



## ER visits predict premature death among teenagers

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### ARTICLE INFO

#### Article history:

Received 25 July 2011

Received in revised form 17 January 2012

Accepted 14 February 2012

#### Keywords:

ER

Premature death

Alcohol/drugs

### ABSTRACT

**Background:** The purpose of this study was to investigate if teenagers visiting an emergency room because of injury have an increased risk of premature death ahead and, if so, identify possible risk factors and suggest preventive measures.

**Methods:** In January 2010, the personal identity numbers of 12,812 teenagers who had visited the emergency room at the University Hospital in Umeå, Sweden, during 1993 through 2006 because of injury were checked against the National Cause of Death Register in Sweden. Standardised mortality ratio and confidence intervals were calculated. For the unnatural deaths that took place in Sweden, the police report, autopsy protocol, and hospital records, if present, were studied.

**Results:** Thirty-eight fatalities were included giving a standardised mortality ratio of 1.44 (95% CI: 1.02–1.98). A majority of the decedents were males ( $n=32$ , 84%) and the median age at the time of death was 21 years. Twenty-three deaths were caused by unintentional injuries and ten by intentional injuries (all suicides), while five deaths were categorised as undetermined whether intentional or not. Seventy-four percent tested positive for either alcohol or drugs or a combination at the post mortem examination. Nine males and one female committed suicide, five tested positive for alcohol (one also for drugs), while four tested negative at the post mortem examination. One died abroad and in this case we lack information on alcohol and drugs.

**Conclusion:** Teenagers visiting an emergency room due to injury experience an increased risk of premature death by unnatural cause and those at risk are especially males. The use of alcohol and drugs often seems to contribute to their untimely deaths. Identifying those at risk when they visit the emergency room for an injury and to take preventive actions at this stage could be a way to reduce the number of fatalities.

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### 1. Background

More teenagers are killed by injury than disease in Sweden (Anon., 2009) and in other countries (Grossman, 2000a,b). Of those aged 15–24 years who die prematurely in the USA, 75% do so from unintentional injury, suicide or homicide and 25% die from disease, and among children 14 years and younger 50% die from injury (Grossman, 2000b). Much effort has been made to reduce the number of casualties among the young. The number of teenagers killed by injury decreased in northern Sweden over the past 20 years (Johansson et al., 2005) as well as in Sweden as a whole (Ekman et al., 2005) and in 13 out of 14 European countries (Morrison and Stone, 2000); however, more work is needed to further reduce these unnecessary deaths.

Alcohol and drugs contribute to both fatal and non-fatal injuries among the young and those under the influence also often sustain more severe injuries, require more hospital care, and have a worse outcome (Draus et al., 2008). A Finnish study on older teenagers reporting an injury found that the use of alcohol increased with age and almost 20% of the oldest teenagers were under the influence of alcohol when the injury occurred, with no sex difference in drinking-related injuries (Mattila et al., 2004). In a US study, almost 10% of the adolescents seeking medical attention due to blunt trauma tested positive for one or more drugs (Draus et al., 2008). Mattila et al. (2008) found in a study on adolescents that health compromising behaviour – such as recurring drunkenness and smoking – adopted at adolescence were strong risk factors for dying from an injury in adulthood, independent of socioeconomic background factors.

Furthermore, injury hospitalisation per se is a significant risk marker for subsequent injury hospitalisation. Individuals with a non-assaultive injury were more likely to be admitted for an assault than those with no previous injury admission. If the initial injury was a result of interpersonal violence, the risk of returning with an

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assaultive injury was much greater and was most likely to occur within 30 days (Dowd et al., 1996). While many demographic risk factors cannot be modified, environmental and behavioural risks can (Grossman, 2000a).

Prior hospitalisation for injury has also been shown to be a risk factor for youth suicide and most of the hospitalisations were due to suicide attempts, but hospitalisation due to unintentional injuries was also identified as a risk factor. The authors concluded that “many” unintentional injury hospitalisations and “a proportion of” motor vehicle crashes in younger adults may represent unrecognised suicide attempts (Grossman et al., 1993).

There are periods in every person’s life when he or she is more prone to take advice and change behaviour, such as soon after sustaining an injury (Monti et al., 1999). Furthermore, health compromising behaviour adopted in adolescence often persists into adulthood (Paavola et al., 2004). Therefore, the emergency room seems to be an appropriate place to identify young persons at risk of further injury – or a premature death – and to initiate preventive measures.

### 1.1. Aim

To investigate if teenagers visiting an emergency room because of injury have an increased risk of premature death and, if so, identify possible risk factors and suggest preventive measures.

## 2. Material and methods

The material comprises 12,812 non-fatally injured 13–19-year olds who visited the emergency room (ER) at the Umeå University Hospital, Sweden, from 1993 through 2006. These teenagers altogether generated 18,764 visits at the University Hospital, which is the only hospital within a radius of about 130 km around the city of Umeå. The primary catchment area is within a radius of 60 km, serving a population of 142,299 inhabitants of which 13,797 were teenagers in 2006 (Official Statistics, Västerbotten’s County Council, 2010).

All injured were asked to answer a questionnaire focussing on when, where, and how the injury occurred. If the injured person was unable or unwilling to answer the questions herself/himself, an accompanying person or a staff member at the ER did so. This occurred in approximately 15% of the cases. The answers were coded and transformed into computer files by trained personnel. Available ambulance and police records together with all available medical records were also studied.

In January 2010, the personal identity numbers of the 12,812 injured teenagers were checked against the National Cause of Death Register in Sweden. Sixty-one persons were found dead through 2007, 49 by unnatural and 12 by natural causes. Four persons died abroad from unnatural causes; they were included in the study concerning their cause of death, age and sex only, since we lack further information on these cases. Eleven decedents had no recorded injury at the ER before the fatal one. These eleven as well as those who died from natural causes were not further investigated. For the unnatural deaths that took place in Sweden, the police report, autopsy protocol, and hospital records, if present, were scrutinised.

The injured were not routinely tested for the presence of alcohol or any other drug at the emergency room. It was, however, sometimes noted in the medical records if they smelled of alcohol or if they admitted that they had been drinking alcohol or taking drugs. In Sweden, unnatural deaths are routinely subjected to a medico-legal autopsy including toxicological analyses.

The standardised mortality ratio, SMR, was calculated as the observed number of deaths divided by the expected number of deaths:  $SMR = O/E$ . For each age and each year, the individuals

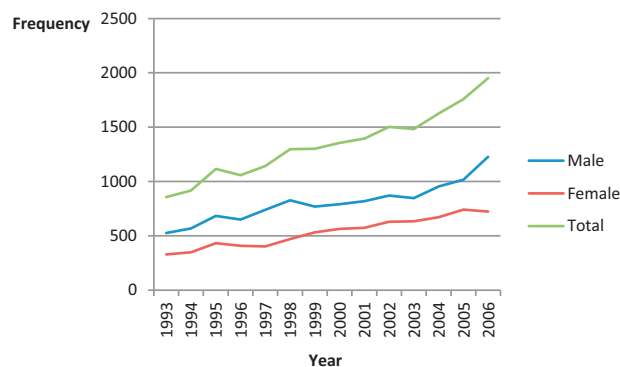


Fig. 1. The number of injuries at the emergency room, Norrlands University Hospital, Umeå. By year and sex.

attending their first visit to the emergency room were followed until death or until December 31, 2007. We used different life tables for the calculation of the expected number of deaths, one for those having their first visit during the years 1993–1999 and another for those having their first visit during the years 2000–2006. This was made in order to minimise the possible effect of time on deaths rates. Different life tables were also used for males and females since injury mortality differs between the sexes. The precision of the SMR estimates was presented by 95% confidence intervals.

The present study and the procedures taken were approved of by The Regional Ethic Review Board in Umeå, Sweden (07-0670).

## 3. Results

Thirty-eight of the 12,812 teenagers died from unnatural causes before January 1, 2008. The standardised mortality ratio for unnatural death was 1.44 (95% CI: 1.02–1.98).

### 3.1. Demographics of index cases

Of the 12,812 teenagers, 7543 (59%) were males and 5269 (41%) were females and altogether they accounted for 18,764 emergency room visits due to injury at the Umeå University Hospital. The number of injury events increased by year ( $n = 857$  in 1993 and  $n = 1952$  in 2006); the number of injured males increased by 133% during the period, and the number of injured females by 119% (Fig. 1). During the same period, the number of teenagers living within the catchment area increased by 22%, the number of emergency room visits at the surgery and orthopaedic units among all ages increased by 15%, and the total number of visits at the emergency room increased by 33%.

Monday through Thursday accounted for approximately the same number of injury events ( $n = 8540$ ) as did Friday through Sunday ( $n = 8325$ ) and in 1899 cases the weekday was not registered. Sports’ activities generated 7961 injury events, falls 5469 injury events, and transportation 3334 injury events, followed by 2000 “other” injury events. Self-inflicted injuries and interpersonal violence generated 1197 injury events of which 174 were classified as suicide attempts. The emergency room visits were mostly due to minor injuries. One male visited the emergency room nine times, two teenagers were registered with three injury events, all others were registered for one or two injury events. In 525 (3%) cases, alcohol was mentioned in the files as a contributing factor to the injury event.

### 3.2. Demographics of the fatally injured

Thirty-two of the decedents (84%) were males and six (16%) females, and the median age at the time of death was 21 years.

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