

Teenager fatalities

Epidemiology and Implications for Prevention

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*This thesis is dedicated to all the youth who have been lost
and the family and friends they have left behind.*

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Abstract

A significant number of teenagers are killed each year by unintentional or intentional injuries. A teenager is in a vulnerable phase of her/his life, going from being a child to adult. This transition often includes testing the limits of their capabilities, which can include, e.g., high speed driving, testing alcohol and other drugs, including drinking and driving. The development from child to adult includes different psychological stress factors, such as, e.g., school problems, broken love affairs and bullying. The demands – perceived or real – also increases over time and vulnerable individuals can turn to self-harm and in the most extreme case suicide.

The aim of this thesis was to investigate teenager fatalities in the northern half of Sweden and to suggest preventive measures.

A survey of teenager fatalities during a twenty-year period revealed that the incidence of unintentional (n=248) deaths decreased, while intentional (n=102) deaths were unaffected over time. Most unintentional deaths were transportation related (n=204) while most of the intentional deaths were suicides (n=88). Twenty-eight percent of the decedents were test-positive for alcohol at autopsy.

In a series of three studies, teenager suicides were investigated in depth, firstly through an interview study with the investigating police officer in charge of the investigation of a teenager suicide. Most of the suicides occurred in rural and depopulated areas despite the fact that most teenagers live in the larger cities along the coastline. A majority of the suicides appeared to be planned. Females, contrary to males, often had a psychiatric history. One of the conclusions was that police officers provide essential information concerning the circumstances around a teenager suicide.

Parents who had lost a child through suicide, and in some cases siblings, were interviewed 15-25 months after the suicide. It was striking how the life of the surviving family members were still affected by the devastating trauma of the suicide; most parents testified that they were still struggling with the question “why?” and that they were thinking of their lost child every day. Post suicide support was often badly timed and insufficient, especially for the younger siblings. The family doctor has an important role as a co-ordinator of a long-term individually formulated support scheme for the bereaved.

Evidence of suicide contagion and suicide cluster formation, i.e., one teenager suicide led to another suicide, was found in these studies, and two suicide clusters were identified, with links between the victims in each cluster. Both clusters occurred within a geographical and timely proximity. Everyone involved in the well-being of the young should be aware of the risk of contagion and suicide cluster formation.

The fifth study concerned 12,812 teenagers who visited the Emergency Room at Umeå University Hospital due to an injury during 1993 through 2006. Sixty-one of these were found dead through 2007, 49 by unnatural (of which 38 were included) and 12 by natural causes. The standard mortality rate for unnatural death was calculated to 1.44 (1.02-1.98), confirming an increased risk of premature death. In many of these deaths, alcohol and drugs may have contributed. By increasing the awareness among health professionals that injury can predict a premature death - primarily among those who develop substance abuse - some premature deaths may be prevented by early intervention.

This thesis confirms that most teenagers die from unnatural causes, mostly in transportation-related events and by suicide. By studying these deaths, preventive measures that could save lives have been suggested.

Abbreviations

a.m.	ante meridiem (before midday)
AUDIT	Alcohol Use Disorders Identification Test
BAC	Blood Alcohol Concentration
B.C.	Before Christ
CAGE	An acronym derived from the four questions in the test
CO	Carbon Monoxide
Dr	Doctor
DVD	Digital Versatile Disc
ER	Emergency Room
e.g.	exempli gratia (for example)
GDLS	Graduated Driver's License System
ICD	International Classification of Disease
i.e.	id est (that is)
p.m.	post meridiem (after midday)
SEK	Swedish Crowns, the Swedish Currency
UK	United Kingdom
USA	United States of America
USD	US dollars
WA	State of Washington
WHO	World Health Organization
YPLL	Years of Potential Life Lost

List of papers

This thesis is based on the following papers, which will be referred to in the text by the corresponding Roman numerals (**paper I-V**).

- I. **Johansson L**, Stenlund H, Lindqvist P, Eriksson A: A survey of teenager unnatural deaths in northern Sweden 1981–2000. *Accid Anal Prev* 2005;37;253–258.
- II. Lindqvist P, **Johansson L**. Teenage suicides in northern Sweden: an interview study of investigating police officers. *Inj Prev* 2000;6;115-119.
- III. Lindqvist P, **Johansson L**, Karlsson U. In the aftermath of teenage suicide: A qualitative study of the psychosocial consequences for the surviving family members. *BMC Psychiatry* 2008;8;26.
- IV. **Johansson L**, Lindqvist P, Eriksson A. Teenage suicide cluster formation and contagion: implications for primary care. *BMC Fam Pract* 2006;17;7:32.
- V. **Johansson L**, Stenlund H, Bylund P-O, Eriksson A. Can ER visits predict premature death among teenagers? *Submitted for publication*.

Sammanfattning på svenska

Tonåringar befinner sig i den fas av livet när de går från att vara barn till att bli vuxna. Denna övergång innefattar ofta att tonåringar provar gränserna för sin förmåga, vilket kan inkludera t.ex. fortkörning eller att de gör andra saker de annars inte skulle ha gjort. Tonåren är också den ålder när många provar alkohol och/eller droger för första gången, man kanske kör påverkad och för en del läggs grunden till ett livslångt missbruk. Utvecklingen från barn till vuxen kan också inkludera olika psykologiska stressfaktorer som till exempel att det börjar gå sämre i skolan, mobbning och trassliga kärleksaffärer. De krav från föräldrar och samhälle - upplevda eller verkliga - som många känner ökar också i tonåren. För en del ungdomar blir pressen alltför stor vilket kan leda fram till ett självmord.

Syftet med denna avhandling var att undersöka onaturliga dödsfall bland tonåringar och att föreslå förebyggande åtgärder.

Den första studien belyser omfattningen av onaturlig död. Incidensen av oavsiktliga (n = 248) dödsfall minskade medan avsiktliga (n = 102) dödsfall var oförändrade över tiden. De flesta oavsiktliga dödsfall var transportrelaterade (n = 204), de flesta avsiktliga dödsfall var självmord (n = 88). Tjugoåtta procent av de avlidna var påverkade av alkohol i samband med dödsfallet.

I den andra studien intervjuades poliser som ansvarat för utredningen av ett tonårssjälvmord. En majoritet inträffade på landsbygden och en majoritet av självmorden förefall vara planerade. Kvinnor, i motsats till män, hade ofta en psykiatrisk sjukhistoria. En slutsats var att poliser kan lämna väsentlig information om omständigheterna kring ett tonårssjälvmord, information som kan vara till gagn i det självmordspreventiva arbetet.

Föräldrar som förlorat ett barn genom självmord, och i förekommande fall syskon, intervjuades i den tredje studien. Intervjuerna utfördes 15-25 månader efter självmordet och det var slående hur livet för de överlevande fortfarande påverkades. De flesta föräldrar vittnade om att de fortfarande kämpade med frågan "Varför?". Det gick inte en dag utan att de tänkte på det barn som tagit sitt liv. Samhällets stöd till de efterlevande upplevdes ofta otillräckligt, särskilt för de yngre syskonen. En slutsats var att familjeläkaren har en viktig roll som samordnare av ett långsiktigt, individuellt utformat stöd till de efterlevande.

Den fjärde studien behandlade risken för smittoeffekter bland unga efter ett tonårssjälvmord. Detta kan ta sig uttryck som ett ökat självskadande beteende, men ett självmord kan också utlösa ytterligare självmord och studien beskriver två kluster med tre fall i varje. Mellan varje enskilt fall inom respektive kluster fanns beröringspunkter och fallen hade också

geografiska och tidsmässiga samband. Att det föreligger risk för sådan smitta bland unga är något som alla inblandade i ungas välbefinnande bör känna till.

I den femte studien utgick vi från 12.812 tonåringar som besökt akutmottagningen vid Norrlands Universitetssjukhus, Umeå, för en icke dödlig skada under åren 1993 till och med 2006. I januari 2010 kontrollerades dessa tonåringar mot det nationella dödsorsaksregistret. Sextioen hade avlidit till och med år 2007, 49 av onaturliga (av vilka 38 inkluderades) och 12 av naturliga orsaker. Jämfört med den förväntade dödligheten i Sverige hade de som besökt akutmottagningen en överdödlighet som för onaturliga dödsfall beräknades till 1,44 (1,02-1,98). Många av de onaturliga dödsfallen var relaterade till bruk av alkohol och droger. Genom att öka medvetandet hos vårdpersonal att skadedrabbade riskerar en för tidig död och att detta gäller framför allt de som utvecklar ett missbruk kan vissa förtida dödsfall förebyggas.

Denna avhandling visar att de flesta unga dör till följd av annat än sjukdom. Genom ett medvetet arbete för att förebygga onaturliga dödsfall skulle detta antal kunna minskas till gagn för efterlevande och för samhället i stort.

Introduction

Injuries are the leading killer of today's teenaged generation [1], as the patterns have changed from infectious towards social aetiologies during the last decades. Globally are unintentional injuries, followed by homicide and acts of war, the most common causes/manners of death among the young in almost every part of the world [1]. In Sweden during the last decade, unnatural death (injury and poisoning) was more common than natural death (disease) among 10 through 19 year-olds [2].

The science of *injury prevention* was developed during the previous century by Hugh De Haven, a World War I pilot, who studied the importance of deceleration of force and its distribution over the human body [3]. Colonel John Stapp of the US Air Force found support for De Haven's findings when he subjected himself to deceleration forces in sledge tests [4]. Another landmark was the suggestion that injuries "act" as if they were infectious diseases, and could be studied in the same way, using the same techniques [5]. The biological principles that govern disease as a community problem are equally well suited for understanding injuries. Specific programs based on an understanding of cause, has long guided the attack on communicable and other diseases. The technical method is that of a focal attack: a concentrated effort on recognized centres of infection and the causes that brought them into being [5].

Sweden is often seen as a country with high standards concerning injury prevention [6-8]. This perception may be the result of the great value we place on protecting children and the elderly and the general belief that society should be an active instrument for improving individual lives [7]. The relative homogeneity of Swedish society, our prosperity, and our receptivity to education are other important factors [7].

Injury prevention strategies

Injuries develop through interchange of energy [9], a physical law extended by William Haddon Jr into the concept of injury prevention. Injury prevention was aimed at preventing hazardous agents to strike people in an amount that exceed injury thresholds, and to minimize the consequences of an injury once it has occurred [10]. In general, there are three injury prevention strategies [11]:

1. *Persuade* persons at risk of injury to alter their behaviour, e.g., to use safety belts and install smoke detectors.
2. *Require* change of individual behaviour by law or administrative rule, e.g., by laws requiring safety belt use and requiring installation of smoke detectors in all new buildings.

3. *Provide* automatic protection through product and environmental design, e.g., air bags or built-in sprinkler systems that automatically extinguish fires.

Each of these strategies has a role in any comprehensive injury-control programme. However, it is a recurrent finding that the second strategy will generally be more effective than the first, and the third strategy will be the most effective. Members of high risk groups such as teenagers tend to be the most difficult to influence with approaches that involve either voluntary or mandated changes in individual behaviour [11].

Beginning in 1962, Haddon developed and refined ten general strategies designed to interfere with the energy transfer and injury process [12]. The following ten strategies were an aid to thinking about them in a logical and systematic way rather than as a formula for choosing countermeasures [12]:

1. Prevent the creation of the hazard (e.g., to stop producing guns).
2. Reduce the amount of the hazard (e.g., the implementation of speed limits).
3. Prevent the release of a hazard that already exists (e.g., by building fences that prevent potential suicide victims from jumping off towers and bridges).
4. Modify the rate or spatial distribution of the hazard (e.g., to slow the burning rate of sleeping bags).
5. Separate in time or space the hazard from that which is to be protected (e.g., the implementation of daytime curfews for trucks in cities).
6. Separate the hazard from that which is to be protected by a material barrier (e.g., by using a bullet-proof vest).
7. Modify relevant basic qualities of the hazard (e.g., to soften corners).
8. Make what is to be protected more resistant to damage from the hazard (e.g., by improving motor vehicle impact resistance).
9. Begin to counter the damage already done by the hazard (e.g., by using automatic sprinkler system).
10. Stabilize, repair, and rehabilitate the object of damage (e.g., by providing emergency care and rehabilitation facilities).

Today, injury prevention is a research field that stands on its own. In the USA, one turning point was when the report "Injury in America" [11] was presented, a study that contributed to the foundation of the National Center for Injury Prevention and Control.

In the same year, the epidemiologist Geoffrey Rose argued that prevention strategies should identify high-risk individuals and offer individual protection, or at a population-based level prevention strategies should control the determinants of incidence in the population as a whole [13]. He

argued that these two approaches to aetiology have their counterparts in prevention. It is often easier to implement a population-based prevention strategy than to implement a strategy aimed at high-risk individuals. The population-based strategy may also be more successful because it does not require behaviour modification and can be maintained indefinitely if appropriate [14]. A population strategy is the best choice if a risk factor is well-established as causing disease/injury, difficult to control or modify on an individual level, and a shift of its distribution in the population does not move some people who are at low risk pre-intervention to a high risk post-intervention [14].

One way to introduce population-based injury preventive measures is through the concept of the Safe Community programme that was developed and first established in Falköping, Sweden in 1978. The programme showed a 27-28% reduction of injuries in the transport, home, and industrial areas at follow up in 1981, but in the control areas there were no effects. The ideas behind the programme have been applied by communities in countries such as Norway, Denmark, Australia, New Zealand, and Canada [15].

Suicide in Sweden

In Sweden, suicides among all ages have decreased during the last 20 years. Still, 1,173 persons aged 15 years and older committed suicide in Sweden during 2002 and another 312 deaths of undetermined manner (i.e., undetermined whether intentional or not) were registered. This number of suicide was more than twice as many killed in traffic during the same year [16]. The number of suicides among 15-24 year-old males increased by 27% and the number of deaths with undetermined manner increased by 77% from 1993 through 2002 [16]. For women, the corresponding figures are a decrease of suicides by 20% and an increase of cases with undetermined manner of death by 111% [16]. For persons 10 to 14 years of age the numbers are small and vary substantially between different years, inconsistencies that make it difficult to interpret trends.

Suicide intervention

The issue of individual or population based suicide interventions can be exemplified by the prevention of suicide by jumping off bridges. A suicide victim who jumps off a bridge tends to live near the bridge or is an inpatient in a psychiatric clinic near the bridge, and the jumpers have a high degree of psychiatric morbidity [17, 18]. They are also on average younger than those who jump off other structures [18]. Despite this knowledge, it is still not easy to identify individuals at risk and to prevent them from jumping. General preventive strategies on the other hand, e.g., barriers and railings that prevent jumping, are easier to implement. This is not to say that general

prevention is easy. It has taken 61 years to take measures against jumping off the Golden Gate Bridge. Since being built in 1937, approximately 1,300 people have jumped off the bridge and not until recently, in October 2008, have Golden Gate officials decided to install a net that will catch would-be jumpers [19].

Internet

The availability of information, for good and for bad, has increased tremendously with the Internet and it can be used as a way to research different methods of suicide. The Internet can provide all the information needed and guide a potential suicide victim through different suicide methods [20-23]. It is also possible to purchase allegedly lethal substances that include descriptions on how to use them [21].

Such information has in fact become a major problem, illustrated by the number of pages with suicide information; entering the word “suicide” in a search engine produces more than 58 million hits, “suicide assistance” generates more than 10 million hits, “commit suicide” more than 4.6 million, “suicide pact” 2.5 million, and “assisted suicide” gives 1.3 million hits (Search engine “Google”, January 8, 2010). Many of these sites offer explicit advice on how to commit suicide.

Vulnerable youths are more receptive than others to suicide information on the Internet [21], and it is possible that the most vulnerable ones are encouraged by the information and commit suicide [21, 24]. Also on Internet, anyone can order a DVD named “Final exit” showing “brand new footage demonstrating helium bag method”. It is stated on the homepage that “this guidance is for the possible use by a terminally or hopelessly ill competent adult who wishes to avoid further unrelieved pain and distress” [25]. There are also web sites in Swedish on how to commit suicide and which method to use. Some of these pages discuss the pros and cons of different suicide methods, at least one even includes a chat room [26].

Suicide pacts – i.e., the suicides of two or more individuals in an agreed-upon plan – are not a new phenomenon, but have up to now been known to involve usually people in the upper middle age who knew each other (mostly childless spouses). Furthermore, a noteworthy proportion of the participants worked in professions connected to medicine, and the methods used were almost always non-violent [27]. Today, suicide pacts are formed among young people and many of these young people would probably have committed suicide on their own; however, with the “help” of Internet, they can find others in the same situation.

Suicide pacts can be formed on the Internet [27], and young people are more prone than elderly to meet and pact through, e.g., chat rooms. In a German investigation, 43% of the youth stated that they chat “frequently” or “very frequently” with others [28].

As a few examples; during year 2000, a Norwegian male and a female from Austria committed suicide together by jumping from “Preikestolen”, a 600-metre high cliff near Stavanger in Norway [29, 30]. They had met on the Internet and the young woman travelled to Norway to commit suicide together with the young man.

In Tokyo, Japan, nine young people, seven in one pact and two in the other, were found dead after having intoxicated themselves by carbon monoxide on the same day in October, 2000 [31]. They were all teenagers or in their early 20’s, and it was reported that “Japan has recently seen a wave of Internet-linked suicides, as people seek companions to die with”.

In France, a 14- and a 15-year-old female committed suicide together in February 2005 after forming a suicide pact on the Internet [32].

Depression

Another primary prevention of suicide in general would be to identify and treat people with depression. Depression is generally recognized as a major risk factor for suicide [33], and a US study of antidepressant medication among adolescents aged 10-19 years indicated that a 1% increase in adolescent use of antidepressants was associated with an annual decrease of 0.23 suicides per 100,000 adolescents. Especially males aged 15-19 years and those from low-income areas benefitted from the treatment [34].

A report from the Swedish National Institute of Public Health concerning young people’s health showed that 3% of the males and 4% of the females aged 16 through 24 years were on antidepressant medication compared to 5% and 9%, respectively, in the whole Swedish population. Medication was more common in the southern parts of the country and in larger cities [35]. The Medical Products Agency in Sweden have released recommendations for the treatment of depression among children and adolescents [36].

The Vision Zero

One example of injury preventive strategies more recently developed in Sweden is the “Vision Zero” by the Swedish National Road Administration [37]. It is estimated that traffic injuries cost the Swedish society about SEK 21 billion each year [38] and the human suffering is immeasurable. The “Vision Zero” was introduced as a basis for the work being conducted on road safety in Sweden and the goal is that no one would be killed or seriously injured in road traffic. Cable guardrails, safer motorways, roundabouts, speed surveillance, safe roadside areas, and safer traffic in built up areas are examples of injury reducing measures from the “Vision Zero”. During 2009, 355 persons were killed, which is the lowest number of persons killed since 1945 and the numbers killed have decreased by 30% since the introduction of the “Vision zero” [39].

Bicyclists account for approximately 10% of all fatalities on Swedish roads and streets and teenagers are pointed out as a group of special interest [40]. Of course, the prevention of head injuries and the use of bicycle helmets are the main foci concerning bicycle injuries and mandatory helmet wearing for all ages is one important injury reducing strategy [40, 41]. A Cochrane report shows that helmets provide a 63 to 88% reduction in the risk of head, brain, and severe brain injury for *all* ages of bicyclists and that helmets provide equal levels of protection from crashes involving motor vehicles (69%) and other causes (68%) [42]. Despite these facts, the bicycle helmet law adopted in 2005 in Sweden includes only those below the age 15.

The “A” word

The “A” word – “Accident” – is sometimes interpreted as an act of God and thereby not preventable. The etymology of the word refers to the Latin word “accidentum” (from ad- “to” + cadere “fall”) and the meaning grew from “something that happens, an event” to “something that happens by chance” and then this was reinterpreted to mean a “mishap”.

In 2001, BMJ publishing group banned the word “accident” because accidents are not unpredictable nor unpreventable [43]. Some might think, as Evans [44] that this is “pedantic quibble”. Nevertheless, *unintentional injury event* will be the preferred term in this thesis.

Aims

- To study the epidemiology of teenager fatalities in northern Sweden and suggest preventive measures.

The more specific aims were

- To study teenage suicide regarding the suicide victim, the family, and the community, and to investigate the feasibility of using police as informants for suicide studies.
- To interview family members that had lost a teenager by suicide and to increase the understanding of the circumstances that these families are living under.
- To disclose and describe possible suicide clustering among teenagers and to suggest preventive measures.
- 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.

Materials and methods

In papers I-IV, the material consisted of teenagers (13 through 19 years of age) living in the northern half of Sweden at the time of their death during the period 1981-2000. Included in the four studies were those that had died from external causes (unintentional deaths, suicide, and homicide) and were autopsied at the Department of Forensic Medicine in Umeå, National Board of Forensic Medicine. The northern half of Sweden consists of four counties constituting approximately 55% of the area of Sweden and 10% of its population (908,000 inhabitants including 81,441 teenagers) (Official Statistics, Västerbotten's County Council, 1991).

According to Swedish law and regulations, the police should investigate all unnatural deaths, and the investigation should include a medico-legal autopsy. These requirements may explain why the number of drop out cases is low [45].

The above is valid for all four studies I-IV, if not stated otherwise below.

Paper I

The study comprised 355 unnatural deaths after excluding individuals not permanently living (registered) in the catchment area at the time of their death (n = 23).

Autopsy protocols and police records were examined and social and hospital records were studied when available. All cases were coded concerning the cause and manner of death using the International Classification of Diseases (WHO, 1977). Cases originally classified as undetermined manner of death were re-evaluated by Dr Lars Johansson and Professor Anders Eriksson, forensic pathologist, to achieve a uniform classification. After re-evaluation, five cases remained undetermined whether intentional or not.

Toxicological data refer to the results from analyses of femoral vein blood at the Department of Forensic Toxicology, Linköping, Sweden. Blood analyses from victims that survived the initial injury event for more than six hours were excluded. Testing for other drugs than alcohol was not performed routinely during the study period.

Paper II

All teenager deaths categorised as suicide at the Department of Forensic Medicine in Umeå (ICD-9, n=15) from 1 January 1993 through May 1995 were included.

Police reports, autopsy protocols, and medical records from the most appropriate district medical office and from child and adolescent psychiatric and paediatric services were requested. Records from other medical clinics

were collected when applicable. The psychological records from the military service were retrieved for males older than 16 years.

The police officers who conducted the investigation of the suicide were chosen as the key informer for the interview. When they referred to other police officers, these other officers were interviewed as well.

The main purpose of the interviews was to gather information not found in the official reports. Subsequently, an informal and confidential interview situation was created. Hence, audio/video-recording devices were not used because it might have interfered with the informant's readiness to present "soft" data. Three issues were always covered: (a) previous suicide attempts, other family members' suicide attempts, friends who attempted suicide or people in the local community; (b) psychiatric morbidity, substance abuse, or antisocial behaviour of the suicide victim or in the family; and (c) social structure of the local community. Otherwise, the interviews were open and this inductive approach was chosen to capture unexpected information and to give the police officers an opportunity to express their thoughts about the case without being influenced by the questions.

The information gathered was dictated separately by each author directly after each interview. Further reflections were also recorded successively.

Paper III

From 1995 through 1998, thirteen suicide victims autopsied at the Department of Forensic Medicine in Umeå were retrospectively identified and consecutively analysed. The surviving families of the 13 cases were invited to participate in the interview study and ten families agreed to participate. The open interviews took place 15 to 25 months after the suicide. The information gathered was manually analysed according to a grounded theory model [46], resulting in allocation of data into one of three domains: post-suicidal reactions, impact on daily living, and family's need for support.

This design increases the understanding rather than reveals causal relationships. In addition, the method requires mutual trust and identification with the respondents and critical self-reflection. The non-verbal communication plays a major role. Furthermore, unlike structured interviews, the researchers are "allowed" to answer questions if the questions help the interview and the respondent. Notes must be taken inconspicuously, thoroughly, and promptly.

Our aim was to come as close to these families as ethics and professional concern allowed. The conversation was permitted to find its own way although three issues were always covered: (a) psychiatric history, (b) substance misuse by the deceased as well as family members, and (c) previous antisocial behaviour of the deceased. All sessions began with this question: "Tell me about NN (the deceased)". All sessions closed with these

questions: “Do you want to tell me anything else that we have not talked about?” and “What do you think of this interview”?

Hard data and subjective reflections were dictated immediately after the interview and, in most cases, for some time afterwards. Each interview was later reviewed in a session with a senior psychologist where the facts of the matter and the counter-transference were analysed and subsequently dictated.

Paper IV

The material comprised of police reports, autopsy protocols, and medical records (if available), and interviews with the investigating police officers of the suicides occurring from January 1993 through May 1995 (Paper II). For the cases from 1995 through 1996, the parents as well as the police officers were interviewed (Paper III).

The Centers for Disease Control definition of a suicide cluster was used: “a group of suicides or suicide attempts, or both, that occurs closer together in time and space than would normally be expected in a given community” [47]. We excluded “suicide attempts” since we did not have enough information on such.

Paper V

The material comprised 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. The University Hospital is the only hospital within a radius of 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 patients at the ER were asked to answer a questionnaire focusing on when, where, and how their injury occurred. If the injured person were unable to answer the questions herself/himself, an accompanying person or a staff member at the ER did so. The information gathered was registered in computer files, and from those files 12,812 teenagers who had altogether 18,764 injury events were identified.

The injured were not routinely tested for the presence of alcohol or any other drug at the ER. It was, however, sometimes noted in the files if they smelled of alcohol or if they admitted that they had been drinking alcohol or taking drugs.

In January 2010, those 12,812 injured were checked against the National Cause-of-Death Register to identify those who had died and their cause of death. Fatally injured persons were routinely subjected to a toxicological analysis in conjunction with a medico-legal autopsy unless hospitalized for six hours or more before death. Four deaths occurred abroad, and they were

not included in the results concerning alcohol and drugs since such information was not available.

Statistics

To calculate the expected number of dead in the study group, for each age and each year the individuals attending their first visit to the emergency care unit were followed until death or until December 31, 2006. To calculate the expected number of deaths, different life tables were used; one life table for those having their first visit during the years 1993-1999 and another for those having their first visit during 2000-2006. Different life tables were used for males and females. Assuming that N males at the age of 13 had their first visit to the emergency care unit in 1993 and that they were followed until death or until December 31, 2006, and using the life tables for males, the probability of dying during the follow up period (p) was calculated. The expected number of dead in this group was then calculated as $N \cdot p$.

Ethics

The Regional Ethical Review Board in Umeå approved of the procedures used concerning papers II-V. Paper I is a register study on deceased, requiring no ethical approval at the time of the study.

Results

Paper I

General (n=355)

Seventy percent of the deaths were caused by unintentional injuries, 29% by intentional injuries (88 suicides, 14 homicides), and 1% were classified as undetermined manner of death. Most of the victims were males (75%) and the median age was 17 among males and 16.5 among females.

The number of unintentional deaths decreased ($p < 0.001$) during the study period (1981-2000), but there was no statistically significant change of the incidence of suicides, which was on average 6.75/100,000 teenagers and year during the study period. Twenty-eight percent (78 males and 12 females, 28 not tested) tested positive for alcohol with a blood alcohol concentration (BAC) ranging from 0.01 to 0.29%.

Unintentional deaths (n=248)

Transportation-related injuries caused most of these deaths (n=204; 82%) and males (77%) dominated. Twenty-five percent of the decedents were test-positive for alcohol. For every test-positive female, there were almost seven test-positive males.

Transportation-related deaths (n=204)

Most of the deaths (n=109, 55%) involved passenger cars; car drivers constituted 52% (n=57) of these. One-quarter of the victims were either a motorcycle or a moped rider, followed by pedestrians and other categories. Three out of four dead were males. Transportation-related deaths decreased significantly among males aged 16 through 19 years during the study period.

Among vehicle drivers, 28% tested positive with a post-mortem BAC ranging from 0.01 to 0.22%. Twelve of the drivers in the single vehicle crashes tested positive for alcohol; they were all males.

Suicides (n=88)

Most suicides were committed by hanging (n=35; 22 males; 13 females), followed by firearm injuries and intoxications. Three out of four decedents were males and the highest incidence (20/100,000 teenagers) was found among males 16 through 19 years between 1986 and 1990. Twenty-six males and four females tested positive for alcohol (35%) with a BAC ranging from 0.02 to 0.29%.

Homicides (n=14)

Seven teenagers of each sex were victims of homicide, with a median age of 16 years. The perpetrator was always a male, was known by the victim in 11 cases, and was a family member in four cases (three fathers, one brother). One homicide victim tested positive for alcohol.

Undetermined manner of death (n=5)

After re-evaluation, five cases remained impossible to classify as either intentional or unintentional. Two were struck by a train (both tested positive for alcohol with a BAC of 0.13 and 0.20%). Two died by drowning with a post-mortem BAC of 0.18 and 0.20%, and the fifth victim (test negative) crashed his car into a parked truck.

Paper II

General (n=15)

Eleven males and four females committed suicide and most of them were living in the interior, rural parts of the study area. Most of them were raised in their original family and all but two had one or more siblings. Three suicide victims were known to consume excessive amounts of alcohol and another two were regarded as abusers of both alcohol and illicit drugs although none were categorised in the file material as substance dependent or an abuser. None of the parents were reported to have been treated for a psychiatric disorder or had committed suicide. The male caretaker was in five families regarded as an alcohol abuser.

Four subjects (three females) had been admitted to voluntary inpatient psychiatric care and another subject had been referred to, but not yet examined by, a psychiatrist. Five individuals had made previous suicide attempts; all had been referred to psychiatric treatment. Six died by hanging, four by firearm injuries, four by poisoning, and one by crashing a car. Six of the 15 subjects tested positive for alcohol (BAC 0.03%–0.22%). One teenager who was brought alive to hospital was not tested for blood alcohol but had been drinking before the suicide, according to friends. After analyzing the information gathered, the cases were divided into different subgroups listed below.

Female suicide victims brought up in intact and stable families (n=3)

All grew up in small communities, not far from a city. Each family was described as closely knit but secluded. They were living with their family, attending school, and seemed rather talented. All three had previously been

hospitalised in a psychiatric clinic after a referral from someone outside the family.

They were all facing a life crisis at the time of the suicide. One victim had recognised that her boyfriend had dated others, one had recently graduated but had no future plans, and the third female looked upon herself as a social failure. The suicides were well planned and resolutely carried out. All appeared to have improved psychologically before the suicide; for example, one with an eating disorder started to eat normally. After the suicide, all the parents refused the professional support that was offered.

Male suicide victims brought up in intact and stable families (n=4)

Three of the males lived in the inner, sparsely populated part of the region, and one lived in a suburban part of a major city. Their families were seen as difficult to come to know. None of the suicide victims had been subject to psychiatric care, although one had been talking with his general practitioner about personal problems irregularly for some years. This contact was terminated one year before the suicide. One told a friend a couple of days before the suicide the following: "I might as well hang myself". None of these victims had made earlier suicide attempts.

Two tested positive for alcohol at autopsy (BAC 0.029% and 0.19%). The suicides were retrospectively associated with a broken relationship with a female (two cases), unemployment (one case), and controversy with the parents regarding schooling (one case). As with the parents of the females brought up in a similar social environment, the parents declined offers of psychological counselling after the suicide.

Male suicide victims brought up in a family with social problems (n=5)

All suicide victims were raised in a small community in the vicinity of a minor inland city. The families had various kinds of social problems: split family (four cases), criminality among siblings (two cases), and a physically abusive alcoholic father (one case). Two of the five suicide victims had no record of alcohol abuse or of antisocial behaviour. The other three were in the process of becoming delinquents as well as alcohol abusers, according to the informants.

All but one of the suicides appeared to be impulsive acts after disputes with significant others. Four tested positive for alcohol (BAC 0.13%–0.22%). The fifth had a lethal blood concentration of phenobarbital. However, their arrangements left time for second thoughts; the only carefully prepared suicide concerned a male who had told a physician that he one day could hurt either himself or others. He was referred to a psychiatrist but cancelled the appointment. Two weeks before the suicide, his application to a most desired

school was turned down, and his peers reported that he subsequently became “calm”.

Suicide victims with a severe, traumatic life history (n=3)

The life histories of these three victims (two males and one female) featured severe and ongoing trauma from childhood. Two of the mothers died before the victim-to-be reached school age. Both mothers had been married to alcohol abusing men, one of whom was a violent criminal. The extended families displayed a variety of social and mental deviance: alcoholism, mental retardation, physical abuse, and child neglect.

Although social welfare had initiated more or less temporary placements, the problems continued. One suicide victim, for example, was relocated to live with a relative, whom he later found dead by suicide. Another had been placed in long-term inpatient psychiatric clinic after moving back and forth between his divorced parents. At the age of 12, he was found in a public place, unconscious due to alcohol ingestion, with semen in his rectum. At that time he also made a serious suicide attempt and he was eventually transferred to an institution with limited psychiatric and therapeutic competence where he finally committed suicide. The third case, a female, killed herself in a way strikingly similar to the way her mother had died many years before.

These teenagers used violent suicide methods in public places, such as a dump, a man’s toilet, and a road. According to our interviews, the triggering events were thought to be a broken love affair, disappointment with a father’s alcoholism relapse, and repeated breaking of promises by a mother.

Paper III

General (n=10)

Almost all parents expressed anger at being deceived by their child and by that felt they were also denied the opportunity to provide parental support. Simultaneously, they aired remorse for being angry with someone who obviously had been so lonesome and desperate and the “forbidden” anger appeared to be quite a problem. The search for an answer to the question “why?” still preoccupied most of the parents.

Several of the deceased had been informal leaders for their peers and were average or high achievers in school. Nonetheless, they had faced “normal” problems such as a broken love affair, fear of pregnancy, or difficulties with friends. Just before the suicide, however, the emotional turmoil of the teenagers had in most cases seemingly abated, which, ironically, had put their parents at ease.

Six teenagers had written suicide notes with messages such as “I love you”, “Forgive me”, “I cannot go on living”, “Don’t be angry with me”, “Try to

forget me". These notes shed little light on the issue. Two letters yielded instructions to pass on personal belongings to a sibling.

Impact on daily life

Although a long time had passed since the suicide in most cases, the families were still struggling to move on. Those who had lost their only child appeared to have the greatest difficulty. All had returned to the routine activities of daily life and almost all parents thought it impossible to ever return to "normality"; their ambition was limited to managing another day. None had experienced one full day without thinking of their deceased child. Some parents had entertained the idea of committing suicide themselves, but they decided against this because they were all too familiar with the disastrous effects upon the next-of-kins.

Post-suicidal support

Parents who found and accepted early support from their extended family, friends, or close members of their church were grateful for these people, but those who found themselves subjected to the attention of self-invited professional helpers were more critical.

In the post-shock phase, a minority had received professional counselling; most of the families were helped by clergy. Laymen from the Swedish Organisation for Suicide Survivors played a significant therapeutic role in some cases; however, many families found themselves alone with grief too soon after the suicide. They articulated a need to work the crisis over when the level of anxiety lessened. Generally speaking, the relationship with both friends and community members were, at the time of the interviews, dissatisfying. They felt that others expected them to forget the experience and get on with life.

In cases where one or more siblings were present at the interview, the parents were most pleased with their silent participation. Only few adults, professionals, or others had previously succeeded with involving these children in sharing thoughts about the loss. According to data obtained from some random follow-up contacts, the research interviews had been most beneficial for these children.

Paper IV

General (n=88)

Among the 88 (male/female ratio 3:1) suicide victims during the study period, we found two possible suicide clusters, each including three victims.

Cluster 1

The first cluster involved three teenagers who all knew each other and who all committed suicide by hanging. Two lived in a community adjacent to a city where the third victim lived. The first case was a male in his late teens who regularly attended a church to which the parents of the third suicide victim belonged. His parents perceived him as being “depressed” the last few months before the suicide, and they noticed that he was becoming increasingly “unrealistic” in his thinking. A female in her late teens committed suicide within one year of the index case. She lived and worked close to where the index case lived. She did not exhibit problems at school and had many friends. After her death, the parents recalled that she appeared “calmer” the last month of her life.

The third case, a female in her early teens, committed suicide also within one year after the index victim. Her parents were members of the same church as the first case. This suicide victim knew the index person as a friend and she expressed suicidal thoughts almost from the day he committed suicide. About one month after his suicide, her parents noticed that she was talking to herself, hallucinating, verbalising obsessive thoughts, and openly threatening to commit suicide. She attended several out patient sessions with a psychologist at a child and adolescent psychiatric clinic. There was a history of psychotic disease in her family.

Cluster 2

Three teenagers committed suicide also in the second cluster – two by jumping from a tower and one by hanging. They lived on the same block in the same city and they all knew each other. The index case was a male in his late teens with long-lasting problems with his schoolmates. Some time before the suicide he disappeared from home and his concerned parents found him near the tower from which he later leaped. A male, also in his late teens, was the second victim approximately one year later. He jumped from the same high place as the index case. He told his parents that he was going to visit a friend, but instead he climbed a fence to get access to the tower where he left a suicide note. The third case, a female in her mid-teens, committed suicide shortly after the second case who she identified by name in her suicide note, saying she was now going to talk to him. During her last year, she had an intense interest in suicide-related information such as newspaper articles about suicide and music by artists who had committed suicide. Her father received a telephone call from a school counsellor on the day of the suicide to inform him that his daughter was suicidal and that they should call the child and adolescent psychiatric clinic first thing in the morning. The father rushed home; he arrived too late.

Paper V

Thirty-eight of the 12,812 teenagers were dead from unnatural causes before January 1, 2008, and included in the study. The standard mortality rate for unnatural death was 1.44 (1.02-1.98).

Demographics of index cases

Of the 12,812 teenagers, 7,543 (59%) were boys and 5,269 (41%) were girls and altogether they accounted for 18,764 Emergency Room visits at the Umeå University Hospital due to injury. The number of injury events increased by year (n=857 in 1993 and n=1,952 in 2006); the number of injured boys increased by 133% during the period, and the number of injured girls by 119%.

Monday through Thursday accounted for approximately the same number of injury events (n=8,540) as did Friday through Sunday (n=8,325) and in 1,899 cases the weekday was not registered. Sports' activities generated 7,961 injury events, falls 5,469, and transportation 3,334, followed by 2,000 "other" injury events. Self-inflicted injuries and interpersonal violence generated 1,197 injury events of which 174 were classified as suicide attempts. The Emergency Room visits were mostly due to minor injuries. In 525 cases (3%), alcohol was mentioned in the files as a contributing factor to the injury event.

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. Of the 38 deaths, 23 were caused by unintentional injuries and ten by intentional injuries (all suicides), while five deaths were categorized as undetermined whether intentional or not. Four of the deaths occurred abroad, one from unintentional hypothermia, one from unintentional head injury sustained in a car crash, one fall injury and one suicidal hanging. These four cases were not further included in the results concerning alcohol/drugs since such information was not available.

Twenty-five out of the remaining 34 unnatural deaths (74%) tested positive for either alcohol (n=10) or drugs (n=12) or a combination (n=3). Drugs used included heroin, amphetamine, tetrahydrocannabinol, methadone, benzodiazepines, dextropropoxyphene, morphine, selective serotonin uptake inhibitor, paracetamol and tramadol.

Five out of the 11 tested traffic-related victims tested positive for alcohol and two tested positive for drugs while four were test negative at the post mortem examination. Four out of 7 drivers were under the influence of alcohol (n=3) or drugs (n=1). Furthermore, in two cases it was not possible

to determine whether the victim had been the driver or the front seat passenger. Two out of three passengers tested positive, one for alcohol and one for drugs.

Nine males and one female committed suicide. Four out of nine tested were test positive for alcohol and one for a combination of alcohol and drugs, while four tested negative at the post mortem examination and one was not tested. We searched available file material for signs of concealed suicides, but in no case could we confirm such signs. Five deaths by intoxication (three males and two females) were categorized as undetermined whether intentional or unintentional.

Discussion

Some parents with a troubled teenager in the home have spent endless nights awake, waiting for their teenager to come home from excursions into adulthood. For some, the wait will be in vain and turn into grief and sorrow. A car crash, a fight, a fall, or even a suicide had ended their teenager's life. Can we do anything about these tragic events? Are they preventable or was it just bad luck, a mishap?

Preventable deaths

A study from Philadelphia (USA) judged that 95% of all injury deaths among persons aged 21 years and younger were preventable [48]. The investigators studied 224 injury deaths and these deaths were evaluated by a multi-disciplinary team with the mission to prevent future deaths through review, analysis, and initiation of corrective actions. The injury deaths constituted mainly homicides (19%), unintentional deaths (mostly residential fires/burns) (16%), and suicides (2%). The conclusion was that violent deaths were associated with substance abuse, gang involvement, chronic truancy, academic failure, and access to weapons. Deaths due to fire/burns were associated with the lack of a smoke detector, non-supervision of children, and faulty home appliances [48]. The scenario from northern Sweden is different with a majority of unintentional deaths (n=248, 70%) and of the intentional deaths most were suicides (n=88) with only a minority of homicides (n=14). Nevertheless, there is always a potential to reduce injury and premature death among the young (Paper I).

Another Swedish study claims that 70 out of 335 in-hospital trauma deaths were classified as "avoidable" [49]. Hence, evaluating and improving trauma care should not be forgotten; despite our efforts, injuries still occur. Moreover, when they occur, we must be able to take care of the victim properly to limit the consequences of the injury and to rehabilitate the injured.

Impact on society

In a strict sense, all injuries can be prevented, but it would demand another type of society with severe restrictions of the individual's freedom, restrictions that would not be accepted, neither by the politicians nor by the average citizen. A society such as this would probably make Orwell's society described in his novel *1984* [50] look desirable. The question is this: How far can we stretch the injury reducing measures? What will be accepted?

An acceptable toll?

To apply the “Vision zero” in the sense that no one must die from injury or be seriously injured is, and will probably always be, just a vision. But it is a vision that everyone working in the field of injury prevention must address because if we do not adapt to this view, we will have to decide how many seriously injured and dead represent an acceptable toll. Once we have started this discussion, we have changed the focus from “how many injured and dead can we prevent?” to “how many injured and dead can we accept?” Even so, no researcher believes for real that all injuries can be prevented.

Years of Potential Life Lost

The absolute number of teenagers killed in northern Sweden each year is small, but these deaths will have significant impact upon the society as measured by years of potential life lost (YPLL) – not to mention the impact on families and friends. In fact, death by injury equals cancer and heart disease/stroke deaths put together [51] as measured by YPLL. Years of potential life lost is most often calculated with the age of 65 as an end point, i.e., if a 15 year-old is killed, she/he contributes with 50 years of potential life lost, while death at the age of 60 contributes with 5 years. Put together, this means that death from injury is a burden of the young, while death from disease is a burden of the elderly. YPLL has been applied for some years now and perhaps it is time to evaluate the significance of having the age of 65 as an end point? People now tend to be more active – and healthier – at older ages and many tend to work beyond the age of 65, perhaps the end point should be 70 or even 75 years of age?

Curfew laws

Restrictions with the aim of reducing injury and death among teenagers could be achieved through curfew laws, which have a potential to save lives and prevent injuries. Curfew laws, a means not yet evaluated in Sweden as far as I know, have been implemented and evaluated in, e.g., USA, Iceland, and UK. These laws were initially instigated as a method of crime reduction [52, 53] with the aim to prevent late night, non-productive street presence among teenagers. Many studies showed that these curfew laws were effective in preventing injuries [54-57], although its efficacy for crime reduction has been questioned [57].

Several cities, counties, and states across the US have enacted, or attempted to enact, curfew laws. The typical US curfew starts at midnight and ends at 5 a.m. and comprises all activities of individuals aged 13-17 years in a public place if unaccompanied by an adult [55]. When comparing cities with and without curfews, it was found that curfews were associated with a 23% reduction of fatal injury for 13- to 17-year-olds [55]. A more limited

study estimated a 23% reduction of both fatal and non-fatal motor vehicle injuries for 13- to 17-years-olds [54]. In Florida (USA), trauma admissions dropped significantly after the implementation of curfew laws [57]. Parents of teenagers have also been found to endorse strongly curfew laws and to favour earlier starting times than prevail in most jurisdictions [56].

Night time driving seems to be particularly dangerous to young, novice drivers and driving with passengers of the same age in the car [58-62]. To drive without adult supervision and being male was connected also with a high rate of driver injury crashes [59]. Most of these risk factors could be controlled by curfews. But curfews, in its strictest sense, will impede the freedom of every teenager with respect to most of their activities during specified hours.

Taking results from US studies and transfer the result to Swedish conditions with other infrastructure, stricter gun laws and less interpersonal violence may not be correct. Also, conditions in the southern parts of Sweden may differ from conditions in a city in the northern part of Sweden. However, if a curfew from 10 p.m. to 6 a.m. had been applied in northern Sweden during the 20 years under study (Paper I) and if there had been a 100% compliance with such a law, 115 teenager deaths out of 355 could have been avoided (Paper I).

Multi-stage driver's license

Graduated driver's licensing systems (GDLs), on the other hand, are thought to safely introduce the young to the traffic environment by a multi-stage license. Early license stages are intended to keep adolescents out of high-risk driving situations, such as night time driving and driving with passengers of the same age, while permitting them to gain on-road experience in low-risk environments. Another advantage of GDLs is that they will not affect *all* activities, and they can be designed in many different ways and adapted to circumstances specific to a state or country. GDLs have been introduced in a majority of US states and in numerous jurisdictions in Canada, Australia, and New Zealand [63].

Since October 1, 1998, Swedish teenagers can practise driving from the age of 16, but they have to be under supervision of someone who is at least 24 years old and has held a driver's license for the appropriate category of vehicle for at least five consecutive years and who has been approved of as an instructor for the designated learner driver [64]. Recently, a course at a drivers' school for the instructor-to-be has been implemented. A full license without restrictions can be obtained from age 18.

The New Zealand GDLs were evaluated recently and the main findings were that GDLs are an effective way of reducing traffic crashes among young people, and that a night time driving curfew is an important component of a GDL. Also, restrictions on the carrying of passengers may

help reduce traffic related injuries [65]. Another interesting finding was that drivers involved in the GDLS had a lower proportion of crashes at night than the pre-GDLS drivers, even when the night time driving restrictions no longer applied to them [65]. Evaluation of GDLSs in the US has shown the same results [54, 55, 63, 66]. Another positive effect of GDLSs is that the drivers are older when they are fully licensed; it has been shown that age is a more important factor than driver experience concerning injury prevention [67], a finding that also applies to motorcycle injuries [68].

There is more support for the need of injury prevention programmes aimed at the teenaged drivers. For example, teenage drivers were found to wear safety belts less often than adult drivers and they were found to be involved in 19% of the motor vehicle crashes while comprising only 5.8% of the study population [58].

Suicide

Imagine that it is New Year's Eve and that you are a health care professional on duty. In front of you stand 100,000 teenagers and you know that during the forthcoming year will seven of these kill themselves. You are to identify these seven teenagers and successfully prevent them from committing suicide. You also know that some of them that stands in front of you, mostly females, will make one or more suicide attempts, which identify them as persons at risk. Some will get in contact with you because they suffer from an eating disorder or feel depressed, and some will present with somatic complaints.

A Canadian study showed that 66% of suicide completers versus 59% of the controls had been in contact with a general practitioner the past year, but for the last month before the act the figures were 19% versus 7%. A psychiatrist had been seen in 24% versus 0% the last year and 13% versus 0% the last month [69]. Since a significant proportion of the potential suicide victims had contact with a general practitioner the last year, it seems as if there "is ample room for improvement of health care professionals' detection rates of psychopathology" [69]. Overall, however, when compared to controls, the suicide completers had significantly (p -values ranging 0.01-0.0001) more current and lifetime contacts with mental health professionals and youth protection services [69].

Despite knowing all this, your task is almost impossible. Most of the suicides will appear as a bolt from the blue and not even the parents of the teenager who lived together with her/him on a daily basis would have suspected that their child was suicidal. But if you cannot identify those at risk, can these suicides be prevented?

Hanging

Preventive measures aimed at reducing hanging should focus on the reduction of available means in controlled environments, optimizing the emergency management of “near-hangings”, and by primary prevention of suicide in general [70].

Hanging is the most common way of committing suicide among teenagers (Paper I), a method with a high mortality rate [70]. Ropes, belts, and electric flex are the most commonly used ligatures, while rafters and beams, banisters, hooks, door knobs, and tree branches are the most commonly used ligature points [70]. These objects obviously are virtually impossible to exclude from the environment. Still, suicidal hangings are potentially preventable through the restriction of available means, e.g., in controlled environments such as hospitals, prisons, and police custody, places where approximately 10% of the hanging suicides in England occur [70].

During 2002-2007, there were 40 suicides within the correctional system of Sweden. Most of these suicides were by hanging and a majority took place when the suspect was placed in custody [71], i.e., the victim was supposed to be under surveillance. Clearly, there is a potential for prevention of suicide by hanging.

Approximately 70% of those who try to commit suicide by hanging die, but surviving a near-hanging even after >5 minutes suspension is possible, maybe in part related to the fact that approximately 50% of hangings are “incomplete”, i.e., the victim is not fully suspended [70]. But it is not only a question of surviving, it is also a question of surviving without permanent neurological disability. Thirty-seven out of 42 individuals arriving at a hospital after a suicide attempt by hanging survived; 35 of those survived without persistent neurological disabilities [72]. This is important knowledge to ambulance personnel and trauma care facilities, especially since there have been substantial increases in the number of suicides by hanging [73]. In Sweden, asphyxial deaths among those aged 10 through 19 years have increased from 11 cases in 1997 to 33 in 2008 (1.07 to 2.82/100,000) [74]. Consequently, an increasing number of cases will be expected to reach hospital alive after a near hanging.

Firearms and drugs

Suicide prevention can be performed at an individual level (identifying and treating depression, psychosis, eating disturbances, and other conditions known to be associated with suicide) or at a population level (e.g., stricter gun laws, restricting the availability of licit/illicit drugs). Firearm suicide was second after hanging among teenager suicides in this study, but in most cases, if not all, the registered owner of the firearm used was an adult family member. In an international comparison, Sweden has strict gun laws, requiring, among other things, a firearm to be locked up in a safe when not

in use. Still, 26 teenagers managed to get hold of a firearm and to commit suicide (Paper I).

Restricting the available means for suicide might prevent suicide [75], although there is always a risk that there will be a compensatory increase in the use of other methods. In fact, there is usually some “displacement” (i.e., an increase in suicides by other methods than the restricted one), but the decrease through the restricted means is rarely fully compensated [76, 77].

This also applies to firearms, and the availability [78-81], not the type or method of storage, appears to increase the risk of firearm suicide [75, 82]. Others have, however, found that safe storing and keeping firearms unloaded protects against firearm suicide [83]. Furthermore, firearms were found to be present more frequently in the home of suicide victims compared to both suicide attempters and psychiatric controls with similar psychiatric characteristics as the suicide completers [82].

Restricting access to firearms might be expected to reduce the suicide rate among those aged 15-24 years [78], especially since suicide among adolescents, compared to other age groups, more frequently is an impulsive act [84]; firearms have no place in the home of psychiatrically troubled teenagers [82] and firearm owners should carefully weigh their reasons for keeping firearms in their home against the possibility that it may someday be used to take a human life [79].

Swedish physicians should, according to Swedish laws and regulations, report to the police any patient with a psychiatric or somatic disease that makes her/him unfit to handle a weapon and thereby to be a firearm owner. There are approximately 650,000 license holders in Sweden and the number of reports to the police have increased from 84 in 2002 to 626 in 2006 [85], but the concern is that there still is a substantial underreporting [86]. Today, the debate is whether these laws and regulations are really effective since their enforcement can interfere with doctor-patient relations [86].

The discussion of firearms can be applied to prevent also drug intoxications. Drug suicides by teenagers in this study were almost exclusively performed with drugs prescribed to someone other than the suicide victim (Paper I). Safe storage and using as small packages as possible should be encouraged, and other ways of administering the drug, such as suppositories and plasters, should be considered [87].

CO intoxication

Suicide with carbon monoxide is often performed with a vacuum cleaner hose applied to the exhaust pipe of a car leading the exhausts into the car. Changing the shape and form of the exhaust pipe and hereby making it incompatible with a vacuum cleaner hose would make it more complicated to apply a hose [88]. More time would be needed for preparations, time that

would give others a chance to intervene, and also give the suicidal person a chance to change her/his mind as many teenaged suicides are impulsive acts [84]. An automatic idling stop [88] or a technical device that can measure the carbon monoxide concentration in the car compartment and stop the engine at pre-toxic levels represent other ways to prevent carbon monoxide suicides with car exhausts. Both unintentional and intentional motor vehicle-related deaths have decreased since the introduction of catalytic converters of exhausts, e.g., the rates of carbon monoxide vehicle-related suicides decreased by 43% in the US from 1968 through 1998 [89]. In 2001, 73% of the cars in Sweden had a catalytic converter [90], and in 2003 the corresponding figure had increased to 82% [91]. From 1997 to 2008, suicidal deaths for all ages from intoxication by gas decreased from 0.89 to 0.43/100,000 in Sweden [74].

Suicide clustering

Suicide cluster formation is noted especially among younger people [92], constituting 1-13% of all teenager suicides [93]. In this study, suicide clustering comprised 7% (6/88) of all teenager suicides during a 20-year period (Paper IV). Accounts of suicide cluster formation have been reported from ancient times to the present; this is also known as the Werther effect, a phrase coined in 1974 at the University of California, San Diego, by sociologist David P. Phillips [94, 95]. The name Werther comes from the novel *Die Leiden des Jungen Werthers* (The Sorrows of Young Werther) [96].

*In short, the character Werther falls in love with a woman who is promised to someone else. Werther, being melodramatic as always, decides that he cannot live on when his loved one has been lost to him. He dresses in boots, a blue coat, and a yellow vest and sits at his desk with an open book, and then shoots himself. In the following years, so many young men shot themselves, dressed and seated as Werther, and with an open copy of *Die Leiden des Jungen Werthers* [96] in front of them, that the book was banned in Italy, Germany, and Denmark [94]. Modern research has, however, questioned that there really was a suicide epidemic following the release of this book [97]. Nevertheless, the term "Werther effect" is generally recognised as something describing suicide contagion.*

Although awareness of this phenomenon has been around for centuries, Phillips [95] was the first to conduct formal studies suggesting that the Werther effect was, indeed, a reality. Massive media attention and the retelling of the specific details of a suicide (or, in some cases, unintentional fatal injuries) could in fact increase the number of suicides [94].

One classical study proved the Werther effect on suicides after watching fictional models on television in former West Germany [98]. The TV programme was about a 19-year-old male student who committed a railway suicide and the investigators noticed an increasing number of railway

suicides under extended periods, up to 70 days after the first episode, and the suicides increased (up to 175%) most sharply among those of the same age and sex. The series was broadcasted again one year later (!) with similar effects on the suicide rates (the network was informed about the findings after the first broadcast, but they chose to ignore the information).

Suicide and the media

The Bridgend suicides in Wales, England, have brought the question of media reporting and media's role in suspected suicide cluster formation into focus – once again [99]. In 2007 and 2008, an estimated 25 young people committed suicide by hanging in and around Bridgend compared to an expected number of 2 to 3 [99]. Bridgend, in a newspaper article described as “a very poor, working-class, down-at-heel, everybody's unemployed sort of place”, is a former mining village of some 39,000 people and it is also the county borough, population 132,000 [99]. Few of the suicides were in Bridgend itself, but were dotted all around. National media first reported when seven youngsters had committed suicide and within a few days another 13 had killed themselves. The media reporting accelerated and further suicides were committed [99, 100]. Headlines named Bridgend “suicide town” and “Internet suicide cult town”, and pictures of the suicide victims were published in local and national press. Retrospectively, however, there was no evidence of Internet's contribution to the suicides [99]. Online memorial pages to Bridgend suicide victims were published on the Internet, although the pages were closed due to the risk of still more copycat deaths [101]. A media debate also started concerning the role of media in suicide cluster formation and copycat behaviour [99, 102].

Marilyn Monroe

Another example of the Werther effect is illustrated by the “probable suicide”, as stated by the Los Angeles County Coroner's Office, of Marilyn Monroe in 1962. In the month following her death, most suicides registered in the US were by young blond women who appeared to have used Monroe's suicide as a model for their own. In fact, Marilyn Monroe's death had such an impact on the American society that the overall suicide rate in the U.S. increased by 12% in the following month after her death [94]. Monroe's suicide actually appeared to have caused a whole population of vulnerable individuals to complete their own death, over and above what would be normally expected. This is the copycat effect working with vengeance [94].

Princess Diana

The Werther effect was noticed also after the violent death of Diana, Princess of Wales, including an increased rate of suicide and other forms of deliberate

self-harm [103]. The number of suicides increased in England and Wales with 17% during the month following princess Diana's funeral and this was particularly marked among females aged 25-44 years. The presentation of non-fatal self-harm increased with 44% during the week following her death and this increase was especially marked among females (+65%) [103].

Kurt Cobain

There are also examples of celebrity deaths after which there was no measurable increase in suicide rates - at first. The best-known example is the death of Kurt Cobain who was the guitarist, vocalist, and songwriter of the grunge rock band Nirvana. He had a history of overdoses, reported to the public as "accidents", and a song entitled "I hate myself and want to die" was taken out from the "In Utero" album shortly before the release [104]. According to an interview with Kurt Cobain in the *Rolling Stone* magazine in January 1994, the song was taken out from the album because there were concerns that the public would take the lyric literally and miss the satire.

Kurt Cobain died by a self-inflicted shotgun injury on April 8, 1994, at the age of 27. The news of his death spread rapidly around the world and millions of fans grieved his death. There was much concern that his death would trigger a copycat behaviour among his fans, most of them vulnerable teenagers. Kurt Cobain lived and died in Seattle, Washington, where one could expect the copycat behaviour to be most pronounced. Data obtained from King County, WA, suggest that the expected Werther effect did not occur, but there was a significant increase in suicide crisis calls [104]. Out of 24 suicides in the county during a 7-week surveillance period, only one suicide could be linked to Cobain. During the corresponding period the previous year, there were 31 suicides in the same area [104].

Why did Kurt Cobain's suicide not initiate a suicide epidemic? Three issues were identified by Jobes et al. (1996). First, it was judged that much was done right by the media. The general message was "great artist, great music...stupid act, don't do it; here's where to call for help". Second, Cobain's use of a shotgun countered any romanticised visual image of a lonely, misunderstood star (as was the case with Marilyn Monroe), drifting off into a sleepy overdose death. Third, various efforts within the Seattle community to perform outreach and to provide support and education seem to have been effective [104]. Also, in connection with a memorial vigil, a taped message from Cobain's wife, Courtney Love, was played in which she mourned and cursed her lost husband, making his death disturbing and real. Her honest and open grieving served to de-romanticise the death and made it seem profoundly tragic, selfish, and ultimately wasteful [104].

However, ten years after Kurt Cobain's death, Coleman (2004) argued that there actually *was* a copycat effect after Cobain's suicide, but that the copycat suicides occurred *outside* of Seattle, mostly in countries other than

US. In 2004, the number reached 70 copycat suicides all around the world [94].

Contagious suicides

Teenager suicide clustering can occur at the community level, at the school level [24, 105], or even in a very specific part of a community (Paper IV). The mechanism is contagion, i.e., the suicide of one teenager affects another teenager to also commit suicide. Two such clusters from the northern half of Sweden were described and connections were found between the teenagers in each cluster, indicating true contagion. The teenagers all knew each other within each cluster, they referred verbally and in suicide notes to previous suicides, and there were striking similarities concerning the suicide method.

Although teenager suicides are rare events, increasing knowledge of the risk of contagion and subsequent suicides, when primary prevention has failed, gives us an opportunity to prevent suicide clustering from occurring. Community plans for the prevention and containment of suicide clusters have been released, e.g., by Centers for Disease Control and Prevention [47]. The plans are thought to help communities to plan ways to defuse the tension built up in connection with a teenager suicide and hereby to contain suicide clustering. We identified the general practitioner as a key person to instigate actions to prevent *further* suicides when primary prevention has failed (Paper IV).

Alcohol and other drugs

Alcohol contributed to many of the tragic deaths accounted for in this thesis (Paper I-V). Ninety out of 327 (28%) tested victims tested positive for alcohol at the post mortem examination and the same percentage was detected among drivers of a vehicle, whereas suicide victims tested positive in 35% of the cases (Paper I). In paper V, we found that 74% of the decedents tested positive for alcohol or drugs, and suicide victims tested positive in 55% of the cases.

Alcohol is one of the most commonly used drugs in our western world and the use of alcohol may be as old as mankind. In the beginning, the consumption was restricted to the use of fermented berries, but beer has been used since 6000 B.C. and the use of wine since 3000 B.C. Distillation of alcohol is known in Sweden since 1494 and in the 19th century Sweden had one of the highest alcohol consumption rates per capita in Europe, although today it is one of the lowest with 9.4 litres of pure ethanol per capita aged 15 years or older [106].

However, during the 1990s the highest increase in alcohol consumption in Sweden was detected among teenagers and young adults. Twenty-seven percent of females and 24% of males (aged 16 through 19 years) consume

alcohol at levels that place them at risk [35]. Teenagers in the southern part of Sweden were, compared to those in the northern part, more often inebriated every week. It was more common for males in the northern part to be abstainers [35]. The same report also showed that 4% of the males and 3% of the females (aged 16 through 19 years) had tried cannabis during the last year, and that among those aged 16 through 24 years, approximately 15% had used cannabis at least once in their life [35] supporting the hypothesis that the use of drugs increases with age (Paper V).

Alcohol affects physical co-ordination, reaction time, decision-making, and judgement, and younger people will be affected more quickly. About half of the deaths attributable to alcohol are from injuries [107]. This study (performed in 12 countries) also showed that the proportion of injury cases with alcohol involvement ranged from 6% to 45% (15% in Sweden). A majority of the injury cases were under 35 years of age, with a peak in the late teens and young adult age groups [107]. One of the conclusions of the study was that emergency departments are well positioned for identifying hazardous and harmful drinking [107].

Such identification can be made with the available screening instruments of which the Alcohol Use Disorders Identification Test (AUDIT) [108] and CAGE (an acronym derived from the four questions in the test) [109] are the most commonly used ones. Of these, the AUDIT was the preferable screening instrument when used for under-aged drinkers [110, 111].

During the study period, there was no active screening of alcohol use/misuse among teenagers seeking help at the ER at the Umeå University Hospital (Paper V).

We found, however, that ~ 3% mentioned intake of alcohol in conjunction with the injury event. Another study showed that 9% of adolescents tested positive (cannabinoids 40%, alcohol 30%, polysubstances 23%). The authors concluded that test-positive patients were more severely injured, required more hospital care, and had worse outcome [112]. It is appropriate to implement mandatory drug screening for trauma patients at the ER and to provide programmes to follow up test positives. Apart from saving lives and reducing injuries, alcohol intervention for trauma patients treated at emergency departments and hospitals has in the US been demonstrated to be cost-effective. For every US dollar spent, USD 3.81 were saved [113].

Validity of the material

Fatal injuries

Data on fatal injuries are more accurate than data on non-fatal injuries and by Swedish law and regulation, the police are required to investigate all unnatural deaths, and the investigation should include a medico-legal autopsy (SOSFS 1996:29). All autopsies (paper I – IV) from the area under study were performed at the Department of Forensic Medicine in Umeå, and all cases were collected from the databases of National Board of Forensic Medicine. In paper II - IV, data was also checked against the National Cause of Death Register in Sweden. Thus, we expect the number of missing cases to be low or very low.

In paper I, all injury deaths among victims not permanently registered in the area of investigation were excluded since rates were calculated based on the number of teenagers registered as living permanently in the area. Also teenagers permanently living in the area who sustained their fatal injury outside the catchment area were excluded.

In paper V, most of the cases were autopsied at the Department of Forensic Medicine Umeå. A few cases were autopsied at other departments of forensic medicine. These decedents were identified through the National Cause of Death Register.

Alcohol

We are confident that we present reliable data concerning the detection of blood alcohol concentration (BAC). All tests were analyzed on femoral vein blood with accredited methods at the Department of Forensic Toxicology, Linköping, serving all of Sweden. Results obtained from victims who survived their injuries for more than six hours were not included. To some degree, the alcohol is eliminated and the hospital care before death, including intravenous fluids and drugs, could interfere with the testing of post mortem blood. Many other studies reporting alcohol inebriation rely on public data based on police reports, which, at least in Sweden, have been shown not to be accurate [114, 115].

Concluding remarks

There are no “happy endings” in this thesis and each death accounted for is of course a tragedy. One positive outcome of this thesis may, however, be that it highlights the fact that most teenagers die from unnatural causes, i.e., injury and intoxication, not disease as many may believe. This awareness also raises demands on the society to evaluate and implement injury-reducing measures of which some are suggested in this thesis. But it also raises demands on parents and others working around teenagers. E.g., just by *not* letting a teenager skip the safety belt, or lifejacket, lives may be saved.

Working with this thesis has been emotionally tough sometimes, especially concerning the suicide victims since we gathered so much information on these cases that it felt - at least for me - almost like I had known them. What kept me going through this was a search for understanding and hereby to be able to suggest preventive measures in order to reduce the number of teenager suicides. Why does a teenager choose to end her/his life? In a few cases, I think I got that understanding, but in most cases, I did not. In many cases, the signs of suicide were obvious in retrospective; even *when* it was going to happen was obvious. One must keep in mind, however, that being a parent and overlook these signs is understandable, especially since even health care professionals missed the signs or interpreted the signs in the wrong way.

Hopefully, some of the findings in this thesis may help others see and understand the signs of a teenager in despair, but also to raise awareness of risky situations in daily living. With small measures, such as using a bicycle helmet and installing a smoke detector, we as individuals can all reduce injury and save lives. Decisions on, e.g., graduated driver’s licensing systems and curfew laws, are left to the decision makers and in a wider context, this is a question on what type of society we desire. However, we must all help decision makers realise that more can be done to prevent unnecessary deaths among the young, but at the same time, never forget our own responsibility.

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References

1. Blum RW, Nelson-Mmari K: The health of young people in a global context. *J Adolesc Health* 2004, 35(5):402-418.
2. Official Statistics of Sweden: Causes of Death 2007. From <http://192.137.163.40/epcfs/index.asp?modul=dor>.
3. De Haven H: Mechanical analysis of survival in falls from heights of fifty to one hundred and fifty feet. *War Med* 1942, 2:586-596.
4. Stapp J: Effects of mechanical force on living tissues. Abrupt deceleration and windblast. *J Aviation Med* 1955, 26:268-287.
5. Gordon J: The epidemiology of accidents. *Am J Public Health* 1949, 39:504-515.
6. Ellsasser G, Berfenstam R: International comparisons of child injuries and prevention programs: recommendations for an improved prevention program in Germany. *Inj Prev* 2000, 6(1):41-45.
7. Bergman AB: Ragnar Berfenstam's legacy. *Inj Prev* 2000, 6(1):4.
8. Bergman AB, Rivara FP: Sweden's experience in reducing childhood injuries. *Pediatrics* 1991, 88(1):69-74.
9. Gibson J: The contribution of experimental psychology to the formulation of the problem of safety: a brief for basic research. New York: New York Assoc for the Aid of Crippled Children.; 1961.
10. Haddon W, Jr. and Baker, SP.: *Injury Control.*: Little, Brown&Company.; 1981.
11. Committee on Trauma Research: *Injury in America.* Washington, D.C.: National Academy Press; 1985.
12. Haddon W, Jr.: Energy damage and the 10 countermeasure strategies. *J Trauma* 1973, 13:321-331.

13. Rose G: Sick individuals and sick populations. *Int J Epidemiol* 1985, 14(1):32-38.
14. Michels KB: The promise and challenges of population strategies of prevention. *Int J Epidemiol* 2008, 37(5):914-916.
15. Svanström L: More safe communities programs in Scandinavia have been evaluated: repeating the results from Falköping. *Inj Prev* 1997, 3(3):230-231.
16. Wasserman D: [Increased suicide rate among young people in Sweden. A national preventive program is ready, parliamentary resolution is delayed]. *Läkartidningen* 2004, 101(50):4078-4079.
17. Lindqvist P, Jonsson A, Eriksson A, Hedelin A, Björnstig U: Are suicides by jumping off bridges preventable? An analysis of 50 cases from Sweden. *Accid Anal Prev* 2004, 36(4):691-694.
18. Reisch T, Schuster U, Michel K: Suicide by jumping from bridges and other heights: Social and diagnostic factors. *Psychiatry Res* 2008.
19. Chawkins S: Golden Gate Bridge to get suicide net to catch would-be jumpers. In *Los Angeles Times*. Los Angeles; 2008. From <http://articles.latimes.com/2008/oct/11/local/me-goldengate11>.
20. Prior TI: Suicide methods from the internet. *Am J Psychiatry* 2004, 161(8):1500-1501.
21. Becker K, Mayer M, Nagenborg M, El-Faddagh M, Schmidt MH: Parasuicide online: Can suicide websites trigger suicidal behaviour in predisposed adolescents? *Nord J Psychiatry* 2004, 58(2):111-114.
22. Alao AO, Yolles JC, Armenta W: Cybersuicide: the Internet and suicide. *Am J Psychiatry* 1999, 156(11):1836-1837.
23. Athanaselis S, Stefanidou M, Karakoukis N, Koutselinis A: Asphyxial death by ether inhalation and plastic-bag suffocation instructed by the press and the Internet. *J Med Internet Res* 2002, 4(3):E18.
24. Ringskog Vagnhammar S: Självordssajterna på Internet - ett fenomen som oroar. *Läkartidningen* 2004, 101(49):4028-4032.

25. Humphry, D: Final exit on DVD. From http://www.finalexit.org/ergo-store/index.php?main_page=product_info&products_id=197&zenid=395fde8c8fa0a7a38d1083b7267d3516.
26. Brahn M: Självmordsguiden. From <http://www.sjalvmord.com/>.
27. Rajagopal S: Suicide pacts and the internet. *BMJ* 2004, 329(7478):1298-1299.
28. Generation N - Kinder und Jugendliche nutzen den Computer und das Internet. From http://www.senbjs.berlin.de/jugend/jugendpolitik/generation_n/ge_samtbericht_generation_n.pdf.
29. Laugaland, J: Trolig selvmordspakt. From <http://web3.aftenbladet.no/nyheter/article148337.ece>.
30. Ådnøy, Å.H: Finner hverandre på nettet: Det er umulig å hindre folk i å finne informasjon om selvmord på nettet. From <http://web3.aftenbladet.no/nyheter/article148245.ece>.
31. BBC: Nine die in Japan "suicide pacts". From <http://news.bbc.co.uk/2/hi/asia-pacific/3735372.stm>.
32. AFP: Blog suicide pact feared in teen death. From <http://www.smh.com.au/news/Breaking/Blog-suicide-pact-feared-in-teen-death/2005/02/02/1107228747273.html?oneclick=true>.
33. Committee on Adolescents: Suicide and suicide attempts in adolescents. Committee on Adolescents. American Academy of Pediatrics. *Pediatrics* 2000, 105(4 Pt 1):871-874.
34. Olfson M, Shaffer D, Marcus SC, Greenberg T: Relationship between antidepressant medication treatment and suicide in adolescents. *Arch Gen Psychiatry* 2003, 60(10):978-982.
35. Swedish Institute of Public Health: Resultat från Nationella folkhälsoenkäten 2006-2008 - regionala och nationella resultat. Edited by Swedish Institute of Public Health. Stockholm; 2008.
36. Medical Products Agency: Farmakologisk behandling av depression hos barn och ungdomar – en uppdatering av kunskapsläget. From

- <http://www.lakemedelsverket.se/upload/halso-och-sjukvard/behandlingsrekommendationer/depressionbarn.pdf>.
37. Swedish National Road Administration: "Vision Zero" - from concept to action. From http://www.vv.se/filer/publikationer/nollvisionen_eng.pdf.
 38. Ryen L: Samhällets kostnader för vägtrafikolyckor. Edited by Swedish Civil Contingencies Agency. Karlstad; 2008.
 39. VTI:s trafiksäkerhetsbarometer januari 2010. From http://www.vti.se/templates/Page_12694.aspx.
 40. Svanström L, Welander G, Ekman R, Schelp L: Development of a Swedish bicycle helmet promotion programme--one decade of experiences. *Health Promot Int* 2002, 17(2):161-169.
 41. Björnstig U, Öström M, Eriksson A, Sonntag-Öström E: Head and face injuries in bicyclists-with special reference to possible effects of helmet use. *J Trauma* 1992, 33(6):887-893.
 42. Thompson DC, Rivara FP, Thompson R: Helmets for preventing head and facial injuries in bicyclists. *Cochrane Database Syst Rev* 2000(2):CD001855.
 43. Davis RM, Pless B: BMJ bans "accidents". *BMJ* 2001, 322(7298):1320-1321.
 44. Evans L: Medical accidents: no such thing? *BMJ* 1993, 307(6917):1438-1439.
 45. Öström M, Ahlm K, Eriksson A: [Inadequate management of unnatural deaths]. *Läkartidningen* 2001, 98(9):955-959.
 46. Glaser B: Basics of grounded theory analysis. Mill Valley, CA: Sociology Press; 1992.
 47. O'Carroll PW, Mercy JA, Steward JA: CDC recommendations for a community plan for the prevention and containment of suicide clusters. *MMWR Morb Mortal Wkly Rep* 1988, 37 Suppl 6:1-12.

48. Onwuachi-Saunders C, Forjuoh SN, West P, Brooks C: Child death reviews: a gold mine for injury prevention and control. *Inj Prev* 1999, 5(4):276-279.
49. Boman H, Björnstig U, Hedelin A, Eriksson A: "Avoidable" deaths in two areas of Sweden - analysis of deaths in hospital after injury. *Eur J Surg* 1999, 165(9):828-833.
50. Orwell G: 1984: Atlantis; 1949.
51. WISQARS Years of Potential Life Lost (YPLL) Reports, 1999 - 2002. From <http://webappa.cdc.gov/sasweb/ncipc/ypll10.html>.
52. Weiss SJ, Couk J, Nobile M, Ernst AA, Johnson W: The effect of a curfew on pediatric out-of-hospital EMS responses. *Prehosp Emerg Care* 1998, 2(3):184-188.
53. Chess A: Curfew for juveniles? *Police* 1960, 4(5):13-18.
54. Preusser DF, Williams AF, Lund AK, Zador PL: City curfew ordinances and teenage motor vehicle injury. *Accid Anal Prev* 1990, 22(4):391-397.
55. Preusser DF, Zador PL, Williams AF: The effect of city curfew ordinances on teenage motor vehicle fatalities. *Accid Anal Prev* 1993, 25(5):641-645.
56. Williams AF, Preusser DF: Night driving restrictions for youthful drivers: a literature review and commentary. *J Public Health Policy* 1997, 18(3):334-345.
57. Shatz DV, Zhang C, McGrath M: Effect of a curfew law on juvenile trauma. *J Trauma* 1999, 47(6):1013-1017.
58. Cvijanovich NZ, Cook LJ, Mann NC, Dean JM: A population-based study of crashes involving 16- and 17-year-old drivers: the potential benefit of graduated driver licensing restrictions. *Pediatrics* 2001, 107(4):632-637.
59. Rice TM, Peek-Asa C, Kraus JF: Nighttime driving, passenger transport, and injury crash rates of young drivers. *Inj Prev* 2003, 9(3):245-250.

60. Lin ML, Fearn KT: The provisional license: nighttime and passenger restrictions - a literature review. *J Safety Res* 2003, 34(1):51-61.
61. Williams AF: Teenage drivers: patterns of risk. *J Safety Res* 2003, 34(1):5-15.
62. Foss RD, Evenson KR: Effectiveness of graduated driver licensing in reducing motor vehicle crashes. *Am J Prev Med* 1999, 16(1 Suppl):47-56.
63. Rice TM, Peek-Asa C, Kraus JF: Effects of the California graduated driver licensing program. *J Safety Res* 2004, 35(4):375-381.
64. All you need to know about driving licences. From <http://www.korkortsportalen.se/andra-sprak/>.
65. Begg DJ, Stephenson S, Alsop J, Langley J: Impact of graduated driver licensing restrictions on crashes involving young drivers in New Zealand. *Inj Prev* 2001, 7(4):292-296.
66. Shope JT, Molnar LJ: Michigan's graduated driver licensing program: evaluation of the first four years. *J Safety Res* 2004, 35(3):337-344.
67. Levy DT: Youth and traffic safety: the effects of driving age, experience, and education. *Accid Anal Prev* 1990, 22(4):327-334.
68. Mullin B, Jackson R, Langley J, Norton R: Increasing age and experience: are both protective against motorcycle injury? A case-control study. *Inj Prev* 2000, 6(1):32-35.
69. Renaud J, Berlim MT, Seguin M, McGirr A, Tousignant M, Turecki G: Recent and lifetime utilization of health care services by children and adolescent suicide victims: a case-control study. *J Affect Disord* 2009, 117(3):168-173.
70. Gunnell D, Bennewith O, Hawton K, Simkin S, Kapur N: The epidemiology and prevention of suicide by hanging: a systematic review. *Int J Epidemiol* 2005;34:443-442.
71. Forslund, P: Nytt självmord på häkte - facklig kritik mot personaltätheten. From http://www.svd.se/stockholm/nyheter/artikel_1448435.svd.

72. Penney DJ, Stewart AH, Parr MJ: Prognostic outcome indicators following hanging injuries. *Resuscitation* 2002, 54(1):27-29.
73. Wilkinson D, Gunnell D: Comparison of trends in method-specific suicide rates in Australia and England & Wales, 1968-97. *Aust N Z J Public Health* 2000, 24(2):153-157.
74. The National Board on Health and Welfare: Causes of Death Statistics. The National Board on Health and Welfare; 2009.
75. Lester D: Gun control, gun ownership, and suicide prevention. *Suicide Life Threat Behav* 1988, 18(2):176-180.
76. Lester D: The effect of the detoxification of domestic gas in Switzerland on the suicide rate. *Acta Psychiatr Scand* 1990, 82(5):383-384.
77. Kreitman N: The coal gas story. United Kingdom suicide rates, 1960-71. *Br J Prev Soc Med* 1976, 30(2):86-93.
78. Sloan JH, Rivara FP, Reay DT, Ferris JA, Kellermann AL: Firearm regulations and rates of suicide. A comparison of two metropolitan areas. *N Engl J Med* 1990, 322(6):369-373.
79. Kellermann AL, Rivara FP, Somes G, Reay DT, Francisco J, Banton JG, Prodzinski J, Fligner C, Hackman BB: Suicide in the home in relation to gun ownership. *N Engl J Med* 1992, 327(7):467-472.
80. Klieve H, Svetlicic J, De Leo D: Who uses firearms as a means of suicide? A population study exploring firearm accessibility and method choice. *BMC Med* 2009, 7:52.
81. Miller M, Lippmann SJ, Azrael D, Hemenway D: Household firearm ownership and rates of suicide across the 50 United States. *J Trauma* 2007, 62(4):1029-1034; discussion 1034-1025.
82. Brent DA, Perper JA, Allman CJ, Moritz GM, Wartella ME, Zelenak JP: The presence and accessibility of firearms in the homes of adolescent suicides. A case-control study. *JAMA* 1991, 266(21):2989-2995.

83. Shenassa ED, Rogers ML, Spalding KL, Roberts MB: Safer storage of firearms at home and risk of suicide: a study of protective factors in a nationally representative sample. *J Epidemiol Community Health* 2004, 58(10):841-848.
84. Pfefferbaum B, Geis H: Adolescent suicide: implications for primary care. *J Okla State Med Assoc* 1995, 88(12):523-530.
85. Borgström A: Läkarförbundet kräver sjukintyg för vapeninnehav. *Läkartidningen* 2007, 104:1889.
86. Nilsson Bågenholm E, Flodin T: Ändra vapenlagen! *Läkartidningen* 2007, 104:1879.
87. Thorson J: Själv mord som skada - en profylaktisk entré. *Suicidologi* 2000;5:29-30.
88. Öström M, Thorson J, Eriksson A: Carbon monoxide suicide from car exhausts. *Soc Sci Med* 1996, 42(3):447-451.
89. Mott JA, Wolfe MI, Alverson CJ, Macdonald SC, Bailey CR, Ball LB, Moorman JE, Somers JH, Mannino DM, Redd SC: National vehicle emissions policies and practices and declining US carbon monoxide-related mortality. *JAMA* 2002, 288(8):988-995.
90. Routley V: Motor Vehicle Exhaust Gas Suicide. Review of Countermeasures. *Crisis* 2007, 28(S1):28-35.
91. Transportstyrelsen: Antal personbilar i Sverige med och utan katalysator. Edited by Transportstyrelsen: Transportstyrelsen. From http://www.transportstyrelsen.se/Global/Publikationer/Vag/antal_personbilar_i_sverige_med_och_utan_katalysator.pdf.
92. Gould MS, Wallenstein S, Kleinman MH, O'Carroll P, Mercy J: Suicide clusters: an examination of age-specific effects. *Am J Public Health* 1990, 80(2):211-212.
93. Gould MS, Wallenstein S, Kleinman M: Time-space clustering of teenage suicide. *Am J Epidemiol* 1990, 131(1):71-78.
94. Coleman L: The copy cat effect. How the Media and Popular Culture Trigger the Mayhem in Tomorrow's Headlines: Paraview Pocket Books; 2004.

95. Phillips D: The influence of suggestions on suicide: substantive and theoretical implications of the Werther effect. *American Sociological Review* 1974, 39:340-354.
96. von Goethe J: Die Leiden Des jungen Werthers. Volume Erster Theil. Leipzig: Weygand'schen Buchhandlung.; 1774.
97. Thorson J: [Suicide epidemic after publication of "The Young Werther"? The most-read book in Europe was considered life-threatening]. *Läkartidningen* 1998, 95(49):5660-5661.
98. Schmidtke A, Hafner H: The Werther effect after television films: new evidence for an old hypothesis. *Psychol Med* 1988, 18(3):665-676.
99. Cadwalladr C: How Bridgend was damned by distortion. In *The Observer*. 2009. From <http://www.guardian.co.uk/lifeandstyle/2009/mar/01/bridgend-wales-youth-suicide-media-ethics>.
100. Glover S: Why the Bridgend suicides can't be blamed on the messenger. In *The Independent*. 2008. From <http://www.independent.co.uk/news/media/opinion/stephen-glover/stephen-glover-on-the-press-786683.html>.
101. Online memorial pages to Bridgend suicide victims closed to prevent copycat deaths In *Daily Mail*. 2008. From <http://www.dailymail.co.uk/news/article-517555/Online-memorial-pages-Bridgend-suicide-victims-closed-prevent-copycat-deaths.html>.
102. Laurance J: The Big Question: Should the media stop reporting the suicides in and around Bridgend? In *The Independent*. 2008. From <http://www.independent.co.uk/news/media/the-big-question-should-the-media-stop-reporting-the-suicides-in-and-around-bridgend-785551.html>.
103. Hawton K, Harriss L, Simkin S, Juszczak E, Appleby L, McDonnell R, Amos T, Kiernan K, Parrott H: Effect of death of Diana, princess of Wales on suicide and deliberate self-harm. *Br J Psychiatry* 2000, 177:463-466.
104. Jobes DA, Berman AL, O'Carroll PW, Eastgard S, Knickmeyer S: The Kurt Cobain suicide crisis: perspectives from research, public health,

- and the news media. *Suicide Life Threat Behav* 1996, 26(3):260-269; discussion 269-271.
105. Poijula S, Wahlberg KE, Dyregrov A: Adolescent suicide and suicide contagion in three secondary schools. *Int J Emerg Ment Health* 2001, 3(3):163-168.
106. Alkoholkonsumtion. From <http://www.iq.se/content/om-alko-hol-konsumtionen.aspx>.
107. WHO: Alcohol and Injury in Emergency Departments. Edited by WHO. Geneva: WHO; 2007.
108. Saunders JB, Aasland OG, Babor TF, de la Fuente JR, Grant M: Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO Collaborative Project on Early Detection of Persons with Harmful Alcohol Consumption--II. *Addiction* 1993, 88(6):791-804.
109. Ewing JA: Detecting alcoholism. The CAGE questionnaire. *JAMA* 1984, 252(14):1905-1907.
110. Kelly TM, Donovan JE, Kinnane JM, Taylor DM: A comparison of alcohol screening instruments among under-aged drinkers treated in emergency departments. *Alcohol Alcohol* 2002, 37(5):444-450.
111. Chung T, Colby SM, Barnett NP, Rohsenow DJ, Spirito A, Monti PM: Screening adolescents for problem drinking: performance of brief screens against DSM-IV alcohol diagnoses. *J Stud Alcohol* 2000, 61(4):579-587.
112. Draus JM, Jr., Santos AP, Franklin GA, Foley DS: Drug and alcohol use among adolescent blunt trauma patients: dying to get high? *J Pediatr Surg* 2008, 43(1):208-211.
113. Gentilello LM, Ebel BE, Wickizer TM, Salkever DS, Rivara FP: Alcohol interventions for trauma patients treated in emergency departments and hospitals: a cost benefit analysis. *Ann Surg* 2005, 241(4):541-550.
114. Öström M, Eriksson A, Björnstig U: Reliability of Swedish alcohol statistics in traffic fatalities: a comparison between official statistics and blood alcohol analysis. *J Traffic Med* 1993, 21:171-176.

115. Sjögren H, Björnstig U, Eriksson A: Comparison between blood analysis and police assessment of drug and alcohol use by injured drivers. *Scand J Soc Med* 1997, 25(3):217-223.