WP3

SYSTEMATIC LITERATURE REVIEW OF GOOD PRACTICES FOR FOUR INJURY PRIORITIES:

ALCOHOL- RELATED INJURIES, ROAD TRAFFIC INJURIES, OCCUPATIONAL INJURIES AND DROWNING

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Developed in the context of the APOLLO "Strategies and Best Practices For The Reduction of Injuries" Project, Working Package 3
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EXECUTIVE SUMMARY

Apollo WP3 aims to explore and present the available evidence-based concerning good practices and policies for injury prevention as well as recommendations in the form of a concise European Code Against Injuries. Also, to identify success and failure factors that account for the variability of the burden of all types of injuries among all age groups across member states and develop policy recommendations for overcoming barriers to implementation of injury prevention practices for all injuries among all age groups, building on the strategic document of the EC. During the first module, the aim and tasks were to undertake a systematic literature review to identify, select and assess existing good practices and policies for injury prevention, along with the development of a set of criteria, which would form the basis for the selection of best practices and policies for injury prevention. Also, to determine what represents a successful outcome. The report presented hereby focuses on developments during this first module. The methodology that was used to select those injury prevention priorities to be further targeted by this project is described, as well as the results of the systematic review concerned with good practices and policies for injury prevention.

Overview of the WP3

The aim of the WP3 of the Apollo Project is to identify ways to overcome the barriers in applying good practices and policies to achieve tangible prevention of unintentional injuries in all age groups and development of the European Code Against Injuries (ECAI).

Specific Objectives are:

- Select injury priorities and gather good practices and policies
- Develop evaluation criteria for assessing best practices and policies
- Identify success factors and barriers for the implementation of each of the selected best practices and policies
- Customize selected best practices for individual MS
- Assess applicability, pilot testing and evaluation of the EU Code Against Injuries

Deliverables:

- European Code against Injuries (Best practices and recommendations for effective prevention of all types of injuries in all age groups)
- Success factors and barriers to implementation of prevention related to all types of injuries
- How to overcome the barriers to implement recommendations for youth (<24) injury prevention
- Strategy and Policy Recommendations including feasibility for implementation in various settings

Timetable

Activities	Starting/Ending Months
Preparatory Phase	December 2005
Module 1	January 2006 - September 2006
Module 2	October 2006 – October 2007
Module 3	January 2006 – May 2008
Module 4	May 2008 – November 2008

Module 1

Task 1: Setting injury prevention priorities

Introduction

In the European Union (EU25), there is an appalling annual death toll of about a quarter of a million lives lost due to injuries. Injuries represent the leading cause of death for the residents of the EU below the age of 25 years; furthermore, 40% of all injuries occur among older people. Although the 'injury epidemic' is estimated to cost billion of euros per year in direct and indirect costs, the resources devoted to injury research and prevention are scarce. It is therefore of utmost importance to allocate wisely taxpayers' money in order to efficiently tackle this problem. Hence, a number of issues emerge, such as which injury prevention areas should be considered as 'key priorities' and which specific strategies decision makers should follow in order to produce the best benefit in terms of sustained reduction in the burden of injuries for any given cost. Cost-effective interventions may be available for injuries with a relatively small occurrence in the population, while for those injuries responsible for a high burden of disease there might be no sufficient evidence on cost-effectiveness of interventions. Thus, setting priorities and agreeing upon what is most relevant for injury prevention is an important part in achieving substantial injury reduction.

To tackle the injury problem, the European Commission has recently funded the Apollo programme. Its main goal of is to produce a sustainable reduction in the burden of injuries in the EU through the development and implementation of a comprehensive, proactive and integrated policy strategy for injury prevention. Other important aims concern the identification and application of specific strategies to manage the burden of injuries and the production and dissemination of results in a way that supports self-sustainable injury control. Apollo project comprises six joint sub-programmes, which work in an integrated complementary way. Among these, WP3 focuses on providing guidance for injury prevention and control. Specifically, WP3 aims to identify good practices and effective policies for injury prevention, along with existent tools; also, to emphasize those factors that have made the selected injury prevention practices successful and barriers to injury prevention and develop strategy and policy recommendations for successful injury prevention management.

The fist step in WP3 work plan was concerned with which of the injury areas should be considered essential and further addressed throughout the course of Apollo WP3. Therefore, a methodological approach was designed and applied to deal specifically with the selection of injury priorities for which policies/ strategies will be sought during the next phases of Apollo WP3.

Methodology

Data sources and availability of data

1. Mortality data from World Health Organization (WHO) Statistical Information System (WHOSIS) and Centre for Research and Prevention of Injuries (CEREPRI) Statistics Portal: standardised mortality rates for the five leading causes of injury death in the EU-25 overall, by each age group (children 0-14 yrs old, adolescents and young adults 15-24 yrs, adults 25-44 yrs old and 45 to 64 yrs old 64, and elderly people 65+) were computed- Figure 1: CEREPRI Statistics Portal (http://www.euroipn.org/stats_portal/)
2. Premature mortality in terms of years of potential life lost (YLL): data from the WHO Burden of Diseases Project (2002) by age group and cause of injury death (five leading causes of injury death)
3. Non-fatal injuries: sources explored
    a. WHO*:* hospital discharge data for all injuries (NB information by specific type of injury was not available)
    b. Injury Data Base (IDB) data at EU level: home and leisure injuries (NB issues concerning the reprsentativity of these data)
    c. Disability from injuries provided by some surveys for some countries (United Nations) (NB scarce data- generally outdated)
    d. Delivery of data concerning injury morbidity from Apollo WP2 programme
4. Community concern: top 10 injury prevention priorities with respective scores, as selected by experts participating in the survey 'Key injury prevention priorities in the EU', run by the European Working Party on Accidents and Injuries (WP-AI) Secretariat- Table 1: injury prevention priorities
5. Feasibility to prevent injuries: effective/ cost-effective actions with respective scores by cost-effectiveness, as proposed by experts participating in the survey 'Feasible actions for injury prevention in the EU', organised by the WP-AI Secretariat- Table 2: actions for injury prevention
6. Cost of injuries: Eurocost project run by the Consumer Safety Institute in Amsterdam, the Netherlands
7. Burden of injuries due to alcohol consumption was computed (using a proxy) for road traffic injuries, assuming that alcohol is involved in about 40% of injury deaths on the roads.
8. Data on occupational injuries for the working age group were retrieved from the Eurostat.

Data processing

A matrix has been constructed based on some criteria that were agreed upon after consultation with experts participating in WP3 and WP3 first meeting in Athens. To each criterion, experts attributed a score (from 1- least important to 5- most important) and a weight (from 1- least important to 3- most important) according to its perceived importance. The weight ensured that some criteria influenced the final score more than other factors, thus, were considered more important. The weighed score resulted from the multiplication of the importance score with the weight for each criterion. The priority score was computed summing all weighted scores corresponding to all criteria taken into account for each type of injury considered. Mortality from injuries was attributed the highest weight- 3, while for the two other criteria considered (community concern and feasibility for prevention), experts attributed a weight of 2.

To exemplify, road traffic injuries represent the leading cause of injury mortality among children: therefore it scored highest- 5. Consequently, the weighted score for this specific criterion into account was 15. By adding the score for childhood injuries in terms of 'community concern'- 3.8 and the respective weight- 2, the weighted score was 7.6. Similarly, the weighted score taking into account the existence of feasible effective actions for injury prevention was computed (8). The priority score resulted from summing all weighted scores above and was 30.6. We repeated the same methodology for the five leading causes of injury mortality in each of the following age groups: children 0-14 yrs, adolescents and young adults 15 to 24 yrs; adults 25 to 44 yrs; adults 45 to 64 yrs; elderly 65+ yrs.

Results

Figures 2-6 exemplify calculations for injury prevention priorities for children. To summarise, road traffic injuries had the highest score (30.6), followed by unintentional drowning injuries (22.6), injuries due to fire/ flames/ burns (19.2), fall related injuries (10.0) and other transport injuries (7.0). Of these top priorities, the WP3 experts agreed upon considering the top 2 priorities for their further work on injury prevention interventions and policies. The same procedure was followed for all other age groups. For adolescents and young adults, the list of priorities and respective scores was: road traffic injuries (30.6), injuries related to alcohol use (27.0), unintentional drowning injuries (16.2), occupational injuries (13.0), and accidental poisoning (7.0). The priorities for the age group 25-44 yrs were: road traffic injuries (30.6), injuries related to alcohol use (18.0), occupational injuries (15.0), accidental poisoning (10.0), and falls (7.0), while for the age group 45-64 yrs these were: road traffic injuries (30.6), injuries related to alcohol use (18.5), occupational injuries (16.0), falls (13.0), accidental poisoning (7.0), and unintentional drowning injuries (7.0). In the age group of elderly

(65+) the priorities were: falls (30.6), road traffic injuries (24.6), injuries related to alcohol use (18.0), injuries due to fire/ flames/ burns (16.2), and misadventures during medical care (16.0). Figure 7 presents all priorities by age group (with red colour have been highlighted those priorities that would be further tackled in the Apollo WP3), while Figure 8 shows how road traffic injuries will be specifically addressed in different age groups, according to their burden.

Figure 1: CEREPRI Statistics Portal (http://www.euroipn.org/stats_portal/)

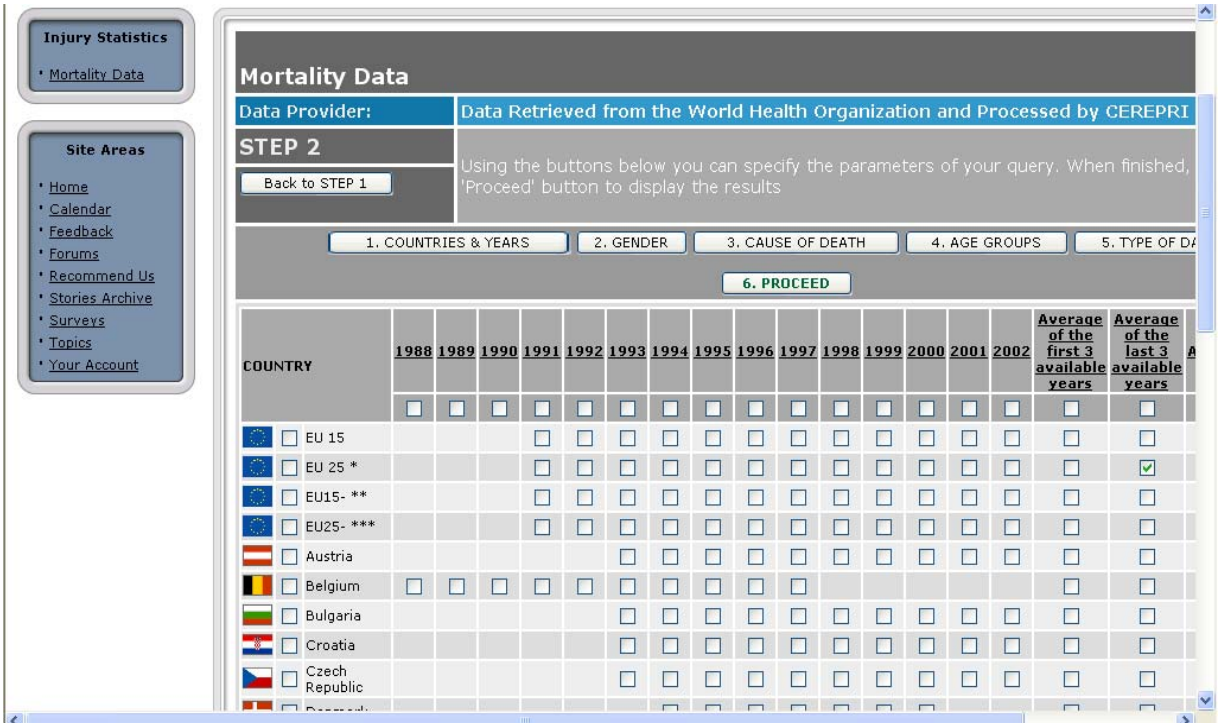

Table 1 Summary ranking of the 10 top key injury prevention priorities generated in the 2nd round by the two panels (world experts and members of the European Union Working Party on Accidents and Injuries, WP-AI)

World Experts			Members of the EU WP-AI	
	Key Injury Prevention Priority	*Mean score**	*Key Injury Prevention Priority*	*Mean score**
1	Falls among the elderly	4.28	Childhood Injuries in general	4.67
2	Injuries related to alcohol use	3.97	Falls among the elderly	4.33
3	Motor vehicle injuries, occupant	3.78	Motor vehicle injuries, occupant	4.13
4	Pedestrian injuries	3.78	Injuries related to alcohol use	4.13
5	Increase injury research/data collection/injury awareness	3.78	Pedestrian injuries	4.07
6	Drowning among children	3.34	Injuries sustained by two wheelers	3.87
7	Domestic violence, including child abuse	3.31	Suicide among youth	3.67
8	Suicide among youth	3.25	Violence in general	3.40
9	Homicide and injuries purposely inflicted	3.13	Drowning among children	3.40
10	Injuries sustained by two wheelers	3.09	Injuries caused by fire/flames/hot liquids	3.20

*Mean score attributed to each priority (ranking from 1= least important to 5= most important)

Table 2 Actions considered highly effective/ cost-effective among the total 13 injury prevention issues ten top prioritized by either or both panels by frequency and mean scores (1= least cost-effective to 5= most cost-effective action)

Prevention priority	**Action proposed as highly cost- effective**	**1st round: N of respondents (cost -effective responses)**	**2nd round: Average Score per Cost- efficient Action**
Motor vehicle injuries, occupant	▪ Enact/ enforce drinking and driving laws ▪ Enact/ enforce speed limits ▪ Enact/ enforce car restraint laws ▪ Improve/ modify roads	35 (104)	4.6 4.2 4.1 3.4
Injuries sustained by two-wheelers	▪ Enforce/ promote helmet use ▪ Environmental modifications to separate two-wheelers in traffic	34 (68)	4.4 3.8
Injuries related to alcohol use	▪ Enact/ enforce drinking and driving laws ▪ Enact/ enforce laws to limit access to alcohol (close bars early, minimum age for consuming alcohol 21 yrs)	34 (54)	4.1 3.8
Injuries caused by fire/ flames/ hot liquids	▪ Smoke detectors/ fire extinguishers: enforce/ promote installation and correct use in both public and private settings	32 (52)	4.0
Pedestrian injuries	▪ Improve/ modify roads (crossing facilities; side walks; better visibility; street lighting) ▪ Traffic calming measures through environmental modifications	34 (72)	4.0 3.6
Violence in general	▪ Enact/ enforce legislation to control weapon (firearms, knives) ▪ Implement/ evaluate intervention (conflict solving/ anger management)	25 (35)	4.0 2.9
Increase injury research/ data collection/ injury awareness	▪ Research funds ▪ Injury surveillance: use existent systems, develop and implement new ones, improve data collection and exploit injury data	33 (53)	3.9 3.5
Homicide and injuries purposely inflicted	▪ Enact/ enforce legislation to control weapons (firearms, knives)	31 (37)	3.8
Falls among the elderly	▪ Safe homes: design/ promotion/ implementation ▪ Increase public awareness about fall injuries and their prevention	32 (60)	3.5 2.6
Childhood injuries in general	▪ Safe homes: design/ promotion/ safety audits ▪ Increase awareness/ educate about injury and violence prevention	29 (55)	3.6 2.7
Domestic violence, including child abuse	▪ Create resources for victims (shelters, help lines, medical, legal and psychological support) ▪ Educate/ increase public awareness about domestic violence	30 (56)	3.5 3.1
Suicide among youth	▪ Interventions with evaluation component for suicide prevention, including recreational and bullying prevention programs ▪ Create/ improve community resources for abuse victims and perpetrators	28 (44)	3.4 3.1
Drowning among children	▪ Pool fencing ▪ Swimming lessons: promote/ make mandatory in schools	32 (48)	3.7 3.2

Figure 2: Setting injury priorities- road traffic injuries among children

To use	Criteria	Measure	Score	Weight	Weighted score
✓	Mortality Rate	2.5	5	3	15
✓	Community concern (Delphi)	In the top 10 of injury priorities	3.8	2	7.6
✓	Feasibility to prevent	Availability of cost-effective measures	4	2	8
	PRIORITY SCORE				*30.6*

Figure 3: Setting injury priorities- accidental drowning injuries among children

To use	Criteria	Measure	Score	Weight	Weighted score
✓	***Mortality Rate***	0.8	3	3	9
✓	Community concern (Delphi)	6th injury priority	3.4	2	6.8
✓	Feasibility to prevent	Availability of cost-effective measures	3.4	2	6.8
	PRIORITY SCORE				*22.6*

Figure 4: Setting injury priorities- injuries due to fire/ flames/ burns among children

To use	Criteria	Measure	Score	Weight	Weighted score
✓	*Mortality Rate*	0.3	2	3	6
✓	Community concern (Delphi)	10th injury priority by WP-AI members	3.2	2	6.4
✓	Feasibility to prevent	Availability of cost-effective measures	3.4	1	6.8
	PRIORITY SCORE				*19.2*

Figure 5: Setting injury priorities- injuries due to falls among children

To use	Criteria	Measure	Score	Weight	Weighted score
✓	*Mortality Rate*	0.3	2	3	6
✓	Community concern (Delphi)	*Not listed*	1	2	2
✓	Feasibility to prevent	Availability of cost-effective measures	1	2	2
	PRIORITY SCORE				*10*

Figure 6: Setting injury priorities- other transport injuries among children

To use	Criteria	Measure	Score	Weight	Weighted score
✓	*Mortality Rate*	0.2	1	3	3
✓	Community concern (Delphi)	*Not listed*	1	2	2
✓	Feasibility to prevent	Availability of cost-effective measures	1	2	2
	PRIORITY SCORE				7

Figure 7: Summary of injury prevention priorities

	AGE GROUP				
PRIORITY	0-14	15-24	25-44	45-64	65+
MV injuries					
Drowning					
Falls					
Fire/ flames/					
Poisoning					
Misadv. Medical					
Alcohol related					
Occupational					

Figure 8: Road traffic injury prevention priorities by age group

PRIORITY	AGE GROUP				
	0-14	15-24	25-44	45-64	65+
MV injuries	Pedestrian injuries Car-occupant injuries	Car occupant Injuries sustained by two-wheelers	Car occupant Injuries sustained by two-wheelers	Car occupant Injuries sustained by two-wheelers	Pedestrian injuries

The indicators proposed and discussed during the 1st Managerial Meeting of APOLLO WP3 were Morbidity (3), Mortality (3), Premature mortality-YPLL (3), Community concern (2), Feasibility to prevent (1), and Medical cost. [Numbers in parentheses indicate the proposed weight for each of the indicators].

After thorough discussion on the nature and drawbacks of the indicators as well as on the weight that must be attributed to each one, the following was consensually decided:

Method for setting injury priorities

a. to remove two indicators from the scoring: "Years of Potential Lost Life" (YPLL) and "Medical Cost".
b. to increase the weight of the "Community Concern" indicator from 1 to 2, as it is considered to be an important measure
c. to factor in morbidity data that will be provided by WP2; if this is not proven possible during March, it was decided to take into account the available morbidity data in a proportionate way.

After applying the two modifications on the indicators, the priorities changed as follows:

Type of Injury	**Age group**				
	0-14	**15-24**	**25-44**	**45-64**	**65+**
Road Traffic Injuries	1	1	1	1	2
Drowning	2	3			
Fire/flames/burns	3				4
Falls	4			4	1
Poisoning			4		
Occupational injuries		4	3	3	
Alcohol related injuries		2	2	2	3

During the 1st Managerial Meeting it was decided that WP3 will focus on the top 2 priority areas per age group.

References

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4. Alexe DM, Skalkidis I, Petroulaki K, Petridou E. (2006). Delphi Technique as a tool in assessing injury priorities and actions for injury prevention in the European Union. *African Safety Promotion, 4,* 119-129.
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6. WHO Statistical Information System: http://www3.who.int/whosis/menu.cfm

Task 2: Systematic review of good practices for four injury priorities: alcohol related injuries, road traffic injuries, occupational injuries and unintentional drowning injuries

Introduction

After defining the injury priorities (road traffic injuries, alcohol related injuries, occupational injuries and drowning) to be targeted by Apollo WP3, the next step was to explore the available evidence concerning good practices for reducing the burden of these injuries. Therefore, the goal of this research was to review published findings on interventions ("good practices") aiming to decrease the burden of these four injury priority areas. The report includes a systematic review of studies that evaluated the effectiveness of practices in preventing injuries related to road traffic injuries, alcohol related injuries, occupational injuries and drowning. Studies contain specific implementations of interventions with defined outcomes and outputs, which are evaluated through process/outcome measures. The methodology used was identical for the all systematic reviews.

This report contains the following chapters below: 1. Methodology, 2. good practices for alcohol related injuries, 3. good practices for road traffic injuries, 4. good practices for occupational injuries and 5.good practices for drowning.

1. Methodology

1.1 Description of the search strategy and the review process

The type of source that was searched was literature containing either *Original articles on interventions* or *Literature reviews on preventive interventions*. Titles and abstracts of the search results were screened for relevance regarding the aim of the review by three reviewers based on the mentioned inclusion criteria below.

Search strategy and selection criteria

A computerized literature search of MEDLINE, ERIC, Cochrane Library, Science Direct, SafetyLit, Wiley InterScience, NIOSHTIC, NIOSH-NORA, Injury Prevention Database, BMJ databases, Google, and the reference lists from review articles and systematic reviews was carried out. Other electronic sources searched also, such as injury-specific websites, related organizations, networks, and international injury prevention centres etc.

Key words used

Alcohol related injuries: injury, accident, fatal, non-fatal, alcohol, alcohol-related, alcohol-use, 'alcohol-abuse, drink AND prevention, intervention, practice, evaluation.

Road traffic injuries: injury, accident, fatal, non-fatal, road traffic, motor vehicle, car, automobile, transportation, pedestrian, road vulnerable users, cyclists, two-wheelers AND prevention, intervention, practice, evaluation.

Occupational injuries: work, workplace, workstation, occupational, injury, accident, fatal, non-fatal, work-related, construction, industry, health care, farm, agriculture AND prevention, intervention, practice, evaluation

Drowning: injury, accident, fatal, non-fatal, drowning, submersion, water accident, water safety, pool safety, aquatic safety, bathtub, bathing area, fresh water AND prevention, intervention, practice, evaluation.

Operational definition

In the context of WP3, the term "practice" was operationally defined as follows:

Practice: A specific implementation of policies with defined outcomes and outputs, which is evaluated through process/outcome measures.

1.2 Criteria

Inclusion criteria

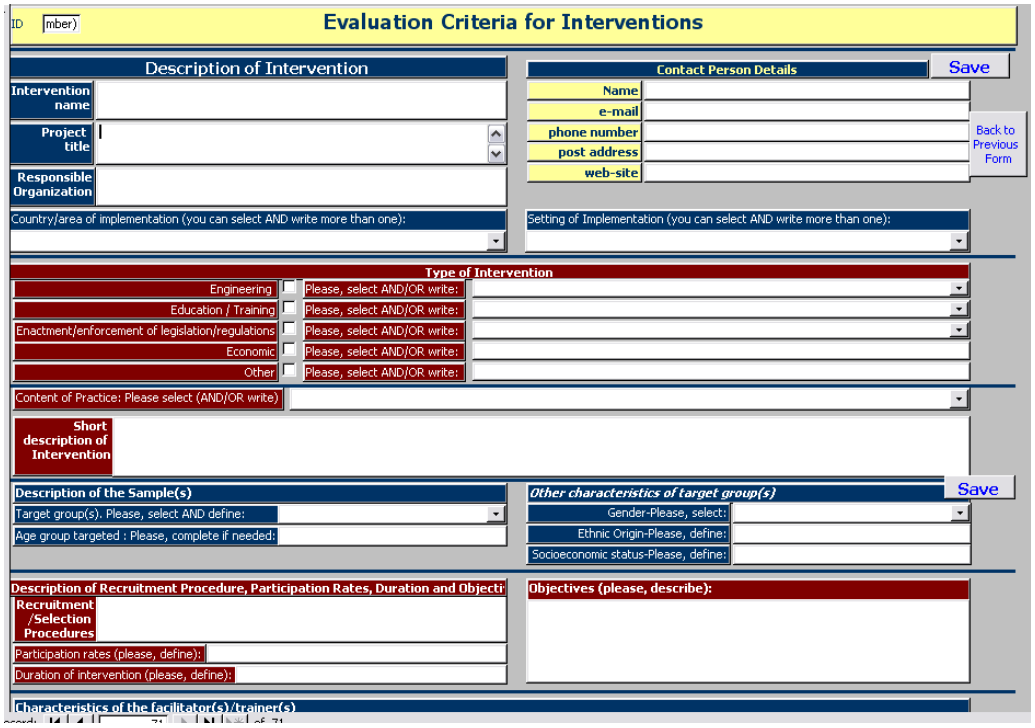
Studies were included if: (1) published between 2001-2006, (2) the population of interest was children (0-14), adolescents/young adults (15-24), adults (25-64) and elderly (65+), (3) the language was English, (4) the injury priorities were alcohol related injuries, road traffic injuries, occupational injuries and drowning, and (5) interventions had available evaluation (Outcome Evaluation, Process Evaluation Formative Evaluation, Economic evaluation)

Data extraction

The data presentation was realized via a comprehensive and user-friendly constructed Access database (figure 9). More specifically, for each study and intervention the following pieces of information were included:

- Information provided for each article: title; type of publication; publication date; website; author(s)
- Description of the intervention: intervention name and type, project title, responsible organization, contact person details.

Figure 9. Access database (evaluation criteria)



Evaluation and rating criteria

The included papers were thereafter retrieved in full and assessed by the researchers. The quality of each study was assessed according to evaluation and 14 rating criteria (Table 3) developed by Apollo WP3 experts and CEREPRI.

Evaluation criteria included: country/area of implementation, setting(s) of implementation, short description, objective(s) of the intervention, content of practice/ intervention, target group(s), age group targeted, other characteristics of the target group(s) (gender, ethic origin, socioeconomic status), recruitment/selection procedures, participation rates, duration of the intervention, characteristics of the facilitator(s)/trainer(s), study design, description of the Evaluation, results of evaluation.

Table 3. Rating criteria

Criteria	Rating scales
(1) Theory: The degree to which the practice's actions are based on clear and well-articulated theory and clearly stated hypotheses	1= no information about the theory or hypotheses specified 2= very little information about theory and hypothesis specified 3= adequate information about theory and hypothesis specified 4= nearly complete information about theory and hypothesis specified 5= full and complete information about theory and hypothesis specified
(2) Fidelity of intervention: The degree to which there is clear evidence regarding participation rates throughout the intervention	1= no or very weak evidence that most of the target population participated throughout the entire intervention 2= weak evidence that most of the target population participated throughout the entire intervention 3= some evidence that most of the target population participated throughout the entire intervention 4= strong evidence that most of the target population participated throughout the entire intervention 5= very strong evidence that nearly all of the target population participated throughout the entire intervention
(3) Retention: Evidence regarding participants' retention rates (follow up after completion of the intervention)	1= no data on retention 2= low retention 3= some retention 4= acceptable retention 5= high retention
(4) Sampling strategy: the quality of sampling design	1= no control group; unspecified sample size or inadequate sample size 2= inappropriate control group included or no attempt at random assignment; inadequate sample size 3= inappropriate control group included or no attempt at random assignment; adequate sample size 4= appropriate control group included; random assignment at individual or other level; inadequate sample size 5= appropriate control group included; random assignment at individual or other level; adequate sample size
(5) Measures: The quality of measures used in the evaluation and the quality of supporting evidence	1= no or insufficient information about measures 2= poor choice of measures; low quality of evidence 3= adequate choice of measures; mixed quality of evidence 4= relevant measures with good quality of evidence 5= highly relevant measures with excellent quality of evidence
(6) Analysis: The appropriateness of statistical analysis' techniques	1= no analysis reported; all analyses inappropriate or do not account for important factors 2= some but not all analyses inappropriate or left out important factors 3= mixed in terms of appropriateness and technical adequacy 4= appropriate analyses but not cutting edge techniques 5= proper, state-of-the-art-analyses conducted
(7) Replications: The exact or conceptual reproduction of both the intervention implementation and evaluation	1= no replication 2= one self-replication 3= two or more self-replications 4= one of two replications by independent evaluators 5= ≥ three replications by independent evaluators
(8) Plausible threats to validity (excluding lack of retention): The degree to which the evaluation design and implementation addresses and eliminates plausible alternative hypotheses concerning program effects.	1= high threat to validity or no ability to attribute effects to the program 2= threat to validity and difficult to attribute effects to the program 3= somewhat of threat to validity and mixed ability to attribute effects to the program 4= low threat to validity and ability to attribute effects to the program 5= no or very low threat to validity and high ability to attribute effects to the program
(9) Integrity: The overall level of confidence that the reviewer can place in project findings based on research design and implementation	1= no confidence 2= weak, at best some confidence in results 3= mixed, some weak, some strong characteristics 4= strong, fairly good confidence in results 5= high confidence in results, findings fully justifiable
(10) Dissemination capability of program materials developed (training in program implementation, technical assistance, standardized curriculum and evaluation materials, manuals, fidelity instrumentation, videos, recruitment forms, etc.)	1= materials, training and technical assistance not available or the module does not require curriculum and training/ qualified trainers and technical assistance not available 2= materials available but of low quality or very limited in scope; training/ qualified trainers and technical assistance either not available or limited 3= materials of sufficient quality with limited technical assistance and/or training/ qualified trainers 4= high quality materials, limited technical assistance and/or training/qualified trainers 5= high quality materials, technical assistance readily available and training/ qualified trainers readily available
(11) Estimation of cost for the implementation of the intervention	1= no relevant information 2= significant additional operating expense or cost to implement 3= minor additional operational expenses or cost to implement 4= some savings as a result of implementation/ capital payback in 10 years 5= significant savings form implementation/ capital payback in 3 years
(12) Cultural or/and Age Appropriateness	1= no claim of culturally or age appropriate materials targeted for specific populations 2= claim of cultural or age appropriate materials but no validation 3= age specific but not culturally appropriate or vice versa with some face validation 4= some age specific and culturally appropriate materials and validation of material presented 5= specific materials, culturally and age appropriate, developed and evaluated or validation of materials presented
(13) Ease of implementation of the Intervention	1= difficult to implement 2= some difficulty to implement 3= minor difficulty to implement

	4= easy to implement 5= very easy to implement
(14) Utility: The overall usefulness of the intervention	1= the evaluation produced clear findings of null or negative effects of the intervention 2= the evaluation produced findings that were predominately null or negative, though not uniform of definitive 3= the evaluation produced ambiguous findings because of inconsistency in result or methods' weaknesses that do not provide a strong basis for the intervention's effectiveness 4= the evaluation produced positive findings that demonstrate the effectiveness of the intervention in some areas, or support the effectiveness of some components of the intervention 5= the evaluation produced clear findings supporting the effectiveness of the intervention

The aim of rating criteria was to rank the evaluated practices in order to select the good ones. The practices were rated on a 5-point scale and the option of n/a was also available.

Method used for ranking: The good practices were ranked through the following steps:

1. Four criteria were excluded from the ranking process as they had more that 30% missing information. The excluded criteria from the raking process were: a. Cultural or/and Age Appropriateness, b. The quality of sampling design, c. Fidelity of intervention (the degree to which there is clear evidence regarding participation rates throughout the intervention) and d. the Retention (evidence regarding participants' retention rates - follow up after completion of the intervention,
2. Included were practices that were rated with more than 3 mean score at the rating scale.

2. Good practices for prevention of alcohol related injuries

2.1 Introduction

WHO outlines causal relationships between alcohol consumption and more than 60 types of disease and injury. It writes, "Alcohol consumption is the leading risk factor for disease burden in low mortality developing countries, and the third largest risk factor in developed countries". Beyond the numerous chronic and acute health effects, alcohol use is associated with widespread social, mental and emotional consequences. Harmful and hazardous alcohol consumption has a major impact on public health and also generates costs related to health care, health insurance, law enforcement and public order, and workplaces, and thus has a negative impact on economic development and on society as a whole. Young people in the EU are particularly at risk, as over 10% of female mortality and around 25% of male mortality in the 15–29 age group is related to hazardous alcohol consumption[2]. The harmful and hazardous consumption of alcohol has effects not only on those who drink, but also on others and on society. This means that alcohol requires greater attention from the public health community than it is receiving at present. Specifically, the report by WHO[3] asserts that alcohol policy can reduce social harm and suggests that government measures to control supply and demand, minimize alcohol-related harm and promote public health are among the most important strategies to reduce such a harm. Research evidence shows that it is possible to develop and implement comprehensive and effective alcohol policies.

The European Commission has adopted a European Alcohol Strategy[4] that aims to help Member States exchange good practice on how to reduce alcohol-related harm effectively. It focuses on the policy areas which are the competence of Member States and therefore only aims to provide support to national and sub-national policies. Effective alcohol social policy can put into place measures that control the supply of alcohol and/or affect population-wide demand for alcohol beverages. Comprehensive policies address legal measures to: control supply and demand, control access to alcohol (by age, location and time), provide public education and treatment for those who need assistance, levy taxation to affect prices and to pay for problems generated by consumption, and harm-reduction strategies to limit alcohol-related problems such as impaired driving. However, their

[2] Alcohol in Europe A public health perspective, P Anderson and B Baumberg, Institute of Alcohol Studies, UK 2006 http://ec.europa.eu/health-eu/news_alcoholineurope_en.htm
[3] World Health Organization (1999). Global status report on alcohol. Geneva, WHO.
[4] Commission of the European Communities (2006). An EU strategy to support Member States in reducing alcohol related harm, available at http://www.a-e-r.org/fileadmin/user_upload/MainIssues/Health/2006/Alcohol/GB-EU_ALCOHOL_STRATEGY.pdf

effectiveness depends on adequate enforcement. Passing a minimum drinking age law, for instance, will have little effect if it is not backed up with a credible threat to remove the licenses of outlets that repeatedly sell alcohol beverages to under-aged people (Harkin et al, 1995).
Below, are summarized the results of a review together with a list of good practices which have been implemented in different societal contexts.

2.2. Results

A total of 129 references were retrieved. Of these 29 fulfilled all inclusion criteria and 23 were characterised as promising. Only the Included and Further reviewed papers were further reviewed and evaluated.

Breakdown of gathered practices

	N
Gathered	**129**
Included papers	**29**
To be further reviewed (promising)	**23**
Excluded papers	**77**
Other date of publish	65
No evaluation	5
Irrelevant Interventions	7

From the total number of papers, 97 documents referred to *Alcohol related injury* and 32 documents referred to a *Combination (road traffic injury; alcohol related injury).*

After the ranking 31 alcohol-related good practices were identified. Taking the body of literature as a whole, our conclusions relating to the published evidence of efficacy of interventions designed to prevent alcohol related injuries are summarized in Table 4. Overall, there was:

Evidence of effectiveness:

Law measures and enforcement

- Enforced laws for 0.05 mg/ml or less blood alcohol concentration (BAC) limits
- Minimum legal drinking age laws (Administrative license revocation, ignition interlocks)
- Lower or zero BAC limit for young and inexperienced drivers
- Sobriety checkpoints
- Alcohol taxation
- Enforcement on restrictions on sales and availability; retail alcohol monopolies; economic and retailer interventions

- Restricting alcohol advertising and promotion, and actions involving counter advertising

Health education, training and other educational interventions

- Media promotion programs and campaigns
- Intervention training programs for servers of alcoholic beverages:
- Alternative transportation (e.g., designated driver programs)
- Assessment and treatment for DUI offenders
- Screening/ Brief interventions:
    - Brief motivational intervention for alcohol plus a booster session.
    - Brief motivational intervention[1]
    - Brief motivational interview (Spiritio et al. 2004)
    - Trauma center Brief Interventions
    - Screening and referral for brief intervention/ screening and education of older patients by physicians
    - Motivational interviewing as a brief intervention.
    - Primary care–based behavioral counseling interventions for risky/harmful alcohol use
    - Emergency department-based interventions
- Comprehensive multi-factorial community interventions
    - School-based and public education programs,
    - Medical screening and treatment,
    - Media advocacy,
    - Community organizing,
    - Environmental policy changes
    - Heightened enforcement of existing policies
- Breath Alcohol Ignition Interlock Devices/programs
- A skill-based interactive CD-ROM intervention program Thinking Not Drinking: A SODAS City Adventure[2]

[1] BI, delivered in 15–20 min, is based on the model of change (Prochaska & DiClemente, 1986) and the principles of motivational interviewing (Miller and Rollnick, 1991), and includes the active elements known as FRAMES (feedback, responsibility, advice, menu, empathy and self-efficacy). After feedback, patients were invited to think about the good and bad things derived from their alcohol consumption, make a balance and draw their own conclusions. Patients were given support material, designed to back up the patient's process from contemplation to decision making. MI was delivered in ~5 min, and limited to empathic advice, after comparing the evaluated behaviour with the advisable one. Patients received an information leaflet.

[2] Thinking Not Drinking is a skills-based program that consists of ten, 45-minute sessions. Grounded in the frameworks of social cognitive theory, problem-behavior theory, peer-cluster theory, and family-networks theory, the sessions cover goal setting, coping, media literacy, peer pressure, and assertiveness training, as well as such preventive strategies as norm correcting, decision making, and effective communication. The CD-ROM emphasizes prevention strategies thematically through a specific problem-solving sequence. Each session in the CD-ROM begins with skill-specific objectives youths must meet to advance to the next session. Navigating through an edgy urban landscape, youths encounter simulated yet realistic obstacles and distractions depicted by animated characters mimicking the age, gender,

Evidence of cost-effective interventions

- Brief interventions offered by alcohol health workers (rather than information only control in reducing alcohol consumption among AED attendees with a hazardous level of drinking)

Unclear or insufficient evidence-further research needed

Health education, training and other educational interventions

- Opportunistic brief interventions (cognitive or behavioral) (Emmen, 2004)[3]; Screening and brief interventions in acute care settings (Beich et al. 2002· Dill et al. 2004· Beich et al. 2003); Intensive interventions (brief counseling)(Sommers et al. 2001)
- Supply side interventions (Ker et al. 2006): (server training, health promotion initiatives, drink driving service, interventions targeting the server setting environment, policy interventions)
- Passive server training programs
- School drug and alcohol education programs
- Community mobilization efforts
- Health warnings
- Designated driver programs: population-based campaigns; incentive programs conducted in drinking establishments (Ditter et al. 2005)
- The Complying with the Minimum Drinking Age project (CMDA)[6]

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and demographic background of the target adolescents. To successfully maneuver through each session, youths must employ specific problem-solving skills. A principal character, acting as the youths' conscience, guides youths through the core problem-solving sequence of Stop, Options, Decide, Act, and Self-praise.

[3] Brief interventions aimed at problem drinkers are not a type of treatment but a category of interventions with general characteristics that give them conceptual coherence. Most comprise assessment, advice, and counselling with educational elements and possibly self help manuals or other forms of written information.

[6] The Complying with the Minimum Drinking Age project (CMDA) is a community trial designed to test effects of two interventions designed to reduce alcohol sales to minors: (1) training for management of retail alcohol establishments and (2) enforcement checks of alcohol establishments.

Table 4. Summary of good practices to reduce alcohol related injuries

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Ayoub, et al. (2005)	Controlled trial with randomization	- 195 hazardous drinkers 538 patients (C = 98, I = 89) - 53% follow up at 3 months -69% follow up at 12 months - Oral and Maxillofacial Outpatient Clinic, West Scotland	**Brief motivational intervention** by a trained nurse (25 min) vs providing an information leaflet on alcohol use and its effects (5 min).	AUDIT scores, behavior change	▪ Patients who have the highest AUDIT scores at recruitment, on average, demonstrate a reduction in drinking days which is statistically significantly greater than those patients in the leaflet group who had the same initial AUDIT score. This change was not seen for patients with low to moderate AUDIT scores.
Barrett, et al. (2006)	RCT (prospective, single-blind)	- 599 adults alcohol misuse patients (I = 287, C = 312) - 12 months follow up - AED in a general hospital in London (UK)	**Treatment**: referral to an AHW who delivered a brief intervention (n = 287) vs an information only control (n = 312).	Cost-effectiveness analysis Primary outcome measure: number of units of alcohol consumed per week	▪ At 6 months follow-up, the difference in the mean number of alcohol units consumed per week was statistically significantly lower in the intervention group (59.7) than in the control group (83.1), (p=0.02). ▪ By 12 months follow-up, the mean number of units consumed per week remained lower in the intervention group (56.20 vs 67.20 in the control group), but the difference was no longer significant, (p=0.09). ▪ Referral to AHWs in an AED produces favourable clinical outcomes and does not generate a significant increase in cost. The incremental cost-effectiveness ratio with the intervention in comparison with the control group was £22. ▪ The cost-effectiveness acceptability Curve revealed that there is at least a 65% probability that referral to an AHW is more cost-effective than the information only control in reducing alcohol consumption among AED attendees with a hazardous level of drinking.

I, intervention group; C, control group; BAC, Blood Alcohol Concentration; AED, Accidental and Emergency Department, AHW, Alcohol Health Worker

Table 4. *(Continued)*

Authors/ Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Carpenter (2004)	Retrospective time-series	- under 21 years of age	ZeroTolerance" (ZT) Drunk Driving Laws	Self-reported alcohol use and drunk driving using data from the 1984 to 2001 Behavioral Risk Factor Surveillance System (BRFSS)	▪ Results indicate that the laws reduced heavy episodic drinking (five or more drinks at one sitting) among underage males by 13%. Mixed evidence was found of ZT effects for females, and no robust effects on drinking participation or drunk driving for either sex.
Crawford, et al. (2004)	RCT (single blinded)	- 599 patients who met the inclusion criteria out of 5240 screened patients I=287 (65.8% at 12 months follow-up) C=312 (63.5% at 12 months follow-up - St Mary's Emergency department (UK)	Screening and referral for **brief intervention**: Patients received either an information leaflet or an information leaflet plus an appointment with an alcohol health worker.	Outcome data (alcohol consumption, number of visits at the ED) were collected by patient interview and examination of hospital records at 6 and 12 months follow up	▪ Opportunistic identification and referral for alcohol misuse in an ED is feasible, associated with lower levels of alcohol consumption over the following 6 months (I=59,7 units of alcohol per week and C=83.1), and reduces re-attendance at the department (1,2 compared with 1,7, t –2·0, p=0·046).
Bjerre, (2003)	Before and after study	- 72 people completed the program out of 350 alcohol offenders (voluntarily participation) - Sweden	**Ignition interlock program** for Driving While Intoxicated (DWI) offenders (covers 2 years and involves strict regulations entailingregular checkups by a medical specialist in the field of alcohol and drug abuse.	The outcome evaluation involved a study of official accident statistics, the number of DWI offenses, hospital discharge registers, and sick leave registers. Data covering the 5 years prior to the DWI offense and onward were collected. Chi-square test was used for statistical analysis of the differences between the groups being compared.	▪ Records from the 5 years prior to the DWI offense showed that the accident rate (road accidents involving injury reported by the police) for the participants in the interlock and control groups was four to five times higher than for the average driver. Noticeable reduction in alcohol consumption among the interlock users was found during the 2 years program implementation. Among men, the mean AUDIT score fell from 11.4 to 2.4. For the interlock group the annual frequency of DWI offenses was reduced from the prior 4.7% per year to zero, while it remained high for control group.

ZT: Zero Tolerance;

Table 4. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
DeYoung et al. (2004)	Quasi-experimental	- DUI offenders: (1) with an IID order or restriction (2) with an IID order (3) installing an IID (4) first offenders with IID order or restriction (5) second offenders with IID order or restriction (6) second offenders installing an IID - California	Program **of Ignition Interlock Devices (IID)**	Outcome evaluation: Assessment of the difference between the interlock and comparison groups on subsequent DUI convictions and crashes.	▪ IIDs can be effective in reducing DUI recidivism, but not in all situations or for all offenders. IIDs are effective in reducing subsequent DUI convictions when they are actually installed on offenders' vehicles. It not appeared to be effective for first DUI offenders with high blood alcohol levels who received an IID order or restriction.
Dinh-Zarr et al. (2004)	Systematic review	23 trials identified; 22 had been completed and 17 provided results for relevant outcomes	**Interventions vs no-interventions** for problem drinking on subsequent injury risk.	Assessment of the effect of interventions for problem drinking on subsequent injury risk.	▪ Trials comparing interventions for problem drinking to no intervention reported reduced motor-vehicle crashes and related injuries, falls, suicide attempts, domestic violence, assaults and child abuse, alcohol-related injuries and injury emergency visits, hospitalizations and deaths. Reductions ranged from 27% to 65%. Brief counseling in the clinical setting was studied in seven trials, in which injury-related deaths were reduced. The majority of trials of brief counseling also showed beneficial effects on diverse non-fatal injury outcomes.
Elder et al. (2002)	Systematic Review	- 12 studies evaluating the effectiveness of RBT checkpoints - 11 studies evaluating the effectiveness of SBT checkpoints	**Random breath testing (RBT) checkpoints**: all drivers stopped are given breath tests for blood alcohol levels. **Selective breath testing (SBT) checkpoints**: police must have reason to suspect the driver has been drinking before demanding a breath test.	Alcohol-related crash-outcomes to non-alcohol-related-crash outcomes	▪ Substantial reductions in crashes were observed for both checkpoint types. Results suggest that both RBT and SBT checkpoints can play an important role in preventing alcohol-related crashes and associated injuries.

DUI, Driving Under the Influence; IID, Ignition Interlock Devices; RBT, Random Breath Testing; SBT, Selective Breath Testing;

Table 4 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Elder et al. (2004)	Systematic Review	- 11 studies included the criteria	**Mass Media Campaigns** for reducing alcohol impaired driving and alcohol-related crashes. The content of the message focuses either on the legal consequences or on the health and social consequences of drinking and driving.	Outcome measures were crashes and measured BAC. Separate effect estimates were calculated for fatal crashes, fatal and nonfatal injury crashes, and property damage crashes	▪ The median decrease in crashes across all studies and all levels of crash severity was 13%. The median decrease in injury-producing crashes, the most common crash outcome, was 10%. Economic analyses of campaign effects indicated that the societal benefits were greater than the costs. There was no clear difference in the effectiveness of campaigns that used legal deterrence messages and those that used social and health consequences messages.
Fink et al. (2005)	Prospective comparison study	- 23 physicians and 665 patients aged 65 and older. - Community primary care	Providing physicians and older patients with **personalized reports** of drinking risks and benefits and patient **education**. Intervention: Combined report, in which six physicians and 212 patients received reports of patients' drinking classifications and patients also received education; Patient report, in which 245 patients received reports and education, but their five physicians did not receive reports; and usual care.	Assessments at baseline and 12 months later to determine patients' non-hazardous (no known risks), hazardous (risks for problems), or harmful (presence of problems) classifications using the Computerized Alcohol Related Problems Survey (CARPS)[7].	▪ The patient report intervention significantly reduced harmful drinking at follow-up from an expected 21% in usual care to 16% and increased non-hazardous drinking from 52% expected in usual care to 58%. ▪ Patients in the combined report intervention experienced a significantly greater average decrease in quantity and frequency. Older primary care patients can effectively reduce their alcohol consumption and other drinking risks when given personalized information about their drinking and health.
Gregor et al. (2003)	Descriptive study of 2-site RCT	- 843 eligible adolescent patients (14-18 years) presenting to the ED; 671 (79.6%) were enrolled and 655 completed the program. [I= 329, C=326] - Site 1: a 950-bed tertiary academic medical center; Site 2: 540-bed teaching hospital	A **laptop-based interactive alcohol prevention program.**[8] Content consisted of elements that would enhance knowledge about alcohol use and the effects of alcohol, promote more cautious attitudes regarding alcohol use and misuse, and promote more positive behavioral intentions in regard to alcohol use and misuse.	Measure the efficacy of the program: patient recruitment, mechanism of injury, injury severity score, alcohol use characteristics, and patients' opinion of the computer program.	▪ Use of an interactive computer program in the ED appears feasible. 47% of recent drinkers reported that the program made them rethink their alcohol use. Further work is being done to evaluate the effectiveness of the program in reducing alcohol-related behaviours among adolescents.

[7] The CARPS contains a scanned screening measure and scoring algorithms and automatically produces patient and physician reports and patient education.
[8] The conceptual elements of the intervention program based on a successful school-based curriculum to prevent alcohol use and misuse among adolescents (Shope, 1996)

Table 4. (*Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Hingson et al. (2002)	Review	- 25 studies (8 targeted to reduce college-age drinking problems)	**Comprehensive multi-factorial community interventions** (school-based & public education programs, medical screening & treatment, media advocacy, community organizing, environmental policy changes and heightened enforcement of existing policies) to reduce college-age drinking problems	Alcohol use behaviour change.	▪ Comprehensive community intervention approaches can be effectively applied to a variety of public health problems. Comprehensive community programs consistently yielded significant reductions in alcohol use or related problems. The majority of programs targeting youth achieved health related behavioural changes in the desired direction. The community intervention approach might be specifically appropriate for college intervention programs.
Hingson et al. (2005)	Quasi-experimental design	- General population - 5 Communities: Kansas City, MO; Milwaukee, WI; San Antonio, TX; and Santa Barbara, CA; & Vallejo, CA	**The Fighting Back program: Community interventions** that focus on reducing alcohol availability and increasing substance abuse treatment. Aim: to develop coordinated, comprehensive strategies to heighten awareness about the issue, and improve prevention, early identification, treatment, and aftercare services.	The ratio of fatal crashes involving a driver or pedestrian with a BAC of 0.01% or higher, 0.08% or higher, or 0.15% or higher were examined relative to fatal crashes where no alcohol was involved for 10 years preceding and 10 years following program initiation.	▪ Relative to their comparison communities, the five FBAT communities experienced significant declines, during the 10 program years, of 22% in alcohol related fatal crashes at 0.01% BAC or higher, 20% at 0.08% or higher, and 17% at 0.15% or higher relative to fatal crashes not involving alcohol. Community interventions to reduce alcohol availability and increase substance abuse treatment can reduce alcohol related fatal traffic crashes.
Howat et al. (2004)	Review		**Interventions that are part of health promotion**: (1) economic interventions (price and taxation), (2) organizational interventions (availability, law enforcement, server intervention, server litigation), (3) policy interventions [drink driving laws (zero tolerance laws, drinking age laws, .05/.08 BAC laws, sobriety checkpoints, increased penalties); advertising restrictions; warning labels], and (4) health education interventions, including the use of media, school and community education, and public awareness programs.		▪ Economic & retailer interventions; alcohol taxation; reducing alcohol availability; legal & legislative strategies; strategies addressing the servers of alcohol *(strong evidence of effectiveness)* ▪ Sobriety checkpoints; lower BAC laws; minimum legal drinking age laws; supportive media promotion programs *(Evidence of effectiveness)* ▪ Restricting alcohol advertising & promotion; actions involving counter advertising *(Moderate evidence for effectiveness)*. Passive server training programs; school drug & alcohol education programs; community mobilization efforts; health warnings. *(Insufficient evidence of effectiveness)* Ecological approaches to reducing alcohol impaired driving using all 4 components of the health promotion model are likely to be the most effective.

FBAT: communities awarded Fighting Back grants by The Robert Wood Johnson Foundation to reduce substance abuse and related problems attempted to reduce availability of alcohol and expand substance abuse treatment programs

Table 4. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Mello et al. (2005)	RCT	- n=539 - An urban Level I trauma center of brief intervention	- Brief intervention (1 ED session) - **Brief motivational intervention** for alcohol **plus a booster session** (n=34) - Standard care (SC) for injured ED patients with an alcohol use problem who were being discharged home (n=46).	At 12 months, alcohol-related negative consequences and injuries	▪ Brief motivational intervention for alcohol plus a Booster session resulted to fewer negative consequences and alcohol-related injuries for subcritically injured ED patients with harmful or hazardous alcohol use, than those receiving brier intervention or SC. A secondary analysis of this result showed that motor vehicle crash patients (n=133) given brief motivational intervention for alcohol plus a booster (n=34) had fewer alcohol-related injuries than those receiving standard care (n=46; P=.001).
Miller et al. (2006)	Cross Sectional	- Under 21 years - 12 USA communities which have Retail Alcohol Policies	State **retail alcohol monopolies**	Estimated associations of monopolies with under-21 drinking, binge drinking, alcohol-impaired driving deaths, and odds a driver under 21 who died was alcohol-positive.	▪ In states with a retail monopoly over spirits or wine and spirits, an average of 14.5% fewer high school students reported drinking alcohol in the past 30 days and 16.7% fewer reported binge drinking in the past 30 days than high school students in non-monopoly states. Monopolies over both wine and spirits were associated with larger consumption reductions than monopolies over spirits only. Lower consumption rates in monopoly states, in turn, were associated with a 9.3% lower alcohol-impaired driving death rate under age 21 in monopoly states versus non-monopoly states. Alcohol monopolies may prevent 45 impaired driving deaths annually.
Moyer et al. (2002)	Review and meta-analysis	56 investigations: 1. comparing BI with control conditions in non-treatment-seeking samples (n=34) 2. BI with extended treatment in treatment-seeking samples (n=20)	**Brief interventions**[9] vs. extended treatment 1. Brief interventions vs. control conditions in non treatment-seeking, primary health care, populations 2. Brief interventions vs. extended treatment in treatment-seeking, primary health care, populations	Calculate the effect sizes for multiple drinking-related outcomes at multiple follow-up points, and took into account the critical distinction between treatment-seeking and non-treatment-seeking samples.	▪ Positive evidence found for brief interventions compared to control conditions in opportunistic samples and as typically delivered by health-care professionals. ▪ Little difference in the effects of brief intervention and extended treatments. However, the results of this review do suggest that brief interventions can be successful in particular settings with selected individuals.

[9] What is considered a 'brief ' intervention in one study is considered an 'extended' intervention in another (Jönson *et al.* 1995). Some features sometimes used to characterize brief interventions include: (1) having a goal of reduced or non-problem drinking as opposed to abstinence; (2) being delivered by a physician or other health-care professional as opposed to an addiction specialist; (3) being directed at non-dependent drinkers as opposed to dependent drinkers; (4) addressing individuals' level of motivation to change drinking habits; (5) being self- (as opposed to professionally) directed, and/or (6) having particular ingredients, summarized by the acronym FRAMES (Feedback of risk, encouraging Responsibility for change, Advice, a Menu of options, therapeutic Empathy, and enhancing Self-efficacy; Miller & Rollnick 1991).

Table 4. *(Continued)*

Authors/ Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Raub et al. (2001)	Controlled trial without randomization	Multiple DUI offenders - One group received an RDP without any other conditions (control). - The other group received an RDP and had to install a BAIID (treatment). - Illinois	**Breath Alcohol Ignition Interlock Device** Program (BAIID)	Assessment of recidivism; DUI arrests	▪ Findings show that there was an 82% reduction in DUI arrests for the first year that the BAIID was installed and 62% reduction over comparable three-year periods. In the short-term, the interlock appears effective for those who use it. However, the BAIID does not appear to promote a long-term change in driving behavior.
Rodrıguez-Martos et al. (2006)	RCT	- ≥18 year-olds (drivers, passengers, and pedestrians) attending the ED after a crash - Emergency room of a level I trauma centre (Spain)	**Brief motivational intervention**[10] (BI) compared with a minimal intervention (MI)	Changes in AUDIT-C score and in the percentage of patients with a hazardous consumption; percentage of patients who scored as hazardous drinkers and did not belong to this category anymore. The score in AUDIT-item 3 (binge drinking) measured independently. Accidents: incidence in the year before the study inclusion compared with that of the follow-up year.	▪ Effectiveness of BI compared with MI hasn't been verified, but a significant reduction in consumption (~70% of casualties had reduced consumption compared with baseline, the percentage of hazardous drinkers had dropped 47%, and 62% of the former hazardous drinkers had become negative) observed in the whole sample, without significant differences by type of intervention. The persistence and dimension of changes suggest a real effect of both interventions, although the lack of a pure control group doesn't allow definitive conclusions.
Schermer et al. (2006)	RCT	- 126 of 157 injured patients in motor vehicle collisions	Trauma center **Brief Interventions** (BI) against DUI arrests vs standard care receive (SC)	DUI arrest within 3 years of hospital discharge.	▪ Approximately one in six participants (n = 21, 16.7%) had a DUI arrest within 3 years of hospital discharge. Within 3 years of hospital discharge, 14 of 64 patients (21.9%) in the SC group had an arrest for DUI compared with only 7 of 62 patients (11.3%) who received the BI. Overall, Patients who receive BI during a trauma center admission are less likely to be arrested for DUI within 3 years of discharge. BI represents a viable intervention to reduce DUI after trauma center admission.

[10] BI, delivered in 15–20 min, is based on the model of change (Prochaska & DiClemente, 1986) and the principles of motivational interviewing (Miller & Rollnick, 1991), and includes the active elements known as FRAMES (feedback, responsibility, advice, menu, empathy and self-efficacy).

Table 4. *(Continued)*

Authors/ Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Schinke et al. (2005)	Before and after study	- 489 adolescents - After-school agencies, in New York City, and parts of New Jersey and Delaware	A **skills-based interactive CD-ROM intervention program** Thinking Not Drinking: A SODAS City Adventure.	Assertion skills, Youths' ability to perceive harm, questions related to self-efficacy, problem solving, educational attainment, peer interactions, and family rules related to alcohol and substance use.	▪ Positive increase in perceived harm of alcohol use and increased assertiveness skills (I=4.41, C=4.21). ▪ CD-ROM technology offers a new and promising medium for engaging high-risk youth in an alcohol abuse prevention program. Study implications and future applications of the present approach are discussed.
Shope et al. (2001)	RCT	- 4635 10th-grade students. I=1820 C=2815 - southeastern Michigan	A **high school-based alcohol prevention program**: Alcohol Misuse Prevention Study (AMPS) 10th-Grade Curriculum.	Alcohol-related and other serious offenses, and at-fault, single-vehicle, and alcohol-related crashes and follow-up for an average of 7.6 years after Licensure.	▪ The AMPS curriculum reduced the risk of serious offences during the first year of licensure by an estimated 20%, adjusting for sex, race, alcohol use/misuse, age at time of licensure, family structure, and parental attitudes toward young people's alcohol use. A high school - based alcohol prevention program can positively affect subsequent driving, particularly that of students who do not use alcohol regularly
Shults et al. (2001)	Systematic review	76 studies	**Population-based interventions**: - 0.08 BAC laws; Lower BAC laws for young/ inexperienced drivers; - Minimum legal drinking age laws (Administrative license revocation, ignition interlocks); - Sobriety checkpoints; - Intervention training programs for servers of alcoholic beverages	Fatal and non-fatal injuries resulting from alcohol-related motor vehicle crashes.	▪ 0.08 blood alcohol concentration laws, minimum legal drinking age laws, and sobriety checkpoints *(Strong evidence of effectiveness)* ▪ Lower blood alcohol concentration laws for young/ inexperienced drivers, intervention training programs for servers of alcoholic beverages *(Sufficient evidence of effectiveness).*
Elder et al (2002)	Systematic review	17 studies identified of the effectiveness of RBT; 12 met inclusion criteria 15 studies identified of the effectiveness of SBT; 11 met the inclusion criteria	**Sobriety Checkpoints** (RBT and SBT)	When available, selected effect measures that compared alcohol-related crash outcomes to non-alcohol-related outcomes	▪ For RBT checkpoints, median decreases were 22% for fatal crashes and 16% for fatal and nonfatal injury crashes. SBT checkpoints were associated with decreases in fatal crashes of 20%. *(Strong evidence of effectiveness)*

RDP, Restricted Driving Permits; BAC, Blood Alcohol Concentration;

Table 4. *(Continued)*

Authors/ Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Smith et al. (2003)	RCT	- 151 participants - Oral and maxillofacial surgery out-patient clinic in an urban teaching hospital	**Brief motivational intervention**	Total alcohol consumption, typical weeks consumption and days abstinent in preceding 3 months; the AUDIT score; a short form of the Alcohol Problems Questionnaire; measure of satisfaction with social relationships.	▪ There was a significant decrease in 84-day total alcohol consumption across the year ($P < 0.006$) and a significant effect for the motivational intervention ($P < 0.029$). This pattern was repeated for days abstinent and alcohol consumption in a typical week as well as alcohol-related problems. There was a significantly greater reduction in the percentage of hazardous drinkers in the motivational intervention group (from 60% to 27%,) compared to the control group (from 54% to 51%).
Vasilaki et al. (2006)	Meta-analytic review	- 22 studies	**Motivational interviewing** (MI) as a brief intervention vs no intervention	Reductions in alcohol consumption	▪ Brief MI is an effective intervention for reducing alcohol consumption. MI is more effective with young adults who are heavy-or low-dependent drinkers than with older drinkers or those with a more severe drinking problem.
Wagenaar (2005)	multi-community time-series quasi-experimental trial with a nested cohort design.	CMDA was implemented in 20 cities in four geographic areas in the US Midwest.	The Complying with the Minimum Drinking Age project (CMDA) is a community trial designed to test effects of two interventions designed to reduce alcohol sales to minors: (1) training for management of retail alcohol establishments and (2) enforcement checks of alcohol establishments.	Propensity for alcohol sales to minors;	▪ Effects of the training intervention were mixed. Specific deterrent effects were observed for enforcement checks, with an immediate 17% reduction in likelihood of sales to minors. These effects decayed entirely within 3 months in off-premise establishments and to an 8.2% reduction in on-premise establishments. Enforcement checks prevent alcohol sales to minors but a regular schedule of enforcement is necessary to maintain deterrence.
Whitlock et al. (2004)	Systematic Review	- 12 studies included - Multiple primary care settings	Primary care–based **behavioral counseling interventions** for risky/harmful alcohol use	Reported mean drinks per week or average daily consumption; the proportion of participants with safe or moderate alcohol use; the proportion of participants not bingeing;	Six to 12 months after good quality, brief, multi contact behavioural counselling interventions (those with up to 15 minutes of initial contact and at least 1 follow-up), participants reduced the average number of drinks per week by 13% to 34% more than controls did, and the proportion of participants drinking at moderate or safe levels was 10% to 19% greater compared with controls. One study reported maintenance of improved drinking patterns for 48 months. Effective interventions generally included advice, feedback, goal setting, and additional contacts for further assistance and support, Very brief or brief single-contact interventions were less effective or ineffective in reducing risky/harmful alcohol use.

AUDIT, Alcohol Use Disorders Identification Test;

Table 4. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Willis et al. (2004)	Systematic review	- 14 studies	**Ignition interlock device programs**	Examining rates of recidivism while the ignition interlock device was installed in the vehicle and after removal of the device.	▪ The interlock programme appears to be effective while the device is installed in the vehicle of the offender. None of the studies provide evidence for any effectiveness of the programmes continuing once the device has been removed
Spirito et al. (2004)	RCT	- 152 patients aged 13-17 years out of 287 eligible patients I=78 C=74 - An ED of an urban hospital in the Northeast	**Brief Motivational Interview** (MI) aiming to reduce alcohol-related consequences and use among adolescents treated in an ED after an alcohol-related event vs Standard Care (SC)	ADQ questionnaire: Drinking frequency (days per month); quantity (drinks per occasion); frequency of high-volume drinking (≥5 drinks per occasion); and frequency of intoxication over the prior 3 months. Other questionnaires: ADI, YADDQ, AIC, SMAST, AHBQ	▪ Both conditions resulted in reduced quantity of drinking during the 12-month follow-up, whereas alcohol-related negative consequences were relatively low and stayed low at follow-up. Adolescents who screened positive for problematic alcohol use at baseline reported significantly more improvement on 2 of 3 alcohol use outcomes (average number of drinking days per month and frequency of high-volume drinking) if they received MI compared with SC
Blow et al. (2006)	RCT	- injured patients in Emergency Department (n=4.476)	Four interventions: (1) tailored message booklet with brief advice, (2) tailored message booklet only, (3) generic message booklet with brief advice, and (4) generic message booklet only.	Alcohol consumption at 3 month and 12 month follow up.	▪ Each of the intervention groups significantly decreased their alcohol consumption from baseline to 12-month follow-up; subjects in the tailored message booklet with brief advice group significantly decreased their average weekly alcohol consumption by 48.5% ($p<.0001$). Those in the brief advice conditions (tailored or generic) significantly decreased their average consumption during the 12 months of the study compared with the no brief advice conditions. Younger adult women (ages 19-22) who received some brief advice were the most likely to decrease their heavy episodic drinking.

ADQ, Adolescent Drinking Questionnaire; ADI, Adolescent Drinking Inventory; YADDQ, Young Adult Drinking and Driving Questionnaire; AIC, Adolescent Injury Checklist; SMAST, Short Michigan Alcoholism Screening Test; AHBQ, Adolescent Health Behavior Questionnaire.

Conclusion

The results of the systematic literature review on alcohol-related injuries prevention indicate that there are many different preventive interventions that can be implemented aiming to reduce excessive alcohol consumption and the consequent alcohol related injuries.

The majority of identified studies evaluated the effectiveness of brief interventions in emergency departments. Brief interventions consist of structured techniques that are used to help motivate problem drinkers to become more accepting of specific interventions and become more successful in their treatment programs (McCammon, 2001). Brief interventions consist of 6 components that spell out the acronym FRAMES and are based on a technique known as motivational interviewing (McCammon, 2001). Feedback is provided through a discussion of the clinical assessment of the drinking problem with the patient and family. The responsibility of effecting a behavioral change is placed with the patient and serves to empower him or her to choose healthy options. Specific advice to help the patient effect a behavioral change and specific treatment recommendations are provided. Patients are given a choice from a menu of goals and action strategies for changing behaviour.

Approaches that attempt to bring about change in drinking and driving behaviour through education alone are likely to have limited or no success, whereas those that combine educational with other behavioral, environmental, policy, and organizational changes are likely to be the most effective (Shults et al., 2001). Although school-based alcohol prevention programs have the reduction of alcohol misuse and the related injuries as their ultimate goal, such outcomes are seldom measured.

Ecological approaches aiming to reduce alcohol impaired driving using all four components of the health promotion model are likely to be the most effective. Economic interventions (e.g. taxations), alcohol licensing, reducing the alcohol availability, off-premise monopoly systems, can limit both the levels of alcohol consumption and of alcohol-related problems. Server intervention programs (e.g. server training) and interventions targeted to the drinking environment have been associated with decrease in intoxication and nighttime injury crashes. Mass media campaigns can have significant effects on increasing knowledge, changing attitudes, changing perceived norms, improving health-related behaviours and can be effective in reducing alcohol-impaired driving and alcohol-related crashes (Elder et al. 2004; Howat et al. 2004). Perhaps the best example of reducing the level of alcohol-related harm is the enforcement of laws related to lower BAC limits (.02 or .05%) (Shults et al., 2001), sobriety checkpoints

(Shults et al., 2001), drinking and driving legislation, and increase the legal drinking age (Shults et al., 2001).

Furthermore, the literature clearly suggests that ignition interlocks seem to be effective. However, in order to have an overall impact on traffic safety, they must be part of a compulsory strategy to combat repeat drunk driving.

There are also interventions which provide low or insufficient evidence of effectiveness and further research is recommended. These interventions relate to restrictions on advertising and promotion, health and safety warnings (Stockley, 2001), school-based educational programs.

The effectiveness of the interventions described here may depend on the economic infrastructure of a country or region. Hence, the transferability of these strategies from high-income to low- or middle-income countries needs further research.

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3. Good practices for prevention of road traffic injuries

3.1 Introduction

The rapid development and expansion of the road network and the increase in number of motor vehicles have led to a substantial rise in levels of both passenger and freight movement. Injuries resulting from road accidents continue to pose a serious public health problem and are the leading cause of death among people under the age of 25. Consequently, safety related issues have emerged. The number of road accidents and fatalities has been growing in recent years, which call for concerted and multi-disciplinary preventive and remedial efforts. Without increased safety effort and appropriate action to match the growing number of motor vehicles in low to middle income countries, road traffic injury is predicted be the third leading contributor to the global burden of disease and injury by 2020 (Murray et al. 1996· Peden et al 2004).

Despite the growing burden of road traffic injuries, road safety has received insufficient attention at both international and national levels[1]. This has resulted in part from: a lack of information on the magnitude of the problem and its preventability; a fatalistic approach to road crashes; and a lack of the political responsibility and multidisciplinary collaboration needed to tackle it effectively (Peden et al. 2004). Road traffic injuries can be prevented, and their consequences can be alleviated if the appropriate practices, policies, strategies, road safety regulations and guidelines are in place. While practices and policies have been implemented, to be effective these policies must be enforced fairly, firmly and consistently.

3.2. Results

A total of 149 references were retrieved and reviewed. Of these 47 fulfilled all inclusion criteria and 12 were characterized as promising.

Breakdown of gathered practices

	N
Gathered	**149**
Included papers	**47**
To be further reviewed (promising)	**12**
Excluded papers	**90**
Other date of publish	75
No evaluation	5
Irrelevant interventions	5
Not full text available	5

After the ranking process, 52 good practices were identified. Taking the body of literature as a whole, our conclusions relating to the published evidence of efficacy of interventions designed to prevent road traffic injuries are summarized in Table 5. Overall, there was:

Evidence of effectiveness:

Engineering:

- Traffic calming and speed control
  - Traffic calming interventions in rural areas[11] (lane narrowing, narrowing of road entrances, speed humps/ rumps, roundabouts, special speed zones, roadway barriers, improving signage and lighting, and redistributing traffic, e.g. one way streets)
  - Area-wide urban traffic calming schemes (street closures, guardrails, turning bans at junctions, staggered one-way regulations or street narrowing; speed reducing devices in local roads; installing or upgrading traffic signals at junctions, prohibiting kerb parking or widening the road)
  - Bicycle paths or lanes; one-way street networks; school-zone measures; pedestrian indicator lights; lowering of bumper heights; edge lines; wrong-way signs;
  - Pedestrianisation schemes (raised platforms on the road to slow car drivers, two zebra crossings with adjacent railings, creation of parking bays; sidewalks; pedestrian crossing signs; speed limits;)

[11] Traffic calming referres to the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behaviour, and improve conditions for non-motorised street users. Eligible schemes included those that involved a number of specific changes to the road layout, road hierarchy or road environment, for example road narrowing, road closures, creation of one way streets, changes at junctions, miniroundabouts, road surface treatment, or speed humps.

- Occupant restraints: seat belts; child safety seats; age-appropriate child restraint seats
- (Mobile) speed cameras; red light cameras
- Vehicular design; Air bags (when are used together with seat belts);

Legislation/regulation/enforcement:

- Minimum legal drinking age laws;
- Alcohol sobriety checkpoints;
- Lower BAC limit laws;
- Mandatory bicycle and motorcycle helmet laws;
- Enhanced enforcement programs for safety belt laws; primary enforcement of safety belt laws[12]
- Enforcement of child safety seat use laws; child restraint loan schemes;
- Graduated driving licensure (night-time curfew laws, no carrying of young passengers, blood alcohol limit of 30 mg/100 ml, limitations of extra passengers; roadway restrictions);
- Administrative per se license suspension laws; licensure suspension laws;
- Night-time conspicuity-enforcement measures; daytime running lights; automated enforcement devices (e.g., red light camera);
- Speed enforcement detection devices (speed cameras; radar and laser devices)
- Alcohol Ignition Interlock Systems;

Education/Training:

- Education on conspicuity-enhancement measures;
- Community-wide health promotion campaigns/ distribution and education programs (to increase bicycle and motorcycle helmet use, and to promote children's car seat and seatbelt use)
- Skills training programs for pedestrians, motorcyclists and bicyclists

Other:

[12] Primary enforcement safety belt laws allow a police officer to stop a motorist solely for not wearing a safety belt. Enhanced enforcement of safety belt laws can involve increasing the number of officers on patrol, increasing citations for safety belt violations during regular patrols, use of safety belt checkpoints, or a combination of these efforts. These programs are conducted in addition to normal enforcement practices and are usually coupled with intensified publicity.

- Conspicuity measures, (use of reflective or fluorescent clothing, headlight operation, and colour of helmet, clothing, and motorcycle).

Evidence of cost-effective interventions

- Legislation, combined with community education and helmet promotion campaigns

Unclear evidence

Engineering:

- Rumble strips (Ker, 2003); traffic roundabouts and other traffic control devices (stop signs, traffic lights, right-turn-on-red light (Ker, 2003) e.t.c);

Legislation:

- Curb parking regulations (Ker, 2003);
- Increasing age of driver licensure (Ker, 2003);

Education/Training

- Public awareness campaigns and legal approaches addressing the problem of driver fatigue (Fletcher, 2005)
- Alcohol safety education (Ker, 2003)
- Road safety programs combining educational and environmental measures in an integrated package (Towner at al. 2001)
- School-based instructional programs; peer organizations; social norming programs[13];
- Pedestrian safety education (direct and indirect) (Duperrex, 2002)

Ineffective:

Engineering:

- Painted crosswalks or "zebra crossings" alone (Ker, 2003)

Education/Training:

- School-based driver education (Ian, 2001· Roberts, 2001); skid schools (Ker, 2003)
- General mass media or training events (Towner at al. 2001)
- Post-license driver education (remedial driver education, advanced driver education) (Ker, 2003· Grabowski, 2001)

[13]School-based instructional programs are a commonly used approach to addressing the problems of DD and RDD. These programs vary widely in their focus, with some targeting a variety of consequences of substance use and others more directly focused on problems related to alcohol-impaired driving. School-based peer organizations are groups of students, often with faculty advisors, who encourage other students to refrain from drinking, DD, and RDD. Social norming programs generally consist of ongoing, multiyear public information programs conducted on college campuses to reduce alcohol use, although they can also be conducted in other settings and for other target behaviors. (Elder RW, Nichols JL, Shults RA, Sleet DA, Barrios LC, Compton R, Task Force on Community Preventive Services. (2005). Effectiveness of school based programs for reducing drinking and driving and riding with drinking drivers: A systematic review. Am J Prev Med. 2005; 28(5 Suppl):288-304.)

- Education-only programs aiming at parents (Zaza, 2001), young children, healthcare professionals, law enforcement personnel.

Table 5. Summary of good practices to reduce road traffic injuries

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Attewell et al (2001)	Meta-analysis	N/A	**Bicycle helmets**	Brain injury, facial injury, neck injury, fatal injury.	▪ There is a statistically significant protective effect of helmets. Bicycle helmets prevent serious injury and even death
Begg et al (2001)	Before and after intervention study	- young drivers licensed before GDL (n=2,252); drivers who held a restricted graduated licence (n=980); drivers who held a full graduated licence (n=1,273) - New Zealand	**Graduated Driver Licensing**: night-time curfew, no carrying of young passengers, and a blood alcohol limit of 30 mg/100 ml.	The impact on young driver crashes	▪ Some of the GDL restrictions, especially the night-time curfew, have contributed to a reduction in serious crashes involving young drivers
Bunn et al. (2003)	Systematic review and meta-analysis	N/A	**Traffic calming schemes** (treatment of both main roads and residential roads)	Road user deaths; injuries (fatal and non-fatal);	▪ Area-wide traffic calming in towns and cities has the potential to reduce road traffic injuries
Bunn et al. (2003)	Review	N/A	**Area-wide traffic calming schemes**	Road traffic crashes, all road user deaths and injuries, pedestrian-motor vehicle collisions and road user deaths.	▪ Area-wide traffic calming in towns and cities may be a promising intervention for reducing the number of road traffic injuries, and deaths
Chen et al (2006)	Retrospective study	- all 16-year-old drivers involved in fatal crashes in the United States from 1994 through 2004 - United States	**Graduated driver licensing programs**	Crash data	▪ Comprehensive graduated driver licensing programs are associated with reductions of ~20% in 16-year-old drivers' fatal crash involvement rates. The greatest benefit seems to be associated with programs that include age requirements and >=3 months of waiting before the intermediate stage, nighttime driving restriction, and either >=30 hours of supervised driving or passenger restriction.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Coffman (2002)	Review	N/A	**Bicycle helmets**	N/A	▪ Legislation, combined with community education and helmet promotion campaigns, remains the most cost-effective approach for increasing helmet use.
Christie et al (2003)	Controlled before and after study	- Persons injured by road traffic before and after intervention. - South Wales, UK.	Use of **mobile speed cameras** at 101 sites.	Rate ratio of injurious crashes at intervention and control sites.	▪ The route based method is the better method of measure effectiveness at distances up to 500 metres. This method demonstrates a 51% reduction in injurious crashes
Corben et al. (2004)	Benefit cost analysis	- N/R - Australia	**Road infrastructure**: crashworthy infrastructure and road design: flexible roadside barriers and W-beam systems; Edge-lining; Shoulder sealing with (tactile) edge-lining; Clear zones; Guardrails or other barriers; Curve realignment; Pavement widening; Pavement resurfacing; barrier treatment; removal of hazards		▪ Fatal and serious injury crashes involving run-off-road and head-on events have reduced by up to 90 percent by extensive use of flexible barriers. Large-scale programs implementing barriers along substantial lengths of road are required. ▪ Preliminary work indicates BCR values mainly of over 1, and as high as 4.7, with substantial return for investment on average, if the entire route is addressed as a whole.
Council et al (2005)	Experimental design	- 132 treatment sites and approximately 50 unsignalized intersections in each jurisdiction. - United States	**Red light cameras** monitoring intersections	Interviews were conducted for several potential jurisdictions known to have significant RLC programs. Control sites were selected from sites which hadn't installed cameras.	▪ A significant decrease in right-angle crashes was found, but there is also a significant increase in rear end crashes. The study also revealed the presence of warning signs at both RLC intersections and city limits and the application of high publicity levels will enhance the benefits of RLC systems.
Cummings et al. (2002)	Matched pair cohort study	- 51 031 driver-passenger pairs in the same vehicle. - All passenger vehicle crashes in the United States during 1990-2000	Use of **air bags** in vehicles	Relative risk of death within 30 days of a crash.	▪ The average risk of driver death was reduced 8% (95% confidence interval 4% to 12%) by an air bag. Benefit was similar for belted and unbelted drivers and was slightly greater for women. However, seat belts offered much more protection than air bags.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Cvijanovich et al. (2001)	Population-based descriptive study	- 16-17 years old teenager drivers	**Graduated driver licensing programs**	Comparison of fatalities between 16- to 17-year-old drivers with 18- to 59-year-old drivers.	▪ Graduated driver licensing programs that target state-specific characteristics of TDs may decrease morbidity and mortality
Delaney et al (2004)	Quasi-experimental, before-after, treatment and control design.	- primary schools throughout Victoria	**Safe Routes to Schools (SRTS) community based road safety program**: The program includes education, engineering, encouragement and enforcement initiatives, aimed principally at reducing casualty crash frequency and severity for children as pedestrians, bicyclists and passengers.	Examines the crash effects associated with the program across a number of road user groups at all times of day and at the times at which children are likely to be traveling to and from school.	The largest percentage reduction in casualty crashes was identified for primary school-aged pedestrians and bicyclists traveling during school travel times only (17.9%). Crashes involving primary school-aged pedestrians and bicyclists at all times, and crashes involving primary school-aged children at all times, were estimated to have fallen by 12.6 and 12.7 percent respectively. In addition, a 4.8 percent reduction in crashes involving all road users at school travel times was identified. Attempts to estimate the effect of the program in each year following the implementation of the program were statistically inconclusive, most likely because of insufficient data. In respect of the severity of crashes involving the relevant road users, no statistically reliable reductions in fatal and serious injury crash frequency could be identified at the five-percent level
Zaza et al. (2001)	Systematic review	N/A	**Safety belts use**	Changes in safety belt use and number of crash-related injuries.	▪ Strong evidence was found for the effectiveness of safety belt laws in general and for the incremental effectiveness of primary safety belt laws relative to secondary laws. Strong evidence for the effectiveness of enhanced enforcement programs for safety belt laws was also found.
Durbin et al (2005)	Cross Sectional (correlational study)	- 229 106 children (<16 years in 146 613 crashes) - United States	**Rear seating for all children** <13 years of age and the use of age-appropriate restraints, including child safety seats and belt-positioning booster seats.	- Children who were involved in crashes of insured vehicles in 15 states, with data collected via insurance claims records and a telephone survey.	▪ Unrestrained children in the front were at the highest risk of injury (40%) and appropriately restrained children in the rear were at the lowest risk, for all age groups. ~62% of the children used seat belts, 35% used child restraints (including child safety seats and booster seats), and 3% used no restraint.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Ebel et al. (2003)	Prospective, non-randomized, controlled community intervention trial.	-3609 booster-eligible children 4-8 yrs - 4 communities in the greater Seattle, Wash; Eight communities in Portland, Ore, and Spokane, Wash, served as control sites.	**A multifaceted community booster seat campaign**	Observed booster seat use 15 months after the start of the campaign.	▪ Results suggest that a multifaceted community education campaign can significantly increase the use of child booster seats
Ekman et al. (2001)	N/A	- two age groups--0-6 and 7-14 years - Sweden	Legislation and promotion of **child-restraint use** in motor vehicles		▪ The level of restraint use for children in the front seat was 97% in 1988 and was equal to 1995. Mortality data shows a decrease of 2.8% on an average per year, 76% over the study period. A significant change over time in the two intervention areas was shown (annual changes of -2.8 and -1.8%), but not in the rest of Sweden
Elvik (2001)	Meta-analysis	- Residential areas	**Area-wide urban traffic calming schemes** (reclassification of the street network; street closures, turning bans at junctions, staggered one-way regulations or street narrowing; speed reducing devices in local roads; installing or upgrading traffic signals at junctions, prohibiting kerb parking or widening the road.	- number of injury accidents	▪ Area-wide urban traffic calming schemes on the average reduce the number of injury accidents by about 15%. The largest reduction in the number of accidents is found for residential streets (about 25%), a somewhat smaller reduction is found for main roads (about 10%). Similar reductions are found in the number of property damage only accidents
Elliott et al. (2006)	Cohort study	- 2 - 6 years children in two-way crashes occurring between 1998 and 2003. -United States	**Child restraint systems** (rear-facing and forward-facing car seats, and shield and belt-positioning booster seats)	- The death of child passengers from injuries incurred during the crash.	▪ Child restraints, when not seriously misused were associated with a 28% reduction in risk for death in children aged 2 through 6 years. When including cases of serious misuse, the effectiveness estimate was slightly lower (21%)

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Forjuoh et al. (2003)	Review	N/A	Interventions and strategies that have been developed to counter traffic-related injuries in High Income Countries in terms of their effectiveness and their applicability to Low Income Countries.		▪ Proven effectiveness: seat belts; air bags; motorcycle helmets; bicycle helmets; sidewalks; roadway barriers; pedestrian crossing signs; education on conspicuity-enhancement measures; roadway lighting; speed limits; speed ramps/bumps; curfew laws to restrict teenage driving; minimum drinking age laws; alcohol sobriety checkpoints; lower BAC laws; child safety seats; vehicular design; child seat use laws; ▪ Sufficient evidence of effectiveness: bicycle paths or lanes; one-way street networks; school-zone measures; pedestrian indicator lights; graduated driving licensure; adminidtrative per se license suspension laws; ignition interlock systems; licensure suspension laws; motorcycle rider education; lowering of bumper heights; running light conspicuity measures; nighttime conspicuity- enforcement measures; daytime running light; automated enforcement devices (e.g., red light camera); edge lines; wrong-way signs;
Grabowski et al. (2001)	Review	- younger and older drivers	**State regulations**	Motor vehicle fatalities	A number of state-level policies and regulations may affect the number of motor vehicle crashes and fatalities in these two high-risk groups
Gresham et al. (2001)	Randomized pretest and posttest comparative design	- 2,465 elementary school-aged children - San Diego County, California	**Think First for Kids (TFFK):** a curriculum addressing injury prevention, on self-reported, high-injury risk behavior and knowledge about safety behaviors and the brain and spinal cord. The TFFK curriculum integrates math, literacy, and science objectives. Classroom interactions and homework assignments have children count, read, and perform problem-solving exercises. Safety components were developed to elucidate and enhance interest, learning, and acceptance of safety measures.	The program was evaluated by using a student self-report pretest and posttest consisting of questions of a forced-choice format, multiple-choice, and sequencing questions relating to knowledge or concepts presented in the TFFK curriculum at each grade level.	▪ The study showed that children often lack basic knowledge regarding safety and do not recognize behaviors considered high risk for injury. By using multivariate analysis, the intervention children had a significantly greater increase in knowledge about the brain and spinal cord and safe behaviors to prevent traumatic injury, and a decrease in self-reported, high-risk behaviors (p. 001) when compared with control subjects, adjusting for the covariates gender, socioeconomic status, and race/ethnicity.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Hall et al. (2004)	RCT	- primary school children - 27 Western Australian primary schools	A **school-based peer leader bicycle helmet intervention** (a peer-led classroom curriculum for 10-12 year old children)	Helmet wearing rates	▪ Using peer teachers is a useful strategy to engage students in normative-based protective behaviours. The logistical challenges this strategy presents appear to be worth the outcomes
Hartling et al. (2004)	Systematic review	- 16 yrs old teenage drivers	**Graduated driver licensing**	The different crash types (overall, injury, fatal, night-time, alcohol, and those resulting in hospitalization)	▪ The existing evidence shows that GDL is effective in reducing the crash rates of young drivers, although the magnitude of the effect is unclear
Hotz et al. (2004)	Randomized comparative design	- 2300 elementary school children -two high-risk urban school districts	**WalkSafe Program**: a school based educational injury prevention program for children grades Kindergarten through 5.	N/A	▪ The WalkSafe program was shown to improve the pedestrian safety knowledge of elementary school children
Istre et al. (2002)	Evaluation study	- 7413 observations conducted (4137 comparison observations) on preschool-aged children - West Dallas	**Education program to increase the use of child restraint use**		▪ The program was successful because it incorporated religion, cultural beliefs, and community into the interventions, and because it was ongoing and multifaceted. The program was most successful among persons who attended the community health center and in the youngest age group (children younger than 2 years)
Kedikoglou et al (2005)	Cohort study	- Parents of newborn infants188 families (60% of informed parents)	**An infant car-restraint loan scheme** (information campaign for car-restraint use and donation of car-restraints).	Car-restraint use	▪ 154 families (81.9%) subsequently purchased the appropriate next-stage child car restraint. It is also of interest that there is a suggestive correlation of younger maternal age with higher rate of purchasing the subsequent stage child car restraint device. A potential explanation is that younger mothers are more receptive to uptake of new information. Also a loan programme of infant car-restraints was shown to be particularly cost effective.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Kwan et al. (2002)	Systematic review	N/A	**Visibility aids**	Drivers' detection and recognition responses.	▪ Fluorescent materials in yellow, red and orange colours improve detection and recognition in the daytime. For night-time visibility, lamps, flashing lights and retro reflective materials in red and yellow colours increase detection and recognition. Retro reflective materials arranged in a 'biomotion' configuration also enhance recognition However, the effect of visibility aids on pedestrian and cyclist safety remains unknown.
LeBlanc et al. (2002)	Observational study	- N/R - Hillsborough County, Florida:120 observation sites were used—schools, playground areas, parks, bike paths, and intersections.	**Mandatory helmet use** for cyclists: An extensive media campaign (pamphlets, newspapers, radio and television) was conducted in July and August to inform the public about the law.)	Compliance to the law.	▪ The rate of helmet use rose dramatically after legislation was enacted, from 36% in 1995 and 38% in 1996, to 75% in 1997, 86% in 1998 and 84% in 1999. The proportion of injured cyclists with head injuries in 1998/99 was half that in 1995/96 (7/443 [1.6%] v. 15/416 [3.6%]) (p = 0.06). Police carried out regular education and enforcement. There were no helmet-promoting mass media education campaigns after 1997.
Liller et al. (2003)	Before and after study	- Approximately 120 observation sites were used - Nova Scotia: arterial, residential and recreational road	**Bicycle helmet law** for children under the age of 16.	changes in children's bicycle helmet use and motor vehicle bicycle related injuries	▪ The results show a significant increase in bicycle helmet use among children, ages 5–13, in the post-law years compared with the pre-law years. Also, there has been a significant decline in the rates of bicycle related motor vehicle injuries among children in the post-law years compared with the pre-law years
Lin et al. (2003)	Review	- Teenage drivers (13-17 yrs) - United States: Road	**Graduated driver licensing** (GDL): Nighttime driving and passenger restrictions	N/R	▪ Nighttime driving restrictions have been shown to effectively reduce the number and rate of crash involvements on the part of teenage drivers. Data suggest that having passengers in the car increases the likelihood of a fatal injury in young drivers and that this risk increases with the number of passengers. Young drivers were more likely to cause a crash when accompanied by their peers. Nighttime driving and passenger restrictions are effective in decreasing injuries among teenage drivers and their passengers, especially in the context of a full GDL system.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Liu et al. (2004)	Review	- Motorcycle riders - N/A	Use of **motorcycle helmets**	Helmet use; death, head, neck or facial injury	▪ Motorcycle helmets appear to reduce the risk of mortality, of head injury and the risk reduction is estimated to be 72% (OR 0.28, 95%CI 0.23, 0.35).
Mohan (2004)	Systematic review	- N/A - South Asia	**Actions for road safety**: policy measures; infrastructure; law and enforcement	N/A	▪ Evidence based effective actions: Policy Measures: Establishment of road safety departments by national governments to build capacity at national and local levels to monitor the magnitude, severity and burden of road traffic collisions and injuries; Setting up of research groups to focus on road safety; Training of road safety professionals. Law and enforcement: Compulsory use of seat belt by car users; Making it mandatory for children to ride in back seats only; Mandatory helmet use by two-wheeler riders; Daytime headlamp use by motorcyclists; Control of drinking and driving; Limiting speeds to less than 50 km/h on major roads in cities and less than 30 km/h in residential neighbourhoods and business districts. Infrastructure: Traffic calming measures in urban areas; Provision of separate lanes for bicycles and other slow traffic; Safe walking and street crossing facilities for pedestrians; More widespread use of roundabouts
Morrison et al. (2003)	Review of systematic reviews	- N/A	**Transport interventions**	Health effects: social, psychological, and physical effects that could be measured on humans.	▪ The most effective transport interventions to improve health are health promotion campaigns (to prevent childhood injuries, to increase bicycle and motorcycle helmet use, and to promote children's car seat and seatbelt use), traffic calming, and specific legislation against drink driving
Morrison et al. (2004)	Prospective cohort study	- 750 households (25% non-response rate) -Community	**Traffic calm scheme** [comprised five sets of speed cushions (raised platforms on the road to slow car drivers), two zebra crossings with adjacent railings, and creation of parking bays]	physical health (physical component summary) and mental health (mental component summary)	▪ There were increases in observed pedestrian activity in the area after the introduction of the traffic calming scheme. Physical health improved significantly but mental health did not change. Traffic related problems improved, while other local nuisances were reported to be worse

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Newstead et al. (2001)	Quasi-experimental study	- Queensland, Australia.	**Random Road Watch (RRW): a randomized police enforcement program**	Crash frequency	▪ Analysis showed that the program is effective overall. Estimated program effects were largest on fatal crashes, with an estimated reduction of 31%. Estimated aggregate program crash effects reduced with crash severity and increased with time after program introduction. Crash reductions in the third year after program introduction translated into savings, at state level, of some 12% of the state's crashes of all severities and some 15% of the state's fatal road crashes. Overall, the program produced a significant 11% reduction in total crashes in areas outside of metropolitan Brisbane. The opportunity-cost benefit :cost ratio for the program was estimated to be 55:1
P.Papaioannou, et al. (Not reported date of publication)	Before and after study	- Residents - Thessaloniki Metropolitan Area, Greece	**Traffic calming measures** and pedestrianisation schemes	Traffic flow; Road accidents with fatalities and/or injuries; Opinion data from interviews	▪ Traffic-calming measures do have positive effects on traffic, safety and the environment. However, some negative effects are likely to occur at roads surrounding the areas where the measures were implemented
Peden et al. (2004)	Report	N/A	**Environmental modification** [land-use and transport planning; road design; improving motorvehicle crashworthiness; road safety audit; management of road infastructure, traffic calming measures; low-cost remedial measures and crash-protective roadsides] Promotion/awareness raising (public information and education campaigns) Low enforcement monitoring (enforcing speed limits, seat belt use laws, child restraints; helmets use; BAC limits enforcement through RBT at sobriety checkpoints; use of daytime running lights;)	N/A	▪ All the above recommended actions seem to be highly effective.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Pilkington et al. (2005)	Systematic review	N/A	**Speed cameras**	Road traffic collisions, injuries, and deaths.	▪ Speed cameras are an effective intervention in reducing road traffic collisions and related casualties. The level of evidence is relatively poor, however, as most studies did not have satisfactory comparison groups or adequate control for potential confounders. Controlled introduction of speed cameras with careful data collection may offer improved evidence of their effectiveness in the future
Poli de Figueiredo et al. (2001)	Cross Sectional (correlational study)	- Injured patients - a level I trauma centre in downtown Sao Paulo	**Brazilian Traffic Code**: Large increase in fines and rigid penalty scoring system that leads to driver license withdrawal. Raised speed limits on many roads, closer monitoring of adherence to the rules.	- the incidence of injured patients and immediate deaths in road accidents and emergency room admissions after the first year of the new code.	▪ Very costly tickets and threatened driver licences have proved very effective in decreasing immediate deaths from trauma. There was an overall 21.3% reduction in the number of accidents and a 24.7% reduction in immediate deaths, saving 5962 lives on Brazilian highways. Tickets issued fell by 49.5% (601 977 during 1997 to 304 785 during 1998). Motor vehicle accident-related emergency room admissions decreased by 33.2%.
Povey et al. (2003)	Time series survey	- Speed estimates at randomly selected locations - New Zealand open roads	**Speed enforcement**: radar and laser speed measurement devices were used, visible speed cameras, fines resulted from speeding infringements Enforcement activity has been accompanied by high-impact advertising and publicity campaigns to convey the harmful consequences of speeding	-Reduction on speed; reported injury crashes; number of tickets issued by speed cameras	▪ Changes in speed were found to have a significant effect on open road injury crashes in low alcohol hours. A reduction of 12% in injury crashes and 13% in injuries and deaths was found to be associated with a 1km/h reduction in mean speed

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Quine et al. (2001)	Two-by-three mixed design	- 97 school-aged cyclists who did not initially use a helmet: Intervention group (n=48), and control group (n=49)	**A theory–based intervention to encourage the use of protective helmets**: Intervention group (a booklet containing a series of persuasive messages based on the identified salient beliefs) and control group (a different series of messages concerning a cycling proficiency and bicycle maintenance course.)	Initial beliefs (before the intervention; the immediate effects of the intervention; five months later, the long-term effects of the intervention on beliefs, intentions, and behaviour were assessed.	▪ The behavioral, normative and control beliefs and intentions of intervention participants became more positive than those of control participants, and the effect was maintained over time. There was also a significant effect on behavior: at 5-month follow-up, none of the 49 control children had taken up helmet wearing, while 12 (25%) of the 48 intervention children had .
Rodgers (2002)	Cross sectional study	- Children and adolescents under 16 years old - United States	**State helmet laws**	Quantify the independent effect of the state helmet laws on helmet use.	▪ State helmet laws significantly increase helmet use by children and play an important part in any comprehensive effort designed to achieve this goal
Servadei et al (2003)	Pre-post evaluation of law	- Motorcycle-moped rider survey for helmet use compliance and all residents in the region admitted to the Division of Neurosurgery of the Maurizio Bufalini Hospital in Cesena, Italy for TBI. -Romagna region, northeastern Italy	The revised Italian **mandatory helmet law**, with police enforcement	Helmet use compliance and change in TBI admissions and type(s) of brain lesions.	▪ Helmet use increased from an average of less than 20% to over 96%. A comparison of TBI incidence in the Romagna region shows that there was no significant variation before and after introduction of the revised helmet law, except for TBI admissions for motorcycle-moped crashes where a 66% decrease was observed. In the same area TBI admissions by age group showed that motorcycle mopeds riders aged 14–60 years sustained significantly fewer TBIs. The rate of TBI admissions to neurosurgery decreased by over 31% and epidural hematomas almost completely disappeared in crash injured moped riders.
Shults et al. (2004)	Meta-analysis	N/A	**Primary enforcement safety belt laws; enhanced enforcement of safety belt laws**	Safety belt use; fatal and nonfatal injuries	▪ Primary laws are more effective than secondary laws in increasing safety belt use and decreasing fatalities and that enhanced enforcement is effective in increasing safety belt use. Increases in belt use are generally highest in states with low baseline rates of belt use

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Shults et al. (2004)	Review	N/R	**Primary enforcement laws**	N/A	▪ States that directly enacted primary laws showed larger increases in observed seat belt use. Smaller, but substantial increases in belt use were observed in states that replaced secondary with primary laws.
Svanstrom et al. (2002)	Cross sectional (correlational study)	- N/A -Sweden	**Swedish National Bicycle Safety Programme** (mandatory helmet-wearing legislation, in combination with information and educational efforts for all age groups	Incidence rates of head injuries and reported helmet use	▪ Considerable reductions has been made on reduction of bicycle-related injuries over the last two decades.
Towner et al. (2001)	Systematic review	- N/R	▪ **Environmental** modification (Area-wide urban safety measures; UK Urban Safety Project; 20mph zones; bicycle tracks; school-crossing patrols) ▪ **Capacity building** (Education/enforcement aimed at driver, at child/parent; Bicycle training; Bicycle helmet educational campaigns; Child restraint educational campaigns; Seat belt and child restraint educational campaigns; Education aimed at child bus passengers; pedestrian skills training; pedestrian education-traffic clubs; bicycle helmet campaigns; child restraint loan schemes) ▪ **Law enforcement** monitoring (Bicycle helmet legislation; Child restraint and seat belt legislation; enforcement of car passenger laws-police enforcement, publicity advertising of campaigns)	Changes in mortality or morbidity, road traffic injuries, speed reduction, observed or reported behaviour, change in hazard, or change in knowledge.	▪ Area-wide engineering schemes and traffic calming measures (strong evidence of effectiveness) Pedestrian skills training programs have been shown to improve children's skills. There is some evidence that bicycle training schemes can improve safe riding behavior. Bicycle helmet education campaigns can increase the use of helmets. Cycle helmet legislation has been associated with injury reductions. The loan of car safety seats appears to be an effective strategy to increase the numbers of children transported safely in cars. Educational approaches appear to be an effective means of increasing the numbers of babies and children restrained in cars. Legislation requiring the restraint of children in cars is associated with reductions in injury and death. Enforcement of car passenger restraint legislation has achieved some increases in observed restraint use.

Table 5. *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Turner et al. (2005)	Systematic review	- N/R	**Community-based models**[ii]	Injury rates due to motor vehicle crashes; observed changes in child restraint use	▪ While this review highlights that there is some evidence to support the effectiveness of community -based programs to promote car restraint use and/or motor vehicle occupant injury, limitations in the evaluation methodologies of the studies requires the results to be interpreted with caution
Wells et al. (2004)	Population-based case control study	- 463 motorcycle drivers (cases) involved in crashes leading to hospital treatment or death; 1233 motorcycle drivers (controls) recruited from randomly selected roadside survey sites. - Auckland region of New Zealand	**Conspicuity measures**, (use of reflective or fluorescent clothing, headlight operation, and colour of helmet, clothing, and motorcycle).	Estimates of relative risk of motorcycle crash related injury and population attributable risk associated with conspicuity measures, including the use of reflective or fluorescent clothing, headlight operation, and colour of helmet, clothing, and motorcycle.	▪ Low conspicuity may increase the risk of motorcycle crash related injury. Increasing the use of reflective or fluorescent clothing, white or light coloured helmets, and daytime headlights are simple, cheap interventions that could considerably reduce motorcycle crash related injury and death
Wilson et al. (2006)	Systematic review	N/A	**Speed enforcement detection devices** (including speed cameras and radar and laser devices)	The impact of speed enforcement detection devices on speeding, road crashes, injuries and deaths	▪ SEDs are a promising intervention for reducing the number of road traffic injuries and deaths
Wu et al. (2005)	RCT	- Enrolled 200 assenting English-speaking children (5-16 years) admitted to the ED for treatment, and who did not currently own a helmet. - An urban pediatric ED	**Directly receiving a free helmet in the ED** (ED-based intervention) combined with counseling for helmet use	The reported helmet use at follow-up, assessed by telephone interviews of both the child and a parent.	▪ Directly receiving a free helmet in the ED significantly increased reported helmet use relative to the control group; Receiving a free helmet also significantly increased reported helmet use when compared with the voucher intervention group.

Table 5. *(Continued)*

[ii] Multi-strategy community based programs use a combination of social and physical environmental interventions in the context of community-directed activity. The community-intervention model is characterised as having; a shared ownership of the injury problem and its solution, by experts and community members, and joint responsibility for determining the priorities and interventions that are appropriate, an understanding that injury prevention involves a complex causal web embedded in social and organisation structures, a coordinated multi-strategy response, and an emphasis on optimising community involvement.

Authors/Year	Study Design	Participants/ Setting	Content of the Intervention	Outcome Measures	Key results
Zaza et al. (2001)	Systematic review	- Children 1-4 yrs. - most of them implemented in United States	Five **population-based interventions** to increase child safety seat use: child safety seat laws, community-wide information and enhanced enforcement campaigns, distribution and education programs, incentive and education programs, and education only programs.	Changes in the use of child safety seats or injury rates. Observed use of child safety seats was the preferred measure and was used when available.	▪ Child safety seat laws (seat laws reduce fatal and nonfatal injuries and increase child safety seat use) and distribution plus education programs. (Strong evidence of effectiveness). Community-wide information plus enhanced enforcement campaigns and incentive plus education programs. (Sufficient evidence of effectiveness).

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4. Good practices for prevention of occupational injuries

4.1 Introduction

Workplace fatalities, injuries and illnesses remain at unacceptably high levels and involve an enormous and unnecessary health burden, suffering, and economic loss amounting to 4–5% of GDP. WHO estimates that there are only 10-15% of workers who have access to a basic standard of occupational health services.[1]

For the year 2000 ILO estimates show that annually there are two million work-related deaths - more than 5.000 every day - and for every fatal accident there are another 500-2.000 injuries, depending on the type of job. In addition, the ILO said for every fatal work-related disease there are about 100 other illnesses causing absence from work.[2]

Overall ILO estimates that there were 351.251 fatal occupational accidents in 2001 compared with only 41.748 reported to the agency. The organisation argues that unintentional injuries leading to death are just the tip of the iceberg and estimates that about 500 to 2000 smaller injuries take place for each fatality.[3]

The ILO firmly believes that work-related accidents and ill-health can and indeed must be prevented and that action is needed at international, regional, national and enterprise levels to achieve this. Part of the answer also lies in more or better education and training, with occupational safety and health better integrated within vocational training courses as well as enterprise training programs. However, real success in reducing work-related accidents and ill-health can only be achieved with a positive commitment amongst all concerned to prevention, a concept that is at the heart of what has been termed a "preventative safety and health culture".[4]

Prevention involves management, foresight, planning and commitment - to anticipate hazards, assess risks and take action before an accident happens or an illness has been contracted. This can only be achieved with the cooperation of all concerned - the employer, who has the prime responsibility to provide safe and healthy working conditions, managers, supervisors, workers and their safety and health representatives, trade unions - through communication, collective agreements, safety committees etc. All these parties have an important part to play in improving occupational safety and health through effective social dialogue[4]

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[1] WHO-Occupational health http://www.who.int/occupational_health/en/

[2] ILO Communication, “Work-related fatalities reach 2 million annually”, Press Release, *ILO/02/23 http://www.ilo.org/public/english/bureau/inf/pr/2002/23.htm*

[3] Zarokostas, J., International Labour Organisation tackles work related injuries. BMJ 2005;331:656

4.2 Results

A total of 113 references were retrieved. Of these 28 fulfilled all inclusion criteria. Only the Included documents were further reviewed and evaluated.

Breakdown of gathered practices

	N
Gathered	**113**
Included papers	**28**
Excluded papers	**85**
Other date of publish	33
No evaluation	36
Age of the targeted population	2
No injury priority (intervention targeted on disorder/ illness)	13
Other language	1

Taking the body of literature as a whole and after the ranking process, our conclusions relating to the published evidence of efficacy of interventions designed to prevent work-related injuries are summarized in Table 6. Overall, there was:

Evidence of Effectiveness

For musculoskeletal injury prevention

- Safety devices accompanied by written guidelines/ instructions and policies as well as the appropriate training
- Awareness raising programs to promote safe practices and peer reminders to avoid unsafe practices
- Ergonomist for assessing the risk of manual handling in the workplace and making recommendations in reducing the rate and severity (time lost and cost) of workers' injury
- Case management and intervention on injury incidence and time loss

For work-related skin /eye /hearing injuries

- Consultative teams consisted of representatives from both, management and employees/ workers
- Recommendations for prevention of work-related skin /eye /noise problems in various workplaces

- Educational programme for a group of frontline employees, who underwent formalised training, and subsequently introduced the information to their colleagues

For falls-related injuries

- Workstation modifications- Fall Protection Systems including engineering modification and training (task-specific instruction and training on proper use of personal protective equipment (PPE))
- Enforcement of construction industry safety programmes implementation (including fall prevention practices and technologies) via a third party (e.g. University) participation
- Site visits and communication from the third party aiming to reinforce the intervention by helping the companies to make proper changes in their safety activities and the safety of their work environment
- Application of a post-offer, pre-placement assessment program

In general

- Identification and investigation of work situations at high risk for injury and formulating and disseminating prevention strategies to those who can intervene in the workplace by National/ Local Authorities
- Multi-component prevention campaigns (including educational brochures and broadcasting/ publication of television/ radio programmes and local newspaper articles containing expert advice on the subject)

Also, some interventions identified as fairly/ partially effective such as:

- Non evidence based (evaluated) effective safety devices (e.g. tools, equipments)
- Non evidence based (evaluated) workstation modification/ redesign (e.g. alternatives workstation and postural interventions for prevention of musculoskeletal symptoms among computer users)[14]
- Non evidence based (evaluated) product modifications (e.g. use of a software as strategy to maintain a client's compliance with a injury prevention program)
- Educational safety intervention that may be appropriate for secondary prevention aid only or some types of educational intervention (e.g. no face validity evaluated)

[14] Gerr F, Marcus M, Monteilh C, Hannan L, Ortiz D, Kleinbaum D. A randomised controlled trial of postural interventions for prevention of musculoskeletal symptoms among computer users. Occup. Environ. Med. 2005; 62:478-487.

- Cognitive behavioral therapy (CBT) intervention (seems to be appropriate for secondary prevention aid)
- Sensitizational /informational Campaigns that are not implemented in the appropriate settings

Ineffective

- Personal Safety Equipments (PPE) for skin, eye, hearing protection; although most of the PPE are available effective, usage of them is not widely accepted (due to the lack of regulations, information, training, etc.) and the workers/ employees/ farmers etc. do not use them[15, 16]
- Accident only investigation as intervention is not effective for injury prevention
- Ineffective recruitment strategies to safety interventions are the main cause for many safety programs low effectiveness[17]

[15] Carpenter WS, Lee BC, Gunderson PD, Stueland DT. Assessment of Personal Protective Equipment Use Among Midwestern Farmers. Am. J. Ind. Med. 2002; 42:236–247.

[16] Daniell WE, Swan SS, McDaniel MM, Camp JE, Cohen MA, Stebbins JG. Noise exposure and hearing loss prevention programmes after 20 years of regulations in the United States. Occupational and Environmental Medicine. 2006; 63:343-351.

[17] Kidd P, Parshall M, Wojcik S, Struttmann T. Overcoming Recruitment Challenges in Construction Safety Intervention Research. American Journal of Industrial Medicine. 2004; 45:297–304.

Table 6. Summary of good practices to reduce work-related injuries

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Baptiste et al. (2006)	Quasi-experimental	All Caregivers of the participated Acute Care Units 8 Acute Care Units	Air-assisted friction reducing devices for lateral patient transfers	Qualitative: Assess through subjective feedback of caregivers actually using the devices. Data were collected through caregiver surveys, which rated comfort, ease of use, perceived injury risk, time efficiency, and patient safety. An overall performance rating was calculated as the sum of these five categories.	Effective: Caregivers rated air-assisted devices significantly higher ($p < .05$) than other devices. Lateral transfer devices are recommended over the traditional draw sheet method for performing lateral patient transfers. These friction-reducing devices are a cost-effective solution to the load of lateral patient transfers and should be favourably considered when purchasing patient-handling technologies.
Becker et al. (2001)	Quasi-experimental	16 contractors of Construction Companies (50-250 employees) 16 Construction Companies	FALL-SAFE INTERVENTION: Increase of Construction contractors' fall prevention practices and technologies with the contribution of a University (third party) intervention	Impact /Effectiveness evaluation: Pilot stage: intervention impact was measured by opinion and activity questionnaires and by site audits conducted by WVU faculty. Questionnaires were obtained from construction company owners, supervisors, and workers for intervention and control contractors, pre-intervention and post-intervention. These same questionnaires will be administered again after 1.5 years of program participation. Site audits were conducted before program participation (baseline) and quarterly through 1.5 years of participation.	Effective: Intervention contractors were observed to have improved their mean hazard control scores by 11 percentage points, while control contractors improved five points. The observation that the mean scores for both control and intervention groups showed improvement over time was the unexpected finding of this study. This improvement could represent secular improvement in fall hazard control practices in the industry, or could represent a response to the appearance of a third party person on sites performing the audit activity. Given the improvement of program and hazard control scores in both intervention and control groups, it appears that the Fall-Safe intervention can be credited with improving scores for the intervention contractor group to greater degree than the improvement seen in the control group.
Bronner et al. (2003)	Retrospective /prospective cohort study	42 professional dancers 1 Modern dance Organization	Case management and intervention on injury incidence and time loss	Quantitative measures to identify the effect of comprehensive management (case management and intervention) on injury incidence, time loss, and patterns of musculoskeletal injury in a modern dance organization. (Pre and post intervention injury data analysis: Injury data were analyzed over a 5-year period, 2 years without intervention and 3 years with intervention)	Effective: Comprehensive management significantly reduced the annual number of new workers' compensation cases from a high of 81% to a low of 17% and decreased the number of days lost from work by 60%. Benefits also included early and effective management of overuse problems before they became serious injuries and triage to prevent overutilization of medical services. This comprehensive management program effectively decreased the incidence of new cases and lost time. Both dancers and management strongly support its continuance.

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Carrivick et al. (2001)	Quasi-experimental study	Hospital cleaners (145) and orderlies (140) Cleaning Services Department (of a 600 bed Hospital)	Formation of a consultative team consisted of representatives from management, employees and the hospital's ergonomist for assessing the risk of manual handling in the workplace and making recommendations in reducing the rate and severity (time lost and cost) of workers' compensation injury	Quantitative: Lost time injury: A new workers' compensation injury resulting in one shift or more off work during the study period. Claim cost: Total cost of compensation for a lost time injury includes lost salary, medical costs, legal costs, travel costs, rehabilitation costs, settlement, and common law costs. Duration: Duration was the working hours ever lost from a lost time injury. Hours worked: Hours worked were the number of hours actually worked (not including leave, extra payment for overtime, etc) by a group (study hospital cleaners and orderlies only). Frequency: Frequency was lost time injury per hours worked. Duration rate: Duration rate was the total duration divided by hours worked. Claim cost rate: Claim cost rate was the total cost of compensation claims of the workers divided by hours worked.	Effective: Statistical analysis showed that implementation of the recommendations significantly reduced numbers and rates of injury, but not the severity of injury, in the cleaning services study group. There was no difference in numbers or severity of injuries for the comparison groups before and after implementation of the recommendations. The recommendation of the consultative team can produce a meaningful and sustained reduction in rates of injury within an at risk population. The results support a consultative approach to reducing workplace injuries from manual handling. The team process has potential for application to occupational groups at risk of exposure to other types of hazards.
Charney et al. (2006)	Pretest-Posttest study	Health care givers from 31 small Hospitals 31 Hospitals in Washington	Zero lift programs in small rural hospitals in Washington state: reducing back injuries among health care workers	Quantitative: Compared patient-handling injury data prior to program implementation with those after program implementation	Effective: Patient-handling injury claims decreased by 43% in the participating hospitals from 2000 to 2004 (i.e., from 3.51 to 2.23). The time lost frequency rate decreased by 50% (i.e., from 1.91 to 1.03).
Chung et al. (2002)	RCT	16 operators 1 Manufacturing Company	Evaluation of a New type of wafer container (pod) with power grip handles	Quantitative: Measurement of the effect of pod type and carrying distance on maximal acceptable weight of lift (MAWL), wrist posture, (RPEWB), heart rate (HR) and whole body rating of perceived exertion for a 12-hr shift work situation. The MAWL evaluation was a psychophysical approach. Also, the subject's wrist posture, physical workload in HR response, and subjective were measured.	Partially effective: This study concentrates on evaluating the influences of wafer container type and carrying distance on workers' MAWL, HR, wrist posture, and RPEWB. The pod type does have a significant effect on wrist posture and an obvious influence on MAWL, but it does not have significant effect on whole body workload. The new pod with power grip handles induced a greater MAWL and better control of the pod than the old type. On the other hand, the new pod's vertical handles also induced greater radial deviations and less ulnar deviations than the old type. It seems that the use of the new pod type still caused the high wrist radial deviation problem. Some improvements such as tilting the handle angle and lowering the handle position are proposed. For the carrying-distance effect, the long carrying distance tends to reduce the lifting capability in MAWL and increase the whole body workload in HR. The significant participant effect on all the response variables again demonstrates the significant individual differences in physical and psychophysical capabilities, as well as the subjective perception on whole body and local exertions.

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Collins et al. (2004)	Effectiveness (pre- and post-measures) without control group/ Cost-benefit evaluation	1728 Nursing staff Six nursing homes (covering a total of 552 licensed beds and facilities ranged in size from 60 to 120 beds)	"Best practices" intervention included: Equipment interventions (3 types of equipment), Written guidelines "zero lift policy", Training (knowledge based training and demonstration of the use of the lifting equipment and skill based training. Training sessions with job specific content. During new employee orientation, and annually as part of continuing education. Maintenance staff received annual training	Quantitative Measurements: Injury rates, costs, and lost and restricted workday rates were compared for the three year pre-intervention (1995–97) and three year post-intervention (1998–2000) periods. Data sources: Injuries, hours worked, and demographic data were supplied by the participating nursing homes for all nursing staff from 1 January 1995 through 31 December 2000.	Effective: Controlling for multiple factors, strong evidence was found to support an intervention consisting of mechanical resident lifting equipment, worker training on the proper use of the lifts, and a zero lift policy as a protective measure for preventing staff injuries associated with resident handling. This study utilized multiple sources of injury data (workers' compensation injury claims, OSHA 200 logs, and first reports of employee injury) to examine the impact of the prevention program on minor and severe injuries. Resident handling injury rates were significantly reduced from the pre-intervention to post-intervention time period for all three injury data sources. The largest reductions occurred among the more serious injuries that resulted in workers' compensation claims. The data also suggest that the effect of the mechanical lifting equipment intervention was beneficial for all nursing homes, for workers in all age groups, lengths of tenure, and for full time, part time, and per diem staff.
Flyvholm et al. (2005)	RCT (1 year follow up)	Danish gut cleaners n=736 (baseline) n=748 (follow up) 18 Swine Slaughterhouses, (each having a separate gut cleaning department)	Recommendations for prevention of work-related skin problems in various workplaces The intervention consisted of an evidence based prevention programme and a documented method for implementation	The effect of the intervention was evaluated by telephone interviews using a standardised questionnaire based on the Nordic Occupational Skin Questionnaire (NOSQ-2002) with modified and additional questions on exposure, preventive measures, information, and discussions on prevention of skin problems, etc	Effective: At one year follow up t a significant 27% relative reduction of occupational eczema in a high risk group was feasible through implementation of an evidence based prevention programme. The prevention programme aimed at reducing occupational skin problems among workers with wet work proved feasible to implement. The eczema frequency was reduced, although the duration of wet work could not be reduced substantially.
Guthrie et al. (2004)	Case crossover (pre and post measures)	Orthopedic and Neurology Units' Nurses 1 Hospital in Minnesota	A patient lifting intervention for preventing the work-related injuries of nurses	Quantitative: An evidence-based process was used to implement an effective lifting intervention, including a back school, a lift team, and mechanical lifting equipment, on the orthopedic and neurology units in a Minnesota hospital. A two-week pilot determined if enough work would be generated to justify hiring a permanent lift team. Then the entire lifting intervention was studied on the two units. Measured: rate of injuries, salary and work-replacement costs, and number of lifts per day.	Effective: The injuries for the two units decreased from 21 to 9 injuries. The lift team averaged 80 lifts per day and 95% of the nursing staff attended the back school. The lift team and new mechanical lifting equipment were successfully disseminated resulting in significant reductions in costs. Suggested improvements include additional supervision and lift team scheduling changes, regular staff meetings, and ongoing education.

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Harbin et al. (2005)	Correlational study	2,482 prospective new employees Electrical equipment Manufacturing Facility	Application of a post-offer, pre-placement program in an electrical equipment manufacturing facility. The aim of this study was to develop a testing protocol for determining physical capacity that could be adapted for a post-offer, pre-placement program.	Functional capacity evaluation (FCE) testing was used to determine the physical capacity of 2,482 uninjured, healthy prospective new employees of a large food production plant. A comprehensive medical history and 20 different anthropometric, fitness, strength, and lifting tests were administered to all new hires in the first phase of this study to determine if injury incidence could be estimated through functional screening testing. A second study was designed to determine the effectiveness of the application of a post-offer, pre-placement program in an electrical equipment manufacturing facility.	Effective: Strength testing alone was of no predictive value for work injury incidence. There was a strong correlation of physical capacity to physical job requirements. If an employee had the physical capability to perform the essential functions of the job, there was a lower injury rate as compared to the employee not demonstrating the physical strength or ability to perform the essential functions of the job. The incidence of low back injuries in those workers with the physical capabilities to perform the required functions of their job was 3%. However, among those workers who did not demonstrate the strength or physical abilities to perform their job, there was a 33% incidence of low back injuries. This study indicates that physical capacity testing that compares lifting ability to job lifting requirements correlates to work injury incidence.
Held et al. (2002)	Prospective RCT Study	375 wet work employees Gentofte Hospital	The intervention included an educational programme for a group of frontline employees, who underwent formalised training, and subsequently introduced the information to their colleagues. As part of the intervention a skin care policy including written instructions was established at each workplace.	Evaluation of knowledge (based on a quiz testing basic knowledge about skin care) Evaluation of behaviour and skin symptoms (via self administered questionnaires and clinical examinations). Afterwards a trained doctor or nurse examined their hands. Clinical examination included registration of symptoms and localisation; results were transformed into a scoring system dividing the participants into five groups: no skin symptoms, very mild, mild, moderate, and severe.	Effective: Evaluation after the five months of intervention revealed for intervention group in comparison to the control group: a significantly higher information level on skin care, a significant change in behaviour, and significantly less skin symptoms as evaluated clinically. No significant difference was found for self reported skin problems. The intervention was successful with respect to information level (knowledge), behaviour, and clinical symptoms. Implementation of a skin care programme as part of an occupational health and safety management system is recommended as a prophylactic measure for employees in wet occupations Results show that an educational program directed at participatory teams may be a successful preventive measure at workplaces with wet work. Information level about skin care was significantly improved in the intervention group and risk behaviour was minimised in important domains: number of hours with wet hands was reduced and use of cotton gloves increased. Furthermore, a statistically significantly reduced number and severity of irritant skin symptoms on the hands was found in the intervention group compared to the control group.

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Higgins et al. (2001)	Investigations of occupational traumatic fatalities from targeted causes that determined by NIOSH (after reviewing NTOF and CFOI data, current work related injury and fatality literature, and consulting with agencies responsible for worker safety and health)	Health or Labour Depts from 15 states (Alaska, California, Iowa, Kentucky, Massachusetts, Missouri, Minnesota, Nebraska, New Jersey, Ohio, Oklahoma, Texas, Washington, Wisconsin, and West Virginia) National Institute for Occupational Safety and Health (NIOSH)	FACE Model -Fatality Assessment and Control Evaluation program For the prevention of traumatic occupational fatalities by identifying and investigating work situations at high risk for injury and formulating and disseminating prevention strategies to those who can intervene in the workplace	Conduction of surveillance, targeted investigations, and prevention activities at the state level using the FACE model for participating FACE states. Investigation of deaths targeted by NIOSH, and participating states based on analysis of their state's fatal traumatic injury data.	About 17 workers were fatally injured at work each day in the United States in 1999. Both the rate and the numbers of occupational fatalities in the United States are decreasing, but with 6023 deaths in 1999, more needs to be done. Programs such as FACE demonstrate one approach for prevention of traumatic occupational fatalities. Investigations conducted through the FACE program allow the identification of factors that contribute to fatal occupational injuries. This information is used to develop comprehensive recommendations for preventing similar deaths.
Lineberry et al. (2002)	Case study	Small construction companies workers Small construction companies	A multiple-use educational intervention for extension ladder set-up and use	Qualitative: Focus groups composed of workers from small construction companies have identified conflicting knowledge about procedures to set-up and use extension ladders and especially about their assessment of risk in the context of ladder use, both for access to an upper level and for use as a working platform.	Effective: Based on these interviews, the co-authors have created a practical training intervention in the form of two sets of simply-worded guidelines, each grouped into manageable numbers of tasks and subtasks. Practical uses of the guidelines will be offered and results of a recent prioritization of these subtasks by experienced safety professionals familiar with ladder safety will be summarized. Lessons learned during application of these guidelines in tool-box sessions (field trials) with two experienced groups of ladder users employed by small construction companies in Kentucky will be described.
Mancini et al. (2005)	Pre- , peri-, post-, late post-, very late post- measures	237 workers of metal-ware factories Community (targeted metal-ware factories)	Multicomponent prevention campaign for work related eye injuries: the main intervention included distribution to all factories of specific educational brochures and broadcasting/ publication of television/ radio programmes and local newspaper articles containing expert advice on the subject.	Quantitative: Measured eye injury rates (versus non-eye injury rates) among metal workers during "pre-intervention" (1988–90), "peri-intervention" (1991–92), "post-intervention reinforcement" (1993–96), "late post-intervention" (1997–2000), and "very late post-intervention" (2001–03) periods with respect to two comparison sectors (construction and wood/ ceramics).	Effective: The periods did not by themselves determine an overall reduction in eye injuries. The period/sector interaction terms were related to significant reductions for the metal sector when crossed with the "post-intervention reinforcement" (IRR = 0.77, 95% CI 0.61 to 0.97; % decline = 23.4), the "late post-intervention" (IRR = 0.63, 95% CI 0.50 to 0.79; % decline = 37.4), and the "very late post-intervention" (IRR = 0.58, 95% CI 0.43 to 0.77; % decline = 42.4) periods, suggesting a sustained reduction in eye injury risk following the main intervention. Results suggest that a carefully coordinated, extensive, multicomponent intervention can lead to lasting reductions in the burden of eye injuries

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
McLellan et al. (2006)	RCT	Fire-fighters Defence R&D Canada, Toronto	The management of heat stress for the fire-fighters Aims: to define safe work limits for fire-fighters wearing their protective clothing and working in warm environments; to examine strategies to reduce the thermal burden and extend the operational effectiveness of the firefighter	Quantitative: For the first phase, subjects wore their protective ensemble and carried their self-contained breathing apparatus (SCBA) and performed very light, light, moderate or heavy work at 25 degrees C, 30 degrees C or 35 degrees C. Three experiments were conducted for the second phase of the project. The first study test the replacement of the duty uniform pants with shorts reduced the thermal strain. The second study examined the importance of fluid replacement. The last experiment compared active and passive cooling.	Effective: The first study revealed that replacing the duty uniform pants that are worn under the bunker pants with shorts reduced the thermal strain for activities that lasted longer than 60 min. The second study's data revealed that fluid replacement equivalent to at least 65% of the sweat lost increased exposure time by 15% compared with no fluid replacement. From the last experiment the data revealed that both the use of a mister or forearm and hand submersion in cool water significantly increased exposure time compared with passive cooling that involved only removing most of the protective clothing. Forearm and hand submersion proved to be most effective and produced dramatic increases in exposure time that approximated 65% compared with the passive cooling procedure. When the condition of no fluid replacement and passive cooling was compared with fluid replacement and forearm and hand submersion, exposure times were effectively doubled with the latter condition.)
Menzel et al. (2006)	Randomized clinical trial	32 registered nurses and nursing assistants with a history of back pain in the past year Department of Health Care Environments and Systems, University of Florida, College of Nursing	Cognitive behavioral therapy (CBT) intervention: The CBT intervention was a weekly stress and pain management session over 6 weeks led by a clinical psychologist.	Quantitative: Data for both groups were collected at baseline and at 6 weeks, with work absence data caused by back pain self-reported for 12 weeks	Partially effective: Pain intensity scores declined in the intervention group, indicating a large effect. However, stress scores increased. Depression scores accounted for one-third of the variance in hours absent because of back pain. Although there was a high dropout rate in the intervention group, a cognitive-behavioral intervention shows promise as a secondary prevention intervention.
Monsey et al. (2003)	Between subjects design	26 participants who were instructed in a preventative stretching program University of Hartford, West Hartford	Repetitive strain injury (RSI) prevention program: Computer reminder software as strategy to maintain a client's compliance with the program	Quantitative: To measure compliance, all participants recorded the number of times per day they stretched.	Fairly effective: Although a statistically significant difference was not found in the mean number of stretch breaks taken by the two groups ($p = 0.09$), further analysis suggested a type II error may have occurred. The effect size, d, revealed a large effect suggesting that the computer software had an impact on the frequency of stretch breaks, with the mean number of breaks per hour of work greater for the treatment group. Results strongly suggest that further research is warranted in this area.)

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
OHSAH (2003)	Between and within subjects	15 laboratory technologists Hospital laboratories and privately funded research laboratories.	Workstation redesign: Workstation adaptations that are expected to minimize the risk of musculoskeletal injury in laboratory technologists who perform pipetting tasks	Quantitative: Biomechanical assessment: measurements of joint angles, joint torques (forces acting around joints), postural information, and work envelope data) Qualitative: Various assessment tools: pain/discomfort questionnaire, background questionnaire, and design input questionnaire.	Results available only for the 1sth phase: A review of existing workstations showed that the majority of laboratories spent little time addressing ergonomic principles in the setup of their workstations. Workstations at the intervention and control sites did not accommodate the different heights of the laboratory technologists. They also did not account for the varied types of tasks being performed at the workstations. The features should be addressed in the new design based on the 1st phase results are: Height of the primary work counter, Adjustability of the workstation, Height adjustability of the seat pan and back of the chair, Proper task lighting, Overall comfort of the workstation
Paine et al. (2004)	Observational study	Construction workers (decking crew, iron workers, welders, etc.) [59,237 workhours (29.6 full time equivalent workers based on 50 forty-hour weeks)] 6 Capco Steel construction sites	Evaluation of a Decking Fall Protection System including engineering modification and training (task-specific instruction and training on proper use of PPE according to OSHA regulations &manufacturer instructions) Safety information also was provided at daily meetings and during weekly task-specific toolbox talks.	Quantitative and Qualitative: The evaluation involved: Observing worker training in this new fall protection system; Observing installation of the system; Observing its use during decking operations; and Collecting fall data and work-hours of installing decking. Site foremen were given only 24-hour notice of site visits.	Effective: The proposed fall protection system ensures that workers installing decking have 100-percent fall protection during this hazardous activity.
Pedersen et al. (2004)	RCT	38 office employees (National Institute of Occupational Health.) National Institute of Occupational Health (Experimental Laboratory)	"Readiness training" on the response to sudden back loading The participants received ten 45-min training sessions during a 4-week period. The training focused on reactions to a variety of expected and unexpected sudden trunk loadings, including balance and coordination exercises.	Quantitative: Before and after the training, all subjects were tested for reaction to sudden trunk loading (SL). This entailed applying a horizontal force of 58 N to the subject's upper back. Elapsed time – measured between SL and stopping – decreased significantly in the training group (from 337 to 311 ms) compared with the control group.	Moderate: In this study, training had an impact on the subject's reaction to sudden trunk loading. Stopping time decreased significantly in the training group, compared with the control group. The effect size was 0.53 standard deviations, which is considered moderate. However, taking into account that training lasted only 1 month, the results were substantial. This study is apparently one of the first to demonstrate that the response to sudden trunk loading can be improved in healthy subjects without an increase in pre-activation and associated trunk stiffness. In perspective, the results indicate a possibility for a training-induced reduction of the risk of low-back injuries, e.g., in nurses exposed to sudden trunk perturbations during patient handling.

Table 6 *(Continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Spangenberg et al. (2002)	Case crossover (simple before and after measures without control group)	Road construction's employees (4250 man-years (1 MAN-YEAR =1600 h). The safety campaign implemented midway during the construction of the railway and road link across the Sound, Øresund, between Denmark and Sweden	The Øresund Link multi-faceted safety campaign Attitude: A mascot; A newsletter; Notice boards in meeting rooms, etc. Behavioural: An award of DKK 25,000 (twice a year) for employees at the safest site; Specific theme campaigns	Quantitative: Injuries, which resulted in more than one day's absence from work after the day of the injury, were selected for the analysis. The effect of the Øresund safety campaign was evaluated by using a simple before and after design without a control group	Partially effective: The effect of the campaign was a 25% reduction of the number of injuries resulting from accidents, which did not completely fulfil the objective set by the site owner. This effect became only just statistically significant when heterogeneity of type of work before and after the campaign was taken into account. The modest effect of the safety campaign might be explained by the fact that the site, like any construction site, was a temporary workplace, where several contractors' had short-term project assignments. Apparently, the contractors working routines were not sufficiently affected by the campaign. Other factors, that might affect a campaign at a construction site, are discussed.
Srikrajant et al. (2005)	Quasi-experimental study design (control group)	24 health care workers The emergency and labor rooms in Sermngam Hospital, Lampang	Education program and problem solving work group on nursing practices for prevention of needlestick and sharp injury. Interventions included education and posters to promote safe nursing practices, peer reminders to avoid unsafe nursing practices, providing devices for recapping needles and small-sized trays to facilitate one-handed recapping, and making a hole in the lid of a sharp container Nursing practices on prevention of needlestick and sharp injury were prospectively monitored	Quantitative: Data collection included demographics, a participatory problem solving plan, and safety nursing practice observation recording form. The study was divided into a two months observation period, followed by a one month intervention period and a two month post-intervention observation period.	Effective: Compared to the pre-interventional period, significant improvement on safety nursing practices for all nursing practice categories were observed in the experimental group after the intervention (P=0.001). Compared to the control group, all safety nursing practice categories were performed more often in the experimental group (p=0.001). The educational and problem solving work group on nursing practices to prevent needlestick and sharp injury were effective and should be considered as an intervention to reduce needlestick and sharp injury in emergency and labor rooms at Sermngarm Hospital.
Varonen et al. (2002)	Correlational study (use of matched groups)	2.133 workers (min 51-max 264) 16 wood-processing companies in southern Finland	Work environment and Safety Activities: Site visits and phone communication aiming to reinforce the intervention by helping the companies to make proper changes in their safety activities and the safety of their work environment	Quantitative (based on checklists): Site studies, Measures for the safety level of work environment, Measures for the companies' safety activities, Accident analysis	Effective: In the period of 1989–1994, the accident rate of the experiment companies showed a clearly greater decline than was the case at the control companies or in the Finnish wood-processing industry as a whole. The accident rate decreased to a statistically significant degree in four experiment companies but in only one control company This study indicates that occupational accidents can be prevented by identifying and anticipating hazards and by implementing safety measures that concern the work environment, by initiating safety activities such as the provision of safety information and safety rules, by the familiarization of new employees with the workplace, by giving safety training to management and supervisors, and by allocating an active role to the safety committee. Such measures are feasible only if the highest-level management of the company supports them.

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5. Good practices for prevention of accidental drowning

5.1 Introduction

Despite the fact that drowning can be often preventable, it remains a leading cause of unintentional injury death, especially in children aged 0-14 years old.

In 2000, an estimated 409.272 people drowned, which makes drowning the second leading cause of unintentional injury death globally, after road traffic injuries. Drowning affects all age groups throughout the world, but certain groups are particularly vulnerable. Over half of the global mortality occurs among children less than fifteen years of age. Furthermore, 97% of all deaths from drowning occur in low- and middle-income countries (WHO, 2003). In the eastern and south-eastern regions of the world, more children die annually from drowning than from pertussis, measles, diphtheria, plague, cholera, dengue fever and typhoid fever combined (van Beeck, 2005).

In the European Union (EU-25), more than 300 children younger than 14 years old lost their lives due to accidental drowning in 2002, 100 of which were less than 4 years of age.[1] But the problem is even greater. For each childhood drowning fatality, it is estimated that there are 1 to 4 nonfatal submersions serious enough to result in hospitalization. Children who eventually manage to survive from drownings, most of the times, are severely brain damaged due to lack of oxygen during submersion or lose basic functioning and live in a permanent vegetative state (Grenfell, 2003).

The financial burden of drowning, therefore, seems enormous. Apart from the direct medical care costs for drowning survivors, there are indirect costs that occur as a consequence from the years of potential life lost. The fact that the highest mortality from drowning worldwide is among the 0-15 age group means that these children do not survive to reach the age of economic productivity. Although cost data is not readily available for the European Union, annual total cost of drowning injury in Australia was estimated at US$ 85.5 million for the period 1995-1996, whereas annual total cost estimates for coastal drowning in the United States amounted to over US$ 273 million in direct and indirect costs (1997) (WHO, 2003).

It is clear that effective strategies are needed to prevent these tragedies. However, analysis of the drowning literature demonstrates that the evaluation of interventions aiming to prevent childhood drowning has been limited. In general, few rigorously evaluated interventions are available in the

[1] Data retrieved from the World Health Organization and processed by CEREPRI (Available at: http://www.euroipn.org/stats_portal/).

international literature. This report aims to summarize the evidence on interventions that have sufficient evidence to be effective or are promising interventions in reducing the burden of childhood drowning.

5.2 Results

A total of 70 references were retrieved and reviewed. Of these 13 fulfilled all inclusion criteria and 4 were characterised as promising.

Breakdown of gathered practices

	N
Gathered	**70**
Included papers	**13**
To be further reviewed (promising)	**4**
Excluded papers	**53**
Other date of publish	36
No evaluation	9
Age of the targeted population	2
Not full text available	5
Other language	1

From the total number of papers, 69 documents referred to *Drowning* and 1 document referred to both drowning and occupational injury.

After the ranking process 13 good practices were identified and are summarized in Table 7.
Overall, there was:

Evidence of effectiveness:

Engineering

- Four-sided pool fencing (at least 4 feet high) with a self-closing, self-latching gatepool
- Environmental design changes at aquatic facilities (e.g. buoys and markers to delimit swimming areas, and lifesaving devices consisting of life jugs, ring buoys and lines, poles and prominent signs – all are not mentioned in table)
- Swimming pool alarms and wristbands

Law measures and enforcement

- Swimming pool-fencing legislation (e.g. perimeter fencing around the pool and property and isolation fencing around immediate pool only)

- Pool safety inspections

Health education, training and other educational interventions

- Campaign for increasing life vest use and ownership
- Campaign for raising water safety awareness
- Campaign for raising community awareness of the issue of drowning, raising awareness in parents and carers of high risk age groups and locations for drowning, raising awareness in parents and carers of supervision and pool fences as crucial prevention factors, raising awareness of other key preventive strategies (e.g. proficiency in CPR- not mentioned in table, learn to swim), raising consumer awareness of legislative requirements and raising community awareness of dangers of newly available large inflatable pools – what outcomes are these effective in increasing or preventing?
- Water safety workshops for Community Health Workers (CHWs were considered to be a key group to facilitate the delivery of water safety information to parents and caregivers of children aged 0-5 years old)
- A public swimming pools supervision swimming program aiming to provide knowledge to parents of what constitutes appropriate levels of supervision of children
- Education program that teaches high school students about water safety and personal flotation device (PFD) use; the students in turn teach elementary school students the same skills, adapted to their age level
- A school-based intervention for children

Economic interventions

- Life vest loan program and bulk discount schemes (Brenner, 2003)

Other

- Constant adult supervision around water
- Lifeguard supervision in public bathing areas
- Use of an approved personal flotation device (PFD)

Some interventions provided unclear of insufficient evidence of effectiveness, such as bath seat use (Byard, 2004· Sibert, 2005· Thompson, 2003), swimming lessons for children older than four years old, pool covers (e.g. solar or plastic covers) (Franklin 2003), and mandatory PFD wear legislation (McNamara, 2006). As ineffective was identified the swimming lessons for children younger than four years old (McNamara, 2006).

Table 7. Summary of good practices to reduce accidental drowning

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Bennett et al. (1999)	Telephone surveys before, during and after the campaign	-332 completed interviews with parents (pre-campaign survey), 200 completed interviews (tracking surveys) and 480 completed interviews (post-campaign survey) -King County, Washington	"Stay on Top of It": A community-wide **drowning prevention campaign**	Change in life vest use and ownership among 1-14 year old children; predictors of life vest use; campaign awareness	▪ Reported life vest use by children on docks, beaches, or at pools increased from 20% to 29% ($p<0.01$) and life vest ownership for children increased from 69% to 75% ($p=0.06$). Among parents aware of the campaign, reported child life vest use increased from 20% to 34% ($p<0.001$) and ownership increased from 69% to 80% ($p<0.01$). Among families unaware of the campaign, neither life vest use nor ownership changed significantly.
Branche et al (2001)	Case reports	N/A	**Lifeguards in public areas**	N/A	▪ Trained, professional lifeguards have helped keep drowning rates low for 40 years, and have significantly reduced the number of drownings in the United States
Brenner et al. (2003)	Systematic review	N/A	(1)**Four-sided fencing**; (2) **pool alarms and pool covers**; (3) **swimming instruction**; (4) **supervision/lifeguards** and (5) **personal flotation devices**.	N/A	▪ Four-sided fencing, supervision/ lifeguards, pool alarms and personal flotation devices are very important prevention strategies. Swimming instructions improve swimming ability but there are no data to show that swimming lessons actually decrease the risk of drowning.
Franklin et al. (2003)	Before and after evaluation study (Pre, post and final questionnaires)	-461 CHWs participated in the evaluation of the 31 workshops (435 CHWs completed the pre workshop questionnaire, 445 CHWs completed the post workshop questionnaire and 46 completed the final questionnaire) - Centres in New South Wales, Australia	"Keep Watch" community **health workers water safety program.** The program addresses four key areas: fencing, supervision, water familiarization, CPR.	Water safety awareness of community health workers	▪ The workshops were successful in increasing the CHWs knowledge about drowning prevention and water safety for children aged 0-5 years old.

Table 7 *(continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
IMPACT (2005)	Systematic review	N/A	(1) Presence of fencing and pool fencing regulations, (2) increasing PFD use via education and social marketing, mandatory PFD wear legislation, (3) immediate (bystander) resuscitation, (4) swimming lessons for children less than four years old; (5) efficacy of lifeguard supervision of public swim areas	N/A	▪ Presence of fencing, pool fencing regulations, increasing PFD use via education and social marketing, immediate (bystander) resuscitation and lifeguard supervision of public swim areas are effective interventions for the reduction of drowning rates.
Logan et al (1998)	Randomly dialed national telephone survey	-5238 completed interviews -United States	Adequate **pool fencing**	Drownings in residential pools	▪ The findings of the survey suggest that adequate pool fencing can prevent drownings among children, but other prevention strategies need to be considered as well (e.g. Pool covers and alarms).
McNamara (2006)	Pre and post surveys	Centres in Western Australia	"Watch Around Water" public **swimming pools supervision program**	Proportion of parents who know what constitutes appropriate levels of supervision of children and effectively supervise their children in public aquatic facilities	▪ Approximately 90% of respondents identified supervising your child as an important way to prevent young children aged between 0 and 5 from drowning in the post survey. Also, 74 % of respondents identified adequately supervising a child aged three around water as keeping them within arms reach.
Mitchell et al (2004)	Telephone surveys at baseline and at two periods after the televised airing of the campaign	New South Wales, Australia	"SafeWaters" **water safety campaign**	Public awareness of water safety issues and appropriate safety precautions	▪ Prompted recall of the campaign at both post-campaign surveys increased significantly from baseline. Prompted recall of key water safety messages from the campaign showed a significant increase in seven of the eight messages at post-campaign survey 1, declining to two of the eight messages at post-campaign survey 2. Respondents generally reported that they always or mostly practised water safety-related behaviour.

CHWs, Community Health Workers; CPR, Cardio-pulmonary resuscitation; PFD, Personal Flotation Device

Table 7 *(continued)*

Authors/Year	Study Design	Participants/ Setting	Interventions	Outcome Measures	Key Results
Salomez et al. (2004)	Review	N/A	(1) Adequate adult supervision; (2) swimming lessons for children older than four years old, (3) proper fencing of private swimming pools, (4) pool alarms and pool covers (5) PFD use	N/A	▪ Adequate adult supervision, swimming lessons for children older than four years old, proper fencing of private swimming pools, PFD use (Strong evidence of effectiveness) ▪ Pool alarms and pool covers (Unclear evidence of effectiveness – further research needed)
State of Alaska, Health & Social Services (2006)	Observational study	Alaska	"Kids Don't Float" program consists of two components: PFD loaner program for use at harbors & boat ramps, and education program that teaches high school students about water safety and PFD use; these students in turn teach elementary school students the same skills, adapted to their age level	PFD use, Boating-related drownings in Alaska	▪ Significant increase in PFD use ▪ At least 5 lives were saved since the program started
Tan (2004)	Review of literature	N/A	(1) Supervision, (2) environmental design changes, (3) legislation, (4) swimming lessons and aquatic safety education	N/A	▪ The study shows that the main measures of drowning prevention may be broadly divided into supervision, environmental design changes, legislation, swimming lessons and aquatic safety education.
Weerdenburg (2000)		Community (Illawarra)	"Be Water Wise – Supervise" Illawarra **child drowning prevention campaign**	Childhood drownings	▪ There were no drownings in the Illawarra region in the 0-5 year age group during the period of the campaign.

Whitfield (2000)	Case-Control (between subject design)	N/A	**Swimming pool alarms** and a **wristband**	Performance of four different alarm systems and a wristband with remote alarm	▪ The subsurface pool alarms generally performed better than the surface alarms. They were more consistent in alarming and less likely to false alarm than the surface alarms. The wristband alarmed when submerged in pool water or exposed to another water source, such as tap water. This means that pool alarms, as well as wristbands, may supplement, but are not a substitute for supervision or barriers completely surrounding pools.

Conclusion

Analysis of the drowning literature demonstrates that the evaluation of potential prevention interventions has been limited. Pool fencing is the most effective preventive intervention to decrease the risk of drowning in swimming pools. Installation of 4-sided fencing has been shown to decrease the number of pool immersion injuries among young children by more than 50% (Brenner, 2003). Use of Personal Flotation Devices and pool alarms are recommended by numerous agencies and related organizations. Close supervision of young children around any water is an essential preventive strategy, but inevitable lapses make supervision alone insufficient. One other drowning prevention strategy is to provide lifeguards in public areas where people swim. The chance of drowning at a beach protected by life-guards may be less than 1 in 18 million (Branche & Stewart, 2001).

Researchers have concluded that community education and awareness is necessary for drowning prevention (Nieves, 1996). However we know little about the effectiveness of community education and awareness programs in terms of adopting safer practices or reducing drowning and near-drowning rates.

The literature review provided unclear or insufficient evidence of effectiveness of some interventions, such as bath seat use (Byard, 2004; Sibert, 2005; Thompson, 2003), swimming lessons for children older than four years old, pool covers (e.g. solar or plastic covers) (Franklin 2003), and mandatory PFD wear legislation (McNamara, 2006). As ineffective was identified the swimming lessons for children younger than four years old (McNamara, 2006). Swimming lessons do not prevent drowning in children less than four years of age, but improves their swimming ability.

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