis of SF-36 health profile and summary measures: summary of results from the Medical Outcomes Study. Med Care 1995;33(4 Suppl):AS264–79.
38. Avison WR, Turner RJ. Stressful life events and depressive symptoms: disaggregating the effects of acute stressors and chronic strains. J Health Soc Behav 1988;29: 253–64.
39. O'Day BL, Corcoran RJ. Assistive technology: problems and policy alternatives. Arch Phys Med Rehabil 1994;75: 1165–69.
40. Brabyn LA. A follow-up survey of prototype vocational aids for the blind. San Francisco (CA): Rehabil Engr Center, Smith Kettlewell Institute of Visual Sciences; 1981.
41. Caudrey DJ, Seeger BR. Rehabilitation engineering service evaluation: a follow-up survey of device effectiveness and patient acceptance. Rehabil Lit 1983;44:80–84.
42. Osberg JS, DeJong G, Haley SM, Seward ML, McGinnis GE, Germaine J. Predicting long-term outcome among post-rehabilitation stroke patients. Am J Phys Med Rehabil 1988;67:94–103.
43. Kohn J, Enders S, Preston J, Motloch W. Provision of assistive equipment for handicapped persons Arch Phys Med Rehabil 1983;64:378–81.
44. Kohn JG, LeBlanc M, Mortola P. Measuring quality and performance of assistive technology: results of a prospective monitoring program. Assist Technol 1994;6:120–25.
45. King RB. Quality of life after stroke. Stroke 1996;27: 1467–72.
46. Gordon WA, Hibbard MR. Poststroke depression: an examination of the literature. Arch Phys Med Rehabil 1997; 78:658–63.
47. Sandin KJ, Cifu DX, Noll SF. Stroke rehabilitation. 4. Psychologic and social implications. Arch Phys Med Rehabil 1994;75:S52–55.
48. Kauhanen M-L, Korpelainen JT, Hiltunen P, Nieminen P, Sotaniemi KA, Myllyla VV. Domains and determinants of quality of life after stroke caused by brain infarction. Arch Phys Med Rehabil 2000;81:1541–46.
49. Carod-Artal J, Egido JA, Gonzalez JL, Varela SE. Quality of life among stroke survivors evaluated 1 year after stroke: Experience of a stroke unit. Stroke 2000;31: 2995–3000.
50. Corr S, Bayer A. Poor functional status of stroke patients after hospital discharge: Scope for intervention? British J Occup Ther 1992;55:383–85.
51. Caradoc-Davies T, Hawker A. Rehabilitation services in the health sector: the perspectives of providers and consumers. New Zealand Med J 1995;108(Pt 2):32–34.
52. Garber SL, White V, Davidson H. Enhancing quality of life after a stroke [unpublished manuscript]. Department of Veterans Affairs and Texas Woman's University; 1999.
53. Brocklehurst JC, Morris P, Andrews K, Richards B, Laycock P. Social effects of stroke. Soc Sci Med 1981;15:35–39.

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