

Incidence of Traumatic Head Injuries in Swedish Specialised Care from 2008-2022

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I. INTRODUCTION

Traumatic head injuries are a well-known epidemiological issue with an estimated global incidence of nearly 69 million cases per year counting all external causes [1]. Injury epidemiology is a well-established research field, particularly in high-income countries (HICs), where high-quality data allows for the evaluation of past and ongoing injury prevention efforts. However, obtaining nationwide population data, as opposed to data from smaller populations that statistically represent the entire country, is not trivial due to differences in data collection and acquisition for register-based studies. Particularly, despite a prevalence of HICs in the EU, few nationwide publications on head injury incidence rates exist [2].

The Swedish Vision Zero policy was established through parliament approval in 1997, serving as the basis for traffic safety assessment in Sweden and is adopted worldwide. Vision Zero aims to halve the number of deaths in road traffic accidents (RTAs) by 2030 and achieve a 25% reduction in serious injuries among cyclists and pedestrians by 2030 [3]. However, to this day, pedestrian falls in road traffic environments are still not considered as RTAs [4], even though falls have surpassed RTAs as the leading cause of traumatic head injuries [5].

In Sweden, the National Board of Health and Welfare maintains the National Patient Register (NPR) which is considered the gold standard for statistics on injuries, diseases, and treatments. Hospital admission data, i.e., inpatient healthcare, has been collected since 1964, with nationwide reporting since 1987. Outpatient care data collection started in 2001, with 2008 being considered a reasonable starting point for epidemiological studies due to earlier quality issues and reporting adherence. Only two nationwide Swedish head injury epidemiology studies exist [6–7], both limited to inpatient care data due to outpatient care data quality.

The objective of this study is to provide an update on the incidence of head injuries in Sweden. Given that concussion, the most common traumatic brain injury is known to be underreported [8], including data from both outpatient and inpatient care can help address underreporting issues. The specific aim of this study is to identify the needs for head injury prevention, by evaluating if Vision Zero efforts have reduced head injuries.

II. METHODS

Total specialised healthcare data on head injuries were extracted from NPR by a statistician at National Board of Health and Welfare. Similar to previous studies [6–7], this study included all skull and intracranial injuries based on ICD-10 (S02 and S06, respectively). The data were limited to primary diagnoses only, indicating each incidence of a specific injury as the main reason for the healthcare contact. No ethical approval was needed as all data were anonymized.

The data presented in this study are total injury rates per 100 000 inhabitants, without distinguishing between specific injury types and corresponding external causes. Presented data are formatted with two stratifying variables: sex- and cause stratification, and sex- and age stratification. Causes are classified as Fall, Traffic, Violence, Other and Missing. Statistical analyses were performed using R version 4.1.1 to evaluate the epidemiological trend over the period 2008–2022. Adjusted p-values, starting at 0.05 significance level, were calculated using Bonferroni correction to enable comparisons between groups and reduce type I errors due to multiple tests. However, descriptive analyses are also made in relation to the research aim to mitigate the inherent conservativeness of the correction for multiple comparisons and reduce the risk of type II errors. Linear regression was applied for trend analysis.

III. INITIAL FINDINGS

In absolute values, the overall injury rates per 100 000 for both men and women have decreased since 2008, from 436 and 298 to 343 and 285 in 2022, respectively (Figure 1). Falls remain the main cause of skull and intracranial injuries. The linear regression showed a reducing trend for violence (both sexes), other (men), and missing (both sexes) with adjusted significance level for 10 tests ($p = 0.005$). When stratified by age groups and sex, it is evident that the injury rates are highest for 85+ with an increasing trend. Linear regression results, with adjusted significance level ($p = 0.0014$, $n = 36$ tests), showed statistically significant results for all groups except for age 60-84 among men, and age 25-79 among women.

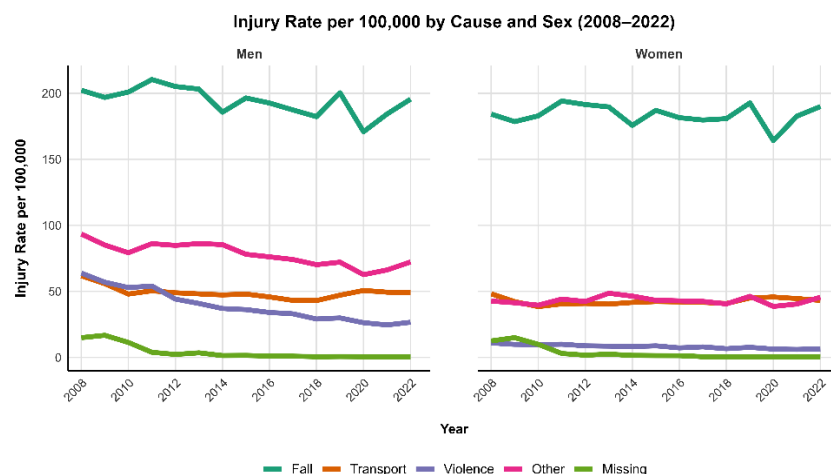


Figure 1. Total head injury rates stratified by external causes for men and women during 2008–2022.

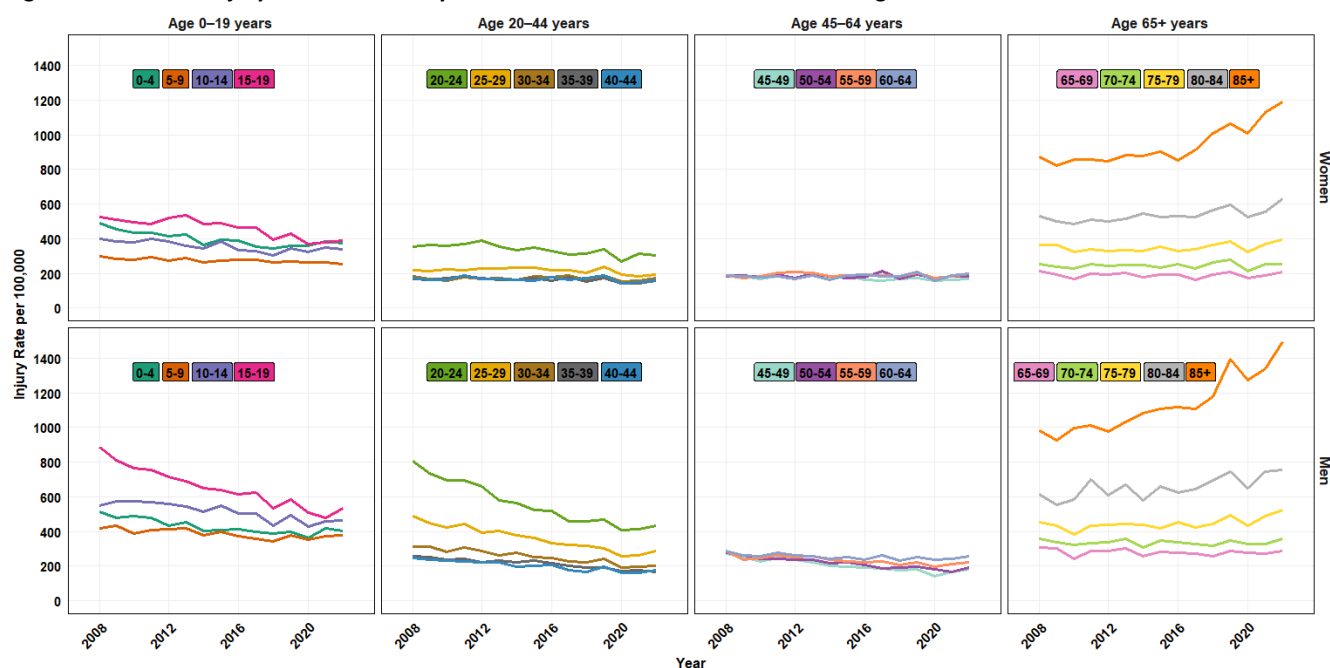


Figure 2. Head injury rates stratified by age groups and sex (men – bottom, women – top) during 2008–2022.

IV. DISCUSSION

Through descriptive analyses of Figure 1, it appears that the head injury incidence for men is decreasing and approaching the rates of women, with women displaying slower and more inconsistent decrease in trend. Falls remain the most common cause of head injuries. However, compared to men, there is no clear significant decreasing trend for women in falls and traffic-related injuries. Analyses of residuals and Q-Q plot seems to indicate that some model assumptions might be violated. The conservativeness of the Bonferroni correction decreases the statistical power for the results in Figure 2 due to the increased number of tests ($n = 36$), particularly for men aged 75–84 and especially 80–84, where an increase is shown visually and by the slope of the regression model. The inconsistent decrease of injury rates for women in Figure 1 is supported by Figure 2, where descriptively, the rates remain quite constant over the study period and supported by statistical insignificance throughout ages 25–79. For men, this occurred in the older age groups of 60–84. The high incidence and drastically increasing trend for 85+ for both sexes is very concerning due to Sweden's aging population. It is well-known that falls are common among the elderly, and previous Swedish studies [6–7] have identified falls as the main cause. It is clear that immediate and prioritised efforts in elderly head injury prevention is warranted. Understanding the relationship between external causes and specific injury types (such as subdural hematoma) is needed to reach the goals of reducing serious injuries by 25% or more. For example, a detailed understanding of injury mechanisms during low-energy falls (from standing height) is needed.

V. ACKNOWLEDGEMENTS

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VI. REFERENCES

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