

Injuries to head and extremities in bus-related accidents in Sweden during 2003–2023

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I. INTRODUCTION

Bus travel is considered a safe transport mode that promotes active mobility and is environmentally friendly. There is a large ongoing expansion of bus transport, such as the development of autonomous buses. The overall aim with the expansion is to increase availability and usage to help achieve the goals set in Agenda 2030, while also reducing road traffic injuries as part of Vision Zero and the nine recommendations formed during the 3rd Global Ministerial Conference on Road Safety. Although bus-related injuries are quite few compared to passenger car injuries, they still occur and can affect future usage of the bus as a transportation mode. Often, injury statistics report the total number of injuries to a body region with little information about different subtypes. To better understand how specific injuries occur and how they can affect injured persons, tissue-level injury mechanisms must be studied. State-of-the-art finite element (FE) human body models (HBMs) have the capability to predict specific injuries at a tissue level, which can be used to evaluate injury prevention measures. To further develop and enhance details in HBMs, different pieces of information from injury statistics may enhance the models. To support and continue safe bus travel, more information is needed about what kinds of injuries occur in bus-related accidents. Therefore, the aim of this study was to decode specific injuries to provide opportunities for injury mechanism knowledge. In turn, our hope is to provide a focus on injuries that have risk of long-term consequences and high societal costs, to proactively ensure that current and future bus travel becomes safer as bus travel usage becomes higher.

II. METHODS

Data gathered between 2003 and 2023 from the Swedish Traffic Accident Data Acquisition (STRADA) database were analysed to get an overview of injury and bus accident types. STRADA contains information from both police and hospital reports, with national coverage from police reports since 2003 and correspondingly since 2016 for all Swedish hospitals with emergency care. STRADA uses the AIS-coding system to classify and describe the severity of injuries, which is why we decoded the diagnosis to pinpoint the prevalent injury subtypes in each body region. As there were many unique injuries in STRADA, with single-digit incidences, only AIS1–3 level injuries and accident types with more than 10 cases were included. AIS versions 2005/2008 and 2015 were used to translate the AIS code to specific injury. To further narrow down the focus, the analysis was based on injured body regions that are known to have a higher risk of medical impairment, but have shown to have high societal costs indicated by e.g., long-term health care and work absence (see e.g. [1-2]). As such, the head and the upper and lower extremities were chosen due to both high risk of long-term consequences and high societal costs in fall accidents [1-2]. These injury types are supported by previous injury statistics regarding standing bus passengers (see e.g. [3-5]), which have high risk of losing balance in non-collision incidents caused by driver manoeuvres. For this smaller study, torso injuries were omitted but should be studied in the future with respect to risk of long-term consequences and societal costs, due to its relevant injury incidence [3-5].

III. INITIAL FINDINGS

Table I presents the total number of injuries per body region where specific injuries with ≥ 10 cases were included in the presented results. Only minor differences were found between AIS versions for injury codes, but they were reported with the same coding for the included specific injuries. Hence, the AIS code for a specific injury was translated “as is” in STRADA, with the relevant AIS version. Overall, upper extremity injuries occurred mainly at AIS1–2, with higher incidence for sprain and strains at AIS1, and specific fractures at AIS2, such as distal radius fractures (43%) and proximal humerus fractures (26%). For head injuries, concussions were most common (68% in AIS1 injuries and 50% in AIS2 injuries), with subarachnoid and subdural haematomas occurring at AIS2 and 3, respectively. Lower extremity injuries were mostly associated with foot (27%), pelvic ring (20%) and fibula (19%) fractures at AIS2, while hip fractures dominated the AIS3 level with higher relative incidence at around 78% of the total. The most common accident type was single accidents and uncategorised accident types (denoted as

