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# Systematic review of the epidemiology of non-collision injuries occurring to older people during use of public buses in high income countries

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## ABSTRACT

Each year more than 6000 people are injured on public buses in the UK, approximately half of whom are aged 65 or over. This review synthesises the published literature on the epidemiology of non-collision injuries occurring in older people using public buses, to enable understanding of the size and nature of the problem of injuries, and to explore strategies for improving the safety of public transport for older people.

We searched PubMed, Embase, CINAHL, web of science, and Transport Research International Documentation (TRID). Studies were included if they were cross-sectional, case-control or cohort Studies. Pairs of reviewers independently screened Studies for inclusion, assessed risk of bias, and extracted data. Ten studies were included in the review. Older people and women were found to be over-represented in non-collision injuries. Most injuries occurred during daytime hours and on weekdays. Injuries most commonly occurred whilst passengers were standing and either moving around the bus, boarding, or alighting, and whilst the bus was accelerating or decelerating. Bruising was the most common injury amongst emergency department attenders, although between 18% and 33% suffered more serious injuries such as fractures or dislocations. Many injuries to older public transport users are potentially preventable public transport needs to be safe and accessible, and to be perceived as such by older people to ensure independence in outdoor mobility.

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## 1. Introduction

Public transport is often perceived as one of the safest means of transport, since the proportion of casualties that occur on public transport is very low (Department for Transport, 2011). However, each year more than 6000 people are injured on buses alone in the UK, with over 400 being killed or seriously injured (Department for Transport, 2008), approximately half of whom are aged 65 and over. Older people may be at increased risk of injury as a result of age-related health conditions such as stroke, arthritis, Parkinson's disease, dementia, sensory or cognitive impairment, balance or mobility problems, and frailty.

Due to the ageing population in the UK (Cracknell, 2010), most of whom will expect to live many years after retirement in good health, there is an ever-increasing number of potential older users of public transport. Older people may also be more reliant than others on public transport due to issues of income, subsidies for public transport, loss of a partner who drove, or loss of a driving licence due to physical or cognitive impairments. Public transport has been found to be vital for older people to provide access to goods and services to enable independent living, to enable older people to contribute to society through working, caring responsibilities or volunteering, and to avoid social isolation, with its attendant negative impact on health (Age Concern, 2008).

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However, people aged 80 years of age and over have been found to make only half the number of outdoor journeys, and to travel less than one-quarter of the distance, of those aged 50–54 years (Department of Transport, 2000). There is also evidence that elderly people find it difficult to utilise transport services because of an inability to carry heavy loads and a fear of crime when outside at night (Gilhooly et al., 2003). In addition, older people may be deterred from using public transport if they are afraid of falling (Logan et al., 2004). A study of 81 older people's experiences of outdoor mobility (Marsden et al., 2008) found that the barriers and enablers to using public transport are a complex mix of environmental, health, societal and psychological factors. A key message of the latter study was that improving independence in outdoor mobility is important in maintaining older people's wellbeing. Clearly, in order to ensure this independence, public transport needs to be safe and accessible, and also needs to be perceived as such by older people.

The aim of this systematic review was to synthesise the published literature on the epidemiology of non-collision injuries occurring in older people during their use of public buses, to enable understanding of the size and nature of the problem of injuries, and to explore strategies for improving the safety of public transport for older people.

## 2. Methods

We undertook a systematic review to critically assess and evaluate all research studies addressing the epidemiology of non-collision injuries in older people using public transport. The review was systematic in that we used an organised method of locating, assembling, and evaluating the body of literature using a set of specific criteria (U.S. Department of Health and Human Services). We searched PubMed, Embase, CINAHL, Web of Science, and Transport Research International Documentation (TRID), which combines records from the Transportation Research Board's Transportation Research Information Services (TRIS) Database and the OECD Joint Transport Research Centre's International Transport Research Documentation (ITRD) Database, from the date of their inception to July 2012. The search terms used for each database are given in Appendix A. We also searched reference lists of included studies.

Studies were eligible for inclusion in the review if they:

- were cross sectional, case-control, or cohort studies
- were written in English
- included people aged 60 years and older (including studies that included participants of all ages)
- included people living in high income countries as defined by the World Bank (Marsden et al., 2008)
- reported passengers travelling on public buses and/or coaches (defined as 17 seats or more), overground trains, or trams, who incurred a non-collision injury whilst boarding, alighting or travelling on the vehicle

Studies reporting only injuries resulting from collision incidents were excluded. Studies reporting injuries resulting from both non-collision and collision incidents, which did not separately report non-collision incidents, were included, and this has been highlighted in the description of their findings.

This paper presents only the results relating to injuries incurred on public buses and coaches. i.e. Excluding studies which reported injuries to passengers travelling only on trains or trams.

### 2.1. Study selection

Titles and abstracts of articles were scanned independently by two reviewers (AD, PL) to identify relevant articles to retrieve in full. Where an article appeared to be potentially eligible based on the title, but no abstract was available, the full article was retrieved. Disagreements between reviewers were resolved by consensus-forming discussions with a third reviewer (DK).

Full articles were independently reviewed for inclusion by pairs of reviewers (AD, PL, DK) using a standardised data extraction form containing the inclusion criteria (study design, participants, transport type) and details of the outcomes of interest recorded in the study (type of injury, mechanism of injury, risk factors for injury). Reasons for exclusion were recorded. Disagreements between reviewers were resolved by discussions between all three reviewers.

### 2.2. Data collection process

A standard form was designed for data extraction which included measures of injury occurrence, injury mechanisms, and risk and protective factors for injury. Subgroup analyses (e.g. injury occurrence by age, gender, etc.) were recorded where these were reported. Data were extracted independently by pairs of reviewers (AD, PL, DK). Disagreements between reviewers were resolved by discussions between all three reviewers.

### 2.3. Risk of bias in included studies

A recent systematic review of tools for assessing quality and susceptibility to bias in observational studies in epidemiology identified a number of useful assessment tools (Sanderson et al., 2007). Two of these can be used to assess cohort, case-control and cross sectional studies (Health Evidence Bulletins Wales, 2004; Fowkes and Fulton, 1991), and both cover the three domains considered by their authors as fundamental in terms of assessing risk of bias: appropriate selection of participants, appropriate measurement of variables, and appropriate control of confounding.

The risk of bias in included studies was assessed independently by pairs of reviewers (AD, PL, DK) using the Fowkes and Fulton tool (Fowkes and Fulton, 1991), and descriptions of the extent to which a study met the criteria were reported. Disagreements between reviewers were resolved by consensus-forming discussions between all three reviewers.

### 2.4. Data synthesis

A narrative synthesis of data was undertaken. The occurrence of injuries was described using the measures reported by included studies (e.g. incidence rates, proportions, etc., and 95% CI where these were reported). Injury mechanisms were described using frequencies and percentages. Risk and protective factors for injuries were described using frequencies and percentages and measures of association (e.g. relative risks, odds ratios and their 95% CI), where these were reported by studies. Findings have been summarised in tabular format (see Tables 1–3).

## 3. Results

The process of study selection is shown in Fig. 1. A total of 1669 potentially eligible articles were found from the searches, and a further 11 were identified from reference lists. Fifty of these articles were assessed as being suitable for retrieval to obtain more detailed evaluation. Seven of these (14%) could not be found. Of the 43 articles evaluated for inclusion, 33 were excluded, most commonly because

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