

CHARACTERISTICS OF INJURY EVENTS AMONG WHEELCHAIR USERS IN MOTOR VEHICLE TRANSPORT

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IMPORTANCE OF THE PROBLEM - Recent changes in societal perspectives and legislation and regulation have led to an increased use of public and private vehicles by persons in wheelchairs. The injury risk to wheelchair occupants in motor vehicles, though, is not fully understood. Transportation settings unique to wheelchair users contribute to the likely risks. For example, safety implications apply to individuals when getting into or out of the vehicle on lifts or ramps. Once inside the vehicle, the wheelchair may tip if it is not properly secured, or the individual may fall from the chair if not appropriately restrained. Wheelchair occupants also face risks from moving vehicle crashes, as most wheelchairs are not crashworthy.

OBJECTIVE – We surveyed a large cohort of wheelchair users to identify the frequency of injury involvement in transportation settings. We focused on injuries occurring during vehicle loading and unloading, injuries from sudden vehicle maneuvers, and injuries from crashes. We also examined if the characteristics associated with the reported injury events differ by transportation factors (type of vehicle, mode of vehicle use, and wheelchair securement and restraint use).

METHODS - This report represents a cross-sectional study of the transportation and injury experiences of 336 wheelchair users. All respondents met the eligibility criteria for the study; they used a wheelchair as their primary means for mobility, and they used the wheelchair as a seat in either a public or private vehicle. Nationwide

recruitment was conducted to identify participants. Over 100 distinct disability groups were contacted to identify subjects. Advertisements in newsletters and message boards were also used.

Participants interested in the study (n=600) were given a brief interview by telephone to verify eligibility. This was followed by a 10-page survey that queried transportation use and related injuries among eligible subjects (n=418). 336 persons completed this survey between June 2002 and April 2004. Demographic characteristics of the subjects included average age: 42.6 years, 47% male, duration of use of wheelchair: 18.8 years, and 62% power wheelchair users.

Participants were asked to recall the injuries incurred while using transportation over the previous 3 years. These injuries were categorized by type of vehicle use. This included injuries from loading or unloading from the vehicle, and injuries arising from non-crash situations. Non-crash situations include examples such as the chair tipping or person falling due to quick or sudden braking, sharp turning, and quick acceleration. Injuries from vehicle crashes were also queried.

RESULTS – Transportation use reported in the survey was varied. Overall, 27.9% reported driving at least monthly, 67.8% rode as passengers in private vehicles, 21.4% rode in buses, and 35.4% in paratransit.

Injuries were most frequently reported while loading or unloading from a vehicle. Fifty-three persons (15.8%) reported 99 unique injuries while loading or unloading from a vehicle, at a rate of 43.1 events per 100,000 miles traveled. Extended details were reported on 86 of the 99 incidents. These injuries were noted more often in family (56.6%) rather than paratransit (31.3%) and public bus (9.8%) vehicles. Reported injuries were evenly distributed between loading (44.7%) and unloading (39.5%) events.

Fifty-two persons (15.7%) reported 105 injuries from sudden vehicle maneuvering (31.8 events per 100,000 miles traveled). Most injuries arose from sudden braking (50%) or sharp turning (33.3%), and the wheelchair tipping (33%) or person falling out of the chair (15.3%). Seat belt and securement use was not related to these reported injuries. However, of note was that most of the injuries reported were minor in nature. Only 12.9% of the injuries required medical attention. Table 1 describes the person, environment and injury characteristics of these incidents. Greater involvement was noted for females and paratransit vehicles in these injuries.

Crash involvement in the previous 3 years was reported by 50 persons (14.9%)(10.6 events per 100,000 miles traveled). Extended details were reported on 55 of the 65 crashes. Most crashes (70%) involved 2 or more vehicles, 62% were police-reported, and 38% led to an injury in the wheelchair occupant. No difference in injury occurrence in a crash was observed by seat belt or securement use. With regard to vehicle type, 70.0% of the crashes occurred in a private vehicle, 23.4% occurred in a paratransit vehicle, and 6.7% involved a bus. Two-thirds of the injuries reported required medical attention for treatment. Table 2 outlines the characteristics of the medically-treated injuries. A high percentage of individuals with quadriplegia (60%) were involved. There was an even distribution between family and paratransit vehicles.

DISCUSSION – Distinct patterns of injury frequency were noted in this report for persons in wheelchairs. Injury risk while using motor vehicles appears to be highest while loading or unloading from vehicles. Injuries from vehicle maneuvering are common, but not severe. Injuries from crashes are infrequent. There was no reported difference in injury frequency among persons by seat belt/securement use while in motor vehicles.

This study is one of the first reports of the injuries faced by wheelchair users in motor vehicle transport. The survey methodology used in this report overcomes the limited ability to identify wheelchair users in existing injury/crash data sources. The study population, though, represents a convenience sample, and it is possible that selection bias may influence the results. The results supplement existing research on the engineering and biomechanics of wheelchair failure during crashes by documenting the types and characteristics of injury events encountered. This information lays the foundation for future studies to fully evaluate the transportation risks faced by wheelchair users.

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Table 1: Characteristics of Non-Crash Injuries Requiring Medical Attention

PERSON				INJURY						
Disability	Gender	Age (yrs.)	Mode	Securement Use	Restraint Use	Wheelchair	Vehicle Type	Body Part	Injury Type	Days Off
Amputee	Male	48	Passenger	X		Manual	Paratransit	Ribs & Thigh	Fractures & Contusion	0
TBI	Male	39	Passenger			Manual	Paratransit	Face & Head	Abrasions	2
Degenerative Bone Disease	Female	53	Passenger	X	X	Power	Paratransit	Chest & Ribs	Contusion	0
CP	Female	33	Passenger		X	Power	Paratransit	Abdomen & Leg	Internal Injuries & Contusion	90
MS	Female	51	Passenger			Power	Paratransit	Shoulder & Head	Dislocation	360
TBI	Male	39	Passenger		X	Manual	Paratransit	Face	Abrasions	1
Quadraplegia	Female	52	Passenger	X		Power	Private	Left Ankle	Fractures	Missing
MS	Female	39	Passenger	X		Power	Bus	Knee & Hip	Contusions	1
Paraplegia	Female	50	Passenger			Manual	Bus	Head, Arm & Leg	Head Trauma & Contusion	3

Table 2: Characteristics of Crash Injuries Requiring Medical Attention

PERSON				ENVIRONMENT					INJURY			
Disability	Gender	Age (yrs)	Transport Mode	Securement Use	Restraint Use	Wheel-chair	Vehicle Type	# of Vehicles Involved	Vehicle Towed	Body Part	Injury	Days Off
Quadraplegia	Male	44	Driver	X	X	Manual	Private	2		Neck & Hands	Whiplash	0
Quadraplegia	Male	44	Driver	X	X	Manual	Private	2	X	Abdomen & Neck	Whiplash	4
Quadraplegia	Female	34	Passenger		X	Power	Private	1	X	Head & Leg	Contusion	210
Quadraplegia	Male	56	Passenger	X	X	Power	Private	2	X	Head	Head Trauma & Abrasions	7
Quadraplegia	Female	63	Driver	X	X	Power	Private	1	X	Face	Abrasions	0
Cerebral Palsy	Female	33	Passenger	X	X	Manual	Para-transit	2		Ankle	Fracture	0
MS	Female	46	Passenger			Manual	Para-transit	Missing	Missing	Face	Contusion	0
Spina Bifida	Male	30	Passenger	X	X	Manual	Para-transit	1	X	Upper Back	Whiplash	1
CP	Female	12	Passenger	X		Power	Para-transit	2	X	Hip	Fracture	25
Quadraplegia	Male	55	Driver	X	X	Manual	Para-transit	1	X	Head	Fractures & Contusion	0