GCPH POLICY BRIEFING

Glasgow Centre for Population Health

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THE POTENTIAL IMPACT OF A 20MPH SPEED LIMIT ON URBAN ROADS IN SCOTLAND

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Introduction and aims

This paper has been written to provide evidence in relation to the forthcoming Scottish Parliament Member's Bill proposing the introduction of a 20mph limit in urban settings across Scotland. The specific proposal is to replace the current 30mph default speed limit on restricted roads[a] with a 20mph limit (generally speaking). The focus of the paper is a set of analyses, based on a modelling approach used previously in Wales[1], to estimate the impact of such a reduction on road casualties and the associated monetary value of prevention. The model's assumptions are outlined later in the paper, with potential impacts presented for different scenarios.

Background

A 20mph speed limit was introduced in Edinburgh in four phases between July 2016 and March 2018. Elsewhere in Scotland, 20mph zones (and speed limits) have been introduced in a piecemeal way with each proposal subject to separate speed limit restrictions introduced by local authorities. The Scottish Government supports 20mph speed limits in residential areas. Its Good Practice Guide on 20mph Speed Restriction[2], published in 2015, states that 20mph is the ideal speed limit for residential and built-up areas in Scotland. The document also emphasises that "The Scottish Government is committed to encourage initiatives that cut speed, particularly near schools, in residential areas and in other areas of our towns and cities where there is a significant volume of pedestrian or cyclist activity". However, it is also clear from the document that the government believed that "the power to set appropriate speed limits on local roads to meet local circumstances" should rest with local authorities.

The UK Faculty of Public Health's Manifesto for Public Health calls for the introduction of "good laws to prevent bad health" and save lives[3]. Their manifesto includes setting 20mph speed limits in built-up urban areas as one of the 12 priority areas where specific and urgent action is needed. There is strong evidence that such a measure would have a significant positive health impact, specifically in reducing the number and severity of road traffic casualties. The National Institute for Health and Care Excellence (NICE) and the British Medical Association (BMA) have also both recommended that city-wide or town-wide 20mph limits should be introduced[4,5].

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[a] Restricted roads are defined as roads which are lit by street lights spaced no more than 185 metres apart.

There may be other indirect benefits of 20mph limits, for example, if a lower road speed environment in our towns and cities encourages more people to walk and cycle. Active forms of travel, such as walking and cycling, are the most sustainable forms of transport and are associated with recognised health benefits, including improved mental health, a reduced risk of premature death, and prevention of chronic diseases such as coronary heart disease, stroke, type 2 diabetes, osteoporosis, depression, dementia, and cancer[5]. More discussion of current evidence on likely impacts is presented later on in this paper. Safety issues associated with roads increased rapidly with the growth in the car industry, and motor vehicle use in general. Mortality due to motor vehicle accidents (MVAs) increased in Scotland from the 1950s to the early 1970s, but has fallen since: by 2010, mortality among working-age adults had reduced by over 75% from a peak in 1974[6]. A range of safety measures such as mandatory seat belt use, car safety enhancements, better road design, speed camera use and stricter drink drive legislation have all contributed to improved safety on the roads. In the last ten years (2006-2016), there has been a 36% reduction in traffic accidents reported by the police[7], with a similar improvement seen across all casualty types from slight injury through to fatalities.

It is also worth mentioning the context of overall population health in Scotland. Despite improvements in health, Scotland's health profile compares poorly with the rest of the UK and with other western European countries[6,8]. Health inequalities in Scotland have widened[9] as income and wealth inequalities have increased, a trend which can be seen across the rest of the UK[10,11]. Improvements are needed across a range of health outcomes to improve Scotland's current poor health profile, and initiatives with the potential to significantly enhance road safety should be seen in this wider context.

Current evidence

There is good evidence that lowering average road speed will reduce the number and risk of road traffic accidents (RTAs) as well as severity of injury if an accident does occur. The most likely cause of death in UK children aged 11-16 not attributed to disease is road accidents[12]. The introduction of 20mph zones and limits have been shown to reduce the number and severity of road traffic accidents, as well as average traffic speed and volume[13]. Several studies have shown that the risk of pedestrian death increases gradually up to impact speeds of 30mph and above 30mph the risk of fatality increases more rapidly with respect to speed[14]. Safety benefits may arise both through reducing the likelihood of collision and by reducing the severity of injury should an accident happen.

In London, 20mph zones[b] have led to a 42% reduction in casualties compared with other areas in the city[15]. In slightly older studies in European settings, 20mph zones have been associated with

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[b] It is worth noting the difference between 20mph zones and 20mph limits. The former includes traffic calming measures such as speed bumps and chicanes, aimed at slowing down vehicles, while the latter are usually denoted purely from signage on poles and as roundels painted on the road surface.

a 25% reduction in casualties[16,17]. An evaluation of 20mph zones introduced in Fife in the early 2000s found these to be associated with a 20% reduction in overall casualties[18]. In Portsmouth in 2007, the speed limit was reduced from 30mph to 20mph on 94% of roads leading to a 1.3mph reduction in average speed which was statistically significant. Overall casualties reduced by 22%, although the number of deaths and serious injuries rose slightly (from 19 to 20 per year) – although given the numbers of casualties were relatively low, this may have been a fluctuation due to chance[19].

It is clear that other complementary measures, such as driver education, safety campaigns and effective policing of new speed limits are required to maximise the effectiveness of reduced speed limits[20].

Additionally, lowering traffic speed alongside other measures can encourage people to walk and cycle in urban settings. This measure would also contribute to allaying parental fears regarding their children walking or cycling to school[21]. The health and economic benefits of increasing population levels of active travel are well documented. A review describing the potential effect of increased walking and cycling in urban England and Wales on the National Health Service (NHS) estimated a saving of approximately £17 billion through the reduced prevalence of diseases associated with physical inactivity[22]. In Glasgow, the GCPH[c] estimated the annual health economic benefit accruing from cycle trips into and out of Glasgow city centre in 2012 (calculated on the basis of reduced mortality) to be over £4m[23].

Current statistics on road accident casualties

Transport Scotland publish statistics on road traffic accidents and casualties occurring on Scottish roads in their annual Transport Statistics publication[7] and in more detailed road traffic casualty reports[24]. The statistics reported relate only to personal injury accidents on public roads that are reported to the police, and subsequently recorded, using the STATS19 accident reporting form.

In the last five years (2013-2017) there were on average 10,814 road traffic casualties per year. Of these, the majority were slightly injured 83% (8,998 people), another 15% (1,650 people) were seriously injured and 2% (176 people) were fatally injured.

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[c] The annual health economic benefit accruing from cycle trips into and out of Glasgow city centre in 2012 was estimated using an online modelling tool created by the World Health Organization that calculates the health economic benefits from cycling (http://www.heatwalkingcycling.org).

Casualties by mode of travel (2013-2017)
In relation to the mode of travel, in the period 2013-2017 the majority of casualties (77%) had been travelling in a motorised vehicle, while 15% were pedestrians, and 8% were cyclists (Figure 1).

Figure 1. Casualties by mode of travel as a percentage of all RTA casualties, 2013-2017, Scotland.

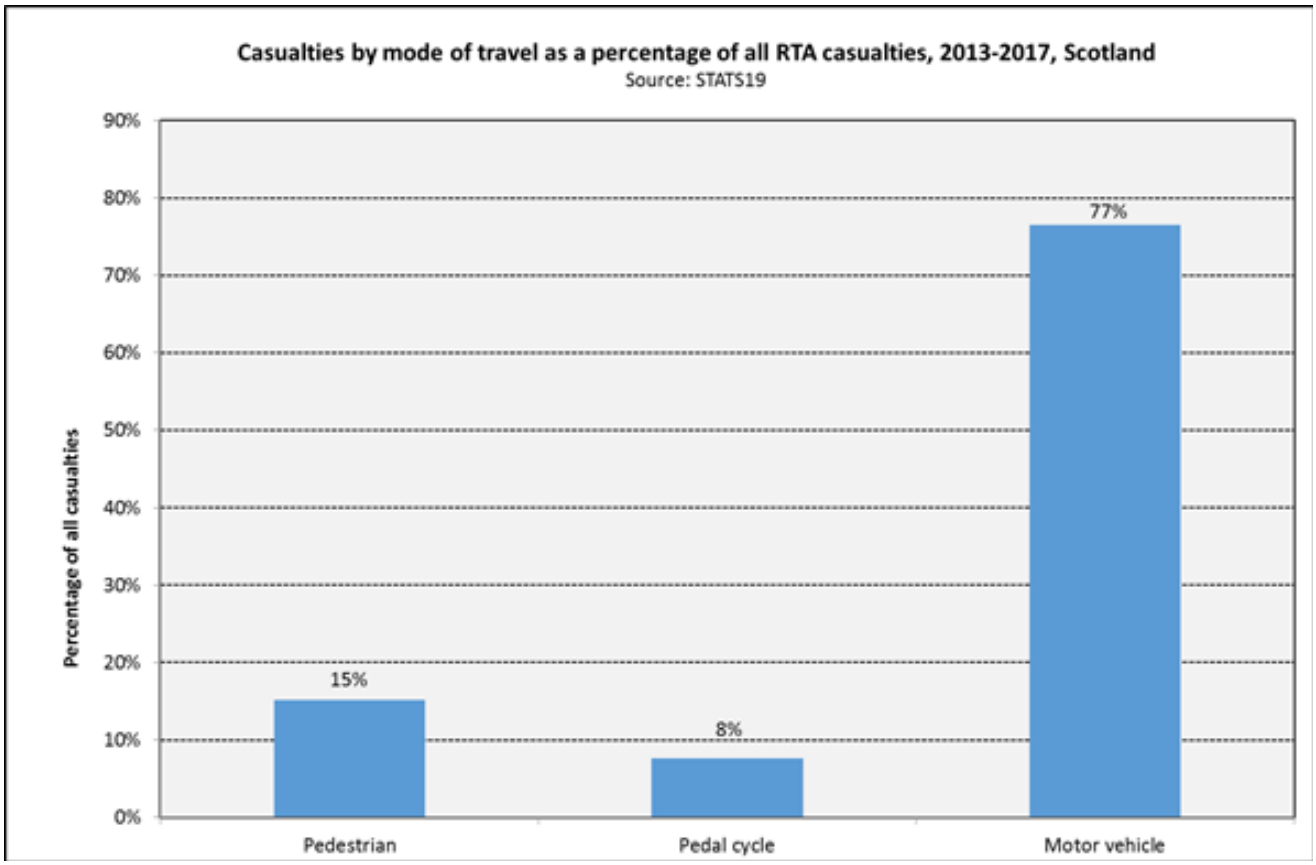
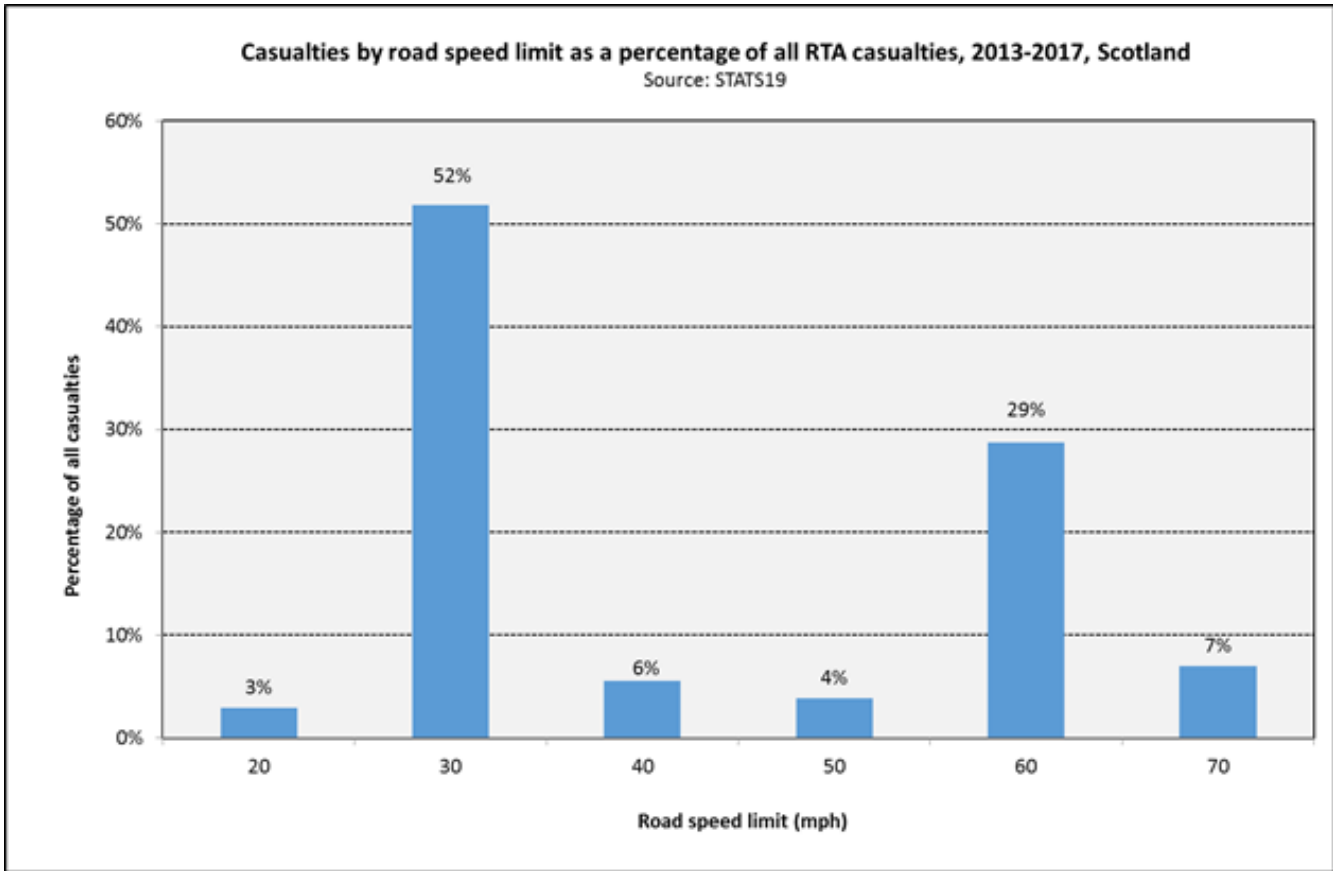


Table A1 in the appendix provides more detail on casualties by type and mode of travel, in Scotland in this period.

Casualties by road speed limit (2013-2017)
Casualties on 30mph roads accounted for 52% of all casualties. Of these 1% were fatalities, 13% serious casualties and 86% slight injury casualties. Casualties on 20mph roads made up 3% of all casualties, the majority involving slight injury (Figure 2).

Figure 2. Casualties by road speed limit as a percentage of all RTA casualties, 2013-2017, Scotland.



It is worth noting that this figure merely points out the types of roads on which casualties most commonly occur and it does not give an indication of the risk of being a casualty on these roads. To provide an accurate measure of risk, or risk exposure, would additionally require estimates of the length of roads of different speed and the numbers of road users of all types on these roads. These types of data are currently not readily available.

Table A2 in the appendix provides more details on casualties by speed limit and severity in the period 2013-2017.

Casualties by mode and road speed limit (2013-2017)

Pedestrians and cyclists make up 15% and 8%, respectively, of all casualties on all roads (Figure 1, above), but on 30mph roads pedestrian and cyclist casualties make up a greater proportion of casualties: 25% and 11% respectively.

Furthermore, pedestrians account for 47% of all serious casualties on 30mph roads and cyclists account for 15% of serious casualties on these roads.

In terms of all pedestrian fatalities, the majority occur on 30mph roads. Pedestrian fatalities account for 63% of all casualties on 30mph roads, while cyclists account for a further 4% of the fatalities occurring on 30mph roads.

In summary, the most vulnerable road users, pedestrians and cyclists, make up over 60% of serious or fatal casualties on 30mph roads. Table A3 in the appendix provides more detail on the proportion of casualties by severity, road speed and mode of travel in Scotland in this period.

Methods

Police road traffic accident data (STATS19) for 2013-2017 were used to identify all crash casualties injured on roads in Scotland with a 30mph limit. The average annual numbers of fatal, serious and slight casualties on 30mph roads were then calculated on Scottish roads during this period.

The evidence of casualty reductions achieved through other 20mph limit schemes is very limited and variable. However, there is evidence on the impact of speed on the frequency of accidents in the UK. It has been estimated that as a 'robust' general rule that a 1mph reduction in average speed can achieve a 5% reduction in accident frequency[25].

Using this rule and applying it to the average speed reductions observed in two recent '20mph limit' schemes, in Bristol and in a pilot scheme in South Central Edinburgh, estimates of the potential reduction in casualties across Scotland have been made.

As an upper estimate, a potential **13.5% reduction in casualties** might be possible were a reduction in average speed similar to that in Bristol of 2.7mph to be achieved (2.7 x 5% = 13.5%)[d].

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[d] The calculation assumes a 5% reduction in casualties for every 1mph of average speed reduction. Strictly speaking the 5% reduction referred to in the TRL report[24] relates to road traffic accidents rather than casualties. However, the STATS19 data used for this analysis is based on recording accidents involving injury and therefore every STATS19 accident record involves at least one casualty.

Alternatively, if the average speed reduction in the South Central Edinburgh pilot of 1.9mph were to be achieved, a potential **reduction in casualties of 9.5%** might be possible (1.9 x 5% = 9.5%).

Finally a **reduction of 2.6%** in overall casualties has been calculated in order to show the reduction needed to save just one life.

Each reduction estimate was applied to the average annual casualties on 30mph roads in Scotland in the period (2013-2017) to estimate the potential reduction in actual casualties.

Estimates of the monetary values for the prevention of fatal, serious and slight casualties for 2016 were calculated using UK Department for Transport (DfT) 'value of prevention' data (using 2016 prices) (Table 1)[26].

Table 1. Average value of prevention per casualty by type of casualty.

Average value of prevention per reported casualty, GB, 2016.

	£ (2016 prices)
Accident/casualty type	**Cost per casualty**
Fatal	1,841,315
Serious	206,912
Slight	15,951

The valuation of both fatal and non-fatal casualties is based on a willingness to pay (WTP) approach, which encompasses all aspects of the valuation of casualties, including three main elements of cost[27]:

- **Loss of output due to injury**. This is calculated as the present value of the expected loss of earnings, plus non-wage payments made by employers.
- **Ambulance costs and the costs of hospital treatment**.
- **The human costs of casualties**. These are based on willingness to pay to avoid pain, grief and suffering to the casualty, relatives and friends, as well as intrinsic loss of enjoyment of life in the case of fatalities.

The air pollution effects of introducing a 20mph limit have not been calculated due to a lack of reliable data for relevant geographies[e].

Results

In the five-year period between 2013 and 2017, there were over 54,000 road traffic casualties reported via the Police STATS19 recording system in Scotland. As an annual average, this represents 10,814 casualties per year. Of these just over half (52%) were injured on 30mph roads, and broken down further this equates to 40 fatalities, 732 seriously injured casualties and 4,833 slightly injured casualties.

Using three models assuming different casualty reduction effects (13.5%, 9.5% or 2.6%), estimates were calculated for the annual average number of road traffic casualties that might be avoided, and the associated cost savings, with the introduction of 20mph limits on roads that previously had a 30mph limit (Table 2).

Obviously the largest potential road traffic casualty savings are associated with the model predicting the greatest (13.5%) reduction in casualties, although the models based on reductions of 9.5% and 2.6% would also have notable effects.

Under the 13.5% reduction model there could be 755 fewer casualties of all types (including 5 fewer fatalities) after the introduction of 20mph limits, associated with savings of £39.9 million, based on the DfT's 'value of prevention' methodology. Using the model based on a 9.5% reduction in casualties, 531 fewer casualties overall (including 3 fewer fatalities) are predicted annually, equating to a value of prevention of £27.1 million. A 2.6% lowering in casualties, the reduction required to save one life, is associated with 145 fewer casualties overall and an accompanying value of prevention of £7.8 million.

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[e] The air pollution impact model outlined in the Jones and Brunt paper requires estimates of annual average concentrations of NO_x, NO_2, PM_{10} and $PM_{2.5}$ at residential dwellings by Local Authority (LA), road lengths by LA (total roads & 30 mph roads) and mortality data for people aged over 30 by LA. Only the mortality data are readily available.

Table 2. Estimated annual road traffic casualty savings applying a 20mph limit on roads previously with a 30mph limit, Scotland.

Estimated annual road traffic casualty savings following introduction of 20 mph limits on roads previously with a 30 mph limit, Scotland					
Data: average annual injury road casualties (2013-2017), Scotland (Source: STATS19); calculations: adapted from model proposed by Jones and Brunt[1]					
a) assuming **13.5% reduction in casualties** following introduction of 20 mph on roads previously with a 30mph limit					
Row		**Fatal**	**Serious**	**Slight**	**Total**
A	Crash casualties on roads with 30 mph limit	40	732	4,833	5,605
B	Estimated value of prevention, per casualty (2016 prices, DfT)	£ 1,841,315	£ 206,912	£ 15,951	
C	Estimated value of prevention 30 mph crash casualties: C=A*B	£ 72,916,073	£151,542,524	£77,096,784	£ 301,555,381
D	Casualties avoided by implementing 20 mph limits— 13.5% of actual casualties: D = A*0.0135	5	98	652	755
E	Estimated value of 20 mph limits in Scotland: E = D*B	**£ 9,206,575**	**£ 20,277,399**	**£10,399,947**	**£ 39,883,921**
b) assuming **9.5% reduction in casualties** following introduction of 20 mph on roads previously with a 30mph limit					
Row		**Fatal**	**Serious**	**Slight**	**Total**
A	Crash casualties on roads with 30 mph limit	40	732	4,833	5,605
B	Estimated value of prevention, per casualty (2016 prices, DfT)	£ 1,841,315	£ 206,912	£ 15,951	
C	Estimated value of prevention 30 mph crash casualties: C=A*B	£ 72,916,073	£151,542,524	£77,096,784	£ 301,555,381
D	Casualties avoided by implementing 20 mph limits— 9.5% of actual casualties: D = A*0.095	3	69	459	531
E	Estimated value of 20 mph limits in Scotland: E = D*B	**£ 5,523,945**	**£ 14,276,944**	**£ 7,321,435**	**£ 27,122,324**
c) assuming **2.6% reduction in casaulties** following introduction of 20 mph on roads previously with a 30mph limit [The reduction required to save one life]					
Row		**Fatal**	**Serious**	**Slight**	**Total**
A	Crash casualties on roads with 30 mph limit	40	732	4,833	5,605
B	Estimated value of prevention, per casualty (2016 prices, DfT)	£ 1,841,315	£ 206,912	£ 15,951	
C	Estimated value of prevention 30 mph crash casualties: C=A*B	£ 72,916,073	£151,542,524	£77,096,784	£ 301,555,381
D	Casualties avoided by implementing 20 mph limits— 2.6% of actual casualties: D = A*0.026	1	19	125	145
E	Estimated value of 20 mph limits in Scotland: E = D*B	**£ 1,841,315**	**£ 3,931,333**	**£ 1,993,855**	**£ 7,766,502**
[1] Jones SJ, Brunt H Twenty miles per hour speed limits: a sustainable solution to public health problems in Wales J Epidemiol Community Health 2017;71:699-706.					

Discussion

Modelled estimates

This paper attempts to quantify the likely impact of the introduction of a 20mph speed limit on restricted roads in Scotland on road traffic casualties. Different model assumptions have been presented. These are based on speed reductions observed in previous 20mph limit schemes and the resulting anticipated casualty reductions. This approach has been necessitated due to the current lack of direct evidence of casualty reductions from 20mph signs-only schemes.
The estimates produced should not be seen as predictions, rather modelled estimates of different accident reduction scenarios. The strengths and considerable limitations of this approach are discussed in more depth later in this paper.

The models based on 13.5 and 9.5% reductions in casualties suggest that a reduction in the speed limit from 30mph to 20mph could prevent between 530 and 750 casualties annually, including between 3 and 5 fatalities. The value of prevention was estimated to be between £27.1 million and £39.9 million annually.

20mph zones and 20mph limits

Many studies have highlighted 20mph zones and limits as effective means of improving public health via reduced accidents and injuries[13]. The former, which often include traffic calming and street redesign measures, may be arguably more effective at reducing road traffic accidents and have a greater impact on reducing traffic speed than 20mph limits[28]. The evidence for 20mph zones increasing levels of walking and cycling and children's outdoor play is more uncertain with different studies reporting both positive and negative impacts[29].

As noted above, there are relatively few studies that have looked purely at the impact of introducing a 20mph limit as opposed to a 20mph zone. A review conducted in 2012, prior to the implementation of Bristol's 20mph limit, identified an evidence gap relating to the effectiveness of signs-only 20mph[30]. The study noted that the majority of urban speed management schemes in mainland Europe and the UK had involved the physical implementation of Woonerf[f], Homezones[g] or traffic-calming measures. So while there is a relatively strong evidence base for the effectiveness of physical measures in reducing speeds, in their words "the effectiveness of signs-only 20mph schemes, which were only introduced in England in 1999, has yet to be evaluated through academic research".

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[f] A Woonerf is a living street, as originally implemented in the Netherlands and in Flanders, Belgium. Techniques include shared space, traffic calming, and low speed limits. Under Article 44 of the Dutch traffic code, motorised traffic in a Woonerf or "recreation area" is restricted to walking pace. (Source: Wikipedia)

[g] A Homezone is a term for a living street (or group of streets) as implemented in the United Kingdom, which are designed primarily to meet the needs of pedestrians, cyclists, children and residents and where the speeds and dominance of the cars is reduced. (Source: Wikipedia)

Research by TRL focused more narrowly on the impact of speed reductions on accidents[24] and concluded that a reduction in accident frequency of between 4-6% could be achieved per 1mph reduction in average speed; on urban roads this reduction was specific to roads with low and medium average speeds, the types of roads likely to be affected by a 20mph limit. The reduction achievable varied according to the road type and average traffic speed. In urban areas the potential for accident reduction was greatest on roads with low average speeds *"typically busy main roads in towns with high levels of pedestrian activity, wide variations in speeds and high accident frequencies"*. In the models presented in this paper, the general rule that a 1mph reduction in average speed can achieve a 5% reduction in accident frequency[24] was applied.

Despite the relatively sparse literature on the impact of introducing 20mph limits using only signage, the recent examples of Bristol and the South Central Edinburgh pilot provide partial evidence of impacts.

Case study – South Central Edinburgh pilot

The current evaluation of the 20mph limit introduced across Edinburgh will help unravel the impact on traffic volume, speed and accidents of introducing 20mph limits. The evaluation is at an early stage so it is too early to comment on the impact on casualties. Nevertheless an early pilot undertaken in South Central Edinburgh in 2012 provided some relevant findings[31].

Road speed came down. In 28 locations that had their speed limit changed to 20mph, average 'before' speeds were 22.8mph, while 'after' speeds fell to 20.9mph; an average fall of 1.9mph. Interestingly, speeds after implementation also reduced on the 20 locations that remained with a 30mph limit, although only by 0.8mph (to 25.4mph). After implementation, there was an overall increase in the number of vehicles on most of the 20mph and 30mph streets (about 40% of streets retained a 30mph limit during the pilot).

Before and after attitude surveys of residents from over 1,000 households highlighted a number of positive impacts, including (in priority order) improved safety for children walking about the area, safety for children to play in the street, better conditions for walking, fewer traffic incidents, and better cycling conditions. More detailed statistics on these trends are provided below:

- The proportion of children (all school ages) walking to school increased marginally from 63% to 65%.
- The proportion of older primary school children allowed to play unsupervised outside their home, on the pavement, or in the street rose from 31% to 66%.
- When considering how safe their street is for walking and cycling, there was an increase in the majority who felt that speeds were safe (78% compared with 71% 'before').
- Respondents considered traffic speeds in the local area as safer for both walking and cycling. For cycling, 18% viewed it unsafe (compared with 26% 'before'), while for walking 12% viewed it unsafe (17% 'before').
- The proportion of children (all school ages) cycling to school increased from 4% 'before' to 12% in the 'after' survey; with increases notable among older primary school-age children cycling to school (from 3% to 22%).
- The overall level of support for the 20mph speed limit increased from 68% 'before' to 79% 'after'.

At the point this report was produced it was too early to assess the impact on road traffic accidents of the 20mph limit, but the above statistics emphasise other positive health benefits, which point to the potential to achieve population level improvements in public health through a larger national intervention.

Case study – Bristol

Bristol City Council introduced a 20mph limit across the city in six phases from January 2014 to September 2015. The scheme was intended to be about more than just reducing road traffic casualties and aimed to improve health and wellbeing across the city, taking a holistic perspective as to how slower traffic speeds might impact on people's lives.

The impact of the scheme has been evaluated by a team from the University of West of England. Their study[32] has found statistically significant reductions in average traffic speeds of 2.7mph across the city of Bristol, following the introduction of 20mph speed limits. The study employed a more sophisticated analysis than previous studies of 20mph limits and the authors note that this speed reduction is larger than that seen in previous evaluations in other cities.

Since the introduction of the 20mph speed limits, annual rates of fatal, serious, and slight injuries have reduced from pre-20mph limit rates. The estimated number of road traffic accident related injuries avoided across the city each year is 4.53 fatal, 11.3 serious, and 159.3 slight injuries. The annual saving associated with the decrease in casualties is estimated to be £15,256,309 based on a Department for Transport formula for calculating the cost of road traffic casualties.

There is support in Bristol for 20mph speed limits, with 62% support for such limits on residential roads and 72% on busy streets. However, concerns remain about compliance and behaviour of other drivers. Walking and cycling rates across Bristol have increased since the introduction of the new speed limits, both among children travelling to school and adults travelling to work.

Strengths and limitations

The modelling approach used in this paper is based in part on that put forward by Jones and Brunt[1], but with certain modifications. So it is pertinent to highlight the differences in the current analysis, as well as the strengths and limitations of the approach taken:

- The impact on air quality of introducing a 20mph limit has not been estimated due to a lack of reliable data for relevant geographies. However the impact on air quality, and thus health, of switching from 30mph limits to 20mph appear to be marginal; in the Welsh study the change was estimated to lead to a slight increase in deaths and years of life lost (YLL) associated with nitrogen dioxide (NO2) but a greater reduction in deaths and YLL associated with PM2.5[h].
- A limitation of the analysis is the potential lack of completeness and accuracy of routinely recorded data. There is known under-reporting of road injuries in the STATS19 data. For under-recording to affect the results of the analysis there would have to be selective changes over time in recording of injuries in 20mph zones compared with other road types. Previous national evidence suggests that the rate of under-reporting overall has not substantially changed over time[33].
- The modelling takes no account of other road safety interventions that may happen in conjunction with the imposition of a 20mph limit. A recent example of this is the first introduction of average speed cameras on an urban road (Old Dalkeith Road) in Edinburgh, which has reduced speeding substantially and appears to have reduced accidents[34].
- Various models are presented due to uncertainty over the likely scale of casualty reductions. The reductions presented are based on combining average speed reductions observed in areas covered by recent 20mph limit schemes with a rule of thumb 5% reduction in accidents per 1mph reduction in speed. This is an indirect method for calculating casualty reductions necessitated by a lack of direct observational data.
- There are a number of assumptions behind the models and it is clear also that different local contexts led to different levels of speed reduction in Bristol and South Central Edinburgh. The introduction of a 20mph limit on restricted roads across Scotland would undoubtedly face very varied local traffic, community and socioeconomic contexts. Thus, as noted above, the modelled estimates in this paper should be seen as describing different possible scenarios rather than being definitive predictions.
- If a national 20mph limit was introduced on urban roads in Scotland, it is likely there would be some roads in each local authority exempted from the lowered limit, such as faster 'through routes'. For example, in Edinburgh, the city-wide scheme has been implemented on 80% of streets, with a network of 30mph and 40mph streets in the remaining 20% of streets. As a rough approximation, if the Edinburgh example was followed elsewhere and only 80% of all 30mph roads switched to 20mph limits, the level of casualty reductions and savings shown in this analysis could be reduced by 20%. That said, the actual impacts are very difficult to predict

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[h] $PM_{2.5}$ is a term used to describe particles in the air with a size (diameter) less than 2.5 micrometres (µm).

as the proportion of exempted roads may vary considerably between local authorities and the current risk profiles of roads chosen or exempted from a 20mph limit would impact on the likely levels of casualty reductions observed.

- The monetary values for the prevention of fatal, serious and slight casualties were based on 2016 prices applied to casualty data from 2013-2017. Arguably, values could have been calculated based on 2015 prices (the middle year of the casualty data) or perhaps 2017 prices (not available currently) might provide a better estimate of up-to-date prevention values associated with casualties.
- This paper has not attempted to account for the impact of other transport-related factors and safety-related interventions that could impact on the level of road traffic casualties. It is also worth reiterating that overall transport casualties have been reducing over a long period of years. Further reductions in road traffic casualties in the future, due to factors and interventions unrelated to the introduction of 20mph limits, could potentially dilute the impact of 20mph limits on road casualty reductions.

This paper has focused on the potential cost savings to society due to reduced casualties associated with the introduction of 20mph limits. However, local authorities would incur costs associated with the introduction of such limits. There would be the initial costs associated with signage for each local authority and the cost of awareness raising campaigns around the introduction of the scheme. Additionally, there may be costs associated with policing and enforcing the new limits and potentially costs related to the additions of other traffic calming measures if these are thought to be necessary.

Evidence from previous ‘signs-only’ 20mph schemes that ‘soft’ measures such as “winning hearts and minds”, and police endorsement of schemes, are important, and if ignored or under-resourced these two factors can have a major impact on the cost-effectiveness of 20mph signs-only schemes[29].

Conclusions

This paper provides modelled estimates of the impact on road casualties of introducing a 20mph speed limit on urban roads in Scotland. There are limitations and caveats around the modelled estimates in this paper and the estimates presented should be seen as describing different possible scenarios rather than as definitive predictions.

Based on average speed reductions of between 1.9mph and 2.7mph, taken from two recent 20mph schemes (a pilot in South Central Edinburgh and a permanent scheme in Bristol), significant reductions in road traffic casualties and accidents are potentially possible. Reducing the speed limit on 30mph urban roads to 20mph could potentially prevent 530-750 casualties annually across Scotland (including 3-5 fatalities), based on the impacts seen from similar schemes previously. The value of prevention based on these different scenarios is estimated to be between £27.1 million and £39.9 million annually.

In reality, the success of introducing a 20mph speed limit on urban roads in Scotland will be impacted by differing local contexts and the effectiveness of complementary activities, such as communication and behaviour change campaigns and supportive policing/enforcement. Nevertheless, the introduction of 20mph limits in South Central Edinburgh and Bristol led to reductions in average speed, and in the case of Bristol significant casualty reductions and cost savings in terms of avoided injury and fatality can be demonstrated. Both schemes also had majority public support and demonstrated accompanying increases in feelings of safety and levels of walking and cycling.

The health impacts on air pollution of this type of speed limit reduction has not been estimated due to data constraints, but based on limited evidence this type of change is likely to only have marginal impact.

Evidence from other 20mph schemes suggests that awareness raising, communications activities and police support and enforcement have a positive impact on the effectiveness of schemes. It has been beyond the scope of this paper to explore the costs of implementation of a national 20mph limit on restricted roads. These costs at a minimum would include the cost of new signage, but would in reality incur other relevant costs relating to communication activities, marketing-led soft interventions, police enforcement and monitoring. It is possible that further costs might accrue if additional road changes and traffic calming measures are deemed necessary in some local circumstances.

Acknowledgements

Transport Scotland's Analytical Services Division were very helpful in providing statistics on the number, severity and mode of travel of road injury casualties (from STATS19) on Scottish roads by speed limit. I am grateful to Andrew James Williams and Glenna Nightingale, who are part of the team evaluating Edinburgh's 20mph scheme, for sharing information about the evaluation and the impact of other similar schemes.

I would like to thank colleagues in the Scottish Parliament's Non-Government Bills Unit and my GCPH colleagues David Walsh, Joe Crossland and Jennie Coyle for reading and commenting on earlier drafts of this paper.

Appendix

Table A1. Average annual casualties by type and mode of travel, 2013-2017, Scotland.

		Pedestrian	Pedal cycle	Motorcycle	Car	Taxi	Minibus	Bus/Coach	LGV	HGV	Other	Total	% of column Total
2013-2017	Killed	42	8	28	86	1	1	2	3	3	3	176	1.6%
Annual average	Serious	403	158	283	694	10	5	35	33	14	15	1650	15.3%
	Slight	1193	653	422	5791	144	30	298	312	82	63	8988	83.1%
	All Injuries	1638	819	733	6570	154	36	335	349	99	81	10814	100.0%
		Pedestrian	Pedal cycle	Motorcycle	Car	Taxi	Minibus	Bus/Coach	LGV	HGV	Other	Total	
2013-2017	Killed	24%	4%	16%	49%	0%	0%	1%	2%	1%	2%	100%	
% of row total	Serious	24%	10%	17%	42%	1%	0%	2%	2%	1%	1%	100%	
	Slight	13%	7%	5%	64%	2%	0%	3%	3%	1%	1%	100%	
	All Injuries	15%	8%	7%	61%	1%	0%	3%	3%	1%	1%	100%	

Table A2. Casualties by speed limit and severity, 2013-2017, Scotland.

Casualties by speed limit and severity, 2013 - 2017, Scotland								
Source: Stats19								
Average annual casualites over 5 years		20	30	40	50	60	70	All roads
	Killed	2	40	10	5	102	18	176
	Serious	53	732	77	46	653	89	1,650
	Slight	266	4,833	514	369	2,353	652	8,988
	All Injuries	321	5,605	600	421	3,108	759	10,814
% of casualties by type across all roads	Killed	1%	23%	5%	3%	58%	10%	100%
	Serious	3%	44%	5%	3%	40%	5%	100%
	Slight	3%	54%	6%	4%	26%	7%	100%
	All Injuries	3%	52%	6%	4%	29%	7%	100%
% of casualties by type within each speed li	Killed	1%	1%	2%	1%	3%	2%	2%
	Serious	16%	13%	13%	11%	21%	12%	15%
	Slight	83%	86%	86%	88%	76%	86%	83%
	All Injuries	100%	100%	100%	100%	100%	100%	100%
% of casualties of all types on all roads	Killed	0%	0%	0%	0%	1%	0%	2%
	Serious	0%	7%	1%	0%	6%	1%	15%
	Slight	2%	45%	5%	3%	22%	6%	83%
	All Injuries	3%	52%	6%	4%	29%	7%	100%
		20	30	40	50	60	70	All roads
	Total	3%	52%	6%	4%	29%	7%	100%

Table A3. Percentage of casualties by severity, road speed and mode, 2013-2017, Scotland.

		% of total by speed of road				
Casualty type	Speed limit	Mode of travel				
	road speed	Pedestrian	Pedal cycle	Motor vehicle occupant	Other road user	Total
Killed	20	50%	20%	30%	0%	100%
	30	63%	4%	29%	4%	100%
	40	29%	8%	63%	0%	100%
	50	19%	19%	63%	0%	100%
	60	8%	4%	87%	1%	100%
	70	25%	2%	72%	1%	100%
	Total	**24%**	**4%**	**70%**	**2%**	**100%**
		Pedestrian	Pedal cycle	Motor vehicle occupant	Other road user	Total
Serious	20	49%	20%	30%	1%	100%
	30	47%	15%	38%	1%	100%
	40	17%	10%	73%	0%	100%
	50	7%	7%	86%	0%	100%
	60	3%	4%	92%	1%	100%
	70	3%	2%	94%	1%	100%
	Total	**24%**	**10%**	**65%**	**1%**	**100%**
		Pedestrian	Pedal cycle	Motor vehicle occupant	Other road user	Total
Slight	20	38%	15%	46%	1%	100%
	30	21%	11%	67%	0%	100%
	40	4%	6%	90%	0%	100%
	50	2%	1%	96%	0%	100%
	60	1%	2%	95%	1%	100%
	70	1%	0%	98%	1%	100%
	Total	**13%**	**7%**	**79%**	**1%**	**100%**
		Pedestrian	Pedal cycle	Motor vehicle occupant	Other road user	Total
All Casualties	20	40%	16%	43%	1%	100%
	30	25%	11%	63%	1%	100%
	40	6%	6%	87%	0%	100%
	50	3%	2%	95%	0%	100%
	60	2%	3%	94%	1%	100%
	70	2%	1%	97%	1%	100%
	Total	**15%**	**8%**	**77%**	**1%**	**100%**

References

1. Jones SJ, Brunt H. Twenty miles per hour speed limits: a sustainable solution to public health problems in Wales. *Journal of Epidemiology & Community Health* 2017. DOI: 10.1136/jech-2016-208859. Available at: https://jech.bmj.com/content/early/2017/03/23/jech-2016-208859 (accessed August 2018)
2. Transport Scotland. *Good Practice Guidance on 20mph Speed Restrictions*. Glasgow: Transport Scotland; 2015. Available at: https://www.transport.gov.scot/publication/good-practice-guide-on-20mph-speed-restrictions/ (accessed August 2018)
3. Stewart L, Skinner L, Weiss M, Middleton J. Start Well, Live Better – a manifesto for the public's health. *Journal of Public Health* 2015;37(1):3-5. Available at: https://academic.oup.com/jpubhealth/article/37/1/3/1561597 (accessed August 2018)
4. NICE. *Public health guideline: Unintentional injuries on the road: interventions for under 15s*. https://www.nice.org.uk/guidance/ph31/resources/unintentional-injuries-on-the-road-interventions-for-under-15s-1996292434885 (accessed August 2018)
5. British Medical Association. *Healthy transport = healthy lives.* London: BMA; 2012. Available at: https://www.bma.org.uk/collective-voice/policy-and-research/public-and-population-health/transport (accessed August 2018)
6. Whyte B, Ajetunmobi T. *Still 'The Sick Man of Europe'? Scottish mortality in a European context 1950-2010: an analysis of comparative mortality trends*. Glasgow: GCPH; 2012. Available at: http://www.gcph.co.uk/publications/391_still_the_sick_man_of_europe (accessed August 2018)
7. Transport Scotland. *Scottish Transport Statistics - No 36 - Datasets*. https://www.transport.gov.scot/publication/scottish-transport-statistics-no-36-datasets/ (accessed August 2018)
8. McCartney G, Walsh D, Whyte B, Collins C. Has Scotland always been the 'sick man' of Europe? An observational study from 1855 to 2006. *European Journal of Public Health* 2012;22(6):756-760. Available at https://academic.oup.com/eurpub/article/22/6/756/541851 (accessed August 2018)
9. Scottish Government. *Long-term Monitoring of Health Inequalities – December 2017*. https://www.gov.scot/Publications/2017/12/4517/0 (accessed August 2018)
10. McCartney G, Popham F, Katikireddi SV, Walsh D, Schofield L. How do trends in mortality inequalities by deprivation and education in Scotland and England & Wales compare? A repeat cross sectional study. *BMJ Open* 2017;7:e017590. DOI: 10.1136/bmjopen-2017-017590.
Available at: https://bmjopen.bmj.com/content/7/7/e017590 (accessed August 2018)
11. Thomas B, Dorling D, Davey Smith G. Inequalities in premature mortality in Britain: observational study from 1921 to 2007. *British Medical Journal* 2010;341:c3639. Available at: https://www.bmj.com/content/341/bmj.c3639 (accessed August 2018)
12. Dorling D. Chapter 3: 20 mph Speed limits for cars in residential areas, by shops and schools. In: Newby L, Denison N (eds.) *If you could do one thing: Nine local actions to*

reduce health inequalities. London: British Academy; 2014. Available at: https://www.britac.ac.uk/publications/if-you-could-do-one-thing

13. Cairns J, Warren J, Garthwaite K, Greig G, Bambra C. Go slow: an umbrella review of the effects of 20 mph zones and limits on health and health inequalities. *Journal of Public Health* 2015;37(3):515-520. Available at: https://academic.oup.com/jpubhealth/article/37/3/515/2362676
14. Richards DC. Road Safety Web Publication No. 16: Relationship between speed and risk of fatal injury: pedestrians and car occupants. London: Transport Research Laboratory, Department for Transport; 2010. Available at: http://webarchive.nationalarchives.gov.uk/20120606210143/http://assets.dft.gov.uk/publications/pgr-roadsafety-research-rsrr-theme5-researchreport16-pdf/rswp116.pdf (accessed September 2018)
15. Grundy C. Effect of 20 mph traffic speed zones on road injuries in London, 1986-2006: controlled interrupted time series analysis. BMJ 2009;339:b4469. Available at: https://www.bmj.com/content/339/bmj.b4469 (accessed September 2018)
16. Janssen S. Road safety in urban districts: final results of accident studies in the Dutch demonstration projects of the 1970s. Traffic Engineering Control 1991;32:292-296.
17. Brilon W, Blanke H. Traffic safety effects from traffic calming. *VTI Rapport* 1990;363A:133-148.
18. Fife Council. *Agenda and Papers – Safer Communities – 21st January 2016*. https://www.fifedirect.org.uk/publications/index.cfm?fuseaction=publication.pop&pubid=AF049844-B981-D659-2749C8B3C988157B (accessed August 2018)
19. Atkins Transport Planning & Management. *Interim Evaluation of the Implementation of 20 mph Speed Limits in Portsmouth. Final Report - September 2010*. London: Department for Transport; 2010.
20. Road Safety Observatory. *Speed limits.* http://www.roadsafetyobservatory.com/Summary/roads/speed-limits (accessed August 2018)
21. Lorenc T, Brunton T, Oliver S, Oliver K, Oakley A. Attitudes to walking and cycling among children, young people and parents: a systematic review. *Journal of Epidemiology & Community Health* 2008;62(10):852-857.
22. Jarrett J, Woodcock J, Griffiths UK, Chalabi Z, Edwards P, Roberts I, Haines A. Effect of increasing active travel in urban England and Wales on costs to the National Health Service. *The Lancet* 2012;379:2198-2205.
23. Glasgow Centre for Population Health. *Briefing paper findings series 37: Cycling is good for health and the economy*. Glasgow: GCPH; 2013. Available at: http://www.gcph.co.uk/publications/431_findings_series_37-cycling_is_good_for_health_and_the_economy (accessed September 2018)
24. Transport Scotland. *Key Reported Road Casualties Scotland 2017*. https://www.transport.gov.scot/publication/key-reported-road-casualties-scotland-2017/ (accessed August 2018)
25. Taylor MC, Lynam DA, Baruya A. *The effects of drivers' speed on the frequency of road accidents. TRL Report 421 (Prepared for the Road Safety Division, DEFR)*. Crowthorne:

Transport Research Laboratory; 2000.
26. Department for Transport. Accident and casualty costs (RAS60); Table RAS60001 (Last updated 28 September 2017). https://www.gov.uk/government/statistical-data-sets/ras60-average-value-of-preventing-road-accidents#excel-data-tables-for-ras60 (accessed September 2018)
27. Department for Transport. *Reported Road Casualties in Great Britain: 2012 Annual Report: A valuation of road accidents and casualties in Great Britain in 2012*. London: DfT; 2013. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/244913/rrcgb2012-02.pdf (accessed September 2018)
28. ROSPA. *Road Safety Factsheet: 20mph zones and speed limits factsheet*. https://www.rospa.com/road-safety/advice/drivers/speed/20mph-zones-and-limits/ (accessed September 2018)
29. NICE Transport Review. *Physical Activity and the Environment. Review One: Transport*. London: NICE Public Health Collaborating Centre; 2006.
30. Toy S. *Delivering soft measures to support signs-only 20mph limits*. Bristol: University of West of England; 2012. Available at: http://www2.uwe.ac.uk/faculties/BBS/BUS/Research/BSMC/20mph%20Research%20Findings.pdf (accessed September 2018)
31. Transport and Environment Committee, City of Edinburgh Council. *South Central Edinburgh 20 mph limit pilot evaluation*. http://www.edinburgh.gov.uk/downloads/file/7820/south_central_edinburgh_20mph_limit_pilot_evaluation_2013 (accessed September 2018)
32. Pilkington P, Bornioli A, Bray I, Bird E. *The Bristol Twenty Miles Per Hour Limit Evaluation (BRITE) Study. Project Report*. Bristol: University of the West of England; 2018. Available at: http://eprints.uwe.ac.uk/34851 (accessed September 2018)
33. Ward H, Lyons R, Thoreau R. *Road safety research report No 69: Under-reporting of road casualties—phase 1*. London: Department for Transport; 2006.
34. BBC Scotland. Offences drop on Scotland's first urban road with average speed cameras. *BBC Scotland*. September 4 2018. https://www.bbc.co.uk/news/uk-scotland-edinburgh-east-fife-45399286 (accessed September 2018)

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