

Transportation Technology Utilization by Persons with Disabilities: Retrospective Analysis of a Proprietary Client Database



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ABSTRACT

Objective: To carry out a preliminary study of the safety and reliability of aftermarket motor vehicle adaptive equipment utilized by consumers with disabilities

Design: Retrospective record review

Setting: Community-based proprietary database from a regional consulting firm specializing in vehicle modification and transportation access

Participants: 2150 clients with physical disabilities

Main Outcome Measures: Descriptive and ordinal analysis of data pertinent to the report of motor vehicle accidents and equipment malfunction

Results: The aggregate cost of vehicle modifications in this group exceeded 12 million US dollars. Our analysis focused upon severely disabled clients that had been outfitted with expensive, high-technology driving systems. Long-term outcomes data had not been actively solicited by the consulting firm, but considerable information on mechanical malfunctions and automobile collisions had been tabulated based upon unsolicited self-reports of adverse events by clients and third party payors. Clients with a wide variety of disabling conditions were studied. Overall, 29 road traffic accidents (1 fatal) were reported, along with 36 equipment malfunctions. Across many types of vehicle modifications,

both equipment malfunction (Chi-square $p < 0.00$) and vehicle collisions ($p < 0.00$) were associated with the use of expensive, hi-technology driving systems with power assisted steering. Persons disabled from spinal cord injury (SCI) ($p = 0.01$) and especially those with tetraplegia ($p = 0.001$) were likely to report accidents and equipment failures, compared to other diagnoses. Among other groups with severe disability, spinal muscular atrophy was associated with accidents and vehicle malfunction ($p < 0.00$), but muscular dystrophy was not ($p = 0.75$)

Conclusions: In a large and varied group of disabled persons who had sought consultation for drivers rehabilitation technology, vehicle accidents and equipment malfunctions were most likely to be reported in instances where tetraplegic SCI clients utilized high-technology driving systems.

BACKGROUND

Review of National Highway Traffic Safety Agency (NHTSA) and Centers for Disease Control (CDC) studies reveals:

- As a group, disabled drivers who use vehicle adaptations are no more likely to have vehicle crashes or injuries than their able-bodied counterparts.
- Mechanical hand controls have been safely used for over 60 years and have undergone comparison testing by NHTSA

HOWEVER:

- Previous studies have employed derivative statistics, and are unable to discriminate the relative risks faced by persons with specific types of disabilities or vehicle modifications.
- NHTSA studies note that drivers of adapted vans report the lowest level of confidence in their vehicles' safety and reliability

Figure 1



METHODS

We obtained unrestricted access to the records of a regional, multi-state consulting firm that specializes in promoting private vehicle accessibility for disabled persons.

This database contains the records of 2150 clients with a wide variety of disabilities. Long-term outcomes data had not been actively collected by the consulting firm, but considerable information on mechanical malfunctions and automobile collisions had been obtained, based upon unsolicited self-reports of adverse events by clients and third party payors. Chi-square analysis was carried out to discern whether specific disabilities or types of vehicle modifications were significantly associated with reported vehicle malfunctions or vehicle crashes.

Figure 2



RESULTS SUMMARY

These factors were significantly associated with reports of vehicle malfunction and crashes:

- Use of high-technology driving systems with power assisted steering
- Having the diagnosis of spinal cord injury or spinal muscular atrophy
- Tetraplegic neurological status.

INCREASED RISKS?

The risk of adverse vehicle events in the disabled population may be increased by:

- Impaired functional abilities of the disabled driver
- Overestimation of driver capabilities
- Mismatch between driver and technology
- Untested and unregulated disabled-driving technology products
- Mismatch between products and a myriad of different vehicles
- Incorrect installation/maintenance of vehicle adaptive equipment
- Inadequate disabled driver training and evaluation

Most Common Disabling Diagnoses among 2150 Clients Seeking Transportation Consultation

Diagnosis	N
Spinal cord injury	680
Multiple sclerosis	226
Cerebral palsy	151
Spina bifida	135
Muscular dystrophy	115
Stroke	57
Post polio syndrome	46
Brain injury	25
Other disabling diagnoses	715

Vehicle Crash and Malfunction Reports in 2150 Disabled Persons (N=29)

	Reported Crash N=29	Chi test	Reported Malfunction N=36	Chi test
Spinal Cord Injury (SCI)	15 of 680	$P = 0.018$	23 of 680	$P = 0.000$
No SCI	14 of 1470		13 of 1470	
Tetraplegia	18 of 538	$P = 0.0002$	27 of 538	$P = 0.000$
Paraplegia	2 of 562		1 of 562	
Muscular Dys. (MD)	2 of 120	$P = 0.75$	3 of 120	$P = 0.462$
No MD	27 of 2030		33 of 2030	
Spinal Musc. Atrophy (SMA)	3 of 19	$P = 0.000$	4 of 19	$P = 0.000$
No SMA	26 of 2131		32 of 2131	
Assisted Steering (AS)	24 of 201	$P = 0.000$	36 of 201	$P = 0.000$
No AS	5 of 1949		0 of 1949	

CONCLUSIONS

In a group of 2150 disabled persons utilizing private vehicle modifications for transportation, reported crashes and equipment malfunctions were uncommon, but were most likely to be noted in instances where tetraplegic spinal cord injured persons utilized expensive, high-technology driving systems. Every aspect of vehicle operation in this setting deserves higher scrutiny and further study.

For Further Information

Automotive Safety Issues for Persons with Disabilities
www.nhtsa.dot.gov/cars/rules/adaptive/
 National Transportation Availability and Use Survey 2002
 Bureau of Transportation Statistics
www.bts.gov/omnibus_surveys/targeted_survey