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Towards an understanding of the full spectrum of travel-related injuries among older people

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ABSTRACT

The development of a traffic system that is age-attuned needs to take account of both mobility and safety issues, in particular in terms of interventions which lead to a change in the relative proportion of modes of transport utilized, as has been postulated for the impact of medical screening of older drivers. Statistics for travel-related injury have been dominated by impacts between motorized vehicles and either other motorized vehicles or unprotected road users to the point of neglecting other significant forms of traffic-related injury.

This review of research in two emerging areas of concern – non-collision injuries in public transport and single pedestrian accidents – confirms that both of these causes of death and injury in traffic require further research and monitoring in traffic injury prevention. Although the research base is slender, the data is consistently suggestive of significant need for both concern and further research, and to ensure that the factors underlying these accidents are addressed so as to enhance preserved safe mobility for older Europeans.

1. Introduction

The development of a traffic system that is age-attuned needs to take account of both mobility and safety issues, in particular in terms of interventions which lead to a change in the relative proportion of modes of transport utilized, as has been postulated for the impact of medical screening of older drivers (O'Neill, 2012). For example, studies have shown that older women, who are still fit to drive, often choose not to renew their driver's licence when screening is required (Siren et al., 2004). In addition, studies of jurisdictions with routine medical screening of older people show no change in death and injury among protected road users but increases among protected road users, leading to concerns that this represents a shift in transport modality (Siren and Meng, 2012).

From a safety perspective, it is becoming clear that the statistics for traffic-related injury have been dominated by impacts between motorized vehicles and either other motorized vehicles or unprotected road users to the point of neglecting other significant forms of traffic-related injury.

Two emerging areas of concern are those of non-collision injuries in public transport and single pedestrian accidents. Although the research base for these forms of accidents is slender, the data is consistently suggestive of significant need for both concern and further research, and to ensure that the factors underlying these accidents are addressed so as to enhance preserved safe mobility for older Europeans. A particular impetus is also given by the possibility that current policies in some European countries, such as medical screening of older driver, may give rise to increased use of both public transport and walking (Hakamies-Blomqvist et al., 1996).

2. Methodology

A search was undertaken on the Transportation Research Board TRID, MedLine (PubMed), CINAHL and PSYCHINFO databases using the search terms: a) "non-collision" AND (bus or "public transport") AND (injury OR injuries OR accidents OR death), and b) "Accidental Falls"Mesh AND ("Aged"Mesh OR "Aged, 80 and over"Mesh) AND (outdoors OR pedestrian) from 1970 to 2015. The resulting papers were

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screened for relevance to one or both topics on the basis of relating to falls, injury and death associated with non-collision bus injuries and single pedestrian accidents. The search on non-collision injuries on public transport produced 5 relevant papers in MedLine, 11 in TRID, 2 in PsycInfo and none in CINAHL. For single pedestrian accidents, the MedLine search produced 95 papers, of which 24 were considered relevant, CINAHL search "DH accidental falls AND DH aged AND (pedestrian OR outdoors)" uncovered 13 papers of which 6 were considered relevant, 2 in TRID, and none in PsycInfo.

3. Non-collision injuries in public transport

Non-collision bus injuries, those which do not involve crashes with other vehicles, pedestrians or fixed objects, have assumed an increasing importance, given knowledge that such injuries can be serious, and account for a significant proportion of bus and coach injuries across the lifespan. One of the earliest studies reviewed accident data over a period of 12 months supplied by 30 bus operators, and covering about 30,000 vehicles in the UK. 56% of the passenger injuries were sustained in non-collision accidents and 43% of these occurred to passengers who were estimated to be over 60 years of age: in terms of the relative concern for older people, contemporary surveys suggested that elderly passengers average less than 20% of all passengers carried. Reported accident rates for females over 60 years of age were higher than those for males in this age group. Boarding accidents formed an especially significant proportion of accidents to the elderly and aisle accidents were a special risk for female passengers of all ages. The data available did not permit the effect of vehicle layout and furnishing to be clearly related to accidents (Transport and Road Research Laboratory, 1980). In a related study they investigated bus design and acceleration patterns with 60 older people, and made recommendations on handhold and step design, as well as acceleration patterns for standing and sitting passengers.

A Swedish study supported these trends but also emphasized the gravity of many of the accidents: it indicated that more than half of bus and coach injuries occurred other than in a collision, 43% had injuries with a Maximum Abbreviated Injury Score of 2+ and 57% of all days at hospital were caused by non-crash events (Björnstig et al., 2005). Of these accidents, two-third occurred on boarding or alighting, and one-third while the bus was moving. The authors calculated an incidence rate of 2 bus and coach injuries per 10,000 population per year.

Most of these accidents occur in local bus or transit systems, with most occurring at a speed of less than 30 miles per hour (Kirk et al., 2003). A study from the transportation system in Portland, Oregon, showed a similar breakdown of safety incidents, with 43% arising from non-collision injuries (Strathman et al., 2010). Over 80% of non-collision incidents involved passenger slips, trips, and falls, and about 44% of these incidents occurred during boarding or alighting. Other slip, trip, and fall incidents often occurred during the phases of acceleration and deceleration associated with bus stops. The remaining non-collision incidents were associated with a wide variety of circumstances, the most common being struck by a door movement, or by a falling or moving object in the vehicle. Non-collision incidents peaked between the hours of 16.00 and 18.00.

Although a relatively small proportion of journeys by older people are made by public transport, with a tendency towards use by those who are physically more fit (Davis et al., 2011), there are a range of reasons why this is the case (Rupprecht, 2007), including access (Davey, 2007), convenience, security, but also unhappiness with the stability of buses and trams and the risk of falling or injury (Broome et al., 2009). It is likely that older bus users remain more frail than younger passengers and that these fears are not groundless, as research indicates a significant number of injuries relating to public transport among older people (Mitchell and Suen, 1998).

In an Irish study of older people admitted to hospital with traffic injuries, almost one in eight were due to non-collision bus injuries (Cunningham et al., 2000). An Israeli study indicated that such injuries may amount to almost 1000 a year in that country, predominantly among older people (Halpern et al., 2005). In the United Kingdom, over half of injuries (57%) sustained in buses were classified as falls (Leyland Vehicles Ltd., 1990) or non-collision bus injuries (63%) (Kirk et al., 2003): this proportion was substantially greater with advancing age and among women.

Older people were also found to be over-represented in non-collision bus injuries in a US report, comprising 36% of non-collision injuries compared to 17% of collision injuries (Zegeer et al., 1993). These injuries occur during boarding and alighting, acceleration/deceleration, on turning and slip or trip-related falls. The predominance of older people was confirmed in a study in Serbia, with 52.6%, 48.9% and 49% of injuries in 2008, 2009 and 2010 respectively occurring in those over the age of 60 years old, of which 63–70% were women (Zunjic et al., 2012). The actual risk to older people may be higher, as these studies do not control for the proportion of bus users who are older.

Among the underlying risk factors are the issues of inappropriate acceleration and deceleration patterns (forces up to 0.2*G* measured in real-life situations, well over the range of 0.15*G* described by Hirschfield in 1932 as the threshold at which passengers begin to lose their footing (Hirshfield, 1932)) as well as inappropriate design of the internal structure of the buses in terms of both prevention and impact of primary and secondary injuries (Palacio et al., 2009), and the design and protocols of entry and exit from the bus (Björnstig et al., 2005). These issues are replicated in the reports of a high number of injuries related to braking in Austria and Germany. Resolving these problems will also help bus passengers of all ages, as a Swedish study suggests that non-collision bus and coach injuries span the life-course (Björnstig et al., 2005).

4. Single pedestrian injuries

Although falls among older people have been recognized as a significant public health issue for many decades in Europe, a relatively new interest in traffic medicine is the extent to which these occur outdoors (Li et al., 2006, Naumann et al., 2011), and particularly in geographical areas which can be considered to form part of the traffic environment.

The greatest challenge to delineating the extent of the problem is that these injuries and deaths are poorly captured in official statistics (Kormer and Smolka, 2009): most road traffic accident databases do not capture single-pedestrian accidents, and most falls and hip fracture databases do not capture the location of the fall, whether indoors, in garden/yard, or the traffic environment. This is despite the