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PenTAG

APPENDIX 4:

EVIDENCE TABLES

Strategic and regulatory frameworks for guiding, enforcing or promoting activities to prevent unintentional injury to children and young people in the road environment

(for FINAL REPORT, for PDG 3)

List of abbreviations

Abbreviation	Meaning
CI	Confidence interval (around an estimate, for a given level of statistical significance)
DfT	Department for Transport
EU	European Union
kph	Kilometres per hour
KSI	Killed or seriously injured
mph	Miles per hour
MVC	Motor vehicle crash
NA	Not applicable
NR	Not reported
NTIS	National Technical Information Services (literature database)
RTM	Regression-to-mean
SRTS	Safe Routes To Schools (program/programme)
TRL	Transport Research Laboratory
UK	United Kingdom
USA	United States of America

Glossary of key terms

Term	Definition
Casualty	A person who has received an injury (fatal or non-fatal)
Citations	US term for recorded traffic offences
Common site ban	Banning of the sale of alcohol at the same site as petrol (service stations)
Enabling legislation	a piece of legislation by which a legislative body grants an entity or appropriate officials the authorisation or legitimacy to take a certain action(s)
Halo effect	The spread of an intervention's effectiveness (e.g. a speed camera at reducing speed) beyond its immediate location or over time
Legislation	Laws usually enacted following debate and amendment within a national or regional legislative body (e.g. parliament)
Regression to mean	Statistical tendency for relatively high values in a series of outcome measurements to be followed by lower values (especially important to consider where intervention may be prompted by high values e.g. at locations where high numbers of crashes have recently been experienced). Conversely, may also refer to the tendency for higher values to follow relatively low values.
Regulations	Official statements, which may sometimes be legally binding, that can be issued without the need for new legislation at national, regional and local level
Report	A term used in some studies/countries for a recorded traffic offence
Standard	An agreed, repeatable way of doing something. It is a published document that contains a technical specification or other precise criteria designed to be used consistently as a rule, guideline, or definition. They are voluntary, but may be referred to or made compulsory by other laws or regulations.
Warrant	a pre-defined level of conditions at which intervention is considered to be required

Evidence Tables

Evidence Table A. Systematic reviews of speed enforcement devices and programs

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
Pilkington & Kinra, 2005 **Review quality:** + **No. of included studies:** 14 **Publication date range:** up to February 2004	**Title of review:** Effectiveness of speed cameras in preventing road traffic collisions and related casualties: a systematic review **Review aim or Q:** To assess whether speed cameras reduce road traffic	**Interventions included:** Fixed or mobile speed cameras **Comparators included:** No cameras **Populations included:** Not stated (presumably drivers) **Outcomes included:** Collisions, injuries or deaths	**Search methods:** Electronic databases, Internet (Google & road safety & motoring organisations' sites), Key contacts and organisations, all police forces in England & Wales **Databases searched:** Cochrane[2], MEDLINE,	14 observational stuidies (5 with distinct control areas, 8 uncontrolled before and after, 1 where control was time periods when cameras not operating) Collisions: -5% to -69% Injuries: -12%to -65% Deaths: -17% to	**Quality assessment:** Own scale developed and piloted (score 0-12). 5 studies were 'poor' (score 0-5), 9 studies scored 5.5 or 6 ('average'), none were judged good (score >8) **Exploration of heterogeneity:**	**No. of UK studies:** 4 **Other issues:** No child-specific injury outcomes in any studies. **Applicability rating:** +	**Limitations noted in review:** Completeness of identification of unpublished studies. Lack of data in studies on co-factors and adjustment for RTM. Lack of RCTs **Limitations noted by PenTAG:** Including 8 uncontrolled before and after

[1] Only results relating to injury or injury crash outcomes

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
	collisions and related casualties	**Study designs included:** Controlled trials and observational studies **Other inclusion criteria:** No earliest date or language restriction **Exclusion criteria:** Studies where speed cameras are not the major intervention	EMBASE, TRANSPORT (incorporating TRIS, IRRD, and TRANSDOC), Social Science Citation Index, ZETOC, **Other sources searched:** See search method **No. search hits:** 426 (titles and abstracts selected for screening) **No. examined in full-text:** 92 **Synthesis method:**	-71%			studies may have introduced bias

[2] Both the Cochrane Injuries Group Specialised Register and The Cochrane Library (CDSR and CENTRAL)

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
			Narrative & tables, & calculation of risk ratios wherever possible				
Thomas et al. 2008 (also published as report by National Highway Traffic Safety Administration), {US Department of Transportation, 2007 11734 /id} **Review quality:** ++ **No. of included studies:** 13 **Publication date range:** up to September 2005	**Title of review:** Safety effects of automated speed enforcement programs: critical review of international literature **Review aim or Q:** To examine the evidence from around the world as to the effectiveness of automated speed enforcement at improving safety	**Interventions included:** Automated speed enforcement programs **Comparators included:** Absence of automated speed enforcement **Populations included:** Drivers of all motorised vehicles **Outcomes included:** Crashes (if speed data also reported), injuries and injury-crashes,	**Search methods:** Electronic, Internet, Contacting professional associations **Databases searched:** NTIS, Compendex, IRRD, TRANSPORT (incorporating TRIS and TRANSDOC), PsycINFO **Other sources searched:** Specialist library databases of selected US Universities	**Study designs:** 13 CBAs **Fixed conspicuous enforcement:** In 3 studies with control groups, injury crash reductions from 20% to 25%. Another (UK) study reported greater reductions (32% to 46% within 1km and 250m of camera sites), using a multi-variate time-dependent modelling method. Reductions in fatal crashes	**Quality assessment:** Own 7-point checklist used. Overall rating as High (1), Medium-High (3), Medium (9), Low-Medium (0) or Low (0). **Exploration of heterogeneity:** Mainly by looking at fixed vs mobile and conspicuous vs inconspicuous enforcement.	**No. of UK studies:** 4 **Other issues:** No child-specific injury outcomes in any studies. **Applicability rating:** + (NB. so few studies in the UK, and so few specifying the types of roads or range of speed limits being enforced, or the presence of other measures e.g. road improvements or media campaigns)	**Limitations noted in review:** Lack of properly controlled study designs (could do RCTs). Poor capture of either negative spillover (displacement of traffic) or positive spillover (halo effects). Need better recording and analysis of other co-factors such as: site factors, enforcement intensity, signing, publicity. **Limitations noted by PenTAG:** No searching of

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
		Study designs included: 'evaluation studies' (not defined) **Other inclusion criteria?:** English language **Exclusion criteria:** Feasibility or technical studies, or perception or self-report surveys	**No. search hits:** Not stated **No. examined in full-text:** 90 (39 in English) **Synthesis method:** Tables and narrative	statistically sig. in 1 study. **Mobile conspicuous enforcement:** Reductions of 21% to 51% in injury crashes (2 studies); 9% to 18% in all crashes (3 studies). **Mobile inconspicuous enforcement:** 16% reduction in crashes (1 study). 2 other studies into daytime casualty crashes or daytime 'speed-related crashes' showed reductions of 20% and 25% respectively. **Comprehensive automated**			health/medical or general biblio-graphic databases (e.g. MEDLINE, Web of Science)

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
				enforcement (fixed, mobile and speed-over-distance): 1 UK study showed 33% reduction in personal injury crashes, 40% reduction in KSI (greater reductions in urban areas & with fixed cameras)			
Wilson et al. 2006 (a Cochrane review) **Review quality:** ++ **No. of included**	**Title of review:** Speed enforcement detection devices for preventing road traffic injuries **Review aim or Q:**	**Interventions included:** All methods for speed enforcement (cameras, radar, laser) whether attended or	**Search methods:** Electronic, Handsearches, Internet, Contacting experts, Reference checking,	**Study designs:** 22 CBAs, 4 ITSs **Injury related crashes:** 6 CBA studies showed pre/post reductions in injury crashes	**Quality assessment:** Independently by 2 reviewers, using adapted EPOC[4] checklist **Exploration of heterogeneity:** Heterogeneity of	**No. of UK studies:** 4 (2 CBA, 2 ITS) **Other issues:** No child-specific injury outcomes in any studies. Only 3 studies were in	**Limitations noted in review:** Poor methodological quality of included studies. Difficulty of assessing the

[4] Cochrane Effective Practice and Organisation of Care Review Group, Data Collection Checklist

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
studies: 26 **Publication date range:** up to 2004	To assess whether the use of speed enforcement detection devices (SEDs) reduces the incidence of speeding, road traffic crashes, injuries and deaths	unattended, mobile or fixed, overt or covert. **Comparators included:** Absence of speed enforcement detection devices **Populations included:** Drivers of all motorised vehicles **Outcomes included:** % drivers speeding or above designated speed threshold; % or absolute pre/post change	Contacting authors, Conference proceedings **Databases searched:** Cochrane[3], MEDLINE, EMBASE, TRANSPORT (incorporating TRIS, IRRD, and TRANSDOC), Web of Science, PsycINFO, CINAHL, EconLit, WHO, Sociological Abst, Dissertation Abst, Index to Theses **Other sources**	from 7% to 30%. 9 CBA studies had relative crash rates from 0.98 to 0.66 (but only 2 results were statistically significant). In an Australian study reduction was higher (30%) in urban than rural areas (20%). **Fatality related crashes:** 2 CBA studies showed pre/post reductions of 13% and 17%. For serious injury and fatal crashes	studies recognised, but unable to explore quantitatively	residential roads. Only 5 studies involved speed limits of 60km or less (12 studies did not specify range of speed limits) **Applicability rating:** + (NB. so few studies in the UK, and so few specifying the types of roads or range of speed limits being enforced, or the presence of other measures e.g. road improvements or	quality on non-randomised designs. Few studies controlled for RTM, long term trend or changes in traffic volumes. Lack of information on control sites. **Limitations noted by PenTAG:** They excluded 'any studies where the effect of enforcement could not be differentiated from the effects of other intervention measures'.

[3] Both the Cochrane Injuries Group Specialised Register and The Cochrane Library (CDSR and CENTRAL)

Author, year & other key details	Subject of review	Inclusion and exclusion criteria	Review method	Main findings[1]	Study quality & heterogeneity	Applicability to UK	Comments
		in speed; duration of speed reduction (time & distance); crash and injury outcomes **Study designs included:** RCTs, CBAs, ITSs **Other inclusion criteria?:** **Exclusion criteria:** Those where the speed enforcement device was not the major focus	**searched:** See search methods above **No. search hits:** Not stated **No. examined in full-text:** 54 **Synthesis method:** Tables and narrative; also some standard summary statistics were calculated (for CBAs)	combined (3 CBA studies) reductions from 31% (in GB) to 58% (in Australia). No post-intervention crashes in 1 study. A Hong Kong study showed a 67% reduction compared with controls (but, non-significant; based on only 4 fatal crashes in total)		media campaigns)	

Evidence Table B. Comparative evaluations of other (non-device-specific) speed enforcement strategies

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
Babusci et al. 2006 USA, Pennsylvania **Study quality:** +	Highway safety corridor new signing and double fines **Components delivered:** New signing about enforcement zone and double fines in 6 highway corridors (frequent signs such as: SAFETY CORRIDOR, FINES DOUBLE NEXT XX MILES) **Comparator(s):** Same corridors before changes in signing and enforcement	**Stated aim:** To determine if the implementation of corridor signing combined with increased enforcement and doubled fines had any impact on driver behaviour **Basic design:** Uncontrolled before and after study **Outcomes:** Mean speeds, speed distribution, vehicle gaps, citation history **Research design other details:** Data both short-	**Location/settings:** Multi-lane highways in Pennsylvania, with a high number of speed-related crashes or speed-related crash rates. All 4 lanes, length 3 to 14 miles, speed limits were 55mph (in 2) 50mph (in 2), 45mph and 65mph. 4 interstate, 2 arterial. **Data sources:** Vehicle speeds, vehicle volumes, vehicle type, vehicle gaps and citation history,	With new signing and enforcement, a statistically significantly higher % of motorists adhering to speed limit and not exceeding speed limit by >10mph in all 5 corridors analysed (see table below) Results for upstream and downstream areas not shown (here) as no discernible patterns. Also, positive but minimal change in number of acceptable (4	**Confounders:** No **Regression to mean:** Not considered or adjusted for	**Applicability rating:** + **Other considerations:** The lower speed limits on these highways (relative to those on similar standard UK roads), and use of mainly mobile police patrols may limit applicability to UK	

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	Other notable aspects:	term (+1 month) and longer term (~6 months) after enforcement introduced **Funding source:** Pennsylvania Department of Transport	captured upstream, midstream, and downstream of the enforcement zones **Data analysis methods:** Comparison of numbers (%) speeding between Pre- and post-enforcement, plus z test for significance **Reported data limitations:** Speed data missing/not reported for 1 of 6 corridors **Reported analysis limitations:** None stated	second) gaps between vehicles **Exploration of subgroups:** None **Uncertainty of estimates:** Significance of differences (α = 0.05 level) reported			
* not significantly different from Pre-		**% vehicles travelling over speed limit (in corridor)**			**% travelling more than 10mph over speed limit (in corridor)**		

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
enforcement level at α=0.05 level (z test)							
	Highway corridor	**Pre-enforcement**	**Post (1 month)**	**Post (6 months)**	**Pre-enforcement**	**Post (1 month)**	**Post (6 months)**
	US 119	72	63	65	18	14	12
	US 30	93	88	88	48	27	27
	I-81 (Carlisle)	87	85	89	28	20	26
	I-81 (Harrisburg)	81	67	66	25	24*	24*
	I-81 (Scranton)	94	85	86	53	33	38
Beenstock et al. 2001 Israel **Study quality:** +	Police traffic convictions issued for driving offences **Components delivered:** Number of police reports issued for driving offences **Comparator(s):** Places and times with no or fewer police reports **Other notable aspects:**	**Stated aim:** To investigate the effect of traffic policing on non-urbaan road accidents in Israel **Basic design:** Multivariate statistical modelling of longitudinal count data set **Outcomes:** Non-urban road accidents Fatal road	**Location/settings:** 135 road sections on non-urban roads **Data sources:** 1993-1995 monthly data on amount of policing of each road section over time, and number of accidents by severity. Compete data set covers 60% of police reports and 75% of	(i) Only large-scale enforcement has measurable effect on road accidents (& in one model, number of accidents varies inversely with no. of police reports). (ii) enforcement effect slightly larger in long-run than short-run. (iii) enforcement effect dissipates	**Confounders:** Apparently very few (non appear in model tables **Regression to mean:** NR	**Applicability rating:** - **Other considerations:**	This method is clearly quite advanced econometrics – not easy to understand in detail (or, therefore, to critically assess)

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
		accidents **Research design other details:** Theoretically structured statistical model, with reported attention to: specifying unobserved heterogeneity, and using time-series property of data to estimate 'dynamic models' (in which short-term and longer term impacts can differ) **Funding source:** NR	accidents in period (135 road sections × 31 months = 4185 observations) **Data analysis methods:** Multi-variate statistical model with elements to account for: serial correlation and dynamic mis-specification; limited dependent variables; heterogeneity; simultaneity **Reported data limitations:** Few variables **Reported analysis limitations:** Number of alternative analyses produce slightly different	rapidly after reduction of its intensity. (iv) no effect on fatal road accidents. (v) weak evidence for spill-over (halo effects) to adjacent road sections If policing is increased by 1% (in short-run) accidents fall by only 0.00358%; fall by slightly more in long-run. **Exploration of subgroups:** Not apparent **Uncertainty of estimates:** p-values of regression coefficients reported			

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
			results.				
Davis et al. 2006 USA, California **Study quality:** -	Vigorous traffic violation enforcement program (increased police motorcycles with radar guns) **Components delivered:** 20 new police motor cycles and radar guns, plus expansion of traffic division of Police Department from 20 to 84 officers **Comparator(s):** Area without the increased enforcement resources and activity (Surrounding County of	**Stated aim:** To investigate whether an aggressive traffic violation enforcement program could reduces motor vehicle crashes, injury collisions, fatalities, fatalities related to speed, and decrease injury severity **Basic design:** Controlled before and after study **Outcomes:** Motor vehicle crashes, Injury collisions, fatalities, speed-related fatalities, injury severity	**Location/settings:** Enforcement expanded within city boundaries of Fresno, California (control area was Fresno county); and targeting areas with high frequencies of collisions **Data sources:** Intervention area: Fresno Police Department data on citations, collisions, fatal collisions, fatalities related to speed, injury severity Control area data from Fresno County Clerk of	Alongside statistically significant increases in citations over the 3 years (in Fresno county), also statistically significant reductions in all outcome measures (except severity of hospitalised injury); see table below **Exploration of subgroups:** none **Uncertainty of estimates:** p values reported	**Confounders:** None explicitly adjusted for or explored (except size of population in area) **Regression to mean:** Not explicitly adjusted for	**Applicability rating:** + **Other considerations:** Speed enforcement system based mainly on police motorcycles and radar guns seems unlikely to be provided in the UK	No statistical comparison of intervention and control areas; just comparison of the magnitude and statistical significance of the separate time-trends

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	Fresno) **Other notable aspects:**	**Research design other details:** Data for 1 year before, 1 year during expansion, and 1 year after expansion **Funding source:** NR	Courts and California Highway Patrol **Data analysis methods:** Fisher's exact test and independent samples *t* test (significance level p<0.05) **Reported data limitations:** NR **Reported analysis limitations:** NR				

Main results:		In 2002	In 2003	In 2004	p value
Citations for moving violations: City of Fresno		26,000	65,000	85,947	
		6% of city pop.	14% of city pop.	17% of city pop.	<0.001
Citations for moving violations: County of Fresno (control)		6% of city pop.	6% of city pop.	6% of city pop.	<0.001
City of Fresno	No. of collisions (as % of pop.)	4,502 (1.0)	4,313 (0.95)	4,136 (0.83)	<0.001
	No. of injury collisions (as % of pop.)	1,750 (0.40)	1,711 (0.38)	1,587 (0.32)	<0.001
	No. of fatalities (% of pop.)	52 (0.012)	46 (0.010)	30 (0.006)	<0.003

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
		No. of speed-related fatalities (% of pop.)		12 (0.003)	6 (0.001)	3 (0.001)	<0.02
	County of Fresno (control)	No. of collisions (as % of pop.)		6,703 (1.7)	6,485 (1.7)	6,422 (1.8)	=0.001
		No. of injury collisions (as % of pop.)		2,825 (0.73)	2,547 (0.68)	2,571 (0.74)	=0.806
		No. of fatalities (% of pop.)		131 (0.034)	163 (0.043)	120 (0.034)	=0.950
	City of Fresno	No. of MVC[5] admissions (% of pop.)		292 (0.069)	282 (0.062)	267 (0.052)	<0.006
		No. injury severity score 1-9 (%)		127 (44%)	154 (55%)	136 (51%)	<0.05
		No. injury severity score 10-16 (%)		56 (19%)	48 (17%)	30 (11%)	<0.01
		No. injury severity score >16 (%)		105 (36%)	80 (28%)	92 (34%)	=0.38
		Mean length of stay in days		4.8 ± 0.5	4.8 ± 0.5	3.7 ± 0.3	<0.05
	County of Fresno (control area)	No. of MVC admissions (% of pop.)		305 (0.075)	330 (0.079)	299 (0.075)	=0.932
		No. injury severity score 1-9		129 (42%)	149 (45%)	146 (49%)	<0.06
		No. injury severity score 10-16		72 (24%)	64 (19%)	45 (15%)	<0.01
		No. injury severity score >16		102 (33%)	117 (35%)	108 (36%)	=0.27
		Mean length of stay in days		6.3 ± 0.5	5.2 ± 0.5	5.4 ± 0.5	=0.2
De Waard & Rooijers 1994	Different methods (face-to-face versus	**Stated aim:** To examine the effect on driving	**Location/settings:** The conditions were applied to	Comparing before with during	**Confounders:** None examined **Regression to**	**Applicability rating:** + **Other**	Main results cont-inued: For all conditions

[5] Motor vehicle crashes

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
The Netherlands **Study quality (Experiment 1):** +	mailing of speed tickets) and intensity levels of enforcing speed limits on motorways **Components delivered:** Methods: On-view stopping (stopped by marked police car on view at roadside), or photographed by police officer with radar and camera but not stopped (sent ticket), or automated speed enforcement with speed radar and camera at fixed point (speeding drivers photographed and tickets	speeds on motorways of: (i) intensity of enforcement, (ii) method of enforcement, and (iii) time delay (for mailed fines) **Basic design:** Controlled before (2 weeks), during (4 weeks) and after (4 weeks) study **Outcomes:** Driving speeds **Research design other details:** Presented as 3 studies across the 6 conditions: intensity, method and time-delay **Funding source:** Dutch Ministry of Justice and the Ministry of	one road section each all with similar speed limits (120kmh) and number of lanes (2+2 with emergency lanes) **Data sources:** Local road authority induction loops measuring mean speeds (and SD) for each hour. Also, induction loops which classify speeds (10kmh bands) 10am to 3pm **Data analysis methods:** Direct comparison of speeds in the 3 phases using Student-Newman-Keuls	enforcement differences: **Intensity:** Stopping every 100th offender made no difference to mean speeds (SNK>0.1); Stopping every 25th offender reduced the mean speed by 1kmh (SNK<0.1, 1 lane only); Stopping every 6th offender reduced the mean speed by 3.5kmh (SNK<0.05 both lanes) **Method (& 1 in 6 apprehended):** Receiving a mailed fine preceded by a feedback letter	**mean:** NA	**considerations:**	where enforcement was associated with a reduction in mean speeds (or the distribution of speeds), cessation of enforcement was associated with similar increases back towards pre-enforcement mean speeds and distribution

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	mailed on basis of licence plate number). Intensity: 3 rates of apprehension, 1:100, 1:25, 1:6 – all applied to on-view stopping. Time delay: either personal feedback letter about the offence (where and when, speed) as soon as possible, with warning that a fine would be coming, or no advance warning letter about fine/ticket **Comparator(s):** See table below **Other notable aspects:**	Transport	procedure **Reported data limitations:** Not all data were available due to technical problems, but assessed as of minor importance **Reported analysis limitations:**	reduced speeds by 3.1kmh (SNK<0.05 for both lanes), and without the letter by 2.0 (SNK<0.1 for 1 lane) Lastly, in the control road section there were slight (and non-significant) increases in mean speed. Results for % of cars driving faster than 130kmh showed similar pattern of statistically significant reductions (before vs during enforcement) **Exploration of subgroups:** No **Uncertainty of**			

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
				estimates: SNK (p values?) reported			
	Study arms:	**Condition name**	**Type of change**		**Ratio apprehended**	**Method**	**Legal transaction**
		Stop 100	Intensity		1:100	On-view stopping	Standard
		Stop 25	Intensity		1:25	On-view stopping	Standard
		Stop 6	Intensity + Method		1:6	On-view stopping	Standard
		Plate 6	Method + Delay		1:6	Licence plate	Standard
		Feedback 6	Delay		1:6	Licence pl. + letter	Feedback
		Control	Intensity + Method +Delay		-	No enforcement	-
	Study results						
Study quality (Experiment 2): +	**Components delivered:** Stopping on view, but scheme based on game theory in which enforcement levels increased in response to speeding levels exceeding a defined tolerance limit **Comparator(s):**	**Aim:** To optimise the effect of enforcement with a minimum of police effort **Basic design:** Controlled before during and after study **Outcomes:** % of speeders **Funding source:**	**Location/settings:** Not stated **Data sources:** Same as above **Data analysis methods** Graphical summary & correlation of enforcement intensity and proportion of speeders **Reported data**	Correlation between enforcement intensity and the proportion of speeders was: *r* = -0.70, p<0.001	**Confounders:** None **Regression to mean:** NA	**Applicability rating** + **Other considerations:**	

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	No police enforcement activity **Other notable aspects:** Weekly adjustment of enforcement level, based on previous weeks levels of speeding	Dutch Ministry of Justice and the Ministry of Transport	**limitations** **Reported analysis limitations**				
Donnelly et al. 2005 Ireland **Study quality:** -	Introduction of a driver's licence 'Penalty Points System' (PPS) for driving offences **Components delivered:** Driver's licence 'PPS' for driving	**Stated aim:** To assess whether the introduction of the PPS has resulted in reduced RTA-related trauma **Basic design:** Uncontrolled	**Location/settings:** 2 regions of Ireland **Data sources:** Hospital trauma data (1 hospital in Waterford, and 6 teaching hospitals in	RTA related discharges (Beaumont hospital) reduced over the three years: 124 (2000/01) 125 (2001/02)[6] 70 (2002/03)	**Confounders:** None examined or reported **Regression to mean:** NA	**Applicability rating:** + **Other considerations:**	Highly questionable use of femoral shaft fractures as proxy for RTA-related trauma

[6] PPS introduced between the 2001/02 and the 2002/03 data collection periods

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	offences **Comparator(s):** Before its introduction **Other notable aspects:** Stated target behaviour is speeding but, not clear what types of offence penalty points may be issued for	before and after study **Outcomes:** Road Traffic Accident-related injuries No. of femoral shaft fractures **Research design other details:** Also looked at hospital length of stay **Funding source:** NR	Dublin) **Data analysis methods:** Before and after comparison of absolute numbers of hospital discharges for 3 comparable 6-month periods **Reported data limitations:** Use of femoral shaft fractures as proxy for RTA-related trauma **Reported analysis limitations:** NR	Especially for neurosurgery: 44 (2000/01) 52 (2001/02)[a] 22 (2002/03) Data from Dublin teaching hospitals and Waterford regional hospital on numbers of femoral shaft fractures showed very slight reductions (from 20 to 16, and 6 to 5) – unlikely to be statistically significant **Exploration of subgroups:** Sub-types of trauma (but low numbers) **Uncertainty of estimates:** None			

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
Elvik & Christensen 2007 Norway **Study quality:** +	Increasing fixed penalties for traffic offences **Components delivered:** Increasing fixed penalties for traffic offences from 1995 to 2004 (e.g. for spped limit 60kmh or lower, and violation from 15 to <20kmh above limit, increased from 1,500NOK (1995-97) to 1,900 (1998-99) to 2,000 (2000-02) to 2,500 in	**Stated aim:** To evaluate the effects of increases in fixed penalties for speeding and not wearing a seat-belt **Basic design:** Regression analysis of longitudinal data **Outcomes:** % of vehicles speeding **Research design other details:** Both a linear model and a logistic	**Location/settings:** Whole of Norway **Data sources:** Speed count data from 34 (of 338 possible) permanent traffic counting stations with sufficiently complete data; speeds from 33 (of 207 possible) speed camera sites (where complete data for all years, & no changes in speed limits) **Data analysis methods:** Dependent	**At permanent traffic counting stations:** % points of increase in compliance (95% CIs): 0.0 (-0.1 to 0.0)[7] -0.3 (-5.5 to 5.0)[8] **At speed camera sites:** 0.0 (0.0 to 0.0)[a] 1.4 (-0.5 to 3.1)[b] **Exploration of subgroups:** Different types of speed measurement site, and seat belts, only **Uncertainty of**	**Confounders:** Only other factor (apart from year and fixed penalty) was location (built-up or not in built-up area) Not able to adjust of levels of enforcement (risk of apprehension) **Regression to mean:** NA	**Applicability rating:** + **Other considerations:** Because speed, unlike seatbelt wearing, is not a one-off decision, but subject to continuous and possibly subconscious behaviour changes, so perhaps less susceptible to changes in penalties (and more about real time perceived risks of	Contrasting results for impact of fixed penalties on speeding and seat-belt wearing

[7] With linear regression model

[8] With logistic regression model

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	2003 and 3,200 in 2004) **Comparator(s):** Rates increased over all Norway, so no comparison group was possible **Other notable aspects:**	regression model (log-odds for violations) were used. Also controlled for long-term trends and between site differences in violation rate **Funding source:** NR	variable = % of vehicles speeding **Reported data limitations:** Data from small subset of all traffic counting stations and speed cameras. No reliable data on rates of violations **Reported analysis limitations:** Potential 'endogeneity bias' (e.g. penalties increased in response to increases in accident rates) not evident when tested for	**estimates:** See 95% CIs above		apprehension)	
Hakkert et al 2001	**Components delivered:**	**Stated aim:** (of the Acciident	**Location/settings:** Covered 700km	Statistically significant	**Confounders:** No specific	**Applicability to source population:**	No injury or injury accident

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
Israel **Study quality:** +	The '700 project': concentrated police enforcement on selected 'high accident' road sections with increases of staffing, vehicles and devices; with linked publicity campaign at launch (for 4 months); Targeted general enforcement of: speed, not keeping to the right, traffic signal and other moving violations **Comparator(s):** Before the intervention, and unexposed control areas **Other notable**	Analysis) to establish the project's influence on safety **Basic design:** Controlled before and after, and interrupted time-series analysis **Outcomes:** 'Severe accidents' **Research design other details:** Three levels of police presence evaluated: within project (high and low presence) and non-project roads **Funding source:** NR	of interurban road **Data sources:** Level of enforcement as assessed by number of traffic arrests (for speeding, driving while under influence , hit-and-run, other) National data on police activity, traffic volume, and monthly location-specific accident data (January 1995 to March 1998) **Data analysis methods:** Generalised linear model fitted to monthly accident counts (separately for before and after	accident reduction in only 1 of the 5 road group areas (see below) **Exploration of subgroups:** Regions (north, centre, south) Intensity of enforcement within the project areas (higher and lower) **Uncertainty of estimates:** 95% CIs given (see below)	adjustments (just data from control areas). Possible impact of diverted traffic not assessed. **Regression to mean:** No specific adjustments; before intervention period was approximately 28 months	++ **Other considerations:** Standard enforcement tools and methods, so applicability to other developed countries with dedicated highway/road police probably good Background trend in road accidents in Israel at the time was increase.	data reported Interesting combination of both before and after (odds ratio) and longitudinal time series data analysis methods

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	aspects: Covered the 20% of inter-urban roads which account for 60% of accidents on inter-urban roads Intervention had an explicit process model		periods), assuming trend and seasonal components; then odds ratio calculated **Reported data limitations:** Lack of longer follow-up (which was planned) **Reported analysis limitations:**				

Subgroup roads (within enforcement project areas)	NB. Data for 'after period' is May '97 to March '98	**Odds ratio (before/after odds on project roads ÷ before/after odds non-project roads**	**95% Confidence Interval**	**Estimated reduction in number of accidents due to project**	**95% Confidence Interval**
Road group: North, higher police presence		1.10	0.60 to 2.02	-5.92	-33.88 to 45.61
Road group: Center, higher police presence		0.61	0.39 to 0.93	88.06	9.85 to 208.44
Road group: South, higher police presence		0.78	0.42 to 1.46	10.74	-12.24 to 53.72
Road group: North, lower police presence		0.83	0.53 to 1.31	26.51	-31.67 to 118.13
Road group: Center, lower police presence		0.52	0.22 to 1.22	30.38	-5.94 to 116.43

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
Jones 1997 USA, Oregon **Study quality:** ++	Two types of driver improvement letter (received on basis of accident or traffic violation record) **Components delivered:** 1. Standard letter lists accidents and violations which triggered it, and more explicit threat of further sanctions if further traffic tickets or accidents occur within 12 months 2. 'soft-sell' advisory letter,	**Stated aim:** To compare the impact of two different types of advisory letter as part of a driver improvement program for drivers with high accident or violation rates **Basic design:** RCT[9] with Survival analysis (time to next accident) following **Outcomes:** Accident-free survival **Research design other details:**	**Location/settings:** State of Oregon, USA **Data sources:** Oregon's Driver Improvement Evaluation System, which randomly withholds regulatory actions from a small sample of drivers. 24 consecutive months of accident and violation data following letters **Data analysis methods:** Cox regression	Standard letter more effective than 'soft-sell' letter at preventing accidents, especially in men (NB. Most results as graphs) For future violations, either letter reduces the risk. **Exploration of subgroups:** Age-groups and gender: Standard letter consistently more effective up to age 40-44 years, then soft-sell	**Confounders:** Age, gender **Regression to mean:** NA (RCT)	**Applicability rating:** + **Other considerations:**	

[9] Probably a randomised controlled trial with survival analysis (random allocation of both types of letter and random selection of control subjects (no letter)

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	gives more general advice and encourages receipient to be more like 'most' Oregon drivers (e.g. 'who go 4 years without a ticket or accident') 'soft-sell' advisory letter, gives more general advice and encourages receipient to be more like 'most' Oregon drivers (e.g. 'who go 4 years without a ticket or accident') **Comparator(s):** No letter **Other notable aspects:**	13,403 received a standard letter 13,623 received an experimental 'soft-sell' letter 1,453 randomly selected control subjects (no letter) **Funding source:** Oregon Department of Transportation (author's employer)	survival model, with stepwide elimination of non-significant interaction terms **Reported data limitations:** None **Reported analysis limitations:** None	letter more effective for older people **Uncertainty of estimates:** Significance of Wald statistics for regression coefficients given (see below)			

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	Cox regression survival analysis of accidents:						
	Variable	***B***	**SE *B***	**Wald Statistic**	**df**	**Significance**	**Exp(*B*)**
	Gender	0.0252	0.0350	0.5189	1	0.471	1.0255
	Age	-0.0105	0.0019	29.7945	1	0.000	0.9895
	Control-treatment	0.1793	0.0730	6.0357	1	0.014	1.1963
	Letter type	-0.2413	0.0886	7.4222	1	0.006	0.7856
	Gender × control	-0.3090	0.1601	3.7270	1	0.054	0.7342
	Age × letter type	0.0064	0.0027	5.3938	1	0.020	1.0064
McCarthy 1999 USA, California **Study quality:** +	**Components delivered:** Areas and periods with more traffic enforcement activity (arrests) **Comparator(s):** Areas and periods with less traffic enforcement **Other notable aspects:**	**Stated aim:** To analyse the impact of relevant city-wide policies on reducing the incidence of fatal accidents **Basic design:** Econometric analysis of panel data **Outcomes:** Road fatalities **Research design other details:**	**Location/settings:** 418 incorporated cities, plus 57 unincorporated areas (mainly rural) **Data sources:** Data on monthly fatalities from California Highway Patrol (108 consecutive months 1981-'89, for each of the 475 areas (51,300	Model (a): a unit increase in traffic arrests per 1000 population reduced expected fatal accidents by 0,007%. Model (b) (with area-type interaction terms): a unit increase in traffic arrests per 1000 population reduced expected fatal	**Confounders:** Other area-level variables in the analysis were: unemployment rate, speed limit law, seat belt law, alcohol licences, common site ban, **Regression to mean:** NA	**Applicability to source population:** + **Other considerations:** Mode of enforcement by California Highway Police may well not reflect current speed enforcement practices in the UK, especially in the context of a network of fixed	A surprising result of the analysis is that mandatory seat belt legislation appears to have been ineffective in reducing fatal accidents

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
		2 models fitted, one with interaction terms between public policy variables and dummy variables for cities and unincorporated areas. **Funding source:** NR	observations), plus policy and police citation data (California Department of Justice) **Data analysis methods:** Negative binomial model (Poisson regression with fixed effects) of fatalities, with explanatory variables which reflect: city type; socio-economics; public policy and other variables (including monthly no. of traffic arrests) **Reported data limitations:** Lack of data on alcohol consumption and	accidents by 0.0056% (considerably greater than the effect of arrests for driving while under the influence) **Exploration of subgroups:** Differential effects by city or unincorporated area **Uncertainty of estimates:** Significance of *t* statistics of regression coefficients reported		automated speed cameras.	

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
			traffic exposure **Reported analysis limitations:** Overdispersion, omitted variable biases				
Newstead et al. 2001 Australia **Study quality:** +	Random Road Watch (RRW) program **Components deleivered:** Widespread and low-level policing strategy, using static marked police vehicles, randomly allocated to locations and times **Comparator(s):** Absence of program **Other notable aspects:** Study was alongside the	**Stated aim:** To estimate the effect of the RRW program **Basic design:** Controlled before and after study, with statistical modelling **Outcomes:** Crash frequency (and four levels of crash frequency, by severity) **Research design other details:** With time-trend analysis **Funding source:**	**Location/settings:** All 7 Queensland Police Regions **Data sources:** Police records of scheduled policing and issuance of tickets. Monthly crash frequency data (source not stated) **Data analysis methods:** Log-linear (Poisson) regression model of time-series data from both enforced and unenforced areas	Average % crash reductions, by severity of crash: see table below Crash reductions attributable to the programme also estimated to have risen with time after the programme **Exploration of subgroups:** Analysis by urban/rural area: possibly more effective in urban that rural areas (larger, statistically significant	**Confounders:** No precise matching of intervention and control sites **Regression to mean:** Likely to be minimal due to: (1) staggered roll-out of program over time unrelated to crash statistics, (2) widespread introduction across areas, (3) evidence from correlation of programme outputs and outcomes by	**Applicability to source population:** ++ **Other considerations:** With widespread programs, geography and scale of region probably important to effectiveness. However, reductions in crash frequency in urban areas (all severities except fatal)	Low doses of enforcement systematically spread across regions - contrasts directly with common strategy of targeting accident 'black spots' or other locations assessed as 'high risk'

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	gradual roll-out of program	Not stated	and times (4 data series, stratified by police regions and urban/rural) **Reported data limitations:** **Reported analysis limitations:** RTM not explicitly addressed (only by having long, 5-year, pre-intervention data period). Model fit not explicitly considered.	reductions in urban areas). **Uncertainty of estimates:** Statistical significance of estimates of reductions were reported (see below)	region.		

	Fatal	Hospitalisation	Medical/First-Aid	Property damage	All crashes
Non-metropolitan: Rural	34.3[10]	4.1	4.9	1.3	4.8

[10] Statistically significant at the p<0.01 level. NB. Negative values indicate an estimated crash increase.

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	Non-metropolitan: Urban		25.7	20.6[a]	14.7[a]	13.1[a]	15.0[a]
	Non-metropolitan: All		31.0[a]	13.2[a]	11.5[a]	8.9[a]	11.2[a]
	Metropolitan south: Rural		-133.5	7.8	31.8	-33.9	-5.1
	Metropolitan south: Urban		62.0	4.1	4.2	32.3[a]	20.8[a]
	Metropolitan south: All		14.3	5.3	12.2	24.8[a]	17.4[11]
Povey et al 2004 New Zealand **Study quality:** -	The introduction of a dedicated State Highway Patrol in 2001/02 **Components delivered:** State Highway Patrol operates from specially marked cars (i.e. intended effect through Police visibility and ticketing); also both camera-	**Stated aim:** To examine the relationship between enforcement activity, vehicle speeds and injury crashes **Basic design:** Statistical modelling of longitudinal data **Outcomes:** Injury crashes,	**Location/settings:** All New Zealand (except Midland Police Region[12]) **Data sources:** 1996-2002 data on speed and injury crashes (Land Transport Safety Authority speed surveys and Traffic Crash Reporting database). No. of	Reductions in open road mean speeds were found, with increases of speed camera infringements and other speed infringements respectively (greater reductions, 1.1% and 1.6% in 85th percentile speeds).	**Confounders:** None examined **Regression to mean:** Not explicitly adjusted for	**Applicability rating:** + **Other considerations:** Rurality a key issue for transferring results from New Zealand to UK (also in relation to ranges of speeds and ticketing rates)	Study also measured an increase in the perceived risk of being caught speed by a Police officer

[11] Statistically significant at the $p<0.05$ level.

[12] Because this police region was the location of another road study, the Hidden Camera Trial.

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	detected and non-camera speeding infringements. **Comparator(s):** Same areas before programme introduction. **Other notable aspects:**	Average and 85th percentile speeds, fatal & serious injury crashes, fatal & serious injuries **Research design other details:** Data for low alcohol hours used (4am to 9.59pm Mon-Fri, 6am to 9.59pm Sat & Sun) **Funding source:** NR (but all authors are from New Zealand Land Transport Safety Authority)	infringements from Police Infringement Bureau **Data analysis methods:** 2-stage regression model (speed as function of number of each type of speeding ticket, then crashes as a function of mean speeds) **Reported data limitations:** No. of fatal and serious crashes and injuries too small to enable detection of effect due to speed **Reported analysis limitations:** Should not use	During low alcohol hours, a 12% reduction of injury crashes was associated with a 1kmh in mean open road speed **Exploration of subgroups:** None **Uncertainty of estimates:** 95% confidence intervals given (and whether result is significant at 0.05 or 0.01 level)			

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
			these models beyond the range of speeds and ticketing rates as in the study.				
				Per 1kmh change in mean speed	**95% confidence interval**	**Per year (1996-2002)**	**95% confidence interval**
		Injury crashes		-12%	(-20% to -3%)	-6%	(-11% to -31%)
		All injuries		-13%	(-20% to -5%)	-7%	(-11% to -2%)
		Fatal & serious injury crashes		-7%	(-17% to 3%)	-3%	(-8% to 3%
		Fatal & serious injuries		-7%	(-18% to 6%)	-3%	(-9% to 4%)
Redelmeier et al 2003 Canada, Ontario **Study quality:** ++	Traffic convictions & penalty points **Components delivered:** Traffic convictions & number of penalty points **Comparator(s):** Same persons without or longer after traffic the	**Stated aim:** To assess whether traffic convictions might be associated with a reduced risk of fatal motor vehicle crashes **Basic design:** Case-crossover **Outcomes:** Risk of fatal	**Location/settings:** Whole of Ontario **Data sources:** Data on fatal crashes in Ontario during 1988, linked to licensed driver characteristics (including whether alcohol was detected at time of crash)	During the year, 8,975 licensed drivers had fatal crashes, and 21,501 driving convictions were recorded for all drivers from the date of obtaining a full licence to the date of a fatal crash The risk of a fatal	**Confounders:** Using the same person as their own control avoids many of the usual problems of adjusting for confounders in large observational datasets **Regression to**	**Applicability rating:** + **Other considerations:** Also tested for adverse effects of police enforcement (examined all deaths involving police activity e.g. road chases) Study did not	Implications of results continued: results suggest that 1 death is prevented for every 80,000 convictions, and 1 emergency department visit for every 1,300 convictions.

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	convictions **Other notable aspects:**	crash **Research design other details:** With matching of periods different lengths of time before the fatal crash **Funding source:** Canadian Institutes for Health Research, Ontario Ministry of Health and a personal chair at the University of Toronto	and the vehicle and roadway conditions **Data analysis methods:** Primary analysis matched a driver's period immediately before the crash with a comparable period substantially before the crash **Reported data limitations:** Imperfect data on alcohol or other risks **Reported analysis limitations:** Not a randomised experiment, and causality cannot be presumed.	crash in the month after a conviction was about 35% lower that in a comparable (much earlier) month with no conviction for the same driver (95% CI: 20%-45%, p=0.0002. The benefit lessened by 2 months after conviction (~20%), and was not significant by 3-4 months. Speeding convictions with penalty points were associated with a larger relative risk reduction than those without penalty points	**mean:** NA	assess other types/levels of deterrence, such as: being charged but not convicted; being stopped but not charged; or being an observer when others are stopped.	

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
				(51% vs 0%, p=0.011) **Exploration of subgroups:** Those with more penalty points have greater risk reduction **Uncertainty of estimates:** Some confidence intervals given (and in figures)			
Yannis et al 2008 Greece **Study quality:** +	Intensification of police enforcement (as measured by speed infringements) **Components delivered:**	**Stated aim:** To examine: the effect of speed and alcohol enforcement on both road accidents and fatalities; whether	**Location/settings:** Whole of Greece (12 regions, 49 counties) except metropolitan areas of Athens and Thessaloniki[13]	Injury accidents significantly decreased by enforcement, but varied by region (and not clear whether only alcohol	**Confounders:** Several examined – regional and county dummy variables and socio-economic and transport	**Applicability to source population:** + **Other considerations:** Nature of non-metropolitan Greek roads and	Models of road fatalities appeared to only be in relation to enforcement of alcohol laws

[13] These two large cities excluded from analysis because: "with different traffic conditions (e.g. more congestion) and consequently different travel patterns and driving behaviours, making the link between road safety and enforcement figures more complex." {Yannis, 2008 978 /id /pt "p.743 in "}

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
	Speed infringements **Comparator(s):** Areas and years with lower or no speed infringements **Other notable aspects:** Examined combined effect of alcohol and speed controls	the effect on accidents and fatalities is similar; and investigation of regional variations **Basic design:** Multivariate multi-level modelling of longitudinal accident data **Outcomes:** Road accidents with casualties fatalities **Research design other details:** Main hierarchical levels are geographical **Funding source:** European Commission (partly)	**Data sources:** 5 years data from 49 counties (245 observations) **Data analysis methods:** Poisson multivariate multi-level modelling of longitudinal accident data: separate models for effect of alcohol controls, speed controls, and effect of both combined **Reported data limitations:** Multicollinearity of speed control and alcohol control data (correlation coefficient = 0.729), both probably reflecting police	enforcement used for modelling this outcome) Fatalities **Exploration of subgroups:** Regional variations only **Uncertainty of estimates:**	features (but none were found to add explanatory power) **Regression to mean:** NA	traffic (and weather) conditions quite different to the UK	

Author & year, Country	Enforcement strategies evaluated	Study design & Study quality	Study population & data sources	Main results	Handling of confounders/RTM	Applicability to UK	Reviewer comments
			enforcement **Reported analysis limitations:** Handling overdispersion (presents a negative Binomial model), and multicollinearity				

Evidence Table C. Comparative evaluations of mass media campaigns alongside speed enforcement strategies

Author & year, Country	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
Cameron et al. 2003 Australia, Victoria **Study quality:** +	Speed-related mass media publicity, alongside variable speed camera enforcement **Components delivered:** Months and places with 50% or 100% increase in police enforcement activity, and with/without publicity campaign **Comparator(s):** Months and places with no change in enforcement, and absence of speed-related	**Basic design:** Quasi-experimental, factorial deisgn: study areas allocated to one of 2 increases in speed camera enforcement (or no change) and presence/absence of speed-related publicity [= 6 comparison groups] **Specific research design:** Plus a before and after element (i.e. cross-over trial with 'wash-out' periods) **Outcomes:** Casualty crashes, crash severity	**Location/settings:** 2 police districts in Victoria **Data sources:** 1999 data on accidents, coverage and timing of publicity, and enforcement activity **Data analysis methods** (Main analysis) (1) Poisson Regression Modelling of crash frequency, and (2) Logistic Regression of crash severity **Reported data limitations** Using same month data when	See tables below for (1) Poisson regression model of casualty crashes (12% (p=0.043) reduction in crash frequency associated with high publicity), and (2) logistic regression of fatal crash severity (41% (p=0.035) reduction in fatal crash outcome associated with very high camera activity), **Exploration of subgroups:** None **Uncertainty of estimates:**	**Confounders:** None in main models (just different levels of enforcement and publicity) **Regression to mean:** NA	**Applicability rating** + **Other considerations:**	

Author & year, Country	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
	publicity campaign **Other notable aspects:** & explored impact of different styles of advertising	(serious vs minor) **Funding source:**	infringements take 7-14 days from day of offence Incomplete data on traffic infringement notices **Reported analysis limitations**	p-values and 95% CIs			

Model 1: Parameter	**d.f.**	**Percentage change**	**Lower 95% CI**	**Upper 95% CI**	**Chi-square**	**p-value**
Enforcement:						
Very low	1	6.82	-1.63	15.99	2.46	0.116
Low	1	3.62	-2.10	9.67	1.51	0.220
High	1	-2.11	-7.21	3.27	0.61	0.435
Very High	1	-3.00	-8.23	2.52	1.17	0.280
Medium		0	0	0		
Publicity:						
High	1	**-12.20**	-22.62	-0.39	4.08	**0.043**
Low		0	0	0		
Enf. × Publicity:						
Very low × High	1	-4.35	-12.46	4.50	0.97	0.324

Author & year, Country	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
	Very low × High		0				
	Low × High	1	-1.29	-7.54	5.38	0.15	0.697
	Low × Low		0				
	High × High	1	2.01	-4.37	8.83	0.37	0.546
	High × Low		0				
	Very high × High	1	3.63	-3.35	11.14	1	0.316
	Very high × Low		0				
	Average × High		0				
	Average × Low		0				
	Model 2: Parameter	**d.f.**	**Percentage change**	**Lower 95% CI**	**Upper 95% CI**	**Chi-square**	**p-value**
	Enforcement:						
	Very low	1	1.44	0.77	2.70	1.29	0.255
	Low	1	0.94	0.60	1.49	0.06	0.803
	High	1	0.97	0.63	1.49	0.03	0.872
	Very High	1	**0.59**	0.36	0.96	4.47	**0.035**
	Medium		0	0	0		
	Publicity:						
	High	1	1.80	-0.60	5.36	1.10	0.294
	Low		0	0	0		
	Enf. × Publicity:						
	Very low × High	1	0.69	0.35	1.36	1.16	0.281

Author & year, Country	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
	Very low × High		0				
	Low × High	1	0.93	0.55	1.57	0.08	0.775
	Low × Low		0				
	High × High	1	0.92	0.55	1.56	0.09	0.768
	High × Low		0				
	Very high × High	1	1.54	0.83	2.83	1.88	0.171
	Very high × Low		0				
	Average × High		0				
	Average × Low		0				
Guria & Leung, 2004 New Zealand **Study quality:** ++	Emotion and shock advertising as major part of 'Supplementary Road Safety Package' (SRSP) **Components delivered:** Advertising campaigns targeting speeding, drink driving and seat belts, and enforcement	**Study aim:** To provide a thorough analysis of the (publicity) package and estimate the number of deaths prevented **Basic design:** Multivariate analysis of longitudinal data (10 years for main model: 1991-	**Location/settings:** Whole of New Zealand **Data sources:** Land Transport Safety Authority records of fatal crashes, fatalities and non-motorcycle fatalities (normal-ised by traffic volume index) Explanatory	Models with excellent fit (R^2 for every model (10-year data) >0.94) (with 10-year annual models): Significant negative relationship between levels of road trauma and: advertising expenditure;	**Confounders:** All other explanatory variables in the analysis (see left) **Regression to mean:** NA	**Applicability rating** + **Other considerations:**	Example model outputs (10-year model of All fatalities, with unemployment, and PCA): Time -0.017* Unemploym't -0.018 CBT -0.093* Enforcement -0.275* Advertising -0.013* Enf. × Adv. -0.012* SRSP × Enf -0.008 SRSP × Adv. -0.009*

Author & year, Country	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
	Comparator(s): Time periods with absence of these and other explanatory variables **Other notable aspects:**	2000) **Specific research design:** Also used Principal Components Analysis (PCA) to avoid problems of OLS when explanatory variables are correlated **Outcomes:** Fatal crashes, fatalities and non-motorcycle fatalities **Funding source:**	variables: trend and seasonal effects, unemployment, Oil crisis (‘70s), changes in speed limits, new vehicle registrations, strategic police hours and advertising expenditure, CBT and speed camera programmes, interaction term between enforcement and advertising **Data analysis methods** Multivariate regression analysis incorporating PCA **Reported data**	strategic enforcement; and interaction term for both factors together (with 29-year model also): All enforcement variables, including the interaction terms have significant negative coefficients **Exploration of subgroups:** NA **Uncertainty of estimates:** Significance of regression coefficients reported			CONSTANT 6.848 Serial correlation test: DW Statistics 2.28 LM Statistics 3.32 Normality test: Wald statistics 1.81 Adjusted R^2: Model 0.980 Estim’d fatality 0.918

Author & year, Country	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
			limitations **Reported analysis limitations**				

Evidence Table D. Comparative evaluations of policies involving quantified road safety targets

Author & year	Strategy evaluated	Study design & Study quality	Study population & data sources	Main results	Confounders	Applicability to UK	Reviewer comments
Elvik 2001 (NB 2-page Report Summary only available)** **Study quality:** +	National and regional road safety targets **Components delivered:** 22 targets of national governments, and 13 targets of local government (in 3 countries) **Comparator(s):** **Other notable aspects:**	**Study aim:** **Basic design:** Before and after design **Specific research design:** NR** **Outcomes:** 'Road safety indicators' **Funding source:** NR**	**Location/settings:** **Data sources:** NR** **Data analysis methods** Multivariate analysis of longitudinal data **Reported data limitations** NR** **Reported analysis limitations** NR**	**Exploration of subgroups:** NR** **Uncertainty of estimates:** NR**	**Confounders:** **Regression to mean:** NR**	**Applicability rating** **Other considerations:**	
Elvik 1993 Norwegian counties **Study quality:** +	Regional quantified road safety targets **Components delivered:** Targets with different levels of ambitiousness **Comparator(s):**	**Study aim:** To compare the safety performance of Norwegian counties with and without quantified road safety targets	**Location/settings:** 19 Norwegian counties **Data sources:** Norwegian Counties **Data analysis methods** Before period:	Best outcomes achieved by counties with highly ambitious targets (both periods) [Counties with quantified targets also spent more	**Confounders:** Explored narratively, e.g. if urban black spots treated earliest and targets adopted earliest too. Also tables	**Applicability rating** - **Other considerations:**	

	Periods and counties which have not yet set road safety targets **Other notable aspects:**	**Basic design:** (1) controlled before and after comparison, (2) comparison between counties with ambitious and less ambitious targets, and without quantified safety targets **Specific research design:** **Outcomes:** Accident rate per km of travel **Funding source:** NR	1982-85 After period: 1986-89 Counties with targets in any time period compared with other counties without in either time period **Reported data limitations** Division into two main time periods **Reported analysis limitations** Progressively less ambitious targets over time make data interpretation difficult	of their budget on safety programmes] **Exploration of subgroups:** NR **Uncertainty of estimates:** NR (just % changes between periods)	showing changes in income, unemployment, alcohol consumption per capita, new driver recruitment. Author concludes unlikely to explain much of observed diffs in safety performance **Regression to mean:** Examined mainly narratively	
Wong et al. 2006 14 countries: UK, Norway, Netherlands, Denmark, Finland, Sweden, New Zealand, Iceland,	National quantified road safety targets **Components delivered:** Actual targets set in each country not described	**Study aim:** To assess whether countries with quantified road safety targets are more successful in reducing road fatalities than	**Location/settings:** See left **Data sources:** World Road Statistics and International Road Traffic and Accident	Aggregate analysis and country by country analysis: mixed results (see table below) but most countries with road targets	**Confounders:** NR **Regression to mean:** Not considered	**Applicability rating** + **Other considerations:**

Australia, Hungary, Spain, Poland, USA, France **Study quality:** +	**Comparator(s):** Years in 'matched' countries without targets **Other notable aspects:** Some comparisons involved aggregating estimates from control countries	countries without such targets **Basic design:** Controlled before and after study **Specific research design:** With 'treatment countries' which set targets later in data period (after 1990) also acting as controls for countries which set targets in 1980s **Outcomes:** Road fatalities in each year, by country **Funding source:** University of Hong Kong, and Research Grants Council of Hong Kong	Database (IRTAD); fatality data for all countries from 1981-1999 **Data analysis methods** Comparison of 3-years before and 3-years after data for intervention and control countries, to estimate an odds ratio **Reported data limitations** Few comparator countries **Reported analysis limitations**	experienced a reduction in road fatalities **Exploration of subgroups:** NA **Uncertainty of estimates:** Statistically significant odds ratios marked ($p<0.05$)

Changes in road fatalities before and after the setting of quantified road safety targets (p-values)

[Numbers lower than 1 mean 'treatment country' has better fatality reduction performance than comparator country]

- : means comparison failed the qualification test

Treatment country	New Zealand	Australia	Hungary	Spain	Poland	USA	France
Norway	-	-	0.878 (0.052)	0.734 (<0.001)	-	0.987 (0.427)	-
The Netherlands	0.715 (<0.001)	0.966 (0.225)	0.711 (<0.001)	0.593 (<0.001)	-	0.774 (<0.001)	0.957 (0.126)
Denmark		1.027 (0.665)	-	0.505 (<0.001)	-	-	-
Finland		1.015 (0.591)	-	0.499 (<0.001)	-	-	-
Sweden					0.645 (<0.001)	1.127 (0.989)	1.095 (0.954)
New Zealand					0.636 (<0.001)	0.957 (0.210)	0.927 (0.087)
Australia					0.967 (0.171)	0.945 (0.037)	0.994 (0.424)
Hungary					0.790 (<0.001)	0.772 (<0.001)	0.812 (<0.001)
Spain					0.847 (<0.001)	-	-