

**Scottish Public Health Network (ScotPHN)**

**Preventing Major Trauma in Scotland:  
Supporting Population Interventions**

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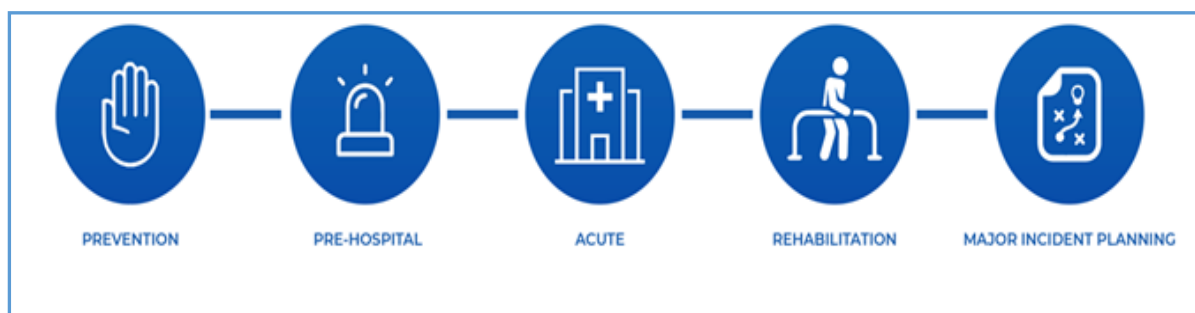
## Contents

<b>1</b>	<b>Purpose .....</b>	<b>3</b>
<b>2</b>	<b>Background.....</b>	<b>4</b>
<b>3</b>	<b>Public Health approaches to the prevention of injury .....</b>	<b>6</b>
<b>4</b>	<b>Where do significant injuries occur? .....</b>	<b>6</b>
4.1	Workplaces .....	7
4.2	Public places and sport .....	8
4.3	Homes and domestic settings .....	8
4.4	Roads.....	9
<b>5</b>	<b>Major Trauma – mechanism and frequency of injury .....</b>	<b>9</b>
<b>6</b>	<b>Violence and Major Trauma .....</b>	<b>16</b>
<b>7</b>	<b>Evidence for Action .....</b>	<b>18</b>
7.1	Road Traffic / Transport Injury.....	19
7.2	Sport injuries .....	21
7.3	Falls in houses and in public places.....	22
7.4	Burns and scalds.....	26
7.5	Suicides .....	26
<b>8</b>	<b>Current National Activity to Prevent Injury.....</b>	<b>27</b>
<b>9</b>	<b>What is needed to prevent traumatic injury, including major trauma?.....</b>	<b>36</b>
<b>10</b>	<b>References .....</b>	<b>38</b>

# 1 Purpose

The recent creation of the Scottish Trauma Network (STN) has re-stated the importance of preventing trauma in Scotland. Prevention features as one of the five key strands of the network's programme, along with pre-hospital retrieval, acute management, rehabilitation and major incident planning.

**Figure 1: key strands of the Scottish Trauma Network<sup>1</sup>**



The purpose of this briefing is to provide a supportive framework for the development of population interventions aimed at preventing major trauma in Scotland. However many interventions will need to feature within a much wider sphere of trauma, inclusive of lesser severity, and through partnership-working. As such this briefing considers:

- the main mechanisms of injury, the settings in which they occur and their frequency;
- an outline of the evidence-base underpinning preventative trauma action; and
- the statutory and non-statutory framework within which stakeholders work in Scotland.

Primary prevention is best described as an action that can be employed before any health harm has resulted. Stone *et al* describe primary injury prevention as the removal of circumstances, risks and hazards that lead to injury. Krug *et al* (2000) discuss the value of primary prevention strategies for injury prevention whilst also acknowledging the importance of treating injuries and improving care of the injured before and during attendance for health care. <sup>2,3</sup> It is perceived that primary prevention of injury has been neglected to some extent in Public Health and wider research in Scotland.

In this discussion paper, evidence-based primary prevention interventions, which avoid trauma and injury in the first place, will be summarised. Secondary prevention of trauma refers to effective management of retrieval, assessment and initial clinical management along the patient pathway towards recovery from injury and is the main focus of the wider major trauma network, not specifically outlined here. Tertiary prevention, where attenuation or resolution of the actual consequences of injury are

the main aims, is not a focus of this paper either, but is the point of action for rehabilitation and other services aimed at addressing longer-term outcomes.<sup>4</sup>

## **2 Background**

Traumatic injury is physical injury of sudden onset and severity which generally requires immediate medical attention and has the potential to lead to long-term disability and/or death. For the purposes of this paper it includes both intentional and non-intentional motivations of physical injury but excludes psychological, metabolic and/or healthcare causes such as ingestion, overdose of chemicals/medication or iatrogenic causes.

Major trauma injuries are usually clinically defined and part of a continuum of unintentional, violent or otherwise adverse events causing health harms. However, the same mechanisms that lead to major trauma, such as falls from height or from standing, road traffic collisions, assaults and household, workplace or leisure incidents, can also result in more minor injuries – the same exposures are involved, hence the same circumstances can be prevented in many instances. From a prevention perspective, it is useful to acknowledge this wider environmental context as well as the important potential consequences to individuals including for employment, social relationships, independent living, recreation, functional status, and overall quality of life. This thus strengthens the argument for primary prevention action rather than waiting for more trauma and injuries to occur.

Across Scotland, work is underway to create four Major Trauma Centres (MTCs) located in Aberdeen, Dundee, Edinburgh and Glasgow to act as centres for regionally co-ordinated clinical trauma services, in the North, East, Southeast and West, respectively, across a national Scottish Trauma Network, with local and national governance structures. Each centre will have specialist teams providing assessment and treatment of patients with significant traumatic injuries, working as part of an overall approach to emergency care alongside wider local NHS services in acute and community settings (e.g. Health and Social Care Partnerships and Local Authorities) as well as the Scottish Ambulance Service, Police Scotland, the Scottish Fire and Rescue Service, the third sector and other partners, all responding to a spectrum of serious injury incidents. The role of a prevention network linking into this is in development.

NHS Emergency Departments and other clinical services may already be working with their local Public Health Departments in Health Boards and elsewhere on injury and violence prevention activity. However, the extent to which this occurs when the often complex and life threatening medical cases present themselves is not known and at

best, variable. The development of major trauma prevention opportunities may, therefore, start from a relatively low base.

A national locus for preventative action in multi-agency settings that champions Community Safety within local and national contexts features through the Building Safer Communities collaborative partnership and is supported within the Scottish Government’s Justice in Scotland framework. Although it has no statutory basis, clear legislative and policy links exist, for example, through the Children and Young People (Scotland) Act 2014 and Getting It Right For Every Child, whose indicator framework SHANARRI encompasses ‘S’ for Safe.<sup>5</sup> Under the current chairmanship of the Assistant Chief Officer of the Scottish Fire and Rescue Service, phase 2 of the Building Safer Communities collaborative has produced a National Strategic Assessment for Unintentional Harm which recognises a challenging landscape and ‘a number of gaps including a lack of overarching policy, strategy or governance arrangements for unintentional harm’.<sup>6</sup>

**Figure 2: Existing Physical Unintentional Prevention Work, Scotland<sup>6</sup>**



Areas of focus for this initiative with respective briefing papers are: Children and Young People, Older People, Deprivation and Home, Road and Outdoor Safety, improvements in data gathering, analysis and sharing, and bridging the gap between strategy and delivery.

It is important to note that within its definition of unintentional harm, the Building Safer Communities collaborative work also includes poisonings and isolation and loneliness as psychological harms, issues which are not included in the Scottish Trauma Network’s sphere of work.

Whilst not captured within the definition of unintentional harm, violence is a major cause of traumatic injury. Extensive work is already underway across Scotland in

relation to the prevention of violence, notable amongst which is the public health approach to violence prevention adopted by Police Scotland in fostering multi-agency collaboration to reduce knife crime and its consequences. However, as with unintentional harm, sectoral policies which seek to prevent violence exist in Scotland and these are also important as ways in which traumatic injury can be avoided. Many of these preventative approaches do, however, seek to address the types of “upstream” inequalities that create and sustain cultures and behaviour that perpetuate violence. In this regard, addressing the social and economic factors that determine inequality and health inequality are also an important focus for prevention.

### **3 Public Health approaches to the prevention of injury**

It is widely accepted that Public Health policy in the form of laws, regulations and guidelines can have a profound impact on health and well-being. This is also well recognised in the field of injury prevention and is frequently described as the E’s of injury prevention.<sup>7,8</sup>

For many years, an abundance of evidence has existed that endorses a multi-faceted ‘E’ approach to the prevention of injury, most successfully applied in a co-ordinated manner.<sup>2,9,10,11,12,13,14</sup> A sixth and additional ‘E’ has been added for consideration as a factor in injury prevention, in support of reducing health and socio-economic inequalities across the spectrum of trauma risk.

The E’s of injury prevention are:

1. Enforcement
2. Environment
3. Engineering
4. Education
5. Empowerment
6. Equity

Figure provides an outline of the Scottish policy landscape for injury prevention along these lines.

### **4 Where do significant injuries occur?**

In considering prevention, it is useful to look at trauma according to the settings in which it occurs.

“Good Places, Better Health” recognises that physical environments are closely linked to health and wellbeing.<sup>15</sup> It identifies the need to connect policy and national

outcomes around how the physical environment influences health and supports five national outcomes:

- our children have the best start in life and are ready to succeed;
- we live longer, healthier lives;
- we have tackled the significant inequalities in Scottish society;
- we live in well-designed, sustainable places where we are able to access the amenities and services we need;
- we value and enjoy our built and natural environment and protect and enhance it for future generations.

In the research used to inform “Good Places, Better Health”, Stone *et al* describe the relationship between safety, injury and environment as a complex one.<sup>2</sup> However, they recognise that, importantly, everyone uses public places and their own specific space and environments, including homes, workplaces and schools and will travel using roads and infrastructures for socialising and recreation on a daily basis. Therefore the risks of injury are always present.

The Child Safety Report Card provides a comparative picture of Scotland with regards to child unintentional injury. It concludes that particularly in the domestic setting, the country does not perform well.<sup>16,17</sup>

#### **4.1 Workplaces**

The Health and Safety Executive (HSE) provides guidance and support to workplaces and industry across the United Kingdom. Their sector plans split workplaces into nineteen sectors, based on industry type and risk profiles.<sup>18</sup> Four specific areas are outlined requiring particular consideration due to the morbidity and mortality risks identified: agriculture, construction, logistics and transport, and manufacturing. Overall there were 144 work-related death injuries across Great Britain in 2017/18, 18 of which in Scotland with 16,000 self-reported injuries leading to over 7 days of absence from work.<sup>19,20</sup>

- Agriculture is identified by the HSE as having one of the poorest records for managing health and safety. In relation to an average of 35 deaths each year 29 in 2017/18), the sector plan states that across the UK, “the fatal injury rate is at around 20 times the all-industry average and shows no signs of improvement over the longer term.” It identifies the main causes of injury as being struck by moving vehicles, falling from height and being injured by animals.<sup>21</sup>
- The HSE plan for the Construction sector identifies that most of the 38 fatal injuries involve small businesses and that nearly half of all reported injuries occur during refurbishment activities.<sup>22</sup>
- The sector plan for Logistics and Transport is also worth noting since this sector also has a worse-than-average record for health and safety performance (15

deaths). It identifies important areas grouped around travel such as welfare arrangements, fatigue, and load safety with significant risks during transit and unloading at delivery point. Work-related road risk requires ongoing focus. The 2015 Transport Safety Commission report notes that 30% of deaths and serious injuries on the roads occur in the course of work.<sup>23</sup>

- Manufacturing includes small-scale motor vehicle repair, woodworking and metal fabrication, paper and plastic manufacture, food and drink production, car manufacture and shipbuilding. Main causes for the 15 deaths identified being struck by something, falls from height and contact with machinery.
- In addition, 100 members of the public across Great Britain suffered fatal injuries in a workplace, though not working themselves. Nearly half related to land transport settings – suicides were excluded.

## **4.2 Public places and sport**

Sporting injuries occur both in and outdoors. The Scottish Health Survey estimates that approximately 15% of the population have had a sports injury in a year and approximately one quarter of attendances at Emergency Departments (ED) could be due to sports injuries, as estimated in one Scottish health board area.<sup>24, 6</sup>

The HSE have produced guidance for leisure activities and a Sector Plan for Sports and Leisure which covers a wide range of activities from children's play to the more thrill-seeking type of sports and activities, such as bungee jumping and motorised leisure pursuits.<sup>25, 26</sup> A key challenge in this area of risk exposure is the need to protect the public whilst not restricting participation or engagement in sport and other health-beneficial activities.

## **4.3 Homes and domestic settings**

Homes are a common setting in which unintentional traumatic injuries occur especially in the younger and the older sectors of our population, where approximately 50% and 75% respectively occur in domestic settings.<sup>27</sup>

The types of injuries are varied, most common being falls which particularly affect the elderly in terms of morbidity and mortality (approximately 16,000 in 2016/17, in 75 year olds and over), but also the younger population (~4,400 in the under 15 years olds), however, these usually do not have long term consequences.<sup>28</sup>

Hospital admissions for burns and scald injuries, whether from exposure to fire, flame or smoke, hot water, bath or steam contact or hot drink scalds, are reported in ISD's Unintentional Injury in Scotland, 2017 report.<sup>28</sup> The magnitude of these vary across Scotland and by age, totalling 251 in those 15 years or older, compared to 206 for those aged under 15 years, in the year ending March 2017. Rates were highest in 0-



4 year olds (57 per 100,000 population), decreasing to a rate one seventh of that in the 5-9 year age group (8 per 100,000), similar to the elderly rate at 12 per 100,000 in the over 75 year age group. This amounted overall to 457 such injuries requiring hospital admission in that year with, notably, no deaths following admission to hospital and less than one per year overall from 2012 to 2016.

The home environment is a setting in which violence also occurs including violence towards a partner, gender-based violence and children, this last outlined in ScotPHN's report on Adverse Childhood Events (ACEs).<sup>29,30</sup> Here, the role of significant negative events often, but not exclusively, reinforced by socio-economically deprived environments, can act as significant risk factors for illness, trauma and lowered resilience in later years. See the section on Violence Prevention.

#### **4.4 Roads**

Laws, regulations and safe travel guidelines have resulted in roads and infrastructures drastically changing for the better in recent decades with resulting significant decreased road casualties. A range of issues have been tackled, including enforcement of speed reduction, modernisation and design of roads and seat belt laws. Such laws are enforced alongside educational, empowering approaches and public awareness campaigns to improve the public's knowledge of road safety. Engineering design changes made to vehicles and a statutory decrease in the blood alcohol level limits from 80mg to 50mg in every 100ml of blood for drivers in Scotland in 2014 have also contributed to safer driving, the latter differentially so, compared to the rest of the UK but consistent with many other European countries.

Such population approaches are applied to all and therefore, safety in this area of risk has improved on a more equitable scale than perhaps other trauma reduction initiatives, though more needs to be done. Important differentials remain in road injury between urban and rural areas of the country and merit further exploration.

## **5 Major Trauma – mechanism and frequency of injury**

Traumatic injury is the most common cause of death for the Scottish population up to the age of 45 years. However, the age group at the highest risk of traumatic death are the elderly, the most rapidly increasing demographic group in Scotland.

As with less severe injury, major trauma is most usefully described by the mechanism of exposure and on this basis can give an indication of the preventative approaches that need to be taken:

- falls, whether from 'standing' height of 2 metres, or more;
- motor vehicle collisions (or land transport accidents);
- assaults; and

- other injuries (e.g. crushing, scalds, hanging, drowning, fire).

Each year, it is estimated that approximately 5,000 people are seriously injured in Scotland. This is on a background of nearly 60,000 emergency hospital admissions for unintentional or violent injury of any degree.<sup>28</sup> However, the magnitude and frequency of traumatic injury across Scotland can be challenging to describe due to definitional issues.

At the most severe end of the spectrum of injury, cause of death analysis from the National Records of Scotland (NRS) reveals that traumatic deaths, whether intentional, unintentional or undetermined in nature amounted to 1,990 in 2017.<sup>31</sup> This was out of a total of 3,152 deaths in Scotland from ‘external causes’, which also includes deaths from prescribed/un-prescribed drugs, and those deriving from errors in healthcare.

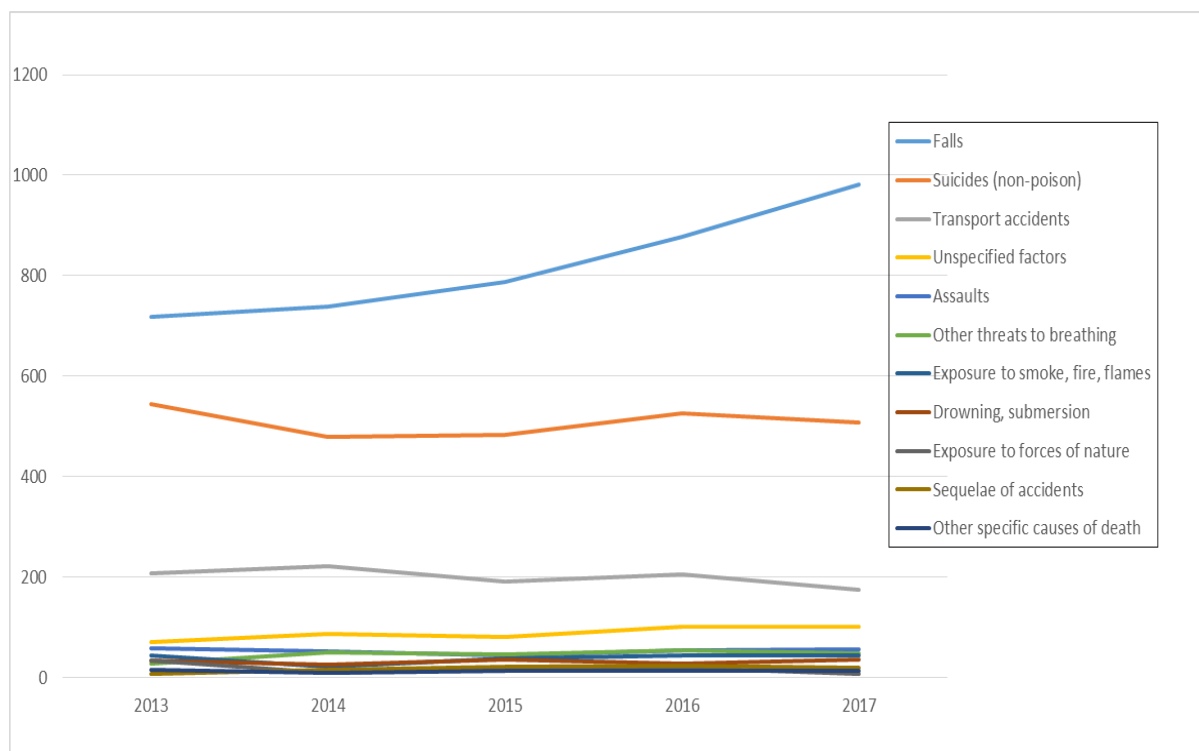
The following table and graph outline the number and trend in deaths from traumatic injuries from 2013 to 2017 in Scotland. An increase over this time period is evident for all causes, with the main component of that being due to the increase in fall-related deaths. Trends for other causes of traumatic death are, however, less clear.

**Figure 3: deaths from traumatic causes, Scotland 2013-2017; source NRS**

	2013	2014	2015	2016	2017
Falls	718	739	787	878	982
Suicides (non-poison)	545	478	484	527	508
Transport accidents	207	222	191	206	174
Unspecified factors	70	87	81	101	102
Assaults	58	52	44	54	57
Other threats to breathing	27	51	45	54	48
Exposure to smoke, fire, flames	43	22	37	43	43
Drowning, submersion	34	25	35	28	36
Exposure to forces of nature	33	10	18	19	8
Sequelae of accidents	7	15	21	23	19
Other specific causes of death	15	9	14	14	13
<b>Total</b>	<b>1,757</b>	<b>1,710</b>	<b>1,757</b>	<b>1,947</b>	<b>1,990</b>

An epidemiological study of trauma deaths in Scotland from 2000 to 2011 suggested that one third occurred in pre-hospital settings, most usually before retrieval from the scene of the incident. This proportion of trauma deaths occurring before arrival in hospital appears to be decreasing over time mainly for those related to road traffic collisions but not for other mechanisms (falls from height or standing, pedestrian/cyclist or penetrating trauma).<sup>32</sup>

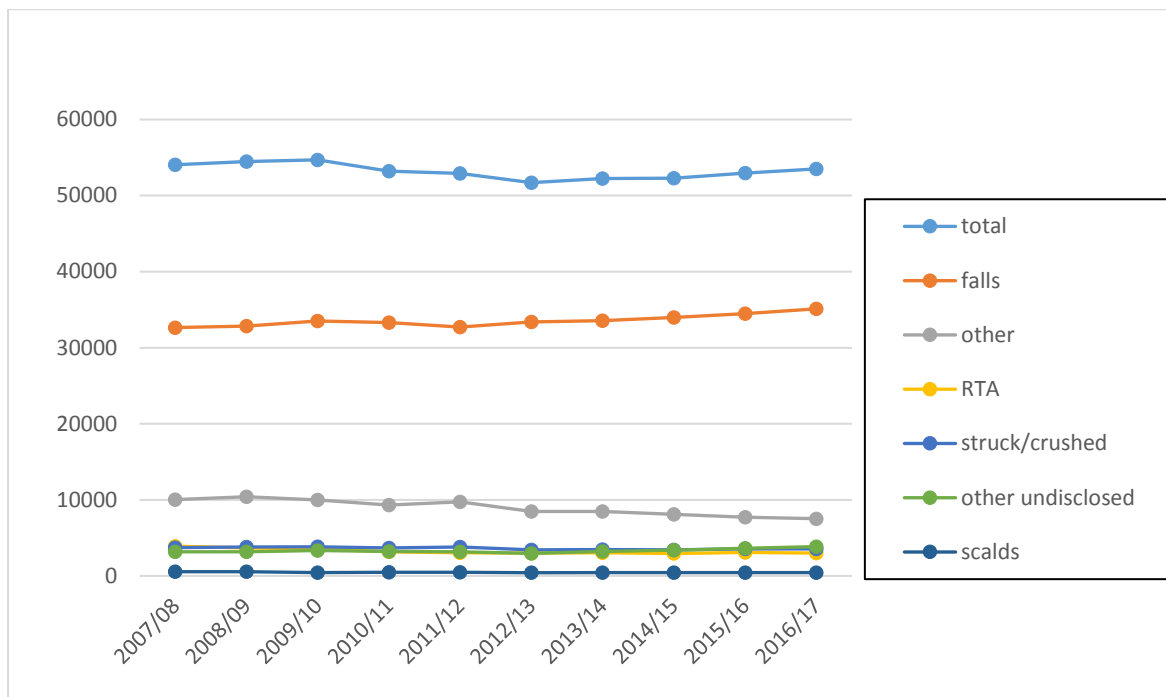
**Figure 4: Deaths from traumatic causes, Scotland 2013-2017; source NRS**



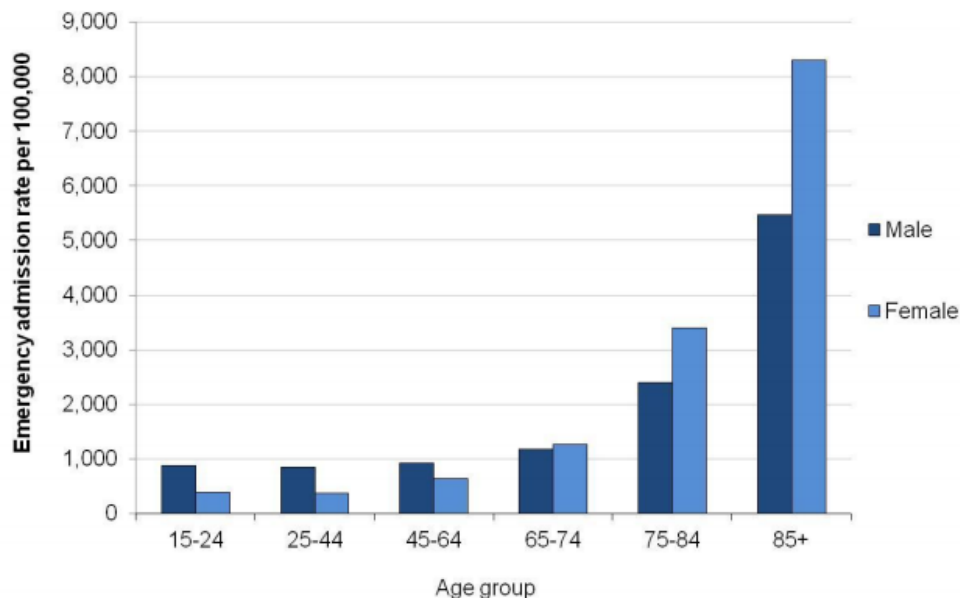
The picture of traumatic injury cases attending hospital services is also useful to this context. ISD's report on Unintentional Injuries in Scotland, 2018 outlines that emergency admissions to hospital for those aged 15 years and over in the year ending 31 March 2017 numbered 49,476, most commonly for long bone fractures and head injuries, an increasing trend (see **Figure 5**) since 2012/13.<sup>28</sup> These derived mainly from falls (more than 31,000 (64%)), with the next most common mechanism of trauma being road traffic collisions at 2,743. For children, aged less than 15 years, nearly half (47%) of the 7,221 unintentional children injured and admitted to hospital were as a result of a fall, again mostly due to fractures or head injuries.

The ISD report highlights that the proportion of injury admissions caused by a fall increases with age from 26% of emergency admissions for those aged 15-24 years to 91% for those aged 85 and over and particularly so for females (see **Figure 6**).

**Figure 5: Hospital admissions for unintentional injury in Scotland, Source ISD**

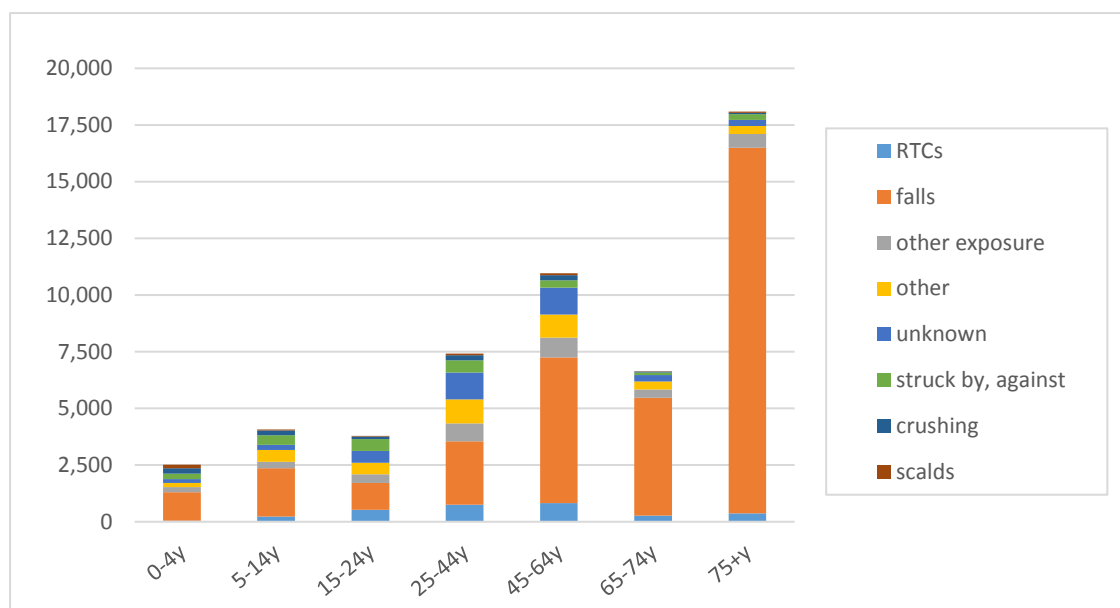


**Figure 6: Emergency hospital admissions of unintentional injury: adult rates (>15 years), Scotland 2016/17, Source ISD**



With this in mind, the most complete source available of Scottish unintentional injury data is from hospital activity sources, which by their nature exclude patients who have not attended hospital. Nonetheless these provide a useful description of trends by age groups and mechanism of injury as illustrated in **Figure 7** for 2016/17. Clearly hospital admissions for injury demonstrate an age gradient and falls are by far the most common mechanism across age groups.

**Figure 7: Emergency admissions for unintentional injury, Scotland 2016/17, Source ISD**



Falls, therefore, are a significant public health issue for all ages. The demographic pressure exerted by this risk factor places an even greater strain and cost burden on the NHS and partner services going forward, especially since such injuries affect functional decline and reduced confidence in older adults.<sup>33</sup>

Whilst undertaking such trend analysis is beyond the scope of this work, some indication of these effects can be gained from a simple reflection on the demographic changes projected over the next 25 years. Using 2014-based population projections the National Records of Scotland (NRS) projects that the total population of Scotland will grow from 5.35 million in 2014 to 5.70 million in 2039.<sup>34</sup> This overall increase in population is particularly notable for the elderly component since a 1.4% increase is projected for children aged less than 16 years, 1.2% increase for people of working age, yet 23.5% is foreseen for individuals of pensionable age to 2039. The repercussions for Scottish trauma care are important since falls in the elderly are a key factor, as illustrated by

Figure 6, which clearly demonstrates a steep age-related increase in emergency admissions from all causes of unintentional injury.

An increase in hospital deaths from unintentional traumatic injury of 11% (from 1,402 to 1,553) was recorded by ISD across Scotland in the year ending 31<sup>st</sup> December 2016 compared to the previous year, on a background of 2% increase in emergency admissions overall – this specifically excludes drug overdoses.

A clear socio-economic deprivation gradient is also noted for both adults and children with regards to emergency admissions from traumatic injury and for adult deaths from trauma, based on NHS activity data.

Scottish Trauma Audit Group (STAG) annual reports consider patients with major traumatic injury (ISS>15) where this has led to hospital admission.<sup>35</sup> Until recently, the STAG definition was limited to trauma cases of age 13 and over once they have arrived in hospital, with admission of at least three days duration or death (within 30 days of admission) to a participating hospital Emergency Department (27 of 30 currently participated in 2017). It is recognised that STAG does not provide a comprehensive Scotland-wide data set yet, but work is ongoing to complete national coverage.

STAG uses the Injury Severity Score (ISS), applied retrospectively, to categorise patients by case severity. In 2017 there were 3,796 STAG cases with significant trauma, of which 24% were minor (ISS<9), 53% were moderate (ISS 9-15), and 23% were major (ISS>15).

Of the 858 major trauma cases reported by STAG in 2017:

- a median age of 50-59 years was described, reflecting the ageing population, males accounting for 73% overall;
- the most common mechanism of injury was falls at 416 (48% of all major trauma), of which over half (n=244; 58%) were from standing height (<2 metres). Males (n=269) as accounted for more falls than females (n=147) suffered major trauma from falls; Men experienced proportionately more of the falls from height than females (M=14%, F=6%);
- Moving Vehicle Accidents (MVA)<sup>a</sup> accounted for 274 cases (32%) of major trauma; three times as many males (24%) as females (8%) experienced MVA major trauma;
- cases resulting from assault numbered 75 (9% of major trauma cases) and males strongly predominated;
- sports-related major trauma was relatively low at 20 cases (just over 2%);
- a further 60 cases were described as due to “other” causes;
- the crude mortality rate for patients included in the 2017 STAG audit was 7%, rising to 23% for those with major trauma. In all there were 303 deaths due to trauma.

The proportions by mechanism of injury varied according to severity. Briefly, it is useful to note that of the 3,796 mild, moderate or major trauma injuries included in the STAG audit, the most common major trauma was due to MVA (32%, 274/858), whilst standing falls were most common for both for moderate trauma (59%, 1,196/2,022) and minor trauma cases (49%, 452/916).

Alcohol remains an important factor across all severities of trauma, broadly consistent over the five year period as recorded by STAG. In 2017, alcohol, when recorded as a risk factor was noted in 24% of major trauma cases amongst men and 6% of women.

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<sup>a</sup> STAG Moving Vehicle Accident refers to any motor vehicle accident e.g. train, car, van etc. It includes bicycles but not motocross which is coded under sport injuries.

A brief comparison of the numbers of fatal cases of traumatic injury across these three quite different sources of data - NRS, ISD and STAG – for the year 2016 is provided in **Figure 7** and is potentially available for further meaningful analysis. It is important to note that depending on the information source and the definition employed, numbers may be quite selective or inclusive. For example, deaths from traumatic causes as registered in statute by NRS (2,138) or as recorded from NHS activity (1,364) or as analysed by STAG for all trauma cases (238) vary widely, each relating to a specific context. Therefore depending on the definition used to designate trauma cases and the population baseline from which they are sourced, numbers vary significantly which must be noted when quoting mortality figures.

**Figure 8: Trauma/injury deaths for Scotland: definitional differences**

	<b>NRS all external injury deaths</b>	<b>NRS only trauma injury deaths</b>	<b>ISD hospitalised injury deaths</b>	<b>STAG trauma deaths</b>
definition	comprehensive vital events registration of all external causes of deaths in Scotland	comprehensive vital events registration of external 'injury' causes of deaths in Scotland <sup>b</sup>	NHS Scotland activity, reporting fatal cases of injury of any severity, following admission to hospital	NHS Scotland activity, reporting fatal cases of major trauma (mostly ISS>15) within 30 days of admission to hospital via (selected) EDs
period	2016	2016	2016	2016
all ages	yes	yes	yes	>13 years
death follow-up	indefinite	indefinite	within admission	within 30 days of admission
<b>case numbers</b>	<b>23</b> (<15 yrs) <b>3,048</b> (≥15 yrs) <b>3,071</b> (all ages)	<b>~20</b> (<15 yrs) <b>~2,118</b> (≥15 yrs) <b>~2,138</b> (all ages)	<b>18</b> (<15 yrs) <b>1,346</b> (≥15 yrs) <b>1,364</b> (all ages)	<b>238</b> (>13yrs) mostly major trauma <sup>c</sup>
deaths at scene	included	included	not included	not included
overdose and other medication and medical intervention error deaths	included	not included	not included	not included
mode - falls (% of deaths)	878 (29%)	878 (~41%)	876 (64%)	133 (56%)
mode - transport (% of deaths)	206 (7%)	206 (~10%)	200 (15%)	53 (22%)

<sup>b</sup> Calculated by exclusion of ICD-10 codes for underlying cause of death from medication or overdose or healthcare events: X40-49, X60-84, Y10-19, Y60, Y40-84, Y83-84, Y87-88, Y87.2, Y90-91, Y95.

<sup>c</sup> These STAG figures regard all STAG deaths, including those recorded through STAG at ISS ≤15 and who died within 15 minutes of arrival in ED.

## 6 Violence and Major Trauma

The WHO defines violence as “the intentional use of physical force or power threatened or actual, against oneself, another person or a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, mal-development, or deprivation”. An international picture of violence statistics, legal framework and prevention programme/services is available by country, where the UK features comparatively well alongside many westernised countries, though all such injuries are ultimately preventable.<sup>36</sup>

In Scotland, 238,651 crimes were recorded by Police Scotland in 2016/17, of which 7,164 (~3%) were documented as non-sexual crimes of violence, a 6% increase from the previous year but one of the lowest recordings since 1974. 4,186 of these were serious assaults. Sexual crimes also increased from the previous year by 5% to 10,822, one of the highest annual numbers recorded since 1971. It is estimated by the Scottish Crime and Justice Survey (SCJS), a population-based survey, that approximately 50-70% of violent crimes in adults remain unrecorded, so such figures are highly likely to be under-estimates of violent crime, generally.<sup>37</sup>

A particular area of violence where under-recording must be taken into consideration is domestic abuse, of which there were 58,810 recorded by Police Scotland in 2016/17, a disappointingly stable picture since 2011. In 47% of these incidents a crime or offence had also been recorded, of which common assault was the most common type (37%), in just over 10,000 incidents. The most commonly affected age group was 26-30 year olds. Incidents occurred most commonly on Saturdays and Sundays (36%), with no seasonal pattern apparent. 88% of recorded domestic abuse incidents occurred in home settings and in 79% of cases, the victim was female and the accused male, a pattern that has been slowly changing since 2007. The SCJS 2014/15 reports that approximately 3% of respondents had experienced partner abuse in the previous 12 months.

In addition to assaults not being reported to Police Scotland, some incidents may not result in hospital attendance or admission, either due to death on site or they remain hidden to healthcare professionals. One study from a Scottish urban area in 2013 recorded a hospital attendance rate for interpersonal violence of 3.6 per 1,000 population, which could translate in up to 20,000 such attendances in Emergency Departments in a year across the country.<sup>38</sup> Yet ISD reports that in the year 2016/17, the number of individual cases of assault admitted to hospital was only 2,346. 22% of these involved injury from a sharp object.

From the annual STAG reports, assaults which resulted in either death or at least 3 days of inpatient stay for individuals over 13 years of age totalled 1,426 over a 6 year period (2011-2016), averaging just over 230 hospitalised assaults each year (an average of 73 of these were designated as major trauma, annually).



A decreasing trend of fatal assaults (murders or culpable homicides) has been seen over the previous 10 years in Scotland, with 61 in 2016/17. In this last year, a sharp instrument was involved in half of these; in only one, this was a gun.

The reasons for this trend and falling levels of some forms of violence in Scotland are bound to be complex and multi-factorial but significant interest has centred on the work of the Scottish Violence Reduction Unit (SVRU), set up in 2005 and based within the now legacy Strathclyde Police force.<sup>39</sup>

The SVRU adopted a public health approach to the problem of gang and knife violence and weapon carrying in the Glasgow area, drawing on international (primarily U.S.) experiences of tackling gang violence. In particular the development of a *Community Initiative to Reduce Violence* (CIRV) focused on the identification of gang members, encouraging agreements to abstain from violence, provided alongside access to various services, opportunities and support. Research indicates that this is likely to have reduced weapon carrying among those participating in the intervention.<sup>40</sup>

The SVRU continues to generate and apply several interventions including *Mentors in Violence Prevention* (school-based primary prevention) and secondary and tertiary prevention including *Street and Arrow*, an employability focused intervention recruiting ex-offenders and the *Navigator* project providing 1-to-1 support for those presenting to Emergency Departments as a consequence of violence.<sup>41</sup>

It must not be forgotten that beyond the immediate trauma, there will often be psychological, economic and social consequences.<sup>37</sup> As with all injury, violence can be the end point of a number of upstream factors found at societal, community, relationship or individual level, found many times along a pathway of maladaptive behaviour.

Addressing incidents where violence has been part of the response, can be fruitful in the longer run, such as through:

- reducing alcohol availability and consumption;
- addressing social inequalities;
- addressing adverse childhood experiences;
- tackling youth violence and a culture of weapon carrying amongst youths, gangs; and
- acknowledging the unequal position of women in society, as a contributor to domestic violence.

A secondary preventative approach, while not necessarily reducing the risk of violence, might reduce the consequences of major trauma resulting from violence.<sup>42</sup> This focuses on the instrument of violence or those settings where violence is most likely to occur, e.g. knife crime, gun shots wounds, concentration of licensed nightspots and gang culture “turf” wars.

Many of these factors are inter-related and so both primary and secondary prevention of trauma must take a multi-faceted approach in order to have an impact on the consequences of violence. An in-depth review of violence and associated preventative measures can be found in ScotPHN Violence Prevention: A Public Health Priority.<sup>38</sup>

Trauma must therefore be seen as a public health issue not only due to its impact on populations and the health services they use, but also because much of it is avoidable.

## **7 Evidence for Action**

The National Institute for Health and Clinical Excellence produced three Public Health Guidelines for preventing unintentional injury during 2010. Whilst Public Health Guidance 29, 30 and 31 focus on evidence and action for preventing unintentional injuries in children, their recommendations are relevant to wider age groups and populations.<sup>7,43,44</sup> These guidelines suggest that leadership is essential for action to be taken, particularly at national level (e.g. Public Health Observatories). They also note that Public Health should be the main driver for facilitation and local delivery and should provide professional responsibility for injury prevention. It is evident that major trauma and all trauma prevention requires a multi-agency partnership approach and is a complex issue in which health needs to play a pivotal role.

In order to identify and consider primary prevention approaches for major trauma, a selective literature review was initially undertaken. It focused on reviews utilising the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement that outlines the process of the development of protocols to ensure that specific items are included within a review.<sup>45</sup> Using the revised PRISMA approach enhances the quality of the systematic reviews.

The search strategy included: Falls, Burns and Scalds, Road Transport/Traffic injury, Major Trauma, Workplace injury, Violence and Sporting injury incidents and prevention. The searches were carried out using Medline, Web of Science, ASSIA, Cinahl, Proquest Public Health, Campbell Collaboration and Cochrane databases. Grey literature was also searched. The time period searched was from 2011-2017 and only literature in the English language was selected.

The literature search was updated in October 2018 to include searches of Medline, Web of Science, Proquest Public Health and Epistemonikos, as well as a search for grey literature. The literature search was also extended to consider both national and local strategy and policy as well as specific topics. The literature, and in particular the systematic reviews, facilitates a greater understanding of where evidence-based primary prevention activities have been developed and published for further consideration and implementation. This process also supports identification of gaps

and areas where further focus may be merited, as well as prompting the question, what next?

## 7.1 Road Traffic / Transport Injury

As previously mentioned, over recent decades, roads and road safety have benefited from a great deal of injury prevention activity resulting in reduction in fatalities and severe injury.

Haddon's Matrix considers human factors, vehicle and equipment factors and environmental factors in pre-event, event and post-event phases of road traffic incidents to discern where action should be taken. Each category of factors is estimated to contribute to 90-95% (human factors), 28-35% (vehicle and equipment factors) and 8-10% (environmental factors) of events respectively.<sup>46</sup> A number of key factors are acted upon or could be acted upon; some examples are provided here.

Speed cameras, including those targeting average speeds have been in operation for years and have a reasonably robust level of evidence-base to back up their effectiveness, despite methodological issues.<sup>47</sup> 20 mph speed restrictions also have an increasing base for effectiveness and preliminary cost-effectiveness in an effort to tackle injuries, especially in children.<sup>48</sup>

Outwith the UK, implementation of a graduated driving licence scheme, is backed up by a good evidence-base. Russell *et al* show that such schemes are effective in reducing crash rates in the first year by approximately 16%, among 16 year old drivers.<sup>49</sup> This is also supported by a moderate quality evidence base deriving from STAT19 dataset analysis where "the main risk factors for road traffic injury to 15-19 year olds are travelling with occupants of a similar age or between 9 pm and 5.59 am".<sup>50</sup>

A UK Department of Transport commissioned review of risk factors and interventions aimed at improving young driver safety by Pressley *et al*, presents a wider review of the evidence on this topic concluding that robust evaluation should be undertaken of promising interventions aimed at:<sup>51</sup>

- engaging parents in managing post-test driving in specific risky situations;
- engaging a range of stakeholders (and utilising a logbook approach) in increasing the amount and breadth of pre-test on-road experience;
- utilising technology (in-vehicle data recorders or 'telematics') and possibly parents to manage driver behaviour post-test; and
- effectively training on hazard perception skills.

Interestingly, the view that traditional educational sessions can impact significantly on crash and collision incidence has not been upheld for many years now either in pre- or post-license situations and yet this remains the primary intervention in operation for learner drivers in the UK.<sup>51,52</sup>

Desapriya *et al* recognise the need to consider vision screening of older adults and the importance of good vision for safe driving for all.<sup>53</sup> However they found that to date there has been no methodologically sound study on this issue.

Stavrinou *et al* have systematically reviewed the literature on the role of mobile phones as risk factors contributing to distractedness and resultant injury for pedestrians and drivers.<sup>54</sup> From the identified low to moderate quality studies, they concurred that mobile technology use impairs youth safety on the roads. Primary prevention using legislation and enforcement on a number of fronts is proposed by Staton *et al*.<sup>55</sup>

Carey *et al* have systematically reviewed the impact of Daylight Saving Time (DST) changes, i.e. shifting daylight to evenings from mornings, using evidence from several high-income countries across four decades.<sup>56</sup> Their interest stems from calls in the UK and Ireland for a permanent move to Central European Time to reduce road traffic accidents. The findings of studies measuring the short-term effects of changes to DST on road traffic collisions, injuries and fatalities are inconsistent. Those focused on longer term effects are more consistent in terms of reducing risk but the review authors suggest caution in the use of findings particularly as most studies did not focus on permanent shifts in time-zones. The review therefore does not support or reject the notion that a permanent shift in light would have a road safety benefit.

Daniels and Risser suggest that whilst many countries have made progress in reducing injuries, fundamental challenges remain.<sup>57</sup> They highlight research and literature with a focus on prospective methodology, less reliant on relatively infrequent retrospective crash injuries to analyse safety effects including reducing speed limits on roads, cycling and cyclists, child restraints and pedestrian safety.

In relation to motorcycles, Araujo *et al* have systematically reviewed the literature to evaluate the effectiveness of interventions to prevent motorcycle crashes.<sup>58</sup> The findings, based on 20 studies, including 11 systematic reviews and 9 observational studies, indicate that the most effective prevention measures (excluding those already a legal requirement in the UK) include use of protective clothing and use of anti-lock brakes. Potentially effective measures were identified as including low speed zones in urban areas, greater penalties for speeding, and driving under the influence of alcohol and more restrictions on obtaining a license. Ineffective measures identified include zero tolerance alcohol laws for those under 21 years, use of daytime running lights and traffic calming interventions on urban road networks. Measures not well evaluated included graduated licensing, protective devices for legs, reflective clothing, measures to combat fatigue and restriction on engine power on motorcycles used by young drivers.

For all-terrain vehicles (ATV) (including quad-bikes), Rattan *et al* have systematically reviewed the literature focused on initiatives designed to improve safety.<sup>59</sup> Based on primarily U.S. studies deemed low quality, the review nevertheless concludes that there is sufficient quality evidence to recommend that helmet use decreases the

incidence of traumatic brain injury among ATV users, both adults and children. They conditionally recommend using legislation as a method to increase helmet use among ATV riders. They were unable to support or reject the need for non-helmet protective gear, and recommend the use of ATV safety legislation, and its enforcement, to reduce injuries.

The literature identified focuses mainly on road transport. Data for train-related injury is published by Transport Scotland 2018 and includes suicides as well as non-intentional deaths and injuries through roads and motorways, air, rail and ferry-related incidents.<sup>60</sup>

## **7.2 Sport injuries**

The literature on injury prevention in sporting activities is extensive and focuses on regular or supervised types of sport. Some examples recommend improving physical fitness and game rule amendment to prevent and protect against injury whilst playing and competing in organised, supervised or team sports.

Abernethy *et al* 2007 focus on injury prevention in supervised sports in their systematic review on adolescents, specifically excluding higher risk sports such as equestrian, snowboarding, skiing, ice hockey, and motorised sport.<sup>61</sup> Key findings illustrate the effectiveness of pre-season conditioning, balance training and education in preventing injury. Preventative interventions centring on the use of protective equipment were not generally supported. Lauersen *et al* concluded that non-stretch strength training reduces both acute and overuse sports injuries.<sup>62</sup>

Woollings *et al* sought to explore risk factors and prevention of injury in climbing and bouldering.<sup>63</sup> Their results with regards to injury prevention are inconclusive, noting the relative newness of the sport.

Kontos *et al* explored the still debatable issue of harm from 'heading' in football, but primary prevention was not addressed.<sup>64</sup>

In relation to musculoskeletal injuries among adult recreational footballers, Kilic *et al* systematically reviewed the evidence on the most common injuries, football-specific risk factors for these, and injury prevention.<sup>65</sup> The Nordic Hamstring Exercise and FIFA11+ injury prevention programmes were found to be effective for the reduction or prevention of musculoskeletal injuries among this group.

More widely, Gledhill *et al* systematically reviewed studies examining the role of psychological interventions in sports injury prevention to determine 'real-world' effectiveness.<sup>66</sup> They reviewed 13 papers, characterised by various methodological limitations including small sample size, focused on interventions that included stress management, relaxation, goal setting, mindfulness, breathing and confidence training. The findings indicate that psychological interventions particularly those with a stress reduction focus, are effective in reducing sports injury rates and injury time loss.

Concerning cycling injuries, Olivier *et al* offered robust conclusions on the effectiveness of helmet use in reducing serious and fatal head injuries and other lesser harms.<sup>67</sup> Hoyer systematically reviewed studies focused on the use of mandatory bicycle helmet legislation and the impact on head injury in adults and children.<sup>68</sup> The findings from 21 studies provide an indication that mandatory helmet legislation reduces head injuries in general, but particularly for serious head injury. Legislation that applies only to children was not found to have any statistically significant effect on all types of head injury among adult cyclists. Among children, larger effects were found when bicycle helmet legislation was applied to all cyclists, not solely children.

In terms of road-using adult cyclists, helmet wearing and facial injury, Fitzpatrick *et al* systematically reviewed studies that compared helmet users to non-helmet users, and that reported incidences of facial injury in each group.<sup>69</sup> The findings from nine number of studies suggested that bicycle helmets may offer some protection against facial injuries and facial fractures (an earlier systematic review concluded that bicycle helmets protect the upper and middle face from serious facial injury but not the lower face<sup>70</sup>) but given the complexity of injury, the review authors suggest that attributing the presence or absence of an injury to helmet use alone is potentially problematic.

Woodfine *et al* noted a particular risk in the six months following a birthday, for use of off-road vehicles including snowmobiles, suggesting that helmets should be included in such gifts.<sup>71</sup> Similarly, Davison *et al* also recognised the protective effects of helmet wearing, though interestingly no difference in terms of socio-economic risk factors (in Canada) were evident.<sup>72</sup> Non-legislative interventions are explored by Owen *et al* who report that these appear to be effective in increasing cycling helmet use, particularly through community-based interventions and when helmets are provided free.<sup>73</sup>

The risk of swimming as a leisure activity features in studies on accidental drowning and near-drowning such as by Wallis *et al* and Vecino-Ortiz *et al* where educational interventions, swimming instruction, access barriers and supervision are cited as effective to some degree in preventing drowning in children and youths.<sup>74,75</sup>

In summary, whilst a wealth of sport-related literature exists, it generally focuses on the prevention of injury in organised, lower risk or more commonly participated in team sports and the prevention of injury for them. Few systematic reviews or meta-analysis have been identified which focus on the more unusual or extreme sporting activities or for primary prevention of major types of sporting injury.

### **7.3 Falls in houses and in public places**

Falls can occur at a person's home, on the roads and pavements and also at a person's workplace. Persons of all ages are at risk of, and can and do fall. The Scottish Government's Framework for Action for the Prevention and Management of Falls in the Community takes an evidence-based approach, though consistent implementation remains a challenge for Health and Social Care Partnerships.<sup>76</sup>

NICE Guideline 161 and Cochrane reviews on the prevention of falls in the community and in care facilities provide an emerging picture for effective interventions.<sup>77,78,79,80</sup>

Systematic reviews focused on community dwelling older people provide some evidence of effectiveness across a range of interventions (multifactorial, multiple component, exercise and Vitamin D interventions). Hopewell *et al* indicate that multifactorial interventions (exercise, environment or assistive technologies, medication review and psychological interventions) and multiple component interventions (such as exercise with another component, e.g. education or home-hazard assessment) may reduce the rate of falls compared with usual care or attention control.<sup>81</sup>

Guirguis-Blake *et al* focus on vitamin D supplementation, exercise interventions (12 months duration, 3 sessions per week); and multifactorial interventions (e.g. exercise, psychological, nutrition, medication management, environment modifications).<sup>82</sup> The findings indicate that multifactorial interventions were associated with a reduced incidence in the rate of falls and multifactorial and exercise interventions were associated with fall-related benefits, but the evidence was most consistent for exercise. Vitamin D supplementation interventions were found to have mixed results, with a high dose being associated with higher rates of fall-related outcomes.

Cheng *et al* indicate that multifactorial interventions; education and exercise; exercise and hazard assessment and modification; exercise with risk assessment and suggestion might be the most effective interventions in reducing falls.<sup>83</sup>

Sherrington *et al* systematically reviewed the evidence around the provision of exercise as a single intervention to prevent falls.<sup>84</sup> The findings indicate that there is strong evidence that exercise as a single intervention prevents falls and that programmes that involve a high challenge to balance and include more than 3 hours per week of exercise have greater fall prevention effects. There was no evidence that exercise could prevent falls in residential care settings, among stroke survivors or people recently discharged from hospital.

A Public Health England literature review has identified several cost-effective interventions to prevent falls, including exercise programmes, in older people living in the community and generalisable to the UK.<sup>85</sup> These include the Otago programme for home based exercise; the Falls Management Exercise (FaME) community based group programme with additional home exercises; Tai Chi or Tai Ji Quan exercises, at home or in the community; and home assessment and modification to identify environmental hazards and reduce risks.

Several systematic reviews have focused on Tai Chi as a means of preventing falls in older people, and Huang *et al*, based on 18 trials, indicate that Tai Chi significantly reduces the number of fallers and the rate of falls, and that the preventative effect increases with exercise frequency and type of Tai Chi practiced.<sup>86</sup> Lomas-Vega *et al* reviewed 10 trials, deemed low quality, that suggest that Tai Chi can offer a protective

effect for fall incidence in the short term and less so in the longer term, although Tai Chi practice may not influence time to first fall.<sup>87</sup>

Across all settings, Tricco *et al* systematically reviewed fall-prevention interventions for older people in the community and within a range of institutional settings (hospital, clinic, long term care etc.).<sup>88</sup> The findings, drawn from 283 RCTs, indicate that exercise alone and various combinations of interventions (exercise, vision assessment and treatment, environmental assessment and modification, multifactorial assessment and treatment, and vitamin D supplementation) were associated with lower risk of injurious falls compared with usual care. The combination of exercise along with vision assessment and treatment was identified as the intervention most strongly associated with reduction in injurious falls. However, the review authors suggest that the findings indicate a need for a tailored approach as some combinations of the interventions, including exercise, may increase risk of falls among patients who had fallen previously.

More specifically for care settings, the evidence appears inconclusive. Cameron *et al* systematically reviewed the evidence around interventions aimed at preventing falls in older people in residential or nursing care facilities, or hospitals.<sup>79,80</sup> The findings indicate that exercise may make little or no difference to the rate or risk of falling in care facilities. General medication review may make little or no difference to the rate or risk of falls in care settings, and there is moderate-quality evidence that vitamin D supplementation probably reduces the rate of falls but not risk of falling in care facilities. Multifactorial interventions may make little or no difference in the rate or risk of falls in care settings. In hospitals, the impact on rate and risk of falls of additional physiotherapy in rehabilitation wards is unclear. Likewise for the effects of bed and chair sensor alarms in hospitals or for the multifactorial interventions.

Francis-Coad *et al* systematically reviewed complex falls prevention interventions (delivered across at least two or all of the following levels: resident, residential facility or residential organisation) for older people in long term care settings.<sup>89</sup> Based on a small number of studies, 12, delivering a variety of interventions, the findings indicate that there was no significant reduction in fall rates or the proportion of residents who fell, but likelihood of fall may be reduced when the interventions were also supported by additional staffing, expertise or resources.

In relation to acute care settings, Avanecean *et al* systematically review the evidence to assess the effectiveness on falls of patient-centred interventions aimed at adults in the acute care setting.<sup>90</sup> The limited evidence base (5 RCTs) indicates that patient-centred interventions (e.g. communication tools aimed at nurses, person-centred education, exercises, assessments of medication lists, examinations for need of corrective lenses, assessments for infection and the need for ambulatory aids) in addition to tailored patient education might have the potential to be effective in reducing falls and fall rates in acute care hospitals.



A systematic review focused on the use of bedrails in preventing falls among hospitalized older adults to no use of bedrails or any type of physical restraints was unable to identify scientific evidence comparing use.<sup>91</sup>

Among older people hospitalised and then discharged to the community, Naseri *et al* systematically reviewed the evidence, deemed low to moderate in terms of quality, that evaluated falls prevention interventions.<sup>92</sup> Interventions were delivered, or were initiated in hospital, within one month post-discharge and measured falls outcomes within at least 6 months after discharge. Interventions included those centred on home hazards, exercise, balance and resistance training, nutrition, educational interventions and geriatric team management. The findings, based on 16 RCTs, identified limited evidence that home hazard modifications reduced falls outcomes.

In terms of interventions aimed at older people – with cognitive impairment, Gagnon-Roy *et al* using a scoping review sought to identify the evidence surrounding incidents (falls, burns, transport accidents, harm due to self-negligence or wandering) among cognitively impaired older people leading to emergency department visits and hospitalisation, and the preventive measures that might reduce such incidents.<sup>93</sup> Falls, transport accidents and burns provide the three main reasons why older people with and without cognitive impairment present to Emergency Departments, although little is known about the circumstances in which the incidents occurred. Although many potential preventive measures were identified, few were tested with older cognitively impaired adults.

The rate and risk of falling were reduced in community settings in group and home-based exercise programmes (including Tai Chi) and home safety interventions with the effectiveness of the latter increasing when delivered by occupational therapists. In care facilities, there appears to be a role for vitamin D supplementation in reducing the risk of falls but conflicting results remain for the role of exercise, though in hospitals exercise appears to be effective. Multi-factorial interventions in both settings provide some benefit; in community settings this can include individual risk assessments, selected cataract and/or pace-maker interventions, medication review but cognitive behavioural and educational interventions did not have significant impact. Compliant flooring or soft energy absorbing flooring is identified by Lachance, however, inconclusive results are presented in relation to prevention of the fall itself.<sup>94</sup>

Alcohol consumption associated with major trauma injuries is identified in the repeated STAG reports as a risk factor for falls and is consistent with an epidemiological review by Kool in falls among young and middle-aged adults.<sup>95</sup> A multitude of evidence supports the effectiveness of alcohol brief interventions in a variety of settings such as; primary care, emergency departments, hospital and digitally. Though such conclusions are significantly less apparent or all together absent for ante-natal and school settings, or where significant mental illness or co-substance misuse exist.

<sup>96,97,98,99</sup>

Sanchez-Ramirez and Voaklander systematically reviewed the evidence of the impact of policies regulating alcohol trading hours and days on outcomes including assault and violence, motor vehicle crashes and fatalities, injury, visits to the emergency department and hospital.<sup>100</sup> Interventions of interest included restriction, or extension, of alcohol trading hours and removal of alcohol sales bans on specific days. The findings of the review, based on 26 studies (primarily drawn from high-income countries including the U.S., Canada, Australia, U.K., Germany and Sweden), indicate that policies that restrict the times of alcohol trading and consumption can contribute to reducing injuries, alcohol-related hospitalisations and emergency department visits, homicides and crime. However, the association between alcohol trading policies with assault and violence, and motor vehicle crashes and fatalities while positive, is thought to be complex.

#### **7.4 Burns and scalds**

Literature suggests that the more serious burns and scalds occur as a result of domestic house fires and bath scalds, but this type of exposure also includes burns as a result of exposure to live fire, flame and smoke, hot water or steam contact from bath water scalds and hot drink scalds.<sup>101,102</sup> The evaluation of the effectiveness of primary prevention approaches is disappointing. Turner *et al* identified four controlled community-based studies on this issue, only two of which were confirmed to be of useful quality, neither of which demonstrated that such approaches reduce child injury from burns.<sup>103</sup> More recent reviews by Pearson *et al* and Kendrick *et al* focussing on the wider topic remit of household safety equipment and injuries confirmed this and specifically noted that although the proportion of families with safe hot water temperatures, functional smoke alarms and a fire escape plan can be increased, this was not reliably sustained over time, that socio-economic implementation inequalities featured and that outcome data infrequently included health/injury outcomes, but only selected process indicators.<sup>104,105</sup>

The role of parenting and injury prevention was reviewed by Kendrick *et al*, not solely linked to burns and scalds, where a moderate level of study quality supported a conclusion that parenting interventions provided in the home focussing on economically disadvantaged groups were effective in reducing injury in children.<sup>106</sup> However, the best setting for such injury prevention educational opportunities leading then to true impacts has not been identified.<sup>107</sup>

#### **7.5 Suicides**

Efforts in the primary prevention of suicide have been successful when looking at trends over the past 10 years but this progress has slowed in more recent times.<sup>108</sup> The revised Suicide Prevention Action Plan promotes empathy, support and specific training targeted at those risk but also support for bereaved families.

## 7.6 Workplace

Several systematic reviews and a systematic literature review focus on injury prevention in the agriculture industry but provide little conclusive evidence of what works to prevent or reduce injury. Rautiainen *et al* considered studies that included a combination of educational interventions (e.g. financial incentives, written information, visits and discussion, courses and safety checks).<sup>109</sup> However, the effect sizes of such interventions were deemed small and not statistically significant. A systematic literature review by Nilsson evaluated intervention projects on injury prevention, which included those over the age of 55, working in agriculture.<sup>110</sup> The small sample of studies suggested that a lack of injury decrease among older agricultural workers was a consequence of reduced intervention participation in programmes, to apply new safety practices post-intervention, or to use safety equipment such as tractor roll-bars after receiving safety information. Volkmera and Molitor systematically reviewed interventions, addressing injury prevention and management among agricultural workers and the role of occupational therapists.<sup>111</sup> Based on a limited pool of low quality evidence the review authors indicate that there was moderate evidence of effective interventions within the scope of occupational therapy practice.

A systematic review by van der Molen *et al* looked at the evidence focused on preventing fatal and non-fatal injuries in construction workers.<sup>112</sup> The findings based on 17 studies, deemed poor quality and at high risk of bias, drawn from high-income countries, indicate that most interventions have not been adequately evaluated. The review findings indicate that there is very low-quality evidence that introducing regulations may or may not result in a decrease in fatal and non-fatal injuries. Regionally oriented safety campaigns, training, inspections or the introduction of occupational health services may not reduce non-fatal injuries in construction companies. Company-oriented safety interventions such as a multifaceted safety campaign, a multifaceted drug workplace programme and subsidies for replacement of scaffolding may reduce non-fatal injuries among construction workers.

## 8 Current National Activity to Prevent Injury

Following the Scottish Government's Building Safer Communities (BSC), Phase 1 and its strategic approach to crime reduction as part of the justice change programme, BSC Phase 2 was launched with the aim of "reducing unintentional physical and psychological harm that could have been predicted and prevented".<sup>6,113</sup> A suite of resources are available on the BSC website providing comprehensive analysis and an evidence-based approach to injury prevention. These are:

1. National Strategic Assessment for Unintentional Harm;
2. National Strategic Assessment summary report; and
3. Thematic papers for:

- Children and Young People;
- Road Safety;
- Home Safety;
- Deprivation;
- Older people; and
- Outdoor safety.

BSC's thematic papers have been designed for practitioners with an interest in particular aspects of unintentional harm and also for policy makers. The papers provide key information about particular issues and also support practitioners to tackle unintentional harm locally using the further reading/support links and case studies. They have also been designed to be used in conjunction with the linked National Strategic Assessment for Unintentional Harm with data from a number of partnership sources e.g. Scottish Ambulance Service and ISD etc. Priority areas in the National Strategic Assessment include: a) the under-fives, b) the over-65s, c) socio-economic deprivation, d) strategic data gathering, sharing and analysis, and e) bridging the gap between strategy and delivery.

**Figure 9**, below outlines existing frameworks, policies and regulations relevant to primary injury prevention activity grouped by settings, as identified in literature and through mapping; gaps are noted.

**Figure 9: Mapping Policy, Frameworks and Regulations and Primary prevention**

Place	Mechanisms	Framework Policy/Regulation	Primary Prevention activity	Partners identified	Gaps
Public Places	Road Traffic Incidents	Road Traffic Act Scotland 1988  Road Traffic Regulation Act 1984	<ul style="list-style-type: none"> <li>• dangerous and careless driving offences.</li> <li>• driving under the influence of alcohol or drugs</li> </ul>	Scottish Government, Police Scotland	
Public Places	Road Traffic Incidents – cycling	Cycling Action Plan for Scotland 2017 - 2020 <sup>114</sup>  The Highway Code (UK) <sup>115</sup>	<ul style="list-style-type: none"> <li>• Introduction of a 30 km/h or 20 mph speed limit in built-up areas</li> <li>• Continue to support 3 levels of UK Bikeability Scotland for 100% of participating schools to deliver training, provide access to cycles and secure parking, increasing cycling at all levels</li> <li>• Use of planning policy - Designing Streets and Smarter Choices, Smarter Places as good practice<sup>116</sup></li> </ul>	Scottish Government, Local Authority, Police Scotland, Scottish Fire and Rescue, Road Safety Scotland, Community Safety Partnerships and Private Sector.	<ul style="list-style-type: none"> <li>• SOA's - Local Transport Strategies each contain area-specific aims and objectives. Health is not always specifically listed as a partner</li> <li>• Standardised recording - STAT 19's and marrying up with ISD Hospital admission data, etc<sup>12</sup></li> <li>• Understand Las' processes for road safety provision, e.g. enforcement of speed limits 20MPH and Motorway responsibility? Mapping these against all RTI's or other travel-related incidents &amp; injuries.</li> <li>• Child and adult death reviews - are findings used?</li> </ul>
Public Places	Road Traffic Incidents	Go Safe on Scotland's Roads, It's Everyone's Responsibility. Scotland's Road Safety Framework to 2020 <sup>14</sup>	<ul style="list-style-type: none"> <li>• Investigate what part alcohol is playing in pedestrian casualties</li> <li>• Pedestrian training and active travel for both older adults and children</li> <li>• Separation of opposing lanes of traffic on single carriageway rural roads</li> </ul>		<ul style="list-style-type: none"> <li>• From age 70, drivers are required to renew their driving licence with no requirement to produce evidence of fitness, they are required to notify medical conditions that may affect driving<sup>44</sup></li> <li>• Use of speed cameras and average speed cameras to reduce speeds on roads<sup>47</sup></li> <li>• Practical training for pedestrians</li> </ul>

					<ul style="list-style-type: none"> <li>• <a href="#">Kerbcraft</a>, a child pedestrian training resource developed by the University of Strathclyde.</li> </ul>
Public Places	Road Traffic Incidents	TRANSPORT SCOTLAND. 2014. Good Practice Guide on 20 MPH Speed Restrictions <sup>117</sup>	<ul style="list-style-type: none"> <li>• Reducing speed - 20 mph speed restrictions can also help promote active travel choices, resulting in improvements to local and wider environment</li> </ul>		
Public Places	Road Traffic Incidents	Scotland's National Transport Strategy, 2016 <sup>118</sup>	<ul style="list-style-type: none"> <li>• Separation/segregation of different types of road users, e.g. lorries, cars, cyclists, pedestrians<sup>44</sup></li> </ul>		
Public Places	Road Traffic Incidents	PH Guidance 31 NICE Guidance Road Safety <sup>44</sup>  Reducing unintentional injuries on the roads among children and young people under 25 years <sup>119</sup>	<ul style="list-style-type: none"> <li>• Consider changes to speed limits, appropriate engineering measures on rural, in line with DfT guidance</li> <li>• Implement city or town-wide 20 mph limits and zones, using traffic volume, speed, function to determine which.</li> <li>• Develop engineering measures for safer routes commonly used by children/young people, including to school: parks, colleges, leisure sites<sup>116</sup></li> </ul>		<ul style="list-style-type: none"> <li>• STATS 19 is not a complete or perfect dataset (Department for Transport 2009).</li> <li>• estimates, based on national travel survey, estimate a total number of casualties around three times the number recorded in STATS 19.<sup>32</sup></li> </ul>
Public Places	Road Traffic Incidents	Road Safety Framework Scotland Mid-term Review 2016 <sup>120</sup>	<p>The overarching aim, in moving towards the Framework's Vision Zero, is to reduce the number of people killed and seriously injured across three Priority Focus Areas.</p> <ul style="list-style-type: none"> <li>• speed and motorcyclists</li> </ul>		<ul style="list-style-type: none"> <li>• What do national and local action plans include following the mid-term policy review?</li> </ul>

			<ul style="list-style-type: none"> <li>• pre-drivers, drivers aged 17 to 25 and older drivers</li> <li>• cyclists and pedestrians</li> </ul>		
Public Places	Road Traffic Incidents	Child Safety Report Card for Scotland. 2012 <sup>121</sup>	<ul style="list-style-type: none"> <li>• Enhancing pedestrian safety through legislation placing burden of proof on driver in child pedestrian crashes and supporting efforts to modify European vehicle design standards, e.g. pedestrian friendly bumper heights</li> <li>• Enhancing <b>passenger/driver safety</b> with national laws that children remain seated rear-facing until age 4 years, that children and adolescents seated in the back seat of a motorised vehicle until age 13 years, graduated licensing for new drivers</li> <li>• Enhancing cycling safety by legally requiring bicycle helmet use for all ages</li> </ul>		<ul style="list-style-type: none"> <li>• Legal driving age and graduated driver licences and prioritising child walking and cycling in road design<sup>122</sup></li> <li>• Assessment of ability to drive and any medical impairments e.g. sight, medication and cognitive ability as well as physical ability</li> <li>• Zero tolerance for alcohol?</li> <li>• Setting (and enforcing) lower blood alcohol concentration limits for novice drivers and zero tolerance for offenders</li> </ul>
<b>Place</b>	<b>Mechanisms</b>	<b>Framework Policy/Regulation</b>	<b>Primary Prevention activity</b>	<b>Partners identified</b>	<b>Gaps</b>
Public Places	Violence	Building Safer Communities, phase 1 <sup>113</sup>	<p>Acting on risk factors for violence</p> <ul style="list-style-type: none"> <li>• alcohol control via minimum unit pricing</li> <li>• alcohol licensing</li> <li>• street violence initiatives (at the same time)</li> </ul> <p>Reduce access to tools of violence –</p>	<p>Police Scotland</p> <p><a href="#">Violence Reduction Unit</a> <a href="#">Medics Against Violence</a></p> <p><a href="#">SHAAP</a></p> <p><a href="#">No Knives, Better Lives</a></p>	<ul style="list-style-type: none"> <li>• While A&amp;E departments involved no automatic inclusion of Public Health in all partnerships.</li> <li>• Limited evaluation for street violence initiatives which is usually for pilots rather than large-scale.</li> </ul>

			<ul style="list-style-type: none"> <li>• knife availability</li> <li>• stop and search</li> <li>• reduce attitudes to tools, acts of violence through education initiatives</li> <li>• Work with gangs to reduce need for gangs or poverty or turf wars</li> <li>• Reduce poverty, inequalities so violent acts are not status mark</li> </ul>		
Public Places	Violence	Alcohol Minimum Pricing Act (2012) and relevant order <sup>123</sup>	<ul style="list-style-type: none"> <li>• Reduces access to alcohol through alcohol by volume pricing.</li> </ul>	<ul style="list-style-type: none"> <li>• Scottish Government, local authorities</li> </ul>	
Public Places	Violence	<a href="#">Getting it Right for Every Child</a>	<p>Suspected child abuse</p> <ul style="list-style-type: none"> <li>• Awareness of age at which abuse is most likely to occur (0-12 months).</li> <li>• Awareness that assault is more likely to happen to males</li> <li>• Awareness of association with deprivation</li> </ul> <p>Work on poverty and inequalities</p>		
Public Places	Violence	<a href="#">Equally Safe</a>	<p>Gender-based violence</p> <ul style="list-style-type: none"> <li>• Work on accepted gender roles</li> <li>• systematic inequalities</li> <li>• attitudes to women in society</li> </ul>	COSLA VAW Partnerships	
<b>Place</b>	<b>Mechanisms</b>	<b>Framework Policy/Regulation</b>	<b>Primary Prevention activity</b>	<b>Partners identified</b>	<b>Gaps</b>
Public Places	Sporting Injuries  Team sports	Physical Activity Implementation Plan: A More Active Scotland 2014 <sup>124</sup>	<ul style="list-style-type: none"> <li>• Promoting and ensuring the application of sensible,</li> </ul>	Sport Scotland, Scottish Government, Local Authority, HSCP's and Public Health	<ul style="list-style-type: none"> <li>• Consistency in use and assessment of safety equipment standards, e.g.</li> </ul>



	<p>Motocross, Bungee jumping and motorised leisure activities.</p> <p>Swimming</p> <p>Cycling</p>	<p>HSE Sector Plan for Sport and Leisure<sup>26</sup></p> <p>The UK Drowning Prevention Strategy<sup>125</sup></p> <p>Scotland's Drowning Prevention Strategy<sup>126</sup></p>	<p>effective, proportionate risk management</p> <ul style="list-style-type: none"> <li>• regulation for new and novel equipment and activities</li> <li>• Recommendations on helmets for cycling</li> <li>• Raising water safety awareness through schools and swimming lessons</li> </ul>		<p>helmets for cycling, horse riding or skiing</p> <ul style="list-style-type: none"> <li>• Amended rules for game play, e.g. rugby under 19's and reduced spinal injuries; head injury and football</li> <li>• Identification of most common sports resulting in major trauma</li> <li>• Evidence base relevant to extreme or adventure sports</li> <li>• The role of supervision and instructor controlled/regulated environments Vs non- supervised or controlled use.</li> <li>• Motocross: regulation and training for users/instructors Vs self-taught and self-regulated</li> <li>• Inequalities as a determinant for sports injuries</li> </ul>
Place	Mechanisms	Framework Policy/Regulation	Primary Prevention activity	Partners identified	Gaps
Public Places	<p>Work-related injuries</p> <ul style="list-style-type: none"> <li>- logistics and transport</li> <li>- agricultural</li> <li>- construction</li> <li>- manufacture</li> </ul>	<p>The Health and Safety at Work etc. Act 1974 (HSW Act)</p> <p>Road Traffic Act 1988</p>	<ul style="list-style-type: none"> <li>• The HSE with local authorities (and other enforcing authorities) is responsible for enforcing the Act.</li> </ul>	<p>Partnership on Health and Safety in Scotland (PHASS) membership comprises:</p> <ul style="list-style-type: none"> <li>• Scottish Government;</li> <li>• Healthy Working Lives (NHS Health Scotland);</li> <li>• HSE Society of Chief Officers of Environmental Health;</li> <li>• REHIS;</li> <li>• SCDI;</li> <li>• CBI;</li> <li>• STUC;</li> <li>• Scottish Hazards campaign;</li> <li>• FSB;</li> <li>• Professional OHS orgs;</li> </ul>	

				<ul style="list-style-type: none"> <li>• Scottish Chamber of Safety and the voluntary sector;</li> <li>• Site Safe Scotland (Scottish construction group);</li> <li>• Step Change in Safety (offshore oil and gas sector);</li> <li>• The Scottish Farm Safety Partnership</li> </ul>	
Public Places	Work-related injuries strategy	A Scottish Plan for Action on Safety and Health 2016 and beyond <sup>127</sup>	<ul style="list-style-type: none"> <li>• Strengthen stakeholder engagement and partnership action in poorer performing sectors</li> <li>• Work with care sector to establish a Scottish Social Care Partners Forum</li> <li>• Map existing provision of occupational health and safety services to co-ordinate a support network</li> <li>• Help sectors build suitable training and development opportunities for workers to improve understanding and implementation of workplace health &amp; safety</li> </ul>	PHASS as above	
<b>Place</b>	<b>Mechanisms</b>	<b>Framework Policy/Regulation</b>	<b>Primary Prevention activity</b>	<b>Partners identified</b>	<b>Gaps</b>
Homes and Dwelling Houses	Falls	Scottish Government (2014): Framework for Action for the Prevention and Management of Falls in the Community 2014/16 <sup>76</sup>	<ul style="list-style-type: none"> <li>• Identify individuals at risk of falls and/or fragility fractures</li> <li>• Support health improvement, self-management to reduce risk of falls and fragility fractures</li> </ul>	Scottish Government, Local Authority: COSLA, Community Safety Partnerships, Public Health, HSCP's, Private Sector and Voluntary Organisations	<ul style="list-style-type: none"> <li>• Should falls prevention begin earlier in life and before falls begin to happen.</li> <li>• Does an ageing population understand the need to increase physical activity and particularly to develop strength, balance and gait as primary prevention activities to reduce the risk of falls?</li> </ul>

		Scottish Government (2018): Scottish Patient Safety Programme <sup>128</sup>			<ul style="list-style-type: none"> <li>Unclear level and consistency of implementation across HSCPs across Scotland.</li> </ul>
Place	Mechanisms	Framework Policy/Regulation	Primary Prevention activity	Partners identified	Gaps
Homes and Dwelling Houses	Burns and scalds from Domestic House fires or Bath scalds	Building Standards and Regulations Scotland (2006) – Technical Handbook Domestic Safety <sup>129</sup>  Supported by CAPT and RoSPA	<ul style="list-style-type: none"> <li>Installation of a thermostatic mixing valve (TMV) to limit the temperature of water to 48°C in new builds and major refurbishments, using a risk assessment approach.</li> </ul>	Scottish Government, Local Authorities, HSCP's, Public Health, Scottish Fire & Rescue Service, Community Safety Partnerships	<ul style="list-style-type: none"> <li>Fitting Thermostatic Mixing Valves (TMV's) in all social housing and rented homes</li> <li>Setting and enforcing laws on hot-water tap temperature consistently and educating the public effectively.</li> <li>Lack of specific epidemiology analysis to assess effectiveness</li> <li>Assessment in terms of legionella risk</li> </ul>
Homes and Dwelling Houses	Burns and scalds from Domestic House fires or Bath scalds	Building standards and regulations, Scotland – Technical handbook Domestic Fire 2017 <sup>130</sup>	<ul style="list-style-type: none"> <li>Domestic Fire Sprinklers in high rise domestic housing and residential care settings including sheltered housing complex. Domestic fire alarms.</li> </ul>	Scottish Government, Local Authorities, HSCP's, Public Health, Scottish Fire & Rescue Service, Community Safety Partnerships	<ul style="list-style-type: none"> <li>Automatic Fire Suppression systems or sprinkler systems.</li> <li>Fitting hard wired or 10 year audible smoke alarms/detectors consistently.</li> </ul>

## 9 What is needed to prevent traumatic injury, including major trauma?

One of the most striking things highlighted in this briefing, whether it is in the literature review or the mapping of existing policy /strategy/ regulation in Scotland, is the relative *lack* of focus on major trauma at the more severe end of the spectrum of injury prevention. By drawing on the existing approaches and evidence for overall primary injury prevention, this briefing has identified and reinforced the settings and mechanisms of injury and provided some sense of magnitude of the issues. This highlights gaps across the specific major trauma and injury areas and though often disappointing, it does provide a new and refreshed opportunity to act and consider future research and the application of good practice for prevention. We need to understand how these gaps can be bridged.

One way of doing that will be to learn from the evaluation of existing strategies and policies, how they have an impact. This will help clarify the current and potential contribution that could be made to preventing major trauma. We also need to ensure we have access to any examples of evidence-based practice that have not been published, for whatever reason.

Does Scotland's data provide adequate detail regarding the causes and consequences of specific injuries? Unpicking and unravelling this through, for example, the Scottish Trauma Network and developing Major Trauma Centres, may provide greater detail which could be used to influence and develop primary prevention activity. To do this we may need to test the assumptions that are made about how specific activities will reduce hospital attendances and admissions. For example, it may be that a clearer focus on risk management rather than specific injury types is rewarding? However, if we use specific area data as an example, numbers of injuries are often relatively low, therefore resulting in low prioritisation of the issues leading to them. A wider focus is merited here.

Clearly making sure that there is evidence which specifically supports the primary prevention of major trauma will be essential to facilitate the reorientation of resources that would not only protect lives, but also prevent long-term illness and disability.

Equity of prevention and how this is applied in Community Planning Partnerships' Local Outcome Implementation Plans (LOIPs) and other local and national agency action plans needs to be considered. Existing coverage of LOIPs will provide a useful mechanism for identifying local activity which can have a direct impact on major trauma through effective implementation of primary prevention approaches for example, implementation of 20 mph speed limits or co-ordinated falls prevention programmes. Making the case for wider Public Health co-benefits should also be considered, for example, by highlighting how speed restrictions on roads can also improve local air quality, encourage physical activity, and promote mental health and

wellbeing. Other particular evidence-based initiatives, such as graduated licensing, falls prevention and water safety initiatives should also be given key consideration.

One clear area where such an approach could be progressed rapidly relates to roads injuries and road safety. Placing major trauma prevention within the new Scottish Transport Strategy now being developed, as well as building better links between the national and local agencies and groups that address road safety with Public Health and Health Improvement teams will be important in influencing and delivering preventative action.

Beyond road injury, participating in BSC Phase 2 is another key opportunity for driving forward the wider prevention agenda and could be explored with an emphasis on primary and E-prevention activities. This briefing overlaps with some of the activities being developed through Phase 2 of BSC and will be welcomed by the BSC Strategic Group; however, this would also benefit from specialist Public Health input.

Generally, key players' work on injury prevention are also worth exploring locally and there is merit in re-focussing engagement efforts through formal and informal local partnerships. Anecdotal evidence suggests that as injury prevention has become less of a priority for health, it is sometimes mentioned that "health" were invited to the table, but didn't attend? If we are to achieve a more pro-active approach to preventing major trauma, this is an area which needs to be addressed timeously.

As noted, some of the literature considered in developing this briefing suggests that prevention has been neglected. Developing a greater desire for primary prevention in its real and true form would be beneficial for our whole population. Should Scotland be a forward thinking leader and carry out research and recognised evaluation, ensuring that findings are published on early intervention and prevention on major trauma? Translational aspects of primary prevention activity are not likely to have been stretched to their full implementation potential in Scotland. However, some of the literature does suggest that prevention has been too easy to side-line or even neglect. Developing a greater desire for primary prevention in its real and true form and integrated within wider spheres of partnership action would be beneficial on a number of fronts.

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