NICE National Institute for Health and Care Excellence

Preventing unintentional road injuries among under-15s

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Contents

Introduction

This is one of three pieces of NICE guidance published in November 2010 on how to prevent unintentional injuries among under-15s. A second publication covers strategies, regulation, enforcement, surveillance and workforce development and a third covers unintentional injuries in the home.

The Department of Health (DH) asked the National Institute for Health and Clinical Excellence (NICE) to produce public health guidance on preventing unintentional injuries to those aged under 15 on the road. This guidance focuses on road design and modification.

The guidance is for local highway authorities, local strategic partnerships, directors of public health, health professionals who have a responsibility for preventing or treating unintentional injuries affecting children and young people aged under 15, and school travel planners. It may also be of interest to road users, children, young people, their parents and carers and other members of the public.

This is one of three pieces of NICE guidance on how to prevent unintentional injuries among children and young people aged under 15. In particular, it is closely linked to guidance focused on strategies, regulation, enforcement, surveillance and workforce development. (This covers unintentional injuries on the road, in the home and in outdoor settings and was published in November 2010.) The other publication addresses unintentional injuries in the home.

The guidance complements, but does not replace, NICE guidance on promoting physical activity (for further details, see section 7).

The Public Health Interventions Advisory Committee (PHIAC) developed these recommendations on the basis of reviews of the evidence, cost-effectiveness modelling, expert advice, stakeholder comments and fieldwork.

Members of PHIAC are listed in appendix A. The methods used to develop the guidance are summarised in appendix B. Supporting documents used to prepare this document are listed in appendix E.

Full details of the evidence collated, including fieldwork data and stakeholder comments, are available on the NICE website, along with a list of the stakeholders involved and NICE's supporting process and methods manuals.

1 Recommendations

This is NICE's formal guidance on preventing unintentional injuries among children and young people aged under 15: road design and modification. When writing the recommendations, The Public Health Interventions Advisory Committee (PHIAC) (see appendix A) considered the evidence of effectiveness (including cost effectiveness), fieldwork data and comments from stakeholders. Full details are available online.

The evidence statements underpinning the recommendations are listed in appendix C.

The evidence reviews, supporting evidence statements and cost-effectiveness modelling are available online.

PHIAC considers that the recommended measures are cost effective. For the gaps in research, see appendix D.

Context

The recommendations in this guidance should be implemented as part of a broader strategy that includes driver and public education and enforcement activities.

Note that in November 2010, NICE published guidance on strategies, regulation, enforcement, surveillance and workforce development to prevent unintentional injuries.

The recommendations in this guidance cover 20 miles per hour (mph) limits, 20 mph zones and engineering measures to reduce speed or make routes safer, reflecting the evidence identified and expert discussions. The absence of recommendations on any other measures is a result of a lack of evidence that met the inclusion criteria for the evidence reviews. It should not be taken as a judgement on whether or not any other measures are effective and cost effective.

Definitions

This guidance uses the term 'unintentional injuries' rather than 'accidents', since 'most injuries and their precipitating events are predictable and preventable'[1]. The term 'accident' implies an unpredictable and therefore unavoidable event.

Engineering measures to reduce speed or make routes safer comprise physical features such as speed humps, chicanes or changes in traffic priority (that is, changes in the right for traffic to proceed). These may be used on single roads or across a larger area.

20 mph limits are imposed using signs at the start and end of roads covered by the limit and reminder signs at points in between (terminal and repeater signing).

20 mph zones are areas where engineering measures must be used to slow traffic.

Whose health will benefit?

The recommendations aim to help children and young people aged under 15, although there may also be benefits for the wider population.

Recommendation 1 Health advocacy and engagement

Who should take action?

- Directors of public health and other health professionals with responsibility for preventing or treating injuries.
- Local strategic partnerships.

What action should they take?

- Ensure a senior public health position includes leading on, and responsibility for, the health sector's involvement in injury prevention and risk reduction.
- Support and promote changes to the road environment as part of a broader strategy to prevent injuries and the risk of injuries.
- Support coordinated working between health professionals and local highways authorities to promote changes to the road environment.

Recommendation 2 Needs assessment and planning

Who should take action?

Local highways authorities.

What action should they take?

Work with other partners to introduce engineering measures to reduce speed as part of a broad strategy to prevent injuries and the risk of injuries (see recommendation 1).

These measures should be:

- developed after considering data on risk of injury (such as traffic speed and volume) and injuries (including levels of casualties, their age, the groups involved and where they occur)
- designed and constructed in line with current good practice guidelines and case studies (such as 'Manual for streets'), and determined by local context and the characteristics of the site (including physical limitations such as geological considerations)
- designed taking into account all road users (not just car users), including vulnerable road users (such as pedestrians, cyclists and those with impaired mobility)
- developed using effective processes of community engagement to seek the views of children, young people, their parents and carers (as outlined in NICE public health guidance 9 'Community engagement') and with involvement of other interested parties such as the emergency services and local businesses
- implemented based on local priorities for modifying the transport infrastructure
- evaluated for their effect in terms of reducing the risk of injury and reducing the number of actual injuries
- evaluated for any unintended consequences, such as the impact on the number of people walking or cycling or on injury rates in neighbouring streets.

Recommendation 3 Measures to reduce speed

Who should take action?

- Local highways authorities.
- Local strategic partnerships.

What action should they take?

- Introduce engineering measures to reduce speed in streets that are primarily residential or where pedestrian and cyclist movements are high. These measures could include:
    - speed reduction features (for example, traffic-calming measures on single streets, or 20 mph zones across wider areas)
    - changes to the speed limit with signing only (20 mph limits) where current average speeds are low enough, in line with Department for Transport guidelines.
- Implement city or town-wide 20 mph limits and zones on appropriate roads. Use factors such as traffic volume, speed and function to determine which roads are appropriate.
- Consider changes to speed limits and appropriate engineering measures on rural roads where the risk of injury is relatively high, in line with Department for Transport guidance.
- Take account of the factors identified in recommendation 2 when introducing measures.

Recommendation 4 Popular routes

Who should take action?

- Directors of public health.
- Local highways authorities.
- Local strategic partnerships.
- Public health professionals with an injury prevention remit.
- School travel planners.

What action should they take?

- Consider opportunities to develop engineering measures to provide safer routes commonly used by children and young people, including to school and other destinations (such as parks, colleges and recreational sites). This should be done as part of the development of a broad package of measures to address travel, for instance when developing school travel plans.
- Include school governors and head teachers in discussions about changes relating to school travel.

[1] Davis R, Pless B (2001) BMJ bans 'accidents'. Accidents are not unpredictable. BMJ 322: 1320–21.

2 Public health need and practice

Deaths and injuries from road collisions

The rate of deaths and serious injuries from road collisions has been declining over recent decades (by about 4% per year in all ages and 9% in children). However, unintentional injury is still a leading cause of death among children and young people aged 1–14 (Audit Commission and Healthcare Commission 2007) and nearly half (44%) of those deaths in England and Wales are transport-related (Office for National Statistics 2009).

In 2009, 65 young people aged under 15 were killed and 18,307 were injured on the roads in Great Britain, 2267 of them seriously. Of those killed or seriously injured, 1507 (65%) were pedestrians. Cyclists (381) and car passengers (380) made up the bulk of the remainder (that is, cyclists and car passengers each accounted for around 16% of the total) (Department for Transport 2010a).

The most commonly used statistics on children injured in collisions come from 'Road casualties Great Britain'. This is based on STATS 19. However, 'Road casualties Great Britain' notes that: 'although STATS 19 is the most detailed and useful source of information on road casualties at national level, it is not a complete or perfect dataset' (Department for Transport 2009). It also notes that other estimates, based on the national travel survey, give a total number of casualties around three times the number recorded in STATS 19.

The number of people killed or seriously injured on the road increases with age. There is a noticeable increase between ages 10 and 11, which coincides with the move to secondary school and probably with increasingly unsupervised travel.

In 2008, 65% of children or young people killed or seriously injured were boys. This higher rate in boys is seen in all modes of transport (except for car passengers, where girls account for 54% of those killed or seriously injured).

Overall, population-based casualty rates for England are better than the European Union (EU) average. However, this rating masks poorer figures for pedestrians (Department for Transport 2008).

There are other people besides casualties whose health is affected in less apparent ways. People can be traumatised by near misses, or avoid activities or opportunities because of danger (real or perceived) on the roads. These opportunities include walking or cycling, meeting friends and family and other types of recreation, as well as the freedom to develop independence.

Exposure to road danger

In recent decades, children's exposure to danger from various modes of road transport has changed considerably. By 2003, the average mileage travelled as a car occupant had increased by 70% compared with 1985. The average mileage walked had declined by 19%, and the average cycled had declined by 58% (Sonkin et al. 2006).

A Play England survey (2007) suggests that children now spend less time playing outside – 71% of adults played outside in the street or area close to their homes every day when they were children, compared with only 21% of children today.

Most traffic casualties among children and young people occur in urban rather than rural areas (2073 compared with 734 among those aged 0–15 years in 2008). In addition, the percentage of pedestrian casualties is higher in urban compared to rural settings (73% compared with 36% in 2008) (Department for Transport 2010b).

In urban settings, most casualties (74%) are on minor roads (Department for Transport 2010). Younger children (aged up to about 8) tend to be injured on streets close to their home. As they get older (around 11 and above) they tend to be injured further from home, and on busier roads, reflecting their increasing licence to travel independently. Boys tend to be given greater independence at an earlier age (Towner et al. 2005) and so this shift occurs at a younger age for boys.

Inequalities

Among young people aged under 15, the likelihood of dying as a car occupant is 5.5 times higher if their parents are unemployed than if they have managerial or professional jobs. This ratio exceeds 20 among pedestrians and cyclists. Similarly, more than one quarter of child pedestrian injuries happen in the most deprived tenth of wards (Greyling et al. 2002).

The largest factor resulting in this difference in death rate is exposure to danger rather than behaviour (Edwards et al. 2006). People from lower socioeconomic groups are more likely, for example, to live in neighbourhoods with on-street parking, high-speed traffic and few or no off-street play areas.

National data, such as those reported in 'Road casualties Great Britain' (Department for Transport 2009), do not routinely feature information on the characteristics of the casualty other than age and sex. Information on ethnicity, for instance, has generally come from a small number of local studies which frequently focus on one ethnic group.

A report by the Department of the Environment, Transport and the Regions (2001) states that surveys suggest that there is a higher pedestrian casualty rate among children (age range not stated) from Asian backgrounds than non-Asian peers in the same area. Other groups may be similarly affected but have not been systematically studied.

Factors influencing the rate and severity of road injuries

Factors before, around the time of and after a collision can all help determine whether someone is injured (and how badly) or killed in a road collision. These include: traffic speed, safety training and road surface; use of devices such as anti-lock brakes; use of seatbelts, airbags and other car design features; and the response of emergency services.

Approaches to preventing collisions (primary prevention) focus on altering the behaviour of road users (or the vehicle, if emergency action is required). The former, for example, might include educating people about road dangers or introducing engineering measures to restrict vehicle speed. The latter might include anti-lock brakes or anti-skid road surfaces (Racioppi et al. 2004). Approaches to reducing the severity of injury (secondary prevention) include car design and provision and the use of safety devices.

The logical place to start in considering road injuries is with primary prevention.

It's also worth bearing in mind that when someone feels very safe, this can alter their behaviour so that the actual risk becomes higher than might have been expected. (An example of this 'risk compensation' would be driving faster in a car with anti-lock brakes.).

Road design

Road design has a key influence on speed (Department for Transport 2007). 'Excess and inappropriate' speed contributes to around 30% of fatal crashes in high-income countries (World Health Organization 2004).

Higher speeds reduce the time available for people to react and increase the severity of collisions. Vulnerable road users (cyclists and pedestrians) are at particular risk: pedestrians have a 90% chance of surviving car crashes at speeds below 30 kph but a less than 50% chance at speeds of 45 kph (Racioppi et al. 2004).

3 Considerations

The Public Health Interventions Advisory Committee (PHIAC) took account of a number of factors and issues when developing the recommendations.

3.1 PHIAC agreed that there is a moral imperative to protect children and young people, including on the roads. This includes addressing the behaviour of drivers through a variety of approaches.

3.2 Although engineering measures are important in preventing casualties, PHIAC discussed the importance of other factors. These included education, enforcement, and changing the percentage of journeys undertaken by car, public transport, on foot or by bicycle (modal shift). Engineering, education and enforcement activities are likely to be synergistic.

3.3 Methodological difficulties may make it hard to be clear about what an intervention has (or has not) achieved:

- Engineering measures are not commonly assessed using trials.
- The overall downward trend in injuries makes comparisons over time difficult.
- The numbers of people killed or seriously injured are relatively small, so it is difficult for studies to be adequately powered to determine whether an intervention has been effective.
- There is a lot of work to prevent injuries, both locally and nationally, which may add to the difficulty of identifying effective elements of interventions.
- The diffuse nature of some interventions, often involving multiple components, makes comparisons between them difficult.
- Interventions may be designed to achieve a range of outcomes.
- Interventions are generally designed to reduce casualty rates for all road users rather than just children and young people.

3.4 Much of the evidence considered was from the UK and so was deemed applicable for England. However, PHIAC was aware that older UK publications

might be less applicable, because changing political, cultural and economic backgrounds can alter the effectiveness of interventions. Nonetheless, it noted that the evidence consistently suggests that engineering measures to reduce traffic speed generally do reduce collisions and deaths or injuries among children and young people.

3.5 For inclusion in the reviews, evidence needed to provide data on injuries to children and young people. If data on speed was also provided, this was included. However, the literature relating to speed alone has not been considered in this work. Similarly, studies that did not provide an analysis of injuries to children and young people aged under 15 were not included.

3.6 PHIAC noted that pedestrians are much more likely to be killed in collisions at higher speeds.

3.7 For several types of intervention identified in the scope for this work, the reviews either found no evidence (for instance for woonerven[2] and 'naked streets'[3]) or found no impact on injuries (for instance for 'home zones' – where injury reduction is not the primary purpose). Therefore these interventions do not appear in the recommendations.

3.8 Engineering measures may have other outcomes (both positive and negative) apart from helping to prevent injuries. These include noise, damage to buildings or vehicles (from vibration and the impact of vertical traffic-calming features) and air pollution (including CO_2 emissions). Changes in behaviours influenced by engineering measures may also be related to health outcomes, for instance increasing levels of physical activity by supporting cycling and walking or encouraging greater social contact.

3.9 Changes to the physical environment can have unintended consequences that may disadvantage some groups. For example, changes that remove physical features (such as the distinction between pavement and road) might increase uncertainty on the part of motorists, and so promote a safer driving style. However, they might also make negotiating a street more difficult for people with a visual impairment.

3.10 PHIAC noted that the attitudes of communities and drivers to speed reduction measures are important. Drivers may be more accepting if they can see the point of speed restrictions (such as those near schools – although these areas may not, in fact, have significant injury rates).

3.11 Economic analysis in NICE guidance generally consists of an estimation of the cost per quality-adjusted life-year (QALY) gained. This enables a comparison with what is deemed to be value for money in the health service. However, when assessing road transport interventions other approaches may be more appropriate. In particular, the Department for Transport uses cost–benefit analysis taking a 'broad societal perspective' to assess value for money. Net present value (NPV) is used to determine the total monetary benefit of an intervention less its costs (compared with an alternative intervention) when discounted to its present value. A positive NPV occurs when the sum of the discounted benefits exceeds the sum of the discounted costs. As the costs fall on the transport sector, it is more appropriate to compare cost effectiveness with other transport interventions using a method followed by that sector[4]. This is in line with 'Social value judgements: principles for the development of NICE guidance'.

3.12 Enforcement strategies were not covered in the scope of this guidance. PHIAC noted that NICE's guidance on 'Strategies to prevent injuries in children and young people under 15' (NICE public health guidance 29) was considering enforcement.

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[2] A woonerf (plural woonerven) is a Dutch term for a street where pedestrians and cyclists have priority over motorists. Motorised traffic is restricted to walking pace.

[3] Roads cleared of markings, signage and pedestrian barriers.

[4] See the Department for Transport's 'Transport analysis guidance'.

4 Implementation

NICE guidance can help:

- NHS organisations, social care and children's services meet the requirements of the DH's revised 'Operating framework for 2010/11'.
- National and local organisations improve quality and health outcomes and reduce health inequalities.
- Local authorities fulfil their remit to promote the wellbeing of communities.
- Local NHS organisations, local authorities and other local public sector partners benefit from any identified cost savings, disinvestment opportunities or opportunities for re-directing resources.
- Provide a focus for multi-sector partnerships for health and wellbeing, such as local strategic partnerships.

NICE has developed tools to help organisations put this guidance into practice.

5 Recommendations for research

PHIAC developed some provisional research recommendations, based on the evidence and expert advice from co-optees. These were passed to the NICE committee that has developed related guidance on 'Strategies to prevent unintentional injuries among under-15s'. This has resulted in a comprehensive set of research recommendations covering all types of unintentional injuries.

More detail on the gaps in the evidence identified during development of the guidance on road design and modification is provided in appendix D.

6 Updating the recommendations

This guidance will be reviewed 3 years after publication to determine whether all or part of it should be updated. Information on the progress of any update will be posted on our website.

7 Related NICE guidance

Published

Preventing unintentional injuries among under-15s in the home. NICE public health guidance (2010).

Strategies to prevent unintentional injuries among under-15s. NICE public health guidance (2010).

Promoting physical activity for children and young people. NICE public health guidance 17 (2009).

Community engagement. NICE public health guidance 9 (2008).

Physical activity and the environment. NICE public health guidance 8 (2008).

Behaviour change: the principles for effective interventions. NICE public health guidance 6 (2007).

8 References

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Department for Transport (2007) Child road safety strategy 2007. London: Department for Transport.

Department for Transport (2008) Road casualties Great Britain: 2007 annual report. London: The Stationery Office

Department for Transport (2010a) Road casualties Great Britain: 2009 annual report. London: The Stationery Office

Department for Transport (2010b) Child casualties in reported road accidents Great Britain: 2008 Road Accident Statistics Factsheet No. 5. London: Department for Transport

Department of the Environment, Transport and the Regions (2001) Road accident involvement of children from ethnic minorities: a literature review. London: Department of Environment, Transport and the Regions

Edwards P, Roberts I, Green J, et al. (2006) Deaths from injury in children and employment status in family: analysis of trends in class specific death rates. British Medical Journal 333: 119–21

Greyling T, Hallam K, Daniel G, et al. (2002) Streets ahead: safe and liveable streets for children. London: Institute for Public Policy Research

Office for National Statistics (2009) Mortality statistics: deaths registered in 2008. London: Office for National Statistics

Play England (2007) Playday 2007 – Our streets too! London: Play England

Racioppi F, Ericsson L, Tingvall C et al. (2004) Preventing road traffic injury: a public health perspective for Europe. Copenhagen: World Health Organization

Sonkin B, Edwards P, Roberts I et al. (2006) Walking, cycling and transport safety: an analysis of child road deaths. Journal of the Royal Society of Medicine 99: 402–5

Towner E, Dowswell T, Errington G et al. (2005) Injuries in children aged 0–14 years and inequalities. London: Health Development Agency

World Health Organization (2004) World report on road traffic injury prevention. Geneva: World Health Organization

Appendix A: Membership of the Public Health Interventions Advisory Committee (PHIAC), the NICE project team and external contractors

Public Health Interventions Advisory Committee

NICE has set up a standing committee, the Public Health Interventions Advisory Committee (PHIAC), which reviews the evidence and develops recommendations on public health interventions. Membership of PHIAC is multidisciplinary, comprising public health practitioners, clinicians, local authority officers, teachers, social care professionals, representatives of the public, academics and technical experts as follows.

Professor Sue Atkinson CBE Independent Consultant and Visiting Professor, Department of Epidemiology and Public Health, University College London

Mr John F Barker Associate Foundation Stage Regional Adviser for the Parents as Partners in Early Learning Project, DfES National Strategies

Professor Michael Bury Emeritus Professor of Sociology, University of London. Honorary Professor of Sociology, University of Kent

Dr Sarah Byford Reader in Health Economics, Centre for the Economics of Mental Health, Institute of Psychiatry, King's College London

Professor K K Cheng Professor of Epidemiology, University of Birmingham

Ms Joanne Cooke Programme Manager, Collaboration and Leadership in Applied Health Research and Care for South Yorkshire

Mr Philip Cutler Forums Support Manager, Bradford Alliance on Community Care

Dr Richard Fordham Senior Lecturer in Health Economics, University of East Anglia; Director, NHS Health Economics Support Programme (HESP)

Ms Lesley Michele de Meza Personal, Social, Health and Economic (PSHE) Education Consultant, Trainer and Writer

Professor Ruth Hall Public Health Consultant

Ms Amanda Hoey Director, Consumer Health Consulting Limited

Mr Alasdair J Hogarth Educational Consultant and recently retired Head Teacher

Dr Ann Hoskins Director, Children, Young People and Maternity, NHS North West

Ms Muriel James Secretary, Northampton Healthy Communities Collaborative and the King Edward Road Surgery Patient Participation Group

Dr Matt Kearney General Practitioner, Castlefields, Runcorn. GP Public Health Practitioner, Knowsley PCT

CHAIR Professor Catherine Law Professor of Public Health and Epidemiology, UCL Institute of Child Health

Mr David McDaid Research Fellow, Department of Health and Social Care, London School of Economics and Political Science

Mr Bren McInerney Community Member

Dr John McLeod Reader in Clinical Epidemiology and Primary Care, Department of Social Medicine, University of Bristol; Honorary Clinical Consultant in Primary Care, NHS Bristol; GP, Hartcliffe Health Centre, Bristol

Professor Susan Michie Professor of Health Psychology, BPS Centre for Outcomes Research and Effectiveness, University College London

Professor Stephen Morris Professor of Health Economics, Department of Epidemiology and Public Health, University College London

Dr Adam Oliver RCUK Senior Academic Fellow**,** Health Economics and Policy, London School of Economics

Dr Toby Prevost Reader in Medical Statistics, Department of Public Health Sciences, King's College London

Ms Jane Putsey Lay Member, Registered Tutor, Breastfeeding Network

Dr Mike Rayner Director, British Heart Foundation Health Promotion Research Group, Department of Public Health, University of Oxford

Mr Dale Robinson Chief Environmental Health Officer, South Cambridgeshire District Council

Ms Joyce Rothschild Children's Services Improvement Adviser, Solihull Metropolitan Borough Council

Dr Tracey Sach Senior Lecturer in Health Economics, University of East Anglia

Dr Kamran Siddiqi Clinical Senior Lecturer and Consultant in Public Health, Leeds Institute of Health Sciences and NHS Leeds

Dr David Sloan Retired Director of Public Health

Professor Stephanie Taylor Professor of Public Health and Primary Care, Centre for Health Sciences, Barts and The London School of Medicine and Dentistry

Dr Stephen Walters Reader in Medical Statistics, University of Sheffield

Dr Dagmar Zeuner Director of Public Health, NHS Richmond and London Borough of Richmond

Expert co-optees to PHIAC:

Amy Aeron-Thomas Community Member, 'Strategies to prevent unintentional injuries among under-15s', Programme Development Group; Executive Director, RoadPeace

Peter Andrews Group Manager, Safety Engineering Group, Lancashire County Council

Chris Lines Head, London Road Safety Unit, Transport for London

Amanda Roberts Member 'Strategies to prevent unintentional injuries among under-15s', Programme Development Group; Road Safety Team Leader, Telford and Wrekin Council, Shropshire

Heather Ward Chair, 'Strategies to prevent unintentional injuries among under-15s', Programme Development Group; Honorary Research Fellow, Centre for Transport Studies, University College London

NICE project team

Mike Kelly CPHE Director

Simon Ellis Associate Director

Hugo Crombie Lead Analyst

Kay Nolan Analyst

Lesley Owen Technical Adviser (Health Economics)

Rachael Paterson Senior Editor

Alison Lake Editor

External contractors

Reviewers: evidence reviews

Review 1: 'Systematic reviews of effectiveness and cost effectiveness of road and street design-based interventions aimed at reducing unintentional injuries in children' was carried out by Peninsula Technology Assessment Group (PenTAG). The principal authors were: Kate Ashton, Tiffany Moxham, Julie Frier, Gabriel Rogers, Ruth Garside and Rob Anderson.

Review 2: 'Barriers to, and facilitators of, the prevention of unintentional injury in children on the road: review of qualitative research' was carried out by PenTAG. The principal authors were: Ruth Garside, Kate Ashton, Tiffany Moxham and Rob Anderson.

Reviewers: cost-effectiveness modelling

The economic modelling is reported in: 'Cost-effectiveness modelling of road and street design-based interventions aimed at reducing unintentional injuries in children', which was carried out by PenTAG. The principal authors were: Jaime Peters, Rob Anderson and Tiffany Moxham.

Fieldwork

The fieldwork 'Prevention of unintentional road injury in under-15s: road design' was carried out by Greenstreet Berman.

Appendix B: Summary of the methods used to develop this guidance

Introduction

The reviews and economic analysis include full details of the methods used to select the evidence (including search strategies), assess its quality and summarise it.

The minutes of the PHIAC meetings provide further detail about the Committee's interpretation of the evidence and development of the recommendations.

All supporting documents are listed in appendix E and are available online.

Guidance development

The stages involved in developing public health intervention guidance are outlined in the box below.

1. Draft scope released for consultation
2. Stakeholder meeting about the draft scope
3. Stakeholder comments used to revise the scope
4. Final scope and responses to comments published on website
5. Evidence review(s) and economic analysis undertaken
6. Evidence and economic analysis released for consultation
7. Comments and additional material submitted by stakeholders
8. Review of additional material submitted by stakeholders (screened against inclusion criteria used in review/s)
9. Evidence and economic analysis submitted to PHIAC
10. PHIAC produces draft recommendations
11. Draft guidance released for consultation and for field testing
12. PHIAC amends recommendations
13. Final guidance published on website
14. Responses to comments published on website

Key questions

The key questions were established as part of the scope. They formed the starting point for the reviews of evidence and were used by PHIAC to help develop the recommendations. The overarching questions were:

Question 1: What types of road design or modification to the road and street environment are effective and cost effective in reducing road injuries among children and young people aged under 15?

Question 2: What are the barriers and facilitators to implementing environmental modifications and road/street designs relating to the reduction of road injuries?

The subsidiary question was:

Question 3: What are the barriers and facilitators to implementing environmental modifications and designs relating to the reduction of vehicle speeds and road injuries?

These questions were made more specific for the reviews (see reviews for further details).

Reviewing the evidence

One review of effectiveness and cost effectiveness was conducted, and one review of barriers and facilitators.

Identifying the evidence

The following databases were searched for evaluations (prospective or retrospective) of relevant interventions that used comparative designs (randomised controlled trials [RCTs], non-randomised controlled trials, before-and-after studies, or natural experiments); full economic evaluations and high quality costing studies conducted in the UK or countries of a similar level of economic development, patterns of transport use and urban environment; primary qualitative research involving the analysis of written or spoken evidence regarding attitudes towards, or experiences of, the relevant interventions, qualitative surveys of attitudes towards, or experiences of the relevant interventions:

- Applied Social Science Index and Abstracts (ASSIA)
- Bibliomap
- Centre for Review and Dissemination
- Database of Abstracts of Reviews of Effects (DARE)
- Database of Promoting Health Effectiveness Reviews (DoPHER)
- EPPI CENTRE databases
- ERIC
- Health Management Information Consortium (HMIC)
- MEDLINE
- MEDLINE In Process
- National Health Service Economic Evaulations Database (NHSEED)

- NHS Economic Evaluation Database (Health Technology Assessment)
- PsycINFO
- SafetyLit
- Social Science Citation Index
- Transport Research Information Service (TRIS)
- Trials Register of Promoting Health Interventions TRoPHI

A follow up targeted search was done in TRIS and MEDLINE of specific named programmes and additional traffic-calming methods determined from the results of the original database searches.

Quality appraisal

Included papers were assessed for methodological rigour and quality using the NICE methodology checklist, as set out in the NICE technical manual 'Methods for the development of NICE public health guidance' (see appendix E). Each study was graded (++, +, –) to reflect the risk of potential bias arising from its design and execution.

Study quality

++ All or most of the methodology checklist criteria have been fulfilled. Where they have not been fulfilled, the conclusions are thought very unlikely to alter.

+ Some of the methodology checklist criteria have been fulfilled. Those criteria that have not been fulfilled or not adequately described are thought unlikely to alter the conclusions.

– Few or no methodology checklist criteria have been fulfilled. The conclusions of the study are thought likely or very likely to alter.

Summarising the evidence and making evidence statements

The review data was summarised in evidence tables (see full reviews).

The findings from the reviews were synthesised and used as the basis for a number of evidence statements relating to each key question. The evidence statements were prepared by the

external contractors/public health collaborating centres (see appendix A). The statements reflect their judgement of the strength (quantity, type and quality) of evidence and its applicability to the populations and settings in the scope.

Economic analysis

The economic analysis consisted of a review of economic evaluations (the cost effectiveness part of review 1) and a cost-effectiveness modelling (report 3).

Cost-effectiveness review (part of review 1)

A wide range of electronic databases was searched, including some that are specific to the areas of transport policy/research and safety policy/research. Papers or reports were sought that reported quantitative comparative evaluations of local or regional interventions to reduce injuries in children aged under 15 by road/street design or by modifying the road/street environment and highway design (for example, measures to reduce speed and 20 mph zones).

Studies were included if they were full economic evaluations of relevant types of intervention or scheme, and high quality costing studies conducted in the UK or countries of a similar level of economic development, patterns of transport use and urban environment.

Studies were excluded if they were cost-of-illness studies, or other studies that did not involve assessing the cost and related benefits/effectiveness of particular interventions (or class of intervention). Of 19 identified as potentially relevant 13 were included, all of which were cost–benefit analyses.

Cost-effectiveness modelling

A number of assumptions were made that could underestimate or overestimate the cost effectiveness of the interventions (see modelling report for further details).

Economic modelling was undertaken to explore the cost effectiveness of mixed priority route schemes, mandatory 20 mph zones and advisory 20 mph limits. The results are presented as net present values[5] as well as costs per quality adjusted life-year. They can be found in 'Cost-effectiveness modelling of road and street design-based interventions aimed at reducing unintentional injuries in children'. It is available online.

Fieldwork

Fieldwork was carried out to evaluate how relevant and useful NICE's recommendations are for practitioners and how feasible it would be to put them into practice. It was conducted with practitioners and commissioners who are involved in unintentional injury and transport services. They included those working in community and charitable organisations, local transport planning departments, directors of public health and NHS and government representatives.

The fieldwork comprised:

- Six half-day workshops (two each in Birmingham, London and Manchester) with practitioners including community and charitable organisations, local transport planning departments, directors of public health and NHS, government representatives.
- Seven focus groups (in Hull, London, Manchester, Milton Keynes, Oxford, Portsmouth and Stockport) with transport planning departments in local authorities and within the private sector, including:
    - chartered civil engineers
    - members of the social inclusion team
    - road safety engineers
    - transport planners
    - road safety managers.
- Telephone interviews with:
    - transport planners
    - a policy planner.

The studies were commissioned to ensure there was ample geographical coverage. The main issues arising from these studies are set out in appendix C under fieldwork findings. The full fieldwork report 'Prevention of unintentional road injury in under-15s: road design' is available at online.

How PHIAC formulated the recommendations

At its meeting in July 2009 PHIAC considered the evidence to determine:

- whether there was sufficient evidence (in terms of strength and applicability) to form a judgement
- where relevant, whether (on balance) the evidence demonstrates that an intervention or programme is effective or ineffective or whether the evidence is inconclusive
- where relevant, the typical size of effect (where there is one)
- whether the evidence is applicable to the target groups and contexts covered by the guidance.

PHIAC developed draft recommendations through informal consensus, based on the following criteria:

- Strength (type, quality, quantity and consistency) of the evidence.
- The applicability of the evidence to the populations/settings referred to in the scope.
- Effect size and potential impact on the target population's health.
- Impact on inequalities in health between different groups of the population.
- Equality and diversity legislation.
- Ethical issues and social value judgements.
- Cost effectiveness (for the NHS and other public sector organisations).
- Balance of harms and benefits.
- Ease of implementation and any anticipated changes in practice.

PHIAC noted that effectiveness can vary according to context. For instance, the effectiveness of interventions on mixed priority routes varied with the initial casualty rate.

Where possible, recommendations were linked to an evidence statement(s) (see appendix C for details). Where a recommendation was inferred from the evidence, this was indicated by the reference 'IDE' (inference derived from the evidence).

The draft guidance, including the recommendations, was released for consultation in November 2009. At its meeting in January 2010, PHIAC amended the guidance in light of comments from stakeholders, experts and the fieldwork. The guidance was signed off by the NICE Guidance Executive in March 2010.

[5] Net present value (NPV) determines the total monetary benefit of an intervention less its costs (compared with an alternative intervention) when discounted to its present value. A positive NPV occurs when the sum of the discounted benefits exceeds the sum of the discounted costs

Appendix C: The evidence

This appendix lists evidence statements from two reviews, provided by external contractors (see appendix A) and links them to the relevant recommendations. (See appendix B for the key to quality assessments.) The evidence statements are presented here without references – these can be found in the full review (see appendix E for details). It also sets out a brief summary of findings from the economic analysis.

Evidence statement number B1a indicates that the linked statement is numbered 1a in the review 'Barriers to, and facilitators of, the prevention of unintentional injury in children on the road'.

Evidence statement number E1a indicates that the linked statement is numbered 1a in the review 'Systematic reviews of effectiveness and cost-effectiveness of road and street design-based interventions aimed at reducing unintentional injuries in children'. The reviews are available online.

Where a recommendation is not directly taken from the evidence statements, but is inferred from the evidence, this is indicated by **IDE** (inference derived from the evidence) below.

Recommendation 1: E1a–c, E2a–c, E3a–e

Recommendation 2: B2a–d, E10, E11; IDE

Recommendation 3: E1, E1a–c, E2, E2a–c, E3, E3a–e, E6b, E10, E11

Recommendation 4: E7, E7a, E7b, E9

Evidence statements

Please note that the wording of some evidence statements has been altered slightly from those in the review team's report to make them more consistent with each other and NICE's standard house style.

Evidence statement E1

Five UK based studies evaluated area-wide traffic-calming schemes. There were one controlled (+) and three uncontrolled (one [−] and two [+]) before and after studies, and one ecological study (+). Within these studies, casualties, injury collisions and speed outcomes were reported.

Evidence statement E1a

There is moderate evidence from two uncontrolled before-and-after studies (both UK) that area-wide traffic-calming may reduce rates of killed or seriously injured children (both [+]). Both studies showed reductions in either killed and seriously injured child casualties or collisions in which a child pedestrian or cyclist is killed or seriously injured, but none of these was statistically significant.

Evidence statement E1b

There is moderate evidence from one uncontrolled before-and-after study and one ecological study (both UK) that area-wide traffic calming may reduce child road casualty rates of any severity (both [+]). There is moderate evidence from one controlled and two uncontrolled before-and-after studies (all UK) that area-wide traffic calming may reduce child injury collision rates of any severity (one [−] and two [+]).

Of the two studies that reported child casualty rates, one ecological study showed a statistically significant reduction (rate ratio [RaR] = 0.777 for pedestrians in one of two cities studied, p = 0.002 [+]), while the results in the other city, and the uncontrolled before-and-after study are consistent with a reduction, but do not reach significance (+).

The three studies that reported child injury collision rates (one controlled and two uncontrolled before-and-after studies, all UK) also show reductions, but only one approaches statistical significance when compared with a control group (RaR = 0.524; 95% confidence interval [CI] = 0.258, 1.062 for child cyclists; one [−] and two [+]).

Evidence statement E1c

There is weak evidence from two uncontrolled before-and-after studies that area-wide traffic calming may reduce traffic speeds (one [−] and one [+]).

With the possible exception of the much older study (1990), this evidence is judged as directly applicable to similar roads and/or communities in the UK.

Evidence statement E2

Three UK-based studies evaluated single road traffic-calming schemes. These were all uncontrolled before-and-after studies (three [+]). Within these studies, casualties, injury collisions and speed outcomes were reported.

Evidence statement E2a

There is weak evidence from two UK-based uncontrolled before-and-after studies to show that single road traffic calming may reduce child road casualty rates. Only one of these studies showed a statistically significant reduction in child casualties from 12 to zero ($p < 0.001$ [+]). In the other study, numbers of casualties were too small (decreasing from three to zero) to be meaningful (+).

Evidence statement E2b

There is weak evidence from one UK-based, uncontrolled before-and-after study that single road traffic calming may reduce child pedestrian injury collision rates (RaR 0.0381, $p < 0.001$) while child cyclist injury collision rates were also reduced, but non-significantly (RaR = 0.632, $p = 0.081$ [+]).

Evidence statement E2c

There is weak evidence from two uncontrolled before-and-after studies that single road traffic calming may reduce traffic speeds (both [+]). This evidence is judged as directly applicable to similar roads and/or communities in the UK, although the Chorlton evidence is dated.

Evidence statement E3

Four UK-based studies evaluated 20 mph zones (mostly in urban areas). There were one controlled and three uncontrolled (all [+]) before-and-after studies, one of which was adjusted for background trends. There is some overlap between studies. Two of the studies are of 20 mph zones in London; one of which essentially updates the other. There are also small overlaps between these London-based studies and the England-wide study, and potentially between the

England-wide study and the study based in Hull. Within these studies, casualties and speed outcomes were reported.

Evidence statement E3a

There is moderate evidence from two uncontrolled before-and-after studies (one adjusted for trends on background roads; both UK-based) that 20 mph zones reduce killed or seriously injured child casualty rates (RaR = 0.242, to 0.859 depending on analysis and study, $p < 0.05$ where recorded [++]). One controlled before-and-after study also showed a reduction in killed or seriously injured child casualty rates in the intervention group when compared with a control group; however, this reduction was not significant (+). It must be noted that this study also evaluated schemes in London and is essentially updated by this uncontrolled before-and-after study.

Evidence statement E3b

There is weak evidence from one uncontrolled before-and-after study (London-based), which was adjusted for trends on background roads, that 20 mph zones may reduce child pedestrian killed and seriously injured casualty rates. However, this reduction was not significant once the results had been adjusted for changes in background trends on outside roads (+). One study also showed that 20 mph zones may reduce child pedestrian killed and seriously injured casualty rates (before and after data only reported for this outcome; RaR 0.394, $p < 0.001$ [+]). As noted above, however, this study is essentially updated by the uncontrolled before-and-after 2008 study. The evidence shouldn't therefore be 'counted' twice.

Evidence statement E3c

There is weak evidence from one before-and-after study (controlled data only reported for this outcome) that 20 mph zones may reduce child cyclist killed or seriously injured casualty rates. This reduction approaches statistical significance (RaR = 0.399, $p = 0.06$ [+]).

Evidence statement E3d

There is moderate evidence from three UK-based uncontrolled before-and-after studies (one using adjusted analyses [+]) and one controlled before-and-after study of London schemes (+) that 20 mph zones may reduce child road casualty rates overall, and for child pedestrians and

child pedal cyclists when analysed separately (road casualty rates overall RaR = 0.331 to 0.716 depending on analysis and intervention, $p < 0.001$ where recorded).

Evidence statement E3e

There is weak evidence from two studies that 20 mph zones may reduce traffic speeds (both [+]). This evidence is judged as directly applicable to similar roads and/or communities in the UK, although some data is rather dated.

Evidence statement E6b

There is weak evidence from one case-control study that living in an area with 0–5 streets with a speed limit of 30 kph may increase a child's risk of injury compared with a child living in an area with 15 or more streets with the same speed limit (OR = 5.3, 95% CI = 1.6, 17.6 [+]).

Evidence statement E7

There is moderate evidence from two controlled before-and-after (injury data time-series) studies (both [+]) in the USA that Safe Routes to School (SRTS) programmes based predominantly on engineering measures may reduce the rates of crash-involved child pedestrians or cyclists, or the rate of child injury road collisions.

Evidence statement E7a

In 125 SRTS project areas across California, and after assuming modest (10%) increases in rates of walking and cycling to school due to the programmes (such as increased exposure), a mean reduction of 7% in the all-injury collision rate with child pedestrians and cyclists was estimated (14% for children aged 5–12) (+). However, the estimated impact on fatal or severe child injuries was less conclusive (ranging from a 52% increase to a 24% reduction, again depending on assumed changes in levels of walking/cycling to school).

Evidence statement E7b

The evaluation of 53 projects in three unnamed US States (+) compared linear regression coefficients (giving 'T statistics') between the time-series trends of child injury data for the SRTS sites; these showed significantly greater reductions in crash-involved child pedestrians and cyclists at SRTS sites when compared with at least two of the six 'control' time-series in all three US states (note, all of the 'T' values were negative, indicating that the reductions in crash

outcomes in SRTS sites were always lower [if not always statistically significantly lower] than in the comparison time-series.)

This evidence from evaluations of SRTS programmes in the US is judged as partially applicable to similar localities in the UK.

Evidence statement E9

There is weak evidence from one controlled before-and-after study that combined traffic calming, safe routes to schools and education may reduce child road casualty rates when a before-and-after comparison was made (OR 0.722, p = 0.007 [+]); however, compared with the control group the reduction was not significant. This Swedish evidence is judged as partially applicable to similar roads and/or communities in the UK.

Evidence statement E10

There is moderate evidence from three cost–benefit analyses of a variety of area-wide traffic-calming schemes that show that, even in the short term (after 1 year), benefits are likely to exceed costs in most circumstances. However, there was considerable variation in first year rates of return. This evidence was judged to be partly applicable to the UK road setting.

Evidence statement E11

There is moderate evidence from one cost–benefit analysis of advisory 20 mph speed limits that shows that, in the short term, benefits are likely to exceed costs. Similarly, there is moderate evidence from one cost–benefit analysis of mandatory 20 mph zones that shows that, in the medium to long term, benefits are likely to exceed costs. The evidence on 20 mph zones is judged as being directly applicable to other urban roads in England, whereas the applicability of the evidence on advisory speed limits in Scotland may have less applicability in England and Wales because of the different road regulations relating to 20 mph speed limits.

Evidence statement B2a

Five studies, four UK and one US-based, discuss risk-taking behaviour among children and young people as a potential cause of collisions (two [+] and three [−]).

Evidence statement B2b

Like adults, children and young people often engage in 'common' risk behaviours that are seen as part of everyday life, such as not always using crossings, crossing between parked cars or in traffic.

Evidence statement B2c

One UK study reports that teenagers were more likely to take risks on the road than younger children (aged 8+).

Evidence statement B2d

Three UK studies suggest that a minority of children and young people engage in 'extreme' risks – such as playing 'chicken' in the road or holding onto the back of buses, and that boys are more likely to do this, and to encourage such behaviour in each other. Such behaviours are regarded in a similar way to thrill-seeking sports.

Cost-effectiveness evidence

The economic modelling suggests that setting advisory 20 mph limits is a highly cost-effective way of preventing unintentional injuries on the road (with a net present value[6] [NPV] of £64,209). However, caution is needed in interpreting these results. First, because the studies modelled came from Scotland where the legal definition of what comprises an advisory 20 mph limit is different. Second, the areas where they were introduced were not necessarily comparable for example, in terms of previous collision rates, vehicle speeds and pedestrian usage.

Mandatory 20 mph zones were found to be much more cost effective in areas with previously high casualty rates (1.6 per year per km). The NPV was £90,625 in these areas, compared to a NPV of £25,480 when implemented in low casualty rate areas.

Deterministic sensitivity analyses identified a number of parameters that were important to all interventions: number of casualties in the comparator area, effectiveness of the intervention, the background reduction in casualties and the effective lifetime of the intervention all had an effect.

The modelling did not consider health benefits other than those due to casualties prevented. For instance, it did not consider the health benefits of increased physical activity or the reduction in

air pollution due to a change in road use. It also did not consider the impact that road engineering measures to reduce speed can have on other factors such as congestion or noise. These would only be captured by cost-benefit analysis using a full societal perspective.

Fieldwork findings

Fieldwork aimed to test the relevance, usefulness and the feasibility of putting the recommendations into practice. PHIAC considered the findings when developing the final recommendations. For details, go to the fieldwork section in appendix B and online.

Fieldwork participants who work in transport planning were fairly positive about the recommendations and their potential to help prevent unintentional injuries. Many participants stated that although the recommendations were 'nothing new' and were already being applied in general, engaging the health sector in this area was vitally important. They reported that the recommendations could have a positive impact if they helped to engage the health sector in preventing injuries among young people aged under 15.

Some stakeholders said that at partnership meetings (for example, local strategic partnerships) in their local areas the health aspect of the partnership was often missing, that is, the NHS representatives do not attend local injury prevention partnership meetings. Participants particularly noted NHS directors of public health as an important group to engage and ensure that they were active in work in this area. Others noted that stakeholders from education were also unable or unwilling to engage and that it would be an advantage if the recommendations could help engage education services in injury prevention.

The planning stakeholders consistently said in the workshops and focus groups that the recommendations do not add any content for planners. They said that the draft recommendations do not cross-reference to other supporting material, such as that from the Department for Transport. They also thought some of the content of the recommendations is not consistent with Department of Transport guidance and strategies (for example the road safety strategy). Delegates stated that a cohesive approach from government is important.

Overall, delegates said that the recommendations had a role to play in directing the NHS to plays its part in supporting local strategic partnerships and supplying data requirements.

[6] Net present value (NPV) determines the total monetary benefit of an intervention less its costs (compared with an alternative intervention) when discounted to its present value. A positive NPV occurs when the sum of the discounted benefits exceeds the sum of the discounted costs.

Appendix D: Gaps in the evidence

PHIAC identified a number of gaps in the evidence relating to the interventions under examination, based on an assessment of the evidence. These gaps are set out below.

1. There is a lack of evidence on the effectiveness and cost effectiveness of woonerven, home zones and quiet lanes on preventing unintentional injuries on the road for children and young people under 15.
2. There is a lack of evidence as to whether there was any differential effect of environmental interventions on different populations in terms of age, gender, rural/urban/road type and level of disadvantage.
3. There is a lack of UK evidence on the effectiveness and cost effectiveness of safe routes to school on preventing injuries on the road in children and young people under 15.
4. There is a lack of UK evidence on the effectiveness and cost effectiveness of cycle routes on preventing injuries on the road in children and young people under 15.
5. There is a lack of evidence on the attitudes of drivers/road users to environmental interventions that prevent unintentional injuries in children on the road.
6. There is a lack of UK evidence as to the barriers and facilitators of implementing environmental interventions to prevent unintentional injuries in children on the road, for example, which factors enhance successful implementation of design-based interventions.

Appendix E: Supporting documents

Supporting documents are available online. These include the following.

- Reviews of effectiveness:
  - Review 1: 'Systematic reviews of effectiveness and cost-effectiveness of road and street design-based interventions aimed at reducing unintentional injuries in children'
  - Review 2: 'Barriers to, and facilitators of, the prevention of unintentional injury in children on the road'.
- Cost-effectiveness modelling: 'Cost-effectiveness modelling of road and street design-based interventions aimed at reducing unintentional injuries in children'.
- Fieldwork report: 'Prevention of unintentional road injury in under-15s: road design'.
- A quick reference guide for professionals whose remit includes public health and for interested members of the public.

For information on how NICE public health guidance is developed, see:

- 'Methods for development of NICE public health guidance (second edition, 2009)'
- 'The NICE public health guidance development process: An overview for stakeholders including public health practitioners, policy makers and the public (second edition, 2009)'.

Changes after publication

February 2012: minor maintenance.

January 2013: minor maintenance.

About this guidance

NICE public health guidance makes recommendations on the promotion of good health and the prevention of ill health.

This guidance was developed using the NICE public health intervention guidance process.

Tools to help you put the guidance into practice and information about the evidence it is based on are also available.

This is one of three pieces of NICE guidance published in November 2010 on how to prevent unintentional injuries among under-15s. A second publication covers strategies, regulation, enforcement, surveillance and workforce development and a third covers unintentional injuries in the home.

Changes after publication

January 2014: Title of 'Behaviour change: the principles for effective interventions' updated. This guidance was previously entitled 'Behaviour change'.

Your responsibility

This guidance represents the views of the Institute and was arrived at after careful consideration of the evidence available. Those working in the NHS, local authorities, the wider public, voluntary and community sectors and the private sector should take it into account when carrying out their professional, managerial or voluntary duties.

Implementation of this guidance is the responsibility of local commissioners and/or providers. Commissioners and providers are reminded that it is their responsibility to implement the guidance, in their local context, in light of their duties to avoid unlawful discrimination and to have regard to promoting equality of opportunity. Nothing in this guidance should be interpreted in a way which would be inconsistent with compliance with those duties.

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