

INCREASES IN WHEELCHAIR REPAIRS, BREAKDOWNS, AND ADVERSE CONSEQUENCES FOR PEOPLE WITH TRAUMATIC SPINAL CORD INJURY

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ABSTRACT

This study found a significant increase in the number of repairs and adverse consequences experienced by wheelchair users compared to historical data. Within a 6-month period over half of those surveyed reported requiring a repair with 32.2% of those individuals experiencing consequences from wheelchair breakdown. Inflation of these numbers may be tied to the production of lower quality wheelchairs and may be the result of health insurance reimbursement policies. Further investigation into causality is required and intervention is needed to reverse this potential trend.

BACKGROUND

Greater than 2.8 million Americans use a wheelchair for mobility (LaPlante, 2010). This assistive technology provides users with the opportunity to achieve greater independence in physical functioning, mobility, home life, and vocational settings. Unfortunately, wheelchairs can pose a risk to users when failures occur. McClure et al. (2009) found that 44.8% of full time wheelchair users experienced at least 1 repair in a six month period. Wheelchair breakdown can cause adverse consequences ranging from minor inconveniences to decreased physical functioning, quality of life and safety. In a study by Gall et al. (1997), 33% of adverse incidents and injuries were associated with wheelchair component failure. Another study by Xiang et al. (2006) reported 62.9% of injuries for users 2-5 years of age and 20% of adult injuries were due to component failure.

Efforts have been made by the International Standards Organization, the American National Standards Institute (ANSI), and the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) to develop standards to decrease such incidents of injury and failure. However, current policy does not require wheelchair manufacturers to perform external testing of these standards for the wheelchairs they produce. Laboratory studies have found that many wheelchairs on the market do not meet the aforementioned standards (Fass, 2004; Cooper, 1997; Cooper, 1999). In addition, vendors are reimbursed for wheelchairs according to a coding scheme which is independent of the cost and quality of the device. Such

practices generally encourage cost-cutting and result in lower quality products. Further, policy changes by the Centers for Medicare and Medicaid Services have altered reimbursement protocols which are followed by most insurance providers. The goal of this study was to report the current incidence of wheelchair repairs, breakdowns and consequences and to compare current data to historical data.

METHODOLOGY

Data for this study were collected between June 2006 and February 2011 at 6 Spinal Cord Injury Model System (SCIMS) sites. Participants were enrolled in the study if they were over the age of 16, had a spinal cord injury with discernable neurologic impairment that occurred at least one year ago, were treated at a SCIMS center, and used a wheelchair over 40 hours per week. Subjects answered questions regarding their demographics, wheelchair, and occupation status. Subjects were asked specific questions about the number of repairs required in the last 6 months. Those who indicated repairs were asked to indicate which of the following 5 consequences occurred: (1) no consequence, (2) been stranded, (3) been injured, (4) missed work or school, or (5) missed a medical appointment. The current data set was also compared to a historical data set of 2213 full time wheelchair users collected between April 2004 and March 2006 (McClure et al., 2009) to look for changes over time on the number of repairs and adverse consequences of breakdowns. All centers obtained IRB approval from their local Institutional Review Boards prior to the implementation of study procedures. Further methodology can be found in Worobey et al., 2012.

Data Reduction and Statistical Analysis

To allow for data analysis, the number of repairs variable was recoded into a categorical variable. First, this variable was dichotomized to determine the percentage of participants who needed repairs. Next, the number of repairs variable was recoded into the categories 1, 2-3, and 4 or more repairs. The four consequences were analyzed individually, summed for each person, and also recoded to 0 or 1 or more consequences. Comparisons were made to determine whether subject characteristics such as race, gender and occupational status corresponded with a higher

number of repairs or consequences. Variables were not normally distributed so comparisons were made using either the Kruskal-Wallis or Mann-Whitney U tests. The Holm test was used to correct for multiple comparisons. Comparisons were made across individuals reporting/not reporting repairs and consequences. Chi-square analysis was completed to determine whether wheelchair characteristics were associated with a greater number of repairs or adverse consequences. This set of data was also compared to historical data reported by McClure, 2009. All statistical analyses were completed using SPSS version 14.0. The level of significance was set a priori at $\alpha=0.05$.

RESULTS

A total of 726 full time wheelchair users participated in this study. Participants were on average 42.9 ± 13.79 years of age and 12.5 ± 11.0 years post injury. Demographic information on this group can be found in Table 1. There were no significant differences in amount of repairs or adverse consequences experienced based on age, years since injury, or gender. No significant differences in demographics existed between this data set and the historical data set.

Table 1: Demographic characteristics of study participants

Characteristics	Number of Subjects (%)	Number not reported
Sex		3
Male	585 (80.9)	
Female	138 (19.1)	
Wheelchair Type		0
Manual	435 (59.9)	
Power	272 (37.5)	
Power assist	19 (2.6)	
Injury Level		20
Paraplegia	325 (46.0)	
Tetraplegia	381 (53.0)	
Occupational status		87
Working/Student	353 (49.4)	
Unemployed/At Home	282 (39.4)	
Other	80 (11.2)	

A summary of repairs and consequences compared to historical data can be found in Table 2. 52.6% of participants reported at least one repair in the past 6 months representing a significant increase in the number of repairs compared to historical data ($p<0.001$). A significantly higher number of repairs per person were reported across all participants as compared to historical data ($p<0.001$). The average number of repairs across only those reporting at least one repair was 2.75 ± 4.57 . Of those who could recall the exact number of repairs completed in the last 6 months, 45.8% reported 1 repair, 36.9% reported 2 to 3 repairs, and 17.3% reported 4 or more repairs. A total of 6.7% reported repairs, but could not remember the exact number completed.

There was a significant increase in the number of individuals reporting adverse consequences compared to historical data ($p<0.001$). A total of 178 adverse consequences resulting from wheelchair breakdown were reported. A significantly higher number of consequences per person were reported as compared to historical data ($p<0.001$). Of these consequences, 73.1% reported being stranded, 13.4% reported being injured, 31.1% reported missing school or work, and 32.0% reported missing a medical appointment as a result of wheelchair breakdown. Compared to historical data, a significantly higher percentage of people reported being stranded, injured, missing school/work and missing a medical appointment ($p<0.001$). Of those experiencing consequences, 64.7% experienced 1 consequence, 23.5% experienced 2 consequences, 9.2% experienced 3 consequences, and 2.5% experienced all 4 listed consequences.

Table 2: Historical comparison of Repairs and Consequences

	Current Data (2006-2011)	Historical Data (2004-2006)	p-value
1 or more Repairs	52.6%	44.8%	<0.001
# Repairs/person	1.43 ± 3.56	1.03 ± 2.68	<0.001
1 or more Consequences	31.2%	22.1%	<0.001
# Consequences/person	0.47 ± 0.81	0.30 ± 0.65	<0.001

Subject Characteristics

There was a significant difference in whether consequences were experienced and the total number experienced based on race. Caucasians were less likely to experience consequences ($p=0.031$) and experienced fewer consequences ($p=0.028$) than minorities. Caucasians were more likely to have a backup wheelchair ($p<0.001$). There was an increase in the percentage of minority participants as compared to historical data (23.3% to 39.6%, $p<0.001$). Differences were found in type of funding and combined annual household income between Caucasians and minorities ($p<0.001$). Specifically, there were more minorities in the income brackets of less than \$10,000 ($p<0.0001$) and \$10,000-\$14,999 ($p=0.008$) and more Caucasians in the income brackets of \$35,000-\$49,999 ($p=0.004$) and \$75,000 or more ($p<0.001$). Significantly more minorities reported Medicare/Medicaid as their funding source for their wheelchair (68.6% vs 31.0%, $p<0.001$) and significantly fewer minorities reported private/prepaid insurance as their funding source (14.9% vs 40.5%, $p<0.001$) as compared to Caucasians. Minorities were less likely to have a seat elevator ($p=0.012$) and elevating legs ($p=0.038$).

Consistent with historical data, there were no significant differences in repairs ($p=0.641$) or consequences ($p=0.319$) reported based on occupational status. There were no significant differences in repairs or consequences reported based on level of education and no significant differences in level of education between the two sets of data. The primary funding source which paid for the most

for the participant's wheelchair is as follows: 28.9% Private/Prepaid insurance, 1.6% Department of Vocational Rehabilitation, 46.8% Medicare, 15.8% Worker's Compensation/Veteran's Affairs, 6.9% Self pay. Funding source did not affect the number of repairs or consequences experienced but did differ from historical data ($p < 0.001$). Specifically, there was an increase in those funded by Medicare/Medicaid ($p < 0.001$) and Worker's Compensation/Veteran's Affairs ($p = 0.001$) and a decrease in those funded by Private/Prepaid insurance ($p < 0.001$), Department of Vocational Rehabilitation ($p = 0.033$), and Self-Pay ($p = 0.038$). Significantly fewer people reported having a back-up wheelchair (34.4%) as compared to historical data (62.8%, $p < 0.001$). Additional results may be found in Worobey et al., 2012.

DISCUSSION

Compared to historical data, there has been a significant increase in number of individuals requiring at least one wheelchair repair in a 6 month period. When repairs were required, significantly more participants experienced 4 or more repairs. In addition, a greater number of participants experienced adverse consequences as a result of breakdown. The total number of consequences divided by the number of participants more than doubles that of historical data. It is possible that this increase in the number of repairs is the result of a decrease in wheelchair quality resulting from changes in reimbursement policies and lack of enforcement of standards testing.

Economic Impact

Minorities were more likely to experience a consequence and a higher number of consequences per person. This disparity in performance of assistive technology is consistent with previous studies which have concluded that there remain groups of individuals with disabilities which are not adequately supported by programs with financing for assistive technology (National Council on Disability, 2006). Minorities were also less likely to have a working back-up chair. Individuals rely on wheelchairs to complete mobility related activities of daily living. When a repair is required which prevents a chair from functioning properly, it is often necessary to rely on the use of a back-up chair. The decreased presence of back-up wheelchairs is likely tied to the increased number of consequences reported. Based on the reported funding sources and income levels, this group appears less likely to have the means to accommodate a breakdown. This is in accordance with previous research by Hunt et al, (2004) who found sociodemographic factors were related to receipt of lower quality wheelchairs including minority status, less education, public sector insurance, and annual combined family income below poverty level ($< \$10,000$).

Centers for Medicare and Medicaid Services (CMS) Policies

In 2010 Medicare provided healthcare to 47.4 million Americans (Plunkett Research, 2011). The effect of policies developed by CMS span beyond this group as many insurance providers follow the reimbursement procedures laid out by CMS. CMS uses common procedure codes to categorize durable medical equipment (DME). Reimbursement policies are the same for all chairs within each code. Since there are no current requirements for external ANSI/RESNA testing to ensure consistent quality across chairs within a group, this approach may encourage cost reduction. Quality of chairs may be sacrificed in order to create a higher profit margin.

One of the Medicare Part B requirements for a mobility device is it is appropriate for use in the home. Over time this has been redefined to mean that features of the mobility device not required in the home would not be covered (ITEM, 2006). However, it is not realistic to assume individuals will not require use of a wheelchair outside of the home as well for attending medical appointments, going to work or school, and interacting in the community, etc. This disparity may contribute to the increase in repairs and breakdowns if wheelchairs are only built for the home environment.

Study Limitations

There are several limitations to consider with this study. While we asked about the number of repairs and the type of consequence, we did not ask participants about the number of consequences reported. For example, an individual may have experienced a consequence every time his/her wheelchair was repaired, however it was only noted this consequence occurred. As such, we may have underrepresented the number of consequences experienced. Another limitation is recall bias as participants were asked to recall repairs that occurred up to 6 months prior to data collection. Further, all subjects were recruited from SCIMS facilities, which are centers of excellence so we may have underestimated the number of repairs and consequences as compared to the general population.

FUTURE WORK

It is evident from this work that there has been a significant increase in the number of required repairs and consequences from wheelchair breakdown. Future studies need to look at manufacturer and model of wheelchairs to see if differences can be identified which can allow for targeted prescription of higher quality wheelchairs. Further, future studies also need to educate wheelchair users on maintenance. It is possible that education on routine maintenance such as replacing cushions, caster wheels, and batteries at given time points can help prevent repairs and consequences resulting from wheelchair breakdown.

CONCLUSIONS

This study found a significant increase in the number of repairs and consequences with 52.6% of full-time wheelchair users experiencing at least one wheelchair repair in the past 6 months and 32.2% of those individuals experiencing at least one consequence as a result of wheelchair breakdown. Minorities experienced a greater frequency of breakdown and higher number of reported consequences. There were no differences in repairs and consequences based on occupational status, gender, age, years since injury, level of formal education, or funding source. The increase in required repairs and consequences may be associated with a decrease in wheelchair quality. The repairs and consequences encountered by users may be avoided by maintaining compliance with national wheelchair standards, improving patient and clinical education, and reforming health insurance reimbursement policies.

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