The evaluation of large-scale speed limit policies in two major UK cities

THE 20MPH PROJECT

Funded by the National Institute for Health Research PHR Project: 15/82/12 – Is 20 plenty for health? Evaluation of the 20mph speed limit networks in Edinburgh and Belfast on a range of public health outcomes

NIHR | National Institute for Health Research

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Study design and methods to evaluate a complex 20mph speed reduction intervention

THE 20MPH PROJECT

Our approach

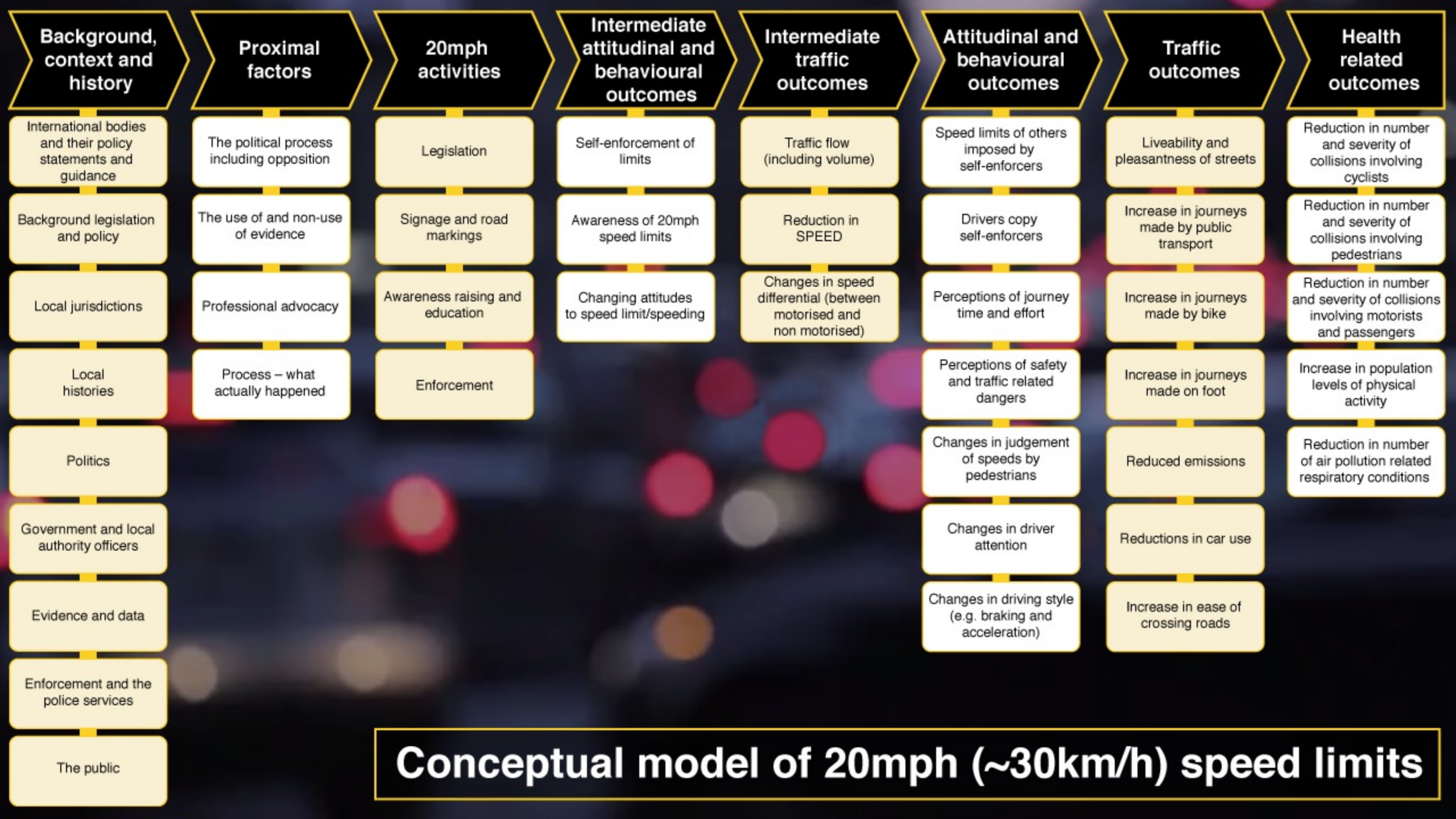
To use rigorous and transparent scientific methods to explore ‘what happens and why’ when 20mph limits are introduced in 2 UK cities

To explore how they came to be, and what was learned, so that future initiatives may benefit from the information generated

Study objectives

work packages

1. How do various outcomes change (or not)?
   - Quantitative
2. Why do various outcomes change (or not)?
   - Qualitative
3. Policy lessons and transferability
   - Policy and informant analysis
4. What is the (health) economic value of 20mph?
   - Economic evaluation and modelling

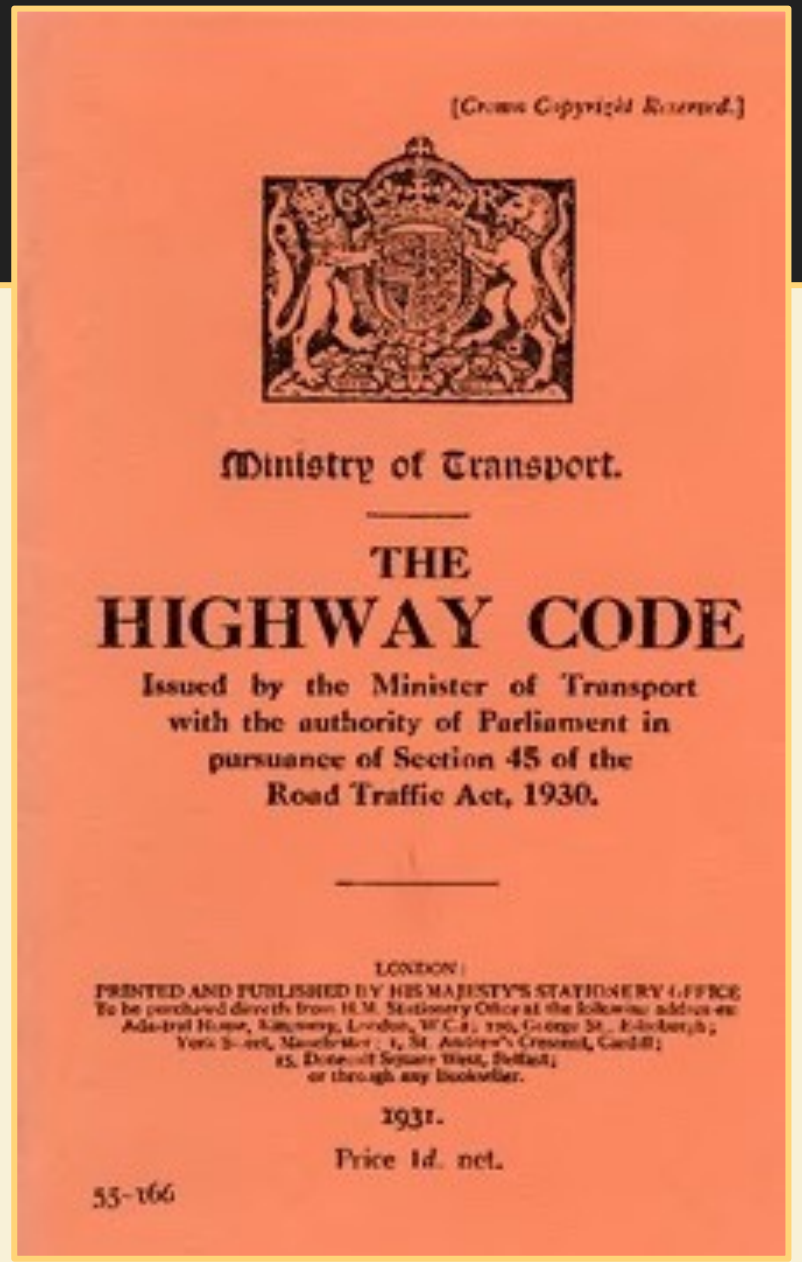

Background, context and history
International bodies and their policy statements and guidance
Background legislation and policy
Local jurisdictions
Local histories
Politics
Government and local authority officers
Evidence and data
Enforcement and the police services
The public
Proximal factors
The political process including opposition
The use of and non-use of evidence
Professional advocacy
Process – what actually happened
20mph activities
Legislation
Signage and road markings
Awareness raising and education
Enforcement
Intermediate attitudinal and behavioural outcomes
Self-enforcement of limits
Awareness of 20mph speed limits
Changing attitudes to speed limit/speeding
Intermediate traffic outcomes
Traffic flow (including volume)
Reduction in SPEED
Changes in speed differential (between motorised and non motorised)
Attitudinal and behavioural outcomes
Speed limits of others imposed by self-enforcers
Drivers copy self-enforcers
Perceptions of journey time and effort
Perceptions of safety and traffic related dangers
Changes in judgement of speeds by pedestrians
Changes in driver attention
Changes in driving style (e.g. braking and acceleration)
Traffic outcomes
Liveability and pleasantness of streets
Increase in journeys made by public transport
Increase in journeys made by bike
Increase in journeys made on foot
Reduced emissions
Reductions in car use
Increase in ease of crossing roads
Health related outcomes
Reduction in number and severity of collisions involving cyclists
Reduction in number and severity of collisions involving pedestrians
Reduction in number and severity of collisions involving motorists and passengers
Increase in population levels of physical activity
Reduction in number of air pollution related respiratory conditions
Conceptual model of 20mph (~30km/h) speed limits

The political processes that made large-scale 20mph speed limit policies a reality in two major UK cities

THE 20MPH PROJECT

Public health policy

Public health law and public health policy are fundamental tools to support population health



50 years of successful road safety policy

- Introduction of seat belts
- Drink driving regulations
- Safe crossings for pedestrians

Policy

Image: Kim Traynor CC BY-SA 3.0

Public policies and formal institutions are usually designed to be difficult to change, which encourages policy continuity…

… So what made the implementation of large scale 20mph speed limit policies possible in Edinburgh and Belfast?

How did Edinburgh and Belfast make it happen?

We were interested in understanding the steps and processes involved in each city, and identifying key characteristics associated with success

Image: Document by Puspito from NounProject.com

Image: Discussion by rivercon from NounProject.com

Policy change takes a long time!

- The process took approximately 15 years
- In neither city were there major landmark events that caused a radical shift in policy
- Small steps were taken over a sustained period of time

Getting 20mph onto the political agenda

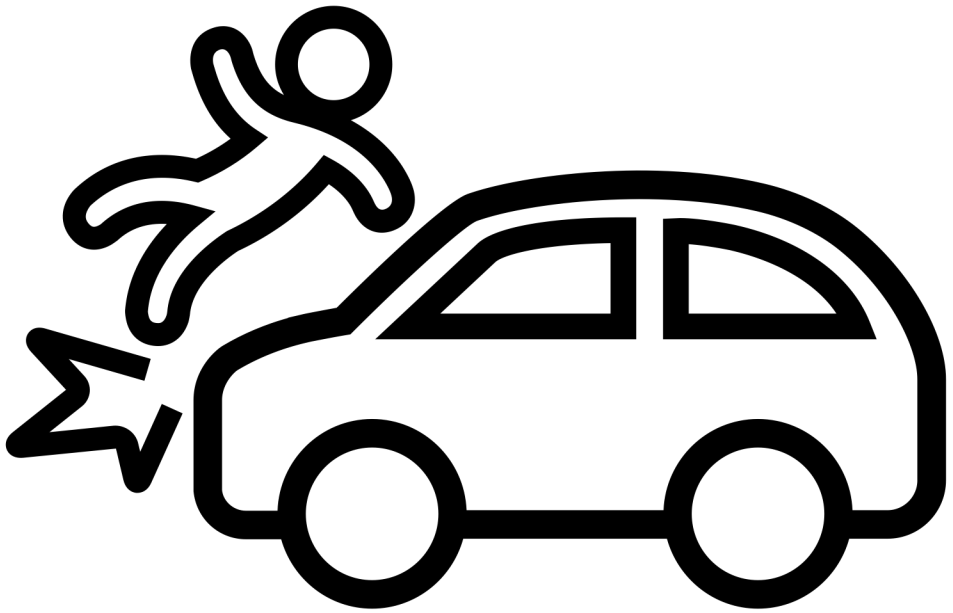


Image: Accident by Minh Do from NounProject.com

- Road safety was the key driver in both cities
- Vehicle speed is the single most important factor in the severity of road collisions
- Fatal injury to pedestrians is eight times higher at 30mph than 20mph

Leadership

- Leadership was key
- Key politicians were critical in moving 20mph restrictions forward
- No clear political divide
- Key individuals in support
- Not party political

Public support

Edinburgh

- Some members of the public were supportive of 20mph
  - Accident prevention
  - Road safety
- Cycling lobby played an important role

Belfast

- Mixed public support (50-50 split)

Starting with the ‘easy wins’

- Tactical first steps
- Small scale restrictions around schools
- Little or no opposition

Pilot schemes played an important role

- Close to schools
- Edinburgh south
  - Young family oriented areas
  - Positive attitude to walking and cycling
- Before pilot – 2/3rds against
- After pilot – 2/3rds in favour

Opposition – bus companies

- Bus companies were concerned about the impact on services and timetabling
- Wi-fi on the buses enables bus companies to see for themselves that the impact would be minimal

Opposition – taxi drivers

- Taxi drivers were firmly opposed to the new limit
- Taxi drivers believe 20mh speed limits should not apply to them as they drive according to ‘common-sense’

Zones vs limits

20mph ‘zones’

20mph ‘limits’

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Selling the dream

- Cities more attractive
- Healthier lifestyle
- Improving the environment
- Sustainability
- Lower emissions
- Lower crime
- Thriving businesses

Conclusions

- In both cities, discussions took place over a long period
- The process was gradualist
- Starting with small pilot schemes was important
- Opposition came from businesses more than the public
- The option to implement limits rather than zones helped to push large-scale schemes forward

Implementation processes

Aims and objectives

Overall aim

- To explore issues around implementation of the intervention
  - Whether the 20mph interventions were delivered as intended
  - What (if applicable) adaptations were made to how the intervention was delivered

Specific objectives

1. To understand and describe what implementation consisted of
2. To understand barriers and facilitators to implementation

Methods – sampling and recruitment

- Purposive sampling framework

Area of Implementation	Example implementation agent
Legislation	City council transport convenors
Road signage	Council design teams, roads services
Education and awareness raising	Council programme delivery teams
Enforcement	Police services

- Additional snowball sampling

Methods – interview schedule topics

Area of investigation

- Stakeholder role
- What implementation consisted of
- Fidelity of implementation
- Facilitators of implementation
- Barriers to implementation
- Contextual factors
- Perceptions of scheme

Image: Discussion by rivercon from NounProject.com

Methods - analysis

- Codebook thematic analysis (Braun and Clark, 2018)
- Inductive and deductive approach
- Consider differences between the two cities

Participant group - Belfast

- Initially, 6 interviews with 8 participants
- Representatives from:
  - Government Departments (n = 4)
  - Police Service Northern Ireland (n = 2)
  - Public transport organisation (n = 1)
  - Third sector organisation (n = 1)
- November 2017 – 22 months after the scheme was implemented
- Follow-up interviews – March 2019
  - Government Departments (n =2)

Participant group - Edinburgh

- Initially, 16 interviews with 16 participants
- Representatives from:
  - Local council (n = 10)
  - Police Scotland (n = 3)
  - Public transport organisation (n = 1)
  - Private sector organisation (n = 1)
  - Third sector organisation (n = 1)
- July 2017 – April 2018 (during phased roll-out)
- Follow-up interviews – April – May 2018
  - Local council (n = 3)
  - Police Scotland (n = 3)

Results – implementation aspects

Both cities

- Issued legislative TRO
- Implemented signage and road markings
- Full-time hours of operation

Results – implementation aspects – differences in scale

Edinburgh

- City-wide
- 5,711 streets
- 687km road networks

Belfast

- City centre
- 76 streets
- 10.7km road networks

Results – implementation aspects – key finding

Predominant perspective was that the interventions were implemented as intended

- Few practical issues noted
- Only minor amendments to some activities

Results – signage and road marking activities

- Rigid Traffic Signs Regulations and General Directions guided implementation

  “The signage is all prescribed by the regulations. I mean, it’s national legislation, there’s no, there’s no leeway upon that…” (Edinburgh, Council)

- Minor amendments made, typically in response to feedback
- TROs viewed as complex, time-consuming and labour intensive

Results – signage and road marking activities - Edinburgh

- Consistent implementation aided by learning through phased roll-out
- Consistency aided in signage visibility and increasing awareness

Results – signage and road marking activities - Belfast

- Barriers of cluttered city-centre impacting on signage visibility

"A lot of people said they didn't even know where the 20mph limit was, despite us having it signed completely in accordance with Chapter 3 of the Traffic Signs Manual. It just gets lost in the sign clutter in the city centre, so we tried yellow backing boards to reinforce it, ..." (Belfast, Government Department)

Results – education and awareness raising - Edinburgh

- Coordinated campaign – physical advertisements, press, media and social media releases phased over time and tailored
- Dedicated council official employed and internal communications group
- Multiple stakeholder involvement
- Messages based on formative research, informed by feedback

"We wanted to get the slogan right, you know the, the 'Life is better at 20...' …So that took some time, and when we did the campaign development, a lot of people came back and said that they, people wouldn't get the 'it's better for walking and cycling, and it's better... it's in a better place to live.' They felt that the road safety was the hook." (Edinburgh, Council)

Results – education and awareness raising - Belfast

- No official Education and Awareness materials
- Perception a dedicated campaign would have been beneficial
- Government organisational structure influenced this aspect of implementation

“….engineers are engineers, 2+2=4, 4+4=8… I think some of the publicity and education of a more esoteric nature would have been useful around the cuddly ends of it "and this is better for communities, and this is better for families." …We probably could have done with more of that, yeah.” (Belfast, Government Department)

Results – enforcement - 1

- Range of views from implementation agents
- General approach: light-touch, reactive, delivered as intended
- Perception from police was that 20mph should be self-enforcing

"…and it was very much about this saying it has to be proportionate and it has to be very measured and we've other things that are... and here's what ACPO [Association of Chief Police Officers] are saying, the best policing minds across Great Britain are saying about them, they're come up with this approach and we're adhering to that, we embrace that." (Belfast, Police)

Results – enforcement - 2

- Enforcement was stable in Belfast
- In Edinburgh, increased resources and efforts allocated:

  "…probably disproportionately we've looked at twenty mile per hour limits over the last year to ensure that visibility and engagement wi' the public, to try and educate them, which I think's quite positive, you know, within it." (Edinburgh, Police)

- Perception that presence alone may deter speeding:

"You know, it doesnae matter if it's speeding, if it's drug taking, if it's assaults – if the police are there, it'll get reduced naturally just wi' our presence." (Edinburgh, Police)

Results – enforcement – 3 - Edinburgh

- Fines consider by Police as just one component of their involvement in implementation of 20s

"…and it's not about just enforcement, it was really about education, so that the public could see that, actually there are limits and at times we will look at those limits and enforce those limits, and also educate people around those limits. So a lot of the work initially was around that education, to see 'There's a twenty mile per hour speed limit sign. There are police officers in the morning on these key roads, looking at that and enforcing that' to get that psychology in play." (Edinburgh, Police)

- Discretion within guidelines was utilised:

"we go on the guidelines of the Procurator Fiscal because they're not wanting inundated with people having this sorta twenty mile an hour zone, they're travelling twenty-one mile an hour… " (Edinburgh Police)

Results – enforcement - 4

- In both cities:

“so resource was certainly one of the issues, and priority, policing priorities was the other issue… with dwindling resources, you've got to go where you're going to get the biggest bang for your buck.” (Belfast, Police)

- Resources and competing priorities were two consistent barriers to increased enforcement

- Perception from other implementation agents regarding enforcement:

“I think there is not enough of monitoring [meaning enforcement] the speed… So, I think enforcement is probably the one where, that is most difficult, ‘cause we [the local authority] don’t control it, it’s the police that control it.” (Edinburgh, Council)

Results – partnership working

Appeared as a key barrier or enabler to implementation

- Edinburgh
  - A dedicated '20mph team' with ring-fenced funding
    - Essential given the scale of implementation
  - Multiple implementation agents involved
    - Efforts were supportive and in tandem

- Belfast
  - No direct involvement from other departments – in part due to scale
  - Creation of a dedicated and collaborative team would have been an enabler

Behaviour change and public health outcomes of 20mph speed limit interventions implemented in two major UK cities

Outline

- Public perceptions
- Public experiences
- Behaviour change and public health outcomes
  - Traffic speed and volume
  - Collisions and casualties
  - Liveability

Public perceptions - methods

- Speed Limits Perceptions Survey (SLiPS) – adapted from Tapp & Nancarrow
- Edinburgh
  - Pre-implementation and at 6 and 12 months post-implementation
- Belfast
  - Post-implementation
- Aimed for 500 participants at each data collection point

Edinburgh public perceptions

Image: CC0 1.0

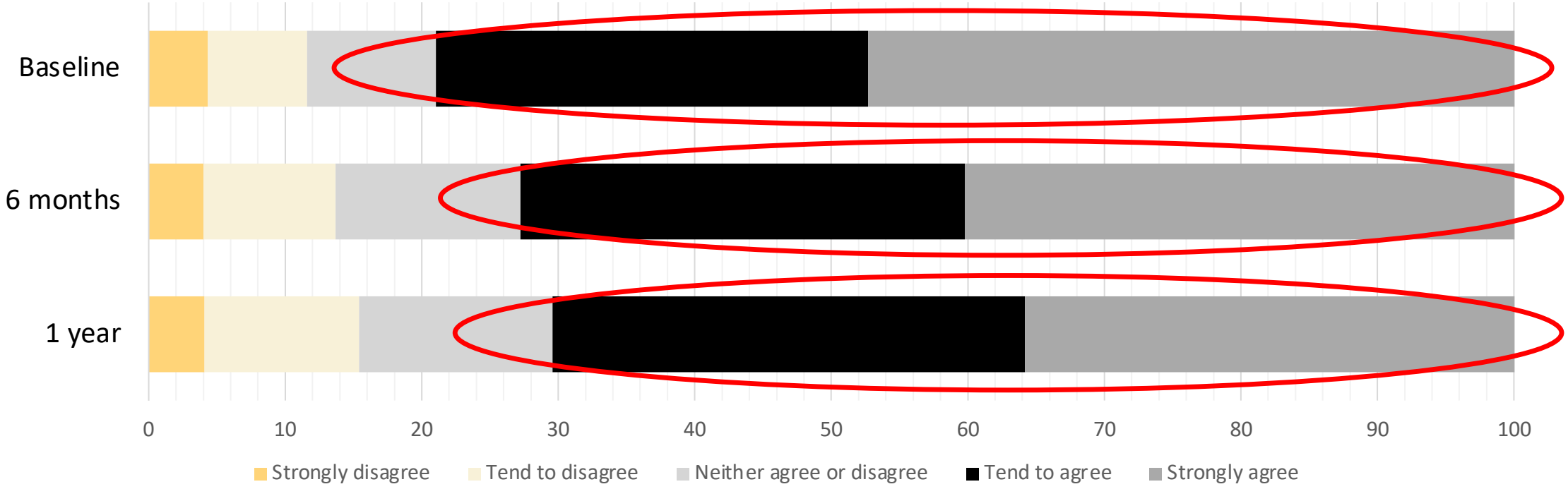
Factor analysis identified five factors:

1. Detraction and resistance
2. Support
3. Rule following
4. Child safety
5. Walking safety

Edinburgh public perceptions – 1: Journey times

- At baseline, almost 80% of respondents agreed that 20mph would lead to longer journey times
- At 1 year follow-up this had dropped to around 70%

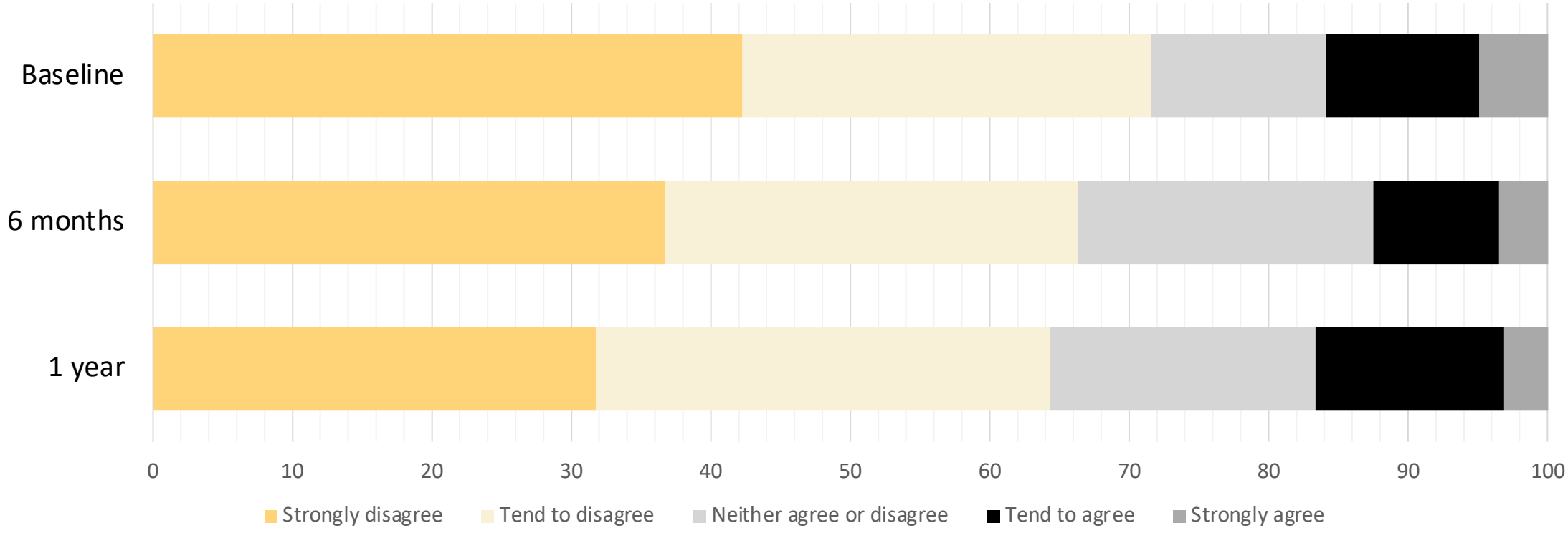
20mph speed limits will/have led to longer journey times:



Edinburgh public perceptions – 2: Traffic flow

- At baseline, just over 15% of respondents thought 20mph would improve traffic flow
- This remained largely unchanged over time

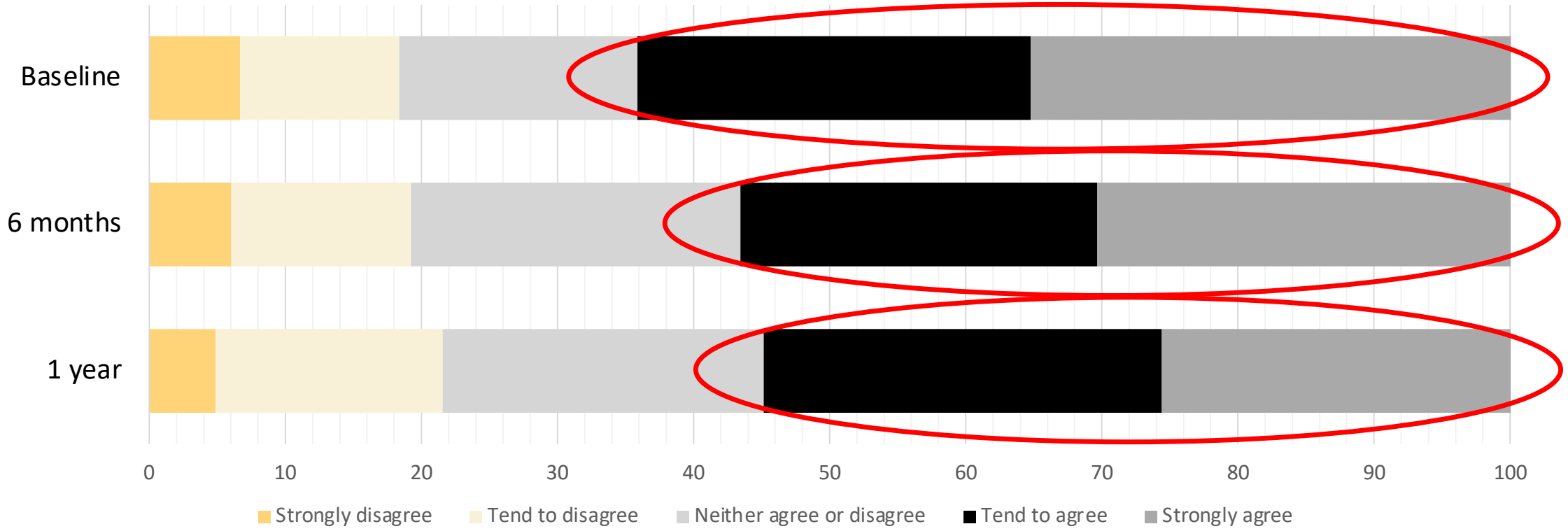
20mph speed limits will/have led to better traffic flow (less stopping and starting):



Edinburgh public perceptions – 3: Congestion

- At baseline, around 65% of respondents thought 20mph would increase congestion
- At 1 year follow-up this dropped to around 55%

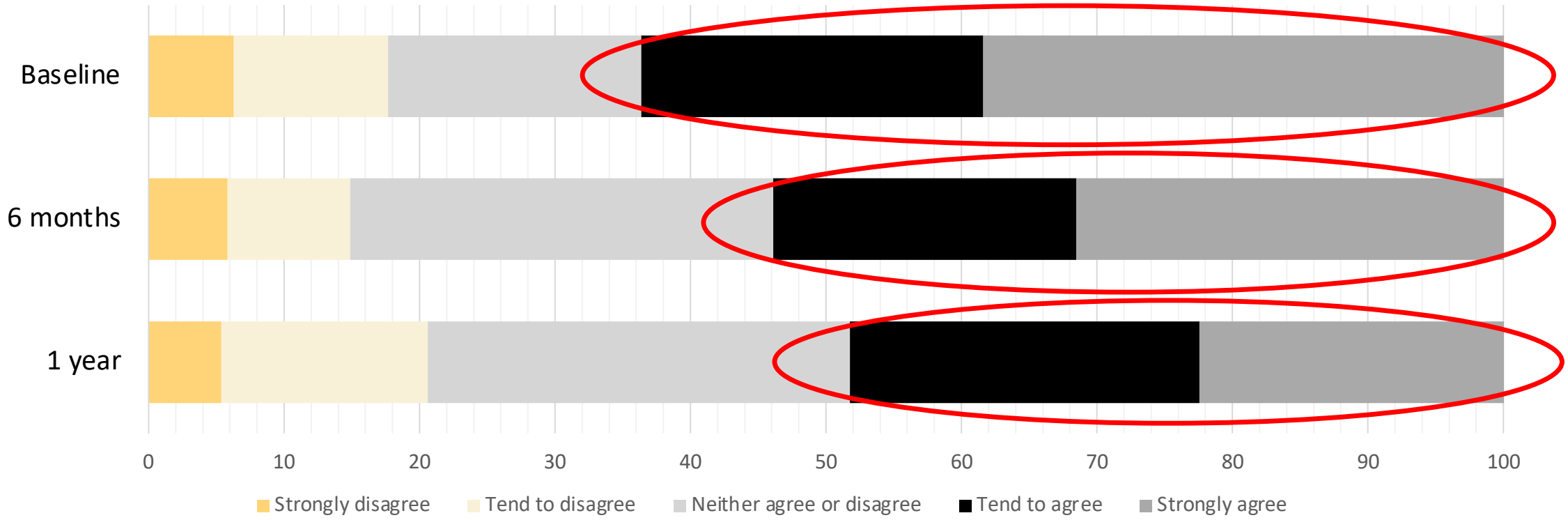
20mph speed limits will/have led to more congestion:



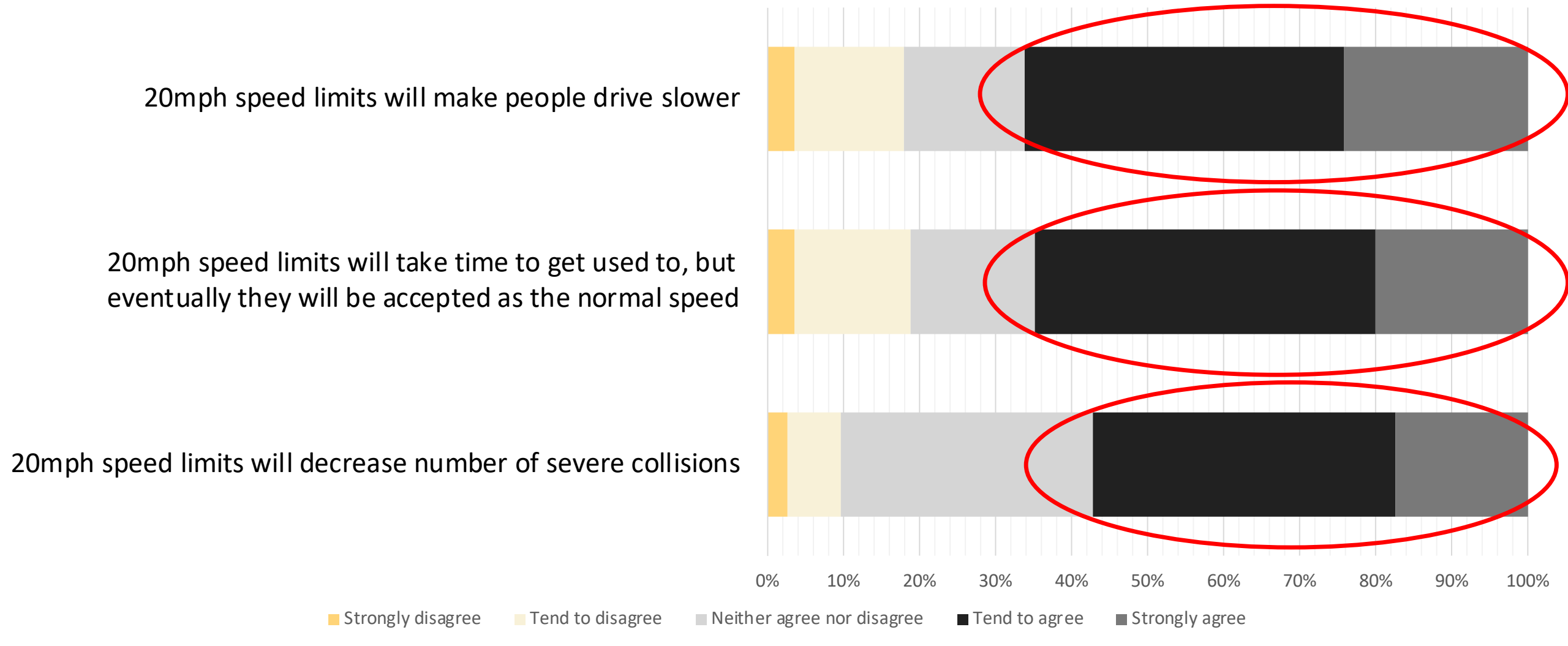
Edinburgh public perceptions – 4: Pollution

- At baseline, over 60% of respondents thought 20mph would increase pollution
- This dropped to below 50% at 1 year follow-up

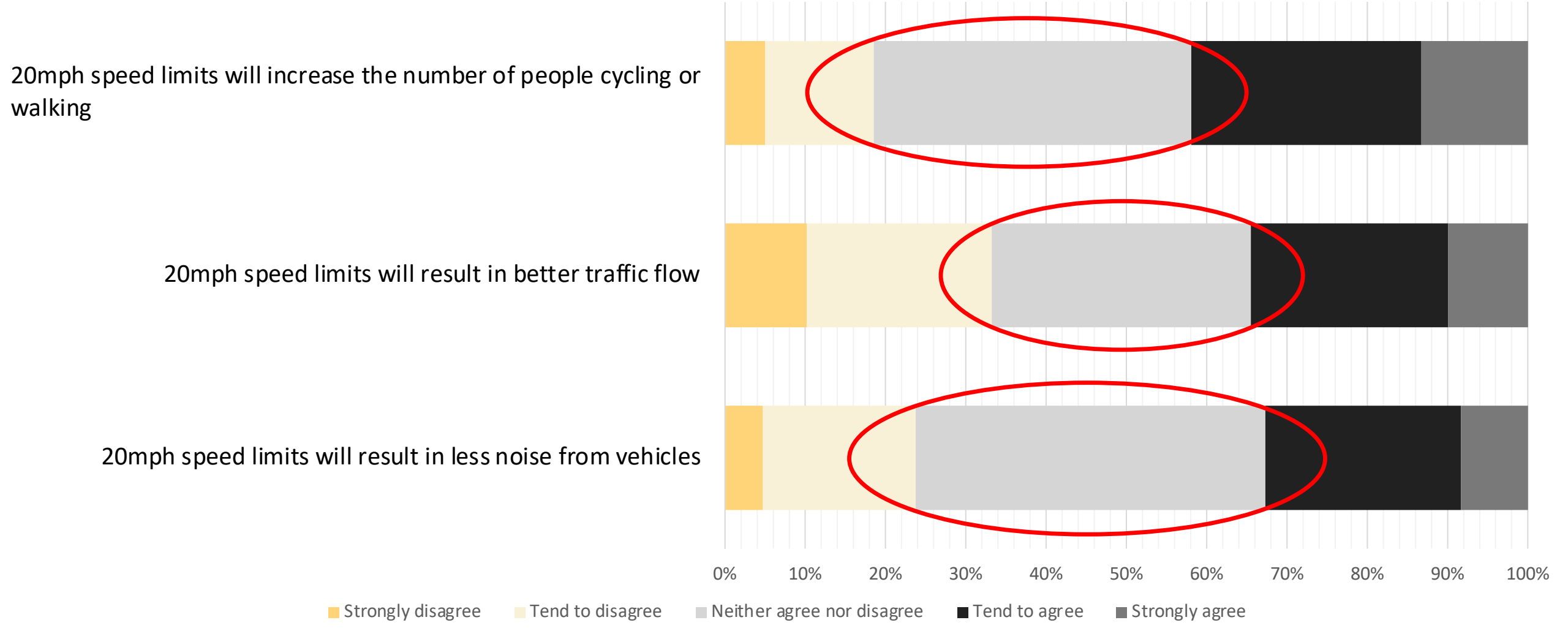
20mph speed limits will/have led to more air pollution:



Belfast public perceptions - 1



Belfast public perceptions - 2



Conclusions

- Future 20mph speed limit interventions should implement comprehensive education and awareness campaigns
- Campaigns need to continue once the policy change is implemented
- We need to share the stories of reductions in collisions and casualties to address the any ambiguous perceptions and dispel ‘myths’, otherwise perceptions of safety are less likely to change
- Overall, perceptions were positive and more positive over time (indicating greater support)

Psychology and behaviour

Transportation Research Part F: Psychology and Behaviour 84 (2022) 99–113

Contents lists available at ScienceDirect

Transportation Research Part F: Psychology and Behaviour

journal homepage: www.elsevier.com/locate/trf

Public attitudes to, and perceived impacts of 20mph (32 km/h) speed limits in Edinburgh: An exploratory study using the Speed Limits Perceptions Survey (SLiPS)

Andrew James Williams [a,*], Jillian Manner [b], Glenna Nightingale [b], Kieran Turner [b], Paul Kelly [c], Graham Baker [c], Claire Cleland [d], Ruth Hunter [d], Ruth Jepson [b]

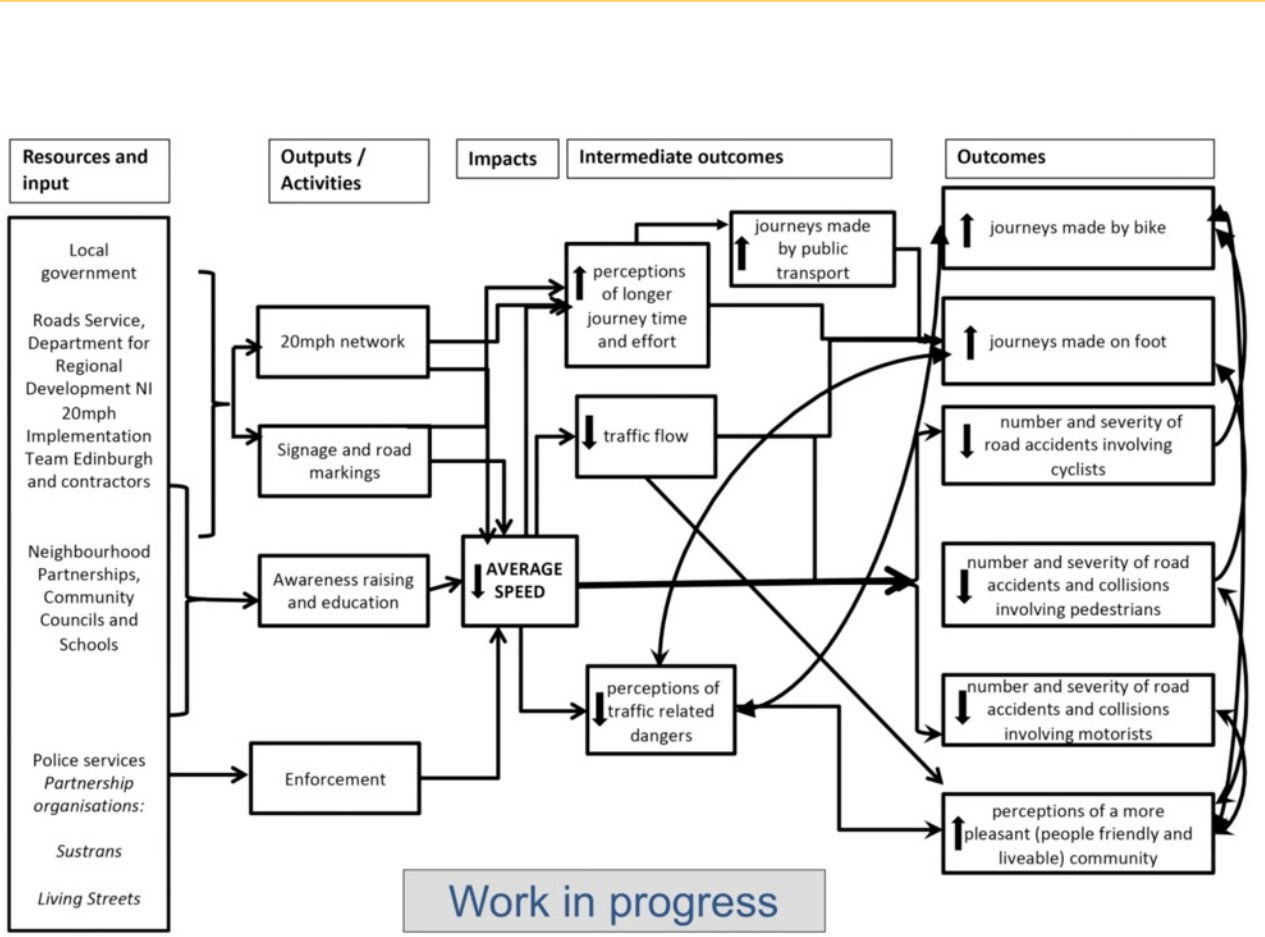
Public experiences – Aims

Investigate people's experiences of, and interactions with the intervention *activities*, examining how and why behaviour change occurred or did not occur.

- How are the effects (or lack of effects) experienced by the general population?
- What causal pathways and mechanisms were reported?
- Are there any unintended/unexpected pathways and consequences that need to be considered by future interventions

Methods

- Purposeful sampling
- Awareness, engagement, rationale, perceptions, enforcement, behaviour change and liveability
- July-December 2018 (Belfast)
- October 2018-July 2019 (Edinburgh)
- Thematic analysis and concept mapping



Results

- Belfast: 9 focus groups with 60 participants
- Edinburgh: 15 focus groups with 100 participants
- Key themes across both cities
  - Awareness
  - Signage
  - Enforcement
  - Behaviour change

Awareness

- Stark differences between cities
- Edinburgh
  - City council's education and awareness-raising activities
  - Local press and social media
  - Political and activist groups
- Belfast
  - Lack of scheme introduction and education or awareness raising campaigns

Image: CC0 1.0

Awareness - continued

"Really? The 20mph zone? We should have been doing 20mph for the last two years? (Laughter)"

(Belfast, city centre worker)

"no flyers, no posters. I used to be in advertising as well, so I do know a little bit about it, and as far as I'm concerned, as a punter, as a consumer, I've seen nothing. I would imagine, as a resident of Belfast, I would be a prime target market - it hasn't got to me. I don't think I'm particularly stupid, I would have seen it"

(Belfast, older adult)

Signage

- Views consistent across cities
  - Some signage visible
  - Insufficient
  - Inadequate

Signage - continued

"It's hard to see where it starts, because the signs aren't very obvious, it's impossible to see where it ends because there's no signs telling you that you're back in the 30mph again. It's confusing for people, when they don't know where it starts and ends."

(Belfast, city centre worker)

"But it's a very valid criticism that a lot of people made, that the signs were too small. And that, I mean, I think, to be fair, quite a lot of the implementation of it by the Council, left a bit to be desired… Yeah, I think that the signage was inconsistent, and I think that it's targeted towards people who are familiar with the system, uh-huh."

(Edinburgh, parent of school-aged children)

Enforcement

- Police versus public views on enforcement differed
  - Police role as implementation agents (educating drivers)
  - Participants, the issuing of fines
- Edinburgh - insufficient and inappropriate. However, if fines were issued it could lead to negative public attitude (unintended)
- Belfast - no perceived enforcement, but visual enforcement (e.g., fines and penalty points) would act as a deterrent

Enforcement - continued

“I would feel safer if I knew that it was enforced, it might give you a false sense of security thinking they're going at 20mph and someone might just be speeding”

(Belfast, a city centre worker)

“I mean obviously the problem is going to be you’re going to have an enormous amount of public outrage if you really do enforce a lot of these things”

(Edinburgh, resident Edinburgh West)

Image: Douglas Sinclair, CC BY 2.0

Behaviour change – driving

- Inconsistent across cities
  - Edinburgh – mixed
  - Belfast - no evidence

"At the moment I think it's 'cause so many other people are doing it [driving above 20mph], you don't feel bad, you know, going above the speed limit 'cause you feel like you have to. You have to go above speed limit for people behind you."

(Edinburgh, cyclist)

Behaviour change – walking and cycling

- Consistent across cities – no evidence

"Going at 20 miles an hour, that is not going to make me a cyclist, I can tell you, never am I going to get on a bike, because I've seen the buses, I've seen how people drive, I'm not going to put myself at that risk."

(Edinburgh, car/private motorised transport user)

"For cycling it's definitely a benefit. Definitely, for me, less scared if I was to cycle round there"

(Student)

Results - Belfast

Contents lists available at ScienceDirect

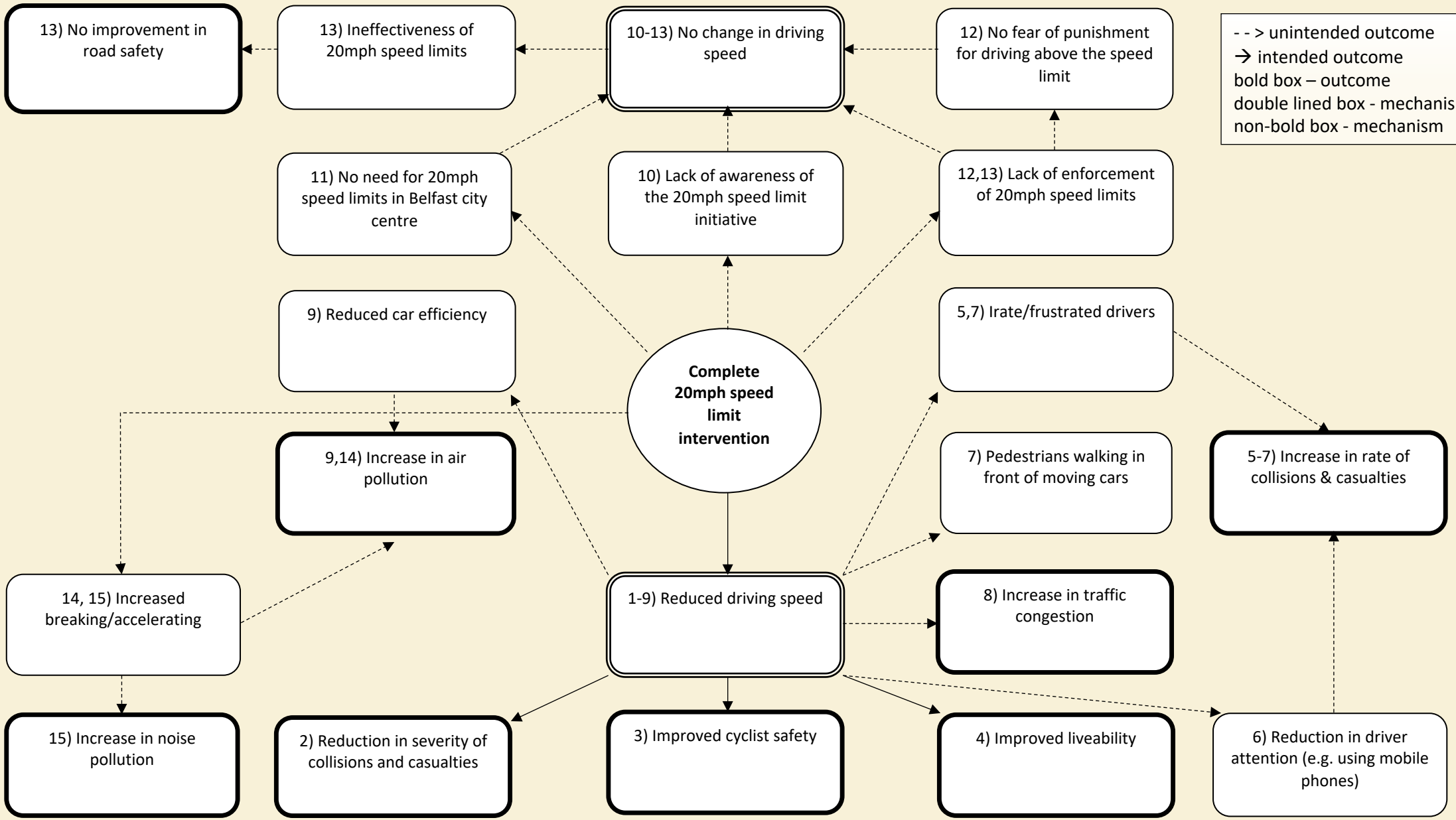
Health and Place

journal homepage: www.elsevier.com/locate/healthplace

Check for updates

A qualitative exploration of the mechanisms, pathways and public health outcomes of a city centre 20mph speed limit intervention: The case of Belfast, United Kingdom

Claire L. Cleland [a,*], Graham Baker [b], Kieran Turner [b,c], Ruth Jepson [c], Frank Kee [a], Karen Milton [d], Michael P. Kelly [e], Glenna Nightingale [c], Ruth F. Hunter [a,**]


13) No improvement in road safety
13) Ineffectiveness of 20mph speed limits
10-13) No change in driving speed
12) No fear of punishment for driving above the speed limit
- - > unintended outcome
→ intended outcome
bold box – outcome
double lined box - mechanism & outcome
non-bold box - mechanism
11) No need for 20mph speed limits in Belfast city centre
10) Lack of awareness of the 20mph speed limit initiative
12,13) Lack of enforcement of 20mph speed limits
9) Reduced car efficiency
5,7) Irate/frustrated drivers
Complete 20mph speed limit intervention
9,14) Increase in air pollution
7) Pedestrians walking in front of moving cars
5-7) Increase in rate of collisions & casualties
14, 15) Increased breaking/accelerating
1-9) Reduced driving speed
8) Increase in traffic congestion
15) Increase in noise pollution
2) Reduction in severity of collisions and casualties
3) Improved cyclist safety
4) Improved liveability
6) Reduction in driver attention (e.g. using mobile phones)

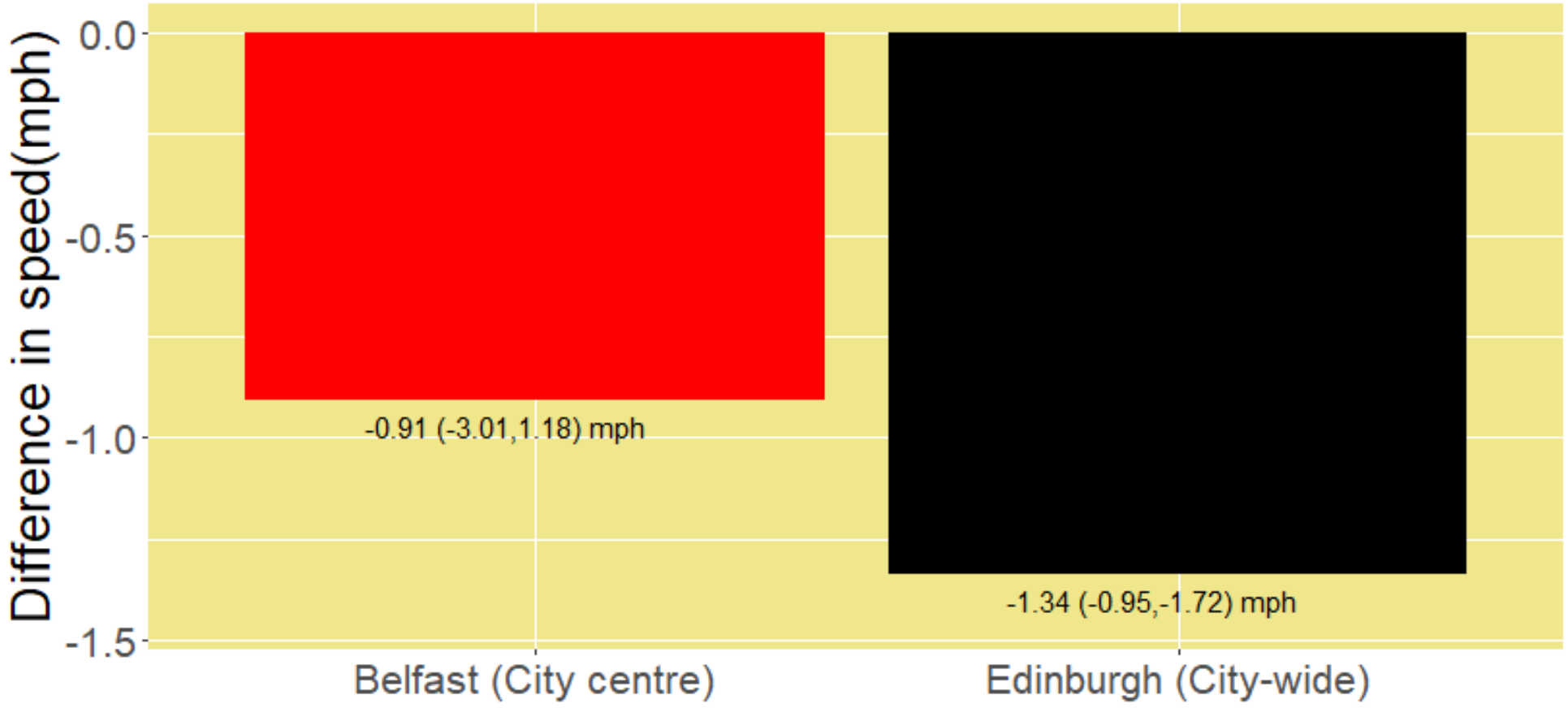
Conclusion – Public experiences

- Complex nature of the way the general public understand and experience 20mph speed limit interventions
- Numerous interacting mechanisms and pathways with mixed experiences/outcomes
- High quality evaluations required to confirm or refute the public health pathways and outcomes
- Transparent reporting of speed limit interventions is needed to enable researchers to determine in/effective components

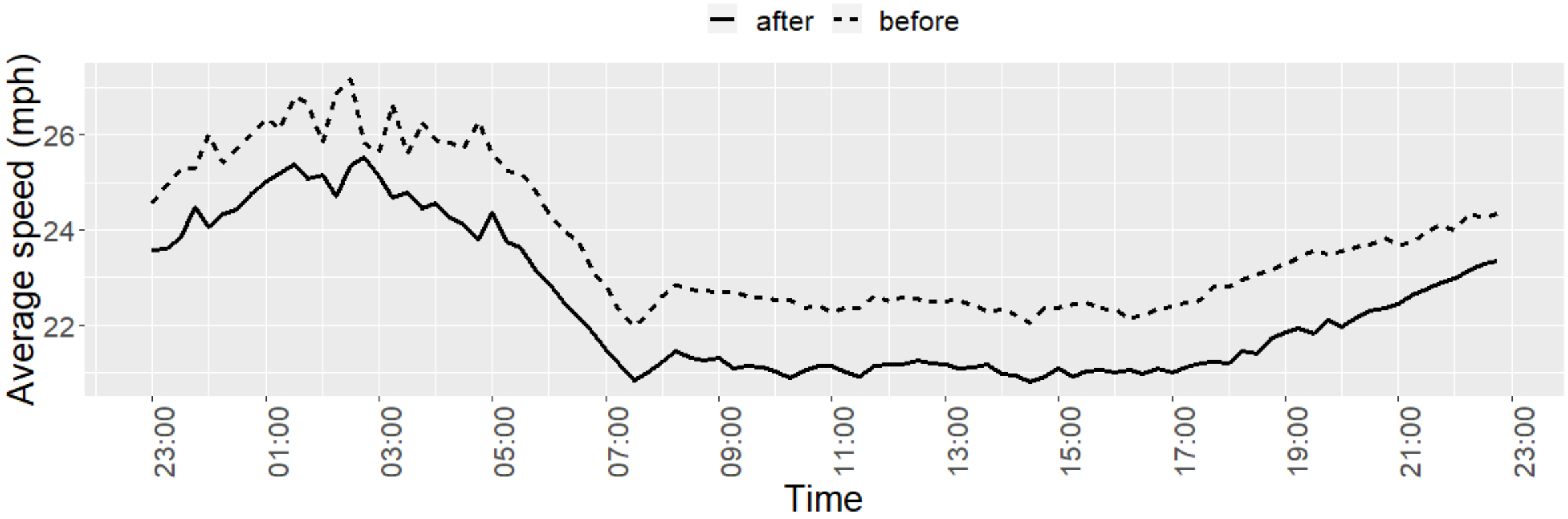
Behaviour change and public health outcomes - methods

- Secondary data analysis
  - STATS19 accident records
    - Police Scotland
    - Police Service NI
  - Automatic sensors
    - 69 x 20mph & 17 x 30mph sites in Edinburgh
    - 23 sites in Belfast
  - MAPS-Liveability via Google Street View

Average speed (mph)

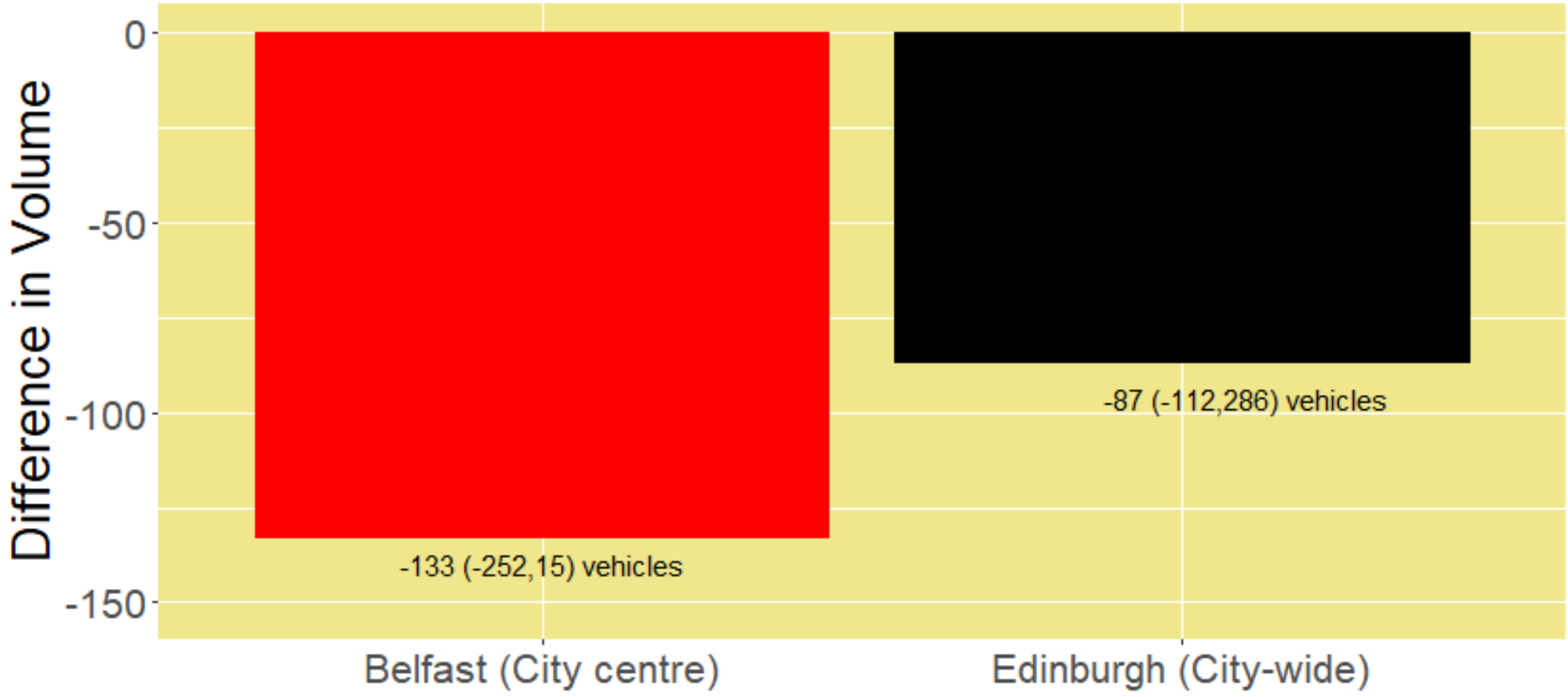


Traffic speed – Edinburgh

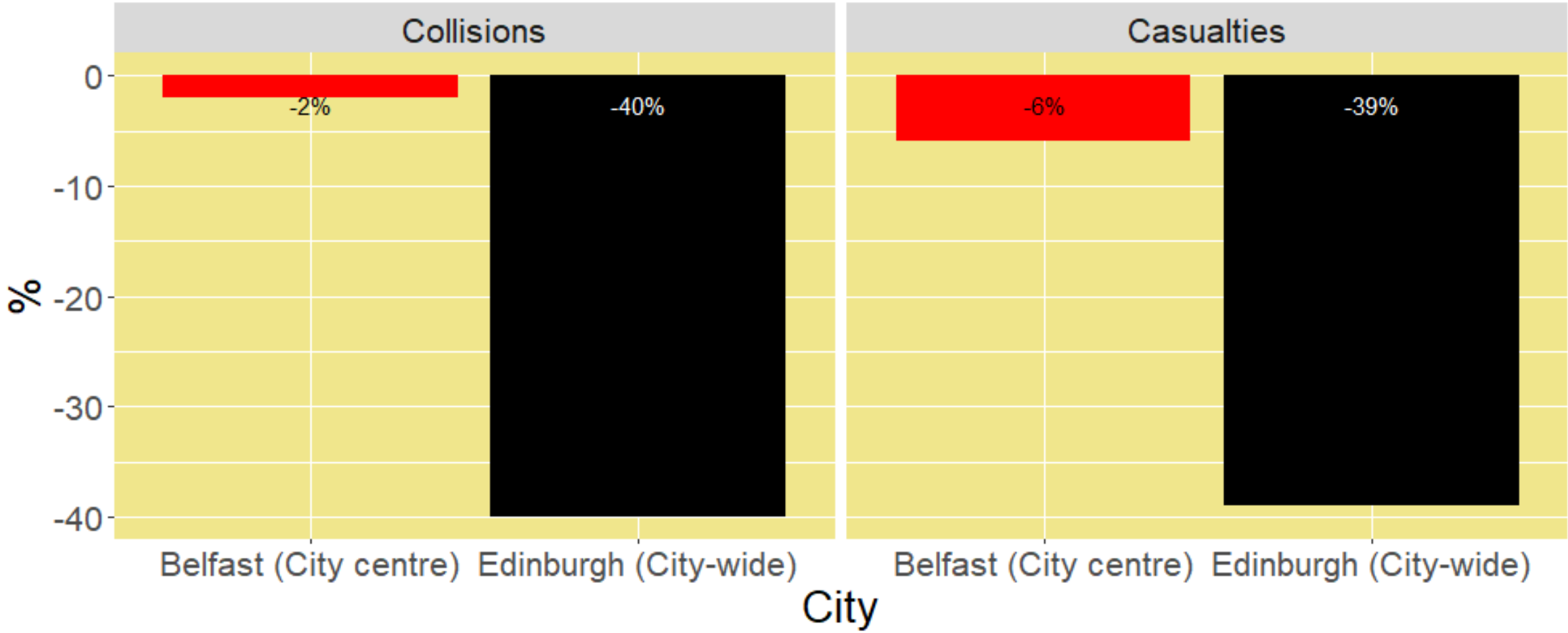


A consistent reduction in speed with relatively higher speeds between midnight and early morning

Average volume (vehicles)



Collisions and casualties



Road traffic fatality rates

Belfast 44%

Image: rovingl CC BY 2.0

Edinburgh 23%

PLOS ONE

PLOS ONE

RESEARCH ARTICLE

Evaluating the citywide Edinburgh 20mph speed limit intervention effects on traffic speed and volume: A pre-post observational evaluation

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Liveability

- MAPS-Liveability to measure liveability via Google Street View
  - Safety
  - Health
  - Sustainability
  - Inclusivity
  - Places
  - Education
  - Traffic/transport
  - Roads
  - Pavements

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Adaptation and testing of a microscale audit tool to assess liveability using google street view: MAPS-liveability

Claire L. Cleland [a,*], Sara Ferguson [b], Frank Kee [a], Paul Kelly [c], Andrew James Williams [d], Glenna Nightingale [e], Andy Cope [f], Charlie Foster [g], Karen Milton [h], Michael P. Kelly [i], Ruth Jepson [e], Ruth F. Hunter [a]

Liveability - continued

Results showed significant increases in total liveability pre- to post-implementation

- Belfast

- Traffic/transport
- Places
- Bicycle rack capacity

- Parked cars
- Total number of moving cars

- Edinburgh

- Traffic/transport
- Places
- Pavements

Walking and cycling

- Planned to determine the impact of 20mph speed limits on walking and cycling
- Many counters were damaged, removed or out of use
  - Could not complete this element of the evaluation
- MAPS-Liveability provides proxy measures of cyclists and pedestrians although no significant increases were seen

Image: John Wigham CC BY 2.0

Conclusions

- Promising findings for a range of public health outcomes
  - Speed, collisions and casualties, fatalities, volume and liveability
- However, findings also showed for the best chance of success future interventions should:
  - Be underpinned by theory and designed to mitigate unintended outcomes and promote intended outcomes
  - Involve a three pronged approach (alongside intervention activities): education, awareness and enforcement
  - Link with the wider complex transport system and interact with other initiatives (e.g., active travel, public transport)

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Effects of 20 mph interventions on a range of public health outcomes: A meta-narrative evidence synthesis

Claire L. Cleland[a], Katy McComb[a], Frank Kee[a], Ruth Jepson[b], Michael P. Kelly[c], Karen Milton[d], Glenna Nightingale[e], Paul Kelly[f], Graham Baker[f], Neil Craig[g], Andrew James Williams[h], Ruth F. Hunter[a,*]

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Use of natural experimental studies to evaluate 20mph speed limits in two major UK cities

Karen Milton[a,*], Michael P. Kelly[b], Graham Baker[c], Claire Cleland[d], Andy Cope[e], Neil Craig[f], Charlie Foster[g], Ruth Hunter[h], Frank Kee[d], Paul Kelly[c], Glenna Nightingale[i], Kieran Turner[i], Andrew J. Williams[j], James Woodcock[k], Ruth Jepson[i]

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Developing and refining a programme theory for understanding how twenty mile per hour speed limits impact health

Kieran Turner[a,b,*], Ruth Jepson[a], Bradley MacDonald[a,b], Paul Kelly[b], Hannah Biggs[a], Graham Baker[b]

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Health and Place

journal homepage: www.elsevier.com/locate/healthplace

A qualitative exploration of the mechanisms, pathways and public health outcomes of a city centre 20mph speed limit intervention: The case of Belfast, United Kingdom

Claire L. Cleland[a,*], Graham Baker[b], Kieran Turner[b,c], Ruth Jepson[c], Frank Kee[a], Karen Milton[d], Michael P. Kelly[e], Glenna Nightingale[c], Ruth F. Hunter[a,**]

Article

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Trend shifts in road traffic collisions: An application of Hidden Markov Models and Generalised Additive Models to assess the impact of the 20 mph speed limit policy in Edinburgh

Valentin Popov[1], Glenna Nightingale[2], Andrew James Williams[1], Paul Kelly[2], Ruth Jepson[2], Karen Milton[3] and Michael Kelly[4]

Economic evaluation

Economic evaluation - theory

We adopted a decision theoretic approach, asking the questions:

- How effective would the intervention have to be for the benefits to exceed the costs?
- How likely is the level of benefits achieved in the Edinburgh and Belfast schemes to have exceeded that?

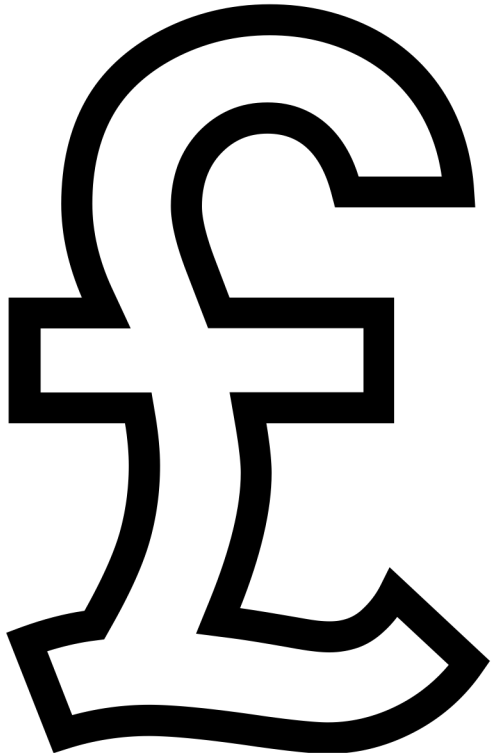

Image: Pound sign by regara from NounProject.com

Economic evaluation - Edinburgh

Image: Kim Traynor CC BY-SA 3.0

We were able to obtain cost data for the Edinburgh scheme, covering design, supervision and project management, construction, awareness raising, and speed and traffic volumes.

Economic evaluation - costs

- Using these data on costs and the available casualty data, we were able to explore the potential monetary value of the benefits of the scheme
- The monetary value of reduced casualties and deaths would need to exceed the costs of the intervention (£2.76m in 2016 prices)
- It is likely that the monetary value of these outcomes exceeds the costs of the scheme

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