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THE HARSTAD INJURY PREVENTION STUDY:

Hospital-based injury recording and community-based intervention

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"*As time goes by*" Herman Hupfeld

"*Confirmation*" Charlie Parker

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ACKNOWLEDGEMENTS

Working as a surgeon, I have on many occasions treated patients with injuries sustained in traffic or other accidents. My notion of contributing to an injury prevention effort - "looking upstream" - found a way of materializing itself when Johan Lund (the man with the black leather bag) in 1984 travelled to Harstad. He was trying to recruit four hospitals in Norway for collecting data in a national injury surveillance system. In the years to come, he returned several times to inspire, meet with key local officials and help in a number of other ways. I wish to extend my warm thanks to Johan, Steffi Wetteland and others at the National Institute of Public Health with whom I have collaborated for more than a decade. The co-operation with injury secretaries and surgeons from the three Norwegian hospitals Trondheim, Stavanger and Drammen is also greatly appreciated.

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ABSTRACT

Introduction

Accidental injury is the leading cause of death in Norway under the age of 50. A 19 % reduction of age standardized accident mortality was observed from 1956 to 1988. In spite of this, next to Finland, Norway has the highest accident mortality rate among the Nordic countries (1). To reduce accidental injury it

is important to gain knowledge about all injuries, not only the fatal ones. The aims of this study were to (i) use a hospital-based injury recording system for gaining local epidemiological information, (ii) analyse this information and select target groups for intervention and (iii) evaluate the outcome of a) traffic injury prevention, b) prevention of burns in small children and c) prevention of fall-fractures in the aged and d) prevention of downhill skiing injuries.

Methods and material

In the Norwegian city of Harstad (population 22 600) data on all injured persons treated at Harstad Hospital were recorded prospectively from 15 May 1985. The variables were selected in co-operation with The National Institute of Public Health and followed the Nordic coding system (2). Trondheim (population 134 000) was the only other city in Norway recording similar data from 1 July 1985. To study the short-term hospital costs of injury connected to some interventions, hospital data were collected retrospectively from the medical records of admitted residents of Harstad.

In 1985 an Injury Prevention Group (IPG) was established in Harstad. As local injury data collection progressed, the function of the IPG improved. Five papers were published relating to Harstad's injury epidemiology (3-7). From 1989 governmental funding financed the administration of the IPG. Meetings were led by an influential politician. The central position of the IPG in the municipal administration facilitated co-operation between health services, the school system, the

police, the traffic and road authorities and a number of other public and private organizations. This broad involvement and network promoted community "ownership" of the injury problem, diffusion of preventive program messages and the maintenance of their effect (8). A comprehensive injury prevention program grew out of the "fledgling" efforts of the early IPG. Co-operation across political party and administrative borders seemed to be enhanced by the uncontroversial aim: the reduction of injuries in the community. After local data analysis, it was decided by the IPG to particularly target burns in small children, traffic accidents, falls in the aged and downhill skiing injuries. The theories and strategies used in the community-based interventions (8,9), included the distinction between active and passive interventions (10), different health education models (11) and Haddon's matrix for classification and evaluation of interventions (12).

The study design was quasi-experimental (13), using both time-series and a reference city (Trondheim). The study population were residents of Harstad. A base-line period without special intervention was 19.5 months for burns in children, 2 1/2 years for traffic injuries, 3 years for fall-fractures in the aged and 5 years for downhill skiing. The corresponding intervention periods were 7 years (burns), 5 years (traffic and falls) and 3 years (downhill skiing). Study end-points were hospital treated injuries (fracture rates for the fall-fracture prevention program). Additional data were obtained in a cross-sectional survey, conducted in the first half of 1994 in Harstad and Trondheim. This survey aimed, among other things, at sampling

awareness and attitudes connected with traffic injury prevention and the possible impact in Harstad of the quarterly distribution of local data by means of a traffic safety brochure - the Traffic Injury Report system (TIR).

Analysis was conducted using χ^2 tests and comparison between rates (14). Epi-info was used for database handling (15).

Results

Burn injury rates for children below 5 years of age (N=40) were reduced 52.9 % ($p<0.05$). Correspondingly admission rates were reduced 63 % (no children below 5 years were admitted for burns the last 3 years).

For traffic injuries (N=988) comparisons were made between baseline and the last 2 1/2 years of the intervention period which were seasonally identical. Overall traffic injury rates were reduced 26.6 % ($p<0.01$). Significant reductions ($p<0.05$) were observed for pedestrian children below 10 years of age and for bicyclists below 16 years. For motorcyclists 18-25 years old, injury rates were reduced to a seventh ($p<0.01$). In automobile drivers below 65 years of age a 27.3 % rate reduction was observed ($p=0.07$). For automobile drivers above 64 years an increased injury rate was found ($p<0.05$).

The cross-sectional survey showed significantly higher scores in Harstad compared to Trondheim for (i) awareness about some traffic safety issues and (ii) positive attitudes concerning

accident preventability. 56.0 % of respondents from Harstad reported to have acquired information or good advice about traffic safety from the TIRs. 42.6 % reported that information acquired from the TIRs was the reason for starting discussions about problems connected with driving and alcohol and/or drugs/speeding/children's safety in traffic.

753 aged persons with fractures were recorded. Fall-fracture rates in homes were reduced 26.3 % for those 65+ years ($p<0.01$). This led to savings in short-term hospital costs for admissions (16.1 %), hospital bed-day consumption (16.7 %) and operations (35.1%).

In downhill skiing 251 injuries were recorded. For this sport a 15% reduction of injury rates was observed when adjusting for exposure ($p=0.24$). The overall crude sports injury rates were stable throughout the study.

The corresponding overall injury rates increased in Trondheim for traffic and fractures ($p<0.05$) and seemed to be unaltered for burns in children below 5 years of age.

Conclusions

After assessing sources of confounding and bias (16-20), it is concluded that the present study indicates strong relationships between interventions and the described injury rate reductions.

The rising injury rates for aged automobile drivers and aged pedestrians are presently a concern for the IPG. The sports accident data provide a basis for designing a local sports injury prevention program.

Continuous prospective hospital recording of injuries in a community is feasible. Local injury prophylaxis can be greatly improved by using local epidemiological knowledge in community-based interventions. Through this approach, a substantial potential exists for the prevention of human suffering from injury as well as the potential for a reduction in short-term hospital costs.

LIST OF PAPERS

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2. Ytterstad B. The Harstad injury prevention study: Hospital-based injury recording used for outcome evaluation of community-based bicyclist and pedestrian injury prevention. Scandinavian Journal of Primary Health Care. 1995;13:141-9.
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TERMS AND CONCEPTS

Injury: Injury to an organism is produced by energy interchange, either mechanical, thermal, chemical, radiant, electrical or by the absence of such necessary elements as oxygen or heat (21). Injuries may be classified as unintentional (accidental) or intentional as either interpersonal- or self-directed violence.

Accident: An accident is defined as an unintentional event characterised by the sudden release of an external force or impact that can manifest itself as body injury (22). Accidents are not necessarily injuries, but for a long time the term has been used synonomously with accidental injury. The traditional term accident has been criticised for having a connotation of unavoidability. In spite of this the continued use of the term was justified in the "First World Conference on Accident and Injury Prevention" as a compromise with traditionalists (9) - and will in the following be used synonymously with accidental injury.

Injury prevention and injury control: These two terms are used almost synonomously. The former means reducing injury incidence, while the latter means reduction of injury severity and/or injury incidence.

Traffic accident: An accident occurring in the road involving at least one vehicle, leading to personal injury treated by the health care system (1).

Blackspot: Road-crossing or road-length of not more than 100 meters with at least four traffic accidents occurring in the course of four years or less.

Home accident: An accident occurring in private homes or in the immediate surroundings such as garage, driveway or yard. The term is used synonomously with domestic accident.

Community: A community can be defined geographically or in terms of the common interest of a group of people such as the aged or an ethnic community. Geographic communities often do not conform to administrative boundaries. The boundaries that are created by social functioning and encompassing individuals with a notion of identification and sharing a feeling of communality, are perhaps most important for describing a community. This description of a community obviously imposes limitations in terms of geographical size and number of inhabitants. In this thesis the terms community and municipality are used synonymously.

1. INTRODUCTION

1.1. Background. Magnitude of the injury problem

The Manifesto for Safe Communities was developed during the First World Conference on Accidents and Injury Prevention in Stockholm i 1989 (9) and states:

"Injuries have enormous individual, social and economic consequences that are only partially understood by governments and the public. Crude figures show that each year nearly three million deaths are reported world-wide from injury and poisoning; over two million of these occur in developing countries. Such deaths affect surviving family members, friends and their communities, whether the death is to a child, a working adult or an elderly person. World-wide, up to one third of all hospital admissions are the result of injuries. Such admissions are costly because of the demands they make on health services for emergency diagnostic and therapeutic care, rehabilitation and lifelong assistance to achieve optimal social functioning. The annual economic costs of injuries in lost productivity of workers and in medical and social costs are estimated to exceed $ US500 billion world-wide. The additional social and psychological costs of permanently disabling conditions for the individuals and their families are only now becoming understood."

Accidental injuries are thus one of the major public health problems in the Western world and the leading cause of death for those below 50 years of age in Norway (1). In terms of potential years of life lost, accidental injuries are ahead of

cancer and second only to cardiovascular disease/stroke (22). Injury (including intentional injury) is the most costly of all major health problems in the US, estimated in 1980 to be about $75-$100 billion per year (21). A recent Swedish thesis estimated the mean cost per injury (excluding material costs) to be SEK 21 000, calculated at 1991 prices (23).

The human cost in the form of suffering, grief and mental and physical disability associated with injuries is best seen by those who daily attend these patients. Although controversy exists about the methods for describing monetary costs of injury, it is important that injury research also includes studies of these costs. Expenditures on injury research lag behind investments in research on cancer and cardiovascular disease/stroke. In the US less than $2 was in 1980 spent on injury research for every $1000 of the cost of injuries themselves (21).

1.2. Injury epidemiology

Because of the impact of the sum of human suffering and societal costs imposed by injuries, there has been an increasing focus on injury control during the last decade. Epidemiology is the fundamental science for studying the occurrence, distribution, causes and prevention of disease. Injury epidemiology is a new discipline with theoretical basis stemming from the wider framework of epidemiology. This young scientific field focuses on the development of epidemiological tools for identifying injury problems, defining their extent

and determining what factors may be manipulated for prophylactic purposes. An outstanding example of the application of this approach occurred when an epidemic of fatal accidents was described in New York children falling from windows in multi-story buildings. After launching the "Children can't fly" program (24), deaths were reduced from about 40 per year in the 1960s to 4 in 1980 (10).

Evaluation of countermeasures may also be done within the framework of injury epidemiology. Especially in the case of large scale interventions it is important that empirical evidence exists for their efficacy. An example of intervention gone wrong was the introduction of drivers' training in US high schools. This program led to increased traffic injury rates, quite the opposite of the hypothesised effect. More than ten years passed before research showed that the drivers' education programs actually increased injury rates by encouraging teenagers to drive earlier and that such education did not reduce crash involvement of those trained (21).

1.3. The need for high-quality epidemiological data

A prerequisite for injury research is the acquisition of data. Unfortunately most sources of data available for the study of injuries have serious inadequacies. Although The International Classification of Disease (ICD) includes an E-code for classification of external cause, this E-code is often missing in data sets (21). Routine data recording according to the ICD does not provide sufficient background information for

effective prophylactic planning. An example: In order to plan strategies for the prevention of drownings, it would be useful for the epidemiologist to have information on whether drownings occurred in unattended pools, unfenced pools or in ponds, rivers or a lake/the sea. It would also be of importance to know something about the product involved, the time and the ongoing activity when the event occurred.

There seems to be agreement among injury epidemiologists that data collection on injuries must be greatly improved. A surveillance system aimed at injury prevention must include a sufficient number of variables for in-depth studies of where, how and to whom did the injury occur, what was the activity at the moment of injury and which products were involved in the event. Prospective collection of injury data using both the ICD and the Nordic system has been found feasible for use in planning injury control (8,23,25).

1.4. Injury prevention: Strategic planning

1.4.1. Fatalism and risk

Before the development of a germ theory, plagues were viewed as "Acts of God" or attributed to witchcraft or sinfulness. The concept of injury control has developed much more recently than the campaigns against infectious diseases, e.g. hygienic precautions and vaccinations. The myth still lingers in the mind of man that accidents are "Acts of God", although the works of Haddon has done much to challenge this myth (26-28).

It has been shown that injury prevention may reduce death from injuries (24) while health promotion programs may prevent death from coronary heart disease (29). There is an increasing concern, however, that such preventive programs may produce unintended consequences or side-effects in terms of increased anxiety, immobilization, illness preoccupation and medicalization (30). The word risk has rapidly gained frequency in medical journals over the past three decades (30) and health promotion has, to a large extent, been the marketing of risk reduction and avoidance, e.g. high-fat diet, smoking, unprotected sex or fast driving.

Risk aversion has its drawbacks. When growing up, the child should learn and develop protective actions for coping with a complex world through risk taking and small accidents. Removing all potential hazards from the child's environment would seriously interfere with this learning process. In line with this thinking there is clearly a limit on how ambitious an injury prevention program should be. An environment that is too safe could lead to death by boredom. Attempts at changing accident-related behaviour should also take into consideration that people possess dispositions to respond in particular ways, also called traits. *Risk seeking* is a personality trait that is characterized by the need for thrill and adventure seeking (31). An example: The introduction of motor sports in Harstad may have represented an activity for satisfying some individuals' need for risk seeking, thus diminishing speeding on public highways. A theory of unintended consequences says that drivers whose crash protection is increased e.g. by seat

belts and airbags will drive more riskily and endanger other road users, so-called *risk compensation theory* (10).

The possibility of unintended consequences should be kept in mind while planning an injury prevention program. If a careful weighting is performed between obvious benefits and sometimes not-so-obvious side-effects, the possibility exists for promoting safety while at the same time avoiding side-effects and keeping boredom at arms length.

1.4.2. Passive or active interventions?

Interventions against injuries may be classified as passive or active. *Passive interventions* may involve modifications of products or the environment and work independently from the actions of the individuals. They are said to be more effective than active ones (10). Regarding products, an example is the airbag, exercising its protective action at the moment of impact without effort on the part of the driver. Another example is a cooker safe-guard which protects the child when installed (Paper III). Examples of environmental passive interventions are separate pedestrian and cyclist roadways, speed-reducing road impediments or blackspot treatment. Some passive measures are often difficult to implement because they require legislative or regulatory changes directed at environmental or product modifications. Such changes may occur slowly because they often require educating both the public, legislators and other decision makers. The protective action of airbags has, for example, been known for three decades. Only now, however, are airbags becoming standard equipment in many

cars. A blackspot which in Harstad yielded 6 injured per year, was treated in 1990, two years after it's detection. The treatment came about after considerable pressure had been exerted upon the traffic authorities. This pressure came about as a result of blacspot detection by the investigators (local accident data). Post-treatment the injury count sank to one per year (Paper I).

Active interventions involve the difficult task of changing the behaviour of the individual. Human behaviour and personal responsibility was recognized by Haddon as "undeniably important in injury causation" (28). In fact, human behaviour has been suggested to be more important for traffic safety than traffic engineering and cars (32). This suggestion is based on the assumption that many of the pertinent technologies are approaching a saturation level or a point of diminishing returns. A passive intervention may in a given situation prove successful as in the case of the most accident-burdened blackspot in Harstad mentioned above (Paper I). Active measures, e.g. the problem of changing accident-related behaviour had to be addressed when trying to remedy the high injury rates in Harstad for young male drivers and female adolescent automobile passengers (Paper I). As part of an active strategy, the free texts (victim stories) were distributed in a traffic injury report (TIR) to all Harstad households (Papers I-II). Empirical evidence of the impact of victim stories on accident-related behaviour has been reported (33).

Promotion of individual behaviour change to prevent injuries has been more effective when the behaviour is easily observable and mandated by a law e.g. motor cyclist helmet use (21). In the case of bicyclist helmet promotion, most studies report low compliance with the program's message in the young adolescent group (Paper II). Unfortunately, this is the very group that because of high exposure and head injury risk, would profit most by helmet use. This illustrates a finding of many studies that both promotion of voluntary behavioural change and laws aimed at changing behaviour tend to be least effective among the very groups that are at highest risk of injury (21). Another example of this phenomenon is the finding that intoxicated drivers and teenagers, two groups with a high risk of involvement in motor-vehicle crashes, had the lowest seat-belt use (21).

In order to bring about changes in accident related behaviour, it is important to have *some* knowledge about models for studying factors that may be manipulated for prophylactic purposes. A multitude of different models and theories have been described or used in scientific papers about changing health-related behaviour. The K-A-P model, ***Knowledge of, Attitudes towards and Practice of*** certain behaviours (34), has been used for studying and bringing about behavioural change and looks feasible for changing accident-related behaviour. An example: About 30 % of Norwegian drivers killed or seriously injured in traffic accidents have an illegal blood alcohol concentration (35). According to the KAP model, information about this relationship should lead to a change towards more

healthy attitudes and subsequently less drunken driving. Unfortunately real-world practice often falls short of the ideal and the application of the KAP model has been criticized. Attitudes may well change after behavioural changes have taken place - without previous cognition (36). Evidence exists that the KAP model may work in the higher socio-economic class. Emotional factors may, to a larger degree, determine behavioural changes in lower socio-economic classes (37). An example: curiosity and emotions evoked by the free texts (victim stories) in the TIR may in some road users have led to the practice of safer behaviour without previous cognition (Paper I).

Behaviour change may also be studied within the framework of *Bandura's social cognitive model* (38). In this model some main determinants for behaviour change are *outcome expectations, outcome expectancy* and *self-efficacy* - all of which may be manipulated in order to change accident-related behaviour. Applying this model, the increase of *expectations* and *expectancies* were promoted in the Harstad study through distribution of the free texts about traffic accidents in the TIR (Papers I-II) and about burns in children in counselling sessions with parents. *Expectation* may be described as the linking of an outcome to a certain act. E.g. "the child pulled down the kettle of boiling water from the cooker and was scalded in her face". *Expectancy* pertains to the value a person places in this outcome and thus in the installation of a cooker safe-guard. *Self-efficacy* may be described as expectancies about one's own competence to perform the behaviour needed to

influence outcomes. An example: when burn rates in children started to decrease, it was important to give positive feed-back to the community because this information may have increased the perception of coping skills in families with small children (Paper III).

Ideal passive interventions would protect all members of a population at all times without any action on their part. However, truly passive interventions are rare. Most passive measures involve a certain amount of action on part of the individual. There is a need for flexibility in combining strategies to arrive at the most effective mix. A discussion on which of the two strategies, passive or active, is the better would be counter productive. Both have an important role to play in injury control.

1.4.3. Health education models

Tones et al. propose three models for health education, the preventive -, the radical-political - and the self-empowerment model (11). The preventive model means persuading the individual to take responsible action, while the radical-political model advocates social and environmental change by triggering political action. The self-empowerment model seeks to foster change through informed choice and not through coercion. Critics of the preventive model point to the unethical practice of blaming the victim for an unhealthy lifestyle and ignoring the socio-political roots of ill-health. This focus on self-blame is illustrated in a textbook describing accident prevention in the US as late as 1961: *"Once*

a sense of personal responsibility for accident causation can be created in the minds of people, great progress will have been made. Then the sequel to an accident will no longer be an orgy of self-pity for having been the victim of an uncontrollable event. Instead the sequel can be a character building period of self-evaluation during which acts of personal stupidity, carelessness and indifference may be identified. Hopefully the accident-causing sequence of events will not be permitted to recur" (39). The modern view of accidental injury does not eliminate personal responsibility, but is does assign greater weight to other factors.

Advocates of the radical-political model emphasise the necessity of structural changes to improve health, but the critics claim that this model might massage the political consciousness of communities to bring about changes dear to the heart of the health educator rather than helping the community make its own decisions. This approach was used for bringing about the intervention in the case of the above mentioned blackspot (Paper I). The outcome was in this case a good solution for all parts involved. But in all fairness: not all campaigns for structural changes initiated from the medical profession or other health educators have resulted in sensible solutions - seen from a community's point of view.

The principle of empowerment in health promotion is endorsed by the World Health Organization in the Ottawa Charter for Health Promotion (40) because it emphasises health education, participation in the process, voluntariness and control over

one's own destiny. Throughout the Harstad injury prevention study, we have tried to maintain this emphasis. Acquired local injury data was (i) used for health education, (ii) a basis for selection of targets for intervention *by the community* (iii) used for documenting post-intervention fall in injury rates. All this promoted increasing community perception of control over one's own destiny.

1.4.4. Haddon's matrix

William Haddon Jr. was a medical doctor, epidemiologist and engineer who headed the US National Highway Traffic Safety Administration from 1966 to 1970. He divided the event leading to injury into three different phases: precrash, crash and postcrash (12). By listing the factors involved (human, vehicles and equipment, physical environment and roadway, socio-economic environment) a matrix with 12 cells is formed (Paper I). Each cell gives an option for research on interventions and evaluation of their effectiveness. An example: A research issue may be taken from the pre-crash socio-economic cell. The Nordic countries have a low traffic injury mortality compared to most countries in Europe. Increase in the cost of alcoholic beverages is associated with a reduction in motor vehicle fatalities (41). Is the high cost of alcohol in the Nordic countries contributing to a low motor vehicle fatality rate?

1.4.5. Experiences from earlier studies

The World Health Organisation (WHO) has emphasized the importance of injury control (Health for All Year 2000). The

goal for Europe is to reduce injury, disability and death from accidents, by at least 25 % (42).

A pioneer Norwegian intervention study reported a 29 % reduction of accidental injury in the fishing community on Værøy island (1000 inhabitants) in Lofoten North-Norway (43). Sahlin reported a post-intervention fall in children's injury rates in Trondheim, but the contents of the interventions were not described (44). A landmark in community-based intervention for accident prevention has been reported from Falkøping, Sweden. Incidences of accidents were reduced significantly, particularly in homes, after three years of intervention (8,45,46). However, the reduction was not significant for burns in small children and for the aged (65+ years). Also this study lacked an accurate assessment of savings connected to the interventions in terms of short-term hospital costs.

To our knowledge, ours is the first study describing the occurrence and community-based prevention of injury in a defined population in a geographically delimited area during a period of about 8 years - including the assessment of savings in terms of short-term hospital costs.

2. AIMS OF STUDY

The aims of this study were:

1 To test the feasibility of a hospital-based injury recording system for acquiring epidemiological information about all hospital treated injuries occurring:

a) in a total population

b) in a geographically limited area

c) during a period of 8 years

2 Analyse this information in order to:

a) describe the local panorama of accidental injury in selected high risk groups - in terms of where, when, how and to whom does injury occur

b) select target groups for intervention based on assessment of local data.

3 Evaluate the outcome of :

a) traffic injury prevention

b) prevention of burns in small children

c) prevention of fall-fractures in the aged

d) prevention of downhill skiing injuries.

3. MATERIALS AND METHODS

Materials and methods will be described in terms of the following 5 items:

1. Study population and community
2. Variables
3. Data recording procedure

4. The Harstad intervention program
5. A cross-sectional survey of attitudes and evaluation of the Traffic Injury Report

3.1. Study population and community

Harstad is located in the southern part of Troms County in northern Norway, about 250 kilometres north of the Arctic circle. The distribution of employment in Harstad was in 1990: Public administration and services 36.3 %, industry, trade and manufacturing 35.7 %, transportation/postal/teleservices and hotel/restaurant 12.1 %, other services 12.1 % and farming/fishing 3.7 %. Unemployment was in January 1993 6.5 % (Harstad municipality, personal communication).

Harstad hospital is responsible for the care of the southern part of Troms county, about 45 000 people. The study population (inhabitants of Harstad municipality) was 21947 on January 1. 1986, increasing to 22678 by January 1. 1993 (unpublished data, Norwegian Bureau of Statistics).

Harstad is situated on an island (Norway's largest) and the distance to the nearest university hospital, Tromsø, is 330 kilometres. Thus, for geographical reasons, all injured from the study population receive primary hospital care in Harstad hospital. "Leakage" of patients to neighbouring hospitals is virtually precluded, unless remitted from Harstad hospital. There are three primary care health centres and some private practitioners in Harstad.

3.2. Variables

Demographic data like name, date of birth, sex and place of residence were obtained. Activity type and time of injury (to the nearest whole hour), day, month and year were recorded. An open ended question (free text) of up to 150 characters contained three distinct parts that are partly consistent with the concept of pre crash, crash and post crash described by Haddon (12). Product(s) related to the incident was recorded. For traffic injuries in Harstad, the site of accident was recorded by six digits according to a code system developed by local traffic authorities (Appendix I). The traffic variables were road user group, vehicle type of injured and conflict vehicle type, if any. Medical variables were injury type, injury mechanism, body part affected and whether admitted to the hospital. Injury severity was coded according to the abbreviated injury scale (AIS) described by the American Association for Automobile Medicine (47).
To avoid registration bias, blood alcohol concentration (BAC) tests were not routinely taken. When the injured was inebriated, it was noted in the free text.

To study the-short term hospital costs of injury connected to some interventions (traffic injuries, burns in children and domestic fall-fractures in the aged), hospital data were collected retrospectively from the medical records of admitted residents of Harstad.

3.3. Data recording procedure

Two Norwegian hospitals (Harstad and Trondheim) have since 1 July 1985 contributed injury data to a national injury surveillance system developed in co-operation with the National Institute of Public Health (1). A somewhat modified Nordic coding system has been used (48).

The injury form (in Norwegian, Appendix II) in Harstad was completed in the emergency room, partly by the patient or someone accompanying him/her and partly by the staff and intern. The information was coded by an injury secretary and fed into the computer. The patient lists in the emergency room were checked daily or after every weekend to ensure that missing forms were completed. Interns that commenced their half-year term in the surgical department received a short course of motivation and injury registration upon arrival. The injury recording procedures have throughout the study period been supervised by the author, aided by another surgeon and/or one of the co-authors.

Trondheim Hospital recorded data basically the same way as Harstad. Because of hospital differences in size, architecture and patient flow, practical organization of data collection differed from Harstad. The main difference being that some data had to be collected retrospectively from medical records. This resulted in some missing data for certain variables and caused some problems using Trondheim as a comparison city (Paper IV).

3.4. The Harstad intervention program

The baselines, intervention starts and ends of studies for the different parts of the program are shown in Fig. 1.

Figure 1 Design and time sequence of The Harstad Injury Prevention Study. **B** = baseline. **I** = intervention. **E** = end of study.

Study year	85-86 1	86-87 2	87-88 3	88-89 4	89-90 5	90-91 6	91-92 7	92-93 8
Burns in children	**B** from 15 May 85	**I** from 1 Jan 87						**E** 31 Dec 93
Traffic injuries	**B** from 1 July 85		**I** + from 1 Jan 88			**I** ++ from 1 July 90		**E** 31 Dec 92
Fall-fractures in elderlies	**B** from 1 July 85			**I** from 1 July 88				**E** 30 June 93
Downhill skiing injuries	**B** from 1 July 85					**I** from 1 July 90		**E** 30 June 93

It must be kept in mind that Baselines to some extent were "contaminated" with interventions because of media reporting. Baseline start for burns in children was 15 May 1985. Injury data were fed into the computer from 1 July 1985. But before that, in order to gain experience, injuries were recorded for six weeks (from 15 May), and kept in a manual file. Data on burns in children were taken from this file in order to gain a longest possible baseline.

Systematic intervention planning in Harstad started in 1985 when an injury prevention group (IPG) was formed. This group consisted of representatives from private and public organizations, including the police, local health services and

municipal authorities. The author and/or another surgeon and the injury secretary represented Harstad Hospital in these meetings, which were called for and led by the local consumer office, a publicly funded office for the protection of consumer rights. The IPG decided that their proceedings, e.g. documented magnitude of local accident problems, choice of targets and intents of interventions should be covered extensively by the local press and other parts of media. Subsequently, the media was invited to meetings, generating a great deal of coverage.

3.4.1. Accidents in children

The first targets chosen for intervention were child accidents in general and burns in small children in particular. There were many reason for these choices. Firstly a national child accident prevention campaign had in 1983 been launched in Norway (1) and the consumers office, the Harstad branches of Red Cross and the Norwegian Women's Public Health Organization had already in 1984 responded to this challenge. Secondly, reports showed that Swedish child accident rates were substantially lower than Norway's (22). Thirdly,the impact of burns in small Harstad children was a matter of concern for the author, being responsible for burn surgery in Harstad Hospital. This impact was not restricted to considerable patient and parental suffering. It also implied the expenditures of hospital resources connected with having a burnt child long term in a surgical ward (described in Paper III). Initially, the most predominant strategy for prevention of child accidents was health education. Through various channels, people were persuaded to change accident-related behaviour e.g. to install

safety devices in their homes, storing medicines and washing detergents out of children's reach and increasing parental vigilance. From 1987, a more systematic approach was used, particularly against burns. The public health nurse corps was increasingly involved through the efforts of a very active and innovative public health nurse that became a permanent member of the IPG. The mandatory vaccination and health check program for small children, gave numerous opportunities for parental counselling sessions in which materials (brochures) from the national campaign against child injuries and local data e.g. victim stories (the free texts) were used. The applied strategies are described in more detail in Paper III.

3.4.2. Traffic accidents

Official under-reporting of traffic accidents has been described in Norway (49). After two years of collecting traffic injury data in Harstad, it became clear from comparisons with police figures, that official under-reporting was a bigger problem than previously thought. This problem was addressed by the IPG which subsequently decided to invest more efforts and resources in Harstad for prophylaxis. These findings and intents were extensively communicated through the local media in 1987 and one year later published in two papers (3,4). In 1987 co-operation was established, through the IPG, between those responsible for hospital data collection and a number of private and public organizations relevant for traffic injury prevention. The co-operation partners and applied strategies are described more extensively in Papers I-II.

Initially, as geographical data about traffic accidents accumulated, blackspots were detected by the authors (Paper I). Pins with different coloured heads (a different colour for each road user group) were placed on a municipal map. This crude but effective system was, in 1989, replaced by a map system for identifying traffic accidents by a 6 digit code (Appendix I). The system was developed by the municipal traffic authorities (Tore Stafne and Dag Jensen , Harstad municipality, personal communication). From 1992, geographical information about traffic accidents was plotted onto a digital map of Harstad. This model was developed through a co-operative effort between the Directorate Of Public Roads, a private Harstad firm (Haalogaland Plankontor) and the author. This system provides geographical and other information about traffic accidents from three sources: the police, the hospital and insurance companies (50).

3.4.3. Fall-fractures in the aged

The national "Campaign Against Home Accidents" started in 1988. Most materials developed in connection with the campaign were disseminated through the county medical officer to the municipal health services which were urged to initiate and co-ordinate the implementation of local accident prevention measures (51). By this mechanism the IPG and Harstad health services became aware of the campaign. From local data analysis it was evident that homes were the main location of accidental injury for children and the aged. As the child injury prevention program was already running, a campaign against accidental injury in the aged remained to be initiated. A

retired city veterinarian became one of the driving forces in this new campaign which made the prevention of fall-fractures a main objective, not only in homes but on icy roads and sidewalks as well. The different practical aspects of interventions are described in Paper IV.

3.4.4. Accidents in sports and leisure.

Even if an intervention was attempted against downhill injuries in 1990 because of their high score on the abbreviated injury scale (AIS) scale (Paper V), the large group of accidents occurring during leisure and sports activities were, as a whole, given little priority by the IPG. This was decided - not because this group does not represent a serious enough problem, but more because of lack of time and resources. Several campaigns were already running. Many of the innovative and active participants, joining the intervention program, were already engaged in voluntary community work in other fields. In 1989 governmental resources were allocated for five years, to fund a part-time sociologist to help co-ordinate plans, make agendas and call for meetings of the IPG. But no "fresh" resources were allocated by the municipality or county. In view of these limited resources, it was decided to intervene more thoroughly in carefully chosen delimited areas rather than spreading preventive resources too thinly over the whole injury problem.

3.4.5. Other areas of intervention

Accidents occurring in schools and kindergartens were focused in some IPG meetings and some interventions were implemented

e.g. by targeting violent school-yard play and distributing local school and kindergarten injury data to the municipal school and kindergarten authorities.

Occupational accidents constitute a formidable challenge that the IPG has discussed but not yet had the resources for addressing in depth.

The Harstad police initiated in 1991 an anti-violence campaign, particularly targeting street violence in connection with the closing of restaurants and pubs (Harstad police, personal communication). The hospital injury recording system was used to corroborate evidence of the effect of this campaign. So far, these results have not been published.

3.4.6. Strategies for intervention

Strategies applied in the Harstad injury prevention study e.g. involving organizations, use of local data and bottom-up approaches were adopted for different reasons. Partly they resulted from local initiatives and partly from co-operation with professionals knowledgeable in the field of injury control meeting regularly at the National Institute of Public Health. Suggestions and experiences coming from injury secretaries and surgeons from the three Norwegian hospitals Trondheim, Stavanger and Drammen were important contributions. The experiences from Trondheim were particularly important: a thesis about traffic accidents and their consequences had

already been published in 1984 (49) and another thesis about injury registration as a tool for prevention came in 1990 (44). The main framework of preventive strategies was supported by reports and declarations that we studied after interventions started. Mostly, from these readings, we became reassured about the soundness of our chosen course of action. Sometimes this course was altered a little. However, the main content of strategies used in the Harstad interventions are comparable to those described in the Ottawa Charter for Health Promotion which came in 1986 (40), the Falkøping study, published in 1986-1988 (8,45,46) and in the Manifesto for Safe Communities which was issued in 1989 (9).

3.5. A cross-sectional survey of attitudes and evaluation of the Traffic Injury Report

Most end-points of this study are injury rates in the study community and in comparison populations. Additional data were obtained in a cross-sectional survey, conducted in the first half of 1994 in Harstad and Trondheim. This survey aimed, among other things, at sampling (i) attitudes connected with traffic injury prevention and (ii) the possible impact in Harstad of the Traffic Injury Report system (TIR). The TIR was one of active interventions described in papers I-II (Appendix III).

The questionnaire was pilot-tested on 60 first-year college students. Thereafter, a sample of 3000 persons aged 18-79 years, 1500 from each of the two cities Harstad and Trondheim, was drawn by the Norwegian Bureau of Statistics. This bureau

and the Institute for Community Medicine, Tromsø University, mailed the invitations to participate. The survey (In Norwegian, Appendix IV), consisted of questions to participants in both cities about attitudes/perceptions towards/about (i) possibilities for the prevention of traffic accidents, (ii) alcohol, drugs, speeding and children's safety in connection with driving, (iii) the importance of traffic safety information given at different administrative levels (school district, municipality, county, and national). In addition the participants were asked questions relating to the impact of a traffic safety brochure issued from the hospital. The response rates were 47.7 % in Trondheim and 48.2 % in Harstad after two requests for a reply.

3.6. Statistics

Differences between incidence rates were statistically analysed in the statistical program Epi Info (15) using a chi-square test and by the comparison of incidences described by Kahn and Sempos (14). The study years were counted from 1 July to 30 June the following year. 1 January census data were used for calculating age- and sex-specific person years of risk. The chi square trend-analysis with Mantel-Haenszel stratified weighting was performed for sex and age groups where rates were tested for departure from the null hypothesis. Comparison of means was done by the two-sided t-test or the Kruska-Wallis test. P-values below 0.05 were regarded as significant.

4. PRESENTATION OF RESULTS

8 components of results will in the following be presented:

1. Descriptive epidemiology
2. Paper I
3. Paper II
4. Paper III
5. Paper IV
6. Paper V
7. Injury rates by study year for a period of 8 years
8. A cross-sectional sampling of attitudes and an evaluation of the Traffic Injury Report.

4.1. Descriptive epidemiology

13769 injuries in Harstad residents were recorded in 8 years, from 1 July 1985. Table 1 shows the distribution of injuries recorded in the Harstad hospital emergency room by study year and reason for contact.

Table 1 The Harstad Injury Prevention Study. Injury count by reason for contact and study year from 1 July 1985

Study year	Unintentional/ accidental	Intentional		Unknown*	Total
		Interpersonal	Self-directed		
1	1768	76	17	5	1866
2	1739	80	17	26	1862
3	1562	62	13	20	1657
4	1562	61	5	16	1644
5	1633	77	6	7	1723
6	1564	103	7	1	1675
7	1539	91	9	1	1640
8	1610	82	6	4	1702
Total	12977	632	80	80	13769

* Includes uncertain reason for contact

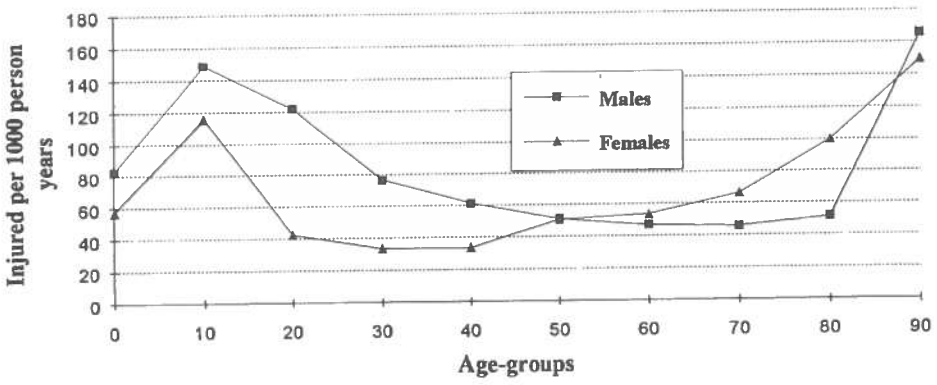
4.1.1. Reason for contact

Regarding *reason for contact*, 94.2 % of the injuries were accidental/unintentional, 4.6 % were interpersonal (violence) and 0.6 % were self-directed. 0.6 % had unclear/unknown reason for contact. The typical open ended response (free text) for intentional injury often mentioned alcohol inebriation and violence or alcohol and neurotropic medicine intake (suicidal).

4.1.2. Age and sex distribution

Males were over-represented in all types of injury: accidental 59.7 % ($p<0.01$), violence 83.9 % ($p<0.01$) and self-directed 56.3% (n.s.). The age and sex distribution of accidental injuries is seen in Fig. 2.

Fig. 2 Accident injury rates in Harstad by age-groups and sex

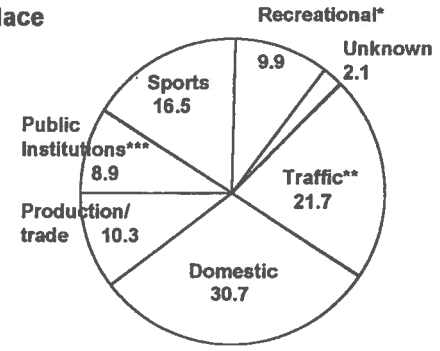


4.1.3. Place of occurrence

Most injuries occurred in homes, followed by traffic and sports areas (Fig. 3). Regarding injuries sustained in public institutions, 6 out of ten occurred in schools and nearly 2 out

of ten in nursing homes. 44.8 % of sports injuries occurred while playing soccer (Paper V).

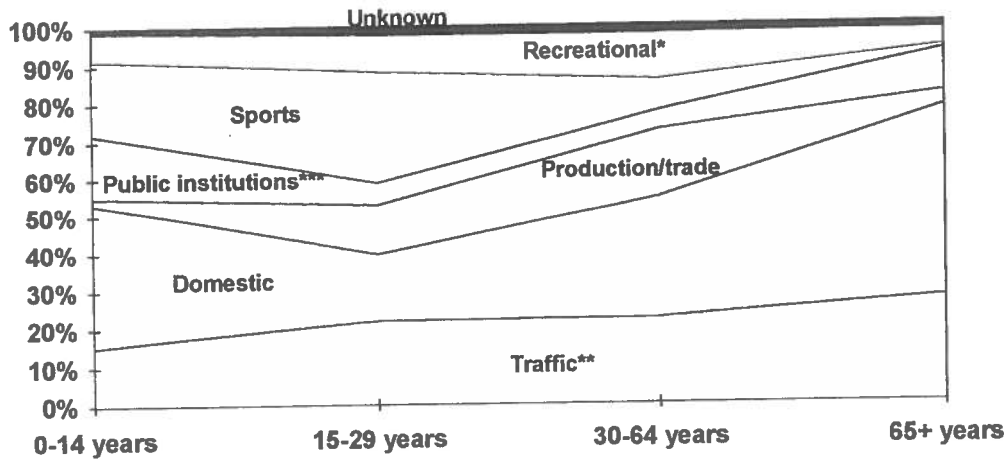
Fig. 3 13769 injuries recorded in Harstad during 8 years from 1 July 1985 by place of occurrence (per cent)



* Includes open air and sea/lake area
** Includes accidents without vehicle involved
*** Includes schools and nursing homes

The scene of injury changes as one goes in a continuum from childhood to old age. Injuries in children and aged people occur most frequently in the domestic area. Traffic related injuries are distributed more evenly through life. Sports arenas are frequently the site of injuries in childhood and adolescence, while production/trade areas frequently is the scene in the 15-65 age group (Fig. 4).

Fig. 4 Accidental injuries in Harstad by place of occurrence and age-groups



* Includes open air and sea/lake
** Includes accidents with vehicle involved
*** Includes schools and nursing homes

4.2. Paper I. Evaluation of hospital-based injury-recording and community-based intervention for traffic injury prevention.

Regarding traffic accidents, official data available for prevention planning is deficient (3,49,52). Hospital injury data, being more complete, provide a better basis for prophylactic work. Hospital treated traffic accident injuries were recorded prospectively for 7 1/2 years in the two Norwegian cities, Harstad and Trondheim. In Harstad the recorded data was used actively in the analysis, planning and implementation of a community-based injury prevention program. Trondheim was used as a reference city. The intervention was divided into three periods, each of 30 months duration. Preventive efforts were implemented to some extent in period 1, increasingly in period 2

and period 3. A 26.6 % overall reduction of traffic injury rates was observed in Harstad from period 1 to period 3 ($p<0.01$), whereas a corresponding significant increase was found in the comparison city. Analysis of data from other sources was not conclusive in supporting the Trondheim data as showing the national trend. Alternative explanations for the injury rate reduction in Harstad were assessed by means of other available relevant data. The exact mechanisms that brought about the reduction of injury rates were hard to elucidate because so many intervention elements were implemented at the same time. It is concluded that at least some of the reduction was related to behavioural and structural changes brought about by the community-based interventions. Important factors for the effect of, and participation in, the prevention program were local relevance and continuous feed-back of accident injury data.

4.3. Paper II. Hospital-based injury recording used for outcome evaluation of community-based bicyclist and pedestrian injury prevention.

Official data available for planning bicyclist and pedestrian safety is particularly deficient. Less than 10 % of bicyclists and 37 % of pedestrians injured in traffic accidents and treated in Norwegian emergency rooms were in 1990 recorded by the police (1,53). Locally, more complete data on injuries occurring in these two road user groups were, in the present study used in passive and active community-based interventions. During 7 1/2 years, data on a total of 275 bicyclist and 137 pedestrian accidents were recorded. Seven out of ten injured

bicyclist and almost half of the pedestrians were below 16 years of age. Among other things, interventions targeted helmet promotion for bicyclists and conspicousness enhancement for pedestrians during the dark season. Passive interventions included building of separate pedestrian and cyclist roads, lowering of speed limits and treatment of blackspots. Active interventions were implemented by using local injury data in a campaign involving schools, the local network of organizations and the media. Written information (Traffic Injury Reports) on traffic injuries containing local data with free texts (victim stories) was distributed quarterly to key participants in the campaign (to all households the last 18 months of the study, N=9300). Significant injury rate reductions were observed below the age of 16 for bicyclists (37 %) and for pedestrians (54 %). After assessing sources of confounding and bias, it is concluded that our safety program for bicyclists and pedestrians seemed effective.

4.4. Paper III. Prevention of burns in small children by community-based intervention.

Burns are known to cause considerable morbidity in children below 5 years of age (54). The epidemiology of burns in small children was charted in a prospective all-encompassing injury recording in the hospitals of the two Norwegian cities Harstad and Trondheim. The study lasted 103.5 months and included children below 5 years of age. During the first 19.5 months (period 1) both cities were exposed to the national child injury prevention program. The following 7 years (period 2)

Harstad (22 000) was, in addition, exposed to intervention through a community action programme using local data on burn injury for accident analysis and motivation. Both active and passive intervention strategies were implemented. Trondheim (134 000) served as the comparison city. From period 1 to period 2 mean burn injury rates decreased 52.9 % in Harstad, from 52.4 to 24.7 per 10 000 person years ($p<0.05$). In Trondheim, a corresponding increase of 9.9 % was observed, from 61.9 to 68.0 per 10 000 person years (n.s.). The developmental difference in rates between the two cities is discussed. An assessment of cost-effectiveness of the Harstad programme gave evidence of considerable savings in terms of short term hospital costs. Burn injury rate reduction in Harstad was considered mainly attributable to the strengthening of public participation and the enhancement of community empowerment achieved by recording and actively using local burn injury data.

4.5. Paper IV. Community-based prevention of fall-fractures in the aged evaluated by means of a hospital-based injury recording system.

Fractures in the aged are costly to individuals and society. In Denmark hip fractures are reported to be more expensive and hospital-day consuming than any other diagnosis (55). In a quasi-experimental study, hospital treated fall-fractures in elderlies 65+ years old were recorded prospectively for 8 years in the two Norwegian cities Harstad and Trondheim. In Harstad, the recorded data was used actively in the analysis and

planning of a community-based fall-fracture prevention program. Trondheim was the non-equivalent reference city. In Harstad, nine out of ten fractures were caused by falls. 50.6 % occurred in private homes, 27.8 % in traffic areas (traffic accidents excluded) and 13.3 % in nursing homes.

The first three years of the study were the baseline, while the last five years contained community-based interventions e.g. the removal of environmental hazards in homes, promotion of healthy life-styles and the use of safe outdoor winter footwear. Fall-fracture rates increased insignificantly in nursing homes, but decreased 26.3 % in private homes ($p<0.01$). For 65-79 year olds a 48.7 % reduction was observed for males ($p<0.05$) and a 23.4 % increase observed for females (n.s.) in traffic areas in winter. The Trondheim data suggested a concomitant significant rise in fall-fracture rates in the control city. Alternative explanations for the injury rate reductions in Harstad were assessed. A strong relationship was suggested between interventions and the observed fall-fracture rate reductions in males in traffic areas and in both sexes in private homes. For the latter patient group, a 16.7 % reduction of hospital admission rates was observed, indicating a substantial savings in short-term hospital costs. It is concluded that fall-fracture prophylaxis in the aged is possible when it is community-based and when high-quality local injury data is used.

4.6. Paper V. The epidemiology of sports injuries. An 8 year study.

Sports injuries account for considerable morbidity and expenditure of resources (23,56). The present study describes prospective recording of hospital-treated sports injuries occurring in Harstad, Norway, during an 8 year period. A prevention program targeting downhill skiing injuries was evaluated in terms of outcome (injury rates). 2234 sports injuries accounted for 17.2 % of recorded accidental injuries. This percentage is consistent with the findings of deLoes and Goldie in the Falkøping study in Sweden which recorded injuries about the same way as Harstad (56). Two out of three injuries occurred in team sports. Soccer accounted for 44.8 % of all sports injuries (42 % in the Falkøping study). Downhill skiing injuries had higher mean scores on the abbreviated injury scale (47) than all other sports combined ($p<0.01$).

Strategies for future injury prevention include community involvement, including sports organizations. Special targets should be the promotion of increased helmet use in downhill skiing for young adolescents and prevention of lower limb fractures in male soccer players 15+ years old. Strategic considerations for prophylaxis should include the feasibility of helmet mandation in adolescent downhill skiers, checks on compliance with mandated use of shin guards and adequate referee reaction to soccer rule violations. An injury prevention program (57) was found suitable for future implementation in Harstad.

Even if post-intervention injury rates for downhill skiing were reduced by 15 % when adjusted for exposure (p=0.24), adjustments in preventive action measures and further observations of injury rates are needed before conclusive evaluation of prophylaxis can be done.

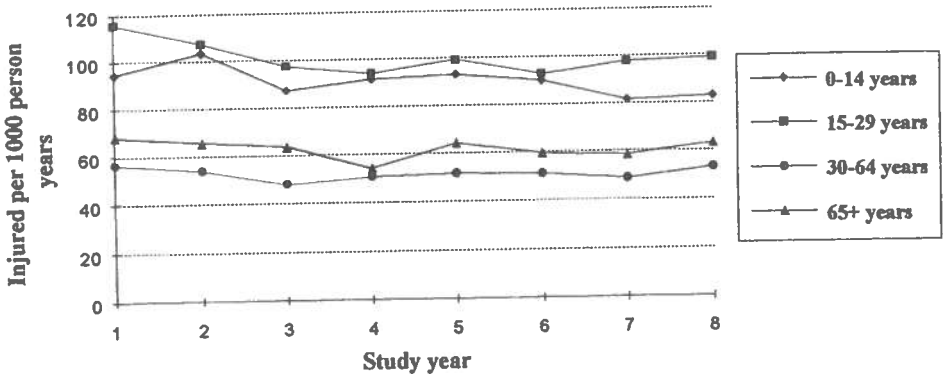
4.7. Injury rates by study year for a period of 8 years

In order to investigate a possible effect of interventions on some injury rates, the running average for some crude injury rates are shown (Figs. 5-7).

4.7.1. Accidental injuries

When comparing the first two study years with the last two years, a 16 % reduction was observed for children's injury rates (p<0.001) and an 11 % reduction was found for 15-29 year olds (p<0.01). The rates seemed stable for 30+ year olds (Fig. 5).

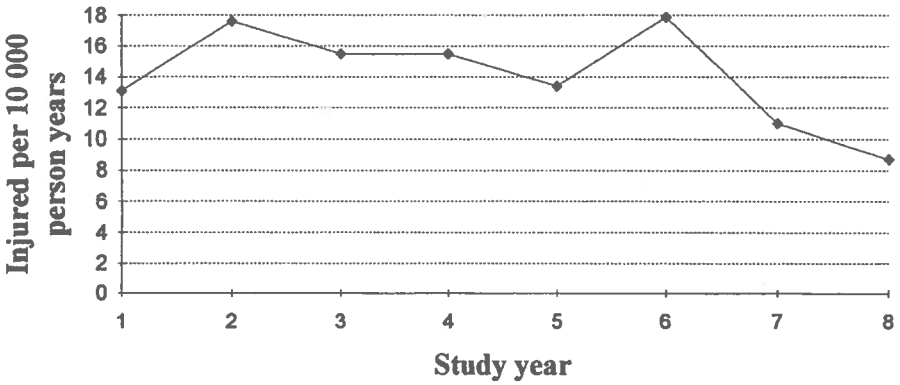
Fig. 5 Accident injury rates in Harstad by age-groups and study year



The stable rates for the aged may partly be explained by rising injury rates in some groups counteracting the falling rates in others.

The falling injury rate for children is consistent with the observed injury rate reductions for children in traffic accidents (Papers I-II) and burns in small children (Paper III). Although interventions also targeted chemical injuries in children (poisonings), the rates for these injuries did not decrease correspondingly (Fig. 6). However, the relative risk for chemical injury in children during the last two study years was 0.63 compared to the six first years (p=0.27).

Fig. 6 Chemical injury (poisoning) in Harstad children 0-14 years old (N=51)

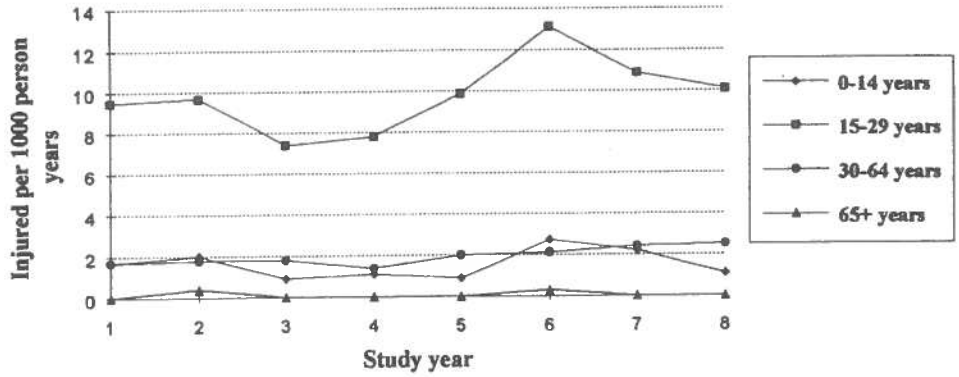


This may suggest that prevention of chemical injuries in children is becoming effective, but may also be explained as random variation in accidents. Further observation is needed before making more conclusive statements about the effectiveness of child poisoning prophylaxis.

4.7.2. Intentional injury/violence

The yearly running average for violence injury rates is shown in Fig. 7.

Fig. 7 Violence injury rates in Harstad by age-groups and study year



The age group 15-29 years is over-representated. An increasing trend seemingly broke in 1992. This corresponds in time with the anti-violence campaign that was started by the Harstad police in 1991. Further observations may indicate whether this change in rates is indicating an intervention effect or just random variation.

4.8. A cross-sectional sampling of awareness, attitudes and an evaluation of the Traffic Injury Report.

Awareness of some traffic safety issues was investigated by questions about frequency of discussions in the family during the last year about (i) alcohol and driving, (ii) drugs and driving and (iii) speeding or (iv) children's safety in traffic

(questions in Norwegian in Appendix IV). The results are presented in Table 2.

Table 2 Percentage of respondents reporting frequency of discussions in the family/among friends during the last year about traffic safety issues* according to residency. Number of respondents were 723 in Harstad and 714 in Trondheim**.

	Discussed often/quite often***			
Driving and	Harstad %	Trondheim %	χ^2	p-value
Alcohol	62.5	51.3	17.7	0.000
Drugs	26.2	21.4	4.2	0.041
Speeding	77.1	69.4	10.4	0.001
Children's safety	77.0	67.4	15.7	0.000

* Alcohol and driving, drugs and driving, speeding and children's safety in traffic

** N varied slightly for the four questions. "Don't know" varied from 1.3 % to 4.0 % of total for each question

***The variable "frequency of discussion" was dichotomized. Often/quite often is shown. Never/seldom may be calculated.

Some attitudes toward traffic safety were sampled by asking whether traffic accidents were perceived as (i) inevitable, (ii) preventable by public action or (iii) preventable by individual precaution (Table 3).

Table 3 Percentage of respondents reporting some perceptions of traffic accident preventability by residency. Number of respondents were 723 in Harstad and 714 in Trondheim*.

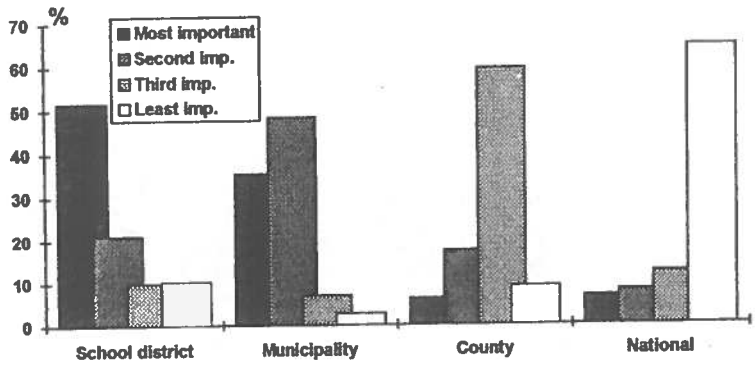
	Disagree**			
Accidents are:	Harstad %	Trondheim %	χ^2	p-value
Inevitable	89.2	86.4	2.20	0.138
Preventable by public action	4.8	10.0	9.31	0.002
Preventable by individual precaution	5.1	8.0	4.49	0.034

* N varied slightly for the three questions. "Don't know" varied from 2.1 % to 5.5 % of total for each question

** Completely or to some extent. Regarding the statement at hand, the participant was invited to agree completely, agree to some extent, disagree completely or disagree to some extent. The variable was dichotomized.

The perceived importance of traffic safety information by different administrative levels (school district, municipality, county and national levels) was investigated. The respondents' ranking of importance of this information differed slightly in the two cities with a tendency towards preference for local information in Harstad (n.s.)(data not shown). The data for the two cities combined are shown in Fig. 8.

Fig. 8 A cross-sectional survey in Trondheim and Harstad. N=1437*. " What kind of information about traffic safety do you consider to be most important for traffic safety in your community?" Ranking of the perceived importance of information by administrative level (shown in %).



*** 8 % answered "Don't know"**

Evaluation of the Traffic Injury Report (TIR)

The TIRs were distributed only in Harstad as part of the local interventions. 56.0 % of respondents from Harstad reported to have acquired information or good advice about traffic safety from the TIRs. 42.6 % reported that information acquired from the TIRs was the reason for starting discussions about problems

connected with driving and alcohol and/or drugs/speeding/children's safety in traffic (Table 2). The distributions of these two respondent categories by age groups and socio-economic status (as expressed by years of education) are shown in Figs. 9-10.

Fig. 9 Evaluation of impact from TIR by agegroup in Harstad residents (n=723). Two categories of impact are shown in % of respondents for each agegroup

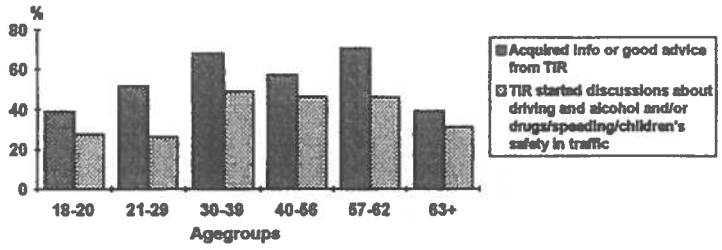
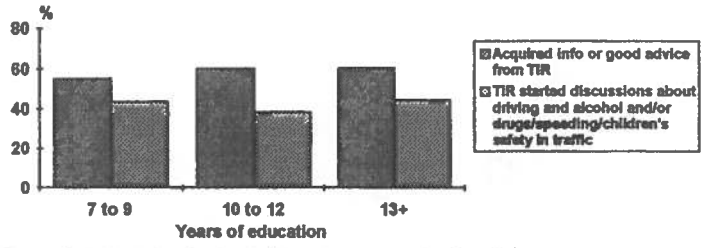


Fig. 10 Evaluation of impact from TIR by levels of education in Harstad residents (n=686*). Two categories of impact are shown in % of respondents for each level of education.



*** years of education range 7 to 20 years. "Unknown" was reported by 14. Respondents reported from 1 to 48 years of education. Answers outside the range 7-20 were excluded**

5 DISCUSSION

Discussions regarding Paper III, Paper V and injury rate changes by study year are included in the presentation of results in chapter 4. This general discussion chapter will be partitioned into the following 6 components:

1. Descriptive epidemiology
2. Prevention of traffic injuries
3. Prevention of fall-fractures in the aged
4. Changing accident-related behaviour. Sampling of attitudes and an evaluation of the Traffic Injury Report
5. Relationship between interventions and injury rate reductions. Methodological issues
6. How to achieve injury control

5.1. Descriptive epidemiology

In order to acquire more complete data, injuries were from 1 January 1992 recorded in primary health care as well as in the hospital emergency room. As a mean for the ensuing 18 months of the study, 15.9 % of all accidents treated by the health services were recorded in primary health care. Extrapolating this percentage to the whole study, a mean for study accident rate of 8.4 per 100 person years may be calculated. This calculated mean rate for accidents treated by the health services in Harstad is lower than national estimates done by the National Institute of Public Health (1,22). When assessing the discrepancy, one must keep in mind that the Harstad rate is influenced by intervention.

5.2. Prevention of traffic injuries

There are those who contend that official traffic accident injury recording is sufficient and complete for accident analysis and injury control. Safety programmes based on the use of official data are being used in most communities in Norway.

However, official (police) traffic accident statistics are in many aspects deficient. Police records accounted for only 29 % of injuries recorded by Harstad health services, based on 7 1/2 years of hospital recordings and a one year sample from primary health care. Blackspot localization is insufficient when only using official statistics and may be vastly improved when combined with traffic accident data from hospitals and insurance records (50). A study like the present one would be impossible to conduct in a city like Harstad using only official data because of the much lower N generated in a specific time span. The programme is very much based on the feed-back of data to the participants in the programme. Collection of a quantity of official data equivalent to ours for analysis and significance testing would in our study have taken over 20 years. It was, for example, important that the motor cycle club had an immediate response to their successful safety promotion. Moreover, police records do not describe traffic injuries sufficiently in terms of medical information needed for effective prophylaxis planning. A Swedish study compared the assessment of injury seriousness done by the police with corresponding assessment in the hospital. Considerable discrepancies were found. Injury seriousness was frequently underestimated by the police (20 %), but also overestimated in one out of six cases (58).

A main objective for any safety programme targeting bicyclists, should be increased helmet use, assessment of which our study, unfortunately, did not include. However the injury data could suggest increased helmet use in children below 10 years of age

and ineffective helmet promotion in children 10-15 years old. This is consistent with the findings of Bergman et al. (33). They found that helmet promotion in the Seattle area had an effect in children 5-12 years old but also expressed a defeatist attitude towards helmet promotion through educational programs targeting adolescents. The resistance of adolescents to helmet promotion can be overcome by conveying messages that helmet use is fun and attractive, helmets provide a new look and a sporting image, and that your friends approve and value the use of helmets (59). Even though our intervention included messages of this sort, we failed in reducing head injury in children 10-15 years old, probably because one needs to overcome a threshold of a certain magnitude (particularly peer pressure) in this age group. For future strategic planning, a helmet mandating law must therefore be considered in Norway. The prevention potential for a law seems to be considerable, especially in children.

Epidemiological studies in the USA have shown that 76 per cent of bicycle accident fatalities in children were due to severe head injuries (60). The use of helmets may reduce the risk of head injury by 85 % (61). In a survey of 5000 Norwegian children by Thuen et al. (62) self-reported use of bicyclist helmets was 20 % in 11 year olds decreasing to 3 % in 15 year olds. This reflects the lack of success by national campaigns for increased helmet use. Also other studies promoting child helmet use have reported a lack of impact (63-64), temporary effects (65) or uncertain effects on helmet use although awareness of the campaign messages increased (66). Successful

interventions have, however, been reported. In an Ottawa study promoting helmet use, the overall use increased from 10.7 % to 32.2%, but the percentage was, after intervention, lower among students in elementary (25 %), secondary (17 %) and post secondary schools (20 %) (67). The most successful results are reported from Victoria, Australia where the use of helmets increased from 5 % to 70 % in primary school children (68), and from Maryland, USA, showing an increase of helmet use in children from 4% to 47 % (69). In both places the changes were caused by laws mandating helmet use.

The preventable fraction of bicyclist head injuries in our study can be calculated from the formula (10):

$$Pe = 100 \frac{E(U2-U1)}{1-U1E}$$

where Pe = expected percentage change in head injury rate, U1 = proportion using helmets before the change and U2 = the proportion using helmets after the change. E = the technical effectiveness of helmets, reported to be 85 % (61). Assuming that a mandating law would increase helmet use from 10% to 60% in Harstad, head injury rates could be reduced 46 % and overall bicyclist injury rates could be reduced 13 %. Extrapolating to national bicyclist injury rates, a law for helmet use could prevent more than 1300 emergency room visits for head injuries in Norway, most of these occurring in older children and adolescents.

5.3. Prevention of fall-fractures in the aged

Surgeons working duties in a community general hospital may daily observe the impact that fractures in the aged have on local surgical, nursing and rehabilitation resources. Clearly a potential exists for preventing human suffering and costs to society caused by these fractures. Some intervention studies using estrogen replacement in women to reduce post-menopausal bone mineral loss have reported significant reduction of hip fracture rates (70-72). However, mass treatment of post-menopausal women with hormones is controversial. In the Framingham Study, heart disease and strokes were found to be increased among estrogen users (73). Other studies have found estrogen to protect against the same diseases (72,74). Estrogen given alone may increase uterine cancer risk (75) and increase risk for breast cancer (72,76). Combining estrogens with progesterone protects against uterine cancer but is reported to increase the risk of cardiovascular disease (72). When an adequate dosage of estrogen is given, the added progesterone may not affect serum lipid level adversely and may also reduce or eliminate the risk for breast cancer (77). Other studies and review articles report bone loss prevention in post-menopausal women on calcitonin (78), gestagen (79), vitamin D or bisphosphonates (80) or even thiazides (81). While bone density data are measures of a proxy, fracture data are more precise for outcome evaluation of post-menopausal fracture prevention. A preventive therapy with estroprogesterons seems to be preferred, providing there is no contraindication. In the absence of fracture data, the modalities of alternative therapies are still debated (82). Osteoporosis in the aged may

be retarded by adequate diet (83-84), reduced smoking (84) and physical exercise (85-86). Several studies have shown increased risk of hip fractures in aged persons with low physical activity (87-88). A Finnish study showed a relationship between alcohol consumption and injuries and death from accidental falls (89). A recent review article found 5 studies where 13-37 % of persons injured in non-fatal falls had been drinking. In 3 other studies, 35-63 % of persons fatally injured in falls had been drinking (90).

The improvements in **environmental** factors like walking surfaces, stairs, railings, lighting and design of chairs and beds are reported to have the potential for reducing the incidence and severity of falls (91), particularly in the age-group 65 to 79 years of age (92). As far back as 25 years ago, 28 % of home accidents in the aged were traced to defects in the physical surroundings (93). Later studies of elderly people seeking care after falls have attributed 39%-52% of the falls to environmental causes (94-96).

A recent case-control study found fall characteristics, bone mineral density (BMD) and body habitus to be important risk factors for hip fracture. The authors concluded that in addition to maintenance of BMD, prevention of hip fractures in the aged should include strategies for reductions in fall severity (97).

At present, there seems to be great interest in measurements of BMD. This test seems useful for the diagnosis of osteoporosis

and for testing the outcome of treatment (98). Theoretically BMD measurements could also be used as one of several predictors for selecting people for prevention of osteoporosis. However, some time may pass before predictors are developed with sensitivity and specificity high enough for determining what groups of post-menopausal women should receive hormone replacement therapy or other types of drugs (25). Research in these areas touches on controversial issues of possible side-effects and cost-effectiveness. In the meantime, while waiting for a consensus, it seems that more studies should be initiated that manipulate less controversial factors like removing/reducing external causes of falls, reducing fall severity, and promotion of healthy lifestyle in terms of diet, physical exercise, reduced intake of benzodiazepin-like medicaments, excessive alcohol intake and smoking. The present study seems to confirm the findings of Poulstrup (25) that fracture prophylaxis in the aged may be successful without the use of controversial hormone substitution regimes or costly drugs.

5.4. Changing accident-related behaviour. Sampling of attitudes and evaluation of the Traffic Injury Report

The results from the cross-sectional survey in the two cities, Harstad and Trondheim, seem to indicate some differences in, awareness about, and attitudes towards traffic accidents. Differences concerning awareness, measured as frequency of discussions about four different traffic safety issues, were significant on all four issues (Table 2). Differences between

the two cities concerning perception of traffic accident preventability was also found (Table 3). Interpreting these differences in relation to the constructs of the KAP model (34) and Bandura's Social Cognitive theory (38), we might have succeeded in manipulating factors determining accident related behaviour. Another, but in our opinion less likely explanation, could be that we simply have measured differences (in awareness about and attitudes towards traffic injury safety) constantly found between people living in small cities and large city dwellers. Measurement of these variables in both cities before and after interventions could have facilitated considerations of causal inference.

The preference for local, compared to central traffic safety information, was marked in both cities (Fig. 8). This should be kept in mind when planning future traffic safety information campaigns.

The impact of the TIRs seemed to be largest among respondents from the third to the beginning of the sixth decade of life (Fig. 9). The impact was larger in women than in men (data not shown). This preponderance of impact might be explained by these age-groups' concern for their children/grandchildren moving about in a dangerous traffic environment - a concern that dwindles with oncoming high age?

The impact of the TIRs seemed to be distributed evenly over socio-economic classes as expressed by years of education (Fig. 10). The impact in the higher socio-economic classes could be

explained by the manipulative potentials by the TIRs on the constructs of the KAP model mentioned in chapter 1.4.2. This chapter also discusses a possible mechanism for impact in lower socio-economic classes.

It may be concluded that awareness about traffic safety questions in Harstad was enhanced by the distribution of TIRs. This is consistent with our findings of preference for local traffic safety information. Furthermore this type of traffic safety information seems to have an even impact on different socio-economic classes - something to be preferred in an egalitarian society.

The question of non-responders (over 50 %) remains to be addressed. The whole census-drawn sample and the non-responders were compared with regard to residency and the possible confounders: age, sex, and marital status. This analysis showed that the census-drawn sample and responders were quite similar in the two cities on the above-mentioned possible confounders. This does not guarantee that our samples are truly representative of the populations in the two cities with regard to the studied variables. However, because similar persons seem to be non-responders in both cities, comparisons between Harstad and Trondheim can be made.

5.5. Relationship between interventions and injury rate reductions. Methodological issues.

Research on causal inferences are facilitated by using closed systems like a laboratory, with controlled conditions. In field studies like the present one, multiple causations are more of a problem because the system is more open. Causal inference is not justified merely by showing a certain time sequence of events.

Among the many conditions proposed for inferring cause, three classical criterias will be mentioned here (13): (i) covariation between the presumed cause and effect, (ii) the temporal precedence of the cause, and (iii) the need for the methodological ruling out of alternative interpretations for a possible cause and effect relationship. Criterias (i) and (ii) are seemingly met in the present study. The third criterium will be discussed by using the following methodological constructs:

1. Non-equivalent variable design
2. Dose-response relationship
3. Threats to validity

5.5.1. Non-equivalent variable design

To strengthen the inference for a causal role of the intervention one could use the principle of non-equivalent variable design (13). Since our accident injury recording includes all areas, we may analyse trends for injuries in other areas - e.g. sports. Because of limited resources and because the injury prevention group wanted to gain experience within a

few limited accident areas, minimal intervention was directed towards sports injuries except for downhill and slalom skiing (Paper V). The 8 year crude injury rates for sports showed remarkable stability (Paper V).

5.5.2. Dose-response relationship

Interventions against traffic accidents were increasingly implemented in two intervention periods after a "baseline" period. Each of these three periods were 2 1/2 years in duration (Papers I-II). A study of this kind may have sources of bias or confounding that the authors cannot control for and causality cannot be proven. However, a significant dose-response to treatment was found through a test for trend. According to Bradford Hill this gives evidence in favour of a causal relationship (99).

5.5.3. Threats to validity

The Harstad Injury Prevention Study has the weaknesses inherent in a non-randomised field study. Partly it may be described as quasi-experimental with a time series design (13). However, it was possible to use a reference field (the city of Trondheim), the inclusion of which is a prerequisite for designing a quasi-experiment with a non-equivalent control group design. For a better quasi-experimental design, data similar to Harstad's from a randomly chosen, more comparable city could have been shown. However, Trondheim was used out of necessity, being the only other city recording injuries from 1 July 1985, in order to indicate secular trend and facilitate causal inference.

When addressing propositions about causes, e.g. "interventions caused injury reductions", one must keep in mind that causality cannot be entirely proven. Validity can be used as the best available approximation of truth or falsity of propositions about cause (13). Some threats to validity will be addressed:

1. Registration effect
2. Coding error, inter- and intra-personal reliability
2. Historic trend
4. Regression effect
5. Investigator bias

5.5.3.1. Registration effect

Registration loss at the end of this study would be a very serious threat to the main thrust of this thesis. However, some arguments may be put forward in support of the high quality of the Harstad data:

- Random checks on data quality and recording of single cases have been performed by the author, another surgeon and one co-author who has participated daily in trauma surgery.
- There is an argument for data quality being improved when the data base is used actively by those who are responsible for its quality. The data has been used for numerous segmental local reports and the publication of 10 scientific papers throughout the project (3-7, and the five present papers).
- Little intervention was implemented in the area of sports injuries (Paper V). The sports injury rates remained constant during the study. Assuming that the study population did not engage increasingly in sports activities

from 1985/1986 to 1992/1993, this suggests a stable and complete injury recording system and weakens the argument that our observed injury rate reductions may be explained by a registration effect. This argument is closely connected to analysis by the non-equivalent variable design.

Admittedly there were possibilities for error in the Harstad IDB. The enthusiasm for recording data could decrease with the passage of time. This very serious threat has been countered by specifying and checking routines for the injury recording secretary and by the continuous motivation of interns and emergency room personnel by the author. Indeed, data quality (validity and reliability) may improve because of increasing compliance with data recording routines over time.

Some accidents are treated in primary health care. If the ratio of accidents treated in primary health care/treated in the hospital increased during the study, this would be a threat to validity. Two counteracting arguments seem to be relevant: increasing demands for health service cost-effectiveness could contribute to accident treatment at lower levels in the health services, increasing this ratio. On the other hand, medico-legal problems and physician culpability have increasingly been focused on by authorities and the press during the last years. This could be construed to produce the opposite effect: an increase of accident cases referred to the hospital for assessment and treatment. The relative weight of these two arguments are difficult to assess.

Injuries were from 1 January 1992, recorded in primary health care as well as in the hospital emergency room. As a mean for the 18 last months of the study, 15.9 % of all accidents treated by the total health services (primary + hospital) were recorded in primary health care. The percentage of accidents recorded in primary health fell from 16.6 % during the first half of 1992 to 15.5 % during the last study year (n.s.). This seemingly stable percentage must be interpreted with caution. However, it might support the suggestion that registration effect can not explain the reductions in injury rates described in this thesis.

A 6.7 % increase in overall accident rates was observed in Trondheim from 1985/86 to 1990 (1). The quality of the Trondheim data for 1985/86 is described as fairly good (1), and the completeness of these data has been reported in a thesis by Sahlin (44). Thus it is considered unlikely that the increasing trend for accident rates observed in Trondheim may be explained by a registration effect.

5.5.3.2. Coding error, inter- and intra-personal reliability. Registration bias.

Harstad and Trondheim hospitals both contribute data to a national injury surveillance system. Uniformity in the two hospitals regarding coding practices, and data validity/reliability has been discussed at yearly meetings in Oslo. The consensus seems to be that data quality is best at higher levels of the NOMESCO coding system e.g. traffic

accident yes/no, while information about the road user group may be missing. The more detailed and complicated the coding of data becomes (lower levels of the NOMESCO coding system), the greater the chance for error. Some types of data, relevant for prevention, have better quality when recorded prospectively e.g. place/time of injury and injury mechanism. Other data, e.g. fracture yes/no may be collected retrospectively because this information is relevant for treatment and is usually present in medical records (Paper IV).

The relatively small size of Harstad Hospital (170 beds) and the continuity of the injury secretary service enhanced the possibilities of good data quality. The same secretary has been working with us since 1987, minimizing the problem of inter-person coding reliability. Hospital data about the admitted patients has been used to perform reliability and validity checks on the Harstad injury data base (IDB). Medical records for patients admitted to the hospital for fall-fractures in homes were checked against the IDB (Paper IV). Out of 186 admitted cases recorded by the IDB, 185 were found in the hospital medical records.

The tendency towards error in more detailed data has been actively fought against in both cities - Harstad and Trondheim. However, the data volume to be checked in Trondheim was six times the size of the Harstad data and resources/personnel allocated for checking were not of a corresponding ratio. In a reliability test performed by the National Institute for Public Health, with a scale ranging from good through medium to bad,

the Harstad data was found to be "good" while the Trondheim data was described as "medium". Validity of free texts were described as "medium" in both cities (22).

To avoid registration bias, blood alcohol tests were not routinely taken. A driver, knowing that a blood sample would be drawn and suspecting himself to have an illegal BAC, would bias his reporting on how he was injured. This bias would be particularly strong in Norway, having quite harsh legal reactions to drunken driving.

5.5.3.3. Historic trend

A downward historic trend for accidental injury rates in Norway would be a serious threat to some of the conclusions about intervention effects in Papers I-V. The national historic trend for traffic injuries was estimated to be downwards for serious and fatal injuries, while the less severe injuries increased (Paper I).

An increasing national historic trend for fracture rates in the aged was indicated by studies reported in Paper IV (less in rural than in urban areas).

National estimates for trends for overall crude accident injury rates are based on data from Harstad and Trondheim. From 1985/1986 to 1990 a national increase of 5.1 % was reported for cases treated in emergency rooms [CI's 2.9,7.2] (1). There is little reliable collateral data available in Norway for corroborating evidence of this national trend.

The possibility exists that local trends for injury rates may be different from national trends. This is the reason for including assessment of injury data from the 6 municipalities surrounding Harstad in the discussion of relationship between interventions and observed injury rate reductions in the study population in Papers III-IV. Concerning overall injury rates in these 6 municipalities, the trend was flat (data not shown). One may assume that these trends were affected by treatment diffusion from Harstad because of geographical proximity. Such diffusion has probably occurred e.g. through the media and/or by contacts between individuals and professionals involved in the Harstad intervention programs. Thus, local trends are not considered to be a threat to validity.

5.5.3.4. Regression effect

Accidents are known to be subject to random fluctuations, as they normally are Poisson distributed. Thus they can be analysed like any recurrent common disease. Comparison of longitudinally recorded incidence rates according to standard epidemiological procedures (14,100) can rule out random variations with the desired probability (as a rule 95 % or more). If the baselines, chosen for the different intervention studies, had particularly high incidence rates, a decrease in rates could occur even if the interventions were not effective. A regression-to-the mean effect could then account for the observed reduction in rates. But Harstad was chosen as one of four hospitals in Norway recording data for a national injury surveillance system, not because of particularly high injury

rates. Regression effect cannot entirely be ruled out, but is considered an unlikely explanation for the entire injury rate reduction observed in Harstad.

5.5.3.5. Investigator bias

A possible source of bias must be discussed concerning the author's role in evaluating the Harstad Injury Prevention Study. I have been involved in the planning of the national injury surveillance system since 1984 and responsible for the injury data recording in Harstad. Also I have been a member of and participator in almost all meetings of the Injury Prevention Group from the start in 1985. I have given numerous speeches, sent multiple reports and answered questions about injury data in the community throughout the study period. Clearly, through this extensive participation and involvement in many aspects of the study, a possibility for bias exists in my subjective assessments of interventions. The presentation of interventions are mostly made on the basis of written documentation (e.g. proceedings from meetings in the injury prevention group, written reports to target groups and newspaper clippings). Resources for unbiased, professional process evaluations have regrettably not been available, but not from want of trying to procure them. However, outcome evaluations are mostly based on the occurrence of injuries treated in the hospital emergency room. Whereas subjective assessments of interventions and processes might have been influenced by "investigator bias", the assessment of temporal changes in injury rates relative to interventions should be unbiased. To avoid bias in the cross-sectional survey of

attitudes and evaluation of the Traffic Injury Report (chapter 3.5), the investigator's name was not mentioned on the invitation to participate.

The design and time sequence of the different "baselines", weighting of interventions, and endpoints (Fig. 1) could have been constructed by the investigator in order to fit into the pattern of injury data. However, even if the sequence of events shown in Fig. 1 is not in detail correct, (e.g. we did not start interventions against downhill injuries exactly on 1 July 1990) this is approximately how events happened.

5.6. How to achieve injury control

5.6.1. Community empowerment

The Ottawa charter aims (inter alia) at:

(i) *Strengthening community action in setting priorities, making decisions, planning strategies and implementing them to achieve better health. At the heart of this process is the empowerment of communities, their ownership and control of their own endeavours and destinies.* Accordingly, the Harstad study aimed at addressing the local injury problem with means defined or agreed upon by the community. The community awareness of injury as a problem was enhanced by disseminating information from the IDB about traffic injuries, burns in children, fractures in senior citizens and downhill skiing injuries. Papers I-V describe how this dissemination of information to individuals was promoted through the media, by

postal information and through a network of organizations. This is in accordance with the use of organizations applied in the Swedish Falkøping study (8) and with a bottom-up strategy. In Thailand, Thavisak has argued for this approach:
"*In order to motivate people to be receptive to health and other improvement action, it is important that they must be involved in the process from the beginning*" (101).
The continuous feed-back of data provided guidelines for adjusting the course of action or "keeping up the good work".

(ii) *Reorienting health services*. *The role of the health sector must move increasingly in a health promotion direction, beyond its responsibility for providing clinical and curative services*. In the Harstad study, very little local resources had to be reallocated from clinical services to preventive ones. Resources were provided by central Norwegian authorities for (i) a part-time injury secretary for collecting, coding and punching data and (ii) administration of the Injury Prevention Group from 1989. All others participating in the program did so, by more or less adjusting their natural way of working toward the direction of the targets agreed upon by the community.

5.6.2. Local data - the locomotive of the injury prevention train

Governments and national authorities can only provide a framework for reducing injuries. National statistics on injuries are of limited value to the local practitioners of injury control.

In the first 4 1/2 years of the study, the database handling was a little complicated and tedious but the data program functioned safely. The program was capable of making simple frequency tables and listings of free text (22). As local demands for injury data became more frequent, a considerable work-load in terms of making segmental reports, was added to the duties of those responsible for the local database. When EPI info (15) in 1990 became available for handling data, ease and capacity was greatly improved for providing prompt reports and data feed-back to all collaboration partners and the Injury Prevention Group. It was considered essential to give rapid answers to requests for data from individuals or organizations. No doubt, the temporal and geographical proximity of the data collected, increased the feeling of "ownership" towards the community injury problem. With the passage of time it seemed like latent potentials were unleashed. Some participants in the different interventions expressed gratitude for getting an opportunity to work in a program that might remedy problems that had previously seemed insurmountable.

5.6.3. Some necessary conditions for injury control

Bergman and Rivara at the Harborview Injury Prevention and Research Centre, University of Washington, Seattle, have evaluated Swedish child injury control efforts (102): *Why does Sweden have the lowest childhood injury rate of any country in the world? The answer lies in a combination of factors including the special characteristics of Swedish society and an energetic 35-year campaign. Contributing societal characteristics are a small, relatively homogeneous, health*

conscious, law-abiding population that values children. Key factors in the campaign have been support of ***trauma surveillance systems*** *and* ***injury prevention research,*** *ensuring safer environments and products through legislation and regulation, and a* ***broad-based safety education campaign using coalitions of existing groups.*** *Emulating the strategies used in the Swedish campaign would markedly reduce the number of US children killed, injured, and disabled from trauma.*

Injury surveillance systems and injury prevention research are common denominators for Harstad and Trondheim. Both cities received funds in 1989 from the same governmental program for co-ordinating accident prevention. If the two cities recorded injuries and received governmental funds for prevention, why then the discrepancy in trends for injury rates?

An injury data recording system may be considered a necessary but not sufficient condition for successful injury control. A functioning cross-sectoral group, involving the local community network, is another necessary condition. Harstad established early on (1985) an injury prevention group (IPG) which started to use the data from the injury data base (IDB) actively for accident analysis and prevention planning. A similarly functioning group was to our knowledge not established in Trondheim. Harstad is a relatively small community (population 22 000) with a network of personal communications between the group in the hospital recording injuries and the members of the IPG. This type of extensive communication between the professionals responsible for the local IDB and the local field

workers probably did not occur in Trondheim. Possible reasons for this were: (i) the heavy work load on the Trondheim injury secretaries and professionals responsible for recording data inhibited active use of local data for prevention (ii) the size of Trondheim (134 000) inhibited prevention because the relevance and "ownership" of local injury problems are less salient in a large community compared to a smaller one (iii) the use of "network" and personal communications are easier in small communities than in larger ones.

5.6.4. The role of nation-wide campaigns

Some bureaucrats and legislators seem to favour the use of resources for accident prevention by initiating costly, centrally originated safety campaigns. The underlying assumption for this kind of approach should be that information and campaign messages diffuse easily from the top through the hierarchy of administrative network to produce the desired outcome. The national "Campaign against Home Accidents" was launched nation-wide during 1988 to 1991. Evaluation of this campaign showed that only 10 % of municipalities estimated the campaign to have influenced local activities to a large extent (51). Also, a general lack of association was found between involvement in the campaign and municipality characteristics. However, it was found likely that the campaign stimulated existing local accident prevention work, particularly in more active municipalities. A positive association was found between local accident surveillance and accident prevention efforts. Finally, it was suggested that local responses to the campaign

relied more on individual initiatives or other idiosyncrasies of the municipalities than in their different characteristics (51). The latter suggestion has support from a Swedish study (103).

5.6.5. The role of legislation and training of health workers

In 1987 a law was passed in Norway that assigned the responsibility for accident injury prevention to the municipal health services (104). This law seemed to be a motivating factor for municipal health authorities mostly because the Harstad programme was up and running for other reasons than the legislative. However, a long time passed before visible action was taken by the formal body of municipal health services. It was the innovators and idealists that worked hardest and initiated preventive action. As one public health nurse put it: "I was allowed to do this preventive work. Nobody was restraining me"! Many innovative tricks are now used for creating public awareness of the injury issue. An example: The Pope broke his hip in 1994. A safety kit with grab-handle and anti-sliding material, used in fall-fracture prevention (Paper IV), was sent to him from the injury prevention field workers in Harstad. They promptly received blessings and His Holiness' thanks from the Vatican. This was used in the media to promote public awareness of the injury problem (Astrid Berg, Harstad municipality health administration, personal communication).

Public health nurses and a few primary health physicians in Norway have had a traditional role to play in injury prevention. This is far from the case for medical professionals who treat injured people in hospitals. *"Especially outside metropolitan areas, professionals who are knowledgeable about injuries and committed to their prevention often feel as if they are working in a vacuum; their colleagues are simply uninterested in or unprepared to act on the injury problem".* This quote, from the US National Committee for Injury Prevention and Control, illustrates one of the challenges facing future injury prevention programs (105). The quote may well be applied to the Norwegian scene. Education in updated injury epidemiology does not seem to have much place in three out of the four Norwegian medical schools, the University of Tromsø being the exception (The National Institute of Public Health, sections for epidemiology at the Universities of Oslo, Bergen and Trondheim, personal communication).

Turning back to the law assigning responsibility for injury prevention to the primary health care, national legislators could do much good by passing a similar law regulating the activities of secondary health care (e.g. hospitals that treat injuries). It might help if a physician interested in prevention, could walk to a meeting of the cross-sectorial injury prevention group without feeling like a thief in the night sneaking away from his traditional curative duties. Moreover, it puzzles this author that updated prospective injury surveillance is not a routine activity in every hospital with an emergency room function - particularly in view of the

existing capacity for recording a lot of administrative and treatment-related data.

5.6.6. The Safe Community

A system of WHO collaborating centres operates world-wide to address the injury problem. One of these centres is the department of social medicine in the Karolinska Institutet, Sweden, promoting the development of a World Health Organisation Safe Communities Network. Several indicators have been developed for describing a "Safe Community":

1. A cross-sectorial group for co-operation in controlling injury
2. Involvement of the local community network
3. Injury prevention should be adapted to a major population strategy and involve all age-groups and environments
4. Especially high risk and vulnerable groups should be identified and targeted
5. An injury surveillance system should be available - long term
6. The injury prevention effort should have long term capacity inherent in a program, ensuring long term future stability.
7. Process documentation and evaluation
8. Structured organisational analysis for identifying co-operation partners in order to reach high risk groups
9. Involvement of health services in surveillance and action programs
10. Involvement of all levels in a community

11-12. Publishing and spreading information about the experiences and findings concerning the issue of injury control

The Harstad Injury Prevention Study complies fairly well with most of these indicators. Some work and development remains concerning indicators 3,4,6,7 and 8. Process evaluation is very costly and only limited resources have been available in Harstad for this very important aspect of injury research. An important feature of this longitudinal intervention study has been the ability to measure end-points in terms of injury rates.

The future stability of the program may seem threatened by the fact that governmental resources for administering the Injury Prevention Group were allocated for five years, until the end of 1994. A possibility for enabling this program to prevail could be a small reorientation of county resources from curative to preventive service in accordance with the Ottawa Charter (40).

Harstad community efforts towards injury control have been assessed by the WHO Collaborating Centre for Community Safety Promotion in Stockholm. Harstad was on 6 June 1994 awarded status as a "Safe Community", being the first in Norway and the eleventh in the world to fulfil the criteria for achieving this status.

6 CONCLUSIONS

1. Long term continuous prospective hospital recording of injuries in a community is feasible.

2. Local injury prophylaxis can be greatly improved by using local epidemiological knowledge in community-based interventions. The present study demonstrates examples of this in the areas of traffic accidents, burns in children and fall-fractures in the aged. No certain decrease can be seen in downhill skiing injuries so far.

3. Through community-based injury prevention a substantial potential exists, not only for the obvious prevention of human suffering, but also for considerable savings in terms of short-term hospital costs. The present study has documented such savings in the areas of traffic injury, burns in children and fall-fractures in the aged.

7 RECOMMENDATIONS

1. All emergency rooms treating injuries should record a minimum set of variables relevant for local injury analysis and control.

2. Considering the great potential for cost savings in the field of injury, a stronger priority towards preventive efforts should be considered by decision-makers and allocators of funds.

3. When allocating future resources for injury prevention in general and traffic safety in particular, governments and authorities should consider a shift from central towards local efforts.

4. Updated education in the field of injury epidemiology should be given higher priority in medical schools and other institutions educating health personnel.

5. A national law mandating helmets for bicyclists should be passed.

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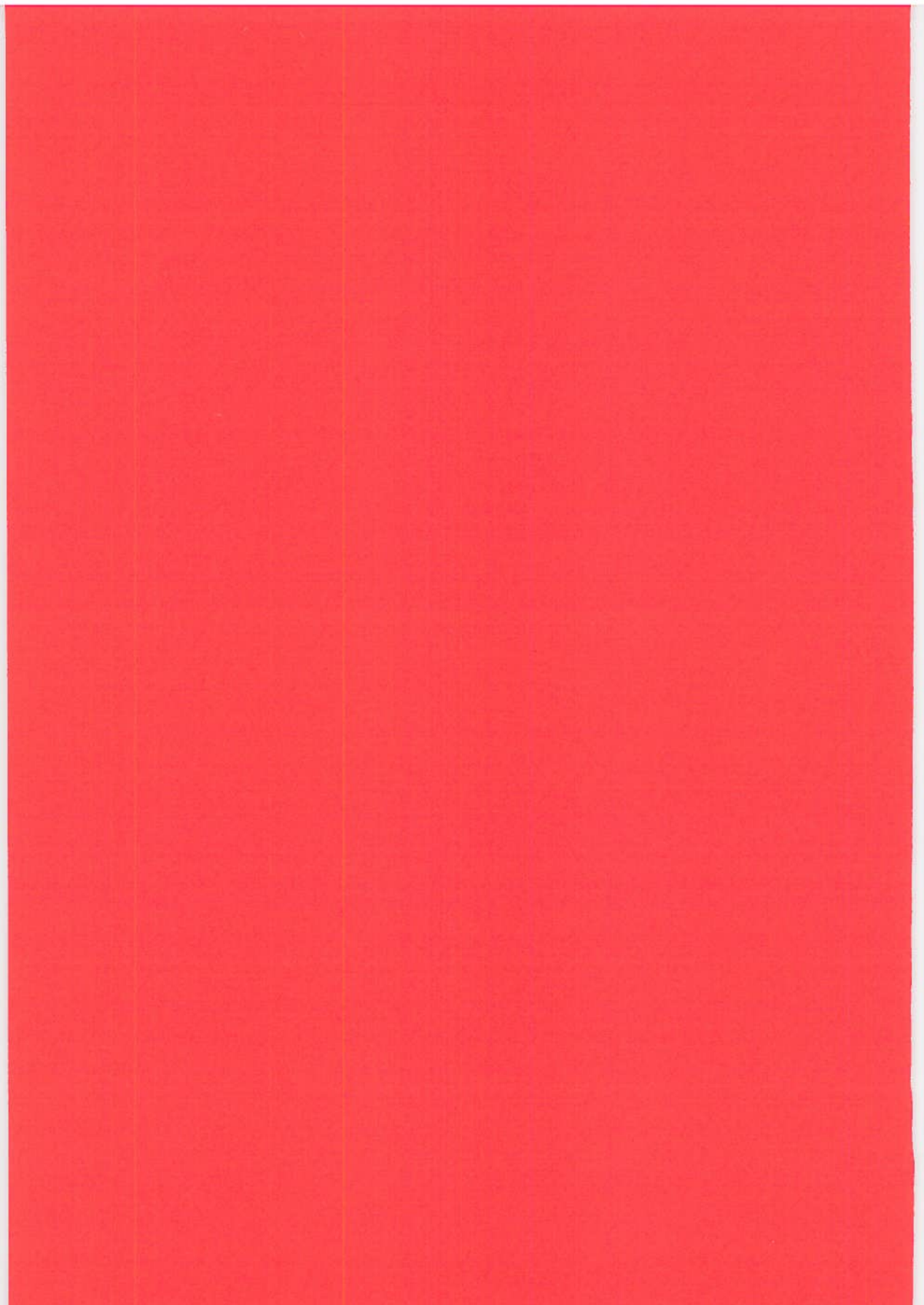
Paper I



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THE HARSTAD INJURY PREVENTION STUDY: EVALUATION OF HOSPITAL-BASED INJURY RECORDING AND COMMUNITY-BASED INTERVENTION FOR TRAFFIC INJURY PREVENTION

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Abstract—In a quasi-experimental study, hospital-treated traffic accident injuries were recorded prospectively for 7½ years in the two Norwegian cities, Harstad and Trondheim. In Harstad the recorded data were used actively in analysis, planning, and implementation of a community-based injury prevention program. Trondheim was the nonequivalent control city. The intervention was divided into three periods, each of 30 months duration. Preventive efforts were implemented to some extent in period 1, increasingly in period 2 and period 3. Traffic safety was promoted in an extensive community program based on the Ottawa charter for health promotion. A 26.6% overall reduction of traffic injury rates was found in Harstad from period 1 to period 3 ($p < 0.01$), whereas a corresponding significant increase was found in the comparison city. Analysis of data from other sources were not conclusive in supporting the Trondheim data as showing the national trend. Alternative explanations for the injury rate reduction in Harstad were assessed by means of other available relevant data. The exact mechanisms that brought about the reduction of injury rates were hard to elucidate because so many intervention elements were implemented at the same time. It is concluded that at least some of the reduction was due to behavioural and structural changes brought about by health promotion. Important factors for the effect of and participation in the prevention program were local relevance and continuous feedback of accident injury data.

Keywords—Traffic accident, Injury prevention, Community-based intervention, Health promotion

INTRODUCTION

September 13, 1899, Mr. Henry H. Bliss of New York was struck by a motorcar as he stepped off a streetcar at the corner of 74th Street and Central Park West (Flink 1975). This historic first motor traffic fatality was soon to be followed by others. Injury from traffic accidents is by now a thoroughly described scourge of mankind. In the United States more than 2.5 million traffic fatalities occurred from 1910 to 1985 (The National Committee for Injury Prevention and Control 1989). From 1980 through 1985 there were 467,510 traffic fatalities in Europe (Jelcic 1988). Although traffic fatalities have decreased in Norway from 1974 (509 per year) to 1991 (323 per year), the rate in 1991, 8 killed per 100,000, was the same as in 1981 (Norges Offisielle Statistikk 1991). In the history of man, traffic injuries constitute a formidable epidemic that must be surveyed with all means available in epidemiology before injury control can be effective.

In most countries prevention of traffic injury has suffered from the shortcomings of inadequate official data. Essential for injury prevention is the collection of data about all traffic injuries, including the nonfatal ones. Many publications have addressed the problem of a low official reporting ratio. The completeness of official reporting is described as 43% to 66% in New Zealand (Morrison and Kjellstrom 1987), 25% in the Netherlands (Harris 1990), 42% to 71% in Norway (Wasmuth and Ytterstad 1988; Lereim 1984) and 23% in Sweden (Lindqvist 1991).

It must be considered futile to wage a campaign against an epidemic based on such incomplete information. We therefore wanted to improve the tools

Table 1. Numbering of the cells in Haddon's matrix

	Human	Vehicles and equipment	Physical environment	Socioeconomic environment
Precrash	1	2	3	4
Crash	5	6	7	8
Postcrash	9	10	11	12
Results	Damage to people	Damage to vehicles and equipment	Damage to physical environment	Damage to society

at hand by prospective, complete data collection, making an injury database (IDB), and to use the local data to promote traffic safety in the community.

To succeed in preventing traffic injuries it is necessary to find target groups, to know theories and models of health behaviour (Søgaard 1993), to know the literature about previous successes (Mela 1977; Robertson 1976; Williams and Zador 1977) and failures (Robertson and Zador 1978; Anderson 1977), and to involve the community in general and the target groups in particular (Farquhar, Maccoby, and Solomon 1984).

The following theoretical concepts could be useful in planning community-based interventions to prevent traffic injuries:

1. Haddon (1980) describes the sequence of events (precrash, crash, and postcrash phases) that lead from accident to injury. By listing the factors involved (human, vehicles and equipment, physical environment and roadway, socioeconomic environment) a matrix is formed. This matrix contains 12 cells, and each gives an option for intervention and evaluation of its effectiveness (Table 1). This conceptual framework has become a paradigm for traffic injury prevention planners.
2. Tones, Tilford, and Robinson (1990) propose three models for health education: the preventive, the radical-political, and the self-empowerment model. The preventive model means persuading the individual to take responsible action, while the radical-political model advocates social and environmental change by triggering political action. The self-empowerment model seeks to foster change through informed choice and not through coercion. Critics of the preventive model point to the unethical practice of blaming the victim for an unhealthy lifestyle and ignoring the sociopolitical roots of ill health. Advocates of the radical-political model emphasise the necessity of structural changes to improve health, but the critics claim that this model might massage the political consciousness of communities to bring about changes dear to the heart of the health educator rather than helping the community make its own decisions. The principle of empowerment in health promotion is endorsed by the World Health Organization because it emphasises health education, participation in the process, voluntariness, and control over own destiny (Ottawa Charter for Health Promotion 1986).
3. Interventions can be characterised as either "passive" or "active". Passive interventions require little individual action on the part of those being protected—e.g. automobile airbags. Active interventions require more participation from the individual and are said to be "less effective" than passive ones (Robertson 1984).

The concept of a comprehensive community program is an innovative one for which there are no prescribed models. Based on the information from the IDB, it was decided to establish a community-based traffic safety project that used both public and private resources to approach all relevant aspects of the traffic injury problem, much in accordance with the Ottawa Charter for Health Promotion (1986). The strategies used for traffic safety promotion in this project were based upon: (i) all the cells in the matrix of Haddon (1980), (ii) all the three models of Tones et al. (1990), and (iii) preference for passive interventions over active ones when possible (Robertson 1984). Our interventions were related to these concepts and strategies, as shown in Table 2. The theoretical basis for promoting safer traffic behaviour include the K-A-P model (knowledge of, attitudes towards, and practice of a particular behaviour, Cust 1979), which is related to the preventive model mentioned above and the social cognitive model of Bandura (1986) with emphasis on outcome expectancy and self-efficacy.

The aims of this study were threefold: (i) to test the completeness of official traffic injury data, (ii) to test the feasibility of a local hospital-based traffic

Table 2. Interventions classified by study period, Haddon's matrix, and strategic models

Interventions	Implemented in period* (weighted) 1	2	3	Haddons matrix, cell number(s)†	Active/passive‡	Health education model§
Injury prevention group activity	+	+ +	+ + +	All	Active and passive	All three
Items in local media promoting traffic safety	+	+ +	+ + +	All	Active, may lead to passive	All three, mostly preventive
Counselling to increase parental vigilance towards small children in traffic, educating children	+	+ +	+ +	1, 5, 6	Active	Preventive
Answering requests for local data from school districts, city planners, private and public organisations		+	+	1, 2, 3, 6	May lead to active or passive	All three, weight on self-empowerment
Speeches to Lions, Rotary, schools, police, automobile societies. Face to face contacts at health fairs and shopping centres		+ +	+ + +	All	Active, may lead to passive	All three
Local restrictions and curfews for serving alcohol in bars and restaurants.	+	+	+	4	Passive	
Media campaign initiated from local accident data for building of separate pedestrian and cyclist roads, lowering of speed limits, intervention in black spots		+	+	3, 4, 6	Passive	Radical political
Building of separate pedestrian and cyclist roads, lowering of speed limits, intervention in black spots		+	+ +	3, 4, 6	Passive	
National law, making local community health authorities responsible for accident injury prevention.		+	+	4	Passive	
Traffic injury report		+	+ +	1, 2, 3, 5, 6	Active, may lead to passive	All three
Using local data to inform motorcycle clubs, primary and secondary schools, youth clubs and driving schools to modify behaviour		+	+ +	1, 2, 6	Active, may lead to passive	Preventive, self-empowerment
Loaning service of safety chairs for small children	+	+ +	+ +	6	Passive	
Free installation of additional high mounted stop lights			+	2	Passive	
Checks on vehicles (e.g. brakes, steering, lights, tires) and speed limit enforcement by police and traffic authorities	+	+ +	+ +	2, 6, 8	Passive	

*Each study period 30 months.
†Haddon 1980.
‡Robertson 1984.
§Tones et al. 1990.

injury database in safety planning, and (iii) to evaluate the outcome of a theory-based community traffic safety project.

MATERIALS AND METHODS

The design of this study was quasi-experimental (Fig. 1). Both nonequivalent control and nonequivalent variable design were used (Cook and Campbell 1979). The study started in 1985, lasted for 7½ years and was divided into three periods of 30 months each, during which increasing efforts of intervention were implemented in Harstad. This city is located 250 km north of the Arctic Circle, whereas the comparison city (Trondheim), which is 6.2 times the size of the intervention city, is geographically so distant (1,000 km) that treatment diffusion should have been avoided. Trondheim and Harstad have both been exposed to nationwide traffic safety programs, but Trondheim has not been exposed to any extra traffic injury prevention of the kind tested in Harstad. Trondheim was chosen as the comparison city, because it had the only other hospital in Norway registering the same type of longitudinal data as Harstad since 1985.

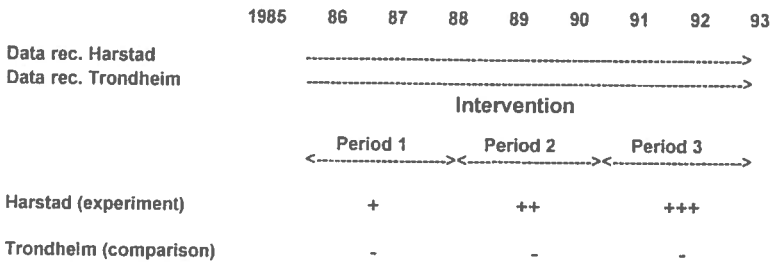

Fig. 1. Quasi-experimental design for the intervention study. Traffic injury prevention. Mean intervention effort increasing for the three periods.

Data recording

During the period July 1, 1985 to January 1, 1993, all injured persons treated at Harstad Hospital were recorded. From January 1, 1992, all injured persons treated in primary health care in Harstad were also recorded. The variables for each injured person were selected in cooperation with The National Institute of Public Health as part of a national injury surveillance system and followed the Nordic coding system (Nordic Medico-Statistical Committee 1985).

Variables

Personal data like name, date of birth, sex, and place of residence were obtained. Activity type and time of injury (to the nearest whole hour), day, month, and year were recorded. A free text of up to 150 characters contained three distinct parts that are partly consistent with the concept of precrash, crash and postcrash described by Haddon (1980). For traffic injuries in Harstad the site of accident was recorded by six digits according to a code system developed by local traffic authorities. The traffic variables were road user group, vehicle type of injured, and conflict vehicle type, if any. Medical variables were injury type, injury mechanism, body part affected, and whether admitted to hospital. Injury severity was coded according to the abbreviated injury scale (AIS) described by the American Association for Automotive Medicine (1976). To avoid registration bias, blood alcohol concentration tests were not routinely taken. When the injured was inebriated, it was noted in the free text.

Data recording procedure, validity, and reliability

The injury form in Harstad was completed in the emergency room, partly by the patient or someone accompanying him/her and partly by the staff and intern. The information was coded by an injury secretary and fed into the computer. The patient lists in the emergency room were checked daily or after every weekend to ensure that missing forms were filled in. All interns who commenced their half-year term in the surgical department received a short course on motivation and injury registration upon arrival. Throughout the whole study period the injury recording procedures were supervised by the authors.

Trondheim Hospital recorded data basically the same way as Harstad. Because of the hospitals' differences in size, architecture, and patient flow, practical organisation of data collection in Trondheim differed from that in Harstad. Accident injury data from Trondheim for 1985/1986 was published in a thesis by Sahlin (1990). Uniformity of coding practices in Harstad and Trondheim and data validity and reliability were tested in yearly meetings at the National Institute of Public Health (Guldvog, Thorgersen, and Ueland 1992). Data validity problems and coding errors of the more detailed information may occur. In the higher hierarchical level of the NOMESCO coding system (Nordic Medico-Statistical Committee 1984), these problems are less pronounced. To minimise validity and reliability error, the comparisons with Trondheim data were made at an aggregate code level.

Statistics

For database handling and statistical computations the Epi Info version 5.01 package was used (Dean et al. 1990). The chi-square test (including trend analysis) and Mantel-Haenszel stratified weighting were performed for sex and age groups when rates were tested for departure from the null hypothesis. P values below 0.05 were regarded as significant.

INTERVENTION

When planning the project, strategies were based on theoretical principles summarised by Farquhar (1984): (i) for *agenda setting* and to enhance

population salience a media campaign was launched in 1987 to focus on the high local traffic injury rate and low official reporting-rate; (ii) to promote *diffusion of communication* and to establish a basis for *long-term maintenance* of the traffic safety program, it was considered essential to involve and activate as many public and private organisations as possible; (iii) *social legitimacy of the educational forces* was ensured through participation of the hospital and other esteemed institutions.

Injury prevention group

An injury prevention group (IPG) was established in 1985. The initial group contained representatives from the hospital and a few public and private organisations. During period 1 this group was led and administered by the local consumer office, a publicly funded office for protection of consumer rights, and meetings were called ad hoc. As part of a national pilot project, government funds were provided in 1989 for a sociologist to lead and administer the group, which from 1990 met monthly or bimonthly. The funding also provided for a part-time public health nurse to work directly in the project. The link was established with the public health nurse corps, whose efforts have been important in child injury prevention. A comprehensive community program grew out of the modest resources available in the initial IPG. The program seemed to have a kind of self-perpetuating momentum. Cooperation was thus established with a number of public and private organisations that carried special weight with local traffic authorities, police, and educational institutions. From 1987 the Norwegian Automobile Society became a working partner in the project. When invited to IPG meetings, one of the local insurance companies offered free installation of additional high-mounted stop lights for their customers. This has been shown to reduce rear end collisions (Malone et al. 1978). Another company arranged injury prevention seminars for key persons in public and private organisations.

Traffic injury report, a local educational device

From 1989 a quarterly pamphlet called *Traffic Injury Report* (TIR) was issued from the hospital. The report contained detailed information about every traffic injury in the city including accident time, location, and description. Every injured person was described by age, sex and group of road user, and injury type and seriousness. Simple statistics and graphs described the local injury panorama, and comments with local relevance were made. Initially the report was sent to 20 addresses in the community, including those of public offices and key bureaucrats. Because diffusion of this information appeared to be slow, it was decided to send the report directly to all persons and institutions that were likely to be interested in traffic injury prevention. From 1991 all educational institutions, including driving schools, were put on the mailing list. From 1992 the report was mailed to every household in the community (n = 9,300). The extra cost of this was covered by an insurance company. The TIR relates to the earlier described strategies and theories as shown in Table 2.

Identification of target groups for intervention

In a paper from the first two years of this study, using the IDB (Ytterstad and Wasmuth 1988), the following road user groups were identified as high risk: (i) young automobile drivers, (ii) motorcyclists, (iii) automobile passengers, and (iv) child pedestrians. Another paper targeted (v) child and early-adolescent cyclists (Wasmuth and Ytterstad 1990).

Young drivers. The high risk young drivers, age 18–24 years, was a major concern of the injury prevention group. Working partners were the driving schools, the Norwegian Automobile Society, the police, and the public school system. The particularly high risk of the inexperienced 18-year-old driver, especially the male, was highlighted when planning educational interventions through the driving schools and the TIR (Table 2). Preventive work included a meeting attended by several hundred young people listening to information given by a popular automobile rally driver and a surgeon. Each of them advocated safe driving habits from his respective position. Primary and secondary schools have been visited by traffic accident paraplegics and police as part of a nationwide traffic safety campaign. Young drivers with old, defective cars have been the concern of the local motor vehicle administration (Table 2).

Motorcyclists. Adjusting for exposure, the injury risk of the 18– to 24-year-old motorcyclist was, in 1985–1987, more than five times that of automobile drivers of the same age in Harstad (Ytterstad and Wasmuth 1988). This finding was extensively communicated to the community through the media and in the injury prevention group. Prime targets for the intervention aimed at this group were the Motorcycle Club, drivng schools and other educational institutions, local traffic authorities, and police (Table 2). Harstad Motorcycle Club (HMC) moved into their new clubhouse in period 1. HMC became the most popular and attractive MC-club in town, with the best equipped repair shop, the biggest stereo, and the nicest guest room. The intervention aimed first at educating and informing by presenting

relevant local data for the club, linking speeding and intoxication to injury/death and urging members to take responsibility for own destiny, increasing outcome expectancy (Bandura 1986; Tones et al. 1990 preventive model). The salience of this message increased considerably after the death of two motorcyclists in a high-speed accident in period 2. The involvement of the HMC in the promotion of safety for their own members was illustrated by a lecture given at a safety conference by a club representative on the promotion and protective effect of helmets and leather suits. Part of the intervention was the continuous feedback of data describing motorcyclist injury rate-reduction (increasing self-efficacy, Bandura 1986; self-empowerment model of Tones et al. 1990). A laudatory editorial comment in the local newspaper on the safety promotion done by the local motorcyclists worked towards the same effect.

Automobile passengers. Data from period 1 in Harstad showed that automobile passengers were more severely injured than drivers (Wasmuth and Ytterstad 1988). These findings and the automobile death of an unrestrained six-month-old baby in 1987 triggered efforts towards the increased use of restraints for passengers, especially children. The main cooperation partners were police and the public health nurse corps. A loaning service of safety chairs for small children has been provided since 1987 (Table 2).

Child pedestrians' child and adolescent cyclists. Interventions for these two road user groups are presented in another paper from this study (Ytterstad 1994).

Planning for traffic safety

In 1987 the investigator met regularly with the city planners and worked for five months with the city transportation plan. The IDB was useful in making priorities for (i) building separate pedestrian and cyclist pathways, (ii) treating accident blackspots, and (iii) planning safe pathways for children going to school (Table 2).

Informing to increase awareness and behaviour change

Empirical evidence exists for the importance of mass media in creating awareness of a program's message (Rogers 1983). After the agenda setting in 1987, media coverage continued regularly. From 1990 this coverage was intensified with approximately bimonthly reports in the local newspaper and media items. While mass media may increase awareness, interpersonal communication may be more effective in motivating behaviour changes (Rogers 1983). In the two intervention periods, an increasing number of requests for information from the data base came to the Injury Prevention Group or to the hospital. Numerous speeches and small segmental reports about the traffic injury problem were given to Lions and Rotary clubs, schools, police, automotive societies, and others interested in traffic safety. Face-to-face contacts were also used at stands in shopping malls and at health fairs (Table 2).

Table 3. Traffic injuries in Harstad recorded 1 January 1992–1 January 1993. Distribution between injured treated in primary health care and hospital

	All injuries		Single-bicycle accident excluded	
Treated in	Number injured	% of total	Number injured	% of total
Primary health care	28	19	21	18
Hospital	122	81	96	82
Total health care	150	100	117	100

RESULTS

Official reporting-rate of traffic injuries

The police recorded 358 traffic injuries in Harstad in the study period (Harstad Police 1992, personal communication). The number recorded by the hospital during the same period was 988. A 12-month sample from primary health care sources during 1992 showed that 19% of all traffic injuries in Harstad were treated outside the hospital (Table 3). Extrapolating for the part of injuries treated in primary health care and assuming that this has been constant during the study period, we estimate that police records accounted for 29% (mean for whole study) of all traffic injuries treated by the health services in Harstad (Table 4). The police reporting rate increased from period 1 to period 3 but remained low (from 27% to 33%).

Overall injury rates

Fig. 2 shows traffic injury rates from period 1 through intervention periods 2 and 3, with and without single-bicycle accidents in both cities. In Harstad, an overall traffic injury rate reduction of 26.6% ($p < 0.001$) was observed from period 1 to period 3. In Trondheim, the corresponding rate increased 25.0% ($p < 0.001$). Table 5 shows age-, sex-, and period-specific trend analysis. The injury rate decreases for children aged under 10 years and for 15- to 24-year-olds were significant ($p < 0.01$), with both sexes analysed together. A significant increase of injury rates for persons aged above 64 years was also noted ($p < 0.01$).

Table 4. Official reporting of injuries from traffic accidents expressed in % of hospital records and estimated total health care. Harstad residents 1 July 1985–1 January 1993 by periods of 30 months

	Hospital recorded		Estimated total health care		Official reports				
						% of hospital records		% of estimated total	
	All accidents	Single-bicycle excluded	All accidents	Single-bicycle excluded	N	All accidents	Single-bicycle excluded	All accidents	Single-bicycle excluded
Period 1	380	294	469	359	126	33	43	27	35
Period 2	323	259	399	316	117	36	45	29	37
Period 3	285	219	352	267	115	40	53	33	43
All periods	988	722	1220	941	358	36	46	29	38

Automobile drivers

Table 6 shows the age- and period-specific trend analysis for automobile driver injury rates in Harstad. From period 1 to period 3 a 29.9% injury rate decrease was found for 18- to 24-year-old drivers ($p < 0.13$) and a 27.3% corresponding decrease for all drivers under 65 years ($p < 0.07$), with both sexes analysed together. Drivers above 64 years had significantly increasing injury rates when both sexes were analysed together ($p < 0.002$). In Trondheim, a corresponding significant increase was found for automobile drivers in all age groups except for those above 64 years old—their rates were stable.

Motorcyclists and mopedists

In both Harstad and Trondheim the majority of injured motorcyclists and mopedists were under 25 and 18 years old, respectively. A reduction of injuries was found for both groups in both cities. The reduction in the motorcyclist injury rate in Trondheim was not significant; whereas in Harstad the injury rate in period 3 was one seventh that for period 1 ($p< 0.001$) (Table 7).

Blackspots

Several blackspots were located and especially one intersection that was treated in 1990 has shown a marked injury rate reduction. Before treatment, this blackspot was the site of 16 accidents and 25 injuries in less than four years. One injured per year was recorded during the two years after treatment.

Fatal injuries and injury severity

Ten Harstad residents were killed in traffic accidents during the study period, six during period 1, two in period 2, and two in period 3 ($p < 0.12$). The mean score according to the AIS changed from 1.453 in period 1 to 1.386 in period 3 (*n.s.*).

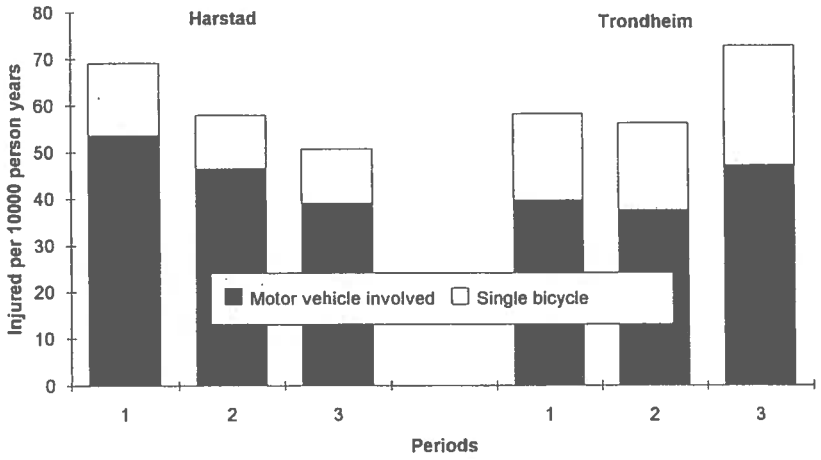

Fig. 2. Traffic injury rates for experiment city (Harstad) and comparison city (Trondheim) by study periods of 30 months each.

Table 5. Trend analysis for age- and period-specific traffic injury rates per 10,000 person years. Residents of Harstad 1 July 1985–1 January 1993

	Period 1			Period 2			Period 3			Test for trend	
Age group	*N*	Rate	*RR*	*N*	Rate	*RR*	*N*	Rate	*RR*	χ^2	*p*-value
Females											
0–4	11	63	1.0	5	27	0.43	3	15	0.24	6.08	0.014
5–9	18	97	1.0	13	72	0.74	6	33	0.34	5.52	0.019
10–14	22	107	1.0	22	111	1.03	17	92	0.86	0.20	0.65
15–24	49	107	1.0	41	90	0.84	31	71	0.67	3.14	0.076
25–34	8	19	1.0	15	35	1.84	13	31	1.65	1.14	0.3
35–64	25	27	1.0	32	34	1.25	38	38	1.43	1.93	0.2
65+	7	18	1.0	8	19	1.09	15	34	1.94	2.47	0.1
All ages	140	51	1.0	136	48	0.97	123	43	0.88	0.95	0.3
Males											
0–4	14	79	1.0	8	42	0.53	5	24	0.30	6.12	0.013
5–9	17	95	1.0	16	89	0.93	9	52	0.55	2.01	0.2
10–14	40	177	1.0	24	125	0.71	25	139	0.78	1.11	0.3
15–24	102	214	1.0	83	171	0.80	65	137	0.64	7.80	0.005
25–34	33	74	1.0	22	48	0.65	17	40	0.54	4.77	0.029
35–64	30	31	1.0	24	24	0.78	23	23	0.73	1.35	0.2
65+	4	15	1.0	10	35	2.33	18	58	3.89	17.25	0.007
All ages	240	88	1.0	187	67	0.78	162	58	0.69	13.61	0.000

Table 6. Trend analysis for age- and period-specific driver injury rates per 10,000 automobile driver's-license-holder (DLH) years. Residents of Harstad 1 July 1985–1 January 1993

	Period 1				Period 2				Period 3				Test for trend	
Age group	*N*	DLH years	Rate	*RR*	*N*	DLH years	Rate	*RR*	*N*	DLH years	Rate	*RR*	χ^2	*p*-value
Females														
18–24	17	2258	75	1.0	13	2490	52	0.69	13	2465	53	0.70	0.97	0.33
25–34	5	3403	15	1.0	7	3638	19	1.31	6	3750	16	1.09	0.02	0.9
35–49	7	3683	19	1.0	9	4478	20	1.06	10	4870	21	1.08	0.02	0.9
50–64	4	1185	34	1.0	6	1565	38	1.14	1	1798	1	0.16	2.86	0.091
65+	0	225	—	—	1	388	26	—	4	510	78	—	2.52	0.113
All ages	33	10784	31	1.0	36	12559	29	0.94	34	13478	25	0.82	0.63	0.4
Males														
18–24	28	2940	95	1.0	24	3120	77	0.81	21	3080	68	0.72	1.36	0.24
25–34	10	4078	25	1.0	13	4153	31	1.28	7	4260	16	0.67	0.59	0.44
35–49	6	5098	12	1.0	4	5645	7	0.60	6	5895	10	0.86	0.06	0.8
50–64	7	2928	24	1.0	4	3108	13	0.54	6	3235	18	0.78	0.22	0.6
65+	0	1345	—	—	3	1695	18	—	9	1923	47	—	7.45	0.006
All ages	51	16389	31	1.0	48	17721	27	0.87	49	18743	26	0.84	0.75	0.4

Table 7. Trend analysis for period-specific motorcyclist and mopedist injury rates per 1,000 driver's-license-holder (DLH) years. Age 18–24 for motorcyclists and age 16–17 for mopedists. Residents of Harstad 1 July 1985–1 January 1993

	Period 1				Period 2				Period 3				Test for trend	
	N	DLH years	Rate	*RR*	*N*	DLH years	Rate	*RR*	*N*	DLH years	Rate	*RR*	χ^2	*p*-value
MC	28	688	40.7	1.0	10	708	14.1	0.35	4	740	5.4	0.13	21.81	0.000
Moped	8	158	50.6	1.0	11	176	62.5	1.23	3	418	7.2	0.14	10.79	0.001

Table 8. Choice of transport form in Trøndelag and North-Norway expressed in %. Significant changes are marked with * (Vibe et al. 1992)

	Trøndelag (proxy for Trondheim)		North-Norway (proxy for Harstad)	
	1984–85	1990–91	1984–85	1990–91
Pedestrian	28.0	21.5*	31.4	23.0*
Bicycle	9.4	6.2*	5.2	4.7
Automobile driver	39.0	51.0*	39.1	54.2*
Automobile passenger	13.8	12.9	13.7	11.0*
Public transport	8.8	6.9*	7.7	5.5*
Motorcycle/other	1.1	1.6	3.0	1.5*
Sum	100.1	100.1	100.1	99.9
Number of travels	1112	1711	1551	2066

*Significant changes.

Hospital admissions from traffic accident injuries

The 1987 sample of all admissions from traffic accidents in Harstad Hospital from the study population was compared with mean per year admissions during 1990–1992. A 42% per year reduction of admissions from traffic injuries was observed (from 45/year to 26/year).

DISCUSSION

Looking at the decrease in the overall traffic injury rates, it would seem that the traffic injury prevention program has been effective. There are, however, several possible alternative explanations for this decrease.

A decrease in traffic density could account for the injury rate reduction. To eliminate this possibility we (i) compared the number of registered automobiles in Harstad per inhabitant (car ownership rate) in the study period with national figures, (ii) measured continuously by sensors traffic density in Harstad during the whole study in one of the city's most heavily used roads, and (iii) got information about travelling habits sampled by the Norwegian Institute of Transport Economics (TØI) in 1984–1985 and 1991–1992 for the areas of Norway where Harstad (Nord-Norge) and Trondheim (Trøndelag) are situated.

Car ownership rate, which in periods 1 and 3 was slightly above the national mean, increased 1.6% from period 1 to 3 (Vegdirektoratet, unpublished data). Traffic density increased 2.5% from period 1 to 3 (Statens vegvesen, unpublished data). Although there were changes in the travelling patterns in this period, the trends were the same in both areas except for motorcyclists (Table 8) (Vibe, Stenstadvold, and Solheim 1992). The use of automobiles in Harstad does not seem to have decreased across the seven years. The observed decrease in motorcyclist injury rates in Harstad could be accounted for by a significant decrease in the use of motorcycles found in North-Norway during the last years. On the other hand this decrease would seem unlikely to explain the reduction of motorcyclist injury rate to a seventh from period 1 to period 3.

Another alternative explanation could be a national decrease in traffic injury rates making the increase in the comparison city Trondheim an exception. Analysing only the two whole years in each period, thus correcting for seasonal variations, the official overall traffic injury rates (injured per 10,000 person years [pyars]) in Norway, decreased from period 1 (28.6) to period 2 (27.5), but increased again in period 3 (27.8). Fatality rates decreased from period 1 to period 3 (from 10 to 8 per 100,000 pyars) (Norges Offisielle Statistikk 1992). The trend varied in different road user groups. Official national figures for driver injury rates (age 18–34) showed an increase for both females and males from 1980 to 1990 (Pedersen 1992). Official statistics on cyclist injury rates decreased until 1988 and increased after that, while pedestrian rates showed a decrease. Even though there is a legal requirement to report single-cycle accidents, the police recorded in 1990 less than 10% of injured cyclists and only 37% of pedestrians injured in traffic accidents and treated in emergency rooms in Norway (Guldvog et al. 1992; Norges Offisielle Statistikk 1993). Official rates for fatalities and serious injuries seem to be more reliable than for less severe injuries (Norges Offisielle Statistikk 1992). Because of the apparent inaccuracy of official figures, the true historic trend for overall traffic injury rates in Norway is uncertain. The trend for Trondheim injury rates was used as complementary evidence for the overall national trend. Although data were recorded uniformly in the two cities, there are some threats to validity that must be addressed. Trondheim was not an ideal choice for comparison, as it is more than six times larger than Harstad. Variations may occur in accident counts for a city for reasons that the investigators can not control for. Seasonal variations for traffic accident injury counts are found in Norway. The mean ratio between first and second half-years during the seven whole years of the study was for 47.0/53.0 Trondheim, 48.4/51.6 for Harstad (hospital figures), and 46.9/53.1 for Norway (official figures). The injury rate decrease in Trondheim from period 1 to period 2 was 3.4% ($p = 0.28$). Correcting for seasonal variation by analysing only the four whole years in period 1 and period 2, the rates were stable (53.8 per 10,000 person years in both periods). Comparisons between period 1 and period 3 in this context are

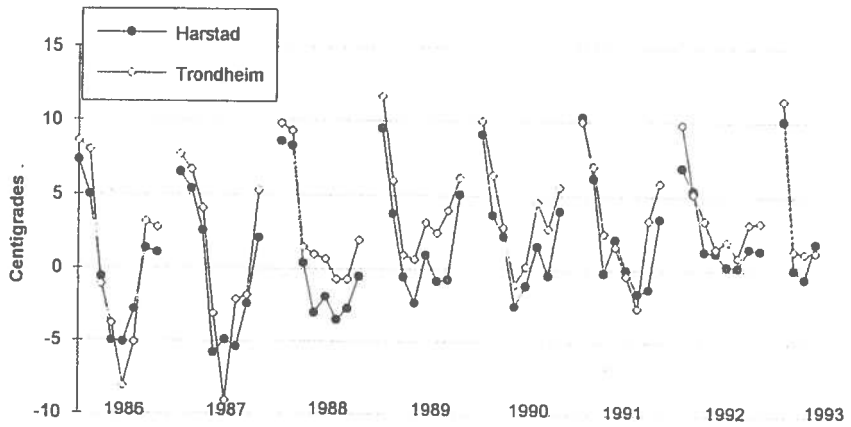

Fig. 3. Temperature variations in Harstad and Trondheim.

valid in both cities because they are seasonally identical. It seems reasonable to conclude that overall traffic injury rates in Trondheim were stable from period 1 to period 2, but increased significantly in period 3. The national official figures and Trondheim data may indicate that during the study the national trend was downwards for serious and fatal traffic injuries, while the less severe injuries increased.

An increasing historic trend is also indicated but far from proven by figures from the Norwegian Association of Insurance Companies (1992, unpublished data): excluding whiplash injuries, the reporting of which increased sharply in Norway from 1989, probably for medico-legal reasons, the national traffic injury rates increased 31% from period 1 to period 3.

The decrease in traffic injury rates in Harstad could also be explained by weather changes. The mean temperature of the winter months increased in both cities during the study period. This is shown in Fig. 3. (The Norwegian meteorological Institute, unpublished data). Snowfall in winter, although initially causing slippery roads and accidents, has a propensity to reduce traffic injury rates (Elvik, Vaa, and Østrik 1989). Accordingly, first and fourth quarters had the lowest injury rates per unit of time, in both cities. Warmer winters could protect against traffic injuries if increased snowfall was the only result. In our opinion, another, more probable mechanism, when winters are warmer, is an increased risk of traffic injury from more frequent temperature fluctuations through the freezing point resulting in more slippery roads.

When evaluating blackspot treatment, one must consider the possibilities of alternative traffic routes ("accident migration"). In the case of the most injury-burdened blackspot in Harstad, no such alternative existed and data from road sensors situated near the road crossing indicate no traffic decrease. When sites are selected for treatment on the basis of an abnormally high recorded number of accidents, as in the case of road-accident blackspots, the number of accidents will often be reduced even if the treatment is not effective. The part of reduction due to regression to the mean can be estimated more safely as time goes by.

In summarising alternative explanations for the injury rate reduction in Harstad, it seems that traffic density reduction, weather changes, or national historic trend for injury rates are unlikely explanations. Regression-to-the-mean effect might be an explanation if Harstad was chosen for the study because it had a particularly bad accident injury rate over a short period prior to the study. But Harstad was chosen as one of four hospitals in Norway recording data for a national injury surveillance system (Lund 1988), not because of high local injury rates in 1984. The injury rate difference between Harstad and Trondheim in period 1 could nevertheless indicate such a particularly high rate, even if official figures for Harstad did not (Harstad Police, personal communication). It is therefore concluded that regression effect can not be entirely ruled out but is considered an unlikely explanation for the entire injury rate reduction in Harstad.

As accidents are known to be subject to random

fluctuations, (normally Poisson distributed) they can be analysed like any recurrent common disease. Since the intervention had been gradually increasing in intensity during periods two and three (Table 2), a dose-response relationship can be looked for. Although a study of this kind cannot prove causality, evidence of a dose response, found through a test for trend, gives greater evidence in favour of a causal association (Bradford Hill 1971).

To strengthen the inference for a causal role of the intervention one could use the principle on nonequivalent variable design (Cook and Campbell 1979). Since our accident injury recording includes all areas, we may analyse trends for injuries in other areas—e.g. sports. Because of limited resources and because the injury prevention group wanted to gain experience within a few limited accident areas, minimal intervention was directed towards sport injuries except for downhill and slalom skiing. The 7½-year sport injury rates showed remarkable stability. The effects of decrease in injury rates for children 15–24 years old, motorcyclists, and young automobile drivers are consistent with the special preventive efforts that were directed towards these groups. The interventions for pedestrian children and young and adolescent cyclists are described in another paper from this study (Ytterstad 1994). No special preventive efforts were directed toward the senior citizen drivers, as only four injured drivers aged above 64 years were recorded through period 2 (Table 6). The significant rise in elderly drivers' injury rates in period 3 is alarming. Official national rates for this road user group were stable during the study period, increasing from 14.1 injured per 10,000 drivers license holder (DLH) years in period 1 to 14.3 DLH years in period 3 (*n.s.*). (Norges Offisielle Statistikk 1993). The increasing injury rates in Harstad for drivers above 64 years of age is now a concern for the injury prevention group. An explanation for the increase may be increased exposure. The closing down of local stores may force many elderly people to shop in distant shopping malls, necessitating increased use of car.

Our community-based intervention had many facets and it is impossible to evaluate causal processes to find out what effects did or did not come about. Partly we promoted traffic safety through education, counselling, and information. Some of the educational effort was the distribution of the traffic injury report. Written material issued to influence driving behaviour was found to be ineffective in California (Anderson 1977). An educational campaign to curb jaywalking was found to have passing effect in Florida (Wiener 1968). Written information and educational campaigns promoting health are reported to be more effective when integrated in a community program (Karlsen, Aarø, and Borchgrevink 1987). The quarterly *Traffic Injury Report* (TIR), issued since 1989, addressed local traffic safety problems that were revealed during data recording and analysis. The temporal and geographical proximity of the data presented seemed to increase the community feeling of "ownership" towards the traffic injury problem. The report contained new information with temporal and local relevance and therefore followed the K-A-P model. This model has been questioned by many but is considered workable when the individuals' involvement (i.e. motivation) is high and there is a clear difference between behavioural alternatives (Flay 1981)—e.g. driving or not driving under the influence of alcohol. But the TIR also contained information and detailed case histories that evoked curiosity and emotions that could have led directly to the practice of safer behaviour without cognition (Ray 1973).

Strategies for maintenance of behaviour change are discussed by Farquhar et al. (1984) and include reminding people of both short-term and long-term personal and social benefits of the changes undertaken. The continuous hospital recording and feedback of traffic injury data to the community served as such a reminder and will in the future hopefully contribute to the maintenance of the Harstad programme.

When evaluating the injury prevention project we have to deal with a combined intervention effort from the IPG, the total health services, the public and private educational institutions, legislative efforts and law enforcement, road builders, private and public organisations of many kinds, and the mass media (Table 2). In our opinion, there exists a multitude of possibilities for different models and mechanisms that might have worked. Blackspot treatment came about because of information from the IDB, spread through the TIR and newspapers, and led to the exertion of public pressure on traffic authorities according to the radical political model (Tones et al. 1990). The mass media are particularly effective in health promotion when local involvement is high (Flay 1981). A high level of public involvement was attempted and probably achieved through the TIR, the media, and the regular meetings of the IPG, which activated other organisations. We therefore consider the mass media (including the TIR) to have contributed substantially to the injury rate reduction. Some legislation was helpful in the process. In 1987 a law was passed in Norway that assigned responsibility for accident injury prevention to the local community health authorities (Sosialdepartementet 1987). According to our experi-

ence, this legislation was a motivating factor for community authorities only because the Harstad programme was "up and running" for other reasons than the legislative.

Two of the determinants of behaviour in the social cognitive theory of Bandura (1986) are the outcome- and efficacy-expectancies. The TIR aimed at informing individuals through schools and households about the increased risk of different target groups, connecting unhealthy behaviour to unfavourable outcomes. Examples of such groups were 15- to 17-year-old female passengers and 18- to 24-year-old drivers. In case histories from recent accidents, injury/paraplegia/death as an outcome was connected to drunken driving and speeding. This information was expected to increase both salience and outcome expectancy. Self-efficacy, especially the ability to act against peer pressure, was considered to be increased through information-induced discussions about traffic injury problems in the schools, the families, the Motorcycle Club, or in other groups.

Behavioural changes in Harstad were indicated by police samples taken September 1992 in Harstad and the neighbouring city of Tromsø (52,000 inhabitants), testing the prevalence of use of restraints for small children in automobiles. An 89% use rate was found in Harstad, while 79% used such restraints in Tromsø ($p < 0.05$) (Troms County Traffic Authority 1992, unpublished data).

We contend that injury rates may be reduced when traffic safety is promoted in a community program like the one implemented in Harstad. How then should resources be allocated when planning for future traffic safety? Some bureaucrats and legislators seem to have faith in using funds for large, centrally originated traffic safety campaigns with information that supposedly diffuses easily from the top through the hierarchy of an administrative network. Regrettably, real-world practice often falls short of the ideal. When the *Traffic Injury Report* was sent to city hall for distribution to the schools, nothing happened. This is but one example of the sources of frustration that must be dealt with in the painstaking process of community injury prevention. Also it is an argument for emphasising the bottom-up model (Rifkin 1983) partly used in Skaraborg County, Sweden, where traffic accident injuries were reduced 28% after three years of intervention (Schelp 1988).

CONCLUSION

Continuous hospital recording of all traffic accident injuries in a community of 22,000 people is feasible. The local database thus accumulated is in many respects superior to the police reports for accident analysis and injury prevention planning. When prevention programmes are implemented, good participation by individuals, groups, and institutions is possible, probably because of the local relevance and continuous feedback of data. In the 7½ year study in Harstad, a 26.6% reduction of the overall traffic accident injury rate was accomplished ($p < .001$). The reduction was significant for motorcyclists, for children aged under 10 years, and for 15- to 24-year-olds (all road users). An injury rate reduction of 29.9% for automobile drivers in the 18–24 age group did not reach significance. A significant increase in elderly drivers' injury rates is now a challenge to the injury prevention group. The assumption of a causal relationship between the intervention and injury rate reduction was strengthened by the assessment and ruling out of some other possible explanations for the reduction. Causality was also indicated by (i) a dose-response to intervention, (ii) comparison-city injury rate increase, and (iii) analysis by the principle of nonequivalent variable design.

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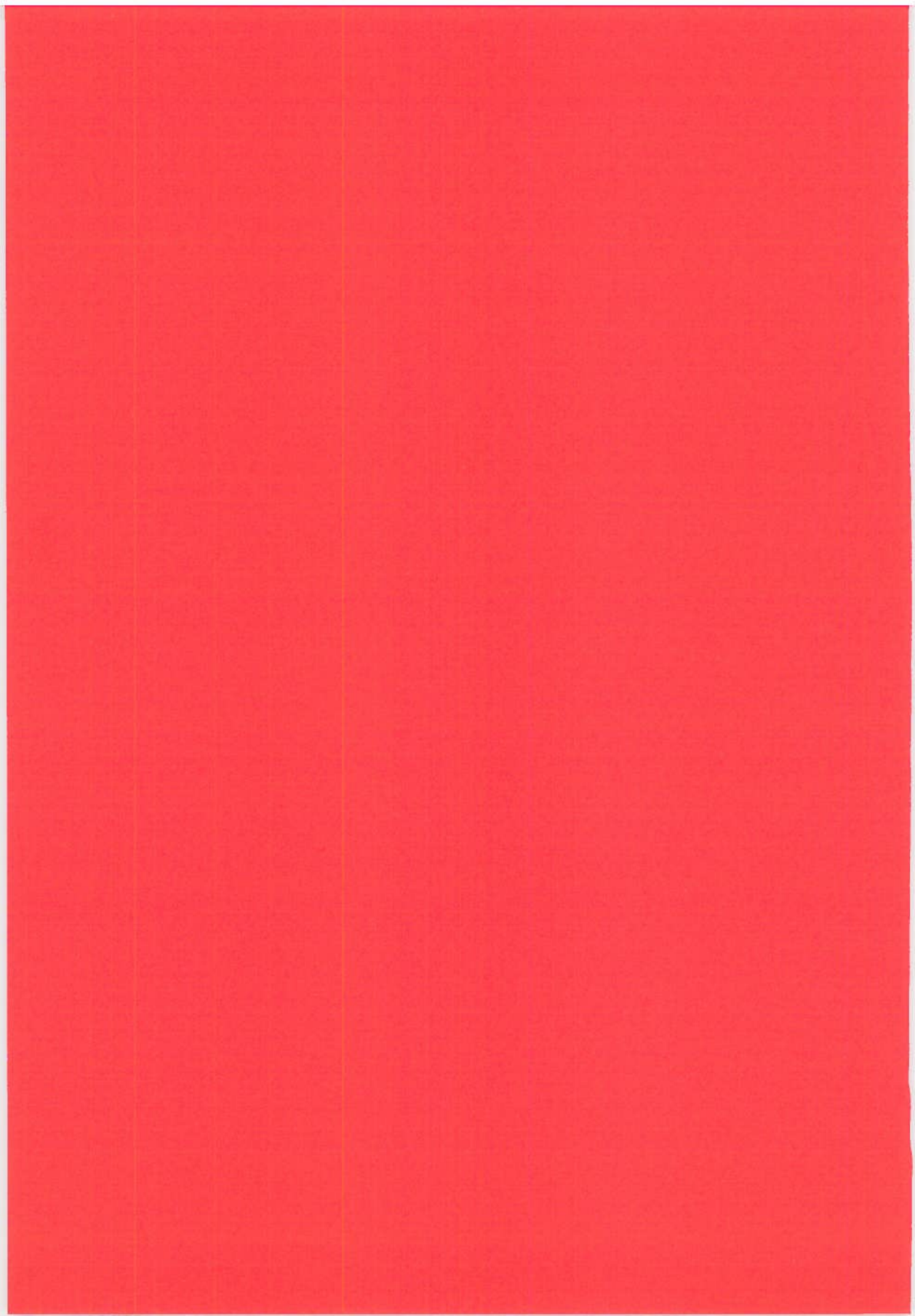
Paper II



The Harstad injury prevention study: Hospital-based injury recording used for outcome evaluation of community-based prevention of bicyclist and pedestrian injury

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Ytterstad, B. The Harstad injury prevention study: Hospital based injury recording used for outcome evaluation of community-based prevention of bicyclist and pedestrian injury. Scand J Prim Health Care 1995;13:141–9.

Objective **– To test the feasibility of a hospital-based injury recording for accident analysis and outcome evaluation of bicyclist and pedestrian injury prevention.**
Design **– Prospective injury recording lasting 7 1/2 years, using a quasi-experimental design.**
Setting **– The population of Harstad (22 000).**
Intervention **– Injury data were evaluated in an injury prevention group and used in planning a community-based intervention. Promotion of bicyclist helmet use and pedestrian safe behaviour was implemented by activating public and voluntary organizations and media. A traffic safety pamphlet containing local traffic injury data was distributed. Changes were made in the physical traffic environment.**
Main outcome measures **– Injury rates for bicyclists and pedestrians.**
Results **– In 275 bicyclists upper extremity and head injuries were predominant and 70% were below 16 years. In 137 pedestrians lower extremity injury was most frequent and children below 10 years had the highest injury rates. Significant injury rate reductions were observed after intervention for child bicyclists and pedestrians**
Conclusion **– A hospital-based injury recording is feasible for bicyclists and pedestrian accident analysis, planning injury prevention, and outcome evaluation of the programme. This study indicates that a significant injury rate reduction in children may have been the result of the intervention.**

Key words: **pedestrian, bicyclist, injury, community-based intervention, bicyclist helmet promotion.**

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Even if the bicycle is a quiet, cheap and enjoyable vehicle, it is also a dangerous form of travel, being the most common product involved in child accidents (1). Pedestrians also travel dangerously, suffering injury risk per kilometre three times that of automobile occupants (2). In 1990, Norwegian bicyclist and pedestrian injuries led to 10 164 and 3 342 emergency room visits, respectively. This represented 46% of all traffic injuries and 4% of all accident injuries. Cases treated in primary health care were not included (3).

High-quality epidemiological data are essential for planning, development, and evaluation of efforts to prevent injuries. In Norway, less than

10% of bicyclists and only 37% of pedestrians injured in traffic accidents (treated in hospitals) were recorded by the police in 1990 (3,4). This under-reporting is a problem because official statistics are the basis for the accident analysis used in traffic safety promotion.

The aims of this study were 1) to analyse all pedestrian and bicyclist injuries recorded in a defined population during a prolonged period, 2) to evaluate the feasibility of an injury data base (IDB) for planning a safety program, and 3) to evaluate the outcome of a community-based intervention for prevention of bicyclist and pedestrian injuries.

Materials and method

The study was conducted in Harstad, Norway (population 22 000). It started on 1 July 1985, lasted 7 1/2 years, and was divided into three periods of 30 months in which increasing intervention efforts were implemented. All injured persons treated at Harstad Hospital were recorded during this period. The recorded variables were compatible with the national injury surveillance (3) and followed the Nordic coding system (5).

Variables

Patient characteristics, e.g. age, sex, residency, road user group, vehicle of injured, conflict vehicle, activity type, time and place of accident, and a free text were recorded. Medical variables were injury type and severity, injury mechanism, body part injured, and hospital admittance. The variables, recording procedure, and measures taken to ensure validity and reliability have been described in more detail earlier (6).

Intervention

The present paper describes part of a comprehensive community-based programme to prevent accidental injuries (6,7). The intervention aimed at activating public and private resources in accordance with the "Manifesto for safe communities" (8). The concepts, strategies, and theories used for intervention planning and implementation were Haddon's matrix, the three models for health education proposed by Tones et al., and Robertson's distinction between active and passive interventions, all of which have been referred to and described in more detail previously (6,7). They relate to the different interventions shown in Table I.

Injury prevention group

An injury prevention group (IPG) was established in 1985 with representatives from primary health care, the hospital, and the municipal administration. The main objectives were promotion of community "ownership" of the injury problem, establishment of networks for communication, diffusion of the programme messages, and maintenance of their effect. To accomplish this, it was considered important to activate all organizations, public and private, relevant for promoting bicyclist and pedestrian safety (9). The IPG became an integrated part of the municipal primary health care, thus fulfilling the requirements of a law that was passed in Norway in 1987 which assigned responsibility for injury prevention to the primary health care level (10). Due to IPG efforts, cooperation was facilitated and established with local and regional traffic authorities, police, and all 14 community school districts.

Identification of target groups

Data from period 1 showed that bicyclists below 16 years and pedestrian children below 10 years were at high risk. Child pedestrians were particularly targeted in the media after an 8-year-old girl was killed by a car when darting across a newly constructed highway.

Traffic Injury Report

From 1989 a quarterly Traffic Injury Report (TIR) was issued from the hospital with detailed information about every traffic injury in the city. This included accident time, location, and detailed descriptions (victim stories) with age, sex, and road user group, and type and seriousness of the injury (Fig. 1). Simple statistics and graphs described the local injury panorama and trends. Recommendations with local and temporal relevance were made. The TIR was distributed to all school districts from 1990, and to every household in the community from 1992 (N=9300).

Table I. Interventions in the Harstad study classified by study period, Haddon's matrix and strategic models

Interventions	Implemented in period* (weighted)			Haddon's matrix, cell number(s)**	Active/ passive***	Health education model****
	1	2	3			
Injury prevention group activity	+	++	+++	all	active and passive	all three
Items in local media promoting traffic safety	+	++	+++	all	active, may lead to passive	all three, mostly preventive
Counselling to increase parental vigilance towards small children in traffic, educating children	+	++	++	1, 5, 6	active	preventive
Answering requests for local data from school districts, city planners, private and public organisations		+	+	1, 2, 3, 6	may lead to active or passive	all three, weight on self-empowerment
Speeches to Lions, Rotary, schools, police, automobile societies. Face to face contacts at health fairs and shopping-centres		++	+++	all	active, may lead to passive	all three
Local restrictions and curfews for serving alcohol in bars and restaurants	+	+	+	4	passive	
Media campaign initiated from local accident data for building of separate pedestrian and cyclist roads, lowering of speed limits, intervention in black spots		+	+	3, 4, 6	active, may may lead to passive	radical political
Building of separate pedestrian and cyclist roads, lowering of speed limits intervention in black spots		+	++	3, 4, 6	passive	
National law, making local community health authorities responsible for accident injury prevention		+	+	4	passive	
Traffic injury report		+	++	1, 2, 3, 5, 6	active, may lead to passive	all three
Using local data to inform motor cycle clubs, primary and secondary schools, youth clubs and driving schools to		+	++	1, 2, 6	active, may lead to passive	preventive, self-empower-ment
Helmet promotion by parent and child counselling, through media, schools, kindergartens, police and organisations	+	++	++	6	active, may lead to passive	preventive, self-empower-ment
Checks on vehicles (e.g. brakes, steering, lights, tires) and speed limit enforcement by police and traffic authorities	+	++	++	2, 6, 8	passive	

* Each study period 30 months ** Haddon 1980 *** Robertson 1984 **** Tones et al. 1990
The references for Haddon, Robertson and Tones et al are given in (6).

Table III. 412* bicyclists and pedestrians (Harstad residents) recorded in 7½ years from 1 July 1985. Distribution of body part injured by road user group

	Bicyclists		Pedestrians	
	N	(%)	N	(%)
Head	84	(31.6)	38	(28.6)
Neck, thorax, abdomen, pelvis	9	(3.4)	3	(2.3)
Upper extremity	87	(32.7)	9	(6.8)
Lower extremity	56	(21.1)	60	(45.1)
Multiple injuries	30	(11.3)	23	(17.3)

* 13 patients had only tooth injuries or missing data for the variable body part injured

Upper extremity lesions and head injury were predominant in bicyclists, while the lower extremity was most frequently injured in pedestrians (Table III). Head injuries were more common in injured bicyclists below 16 years (34%) than in those 16 years and above (23%)(NS). Twenty out of 29 admitted bicyclists below 16 years had head injuries (69%).

Injury rate changes from period 1 to period 3

Significant rate reductions were observed below the age of 16 for both bicyclists (37%) and pedestrians (54%) (Table II). For bicyclists this reduction was larger among males (43.4%) than females (22.6%) (Fig. 2). The pedestrian rate reduction was largest in children below 10 years, larger in females (76.4%) than males (53.6%) (Fig. 3). Head injury rates decreased for bicyclist children below 10 years of age (NS) but increased for those 10–15 years old (NS). For pedestrians hit by a motorized vehicle, a significant rate reduction was found for children below 10 years, while a 78% rate increase was observed for pedestrians 65+ years old (NS).

Discussion

A causal relationship between intervention and the injury rate reductions cannot be claimed before alternative explanations are discussed. Confounders and bias such as traffic density, weather, secular trend, regression- and registration effect have been discussed previously (6). Summarizing these alternative explanations and using Tron-

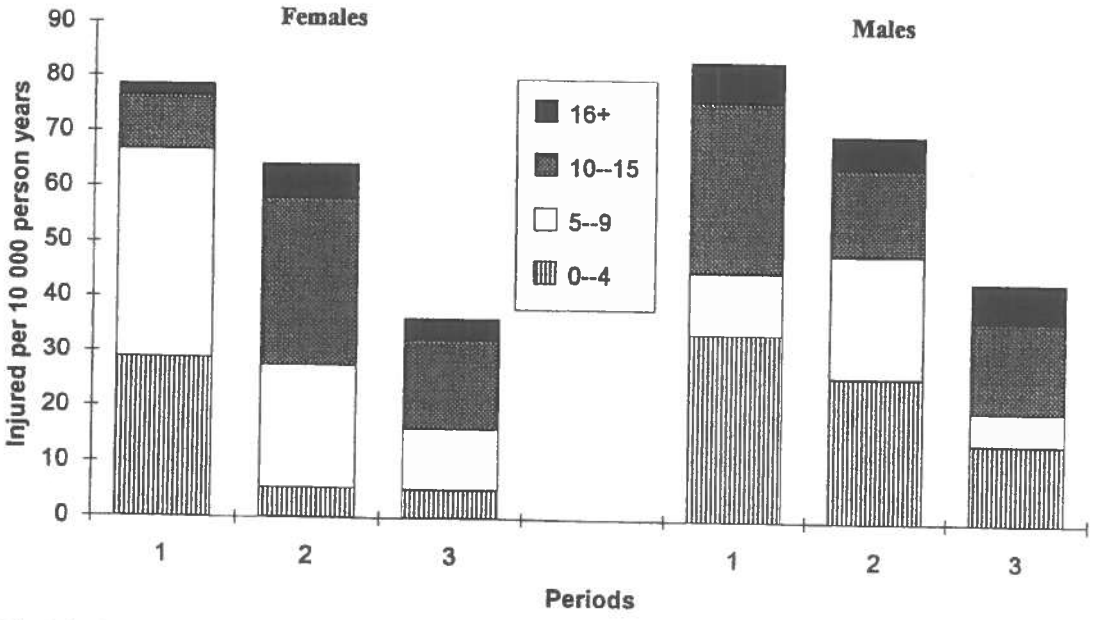

Fig. 3. Pedestrian injury rates for Harstad residents by sex, age-groups and study periods of 30 months each

dheim (136 000) as comparison city (where bicyclist injury rates increased significantly), it was concluded that the traffic injury prevention seemed effective (6). Some threats to the validity of this conclusion must be addressed. (i) The exact number of injured treated outside the hospital is unknown. A twelve month sample from primary health care sources (1992) showed that 18.2% of recorded bicyclists and pedestrians (Harstad residents) were treated in primary health care. The number treated by lay-men outside the health services is unknown. (ii) Trondheim was not an ideal choice for comparison, being six times larger than Harstad. Indeed, variations in injury counts may occur in cities of different sizes for reasons that the investigator cannot control for. For a better quasi-experimental design, data similar to Harstad's from a randomly chosen, more comparable city could have been shown. However, Trondheim was chosen out of necessity, being the only other city recording injuries from July 1 1985, in order to indicate secular trend and facilitate causal inference.

Accident analysis

The confidence intervals for both bicyclist and pedestrian injury rates encompass the estimated national rates for 1990 (hospital-based)(3).

The data showing seasonal variations for pedestrian injury were used in the promotion of conspicuousness-enhancement by fluorescent material on clothing and "dangle tags". The peaks of the diurnal time chart showed the times of the day for increased parental vigilance and police and school surveillance of traffic (Fig. 1).

Increased school participation and parental involvement in the safety programme, which were not assessed, might have contributed to the injury rate reduction. The Traffic Injury Report (TIR) contained geographical and medical information with victim stories (Fig. 1). The geographical information enabled all 14 school districts and other local interest groups to target their safety work and monitor their own traffic injury problems. Demands for speed limit changes, safe behaviour campaigns, and helmet promotion could thus be instigated or modified accordingly. Victim stories are reported to have a powerful impact on traffic behaviour (12). The TIR distribution might have led to parental reinforcement of educational efforts begun in the schools and "grass-roots" pressure for the building of a safer environment (Table I). Some of the reduction of injury could thus probably be attributed to the increased building of separate bicyclist and pedestrian pathways, the efficacy of which has been reported earlier (6).

The role of the IDB was important for adapting safety work to local needs, identifying high risk target groups and economizing with resources.

Also important was the feed-back of post-intervention data to the population through the TIR and media, which presumably promoted community empowerment and control over own endeavours (9).

Bicyclist head injuries

Bicyclist injuries in this study were most common in children and adolescents. They also suffered head injuries more commonly than those aged 16 and over. Even though this difference was not significant in Harstad residents, additional analyses including all residencies showed a significant difference. The frequency of head injury found in admitted children below 16 years is a confirmation of previous studies, in which head injuries ranged from 49% to 67% of bicyclists (all ages) admitted to hospital (13).

A main objective of the intervention was to promote the use of a helmet. The changes in head injury rates in children were not significant and must be interpreted with caution. However, the injury data suggest increased helmet use in children below 10 years of age, whereas helmet promotion was ineffective in children 10-15 years old. These putative trends are consistent with a study from Seattle where helmet promotion was effective in children 5–12 years old. The authors were more defeatist towards helmet promotion targeting adolescents (12). Resistance to helmet use can be overcome by conveying messages that helmets are attractive, provide a sporting image, and that your friends value their use (14). Even though our intervention included this type of message, we failed to reduce head injury in older children, probably because one needs to overcome a threshold of a certain magnitude in this age group. For future planning, other strategies must therefore be considered.

Even if helmet use reduces the risk of head

injury by 85% (15), a survey of Norwegian children showed a self-reported use of bicyclist helmets of 20% in 11 year olds, with a decrease to 3% in 15 year olds (16). This implies a lack of success by national helmet promotion campaigns. Other helmet promotion studies have reported failure (17). The most successful results followed the introduction of mandatory laws (18).

Assuming that a mandatory law would increase helmet use from 10% to 60% in Harstad and using Robertson's formula (19), the preventable fraction of bicyclist head injuries in our study was calculated to be 46%. Extrapolating to national bicyclist injury rates, a law might prevent more than 1300 emergency room visits for head injury in Norway.

Pedestrians

The significant injury rate decrease could be explained by the advantages inherent in community-based interventions involving many organizations (9). Previous pedestrian safety programmes have intervened more narrowly. A media and school programme in the USA (20) had a questionable effect on injury rates.

The driver is the obvious second individual in a pedestrian- motor vehicle collision. An earlier paper from this study showed a 17% injury rate reduction for automobile drivers (NS) and a significant reduction of motorcyclist injury rates (7). A putative trend towards safer behaviour in motor vehicle drivers might have contributed to a significant decrease in injury rates for pedestrians below 10 years of age. The increasing rates for senior pedestrians are not consistent with this argument. Those rates might be explained by the lack of information targeting this group, whose injury risk presently is a concern for the IPG.

Written material issued to influence driving behaviour was found to be ineffective in California (21), while written information and educational campaigns promoting health were effective when they were integrated in a community programme (9, 22).

Conclusion

Bicyclist and pedestrian injury prophylaxis may be improved by gaining epidemiological knowledge from a hospital-based injury data base. Such knowledge may be used in a community-based programme to safeguard soft road user groups who have too often been overrun, metaphorically and literally, by motorized travel.

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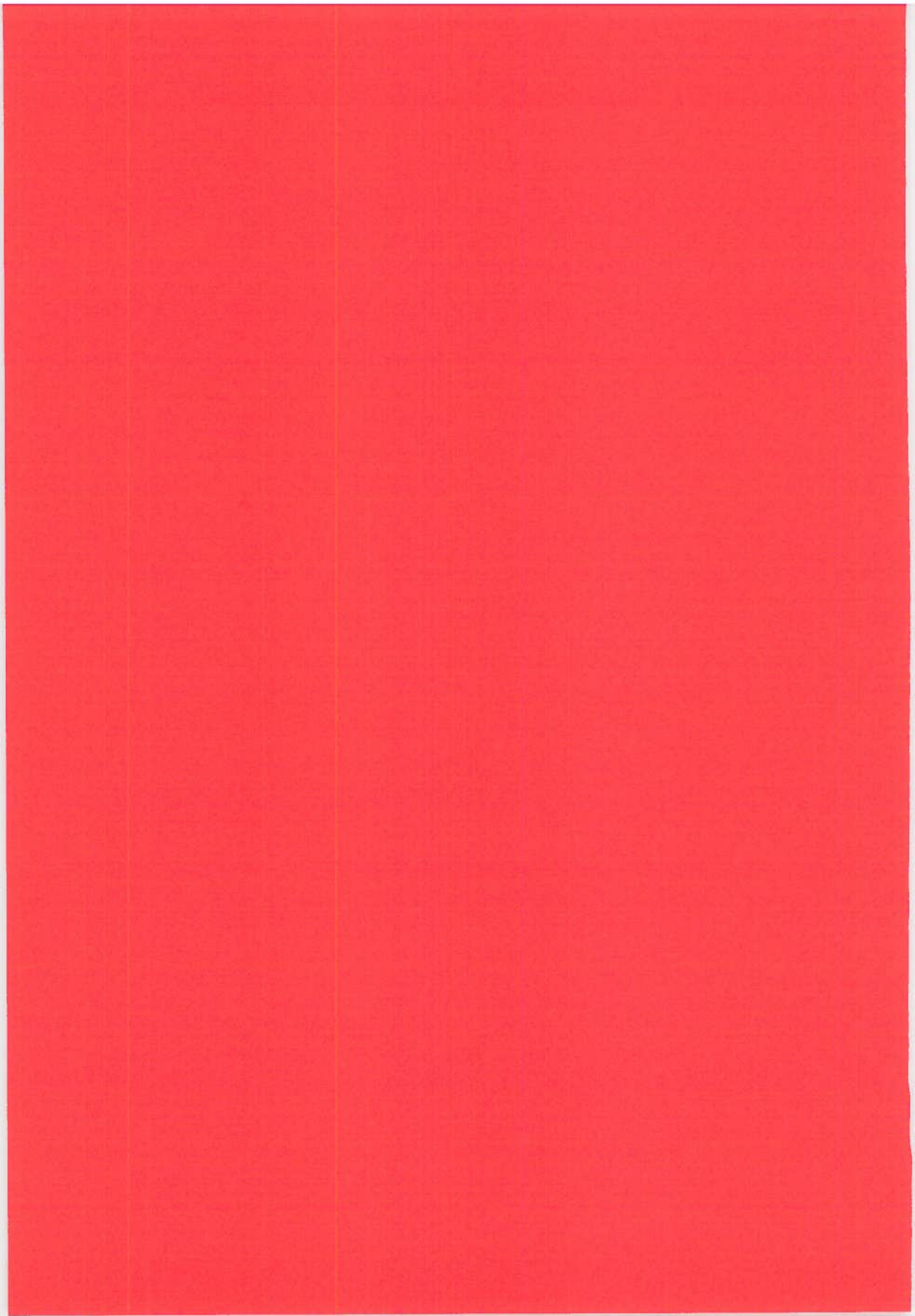
Paper III



BUTTERWORTH HEINEMANN

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The Harstad Injury Prevention Study: prevention of burns in small children by a community-based intervention

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Burns are known to cause considerable morbidity and mortality, and scalding is the most common type of burn injury in small children. A community-based injury prevention programme was initiated in the Norwegian city of Harstad (22 000 inhabitants) in 1987 and evaluated by means of data from a hospital-based injury recording system. One part of the programme aimed at reducing burns in children below 5 years of age. Accident analyses based on the local database revealed coffee to be the most frequent liquid causing scalds, which mostly occurred in the kitchen. Sixty-six per cent of the injured were boys and two-thirds were below 2 years of age. The prevention study was divided in a baseline period (19.5 months) with no local intervention – and a succeeding 7-year period containing a wide range of active and passive prevention strategies. From the first to the second period the mean burn injury rate decreased 52.9 per cent, from 52.4 to 24.7 per 10 000 person years (P < 0.05). In a reference city located 1000 km away, the rates increased from 61.9 to 68.0 per 10 000 person years (NS). The burn injury rate reduction was considered mainly attributable to the strengthening of public participation and the enhancement of community empowerment achieved by recording and actively using the local burn injury data.

Burns, Vol. 21, No. 4, 259–266, 1995

Introduction

Burns are an important cause of severe morbidity and mortality in children[1]. The two most common mechanisms of burns in children are scalding[2–5] and contact with hot surfaces[6], the former resulting in more severe injuries, often requiring hospital admission[2].

The age group below 5 years is reported to be especially at risk from burns in general and scalds in particular[3,7,8]. The majority of scalds seem to occur in children below 2 years of age[2].

Although numerically few, burned children in need of hospital admission comprise a patient group often requiring considerable resources through repeated grafting procedures, hygienic precautions, treatment of infections and supportive care to patients and parents. In a study of children below 7 years of age in Trondheim, Norway, burns were second to fractures in the injury type requiring most hospital care in 1985/86[9].

Epidemiological studies of morbidity are a prerequisite for effective burn prophylaxis – both because each studied population seems to have their special epidemiological characteristics[2,10,11] and because the knowledge of the epidemiology of burns is needed to select target groups for preventive actions[12].

Different approaches to prevent burns in children have been employed, e.g. burn prevention lessons in schools[13,14], information programmes targeting baby-sitters[15], controlling tap water temperature[16,17] and information towards parents with children already treated for burns[18]. Some of these interventions have reported increased attention, knowledge and self-reported change in safety practice, but few studies have reported effects in terms of reduced incidence of burns[6,16]. Effective prevention of burns in Denmark was reported for the period 1978–87 compared to 1968–77 based on national programmes[19–21]. The authors concluded that the positive results were achieved from pursuant prophylaxis. A recent Danish study found, however, an unchanged pattern over the last 10 years, suggesting that the prophylactic campaigns had been insufficient[22]. Many of the referred studies do, however, suffer from lack of control or reference groups.

A community-based injury prevention study in Sweden reported a significant decrease in burn injury rates (all ages), but not in small children[23]. To our knowledge, no other effective studies with a comparable design have been reported. The need for an effective burn prevention programme targeting small children with a thorough description of content and strategy, is obvious.

Aims of study

1. To evaluate the effect of a community-based intervention for prevention of burns in children below 5 years of age in terms of: (a) burn rate changes and (b) changes in short-term hospital costs of child burn injuries connected to the intervention.
2. To describe the distribution and characteristics of all child burns occurring in the population served almost exclusively by Harstad Hospital during a period of 8 years and 7.5 months.

Materials and methods

Study design

The present paper describes the burn prevention part of the comprehensive Harstad Injury Prevention Study[24–26] targeting children below 5 years of age, residents of Harstad city (population 22 000). The burn prevention study lasted for 8 years and 7.5 months and was divided into two periods. Before 1987 (period 1 = 19.5 months, 2292 person years) hardly any local intervention was undertaken. From 1987 (period 2 = 7 years, 11318 person years) a community-based intervention programme was implemented.

The corresponding child population of the city of Trondheim (population 134 000) served as a reference group. Trondheim, which is 6.2 times the size of the intervention city Harstad, is geographically so distant (1000 km) that treatment diffusion should have been avoided. Trondheim was chosen as the reference city because it was the only other hospital in Norway recording the same type of longitudinal data as Harstad since 1985.

To study treatment diffusion, child burn rates in six municipalities surrounding Harstad (population 14 000) were also calculated. Harstad, Trondheim and the six municipalities have all been exposed to the nationwide child safety programmes, but community-based local interventions have only been carried out in Harstad.

Data recording

The prospective data recording started on 15 May 1985 for Harstad and the six surrounding municipalities, and 1 July 1985 in Trondheim. During both periods all injured persons treated in the hospital emergency ward were recorded, making an injury database (IDB). The variables for each injured person were selected in cooperation with The National Institute of Public Health[27] as part of a national injury surveillance system and followed the Nordic coding system[28].

The data from Trondheim available for analysis covered 8 years, 1 July 1985 to 30 June 1993.

Only thermal burns were included in this study. Chemical burns were rare and excluded because they were inseparable from other chemical injuries in the coding system.

For geographical reasons the possibility is minimal for Harstad residents receiving primary burn treatment in a neighbouring hospital, unless injured while being away from home.

Variables of the IBD

Personal data were collected on age, gender and place of residence. Activity type, type of product involved and time of injury, day, month and year were also recorded. A free text of up to 150 characters contained three distinct parts that are partly consistent with the concepts of pre crash, crash and post crash described by Haddon[29]. Medical variables were injury type, injury mechanism, body part injured and admittance to the hospital. Injury severity was coded according to the abbreviated injury scale (AIS)[30].

Data recording procedure, validity and reliability

The injury form in Harstad was completed in the emergency room, partly by the patient or someone accompanying him/her and partly by the staff and intern. The information was coded by an injury secretary and fed into the computer. The patient lists in the emergency room were checked daily or after every weekend to ensure that missing forms were filled in. All interns that commenced their half-year term in the surgical department received a short course of motivation and injury registration upon arrival. The injury recording procedures has, throughout the whole study period, been supervised by the authors.

Trondheim Hospital recorded data in basically the same way as Harstad. Because of hospital differences in size, architecture and patient flow, practical organization of data collection differed from Harstad. Accident injury data from Trondheim for 1985/86 was published in a thesis by Sahlin[9]. Uniformity of coding practice in Harstad and Trondheim, data validity and reliability were tested in yearly meetings at the National Institute of Public Health[27].

The intervention

The theoretical concepts and strategies used for the community-based intervention (*Table I*) included Haddon's matrix[29] (*Table II*), the three models for health education (preventive, radical political and self-empowerment) proposed by Tones et al.[31] and the distinction between 'active' and 'passive' interventions[32]. The community intervention aimed at activating public and private resources in accordance with the Ottawa Charter for Health Promotion[33] and the Manifesto for Safe Communities[34]. Agenda setting, population salience, diffusion of communication, long-term maintenace of programme and social legitimacy of educational forces, summarized by Farquhar[35], were other important concepts and strategies. Bandura's social learning (cognitive) theory[36] was applied in promotion of safe behaviour. These concepts, strategies and theories are described in more detail in a previous report[24].

Injury prevention group and intervention implementation A local injury prevention group (IPG) with representatives from the hospital and several public and private organizations and individuals interested in prevention of all injuries was established in 1985. The administration of, and strategies adopted by, the IPG have been described previously[24]. Because data from period 1 confirmed that small children were at particular risk for burns (especially scalds), children below 5 years of age were selected for intervention. When burn prevention was on the agenda in IPG meetings, it was considered important to involve all public and private organizations that were relevant for the prevention of accidental child injuries. The involvement of organizations promoted diffusion of the programme messages and maintenance of their effect[37]. Throughout the study, a public health nurse worked in the IPG. This linked the IPG with the public health nurse corps which promoted burn prophylaxis through repeated parent counselling sessions within the mandatory vaccination programme. The parents were reached for the first time at a mandatory home visit 2 weeks post-birth.

Strategies for burn prevention recommended by the Atlanta Centre for Disease Control[38] were modified and adapted to local needs by analysing the burn data in the IDB. In particular the free texts (case stories) (*Table III*) were employed during the counselling sessions as examples of situations where injuries may happen. Parents were then instructed on how they could prevent similar situations. Also brochures and posters provided by the national campaigns for child safety promotion were used in these

Table I. The Harstad Injury Prevention Study. Burn prophylaxis in small children. Interventions classified by Haddon's matrix, strategic models and applied concepts in social learning (cognitive) theory

Interventions	*Haddon's matrix, cell number(s)*[29]	*Active/passive*[22]	*Health education model*[21]	*Concept(s) in social learning (cognitive) theory applied*[26]
Injury prevention group activity	All	Active and passive	All three	Social and physical environment
Relevant local private and public organizations promoting child safety (Red Cross, women's organizations)	1, 2, 3, 5, 7	Active and passive	All three	Social environment
Items in local media describing local child burn injury problem, distribution of burn injury data with free texts (*Table III*)	1, 2, 3, 5, 7	Active, may lead to passive	All three	Expectations and expectancies
Promotion of tap water thermostat setting at 55°C through media and individual counselling	2, 5	Active, may lead to passive	Preventive, self-empowerment	Physical environment
Promotion of the availability of cooker safeguards in stores selling electric stoves	3	Passive	Preventive, self-empowerment	Physical environment
Promotion of the purchase and installation of cooker safeguards in homes	2, 5	Active, may lead to passive	Preventive, self-empowerment	Physical environment
Promotion of increased parental vigilance in putative burn risk situations (through items appearing in local media and parental counselling by public health nurses and doctors)	1	Active	Preventive, self-empowerment	Behavioural capability
Promotion of parental skills in giving first aid after burns have occurred (cooling of burnt body areas)	7	Active	Self-empowerment	Behavioural capability/self-efficacy
Data feedback to parents of small children via media and health services showing local ability to cope with child burn injury problem, increasing individual perception of coping skills	4	Active	Self-empowerment	Self-efficacy, positive re-enforcement/reward

Table II. Numbering of the cells in Haddon's matrix

	Human	*Physical environment*	*Socio-economic environment*
Precrash	1	2	3
Crash	4	5	6
Postcrash	7	8	9

sessions. The presentation of free texts aimed at influencing outcome **expectations**, e.g. the risk of a scald occurring in a certain situation, and **expectancies**, e.g. the value associated with such scalds[36]. Examples of practical advice were avoiding drinking hot beverages with a child on the lap, placing hot water, coffee or teapots outside the reach of children and setting the table for tea/coffee without a tablecloth.

To increase parental vigilance necessary for the prevention of contact burns and scalds caused by small children unexpectedly and suddenly overturning containers of hot liquid, the IPG also used local media regularly to inform the public about safe behaviour (active intervention). Both through media and in the counselling sessions, promotion of the use of cooker safeguards, child-safe hot water taps and lowering of tapwater temperature were given high priority. Such 'passive' interventions are reported to be more effective, requiring less participation from the individual than 'active' ones[32]. Practically all water heating in Harstad is electrical. Tap water thermostat setting to 55°C has been correspondingly promoted in kindergartens and homes.

To increase the availability and use of cooker safeguards and safe taps, the local Red Cross, the consumer office and the public health nurse corps also informed vendors of electrical cooking stoves. The programme messages were conveyed by face to face contacts in shopping malls, at health fairs and in the mass media.

A list of intervention activities and their theoretical and conceptual implications are listed in *Table I*.

Changes in short-term hospital costs

To study the short-term hospital costs of child burn injuries connected to the intervention, 9 years of hospital data (from 1 January 1985) were collected (retrospectively) from the medical records of admitted residents of Harstad. The variables were: (i) number of admissions, (ii) consumption of hospitalization bed-days before wounds were epithelialized (spontaneously or by grafting) to the point of safe outpatient follow-up, and (iii) number of procedures (grafting or change of dressings) requiring general anaesthesia. If the patient was referred for specialized primary burn treatment, the data in (ii) and (iii) were included.

Distribution and characteristics of burns

Burns in children do not occur frequently. In order to accumulate sufficient data for epidemiological analyses, all child burns treated at Harstad Hospital were recorded and analysed together. This analysis also includes patients with residency in the six above-mentioned bordering municipalities and other nearby municipalities usually referring patients to Harstad Hospital.

Statistics

For database handling the Epi info version 5.01 package was used[39]. The χ^2 test and statistical comparison of two incidence rates[40] was used. P values below 0.05 were regarded as significant.

Results

Seventy burned children from 13 different municipalities were treated and recorded at Harstad Hospital during the

Table III. The Harstad Injury Prevention Study: examples of free texts classified by products and mechanism of burn injury

Injury mechanism	*Product(s) involved in accident*	*Free texts*
Scald	Upsetting cups	The child upset her mother's coffee cup, the contents spilled over the abdomen
		Father drank cocoa, the child crawled up to table, grabbed cup and upset it
		Sat on lap of father who was drinking coffee, upset cup
		Put hand in cup of hot coffee
		Sat at the kitchen table, grabbed cup of tea, upsetting it
		Had just started to walk, pulled tablecloth, upsetting coffee cup, was scalded
Scald	Upsetting large receptacles with hot liquid	Alone in kitchen, climbed the table and upset full tea pot, getting scalded
		Played in living-room, upset coffee-pot and was scalded
		Stood beside living-room table, upset pot with hot water
Scald	Upsetting large receptacles with boiling liquid, cooking stoves	Pulled down casserole with boiling egg-water from stove
		Pulled down coffee kettle from stove
		Played in kitchen, pulled down from stove a casserole with boiling oatmeal
		Climbed chair close to the stove and pulled down coffee kettle from stove
Scald	From tap	Climbed into bath-room sink and was scalded when opening hot-water tap
		Was scalded from hot water tap in kitchen
		Opened hot water tap and was scalded on left side of abdomen
		She and her twin sister got into bath-room, was scalded from tap
Contact burn	Electrical iron	Mother was ironing, she turned away for a moment, the child overturned the iron and was burned on hand
Contact burn	Electrical cooking stove	Burned hand on cooker
Contact burn	Electrical heating stove	Placed hand on stove
		Fell from chair on stove
		Placed both hands on living-room stove
Contact burn	Wood- or coal-burning stove for heating	Placed both hands on stove, burned both hands
		Was burnt on stove
		While playing in the hall, was burnt on stove
Open fire	Matches	Played with matches, pyjamas caught fire
		Siblings played with matches, bedclothes caught fire
Open fire	Open fire	While playing in the yard, the child ran into the open fire

Table IV. The Harstad Injury Prevention Study: changes in burn rates (per 10 000 person years) in three populations of children 0–4 years old

	*Period 1**				*Period 2†*					
	n	*Person years*	*Rate*	*Relative risk*	*n*	*Person years*	*Rate*	*Relative risk*	χ^2	*P value*
Harstad	12	2292	52.4	1.0	28	11318	24.7	0.47	4.03	0.045
Trondheim	76	12281	61.9	1.0	422	62067	68.0	1.10	0.48	0.489
Six municipalities	4	1525	26.2	1.0	13	5786	22.5	0.86	—	0.766***

*Period 1 was 18 months for Trondheim (from 1 July 1985) and 19½ months for Harstad and the six municipalities (From 15 May 1985).
†Period 2 (from 1 January 1987) was 6½ years for Trondheim and 7 years for Harstad and the six municipalities.
***Two-tailed *P* value Fisher exact test.

study. Forty of these were residents of the intervention city Harstad and 17 were residents of six municipalities closely surrounding Harstad.

Changes in burn injury rates

From period 1 to period 2 burn injury rates decreased 52.9 per cent in Harstad, increased 9.9 per cent in the reference city of Trondheim, and decreased 14.1 per cent in the six municipalities (*Table IV*). The yearly moving average for Harstad and Trondheim is shown in *Figure 1*.

Changes in short-term hospitalization costs (retrospective data)

Hospital data tapped from medical records on Harstad residents showed rate reductions from period 1 to period 2 for admittance of burn cases, hospital bed-day consumption and number of surgical procedures requiring general anaesthesia for burned children 0–4 years (*Table V*).

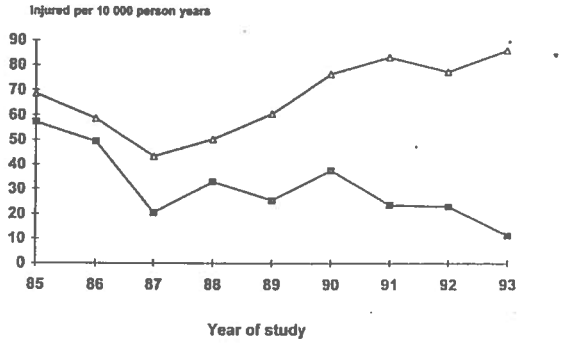

Figure 1. Burn injury rates for children 0–4 years of age in two Norwegian cities. —■—, Harstad; —△—, Trondheim. 1993 data for Trondheim: first 6 months only.

Table V. The Harstad Injury Prevention Study: short-term hospital cost for treatment of burned children 0–4 years of age. Rates for residents of Harstad are given for two different periods (per 10 000 person years) for admission to hospital, hospitalization bed-day consumption and procedures requiring general anaesthesia

	Admissions		*Hospitalization bed-days*		*Procedures requiring general anaesthesia*	
	n	*Rate*	*n*	*Rate*	*n*	*Rate*
Period 1*	4	14.3	29	103.4	5	17.9
Period 2†	6	15.3	55	48.6	11	9.7

*2 years from 1 Jan 1985.
†7 years from 1 Jan 1987.

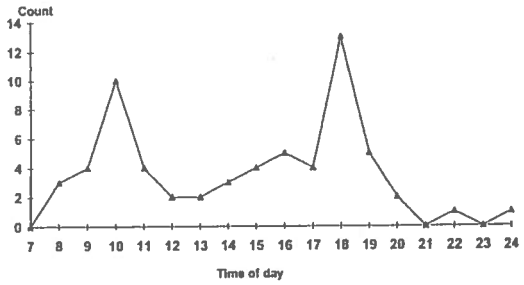

Figure 2. Sixty-three burn injuries by time of day in children aged 0–4 years old. In seven cases the time of accident was unknown.

Distribution and characteristics of burn injuries

Data about all 70 burn patients treated in Harstad were used for the accident analysis, 66 per cent of these were boys ($P < 0.05$), and two thirds were below 2 years of age.

Scalds were predominant (64.3 per cent), 31.4 per cent were contact burns and 4.3 per cent were caused by open fire. Most scalds occurred in the kitchen, while scalds and contact burns were equally frequent in the living room. Among the various hot liquids and foodstuffs causing scalds, coffee (42 per cent) and hot water (40 per cent) were the most frequent. The most common scalding mechanisms were: (i) upsetting cups and larger receptacles of hot liquid from the table or from the stove and (ii) accidental tapwater exposure.

Common products involved in contact burns were electrical stoves and irons, wood- and coal-burning stoves (*Table III*). Playing with matches was causative in two of the three open fire cases.

The injuries occurred most often at around 10.00 h and 18.00 h (*Figure 2*). Seasonal variations were slight.

The upper extremity was most often injured (35.8 per cent), the lower extremity being the second most frequent site of injury (32.8 per cent). Multiple body parts were injured in 22.4 per cent, the trunk in 6.0 per cent and the head in 3.0 per cent.

Discussion

Changes in burn injuries

The decrease in child burn rates in Harstad seems to indicate a successful community-based intervention. Some threats to the validity of this statement must, however, be taken into consideration. The principal threats to validity[41] are: (i) registration effect and (ii) historical trend.

Registration effect Increase in registration loss at emergency visits during the study could account for the injury rate decrease. To counteract registration loss, we randomly checked emergency room routines throughout the entire study to ensure that the injury form was filled in for every treated patient. We assume that the continuous process of reminding and motivating hospital staff to record every treated injury has not made registration less complete throughout the study.

Some child burns are treated in primary health care. If the ratio of burned children treated in primary health care/treated in the hospital increased during the study, this would be a threat to validity. Two counteracting arguments seem to be relevant. Increasing demands for health service cost-effectiveness could contribute to burn injury treatment at lower levels in the health services, increasing this ratio. On the other hand, medicolegal problems and physician culpability has increasingly been focused on by authorities and the press during the last years. This could be construed to produce the opposite effect – an increase of burn cases referred to the hospital for assessment and treatment. The relative weight of these two arguments is difficult to assess, but the rates remained stable for hospital-recorded injury types that were not an issue for any intervention, e.g. sport injuries. This suggests that the burn injury rate reduction cannot be explained as a registration effect.

Historical trend The national historical trend for child burn rates is unknown, because complete national burn injury data for the study period is not available. Trondheim was, therefore, used as a reference municipality for indicating this trend. The choice of Trondheim was not ideal, this city being more than six times larger than Harstad, but no other city had similar data recording. The rate increase in Trondheim was not significant and could indicate slight increasing or stable national child burn rates during the study. A registration loss in Trondheim in period 1 could, however, bias this assessment, but we have no data or information indicating such registration loss[9].

The assumption of stable national rates is seemingly supported by the insignificant reduction in burn injuries of 14.1 per cent in the six municipalities surrounding Harstad. This reduction could, however, also be interpreted as the result of intervention diffusion:

1. Intervention items occurred in local media also covering these six municipalities.
2. Members of participating organizations and health service professionals in Harstad communicated with colleagues in the six municipalities.
3. The availability of safety equipment, e.g. cooker safeguards, also increased for out-of-town people shopping in Harstad.

The burn cases recorded in these six municipalities were, however, so few that the observed injury rate reduction must be interpreted with great caution.

Discussion of causality An evaluation might be considered incomplete without the detailed study of each

active and passive intervention[42]. In a multiple intervention study like ours, a separate evaluation of each intervention becomes, however, difficult. Ideally there should have been measurements of compliance with recommended tapwater thermostat setting, awareness of programme messages and changes in self-reported parental vigilance and self-efficacy. The burn prevention part of the Harstad Injury Prevention Study seems to have been effective, but we do not know which of the elements were working most successfully.

Similar comprehensive community-based programmes aimed at preventing different types of injuries have had limited effects on registered burn injuries in children[13,23]. However some single focused burn injury interventions have had an effect. Advising households to lower tapwater thermostats gave poor compliance in one study[43], but legal regulation requiring new water heaters to be preset at 49°C was effective in Washington State[16]. In a third study the antiscald devices worked, but all but one were removed at 9 months because of sediment build-up, which prevented the water flow. This study also showed discrepancy between heater thermostat setting and tapwater temperature[17].

Home safety assessments done by public health nurses after counselling parents on burn prevention showed a 43.5 per cent compliance with multiple recommendations[18].

The most effective means of burns prevention may be by passive interventions[32], such as legislation regarding tap water temperature[16], mandatory controls on children's nightclothes[44] or restrictions on distribution of fireworks[25]. However, many burn injuries are considered preventable only by promoting behaviour change. Applying social learning (cognitive) theory[36], the increase of **expectation** and **expectancy** was promoted in the Harstad study through distribution of the free texts to health workers who used them in counselling sessions with parents. Expectation may be described as the linking of an outcome to a certain act. For example: 'the child pulled down the kettle of boiling water from the cooker and was scalded in her face'. Expectancy pertains to the value a person places on this outcome and thus in the installation of a cooker safe-guard. Increased **behavioural capability** and **self-efficacy** (perception of coping skills) was promoted through: (i) skill training in counselling sessions and (ii) positive feedback to the community as a whole (positive reinforcement/reward) when burn rates started to decrease. Another aim of this data feedback was the alleviation of a possible programme-induced parental fear for their child. Fear can render the audience immune to the desired message[40].

Even though the active intervention in our study was important, preventive programmes using 'active interventions' solely have failed to reduce burn injuries[47,48]. Active interventions aimed at preventing burns, as well as other health problems, are reported to be more effective when integrated in a community action programme[37,49].

Based on our and other studies, we may conclude that injury prevention programmes must:

1. Be conceived and implemented through multidisciplinary approaches.
2. Use active as well as passive interventions.
3. Involve media as well as lay organizations and public authorities.
4. Be based on accepted theories on behaviour change.
5. Define the target group and the audience precisely.

Cost-effectiveness of the preventive programme

Whereas prevention of human suffering is an obvious benefit, the hospital data, based on the medical records (*Table V*), indicate that savings in terms of hospital inpatient care is another effect. The cost of hospital inpatient care for burns is reported to be similar to surgical intensive care unit costs ($1296 per day in 1986)[50]. A saving of 62 bed-days can be calculated by subtracting observed bed-day consumption for Harstad residents in period 2 from expected (extrapolated from period 1 data). This calculated estimate might be biased by a change in surgical policy towards more active surgical interventions, e.g. primary excisions. The average number of surgical procedures per admission rose from 1.25 in period 1 to 1.83 in period 2 (*Table V*). This increase reflects our adopted policy of more active surgical intervention but also the fact that the burns in period 2 were bigger. The latter explanation is supported by the rise in the average bed-day consumption per admission – from 7.3 days in period 1 to 9.2 days in period 2.

Assuming that treatment diffusion caused some of the burn rate reduction in the six communities, a corresponding additional saving of up to 162 bed-days may be calculated (data not shown). Throughout the study, the main cost of the intervention was the work of the members of the IPG, the public health nurses and the whole array of participating public and private institutions and organizations. However these persons also worked with other parts of the Harstad Injury Prevention Study running parallel with the present one[24–26] – prevention of (i) traffic accidents and (ii) accidents caused by falls in the aged. Savings in terms of hospital admission rate reductions were observed for traffic accidents[24] (42 per cent) and fractures caused by falls in private homes for the aged[26] (16 per cent). Saving hospital outpatient care was another benefit of the programme. Hospital costs from accidents are reported to be 23 per cent of total social economic cost[51]. Bearing this in mind, it seems that the present injury prevention programme has been cost-effective.

Distribution and characteristics of burn injuries

Our material showed an overrepresentation of children below 2 years of age, especially boys. This is consistent with the findings of others[10]. Two-thirds of the patients were below 2 years of age, indicating an important target subgroup for intervention.

The predominance of scalding as a burn mechanism in Harstad is in accordance with the findings of several others[2,3,10]. Most scalds occurred in the kitchen, a finding supported by Phillips et al.[10]. The foodstuff causing most scalds was coffee, consistent with a Danish study[2]. A common scalding mechanism was upsetting cups and other receptacles of hot liquid from the table or from the stove. This also supports Lyngdorf's findings[2], while accidental tapwater exposure seemed to be more common in our study than in that of Lyngdorf.

The slight seasonal variations and double peaked time of accident plot in Harstad is another finding shared with Lyngdorf. He also found a first diurnal peak at 1000 h, but found the second one to be an hour later than Harstad's, indicating different meal-time habits in Harstad and Copenhagen.

The pattern of body parts injured is also consistent with other studies[2,3,10].

Conclusions

Registration effect and historical trend are not considered to be very probable explanations for the significant reduction of child burn rates in Harstad. Even if the evaluation of causal processes may be considered incomplete, the present study indicates that child burn prophylaxis, when based upon sound local epidemiological data and community-based intervention, can be effective at low cost.

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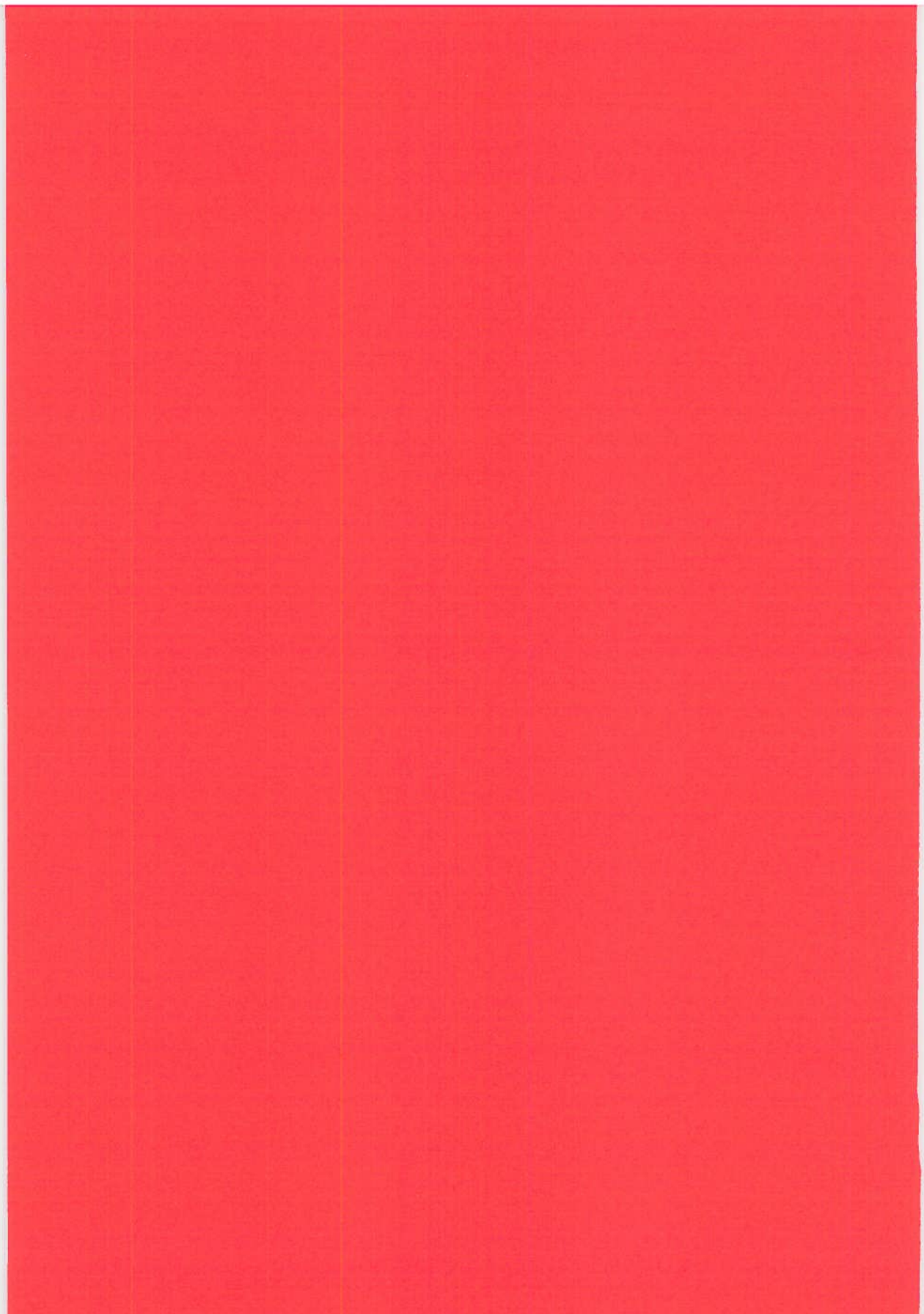
Paper IV



THE HARSTAD INJURY PREVENTION STUDY: COMMUNITY-BASED PREVENTION OF FALL-FRACTURES IN THE AGED EVALUATED BY MEANS OF A HOSPITAL-BASED INJURY RECORDING SYSTEM.

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ABSTRACT

Study objective - To describe a community-based programme of prevention of fall-fractures and evaluate the outcome in terms of changes in fracture rates and short-term hospital care costs.

Design - Prospective intervention study.

Setting - The Norwegian municipalities of Harstad (intervention) and Trondheim (reference), during eight years from 1 July 1985 to 30 June 1993.

Participants - The person years of the study were estimated from yearly census data. For the population 65+ years old they were 22970 in Harstad and 158911 in Trondheim.

Measurements and main results - The variables were selected and coded according to the Nordic system and the data were collected as part of a national injury surveillance system. The first three years of the study provided baseline, while the last five years involved community-based interventions, e.g. the removal of environmental hazards in homes and promotion of the use of safe foot-wear outdoor in winter.

Fall-fracture rates did not decline in nursing homes but decreased 26.3 % in private homes ($p<0.01$). For 65-79 year olds a 48.7 % reduction was observed for males in traffic areas in winter ($p<0.05$). The data from the reference city Trondheim suggested a significant rise in fall-fractures.

From private homes a 16.7 % reduction of hospital admission rates was observed, indicating a substantial saving in short-term hospital cost. The observed fall-fracture rate reductions in private homes and traffic areas suggest that major parts of the interventions were effective.

Conclusion - Fall-fracture prophylaxis in the aged is possible in a community-based setting that utilizes high-quality local injury data.

Key words - Falls, fall-fracture prevention, community-based intervention.

INTRODUCTION

Fractures in the aged are a major health problem in Norway[1-3] and other industrialized countries[4-9]. They are a challenge to orthopaedic surgeons, health administrators and epidemiologists committed to injury prevention.

The study of fracture epidemiology in the aged has for many years focused on hip fractures[1,6,7]. The age-specific incidence of hip fractures has been reported to increase from 1970 in Europe[3,6,7,10] and in most of the world[2,3,11]. In addition to the human suffering they cause, hip fractures are expensive for society. The average per capita cost of a hip fracture in the US was estimated to be $ 41 500 in 1993 current dollars, for an annual expenditure of 10 billion dollars[9]. In Denmark hip fractures are now reported to be more expensive and hospital bed-day consuming than any other diagnosis[12]. Hip fractures, however, represent only a part of the whole problem of fractures in the aged. Fractures of the forearm and vertebrae also present major challenges[13-15].

Epidemiological studies of fractures in the aged have revealed both **endogenous** and **environmental** factors, that may be manipulated for preventive purposes. Very often a fracture is caused by a combination of factors.
Many studies have reported the impact on bone density or fracture rates by **endogenous** factors e.g. hormones, dietary factors, physical activity, alcohol, cigarette smoking and medication[16].
Improvements of **environmental** factors like walking surfaces, stairs, railings, lighting and design of

chairs and beds are also reported to have the potential for reducing the incidence and severity of falls[17], particularly in younger and healthier elderlies[18]. Studies of elderly people seeking care after falls have attributed 28%-51% of the falls to environmental causes[5,19-21].

Some intervention studies targeting falls in the aged have not documented a significant reduction of injuries or fracture rates[22-23]. A community-based intervention study in Sweden documented a significant reduction of accidental injuries (all ages) in homes, but the reduction of injuries in the aged (65+ years) was not significant[24]. A recent Danish study using the health services for intervention, reported a reduction of fall-fractures in elderlies living in private homes[25]. External hip protectors can prevent hip fractures in nursing-home residents[26].

Aim of study

The aim of this study is to evaluate the outcome of a community-based programme of prevention of falls in the aged (65+ years old) in terms of a) fall-fracture rate changes and b) changes in short-term hospital care cost of fall-fracture treatment connected to the intervention.

MATERIALS AND METHODS

Study design

The present study consists of a prospective hospital-based injury recording combined with a fall prevention programme and was conducted in the Norwegian city of Harstad

(population 22500), located 250 km north of the Arctic circle. The intervention against falls was part of a larger injury prevention programme[27-29] and targeted the population 65+ years old. A quasi-experimental design[30] was used. Study end-points were fracture rates. To get an indication of national historic trends, the fracture rates of Trondheim (population 135 000) were used. In addition, the fracture rates of 6 municipalities (population 15 000), referring patients only to Harstad Hospital, were used as an indication of local trend. The 6 municipalities are close to Harstad, making intervention diffusion probable. Trondheim is geographically far from Harstad (1000 kilometres) and has the only other hospital in Norway recording the same type of longitudinal injury data from 1985.

The Harstad study started 1 July 1985, lasted 8 years and was divided into 2 periods. Period 1 ("baseline") lasted for 3 years, contained 8120 person years and included hardly any local intervention. Period 2 lasted 5 years, contained 14850 person years and a community-based fall-fracture prevention program.

Data recording and analysis

All injured persons treated in the hospital emergency rooms were recorded in an injury data base (IDB). The variables for each injured person were selected in co-operation with The National Institute of Public Health[31] as part of a national injury surveillance system and followed the Nordic coding system[32]. Name, date of birth, sex and place of

residence were obtained. Activity type, type of product involved and time and place of injury were also recorded. An open ended question (free text) described the event leading to the injury. Medical variables were injury type, injury mechanism, body part injured and admittance to the hospital. The recorded variables, data recording procedure and measures taken to ensure data validity and reliability are described in more detail elsewhere[28]. For geographical reasons, leakage of patients to other hospitals from Harstad and the 6 municipalities is virtually precluded.

Changes in short-term hospital costs

To study the short-term hospital costs of fall-fracture treatment connected to the intervention, 8 years of hospital data (from 1 July 1985) were collected (retrospectively) from the medical records of Harstad residents admitted after falls in private homes. The variables were (i) number of admissions, (ii) consumption of hospital bed-days and (iii) number of operations related to the falls.

Interventions

The present paper describes part of a more comprehensive community-based programme to prevent accidental injuries. The theoretical concepts and strategies used for the community-based intervention included Haddons matrix[33] and the distinction between "active" and "passive" interventions[34] and are described in more detail elsewhere[27-29]. The community intervention was aimed at activating public and private resources in accordance with

the Ottawa charter for health promotion[35] and the Manifesto for Safe Communities[36]. Agenda setting, population salience, diffusion of communication, long term maintenance of programme and social legitimacy of educational forces, were other important concepts and strategies[37].

Injury prevention group

An injury prevention group (IPG), established in 1985, contained representatives from the hospital and several public and private organizations[28]. When promotion of safety for the aged was on the IPG agenda, every conceivable relevant co-operation partner was invited to establish a network of communication. This strategy aimed at promoting community "ownership" of the problem and diffusion of information and programme messages. Based on analysis of local injury data, the IPG selected different target groups.

Identification of targets for intervention

Local data from period 1 showed that 9 out of 10 fractures in the aged (defined as 65+) were caused by falls and about 50 % occurred in homes (including the immediate surroundings - garage, driveway and yard). A further 25 % occurred in public traffic areas (non-traffic accidents). These fractures were five times as frequent during the seven snow months compared to the snow-free months.

Residents of nursing homes in Harstad and the surrounding municipalities had very high accident injury rates compared to the aged living in their homes[38].

The IPG decided to focus primarily on the problem of fall-fractures in the aged with emphasis on detecting and preventing environmental hazards.

The IPG started the intervention by inviting public and private organizations relevant for promoting safety for senior citizens to a health fair in January 1989. This event was reported by the local media and the scene was set for the implementation of change.

The role of different individuals, professional services and organizations

Leadership of and responsibility for segments of the program

Throughout the project, the investigator and the injury secretary were responsible for hospital data recording and contributing information about local epidemiological characteristics to the IPG. A retired city veterinarian, another member of the IPG, had the important role of planning and implementing education for relevant health personnel concerning the problem of falls-fractures in the aged and environmental hazards in private homes and nursery homes. She also arranged meetings with pensioners to inform them about ways of avoiding falls by eliminating such things as loose cords and sliding mats on floors, installing grab bars and better lighting. General information was also given about risk factors like inebriation, medication, smoking, deficient diet and inactivity. The press was invited to meetings, generating a great deal of media coverage.

Public health services

Throughout the study a yearly mean of 759 dysfunctional, high risk aged living in their homes were visited by the local public health service. Relative to the population at risk there was a negligible reduction in these services from period 1 to period 2. The frequency of visits ranged from several times a day to once a week and were made by nurses, nurses-aids and other helpers. In 1989 these and other health personnel from Harstad attended a course about detecting and remedying home hazards. They learned about local epidemiological characteristics and national know-how relevant to fall and fracture prevention in the aged. Some professionals and health administrators from the 6 surrounding municipalities also attended. To promote the use of safety items and the perception of their usefulness, "victim stories" from the local IDB were used when educating both health workers and pensioners.

From 1991 all Harstad residents aged 75 or 79 years, were given an offer to be visited at home by health personnel. 80 % agreed to this and were paid a visit. The aim of these visits was to promote environmental safety, a healthy diet and lifestyle and the reduction of isolation and inactivity. From 1991 a special health station was established where Harstad seniors could come for routine health consultations. Home safety education was there carried out by public health nurses. Physical exercise for elderlies was promoted by physiotherapists in weekly work-out sessions in gymnasiums.

Pensioners' service

To fix detected home hazards, the IPG in 1989 established a service whereby pensioned citizens, skilled in manual work, could be summoned to improve the physical environment in a clients' home. The cost of this work was a third of market price and paid for by the client. A telephone answering service was organized by the local pensioners society for making appointments.

Voluntary organizations

To promote diffusion of program messages and long-term maintenance of the programme, attempts were made to activate as many voluntary organizations as possible in order to reach a high proportion of the aged population. The Lions club, church organizations, the pensioners society and the Norwegian Women's Public Health Organization were all involved.

Safety equipment

Safety items like anti-sliding material (under mats) and grab bars for stairs and bath-rooms were made available at the city pensioners centre, and the use of these items was promoted. The availability and use of "safety boots" was promoted through local media and the injury prevention network. These boots were extra sturdy and had spiked soles, well designed for walking on icy pavements and roads. The "spiking" of boots was done by a gas station as a low cost service to senior citizens (done in the same way

that automobile tyres are "spiked"). The Pensioner's service arranged the delivery of sand to homes for gritting driveways, stairs and yards.

Statistics

For database handling Epi info version 5.01 package was used[39]. The chi-square test was used as statistical approximation of the comparison of two incidence rates[40]. Mantel-Haenszel weighted relative risk and summary chi-square was used. P values below 0.05 were regarded as significant.

RESULTS

Rate changes for fractures (all injury mechanisms, all places of occurrence).

In Harstad a 9.7 % reduction of overall fracture rates for all ages and both sexes was observed from period 1 to period 2 ($p=0.20$). In the 6 municipalities a corresponding 1.5 % increase was found ($p=0.58$) while the Trondheim rates increased 32.7 % ($p<0.001$) (*Table I*).

Rate changes for fall-fractures in Harstad.

Private homes

A 29.1 % reduction of fracture rates from period 1 to period 2 was observed for females below 80 years ($p=0.03$). A reduction, however not significant, was also found in the other age and sex groups. Overall rate for all ages and both sexes was reduced 26.3 % ($p<0.01$) (*Table II*). Included

in the home accidents were 32 fractures (N=12 in period 1 and N=20 in period 2) that were sustained from falls on an icy surface in the driveway, yard or on outdoor stairs. A 9.5 % reduction of rates was found for this subgroup of fractures (p=0.94).

Traffic area in winter

For males below 80 years a 48.7 % fracture rate reduction was observed (p=0.045). A 23.4 % increase however, was found for females (p=0.41). The overall rate for all ages and both sexes was reduced 12.5 % (p=0.49) (*Table III*).

Nursing homes

The overall fracture rate for all ages and both sexes increased 15.1 % from period 1 to period 2 (p=0.72). In no age or sex-group were the rate changes significant (data not shown).

Changes in short-term hospital costs for Harstad residents related to the intervention against fall-fractures in private homes

A rate reduction was observed from baseline to the intervention period for admissions (16.1%), hospital bed-day consumption (16.7 %) and operations (35.1%) (*Table IV*).

DISCUSSION

Private homes

The observed significant reduction of fall fractures in Harstad homes was consistent with the intervention

targeting physical environment improvement, education and information about fall accidents and fracture risk reduction. The marked reduction of fracture rates in women 65-79 years old living in their homes was also consistent with recent findings from a similar Danish intervention study[25].

Traffic area in winter

The significant fall-fracture rate reduction for males 65-79 years old in traffic areas contrasted with the non-significant increase for females. An explanation could be greater male than female compliance with the recommended use of safe foot-wear. A recent study assessed the attitudes toward the use of fall-safe sturdy shoes. It was found that foot problems, expense, style and lack of knowledge about their importance were barriers to safety shoe use[41]. Shoe style may be less important to males than females. Another possibility could be changes in exposure e.g. if males went shopping more by automobile and less on foot in period 2. Unfortunately, no resources or data exist for the assessment of compliance with different types of safety recommendations or for assessing sex differences in exposure. Municipal spending (adjusted for inflation) for removal of ice and snow, sanding and salting did not increase from period 1 to period 2 in spite of the recommendations from the injury prevention group.

Nursing homes

Fracture rates increased in nursing homes, however not significantly. This may reflect the difficulties inherent in a population of ageing elders. The possibility exists that the fracture rates could have increased more *without* the interventions. The problem of frequent accidental injury in the Harstad nursing homes has recently been addressed in the IPG. From the literature we know that the greatest number of falls in nursing homes and rehabilitation hospitals occur on the day shift when activity is at its peak[42]. A policy of reducing falls through inactivity seems unacceptable. A promising intervention for nursing-home residents is the use of external hip protectors[26].

Has the intervention been effective?

Significant decreases in fall-fracture rates were observed in homes and in men 65-79 years old in traffic areas in winter. These decreases in fall-fractures occurred in a population of ageing elderlies, suggesting that major parts of the interventions have been effective. The principal threats to the validity of this statement are registration effect and national and local historic trends[30].

Registration effect

If registration loss at emergency visits increased during the study, this could account for the fracture rate decrease. To counteract registration loss, we established emergency room routines to ensure that the injury form was

filled in for every treated patient. Random checks by the author or other surgeons in the staff showed good compliance with the registration instructions. Motivation strategies for emergency-room personnel and interns were implemented. The injury data base (IDB) and the hospital data (medical records) were compared to ensure that the admitted cases were not omitted in the IDB.

National historic trend

Although epidemiological studies in Norway have shown increasing age-specific incidence of hip-fractures[1-3], the national historic trend for overall fracture rates in the aged is unknown as complete national fracture data are not available. The Trondheim data are therefore used as indication of this trend. The choice of Trondheim was not ideal, this city being more than 6 times larger than Harstad. Variations in fracture rates might occur in a city for reasons that the investigator can not control for. The significant overall fracture rate increase in Trondheim from period 1 to period 2 contrasts to the decrease in Harstad and stability in the 6 municipalities (*Table I*). This suggests that the national historic trend does not explain the fall-fracture rate reductions observed in Harstad.

Local trend

The stable fracture rates in the 6 rural municipalities close to Harstad can be explained by geography and/or diffusion of intervention. Finsen and Benum showed that

secular increases in hip fracture rates were less in rural compared to urban areas of central Norway[2]. Falch et al. reported that, hip fracture rates in rural Sogn og Fjordane was only 65 % of the rates in urban Oslo[3] in 1988/89.

Intervention diffusion might have occurred as a result of (i) intervention items occurring in media (local newspaper and radio), (ii) the communication between health service professionals, organizations and individuals in Harstad and in the 6 municipalities and (iii) the increased availability of safety equipment for out-of-town aged shopping in Harstad. Intervention diffusion may have biased the trend in the 6 municipalities downwards. This suggests that local trend is not a threat to validity.

Confounders

Generally speaking the age distribution in most industrialized countries are tending toward older elderlies. If this development differed markedly in the three populations described in this study, a confounding effect could occur. The mean age variations through the periods were, however, practically identical (data not shown) in these populations. Data about (i) the proportion of Harstad seniors living at home in the two periods (data not shown) and (ii) weather observations[27] showed that these factors were unlikely to explain the observed decrease of fracture rates in Harstad.

Other confounders could be differences between Harstad and Trondheim regarding changes in medicine prescription patterns, general health condition or the proportion of the

population living alone. No data were available for investigating these confounders. However, the likelihood of differential changes between the two cities is regarded as very low.

Conclusion

Registration effect and historic trend are not considered to be probable explanations for the fall in fracture rates observed in the Harstad population. The present study suggests that the community-based intervention has been instrumental in the significant reduction of fall-fractures in the aged living in private homes. The reduction of male fracture rates from falls on snow and ice may suggest a preventive effect of promoting the out-door use of safe foot-wear.

Even if significant fracture rate reductions were not observed in some areas (nursing homes, females in traffic area), the present study indicates that substantial parts of a prevention programme targeting fall-fractures in the aged, can be effective when based upon sound local epidemiological studies and community-based intervention.

Fractures in the aged are very expensive to society. The observed 16.1 % reduction of admission rates for fall-fractures in homes, indicates a considerable potential for hospital care savings. These results reinforce the need for the investment of resources in hospital based injury registration programmes as well as investment in local community-based fracture prevention programmes for the aged.

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Table I Comparison of overall fracture rates (per 1000 person years) for all injury mechanisms and all places of occurrence in residents 65+ years of Harstad, the 6 municipalities and Trondheim by study period, sex and age-group†. The study started 1 July 1985. Period 1 (3 years) was "baseline". Period 2 (5 years) contained community-based prevention of accidental fall-fractures in Harstad.

	Age group	Period 1 N	Person years	Rate	Relative risk	Period 2 N	Person years	Rate	Relative risk	χ^2	p value
Harstad											
Fe-	65-79	132	3750	35.20	1.00	227	6710	33.83	0.96	0.09	0.764
males	80+	77	1071	71.90	1.00	137	1975	69.37	0.97	0.03	0.866
Ma-	65-79	57	2844	20.04	1.00	74	5281	14.01	0.70	3.73	0.053
les	80+	18	455	39.56	1.00	31	884	35.07	0.89	0.06	0.806
Total	65+	284	8120	34.98	1.00	469	14850	31.58	0.91*	1.66*	0.197
Six municipalities											
Fe-	65-79	78	3546	22.00	1.00	136	5825	23.35	1.06	0.12	0.731
males	80+	78	1227	63.57	1.00	122	2257	54.05	0.86	1.02	0.312
Ma-	65-79	30	2927	10.25	1.00	54	4703	11.48	1.12	0.15	0.701
les	80+	19	759	25.03	1.00	19	1244	15.27	0.62	1.83	0.176
Total	65+	205	8459	23.23	1.00	331	14029	23.59	0.95*	0.30*	0.582
Trondheim											
Fe-	65-79	811	26597	30.49	1.00	1835	45889	39.99	1.30	39.96	0.000
males	80+	404	8642	46.75	1.00	945	15258	61.93	1.31	21.16	0.000
Ma-	65-79	289	19388	14.91	1.00	678	33931	19.98	1.33	16.96	0.000
les	80+	105	3187	32.95	1.00	275	6019	45.69	1.37	7.59	0.006
Total	65+	1609	57814	27.83	1.00	3733	101097	36.92	1.31*	86.31*	0.000

† Comparisons were made for overall fracture rates because of missing in the Trondheim data (period 2) for the variables injury mechanism (30 %), and place of occurrence (33 %)

* Mantel Haenszel weighted relative risk and summary χ^2

Table II Fracture rates from falls in private homes† (per 1000 person years) in Harstad residents 65+ years old by study period, sex and age-group. The study started 1 July 1985. Period 1 (3 years) was "baseline". Period 2 (5 years) contained community-based prevention of accidental fall-fractures.

		Period 1			Period 2				
	Age group	N	Rate	Relative risk	N	Rate	Relative risk	χ^2	p value
Females	65-79	78	20.8	1.00	99	14.75	0.71	4.75	0.029
	80+	48	44.82	1.00	68	34.43	0.78	1.63	0.202
Males	65-79	18	6.33	1.00	27	5.11	0.81	0.30	0.586
	80+	8	17.58	1.00	11	12.44	0.71	0.25	0.618
Total	65+	152	18.72	1.00	205	13.80	0.74*	7.50*	0.006

† Includes immediate surroundings, e.g. garage and yard

* Mantel Haenszel weighted relative risk and summary χ^2

Table III Fracture rates (per 1000 person years) for Harstad residents 65+ years old from falls in traffic area on snow and ice. Traffic accidents are excluded. Data is shown for the 7 snow months by study period, sex and age-group. The study started 1 July 1985. Period 1 (3years) was "baseline". Period 2 (5 years) contained community-based prevention of accidental fall-fractures.

		Period 1			Period 2				
	Age group	N	Rate	Relative risk	N	Rate	Relative risk	χ^2	p value
Females	65-79	29	13.25	1.0	64	16.35	1.23	0.68	0.409
	80+	7	11.20	1.0	9	7.81	0.70	0.20	0.651
Males	65-79	21	12.66	1.0	20	6.49	0.52	4.01	0.045
	80+	3	11.32	1.0	3	5.81	0.52	0.16	0.41†
Total	65+	60	12.67	1.0	96	11.08	0.88*	0.48*	0.487

† Fisher exact two-tailed test

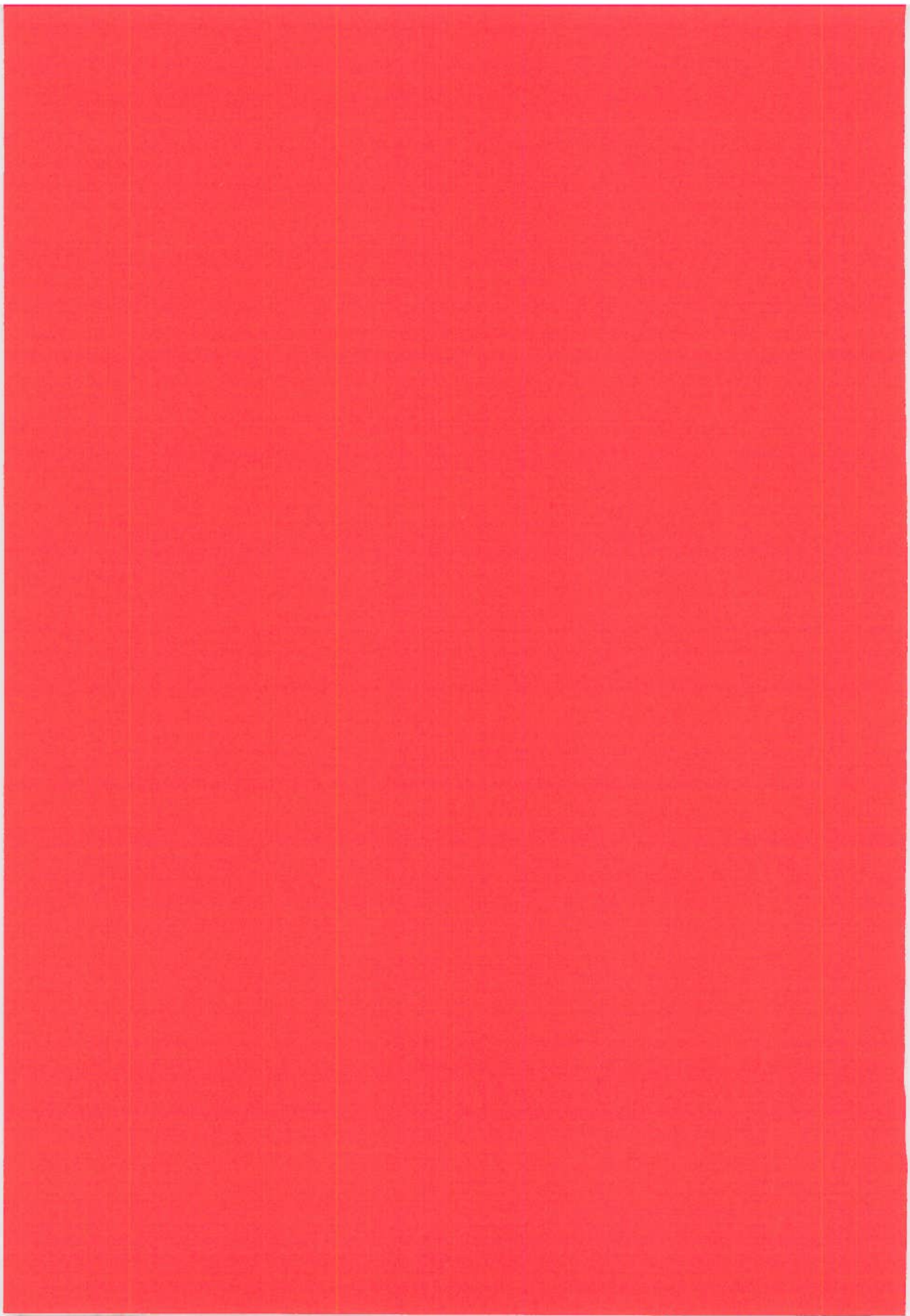
* Mantel Haenszel weighted relative risk and summary χ^2

Table IV Short-term hospital cost of treatment of accidental fall-fractures sustained in homes for persons 65+ years of age. Rates for Harstad residents are given for period 1="baseline" (3 years) and period 2=intervention period (per 1000 person years) for admission to hospital, hospitalization bed-day consumption and operations related to the falls.

	Admissions		Hospitaliza-tion bed-days		Operations (primary internal fixation, reoperations, hemi- or total hip prosthesis)	
	N	rate	N	rate	N	rate
All fractures						
Period 1*	73	8.99	2531	312	79	9.7
Period 2**	112	7.54	3855	260	94	6.3
Hip fractures						
Period 1*	44	5.42	1836	226	59	7.3
Period 2**	56	3.77	2470	166	71	4.8

* 3 years from 1 July 1985
** 5 years from 1 July 1988

Paper V



THE HARSTAD INJURY PREVENTION STUDY: THE EPIDEMIOLOGY OF SPORTS INJURIES. AN 8 YEAR STUDY.

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ABSTRACT

Sports injuries account for considerable morbidity and expenditure of resources. This study describes prospective recording of hospital-treated sports injuries occurring in Harstad, Norway (population 22 600) during an 8 year period. 2234 sports injuries accounted for 17.2 % of recorded unintentional injuries. Two out of three injuries occurred in team sports. Soccer accounted for 44.8 % of all sports injuries. Downhill skiing injuries had higher mean score on the abbreviated injury scale than all other sports analysed combined ($p<0.01$).

A prevention programme targeting downhill skiing injuries was evaluated. Post-intervention injury rates for downhill skiing were reduced by 15 % when adjusting for exposure ($p=0.24$). Further observations are needed for assessing the effectiveness of the downhill skiing safety program.

Strategies for future sports injury prevention include community involvement, particularly sports organizations. Local data analysis seem to justify some priorities, e.g. the promotion of helmet use in downhill skiing for young adolescents and prevention of lower limb fractures in male soccer players 15+ years old.

Prospective hospital recording of injuries provides a tool for the design and outcome evaluation of sports injury intervention research. ***Key words*:** Soccer, downhill skiing, sports, injury, prevention.

INTRODUCTION

Sports injuries are an important cause of morbidity in Norway, with incidence ranking next to home injuries[1]. Because of the high incidence, sports injuries in need of hospital treatment require considerable out- and in-patient resources[2-3]. The World Health Organisation has emphasised the importance of injury control (Health for All Year 2000). The goal for Europe is to reduce injury, disability and death from accidents, including sports accidents, by at least 25 per cent[4]. High quality epidemiological data are essential for the planning, development and evaluation of efforts to prevent injuries[5]. For local sports injury prophylaxis the use of national aggregate data is of limited value because different populations seem to have special epidemiological characteristics[2,6-7] and the use of local data is advantageous for selecting targets for injury prophylaxis[8].

Different approaches to prevent sports injuries have been recommended - e.g. promotion of protective equipment use[9], adequate warming-up before competition[10] or the implementation of a routine prophylaxis program before training or games[11]. The latter was reported to be effective for prevention of soccer injuries[11]. A community-based injury prevention study in Sweden reported a significant decrease in overall injury rates, but did not specifically target sports injuries[8]. Although a few studies have described prospective and complete recording of sports injuries in a defined population[2-3], ours is the first prospective study of such a long duration (8 years), including a preventive part.

The aims of this study were to describe the epidemiology of sports injuries occurring in a community during 8 years and to evaluate the outcome of an intervention implemented against injuries occurring in down-hill skiing.

MATERIALS AND METHODS

Study design

The present paper describes the sports injury component of the comprehensive Harstad Injury Prevention Study[12-14]. The city of Harstad has a population of 22 600 and is located 250 km north of the Arctic circle. The study lasted for 8 years. The intervention component (downhill skiing) had a baseline of five years and an intervention period of three years.

Definition: *A sport injury is in this study defined as an unintentional injury occurring during games or physical training in an area specially designed for sport activities e.g. soccer stadiums, gymnasiums, downhill skiing slopes, skijumping installations and skating rinks. Injuries occurring during horseback riding or during non-competitive physical exercise in open air and recreational areas are excluded.*

Data recording

The prospective data recording started 1 July 1985 and lasted for eight years. During this time data on all injured persons treated in the hospital emergency ward were recorded, and

included in an injury data base (IDB). The variables for each case were selected in co-operation with The National Institute of Public Health[1] as part of a national injury surveillance system and followed the Nordic coding system[15].

Variables of the IDB

Demographic data were age, gender and place of residence. Activity type, place of injury, type of sport, product involved and time of injury, day, were recorded. An open-ended question (free text) described the event leading to the injury. This free text contained three distinct parts that are partly consistent with the concepts of precrash, crash and postcrash described by Haddon[16]. Medical variables were injury type, injury mechanism, body part injured and admittance to the hospital. Injury severity was coded according to the abbreviated injury scale (AIS)[17].

Data recording procedure, analysis, validity and reliability

The recorded variables, data recording procedure and measures taken to ensure data validity and reliability of the IDB are described in more detail elsewhere[12-14].

To aid prophylaxis planning, a separate analysis was completed for children (0-14 years) and adolescents/adults (15+ years).

Downhill skiing injury prevention

Harstad municipality has one ski resort (opened in 1985) with ski-lift and slopes for downhill skiing, run by the Harstad Alpine Club. Practically all hospital treated downhill skiing injuries come from this installation. Data from injured skiers recorded during the first years of the present study was analyzed and discussed in the Harstad community Injury Prevention Group (IPG). The function and composition of this group is described elsewhere[12-14]. The data with free texts (victim stories) were sent to the Harstad Alpine Club together with some recommendations for targeting interventions: (i) promotion of increased helmet use and properly fitted boots and bindings (ii) prevention of injuries occurring from collisions with trees and rocks while skiing outside the downhill area, (iii) prevention of injuries resulting from high speed skiers within the area running into objects or other skiers and (iv) prevention of injuries connected with the ski-lift.

Statistics

Because of warmer winters in the intervention period, injury rates for downhill skiing were adjusted for exposure. For the other sports, the incidence rates given were not analysed in regard to duration of exposure to the sporting activity, but were based on population census data. Epi info version 5.01 package was used for analysis[18]. The chi^2 test was used for testing injury rate changes and incidence rate differences[19]. The Kruska-Wallis test was used for comparing means. P values below 0.05 were regarded as significant.

RESULTS

Injury rate variations during the study

Of 12977 unintentional injuries recorded in Harstad residents from 1 July 1985 to 30 June 1993, 2234 (17.2 %) were sports injuries, yielding a mean sports injury rate of 12.5 per 1000 person years. During the study the yearly overall crude sport injury rate was stable (Table 1).

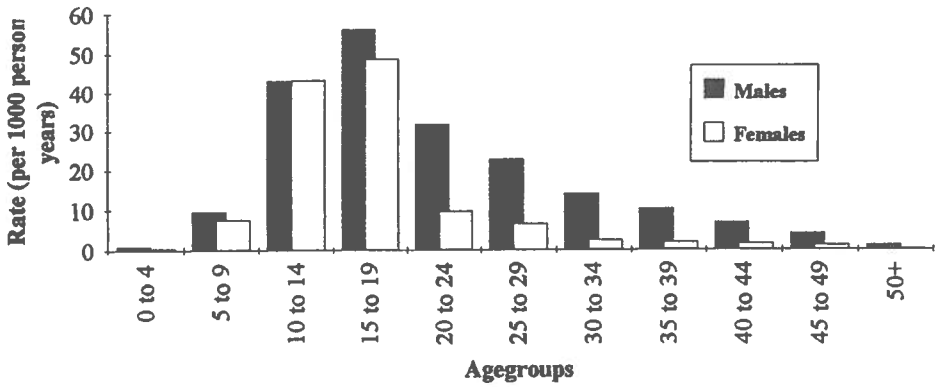
Table 1. Sports injury rates in Harstad residents by study year. From 1 July 1985.

Study year	N	Per cent of study total	Rate (per 1000 pyars)
1	266	11.9	12.1
2	280	12.5	12.7
3	282	12.6	12.7
4	289	12.9	12.9
5	284	12.7	12.7
6	282	12.6	12.6
7	272	12.2	12.0
8	279	12.5	12.3
Total	2234	100.0	12.5

All sports. Age and sex distribution for injury mechanism, injury type and body part injured.

63.4 % of the injured were males who had a higher mean rate (16.0 per 1000 person years, $p<0.01$) and age (21.8 years, $p<0.01$) than females, whose corresponding figures were 9.1 injured per 1000 person years and mean age of 17.2 years. 80.5 % of injuries occurred between 10 and 30 years of age (Fig. 1).

Fig. 1 The Harstad Injury Prevention Study: Age- and sex-specific sport injury rates (N=2234) recorded during 8 years, starting 1 July 1985



Injury mechanism

Falls and trauma from contact with persons or objects accounted for three out of four injuries. The sex distribution of injury mechanisms for two different age groups is shown in Table 2.

Table 2. All sports. Per cent distribution of injury mechanism by sex and age groups

	0-14 years					15+ years				
Injury	Males		Females			Male		Females		
Mechanism	N	%	N	%	p	N	%	N	%	p
Falls	152	46.3	143	45.5		289	26.6	182	36.1	
Contact trauma*	137	41.8	127	40.4		484	44.5	173	34.3	
Acute strain	31	9.5	37	11.8		282	25.9	139	27.6	
Other†	6	1.8	3	1.0		15	1.4	7	1.4	
No information	2	0.6	4	1.3	0.815‡	18	1.7	3	0.6	0.0001‡
Total	328	100.0	314	100.0	-	1088	100.1	504	100.0	-

* Trauma sustained from contact with person or object

† Includes cuts, foreign body and thermal/chemical injury

‡ For a 2x4 table (other and no information analysed combined). Three degrees of freedom.

Injury type

49.6 % of those injured had sprains (partial or total ligament ruptures) or dislocations, 23.3 % had open wounds, excoriations or contusions, 18.4 % had fractures, 2.6 % had concussions or more serious brain injury. Internal injury (other than intracranial) was observed in 0.8 % and 5.5 % had multiple injuries, other injury types or no information. The injury type variations by sex and different age groups are shown in Table 3.

Table 3. All sports. Per cent distribution of injury type by sex and two different age groups

Injury type	0-14 years					15+ years				
	Males		Females			Males		Females		
	N	%	N	%	p	N	%	N	%	p
Sprains or dislocation	108	32.9	146	46.5		547	50.3	306	60.7	
Fractures	87	26.5	60	19.1		198	18.2	66	13.1	
Concussion*	16	4.9	11	3.5		17	1.6	13	2.6	
Internal injury†	1	0.3	2	0.6		12	1.1	2	0.4	
Wounds, contusions	100	30.5	83	26.4		242	22.2	95	18.2	
Multiple, other, no inform.	16	4.9	12	3.8	0.01‡	72	6.6	22	4.4	0.0004
Total	328	100.0	314	100.0		1088	100.0	504	100.	-

* Or more serious brain injury
† Except intracranial
‡ For a 2x5 table (internal injury and multiple, other, no inform. analysed combined). Four degrees of freedom.

Body part injured

As mean for the study, lower extremities were injured in 54.1 %, upper extremities in 29.5 %, head in 10.0 % and other or multiple body parts were injured in 5.9 % of cases. In children, males suffered injuries of the head, thorax, abdomen and spine more frequently than females (data not shown). Data about body part injured was missing in 0.4 % of cases.

Injury distribution and characteristics within sports

Sex variations

Soccer accounted for most injuries, followed by downhill skiing. Males injured while playing soccer represented 36.8 % of the population injured and 9.1 % were female handball players (Table 4).

Table 4. Distribution of injuries by sport and sex

Sport	N	Males* %	p†	% of total
Soccer	1001	82.3	0.00	44.8
Handball	246	17.5	0.00	11.0
Volleyball	155	43.2	n.s.	6.9
Basketball	95	44.2	n.s.	4.3
Downhill	251	64.1	0.00	11.2
Other††	435	56.6	n.s.	19.5
Missing data	51	64.7	n.s.	2.3
Total	2234	-	-	100.0

* Female percentage may be calculated

† For testing sex difference within sport

†† Includes tennis, squash, land hockey, ice hockey, ski jumping, cross-country skiing, scating, body-building, judo, jiu-jitsu, karate, boxing, gymnastics, track and swimming.

Injury type and seriousness according to abbreviated injury scale (AIS)

189 fractures and 499 sprains in soccer accounted for 30.1 % of all injuries. Fractures and concussions were the most frequent injury types in downhill skiing. All but one injury (a downhill skiing injury with AIS 5) had AIS<4. The mean AIS score was higher in downhill skiing than in all other sports analysed combined ($p<0.01$). Little variability was observed between the other sports (Table 5).

Table 5. Distribution of injury type in percent and injury seriousness according to abbreviated injury scale (AIS) within sports.

Sport	Fractures	Ligament ruptures (sprains)	Concussion or more serious brain injury	Other internal or multiple lesions	Wounds and contusions	Other or unknown injury	Mean score	Total
	%	%	%	%	%	%	AIS	N
Soccer	18.9	49.9	1.8	0.8	23.7	5.0	1.175	1001
Handball	12.6	59.8	3.3	0.8	18.7	4.9	1.126	246
Volleyball	9.0	70.3	0.0	1.3	13.5	5.8	1.116	155
Basketball	16.8	67.4	0.0	0.0	11.6	4.3	1.095	95
Downhill	23.9	36.3	5.6	2.4	27.1	4.8	1.363	251
Other*	21.1	40.0	3.7	1.0	29.0	5.2	1.175	435
Missing	17.6	45.1	2.0	5.9	21.6	7.8	1.235	51
Total N	411	1107	57	25	520	114	-	2234

* Includes tennis, squash, land hockey, ice hockey, ski jumping, cross-country skiing, scating, body-building, judo, jiu-jitsu, karate, boxing, gymnastics, track and swimming.

Admitted cases

The variable admitted to hospital was recorded for the 7 last years of the study, during which 5.6 % of the recorded sport injuries lead to admittance (N=112). Soccer accounted for 30.4 % and downhill skiing for 28.6 % of admittances, while 41 % of admitted cases occurred in all other sports combined. 3.3% of recorded females and 7.0 % of males were admitted. Mean age was 24.5 years for males and 21.9 for females. 29.5 % of admitted cases had fractures, 26.8 % had ligament ruptures, wounds, contusions or dislocations, 25.0 % had concussions or more serious neurologic deficit, 1.8 % had internal injury other than intracranial, 3,6 % had multiple injuries and 13.4 % had other injury types.

Intervention. Injury rates for downhill skiing compared to other sports

A 15 % decrease in downhill skiing injury rates was observed between the 5 year baseline period and the 3 year intervention period (adjusted for exposure, p=0.24). Concomitantly the

injury rates were more or less stable in the other sports (Table 6).

Table 6. Injury count and rates per 10 000 person years (in parenthesis) for different sports by study period. Period 1 (5 years) = baseline and Period 2 (3 years) included interventions for downhill skiing.

	Soccer	Handball	Volleyball	Basketball	Downhill	Other	Missing
Period 1	617 (55.6)	146 (13.2)	100 (9.0)	64 (5.8)	179 (16.1)	263 (23.7)	32 (2.9)
Period 2	384 (56.8)	100 (14.8)	55 (8.1)	31 (4.6)	72 (10.6)	172 (25.4)	19 (2.8)
Relative Risk for period 2	1.02	1.12	0.90	0.80	0.85*	1.07	0.97
p value	0.767	0.402	0.599	0.345	0.24*	0.500	0.955

* Adjusted for exposure

The admittance rate for downhill skiing injuries was reduced from 2.8 per 10 000 person years (the last 4 years of baseline) to 1.0 per 10 000 person years (intervention period) (data not shown).

DISCUSSION

The local epidemiology of sports injury

Some of the epidemiological characteristics in our study are similar to other Scandinavian studies describing prospective injury recording, e.g. proportion of sports injuries/all injuries, mean age, female/male ratio and the dominant position of soccer in the injury panorama[3,6]. There are however, some differences in the proportion of different sports injuries, mostly accounted for by geography and local cultural differences. Downhill skiing injuries had the highest frequency of fractures and concussions. This is consistent with a significantly higher AIS score in this sport. Nevertheless, while injuries sustained in downhill skiing were a major problem in our study, they are much less so in the studies from

the flat parts of Sweden[3,6]. Ice hockey, however, accounting for a major part of sport injuries in these Swedish studies, is uncommon in Harstad.

Trends for sport injury rates

The stability of overall sports injury rates observed during an eight year period, may be interpreted as an indication of a reliable and stable hospital injury recording system. This assessment could be biased by (i) an increasing risk exposure due to a population increasingly participating in sports activities, and (ii) a registration loss at the end of the study (registration effect). However, to our knowledge, participation in sports related activities has not been on the rise in Harstad. The possibility of a registration effect has been assessed earlier[12-14] and was found to be an unlikely occurrence. Information for assessing exposure was only available for downhill skiing. Data from the Harstad Alpine Club (personal communication) indicated a lower exposure during the last three years of the study (intervention period) compared to the first five years (baseline). Due to weather conditions, the ski resort had fewer days open per year during the last three years (intervention period) compared to baseline. The relative risk of getting a downhill skiing injury, between the baseline, non-intervention period and the intervention period, when adjusted for the above mentioned exposure difference, was 0.85 [CI's 0.66, 1.10](p=0.24). These figures must be interpreted with caution. Future injury rate calculations based on continuous prospective recordings may help to indicate whether the ongoing downhill safety program is

effective or the calculated 15 % injury rate reduction is due to random variations in accidents.

Prevention strategies

General strategic planning should take into consideration the major epidemiological findings in this study e.g. age and sex distribution, main injury mechanisms, injury type and body part injured.

School involvement

Given that sports injuries occur most frequently during the second decade of life (Fig. 1), it seems reasonable to involve schools more in prophylaxis e.g. information to individuals, parents and coaches. The latter are often recruited from parents or teachers.

Protective equipment

Nearly half of children were injured in falls. This could indicate a need for more sturdy footwear for children engaged in sports. Male children suffered head injuries and concussions most frequently (Table 3). Out of 31 head injuries observed in downhill skiing, 17 (55 %) occurred in 11-15 year olds (data not shown). This could indicate resistance in Harstad to helmet use in this age group. Such resistance has been reported by others[9]. A Swedish study of injuries in downhill skiing reported a distinct decline in helmet use from 66 % in 9-11 years old children to 21 % in 12-14 year olds[9]. Strategies for achieving increased helmet use in this age group must be given priority. Mandatory helmet use should be considered.

Team sports

Team sports accounted for two out of three injuries, soccer injuries being the most frequent (Table 4). Obviously the prevention of team sport injuries in general and soccer injuries in particular must be given high priority. Ekstrand et. al have shown that a prevention programme can reduce soccer injuries by as much as 75 % (including overuse injuries)[11]. The programme is made up of seven different parts and can be used in most team sports: Correction of training, protection by correct equipment, prophylactic ankle taping, controlled rehabilitation after injury, exclusion of players with knee instability, information to coaches and players, correction and supervision by doctors and physiotherapists.

Out of 1001 soccer injuries in our study, 63.8 % occurred in the lower extremities (data not shown). Fractures are costly to patients and the health services in terms of suffering, debility and expenditure of hospital resources. Accordingly this injury type should be a high priority target in planning prophylaxis. Fractures of the lower extremities occurring during tackles in soccer can be prevented by the use of proper protective equipment (shin guards)[11]. Our data showed that males 15+ years old suffered 53 out of 71 fractures of lower extremities occurring in soccer, identifying them as an important subgroup for intervention. Strategic considerations for prophylaxis should include checks on compliance with mandated use of shin guards and adequate referee reaction to rule violations.

According to the principle adapted by the Harstad Injury Prevention program, effective prophylaxis may be initiated by the injury prevention group (IPG) and planned/implemented in co-operation with relevant organisations[12-14,20], e.g. the local branches of the Norwegian associations for the team sports (soccer, handball, volleyball, basketball), municipal authorities and the health services.

Individual sports

The most important individual sport in our study is downhill skiing. A renewed effort for further co-operation with the Harstad Alpine Club is needed in promoting the observation of safety regulations, use of correct bindings and protective equipment and supervised and directed skill training. This model for prophylactic work can be used in most individual sports.

CONCLUSIONS

1. Continuous prospective hospital recording of sports injuries in a community is feasible and provides a tool for evaluating the outcome of sports injury prevention programmes.
2. Local sports injury prophylaxis may be improved by using local epidemiological knowledge in community-based interventions.
3. Although a post-intervention 15 % reduction was observed in downhill skiing injury rates (adjusted for exposure), the

present study has not presented conclusive evidence of an effective intervention against downhill skiing injuries in Harstad. A basis is provided for designing an injury prevention program covering most sports.

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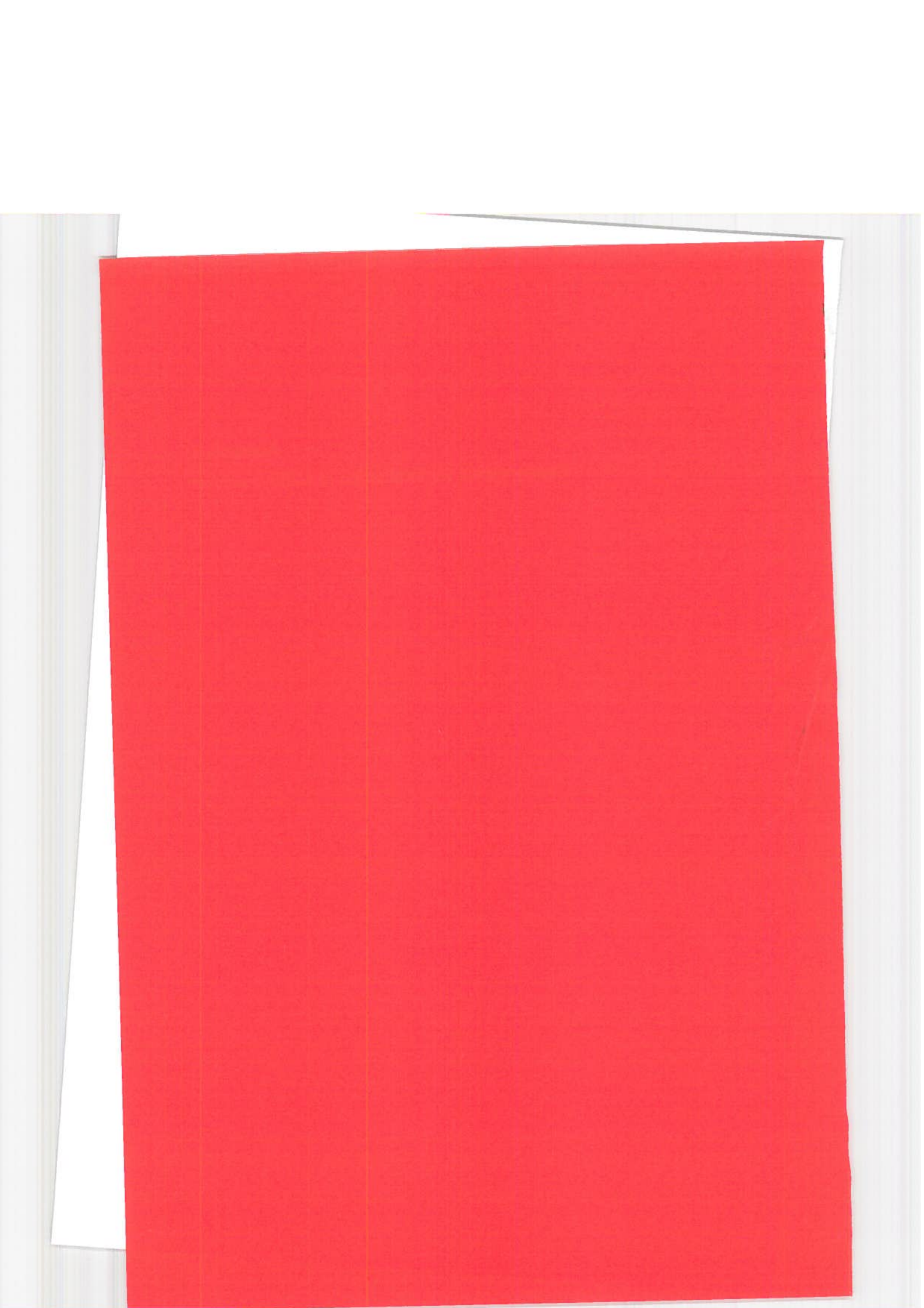
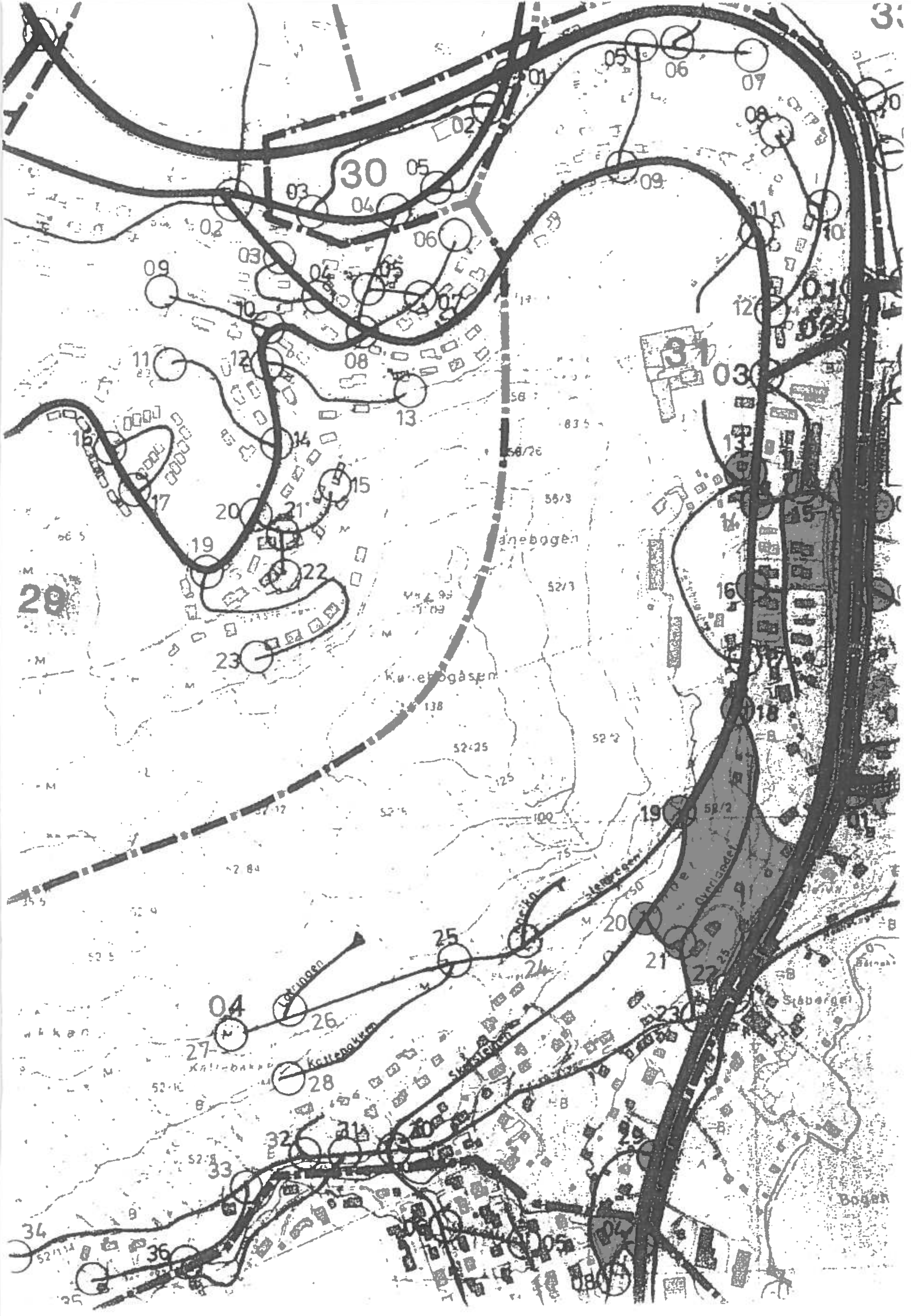
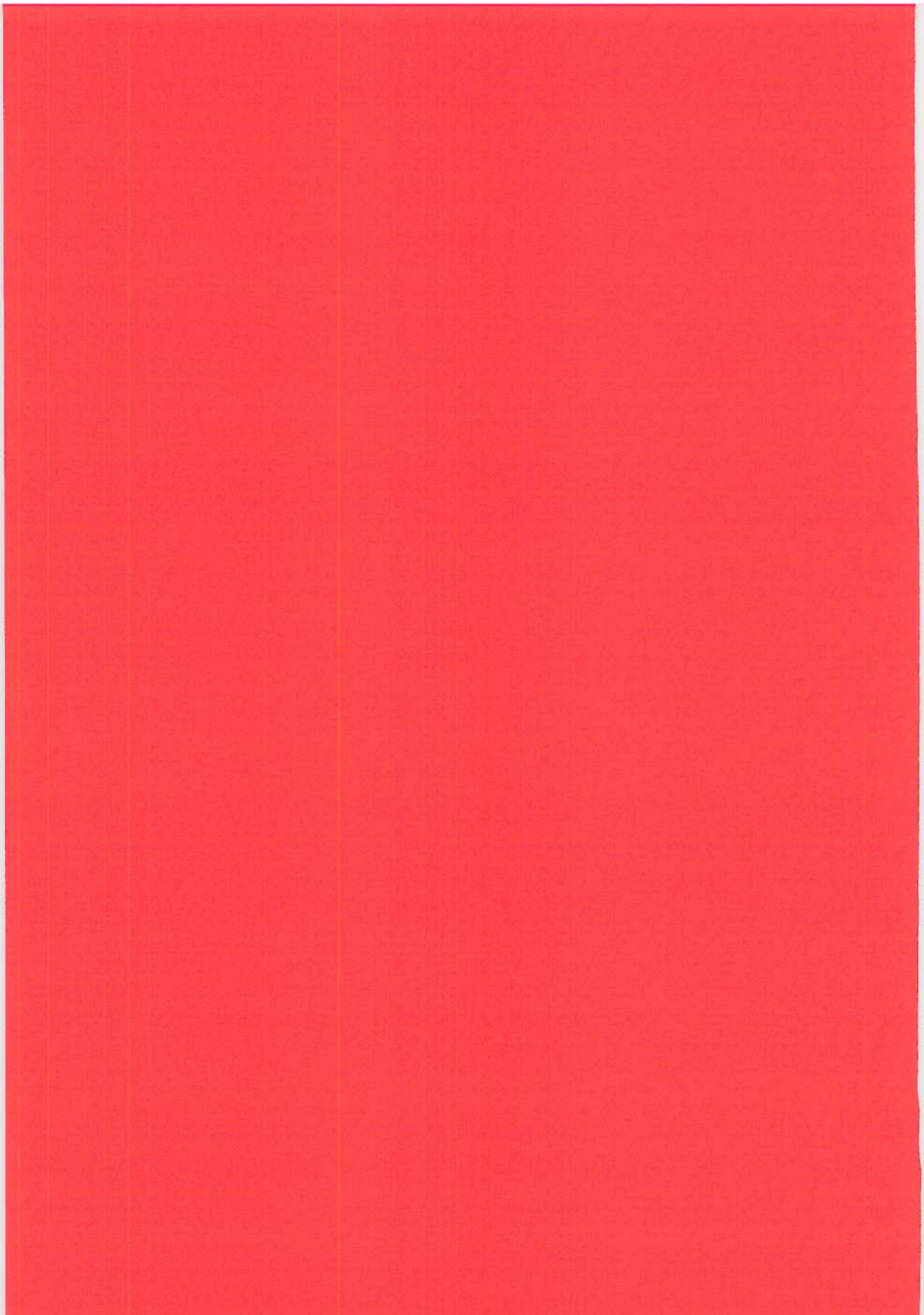




30
31
29
04

Appendix 2

Injury registration form



SKADEJOURNAL (Opplysningene skal kun gjelde for den person som er skadet)

Fylles ut av pasient (den skadede), pårørende eller mottagende personell

Navn: Kjønn: K ☐ M ☐ Født: Dag | Mnd. | År

Postadresse: Bostedkommune:

Arbeidsgiver: Tlf. arb.: Tlf. priv.:

Hvor skjedde ulykken?
Sted/rom/adresse så nøyaktig som mulig. Kommune:

Når skjedde skaden? Dag | Mnd. | År | (kl. 01–24) Kl.: ..... | Er stedet gårdsbruk? ☐ Ja ☐ Nei

Skjedde skaden i løpet av:
☐ Reise til/fra arbeid ☐ Reise til/fra skole/utdanning ☐ Annet
☐ Inntektsgivende arbeid ☐ Utdanning/opplæring .....

Dersom du drev idrett trening, mosjon, var det:
☐ Skoleidrett ☐ Organisert idrett, trening, mosjon
☐ Bedriftsidrett ☐ Uorganisert idrett, trening, mosjon

Dersom ulykken skjedde på gate, vei, var du:
☐ Fotgjenger
☐ Fører
☐ Pass. forsete
☐ Pass. baksete
☐ Pass. i buss
☐ Annet, angi hva

Hva slags fremkomstmiddel brukte du?
☐ Til fots
☐ Sykkel
☐ Moped
☐ Motorsykkel
☐ Personbil
☐ Varebil
☐ Lastebil
☐ Buss
☐ Traktor
☐ Annet, angi hva:

Kolliderte du med annen person eller kjøretøy?
☐ Ingen motpart
☐ Fotgjenger
☐ Sykkel
☐ Moped
☐ Motorsykkel
☐ Personbil
☐ Varebil
☐ Lastebil
☐ Buss
☐ Traktor
☐ Annet, angi hva:

Beskriv hendelsen så detaljert som mulig.

Hva holdt du på med?
(Aktivitet – produkt/ytrefaktor)

Hva gikk galt?
(Ulykkesmekanisme – ulykkesutløsende faktor/produkt)

Hva skadet du deg på?
(Skademekanisme – skadevoldende produkt/ytrefaktor)

Fylles ut av legen

Diagnose:

Kontaktårsak: ☐ Ulykke ☐ Slagsmål, vold ☐ Villet egenskade ☐ Uoppgitt

Skadealvor ifølge AIS-skalaen: (se instruks på baksiden)
☐ 1 liten ☐ 2 moderat ☐ 3 alvorlig ☐ 4 meget alvorlig ☐ 5 kritisk ☐ 6 dødlig

Innlegges i sykehus: ☐ Ja ☐ Nei

Dato Legens underskrift

Takk for hjelpen

Steenberg Grafisk, Drammen - 1/95

Gradering av skadealvor

AIS-skalaen (Abbreviated Injury Scale) klassifiserer skader ut fra trussel mot livets bestående. Skalaen brukes internasjonalt og har spesielt bred innpass i trafikkmedisin. Forgiftninger finnes ikke i AIS-skalaen, men er her tatt med fordelt på de enkelte kategorier etter skjønn.

1. Liten skade: Combustio 1° + 2° til 10%. Cerebrale skader uten bevisstløshet. Forgiftning som ikke forårsaket behandling. Tannskader. Mindre kutt og kontusjoner. Distorsjoner og frakturer i fingre og tær.

2. Moderat skade: Combustio 3° 1 – 5%. Cerebrale skader med bevisstløshet < 15 min. Forgiftning behandlet med tømming av magesekk og observasjon uten regulær innleggelse. Kutt og laserasjoner < 10 cm. Ikke-disloserte frakturer av lange knokler, bekken og kranium. Knusing av fingre og tær.

3. Alvorlig skade: Combustio 3° 5 – 30%. Cerebrale skader inkl. forgiftninger med bevisstløshet > 15 min og amnesi < 3 timer med innleggelse. Kutt og lasersjoner > 10 cm. Multiple costafrakturer. Pneumothorax. Luksasjon av større ledd. Disloserte frakturer av lange knokler. Nerve- eller karskade i ekstremitetene.

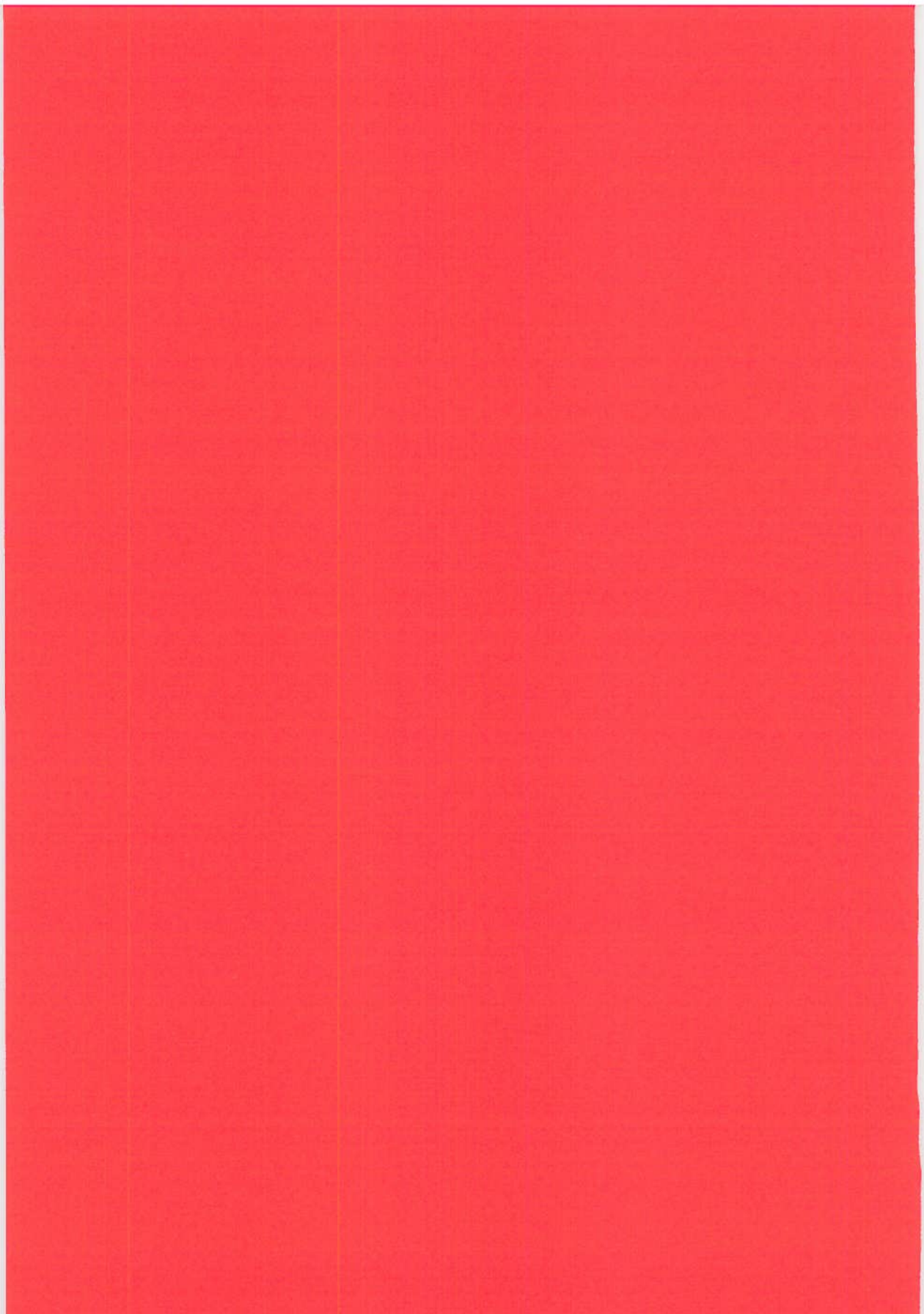
4. Meget alvorlig skade: Combustio 3° 30 – 40%. Cerebrale skader inkl. forgiftninger med bevisstløshet > 15 min og amnesi > 3 timer. Større og multiple kutt og laserasjoner. Flail chest. Multiple eller åpne frakturer. Traumatisk amputasjon av ekstremiteter.

5. Kritisk skade: Combustio 3° 40 – 80%. Cerebrale skader inkl. forgiftninger med bevisstløshet > 24 timer. Intrakraniell blødning. Columnaskader med kvadriplegi. Større thoraxskader. Multiple åpne ekstremitetsfrakturer.

6. Dødlig skade: Maksimal skade som sannsynligvis ikke overleves.

Appendix 3

Traffic injury report



HARSTAD SYKEHUS

Skaderegistreringen kir.avd.

Kvartalsrapport HSSR

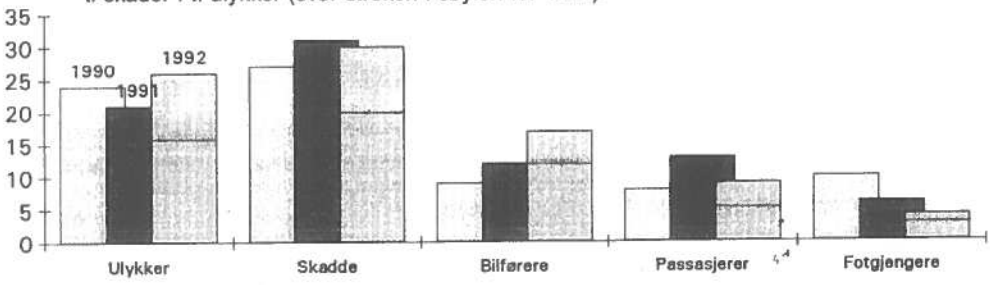
1. kvartal 1992

Trafikkskade-rapport nr. 13

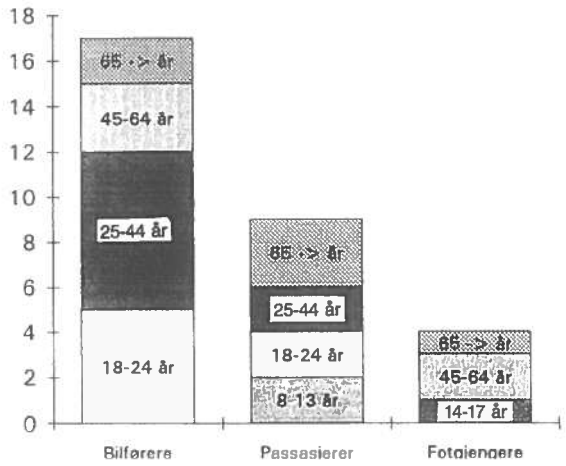
Harstad kommune
01.01.92 - 31.03.92

Sammenligning 1. kvartal 3 siste år

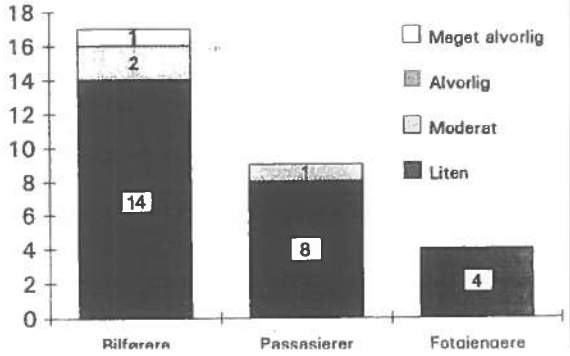
I registreringen for 1992 er det for første gang tatt med skader fra legevakten – dette er ti skader i ti ulykker (over streken i søylen for 1992).



Skader fordelt på alder



Alvorlighetsgrad



TRAFIKKSKADDE til HARSTAD SYKEHUS 1. kvartal 1992

ULYKKESBESKRIVELSER

1. **03.01.92 kl 1015**
RV 83 mellom Breivika og Holtet, 41------

Bilfører, 43 år gammel dame, kolliderte med motgående bil som fikk sleng på tilhenger. Hadde sikkerhetsbelte. Skadet brystet, liten skade.

2. **10.01.92 kl 1500**
Gangsås, bakketopp overf. Teknima, 35-01-03

Bilfører, 40 år gammel mann, kolliderte med møtende lastebil etter at lastebilen først var borti en annen forangående bil. Kutt i hodebunnen, moderat skade.

3. **14.01.92 kl 0845**
Seljestadveien før Domus, 21-01-00

Dame 28 år, bilfører, fikk sleng og skled sidelengs rett inn i rekkverket. Fikk nakkesleng, liten skade.

4. **16.01.92 kl 1905**
Kilhusveien, 49-02-03

Bilfører, 18 års gutt, kolliderte med traktor. Snødrev, dårlig sikt. Skadet albuen, liten skade.

Passasjer i samme bil, en 20 år gammel gutt, fikk lett hjernerystelse.

5. **16.01.92 kl 1645**
RV 83, Nordvikmyra, 46-02---

Kjedekollisjon, 3 biler involvert:

En 69 år gammel mann, bilfører, ventet på å svinge til venstre, tett snødrev. Ble påkjørt bakfra. Nakkeskade, moderat skade.

En 20 års gutt, bilfører, sto i ro med bilen, påkjørt bakfra og traff bilen foran. Nakkesleng, liten skade.

Dame, 38 år, bilfører, kom i stor fart. Dårlig sikt. Kjørte på bilen foran. Nakkesleng, liten skade.

6. **22.01.92 kl 1615**
Stangneskrysset, 31-01-00

Mann 45 år, bilfører, stoppet for gult lys, påkjørt bakfra av trailer. Nakkesleng, liten skade

7. **05.02.92 kl 0810**
Holtet, 41-11-29

Bilfører, jente 22 år, stoppet for en buss, påkjørt bakfra. Nakkesleng, liten skade.

Forsetepassasjer, gutt 20 år, også nakkesleng. Liten skade.

8. **06.02.92 kl 0700**
Ruggevika, 42-02-00

En 71 år gammel mann, bilfører, truffet av trailer da han kjørte ut på hovedveien. Meget alvorlig hodeskade.

9. **15.02.92 kl 0315**
Melvik, 46-03-05

Bilfører, en 24 år gammel mann, kjørte i autovernet, tippet rundt. Liten ryggskade og skrubbsår.

10. **16.03.92 kl 1400**
Mølnåstunnellen, 43-01-02

En 35 år gammel mann, bilfører, kom i 70-80 km/t inn i tunnellen, skled og traff veggen, liten hodeskade.

11. **02.03.92 kl 2215**
Harstadgårdsbakken/Marineveien, 06-07-00

En 25 år gammel mann, forsetepassasjer, fikk slag mot ryggen under en kollisjon. Liten skade.

12. **26.03.92 kl 1245**
Harstadgårdsbakken, 06-04---

Dame 76 år satt i forsetet på bil som kolliderte med annen bil. Trykk mot brystet, liten skade.

13. **21.01.92 kl 1415**
Kryss Steinveien, 31-11-00

En 12 år gammel gutt satt foran på spark. Bil traff mot legg. Liten skade.

14. **14.02.92 kl 1345**
Storgata, 04-02-00

Dame 79 år gikk over gata i gangfelt, bilfører så henne, men klarte ikke å stoppe. Landet på panseret og falt i gata. Liten skade.

15. **26.02.92 kl 1145**
Kryss Eriksgt./Hans Egedesgt., 05-02-00

En 17 år gammel gutt som gikk på fortauet ble påkjørt av en bil som svingte unna en annen bil. Liten leggskade.

16. **27.03.92 kl 1400**
Strandgata, 02-08-00

En dame 55 år, ble påkjørt av personbil i gangfelt. Skadet kne, liten skade.

TRAFIKKSKADDE til HARSTAD KOMM. LEGEVAKT/PRIMÆRLEGER 1. kvartal 1992

ULYKKESBESKRIVELSER

1. **15.01.92 kl 1600**
Autoveien, 30-02-03

Dame 56 år, bilfører, påkjørt bakfra da hun bremset for brøytebil. Nakkeskade, liten skade.

2. **28.01.92 kl 0945**
Kryss RV 83/Harstadbotn, 21-11-00

Jente 22 år, bilfører, kjørte på RV 83 og ble påkjørt av en som ikke overholdt vikeplikten. Liten nakke-/ryggskade.

3. **31.01.92 kl 2030**
Kryss Strandgata/Sverresgt. 02-04-00

En kvinnelig bilfører, 25 år, stoppet for fotgjenger, påkjørt bakfra. Liten nakkeskade.

4. **05.02.92 kl 1410**
Mølnåstunnellen, 43-01-02

Bilfører, 46 år gammel mann, sto stille med bilen ved tunnellen da det var sterk vind. Påkjørt bakfra. Nakkesleng, liten skade.

5. **06.02.92 kl 1715**
Kryss Harstadbotn/RV 83, 21-11-00

Bilfører, en 40 år gammel kvinne, påkjørt bakfra. Ventet på å kjøre ut på hovedveien. Liten nakkeskade.

6 **07.01.92 kl 1130**
Langneskrysset, 29-02-00

Forsetepassasjer, dame 68 år. Kollisjon to biler. Skadet ribbein, moderat skade.

7. **17.01.92 kl 1435**
Kryss St.Olavsgt./Sykehusstien, 16-01-00

Mann 29 år, forsetepassasjer, påkjørt av bil i et kryss. Nakkeskade, liten skade.

8. **20.01.92 kl 2010**
Breivika, 42-20-21

Dame 83 år, forsetepassasjer, kollisjon med møtende bil. Liten brystskade.

9. **04.02.92 kl 2045**
Kryss Skolegt./Hålogalandsgt., 11-12-00

En gutt 12 år satt i forsetet, stoppet for rødt lys, påkjørt bakfra. Nakkesleng, liten skade.

10. **26.01.92 kl 1230**
Kryss Grønnlivn/Nye Stangnesveien, 37-03-00

Dame 48 år, fotgjenger, truffet av bil på svært glatt føre. Bilfører mistet styringen på bilen. Muskelskade lår, liten skade.

KOMMENTAR TIL TRAFIKKSKADERAPPORT NR. 13

For første gang kan skaderegistreringen sende denne rapporten til alle husstander i Harstad kommune. Vi takker Uni-Storebrand for at de finansierer trykking og utsending av rapporten i en toårsperiode. Hensikten med denne rapporten er å forebygge trafikkskader.

Noen tall: I 1986 behandlet Harstad sykehus 144 trafikkskadde i Harstad kommune. I 1991 behandlet vi 115. "Dette er jo en pen reduksjon", kan noen si. Dessverre er det slik at de virkelig alvorlige skadene og dødsulykkene fortsatt kommer. Vi har et felles ansvar for å prøve å forhindre trafikkulykker, spesielt de alvorlige som dreper eller lemlester for resten av livet. Fra 01.07.85 til og med dødsulykken i mai i år, har 16 personer mistet livet i trafikkulykker i Harstad kommune.

Hva kan den enkelte Harstadværing gjøre for å hindre trafikkulykker?

Arbeide i skolekretser eller velforeninger:
Som det vil fremgå av denne rapporten er hver enkelt trafikkulykke beskrevet med angivelse av ulykkessted. Dette gir anledning til engasjement i de enkelte skolekretser for et sikrere trafikkmiljø. Hver ulykke er stedsfestet med 6 tall etter et system utarbeidet ved trafikkavdelingen Harstad kommune. Disse tallene angir veikrysset eller strekningen der skaden skjedde. Hver skolekrets eller velforening kan få utlevert kartverk ved henvendelse til Harstad kommunes trafikkavdeling. Skole og foreldre i fellesskap kan på denne måten holde rede på trafikkulykkene i deres krets, og kanskje gjøre noe med farlige strekninger og kryss. Kanskje en gang- og sykkelvei må bygges?

Ta opp trafikkskader som et tema i familien:
I Harstad er det 9337 husstander, og hvert år behandles ca. 120 skadde. Hvis dette nivået på skader holder seg i 20 år, vil ca. 2400 skader ha oppstått, og ca. hver fjerde husstand vil få en slik skadesituasjon nært innpå livet. Det er ingen hemmelighet at unge mannlige bilførere i Harstad (som i resten av landet) har størst risiko for å skade seg selv eller bli innblandet i en ulykke der andre skades. Den tragedien som rammer ulykkesofrene og deres familier er godt belyst i dag. Dessverre gis det for lite hjelp til den som har vært bilfører og som kanskje uforskyldt blir psykisk merket for livet.

Alkohol og piller: I en undersøkelse har man funnet at ca. en tredjedel av drepte bilførere hadde for høy promille. Erstatningssummen fra forsikringsselskapet kan nektes utbetalt dersom den skadde passasjeren visste at føreren hadde nytt alkohol eller brukt piller eller andre rusmidler. Det samme kan skje dersom kjøretøyets forfatning åpenbart ikke er forskriftsmessig. Hvor mange unge er det som tør motstå presset og nekter å sitte på dersom farten blir for stor eller føreren er rusa? Hvor mange familier har snakket om disse emnene, og hvor mange unge har fått anledning til å skaffe seg holdninger til problemet?

Ulykkespunkter: Det er mange ting vi ikke vet om hvorfor trafikkulykker oppstår spesielle steder. Det er også store tilfeldige variasjoner som jevner seg ut over tid. Imidlertid har det vist seg at enkelte ulykkespunkter fins selv om de fysiske forutsetninger synes å være OK. Et slikt eksempel var Stangneskrysset. Der hadde vi på to år 17 personskader før lyskrysset ble installert. Etterpå har vi registrert EN skade i krysset i løpet av 1 1/2 år. Dette var en typisk whip-lash skade som lett kan oppstå i lyskryss når avstanden til bilen foran ikke holdes stor nok.

Andre ulykkessteder og strekninger er registrert. Området rundt Mølnåsen med tunnellen viser opphopning. Det samme gjelder Vollstad. Disse to stedene kunne man overveie å overvåke med automatisk radarkontroll, som viser seg å ha en bra farts- og dermed kanskje ulykkeshindrende effekt. Bedre lys i tunnellen kunne kanskje hjelpe.

Bruk av sykkelhjelm: På fire og et halvt år registrerte vi 252 skadede syklister. I 1989 ble det solgt ca. 350.000 sykkelhjelmer i Norge, mange også i Harstad. Det er vist at hjelm beskytter mot hodeskader når ulykka er ute. I Harstad fikk vi ingen nedgang i antall hodeskader som tydet på vesentlig økt hjelmbruk. Det er derfor på sin plass at voksne går foran med et godt eksempel og bruker hjelm når de sykler. Hjelmbruken bør øke hos de eldre barna fordi de ofte sykler på offentlig vei og lengre strekninger enn små barn. Husk at hjelmen kan bety forskjellen mellom alvorlig hjerneskade eller ei.

Personvern: Denne trafikkskaderapporten er godkjent av datatilsynet, men vi er interessert i kritikk i alle former dersom noen føler at rapporten burde være annerledes. Eventuelle kommentarer sendes til Skaderegistreringen, Harstad Sykehus.

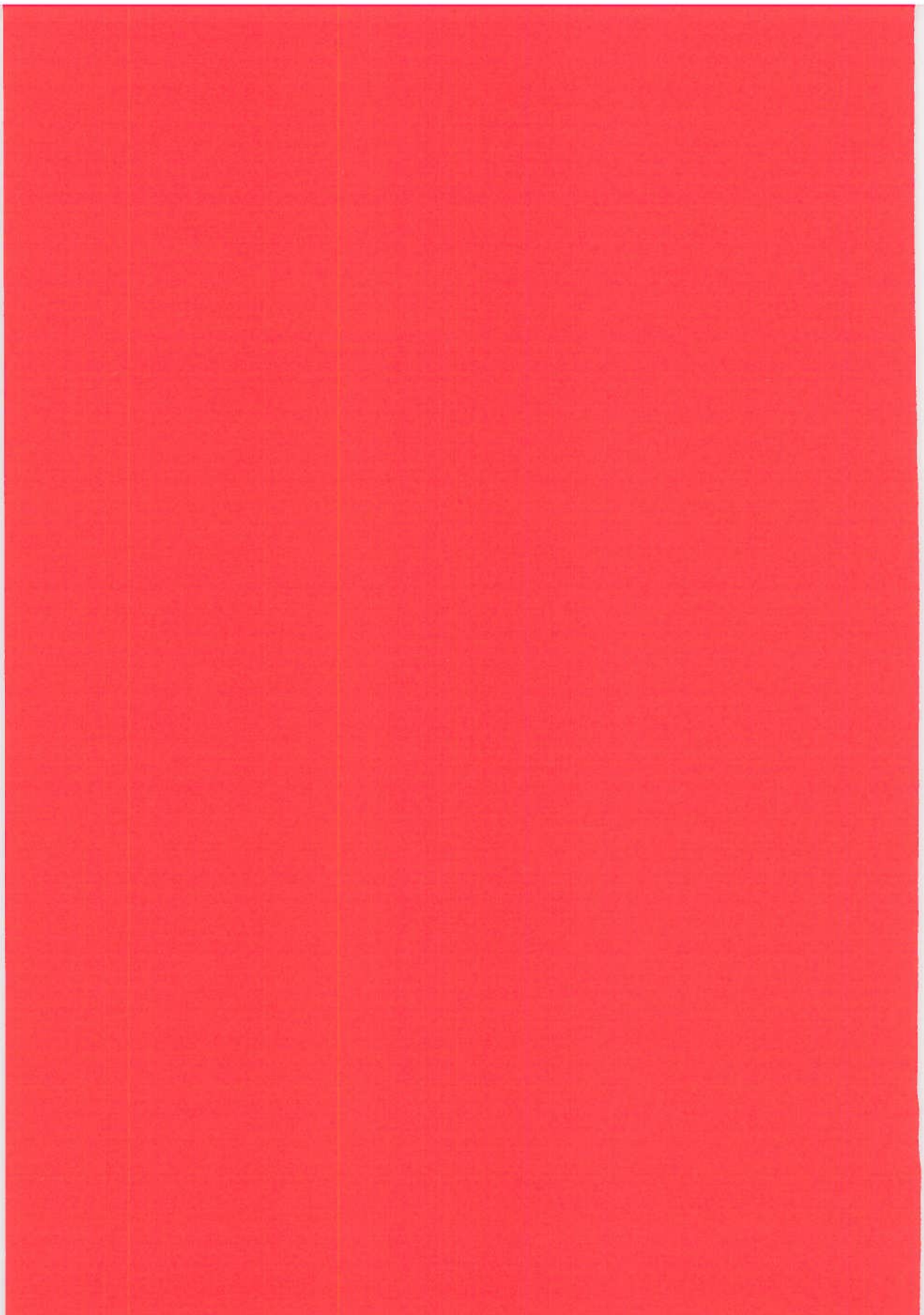
Lykke til med en skadefri sommer!

Layout, tekstbehandling og grafikk:
SCANVEST OLIVETTI

Appendix 4

Questionnaire for sampling attitudes.

Evaluation of Traffic Injury Report.



Spørreundersøkelse

om trafikkulykker i Harstad og Trondheim kommuner

Institutt for Samfunnsmedisin ved Universitetet i Tromsø og Statistisk Sentralbyrå gjennomfører en spørreundersøkelse om forebygging av trafikkulykker i Harstad og Trondheim. En slik undersøkelse vil gi verdifulle bidrag til forebygging av trafikkskader i Norge. Et tilfeldig utvalg av personer eldre enn 17 år i Harstad og Trondheim inviteres herved til å delta i denne undersøkelsen. Vi ber deg besvare spørreskjemaet så nøyaktig som mulig. Dersom ingen av svarene i skjemaet passer helt, kan du sette et kryss for det som ligger nærmest. For at undersøkelsen skal bli så god som mulig, er det viktig at flest mulig svarer. Svarene kan også få betydning for trafikkplanleggingen i ditt nærmiljø. Alle opplysninger vil bli behandlet fortrolig etter de regler som gjelder for slike undersøkelser.

Med vennlig hilsen
Anne Johanne Søgaard
Professor dr. philos

Jeg samtykker i å delta i undersøkelsen Ja ❑ Nei ❑

PERSONLIGE OPPLYSNINGER

1 Hvor gammel er du? _____ år

2 Hvor mange personer bor i din husstand ? _____

3 Hvor mange års utdannelse har du i alt ?
(ta med folkeskole og real/ungdomsskole) _____ år

4 Kjønn mann ❑ kvinne ❑

5 Sivilstand gift/sambo ❑ enke(mann) ❑ ugift ❑ skilt/separert ❑

OPPLYSNINGER OM TRAFIKKSIKKERHET

6 For å iverksette de riktige ulykkesforebyggende tiltak, er det viktig å få oversikt over alle trafikkulykker. Gjennom en egen registrering viser det seg at helsevesenet får rede på flere ulykker enn politiet. Hvor mange av ulykkene som kommer til helsevesenet tror du politiet får rede på?
(kryss av for den prosentandel du tror er korrekt) 30 % ❑ 50 % ❑ 75 % ❑ 90 % ❑

7 Har du lest eller hørt om at trafikkulykkestallene har forandret seg i kommunen din de siste 5 årene? Kryss av for det som passer best.

Det har blitt flere trafikkulykker ❑
Det har blitt færre trafikkulykker ❑
Uforandret ❑
Vet ikke ❑

8 Kan du nevne ett eller flere trafikkfarlige kryss i kommunen din som er blitt ombygd i løpet av de siste 5 årene på grunnlag av sykehusets ulykkesregistreringer?

Ja ❑ Nei ❑ Navn på kryss _____

_____

9 Nedenfor nevnes noen kilder for gode råd eller opplysninger når det gjelder trafikksikkerhet. Kan du huske å ha fått gode råd eller opplysninger fra noen av disse kildene? (Kryss av ja eller nei for hvert punkt. Det er mulig å krysse for begge ja-alternativene)

	Ja, i løpet av siste år	Ja, for mer enn et år siden	Nei
Aviser	❑	❑	❑
Lokalradio	❑	❑	❑
Brosjyre/rapport fra sykehuset i posten	❑	❑	❑
Andre brosjyrer i posten	❑	❑	❑
Skole	❑	❑	❑
Kjøreskole	❑	❑	❑
Familie/venner/arbeidskamerater	❑	❑	❑
TV	❑	❑	❑

Andre, spesifiser _____

10 Her kommer tre forskjellige påstander om trafikkulykker. Angi for hver påstand hvor enig eller uenig du er.

	Helt enig	Nokså enig	Nokså uenig	Helt uenig
Trafikkulykker kommer når de kommer og det er ikke noe samfunnet kan gjøre noe med	❑	❑	❑	❑
Trafikkulykker kan i stor grad forebygges gjennom offentlige tiltak	❑	❑	❑	❑
Ved å opptre fornuftig i trafikken kan jeg i stor grad beskytte meg mot å bli skadet i en ulykke	❑	❑	❑	❑

11 Hvor ofte har dere i familien/omgangskretsen snakket om trafikkulykker og trafikksikkerhet det siste året? (sett kryss ved det svaret som passer best)

Ukentlig ❑ Månedlig ❑ Noen få ganger ❑ Aldri ❑

12 Kan du huske om noen av disse emnene ble diskutert i familien/omgangskretsen det siste året ? (sett kryss ved det svaret som passer best for hvert av de fem punktene)

	Aldri	Sjelden	Nokså ofte	Ofte
• Alkohol og kjøring	❑	❑	❑	❑
• Piller (legemidler), eller narkotika og kjøring	❑	❑	❑	❑
• En nylig inntruffet trafikkulykke med personskade i ditt nærmiljø	❑	❑	❑	❑
• Uforsvarlig høy fart	❑	❑	❑	❑
• Barns sikkerhet i trafikken	❑	❑	❑	❑

Andre trafikksikkerhetsspørsmål, spesifiser _____

13 Hvis noen av emnene i spørsmål 12 ble snakket om i familien/omgangskretsen det siste året, kan du nevne hva som var bakgrunnen for at disse samtalene kom i gang? (Kryss av for hvert punkt)

	Ja	Nei	Vet ikke
Opplevet ulykke selv eller i nærmeste familie	❑	❑	❑
Informasjon gjennom massemedia (aviser, radio, TV)	❑	❑	❑
Egen trafikkskaderapport i posten	❑	❑	❑
Hørt om ulykke i kommunen fra bekjente eller venner	❑	❑	❑

Annet, spesifiser _____

14 Hva slags opplysninger om forekomst av trafikkulykker tror du har størst verdi for trafikksikkerhetsarbeidet i kommunen din? Sett 1 på det viktigste, 2 på det nest viktigste, 3 på det tredje viktigste og 4 på det minst viktige

Sett et tall her (1-4)

Landsoversikter _____

Oversikter fra skolekrets/nærmiljø _____

Kommuneoversikter _____

Fylkesoversikter _____

15 Har du selv noen gang kjørt eller sittet på med en bil som har kollidert eller kjørt av vegen?

Ja ❑ Nei ❑ hvis ja, sett ring rundt "kjørt" eller "sittet på" eller begge.

16 Hvis ja, når skjedde dette sist? _____

17 Har du selv som fotgjenger vært utsatt for en trafikkulykke slik at du ble skadd?

Ja ❑ Nei ❑

18 Hvis ja, når skjedde dette sist? _____

19 Har du selv som syklist vært utsatt for en trafikkulykke slik at du ble skadd?

Ja ❑ Nei ❑

20 Hvis ja, når skjedde dette sist? _____

21 Har du førerkort for bil Ja ❑ Nei ❑

22 Hvor langt kjører du pr. år ?

mindre enn 8000 km ❑ 8000 - 12 000 km ❑ 12 000-16 000 km ❑

16000-20 000 km ❑ 20 000 - 30 000 km ❑ over 30 000 km ❑

23 Hvor gammel var du da du tok sertifikat ? _____ år

24 Hvor fikk du kjøreopplæring ? Harstad ❑ Trondheim ❑ Annet sted ❑

25 Hvor ofte kjører du bil ? Daglig ❑ Ukentlig ❑ Få ganger i året ❑ Aldri ❑

26 Det er umulig å være helt perfekt bilist slik at ingen trafikkregler brytes.Tenk deg at du skal kjøre en ca. 5 km tur i kommunen. Nedenfor gis noen utsagn. Kryss for det svar som passer best.

	Ja, i stor grad	Til en viss grad	I liten grad	Nei overhodet ikke
Jeg er opptatt av å holde god avstand til bilen foran	❑	❑	❑	❑
Jeg er det siste året blitt mer opptatt av å holde god avstand til bilen foran	❑	❑	❑	❑
Jeg er opptatt av å holde meg innenfor fartsgrensen	❑	❑	❑	❑
Jeg er det siste året blitt mer opptatt av å holde meg innenfor fartsgrensen	❑	❑	❑	❑
Jeg er opptatt av å bruke bilbelte	❑	❑	❑	❑
Jeg er det siste året blitt mer opptatt av å bruke bilbelte	❑	❑	❑	❑
Jeg er opptatt av å ikke kjøre med promille eller under påvirkning av medisiner	❑	❑	❑	❑
Jeg er det siste året blitt mer opptatt av å ikke kjøre med promille eller under påvirkning av medisiner	❑	❑	❑	❑
Jeg er opptatt av at bilen er i forskriftsmessig stand	❑	❑	❑	❑
Jeg er det siste året blitt mer opptatt av at bilen er i forskriftsmessig stand	❑	❑	❑	❑
Jeg er opptatt av å avpasse farten etter forholdene	❑	❑	❑	❑
Jeg er det siste året blitt mer opptatt av å avpasse farten etter forholdene	❑	❑	❑	❑

27 Hvis du det siste året er blitt mer opptatt av noen av de de ovennevnte sikkerhetsreglene (spørsmålene i 26), kan du angi en årsak til dette? (kryss av for hvert punkt)

	Ja	Nei	Vet ikke
Opplevet ulykke selv eller i nærmeste familie	❑	❑	❑
Informasjon gjennom massemedia (aviser, radio, TV)	❑	❑	❑
Egen trafikkskaderapport i posten	❑	❑	❑
Hørt om ulykke i kommunen fra bekjente eller venner	❑	❑	❑

Annet, spesifiser _____

Til slutt en åpen rubrikk for en kommentar eller et forslag til bedring av trafikksikkerhetsarbeidet i kommunen din.

_____

_____

TAKK FOR HJELPEN !

TRYKKSENTRALEN. TLF. 77 06 67 99

ISM SKRIFTSERIE - FØR UTGITT:

1. Bidrag til belysning av medisinske og sosiale forhold i Finnmark fylke, med særlig vekt på forholdene blant finskættede i Sør-Varanger kommune.
Av Anders Forsdahl, 1976. (nytt opplag 1990)

2. Sunnhetstilstanden, hygieniske og sosiale forhold i Sør-Varanger kommune 1869-1975 belyst ved medisinal-beretningene.
Av Anders Forsdahl, 1977.

3. Hjerte-karundersøkelsen i Finnmark - et eksempel på en populasjonsundersøkelse rettet mot cardiovasculære sykdommer. Beskrivelse og analyse av etterundersøkelsesgruppen.
Av Jan-Ivar Kvamme og Trond Haider, 1979.

4. D. The Tromsø Heart Study: Population studies of coronary risk factors with special emphasis on high density lipoprotein and the family occurrence of myocardial infarction.
Av Olav Helge Førde og Dag Steinar Thelle, 1979.

5. D. Reformer i distriktshelsetjenesten III: Hypertensjon i distriktshelsetjenesten.
Av Jan-Ivar Kvamme, 1980.

6. Til professor Knut Westlund på hans 60-års dag, 1983.

7.* Blodtrykksovervåkning og blodtrykksmåling.
Av Jan-Ivar Kvamme, Bernt Nesje og Anders Forsdahl, 1983.

8.* Merkesteiner i norsk medisin reist av allmennpraktikere - og enkelte utdrag av medisinalberetninger av kulturhistorisk verdi.
Av Anders Forsdahl, 1984.

9. "Balsfjordsystemet." EDB-basert journal, arkiv og statistikksystem for primærhelsetjenesten.
Av Toralf Hasvold, 1984.

10. D. Tvunget psykisk helsevern i Norge. Rettsikkerheten ved slikt helsevern med særlig vurdering av kontrollkommisjonsordningen.
Av Georg Høyer, 1986.

11. D. The use of self-administered questionnaires about food habits. Relationships with risk factors for coronary heart disease and associations between coffee drinking and mortality and cancer incidence.
Av Bjarne Koster Jacobsen, 1988.

12.* Helse og ulikhet. Vi trenger et handlingsprogram for Finnmark.
Av Anders Forsdahl, Atle Svendal, Aslak Syse og Dag Thelle, 1989.

13. D. Health education and self-care in dentistry - surveys and interventions.
Av Anne Johanne Søgaard, 1989.

14. Helsekontroller i praksis. Erfaringer fra prosjektet helsekontroller i Troms 1983-1985.
Av Harald Siem og Arild Johansen, 1989.

15. Til Anders Forsdahls 60-års dag, 1990.

16. D. Diagnosis of cancer in general practice. A study of delay problems and warning signals of cancer, with implications for public cancer information and for cancer diagnostic strategies in general practice.
Av Knut Holtedahl, 1991.

17. D. The Tromsø Survey. The family intervention study. Feasibility of using a family approach to intervention on coronary heart disease. The effect of lifestyle intervention of coronary risk factors.
Av Synnøve Fønnebø Knutsen, 1991.

18. Helhetsforståelse og kommunikasjon. Filosofi for klinikere.
Av Åge Wifstad, 1991.

19. D. Factors affecting self-evaluated general health status - and the use of professional health care services.
Av Knut Fylkesnes, 1991.

20. D. Serum gamma-glutamyltransferase: Population determinants and diagnostic characteristics in relation to intervention on risk drinkers.
Av Odd Nilssen, 1992.

21. D. The Healthy Faith. Pregnancy outcome, risk of disease, cancer morbidity and mortality in Norwegian Seventh-Day-Adventists.
Av Vinjar Fønnebø, 1992.

22. D. Aspects of breast and cervical cancer screening.
Av Inger Torhild Gram, 1992.

23. D. Population studies on dyspepsia and peptic ulcer disease: Occurrence, aetiology, and diagnosis. From The Tromsø Heart Study and The Sørreisa Gastrointestinal Disorder Studie.
Av Roar Johnsen, 1992.

24. D. Diagnosis of pneumonia in adults in general practice.
Av Hasse Melbye, 1992.

25. D. Relationship between hemodynamics and blood lipids in population surveys, and effects of n-3 fatty acids.
Av Kaare Bønaa, 1992.

26. D. Risk factors for, and 13-year mortality from cardiovascular disease by socioeconomic status. A study of 44690 men and 17540 women, ages 40-49.
Av Hanne Thürmer, 1993.

27. Utdrag av medisinalberetninger fra Sulitjelma 1891-1990.
Av Anders Forsdahl, 1993.

28. Helse, livsstil og levekår i Finnmark. Resultater fra Hjerte-karundersøkelsen i 1987-88. Finnmark III.
Av Knut Westlund og Anne Johanne Søgaard, 1993.

29. D. Patterns and predictors of drug use. A pharmacoepidemiologic study, linking the analgesic drug prescriptions to a population health survey in Tromsø, Norway.
Av Anne Elise Eggen, 1994.

30. D. ECG in health and disease. ECG findings in relation to CHD risk factors, constitutional variables and 16-year mortality in 2990 asymptomatic Oslo men aged 40-49 years in 1972.
Av Per G. Lund-Larsen, 1994.

31. D. Arrhythmia, electrocardiographic signs, and physical activity in relation to coronary heart risk factors and disease. The Tromsø Study.
Av Maja-Lisa Løchen, 1995.

32. D. The Military service: mental distress and changes in health behaviours among Norwegian army conscript.
Av Edvin Schei, 1995.

33. D. The Harstad injury prevention study: Hospital-based injury recording and community-based intervention.
Av Børge Ytterstad, 1995.

34.* D. Vilkår for begrepsdannelse og praksis i psykiatri. En filosofisk undersøkelse.
Av Åge Wifstad, 1996. (utgitt Tano Aschehoug forlag 1997)

35. Dialog og refleksjon. Festskrift til professor Tom Andersen på hans 60-års dag, 1996.

36. D. Factors affecting doctors´ decision making.
Av Ivar Sønbø Kristiansen, 1996.

37. D. The Sørreisa gastrointestinal disorder study. Dyspepsia, peptic ulcer and endoscopic findings in a population.
Av Bjørn Bernersen, 1996.

38. D. Headache and neck or shoulder pain. An analysis of musculoskeletal problems in three comprehensive population studies in Northern Norway.
Av Toralf Hasvold, 1996.

39. Senfølger av kjernefysiske prøvespreninger på øygruppen Novaya Semlya i perioden 1955 til 1962. Rapport etter programmet "Liv". Arkangelsk 1994.
Av A.V. Tkatchev, L.K. Dobrodeeva, A.I. Isaev, T.S. Podjakova, 1996.

40. Helse og livskvalitet på 78 grader nord. Rapport fra en befolkningsstudie på Svalbard høsten 1988. **Av Helge Schirmer, Georg Høyer, Odd Nilssen, Tormod Brenn og Siri Steine, 1997.**

41.* D. Physical activity and risk of cancer. A population based cohort study including prostate, testicular, colorectal, lung and breast cancer.
Av Inger Thune, 1997.

42. The Norwegian - Russian Health Study 1994/95. A cross-sectional study of pollution and health in the border area.
Av Tone Smith-Sivertsen, Valeri Tchachtchine, Eiliv Lund, Tor Norseth, Vladimir Bykov, 1997.

43. D. Use of alternative medicine by Norwegian cancer patients
Av Terje Risberg, 1998.

44 D. Incidence of and risk factors for myocardial infarction, stroke, and diabetes mellitus in a general population. The Finnmark Study 1974-1989.
Av Inger Njølstad, 1998.

45. D. General practitioner hospitals: Use and usefulness. A study from Finnmark County in North Norway.
Av Ivar Aaraas, 1998.

45B Sykestuer i Finnmark. En studie av bruk og nytteverdi.
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46. D. No går det på helsa laus. Helse, sykdom og risiko for sykdom i to nord-norske kystsamfunn.
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47. D. The Tromsø Study: Risk factors for non-vertebral fractures in a middle-aged population.
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Av **Henrik Schirmer, 2000.**

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Av Jon Øyvind Odland, 2000.

50B Окружающая и профессиональная экспозиция, факторы стиля жизни и исход беременности у населения арктической и субарктической частей Норвегии и России
Юн Ойвин Удлан 2000

51. D. A population based study on coronary heart disease in families. The Finnmark Study 1974-1989.
Av Tormod Brenn, 2000.

52 D. Ultrasound assessed carotid atherosclerosis in a general population. The Tromsø Study.
Av Oddmund Joakimsen, 2000.

53. D. Risk factors for carotid intima-media thickness in a general population. The Tromsø Study 1979-1994.
Av Eva Stensland-Bugge, 2000.

54. D. The South Asian cataract management study.
Av Torkel Snellingen, 2000.

55. D. Air pollution and health in the Norwegian-Russian border area.
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56. D. Interpretation of forearm bone mineral density. The Tromsø Study.
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57. D. Individual fatty acids and cardiovascular risk factors.
Av Sameline Grimsgaard, 2001.

58. Finnmarkundersøkelsene
Av Anders Forsdahl, Fylkesnes K, Hermansen R, Lund E, Lupton B, Selmer R, Straume E, 2001.

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66. Helseundersøkelsen i Arkangelsk 2000.
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