

ORIGINAL ARTICLE

# Differences Between Manufacturers in Reported Power Wheelchair Repairs and Adverse Consequences Among People With Spinal Cord Injury



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## Abstract

**Objective:** To compare the frequency of power wheelchair (PWC) repairs and consequences experienced over a 6-month period by individuals with spinal cord injury (SCI) who use a PWC  $\geq 40$ h/wk, based on manufacturer, seating functions, Healthcare Common Procedure Coding System (HCPCS) group, and model, and over time.

**Design:** Convenience observational sample survey.

**Setting:** Spinal Cord Injury Model System centers.

**Participants:** Individuals with SCI (N=945) who use a PWC  $\geq 40$ h/wk.

**Interventions:** Not applicable.

**Main Outcome Measures:** Number of required wheelchair repairs and resulting consequences (ie, being stranded, missing work/school, or missing a medical appointment).

**Results:** Rates of required repairs (47.6%–63.3%) and consequences (26.7%–40.7%) were high across manufacturers. Differences between manufacturers were found among PWCs without seating functions ( $P < .001$ –.008) and among group 2 wheelchairs ( $P = .007$ ). Across the 10 most prescribed wheelchairs in this study, 54.5% to 73.9% of users required 1 or more repairs over a 6-month period. Increases in the number of repairs were also found for several PWC manufacturers with time. Differences were found in participant age, working status, years since injury, and presence of seating functions between manufacturers.

**Conclusions:** The differences found in the number of repairs reported by survey respondents based on PWC manufacturer and the increases in repairs over time require further evaluation.

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In 2009, the Centers for Medicare and Medicaid Services (CMS) reported providing power wheelchairs (PWCs) to 46,134 wheelchair

users.<sup>1</sup> Wheelchairs allow individuals to overcome physical limitations and increase independence.<sup>2,3</sup> Further, PWCs offer seating functions that are essential to pressure relief, functional support, and postural support.<sup>4</sup> Unfortunately, studies<sup>5-7</sup> have shown that wheelchairs often fail to meet their expectations for durability and reliability as set by the American National Standards Institute (ANSI) and Rehabilitation Engineering and Assistive Technology Society of North America (RESNA), who create and oversee the wheelchair standards in the United States. ANSI/RESNA standards allow for objective wheelchair comparison and include standardized testing for durability and safety by simulating 3 to 5 years of typical use.<sup>6</sup> The aforementioned studies demonstrate that subpar durability in

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wheelchairs is spread across various manufacturers and wheelchair types. However, these tests only mimic wheelchair use and are not actual reports of failures related to use.

Worobey et al<sup>8</sup> reported that wheelchair breakdowns and consequences have increased in recent years. As a follow-up to that study, the goal of this study was to identify differences between PWC manufacturers in terms of the amount of reported repairs and adverse consequences. Wheelchairs were compared overall and also based on PWC Healthcare Common Procedure Coding System (HCPCS) groups. We also examined the rates of required repairs and adverse consequences based on the presence of seating functions and among the 10 most frequently prescribed PWC models. Additionally, this study sought to determine whether there were any differences over time within each manufacturer by comparing the frequency of reported repairs and the consequences between a current and historical data set. Outcomes of this study may inform clinicians about rates of required repairs and consequences as well as draw attention to high repair rates across manufacturers.

## Methods

### Participants

Participants were enrolled if they were older than 16 years, had neurologic impairment resulting from a spinal cord injury (SCI) that occurred at least 1 year before the study, were treated at a national Spinal Cord Injury Model System (SCIMS) site, and used a wheelchair  $\geq 40$ h/wk.

### Data collection

Participants completed a questionnaire over the phone or in person regarding the number of repairs required in the 6 months before the study. The 6-month period was selected to maximize the likelihood of accurate recall of the number of required repairs.<sup>9</sup> If repairs were required, participants were asked to indicate whether the following consequences occurred: no consequence, been stranded, been injured, missed work or school, and/or missed a medical appointment. Participants reported sex, race, age, years since injury, occupation, and characteristics of the wheelchair they used most often including type and seating functions (tilt-in-space, recline, elevating leg rests, seat elevator, standing).

Data were collected from participants at SCIMS facilities. The SCIMS program maintains the National Spinal Cord Injury Database (NSCID), which is the world's largest SCI research database. Participants of the NSCID are contacted 1 year after injury and every 5 years thereafter. NSCID participants in our study completed the survey as part of their follow-up. The NSCID

has been found to be a reliable source regarding persons with SCI and captures approximately 13% of new injuries.<sup>10,11</sup> All SCIMS centers obtained approval from their local institutional review boards before the implementation of study procedures.

For the historical data set, participants were recruited from 16 SCIMS facilities from April 2004 through March 2006 in the following cities: Atlanta, GA; Ann Arbor, MI; Birmingham, AL; Boston, MA; Columbia, MO; Englewood, CO; Downey, CA; Houston, TX; Miami, FL; New York, NY; West Orange, NJ; Philadelphia, PA; Pittsburgh, PA; Richmond, VA; Seattle, WA; and San Jose, CA. Participants in the current data set were recruited from 6 SCIMS facilities from June 2006 through February 2011 from the following cities: Chicago, IL; Cleveland, OH; Washington, DC; West Orange, NJ; Philadelphia, PA; and Pittsburgh, PA. In addition to NSCID participants ( $n=116$ ), the current data set also drew from local research registries that allowed sites to have people complete the survey who were receiving care at an SCIMS facility but were not currently enrolled in the NSCID ( $n=141$ ).

To be included in the analysis, participants had to report the manufacturer of their wheelchair and the number of repairs experienced. In order to be inclusive and have a large enough sample to draw conclusions, we only included PWCs by manufacturers that had at least 20 users; thus, Frank Mobility was excluded. Not all of the wheelchairs used by participants in this study are still on the market. However, because models are constantly changing and because performance of previous models could be indicative of performance of later models by the same manufacturer, we elected to keep them in the study.

### Data reduction and statistical analysis

The number of repairs reported was dichotomized into 2 groups: repairs and no repairs. Consequences experienced were analyzed individually and also dichotomized as consequences and no consequences. The number of seating functions was dichotomized as present or absent. Occupation was dichotomized to working/student (working, on-the-job training, sheltered workshop, student) or unemployed/at home (homemaker, retired, unemployed).

For the participants who reported the manufacturer's name and model of their PWC, we determined the appropriate HCPCS groups, and comparisons were made across HCPCS groups.<sup>12</sup> CMS classifies PWCs into 4 HCPCS groups: 1, 2, 3, and 4. These groups classify wheelchairs based on the size of the wheelchair base, user weight that can be accommodated, range the wheelchair can travel, top speed, type of seating, and number of seating functions that can be accommodated. HCPCS groups were used rather than K-codes, since these data span a change in coding for K-codes and information such as type of seat and weight capacity that cannot always be determined from the make and model.

Variables were not normally distributed, so comparisons were made using the Kruskal-Wallis and Mann-Whitney *U* tests. SPSS version 19<sup>a</sup> was used to perform all statistical analyses. The significance level was set a priori to  $\alpha=.05$ . Addressing the primary hypothesis, comparisons were made between manufacturers. For our secondary hypotheses, comparisons were also made based on HCPCS groups, wheelchair model, and seating functions, and between data sets, to look for changes over time.

## Results

A total of 1114 full time PWC users met inclusion criteria for this study. Data from 146 of the 1114 participants were excluded from

#### List of abbreviations:

ANSI	American National Standards Institute
CMS	Centers for Medicare and Medicaid Services
E&J	Everest & Jennings
HCPCS	Healthcare Common Procedure Coding System
NSCID	National Spinal Cord Injury Database
PWC	power wheelchair
RESNA	Rehabilitation Engineering and Assistive Technology Society of North America
SCI	spinal cord injury
SCIMS	Spinal Cord Injury Model Systems

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