Investigating trends and determinants of violence-related injury in England and Wales

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Doctor of Philosophy

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This work has not been submitted in substance for any other degree or award at this or any other university or place of learning, nor is being submitted concurrently in candidature for any degree or other award.

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ABSTRACT

Interpersonal violence is a public health concern in England and Wales. Nationally, over half of all victims of interpersonal violence sustain physical injuries, whilst approximately one-fifth suffer injuries serious enough to require medical treatment. Interpersonal violence therefore places a considerable burden on criminal justice and health service resources.

Accurate and reliable data on the extent and correlates of violence at both national and local level are required in order to inform prevention strategies. Despite this, police and crime survey measures of violence have reported contradictory national trends, whilst few studies in England and Wales have examined either correlates of violence-related injury or the mechanisms explaining how such correlates increase risk of sustaining violence-related injury.

This thesis presents findings from three studies which aimed to remedy these deficiencies. Firstly, Emergency Department (ED) attendance data were collected from 100 EDs across England and Wales and time series statistical methods employed to detect both national and local trends. Secondly, regional price indices for alcohol were calculated and associations with regional rates of violence-related injury and socioeconomic measures examined. Thirdly, potential mechanisms linking deprivation with increased risk of violence-related injury among adolescents and how these differed according to gender were examined qualitatively.

Findings revealed violence-related injury decreased nationally by 6.4% between January 2005 and December 2012. Rates of violence-related injury were shown to be highest among men, 18-30 year olds and those living in the North West of England. Modelling revealed a significant negative association between violence-related injury and the real price of on-trade and off-trade alcohol; in so that a 10% increase in real alcohol price would reduce violence-related ED attendances in England and Wales by over 60,000 per year. Modelling also revealed that poverty and income inequality had the largest impact on rates of violence-related injury. At micro level, adolescent females were shown to be particularly sensitive to the effects of deprivation; poor alcohol regulation by parents and a lack of structured and appealing leisure activities may potentially increase risk of violence-related injury among this cohort.

This thesis has shown ED data to be an invaluable tool for investigating trends and determinants of violence-related injury in England and Wales by clarifying national and local trends and identifying risk factors at both macro and micro level. Implications for violence prevention policies that can be drawn from these findings include targeting regions where violence is higher, raising the price of alcohol above inflation, and improving alcohol regulation and leisure opportunities among deprived adolescents females

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LIST OF ABBREVIATIONS

AOR	Adjusted Odds Ratio
BCS	British Crime Survey
CCTV	Closed-circuit Television
CI	Confidence Interval
CPI	Consumer Price Index
CSDD	Cambridge Study of Delinquent Development
CSEW	Crime Survey for England and Wales
DEFRA	Department for Environment, Food and Rural Affairs
ED	Emergency Department
HMRC	Her Majesty's Revenue and Customs
ICD	International Classification of Diseases
ISP	Information Sharing Partnership
ISTV	Information Sharing to Tackle Violence
LDF	Least Deprived Female
LDM	Least Deprived Male
MDF	Most Deprived Female
MDM	Most Deprived Male
MIU	Minor Injuries Unit
MUP	Minimum Unit Pricing
NCRS	National Crime Recording Standard
NVSN	National Violence Surveillance Network
NHS	National Health Service
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary Least Squares
ONS	Office for National Statistics
OR	Odds Ratio
PSE	Personal and Social Education
PYS	Pittsburgh Youth Study
SSDP	Seattle Social Development Project

UK	United Kingdom
US	United States
VAP	Violence Against the Person
VAT	Value Added Tax
VIF	Variance Inflation Factors
WNHSS	Welsh Network of Healthy Schools Scheme
WHO	World Health Organization

DEDICATION

To Mum.

1 Introduction, thesis aims and literature review

1.1 Chapter outline

Chapter one examines the nature of violence in England and Wales; including, areas of investigation, thesis aims and a review of the relevant literature. Chapter one concludes with a breakdown of chapters two through six.

1.2 Introduction

Violence is a major cause of death and disability worldwide (World Health Organisation, 2014). Globally, interpersonal violence is the second highest killer of males aged 15-29 years behind fatal injuries sustained in road traffic accidents and, in 2012, was responsible for 31,518,566 years lost to premature death or disability (ibid). Not all acts of violence are however fatal. For every person killed as a result of violence, many more sustain injuries serious enough to require medical treatment (Krug et al., 2002). Moreover, the psychological distress experienced by victims of violence has greater longevity than that resulting from accidental trauma (Shepherd et al., 1990a). Violence not only effects individuals directly, for example, through physical injury or psychological distress, but can also impact friends and family of the victim, the local community (for example, fear of crime) and society as a whole (for example, economic costs).

Stipulated in the World Health Organization's (WHO) World Report on Violence and Health, the routine collection and analysis of accurate and reliable data on the extent and characteristics of violence, including the investigation of causes and correlates of violence, at both local and national level, are essential for identifying areas for investigation, implementing targeted interventions and directing prevention strategies (Krug et al., 2002). Traditional measures of violence in England and Wales have reported contradictory trends (Shepherd and Sivarajasingam, 2005). Whilst few studies in England and Wales have examined either correlates of violence-related injury or the mechanisms by which such correlates increase a person's risk of sustaining violence-related injury (for an examination of correlates see Bellis et al.,

2012b, Brennan et al., 2010, Sivarajasingam et al., 2006, Sivarajasingam et al., 2009b). Alcohol use and material deprivation have both been identified as salient risk factors for violence-related injury (Cherpitel and Ye, 2010, Bellis et al., 2012b); however issues regarding causality still remain. For example, a causal association between alcohol use and violence has long been acknowledged but never proven outside of experimental conditions, while causal pathways linking deprivation to risk of violence-related injury are yet to be investigated in England and Wales. The current thesis seeks to address these deficiencies by investigating trends and determinants of violence-related injury in England and Wales using a mixed methods approach. The main aims of this thesis are presented below.

1.3 Aims of thesis

The thesis has two main aims:

1) To bring clarity to national and local trends in violence in England and Wales using Emergency Department (ED) data.
2) To increase understanding of major determinants of violence-related injury in England and Wales at both macro and micro level.

A more detailed breakdown of each chapter is presented at the end of chapter one. Individual chapter aims and objectives are presented at the beginning of each chapter.

1.4 Literature review

1.4.1 A public health approach to violence

1.4.1.1 *Violence: a public health issue*

Health practitioners have long considered violence to be a public health problem (Shepherd and Farrington, 1993). In England and Wales, for example, crime survey estimates suggest that violent victimisation accounted for 18.4% of all crime-related victimisation in 2013/14 (Office for National Statistics, 2014b). The same figures also suggest that over half (57%) of all incidents of violence result in physical injuries to the victim; including, minor bruises/black eyes (31%), severe bruising

(17%), cuts (15%) and scratches (13%) (Office for National Statistics, 2014c). Almost one fifth of all violence (18%) and over half of all woundings (52%) require medical treatment (ibid). Violence therefore places a substantial burden on health services, in particular, ED resources. Indeed, recent estimates from the National Violence Surveillance Network (NVSN) revealed that 234,509 people attended EDs across England and Wales for treatment of a violence-related injury in 2013 (Sivarajasingam et al., 2014b).[1] Sustaining injury as a result of violence can also have severe consequences to the mental health of victims. Assault patients treated at Bristol Royal Infirmary and Dental Hospital, for example, continued to exhibit symptoms of anxiety, depression, and psychiatric disorder, three months after the incident (Shepherd et al., 1990a). In contrast, although initially exhibiting similar symptoms, patients receiving treatment for injuries sustained through accidental trauma showed significantly reduced symptoms after the same three month period (ibid). In England, the annual cost of violence has been estimated at £29.9 billion (Bellis et al., 2012a). This includes £2.9 billion in costs to the National Health Service (NHS) and £4.3 billion to criminal justice services (ibid). Some scholars have suggested, however, that these figures may represent conservative estimates. For example, the cost of violence against women and girls in England and Wales (including; sexual violence, domestic violence, violence in prostitution, trafficking and violence against black and ethnic minority women) has previously been estimated at £40.1 billion (Jarvinen et al., 2008).

1.4.1.2 *Typology of violence*

The WHO categorizes violence in accordance with the characteristics of the offender i.e. self-directed violence (self-abuse and suicidal behaviour), interpersonal violence (family and intimate partner violence and community violence), or collective violence (political, economic, and social violence). Violence does not differ solely by type however; the nature in which violence is inflicted on the victim can also differ. Violence can be categorized as physical, sexual, psychological, or resulting from deprivation or neglect (Krug et al., 2002). As defined by the WHO, violence constitutes:

[1] Based at Cardiff University, the NVSN is a network of EDs in England and Wales which are willing to share anonymized information relating to violence.

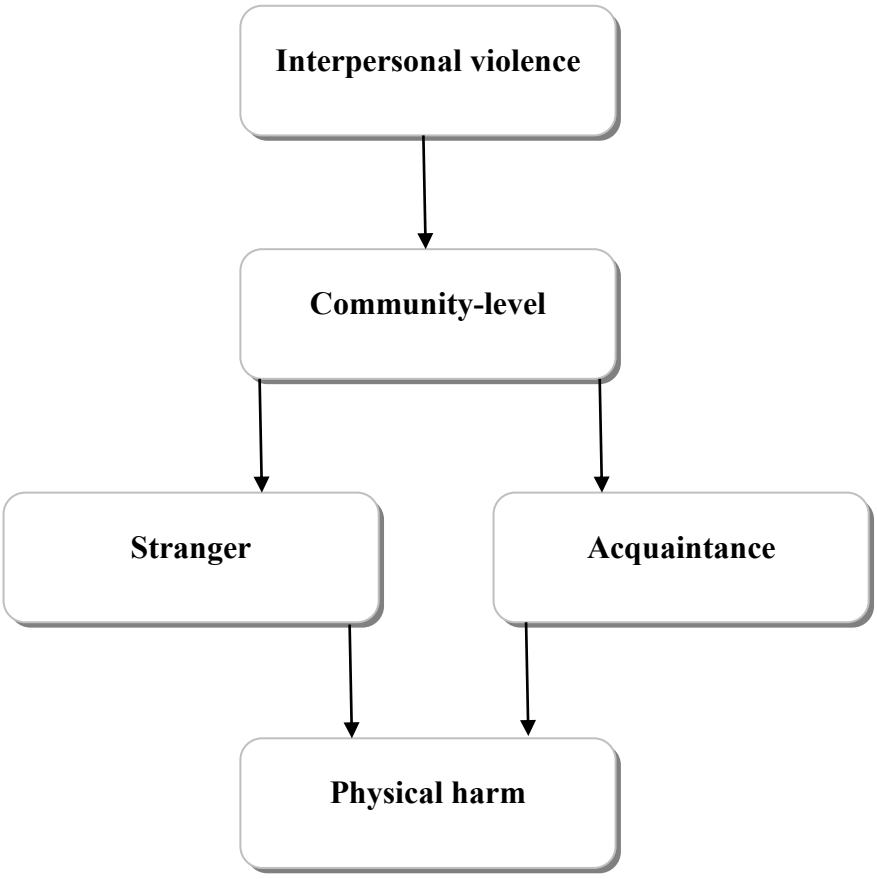
> *"The intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community, that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation"* (ibid: p.5).

In England and Wales, citizens have grown to expect protection from the impact of war, civil unrest or state violence, but have had to contend with the impact of smaller scale interpersonal violence on the streets, in and around licensed premises, in the workplace and at home. Indeed, figures from the Crime Survey for England and Wales (CSEW; formerly the British Crime Survey, BCS) reveal that violence (including; woundings, assault with minor injury, assault with no injury and robbery) most commonly occurred around the home (30%), on the streets (22%), or in and around a pub or club (15%) in 2012/13 (Office for National Statistics, 2014c). It is worth noting, however, that while the UK has experienced a recent escalation in terrorism related violence, such as the attack on London in July 2007 (which killed fifty-two people and injured over 770) (BBC, 2007), this type of violence is incredibly rare.

Interpersonal violence refers to violence perpetrated against family and intimate partners (including; intimate partner violence, elder abuse and abuse of children) and community violence (including; random acts of violence, youth violence, violence in institutional settings and sexual assault by a stranger) (Krug et al., 2002). This thesis focuses specifically on physical injury sustained as a result of community interpersonal violence. Although figures presented above highlight that violence in England and Wales was more prevalent within the home in 2012/13, previous CSEW estimates between 2002/03 and 2011/12 have shown violence to be increasingly more prevalent on the streets (Office for National Statistics, 2014c). Furthermore, at community level, interpersonal violence is categorized by the victim-offender relationship i.e. either 'stranger' or 'acquaintance'. In England and Wales, figures from the CSEW suggest that victims of violence are most commonly assaulted by one of these two victim-offender relationship types (ibid).

This thesis utilises violence-related ED attendances as a measure of community interpersonal violence. Estimates suggest that injuries sustained in violence are most commonly inflicted at night and by strangers. Indeed, 74% of all 'stranger violence', 75% of all woundings and 57% of all assaults with minor injury take place between 6pm and 6am (ibid). Furthermore, previous studies examining violence-related ED attendances in England and Wales indicate that attendances are greater on Fridays, Saturdays and Sundays (Sivarajasingam et al., 2014b, Bellis et al., 2012b). Owing to the average time and day of such attendances, an association with alcohol use and the night-time economy is likely. See Figure 1.1 for the typology of community interpersonal violence used within this thesis.

Figure 1.1 Typology of community interpersonal violence

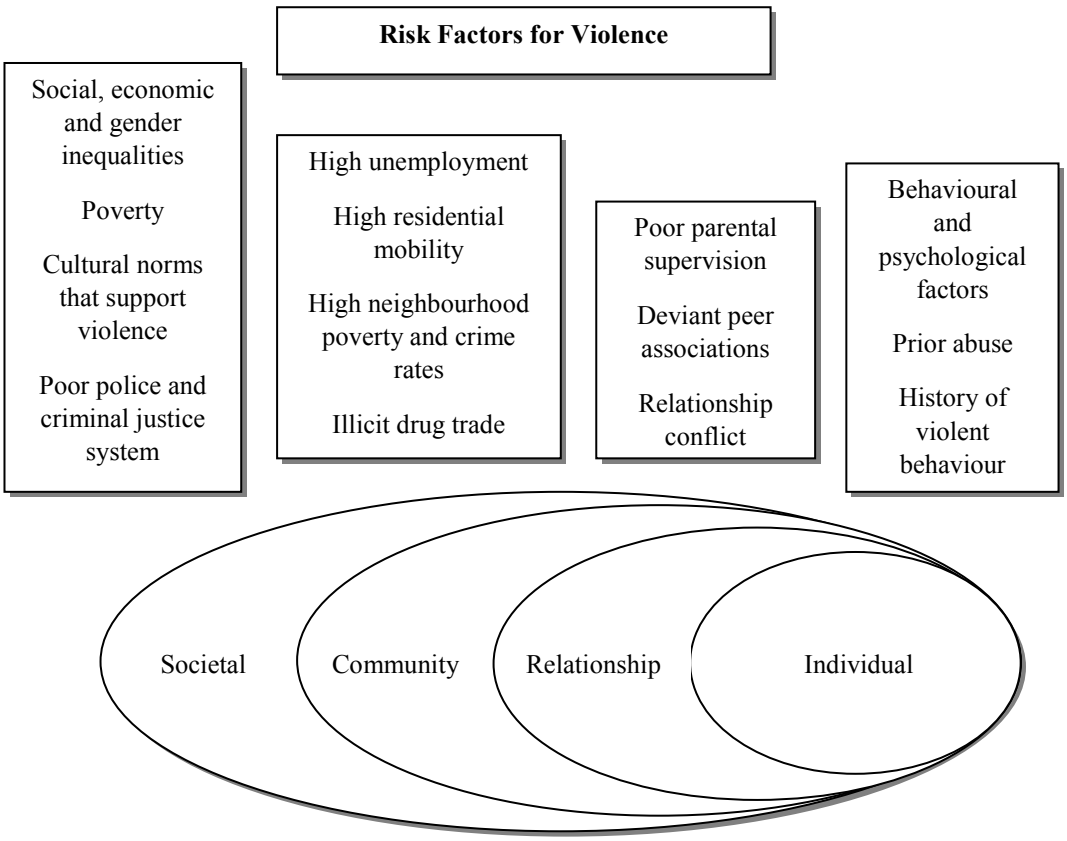


(Adapted from Krug et al., 2002)

1.4.1.3 *Violence: an ecological framework*

From a public health perspective, violence is considered a non-communicable disease and therefore, similar to other diseases, prevention efforts are focused on the identification of causes and at-risk groups (Shepherd and Farrington, 1993). However, violence is multifaceted; meaning no single factor can adequately explain why certain individuals are more likely to either perpetrate or fall victim to violence, or why violence is more or less prevalent in certain communities. Considering this, scholars have applied an ecological framework to violence (see Figure 1.2) in order to better understand the complex interplay between contributing factors across individual, relationship, community and societal levels (Krug et al., 2002).

Figure 1.2 Ecological framework of violence



(Adapted from Rutherford et al., 2007)

1.4.1.3.1 Individual factors

At the individual level, characteristics of the individual that increase the potential for violent behaviour during youth and adulthood are the primary focus. Data from the Cambridge Study of Delinquent Development (CSDD, a longitudinal study of 411 South London males), for example, identified an inverse relationship between resting heart rate at age eighteen (thought to be indicative of a disposition to risky behaviours such as sensation seeking) and involvement in violence up to age fifty (Jennings et al., 2013). Findings suggested that having a heart rate one standard deviation lower than the mean increased the odds of violent offending by 45% (ibid). This association remained after controlling for binge drinking, impulsivity, smoking and body mass index at age eighteen, team sports participation at age sixteen and individual and environmental risk factors at age 8-10 years. In the United Kingdom (UK), levels of self-esteem and self-concern during adolescence have also been shown to significantly predict likelihood of fighting amongst a sample of adolescents (aged 11-16 years) after accounting for gender, cigarette use, illicit drug use, alcohol use and drunkenness (Sutherland and Shepherd, 2002). Furthermore, evidence from the CSDD has also shown hyperactivity, high daring and low nonverbal IQ at age fourteen increased likelihood of violent convictions at age 15-20 (Farrington and Ttofi, 2011).

1.4.1.3.2 Relationship factors

At the relationship level, the influence of family, peers and intimate partners and how these relationships affect risk of violence are the focus. Farrington and Ttofi (2011), for example, identified that males at age 8-10 who experienced a disrupted family, a delinquent sibling, a large family size, low income, poor housing, poor child rearing practices and had a young mother, were more likely to report future violent behaviour and/or convictions for violence. Research from outside the UK support these findings (see Herrenkohl et al., 2000). There is also substantial evidence that associating with delinquent peers increases the risk of violence among adolescents (Herrenkohl et al., 2012, Henry et al., 2012, Bernat et al., 2012, Pardini et al., 2012). In the Pittsburgh Youth Study (PYS, a longitudinal study of Pittsburgh males followed from age twelve), for example, level of peer delinquency (i.e. high or low)

was measured by how many of the respondents' friends engaged in nine delinquent acts; including, physical fighting and stealing (ibid). Findings indicated that level of peer delinquency at age twelve acted as a risk factor for violence at age 13-14 (Odds Ratio (OR): 2.34, 95% Confidence Interval (CI): 1.41 to 3.90, $p<0.001$) but not age 15-18; suggesting respondents with a high number of delinquent friends at age twelve, and therefore reporting a high level of delinquent peer association, were at a greater risk of violence. Although peer delinquency at age twelve was not shown to increase risk of violence among 15-18 year olds in this study, results did indicate that low peer delinquency was a direct protective factor against violence for this age group (ibid). Longitudinal studies by Herrenkohl et al., (2012) and Bernat et al., (2012) have however shown evidence that delinquent peer association at an early age (between 10 and 13 years) is significantly associated with violence in late adolescence (between 15 and 18 years).

1.4.1.3.3 Community factors

At the community level, reasons why violence is more prevalent in certain communities relative to others are explored. Findings from the PYS, for example, identified how experiencing high levels of neighbourhood poverty and crime (measured by the perceived prevalence of neighbourhood unemployment, racial tension, abandoned buildings and criminal activities) at age twelve was a significant risk factor for violence (including rape, assault and robbery) at age 15-18 (Pardini et al., 2012). This finding remained true after controlling for the potential mediating effects of demographic, individual, family, school, peer and other community factors (ibid). Level of neighbourhood attachment has also been shown to influence likelihood of violence. For example, low neighbourhood attachment at age 10-12 has been evidenced as a significant risk factor for violence at age 15-18 (OR: 1.87, 95% CI: 1.3 to 2.7, $p<0.01$) after controlling for other potential risk factors (Herrenkohl et al., 2012). The same study also identified that availability and exposure to marijuana within a neighbourhood was both a strong risk and protective factor for violence at ages 13-14 and 15-18 (ibid).

1.4.1.3.4 Societal factors

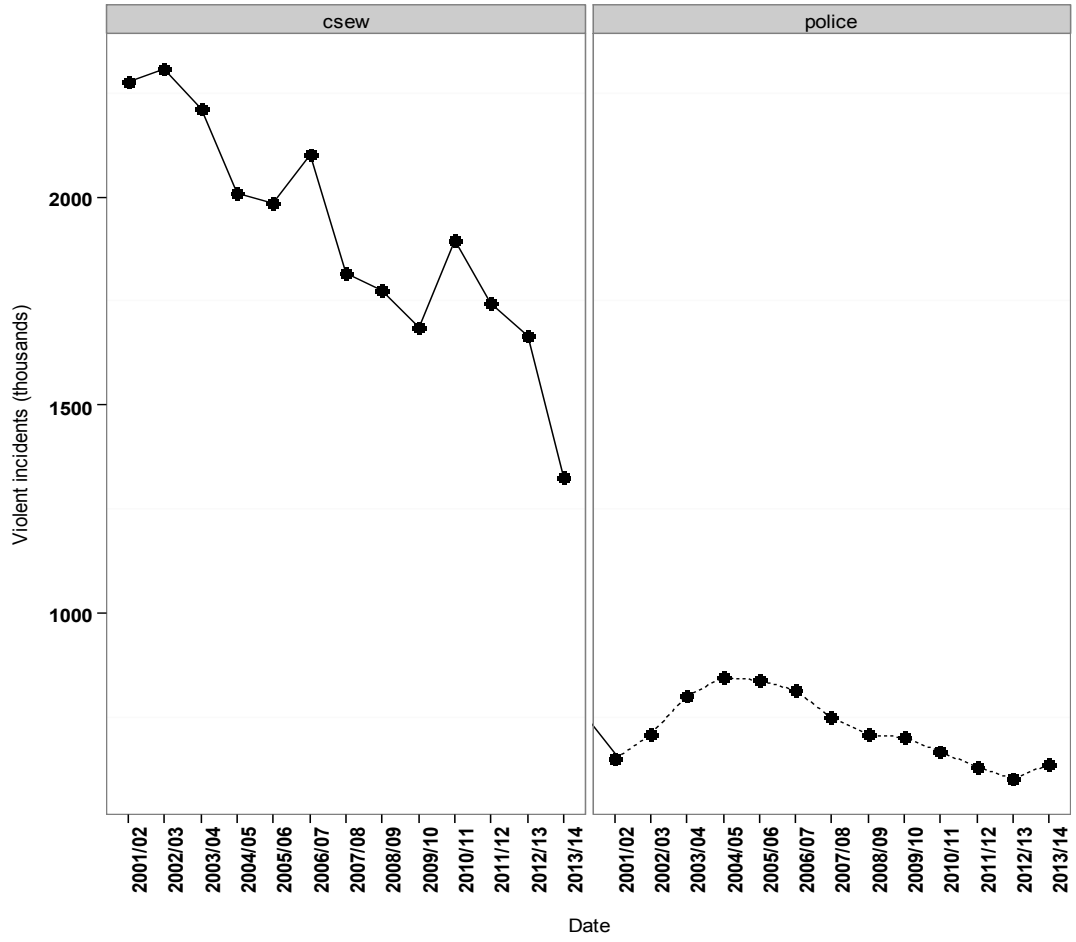
At the societal level, factors which *"create an acceptable climate for violence, those that reduce inhibitions against violence, and those that create and sustain gaps between different segments of society – or tensions between different groups or countries"* are the focus (Krug et al., 2002: p.13). Risk factors at the societal level tend to be much broader, for example, financial inequality has been evidenced as having a significant impact on levels of community violence and, in some cases, is more indicative of violent crime than levels of poverty (Hsieh and Pugh, 1993). Indeed, a recent study examining associations between violence and both health-related and socio-economic factors across 169 countries, found that income inequality was strongly associated with levels of self-reported assault (Wolf et al., 2014).

1.4.2 Trends in violence in England and Wales

Traditionally, levels and trends in violence in England and Wales have been measured by police recorded crime statistics and the CSEW. According to the CSEW, 1,299,000 people were violently victimised in the year ending June 2014 (617,000 with injury), while, comparatively, the police recorded 666,696 violence against the person (VAP) offences (335,488 with injury) (Office for National Statistics, 2014e). A contrast in the number of violent incidents reported by both measures is clearly apparent and most likely results from differences in recording practices (discussed in further detail next). Understood as such, direct comparisons can only be made using violent trends and not the number of reported incidents. However, previous research into trends in community interpersonal violence in England and Wales have revealed that police and CSEW measures often report contradictory trends (Shepherd and Sivarajasingam, 2005). For example, between 2002/03 and 2005/06, VAP offences recorded by the police increased by 18.3% (from 709,000 to 839,000 offences). In contrast, violence according to the CSEW decreased by 13.4% (from 2,714,000 to 2,350,000 offences) (Office for National Statistics, 2014e). Although trends in violence have remained relatively similar according to both measures since 2006, more recent police and CSEW figures have called the legitimacy of police recorded crime statistics into question. Indeed, while

violence according to the CSEW continued to decrease between 2012/13 and 2013/14, VAP offences rose by 11% (see Figure 1.3) (ibid). The ability of both measures, as well as local crime surveys, to accurately portray levels of violence in England and Wales are discussed below.

Figure 1.3 CSEW and police measures of violence in England and Wales, 2001/02 - 2013/14 (March-April)



1.4.2.1 *Police recorded crime statistics*

Police recorded crime statistics are collected by the 43 police forces in England and Wales (including the British Transport Police) and are used to direct local crime prevention strategies and to measure national trends in crime. However, police records only include offences that have been reported to the police and have therefore been criticized as underestimating overall levels of crime (including violent crime). For example, only 40% of violent crimes recorded in the CSEW were

reported to the police in 2012/13 (Office for National Statistics, 2014c). Reasons for underestimation have been suggested as resulting from difficulties in ascertainment, which result from fear of reprisals, poor attitudes towards police involvement, unwillingness to have one's conduct scrutinized and a perceived lack of benefit for the victim (Clarkson et al., 1994).

Police records are also greatly influenced by targeted policing and recording practices. For example, one study found that the installation of closed-circuit television (CCTV) cameras for crime reduction purposes led to an 11% increase in police detection of violence, but a 3% decrease in violence-related ED attendances (Sivarajasingam et al., 2003). Furthermore, changes in police recording practices in April 2002, through the introduction of the National Crime Recording Standards (NCRS, a victim-focused approach whereby both proven and alleged offences were recorded), led to a 22% rise in the number of violent crimes recorded by the police (Simmons et al., 2003). Although, as previously stated, police data have reported similar trends to CSEW in recent times, a report by Her Majesty's Inspectorate of Constabulary, which looked at more than eight thousand reports of crime in England and Wales, concluded that a third of all violent crimes reported to the police are not officially recorded (HM Inspectorate of Constabularly, 2014). Therefore, owing to such limitations, scholars have suggested that police recorded incidents of violence should not be used to measure trends in violence (Shepherd and Sivarajasingam, 2005).

Consequently, in 2014 the UK Statistics Authority de-designated police recorded crime statistics as a national statistic, after stating that it could no longer *"provide assurance that the statistic based on these data meet users' needs"*, or *"ensure that users are made fully aware of the limitations of the recorded crime statistics and the impact that these have on their use of statistics"* (UK Statistics Authority, 2014: p.2).

1.4.2.2 *Crime Survey for England and Wales (CSEW)*

The CSEW is a household victimisation survey of respondents (aged 16 years and over) experiences of crime in the past 12 months. The survey targets around 50,000 households across England and Wales and has a non-response rate of approximately 25%. The 2012/13 CSEW was based on respondents from 35,169 households (Office for National Statistics, 2012a). Since January 2009, the CSEW has also surveyed children aged 10-15 years; with the most recent findings indicating that there were 427,000 violent offences against children in the year ending June 2014 (67% resulting in injury) (Office for National Statistics, 2014d).

The main strength of the CSEW is that it has retained the same methodology (face-to-face interview) since its introduction in 1981 and through rigorous sampling practices, closely represents the demographic population of England and Wales (according to the 2011 census) (Office for National Statistics, 2012a). The CSEW is therefore able to examine long-term underlying national trends in violence across both age and gender combinations.

The CSEW is however not without limitations and is subject to a number of potential biases (Lynn and Elliot, 2000). Respondent bias, for example, can occur when respondents are unwilling to discuss particular behaviours or experiences that they are uncomfortable of embarrassed about (ibid). This could potentially lead to distorted or dishonest responses as a result of what Phillips and Clancy (1972) refer to as the effects of 'social desirability' i.e. the *"tendency of people to deny socially undesirable traits or qualities and to admit to socially desirable ones"* (Phillips and Clancy, 1972: p.923). Respondent bias could also result unintentionally if respondents are unable to accurately recall events. This is a distinct possibility considering that the CSEW enquires about victimisation in the previous 12 months. Moreover, in the 2012/13 CSEW, 18% of interviews were conducted in the presence of the respondents spouse or partner (Office for National Statistics, 2012a). There is an argument to be made that such external influences could potentially impact on responses if the respondent was being, say, domestically victimised. Finally, as a nationally representative survey, the CSEW fails to consider crime at the local level and therefore neglects underlying local trends.

1.4.2.3 *Local crime surveys*

In addition to national surveys there are also local crime surveys. For example, the London Borough of Bexley conduct an annual crime survey (Big Bexley Crime Survey) to identify both the types and prevalence of local crimes, in order to help decide the priorities of the local community safety partnership for the following year (London Borough of Bexley, 2014). The main strength of local surveys is that they provide the richness and context not available in national surveys. For example, a local survey investigating racist incidents and race hate crime in Cardiff was able to combine both quantitative and qualitative elements in order to gain an increased understanding of both the prevalence of racist incidents, as well as the personal effect that racist incidents had on victims (Roberts, 2009). Although local surveys are not an appropriate measure of violence at national level, they can provide the type of micro-level, contextual information, important to local crime prevention efforts and are therefore a useful compliment to national data.

1.4.2.4 *Health data: an alternative measure of violence*

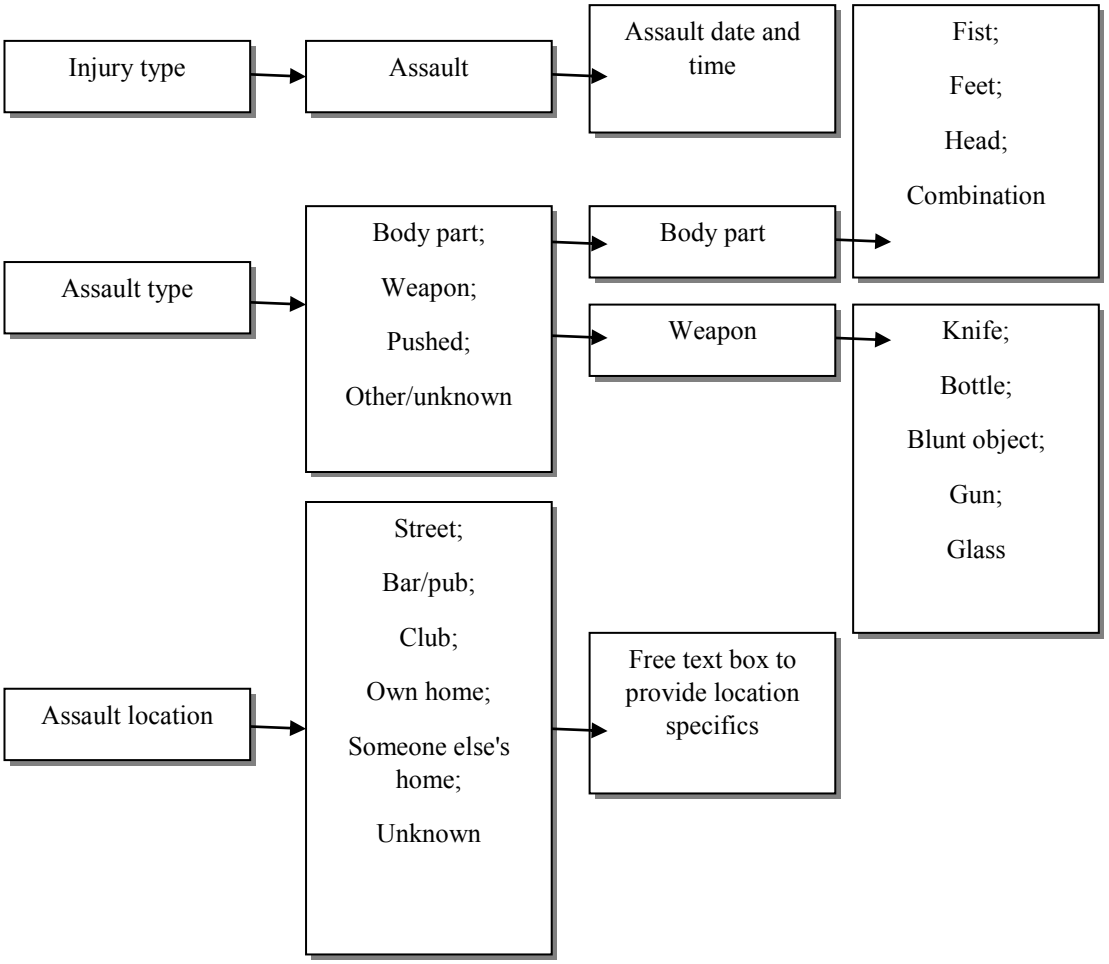
As referred to in the previous section, contradictory trends in violence reported by traditional measures, which likely reflect differences in recording practices, have led public health practitioners to advocate the use of anonymized aggregate health data as an objective alternative (Shepherd and Sivarajasingam, 2005). The ability of ED-derived attendance data, hospital admissions, ambulance call out data and mortality statistics to measure violence are discussed below.

1.4.2.5 *Emergency Department (ED) attendances*

ED data represents a harm-based source of information on violence i.e. that which requires the presence of injury serious enough to require medical treatment. On presentation to the ED, patients are required to state their reasons for attendance, at which point an electronic record is made by reception staff. Violence-related injury is an established category of injury in most ED software packages and a new record is created for each individual attendance, while information relating to the time, date and location of the incident, as well as information on weapon use and assailants, is also recorded (Figure 1.4) (Goodwin and Shepherd, 2000, Giacomantonio et al.,

2014). Information derived from EDs therefore represents a rich source of data on the extent and characteristics of violent incidents and has been used to measure national trends in violence (Sivarajasingam et al., 2002, Sivarajasingam et al., 2009a), incidence and prevalence of domestic violence (Boyle and Todd, 2003), pattern and severity of violence-related injury (Shepherd et al., 1990b) and associations between weapon use and injury severity (Brennan et al., 2006).

Figure 1.4 Recording violence-related ED attendances



(Adapted from Giacomantonio et al 2014)

Information obtained from EDs can be considered a more objective and reliable measure of violence than, for example, police recorded offences or CSEW estimates; which both depend to varying degrees on subjective factors (Shepherd and Sivarajasingam, 2005). Evidence from data matching studies between police and ED sources support this (Sutherland et al., 2002). In Swansea, for example, only 23.6% of assaults were recorded exclusively by the police compared to 65.6% recorded by the ED (ibid); confirming that police data fails to record a substantial amount of violent crime. Research has suggested that targeted policing can effectively reduce crime (Braga and Bond, 2008) and that accurate and reliable data is vital to directing prevention resources to locations where violence is more likely i.e. violent 'hot-spots' (Florence et al., 2011). ED data is therefore best placed to provide such information and can be used to compliment traditional measures.

Indeed, the routine collection, analysis and distribution of aggregate anonymized information obtained from EDs has resulted in substantial reductions in violence-related hospital admissions (ibid, Quigg et al., 2011). In Cardiff, for example, sharing ED data with police, health practitioners and local government representatives (and later representatives of education, transport and ambulance services and local licensees) led to a 35% decrease in assault-related ED attendances, between 2000 and 2005, relative to fourteen similar control cities (deemed so by the Home Office) where information was not shared (Florence et al., 2011). Generally referred to as the 'Cardiff Model', sharing information derived from EDs improved targeted policing through altered police patrol routes, informed CCTV deployment and the identification of problematic licence premises (ibid). Similarly, collection of alcohol-related assault ED attendances and distribution to relevant organizations led to a 30.3% decrease in attendances in North West England between 2004 and 2006 (Quigg et al., 2011). In the UK, following the Tackling Knives Action Plan (2008), which encouraged data sharing to prevent serious knife and violent crime, as well as the increasing recognition of ED data as a viable source of information on violence, the Coalition Government have committed to making *"hospitals share non-confidential information with the police so they can know where gun and knife is happening and can target stop and search in gun and knife crime hot spots"* (HM Government, 2008b, HM Government, 2010: p.13)

Measuring trends in violence using ED attendance data is not without limitations however. Firstly, ED data requires the presence of injury serious enough to require medical treatment and is therefore unable to account for violence where no injury or minor injuries are sustained: recent figures from the CSEW estimate that 47% of violent incidents do not result in injury (Office for National Statistics, 2014b). Secondly, similar to the CSEW, ED data is potentially liable to respondent bias, as patients are required to declare that they have been injured as a result of a violent incident, which could lead to an underestimation of overall levels of violence if patients are dishonest about the circumstance of their injury. Research has also shown that risk of violence-related injury is substantially greater after consuming alcohol (Cherpitel and Ye, 2010) and that acute alcohol consumption can impair both long and short term memory (Jones, 1973). It is therefore possible that patients may not be able to accurately recall the circumstance which led to their injury if they were intoxicated at the time of the incident. In these circumstances, injuries sustained in a violent incident may fail to be recorded as such. Thirdly, research has shown that a person's proximity to an ED is likely to affect their likelihood of attendance, which suggests that attendances in more rural settings may be underestimated (Baker et al., 2011). Finally, ED data does not account for fatal acts of violence i.e. those that die as a result of their injuries; however such numbers are small (discussed in paragraph 1.4.2.8).

1.4.2.6 *Hospital admissions*

Hospital admissions data provide information on all inpatient admitted to NHS hospitals and are collected nationally through the Hospital Episodic Statistics system. However, inpatient admissions data does not include patients who are patched-up and discharged. Therefore, inpatient admissions relating to violence (based on International Classification of Disease (ICD) codes X85-Y09, codes for deliberate external causes) represent much smaller numbers than ED attendances (33,040 admissions in England in 2012/13) and are unable to provide information at local level (Health and Social Care Information Centre, 2013a). Furthermore, inpatient admissions provide little evidence on the circumstances of the assault; such as the time and location, offender characteristics, and the presence of alcohol.

1.4.2.7 *Ambulance call outs*

A data matching study in Peterborough (UK), which compared ambulance and police records of violence, revealed that many violent hot-spots that were identified by information obtained from ambulance call outs were unknown to the police (Ariel et al., 2013). Information on ambulance call outs is therefore a useful compliment to ED attendance data because it can provide an alternative source of information on violent hot-spots, which are crucial for directing targeted interventions and informing violence prevention strategies. However, a potential weakness of ambulance call out data, in relation to its effectiveness at identifying hot-spots for violence, is that the call out location may not necessarily be the same as the incident location, whilst it is possible that multiple call outs may also be made for the same incident. Although bias such as this may potentially distort whether a particular location is truly a hot-spot for violent behaviour or not, ambulance call out data is still a valuable source of information on the occurrence of violence (Wood et al., 2014).

1.4.2.8 *Mortality figures*

Mortality figures provide information on fatal acts of violence, which are unaccounted for by both ED attendances and the CSEW (although homicide offences are included in police recorded data). However, as referred to previously, few homicides occur annually in England and Wales (only 532 recorded in 2013/14). Mortality figures are therefore unable to identify local trends in violence and are best considered a compliment to ED and CSEW measures of violence (Office for National Statistics, 2014d).

1.4.3 Violence and the consumption of alcohol

In England and Wales, CSEW figures estimate that there were 881,000 violent incidents where the victim believed the offender(s) to be under the influence of alcohol in 2012/13; representing almost half the total number of violent incidents recorded (Office for National Statistics, 2014c). The association between alcohol and violence has been investigated across multiple academic disciplines and an increased dose-response relationship has been evidenced (Duke et al., 2011). Alcohol use is

therefore considered a strong risk factor for violent offending and victimisation (Boden et al., 2012, Shepherd et al., 2006).

1.4.3.1 *Violence-related injury and alcohol*

Risk of sustaining violence-related injury is strongly associated with the consumption of alcohol (Shepherd, 1990). This has been evidenced in single-centre ED studies both within (Sivarajasingam et al., 2009b) and across (Cherpitel and Ye, 2010) countries. Cherpitel and Ye (2010), for example, used a case-crossover analysis to estimate the risk of injury after consuming alcohol six hours prior to the incident. They examined the effects of alcohol on likelihood of violence-related injury, compared to likelihood of non-violence-related injury, among patients attending 32 EDs across fifteen countries (Argentina, Australia, Belarus, Brazil, Canada, China, Czech Republic, India, Mexico, Mozambique, Poland, South Africa, Spain, Sweden, and the US). Findings indicated that both within (country-specific) and across (pooled) countries, violence-related injuries were significantly more likely when alcohol was consumed prior to injury compared to injuries resulting from other causes (ibid). Similarly, a single-centre study in Cardiff, which investigated risk and protective factors for violence-related injury by recruiting assault and non-assault patients from an ED waiting room and maxillofacial clinic, found consuming alcohol increased the risk of sustaining violence-related injuries for both genders (Sivarajasingam et al., 2009b). In addition, number of alcoholic drinks consumed prior to the incident and number of visits to a licensed premises in the month proceeding victimisation, have also been associated with increased risk of violence-related injury in England and Wales, after examination of responses to a nationally representative victimisation survey between 2002/03 and 2007/08 (Brennan et al., 2010).

1.4.3.2 *Proving causality*

Proving a causal relationship between alcohol use and violent behaviour has proven exceedingly difficult. It is not simply a question of whether alcohol use causes violence but rather how it causes violence and more importantly, why not everyone

who drinks alcohol becomes violent. Generally, explanations as to why violence and alcohol are linked refer to:

1) A psychopharmacological relationship; where alcohol use directly causes or indirectly facilitates violent behaviour.
2) The situational aspects of the drinking environment; where alcohol use facilitates violent behaviour when combined with certain physical and social characteristics present within the drinking environment.
3) Social and cultural attitudes towards both violence and the consumption of alcohol.
4) An expectancy effect; where alcohol use indirectly causes violent behaviour when combined with specific drinking motives.
5) An unknown common pathology; where alcohol use and violence share common risk factors and are similarly intertwined in the lives of certain people (Graham et al., 1998, Fagan, 1993)

1.4.3.3 *Psychopharmacological relationship*

Evidence of a direct causal relationship between alcohol consumption and aggression has been shown in experimental laboratory studies (Bailey and Taylor, 1991; Duke et al., 2011; Bushman and Cooper, 1990; Hull and Bond, 1986; Exum, 2006). Here the chemical properties of alcohol are suggested to impair internal inhibitory processes giving way to naturally aggressive impulses (Bushman, 1997). Meta-analysis of findings from thirty experimental studies, where aggression is measured by the frequency and intensity of electric shocks delivered by the participant to a fictitious opponent, for example, concluded, after alcohol versus control group and alcohol versus placebo group comparisons, that alcohol consumption causes violent behaviour (Bushman and Cooper, 1990). Findings indicated, however, that the effects of alcohol on aggression are mediated by methodological parameters; for example, effect sizes were larger in studies where spirits were used and smaller when the experimenter was blind to conditions. Similarly, integrated findings from seven meta-analytical studies (including the above study by Bushman and Cooper) suggest that alcohol has a heightened effect on aggression when males are the drinkers, when

spirits are consumed, when a high dose of alcohol is consumed, when the victim is able to retaliate and when non-aggressive response options are unavailable (Exum, 2006).

Although findings derived from experimental studies have been criticised as failing to represent real world situations (Tedeschi and Quigley, 2000), the advantage of experimental studies over non-experimental studies are that they enable causal inferences to be drawn (Chermack and Giancola, 1997). Nevertheless, although causality cannot be inferred from non-experimental studies, an association between violence and alcoholism has been shown for example; one study found alcoholics were twelve times more likely to engage in violent behaviour than non-alcoholics (Swanson et al., 1990), whilst another reported a 31% decrease in intimate partner violence perpetrated by alcohol dependent men following a year of abstention (Murphy et al., 2005).

However, whether or not a direct causal relationship exists between alcohol consumption and violence remains unclear; a direct relationship fails to explain, for example, the influence of social interaction on alcohol-related violence (Fagan, 1990), cultural differences (MacAndrew and Edgerton, 1969), or why those who perpetrate alcohol-related violence do not do so every time they consume alcohol (Levi and Maguire, 2002). In answer to such criticisms, an indirect psychopharmacological relationship between alcohol consumption and violence has been proposed; where alcohol consumption does not cause violence but rather facilitates cognitive changes that result in behaviours more susceptible to violence (Steele and Josephs, 1990). For example, high levels of irritability (Giancola, 2002), exposure to violence promoting stimuli (Giancola et al., 2011) and failure to consider future consequences, have all been evidenced to increase the effects of alcohol on aggression.

1.4.3.4 *Situational aspects of the drinking environment*

In much the same vain as an indirect psychopharmacological relationship between alcohol consumption and violence (see above), certain physical and social characteristics of the drinking environment have been shown to promote violent behaviour. For example, a systematic literature review by Hughes et al (2011), which identified studies that had explored associations between drinking environment characteristics and increased alcohol consumption and related harm, found that venues with poor cleanliness, for example, were related to increased aggression and assaults in Australia, Canada, the US and the UK. Additional factors that were associated with increased alcohol-related harm included physical factors such as crowding and loud music and social factors such as a permissive environment, cheap drinks and drinks promotions (ibid). Overt sexual activity, sexual competition, heavy drinking, under-age drinking (Graham and Homel, 1997), high temperatures, poor ventilation (Graham, 1980), inaccessible bar and toilet facilities (Tomsen, 1997) and the presence of competitive games have also been identified as characteristics of on-trade drinking environments with high frequencies of violence.

In an attempt to better understand the social context of violence within the drinking environment, Graham and colleagues (2012) identified 'hotspots' for violence and examined their association with environmental characteristics (Graham et al., 2012). Visiting 118 bars/clubs in Toronto (Canada) on Friday and Saturday nights, between midnight and 3am, over a two year period (totalling 1334 visits), the authors were able to rank venue hotspots by frequency of violence. Findings showed that the dance floor was the most common location for violence, with 20% of incidents occurring on the dance floor and 11.5% near the dance floor (ibid). Revealingly, the authors found that violent incidents which occurred on or near the dance floor were most common when the location was crowded (79.5% and 70.3% of incidents respectively) Other common locations for violence included the bar (15.7% of incidents), at tables (13.1% of incidents), general areas of movement (6.2% of incidents), the entrance (4.5% of incidents) and at pool tables (4.1% of incidents); which was associated with, for example, overcrowding, noise level, permissiveness, smoking and poor ventilation, dancing and staff-related factors (ibid).

Although the exact reasons why certain environmental characteristics and locations are more conducive to violence are not always clear, it has been suggested that the environment in which alcohol is consumed can lead to behavioural expectations (Graham and Homel, 1997). It has therefore been suggested that the drinking environment is best understood as an ecological system; where it is the combination of variables operating within this system that result in violent behaviour, rather than just one single element (Graham et al., 1980).

1.4.3.5 *Societal and cultural attitudes and expectancy effects*

Across countries, the consumption of alcohol is viewed differently and therefore to some cultures alcohol has different use-values (Makela, 1983). For example, in certain countries alcohol is considered a special commodity that is consumed on special occasions or more frequently over the weekend, compared to countries where alcohol is often consumed with a meal and forms a regular part of everyday life (Room, 1989). In line with this, expectations regarding the relationship between alcohol and violence have also been shown to differ by country (Christiansen and Teahan, 1987). Studying cultural links between alcohol and violence are therefore vitally important to understanding their association. Explanations include; alcohol-related violence as 'time out' (MacAndrew and Edgertin, 1969), alcohol-related violence as 'carnival' (Presdee, 2000) and the 'deviance disavowal' hypothesis (McCaghy, 1968).

In their seminal cross-cultural study, MacAndrew and Edgerton (1969) viewed alcohol-related violence as a period of 'time out' from more accepted, regular behaviour. They concluded that alcohol-related violence occurs when a society does not apply normal social punishments to periods of intoxication and, therefore, cultural attitudes and expectations towards alcohol-related violence are important factors in determining the prevalence of such incidents. For example, in his ethnographic study of alcohol-related violence in Australia, Tomsen stated that *"Rowdy acts of misbehaviour, like pushing, arguing, swearing, loudness and obscenity, are all valued for being part of a continuum of social rule-breaking which*

heightens the pleasurable experience of drinking as time out" (Tomsen, 1997: p.96/97).

In comparison, alcohol-related violence as 'carnival' focuses not only on human behaviour, but on the social act itself, including; emotive aspects (hedonism, pleasure and humiliation), symbolic aspects (performance) and the acts value as a commodity (Presdee, 2000). Understood as such, the night-time economy is viewed as a 'playful space' for alcohol-fuelled hedonism and transgression, where both alcohol and violence are considered pursuable commodities that define a person's social identity in a hedonistic environment free from the mundane routines of everyday life (ibid). Here the consumption of violence *"...is simplified and reduced to a trivial act of instant enjoyment; it thereby becomes no different from, say, the eating of a chocolate biscuit or the drinking of a can of coke…there is no moral debate, no conflict, no remorse, no meaning"* (ibid: p.65).

Numerous studies have highlighted the existence of an alcohol-related aggression expectancy effect, in which consumers believe that drinking alcohol will lead to them to become aggressive (Quigley and Leonard, 2006, Bushman and Cooper, 1990). Meta-analysis by Bushman and Cooper (1990), for example, revealed little difference regarding the effect of alcohol on aggression between anti-placebo (participants who were unaware that they had consumed alcohol) and control group participants (participants who had knowingly abstained from alcohol). Believing that alcohol use leads to aggression, several studies have suggested that alcohol is used by many as an excuse for deviant behaviour. Indeed, similar to alcohol-related violence as 'time out', but from a more individualistic rather than societal standpoint, is the concept of 'deviance disavowal'. The deviance disavowal hypothesis suggests that some people may believe that they can disclaim personal responsibility for deviant acts, such as alcohol-related violence, by attributing the blame to the alcohol (McCaghy, 1968); making those people more likely to engage in delinquent acts when intoxicated. For example, a US study found that young males who believed that alcohol use led to aggression were more likely to consume alcohol prior to offending than those who held no such belief (Zhang et al., 2002). The same study also highlighted a significant interaction between daily drinking pattern and alcohol-

related aggression expectancies on drinking prior to offending, indicating a heightened effect among heavier drinkers (ibid).

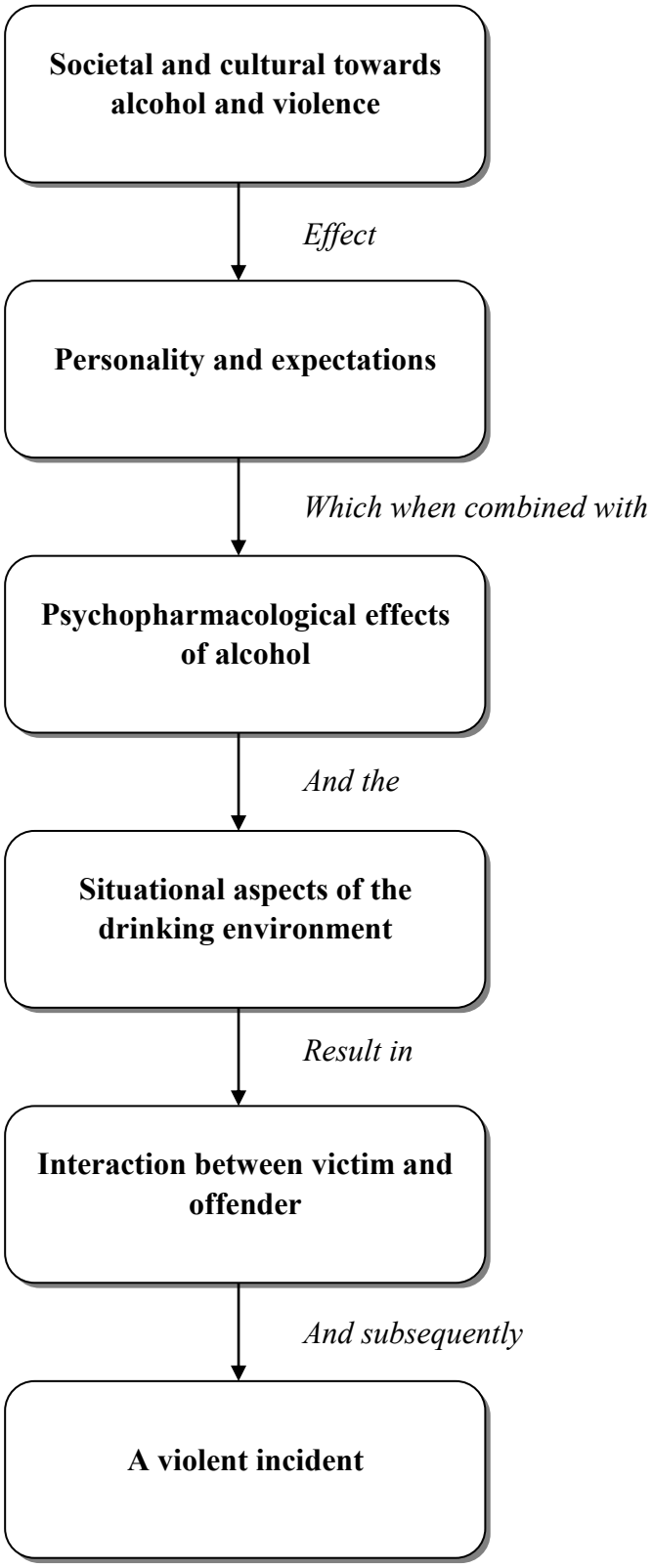
1.4.3.6 *Common risk factors*

Despite evidence from both aggregate and experimental studies that suggest an association between alcohol consumption and violence, methodological constraints have meant that no consensus regarding causality has been reached. It remains possible, therefore, that the relationship between alcohol consumption and violence is spurious and instead the result of unknown common risk factors, for example personality factors such as impulsiveness and risk-taking behaviours during adolescence, which may result in both alcohol consumption and violent behaviour in adulthood (Roth, 1994, Fagan, 1993). Similarly, findings such as that of Swanson et al (1990), that alcoholics are more likely to engage in violence than non-alcoholics, may be indicative of such commonalities. An experimental study by Giancola (2006), for example, which modelled the effect of subjective intoxication, breath alcohol concentration and alcohol-related aggression expectancies on intoxicated aggression in a sample of young male social drinkers, only revealed a significant positive association between aggression and believing alcohol consumption causes aggressive behaviour, when a participant's dispositional aggression was unaccounted for (Giancola, 2006).

1.4.3.7 *An integrated model*

A multitude of research has been undertaken across a number of academic disciplines, which attempt to examine the association between violent behaviour and alcohol consumption. What is clearly evident is that one single theory is unlikely to accurately reflect the complexity of the relationship. Graham and colleagues (1998) instead suggest an integrated model in which many contributing factors influence whether alcohol-related violence occurs (see Figure 1.5).

Figure 1.5 Integrated model of alcohol-related violence



(Adapted from Graham et al., 1998)

1.4.3.8 *Violence and alcohol price*

The economics literature has cut through the causative debate by reporting a significant association between violence and the price of alcohol (as a proxy for alcohol consumption) (Matthews et al., 2006, Sivarajasingam et al., 2006, Markowitz, 2000b). Findings suggest an inverse relationship, in so that an increase in alcohol price would reduce levels of violent victimization (see chapter 3, paragraph 3.4.3, for a review regarding the effects of alcohol price on the consumption of alcohol). These studies incorporate the economic assumption of the downward sloping demand function; that an increase in the price of alcohol will reduce its demand and, as a consequence, reduce consumption. Causation between alcohol and violence can therefore be understood as running from the price of alcohol to alcohol consumption and from alcohol consumption to acts of violence. Here increased alcohol consumption is thought to lower the overall cost of violence and thus increase its prevalence.

Using this approach, research in the US has examined the effect of alcohol price on wife and husband abuse (Markowitz, 2000b), violence on college campuses (Grossman and Markowitz, 1999), domestic violence towards children (Markowitz and Grossman, 1998) and criminal violence (Markowitz, 2000a). In each of the aforementioned studies a significant negative association was identified between a measure of alcohol price and a measure of violence. For example, estimates indicate that the probability of being a victim of wife abuse (defined as when a husband is violent towards his wife) would decrease by 5.34% (95% CI: -1 to -9.7) with a 1% increase in the price of 1 ounce of pure alcohol (a weighted average of beer, wine and liqueur prices) (Markowitz, 2000b). A 1% increase in the real price of beer has also been estimated to significantly decrease the prevalence of fighting among US College students (Grossman and Markowitz, 1999).

With studies such as these there will always be questions regarding the extent to which the findings can be generalized. However, a comparative study examining the differing effect of alcohol price on levels of criminal violence across eight countries (Australia, Belgium, Canada, Finland, Holland, Spain, UK and the US), estimated that a 1% increase in the price of alcohol would reduce robbery by 0.27%, assault by

0.30% and sexual assault by 0.21%. The same study also measured the effect of an increase in tax on one ounce of pure alcohol, estimating decreases of 0.19%, 0.25% and 0.16% respectively (Markowitz, 2000a). In England and Wales, Matthews and colleagues (2006) examined the effect of the 'real' price of a pint of beer (i.e. above inflation) on violence-related injury rates. The authors found the real price of beer to be negatively related to violent injury, in so that a 1% rise in the price of alcohol would result in an estimated reduction of 5000 ED attendances per annum (Matthews et al., 2006). Not conforming to this trend, however, is a 2008 Finnish study that examined the effect of a large reduction in alcohol prices (owing to the 2004 deregulation of import quotas within the European Union which resulted in an average tax reduction of 33% on alcoholic beverages in Finland) on police recorded incidents of interpersonal violence in Helsinki (Herttua et al., 2008). The result of a before (2002-2003) and after (2004-2005) analysis indicated that police recorded rates of interpersonal violence were unaffected by such large-scale reductions in the price of alcohol. However, unlike studies that used a measure of alcohol price, Herrtua and colleagues (2008) merely examined whether violence had increased after the change in alcohol policy.

Of the five studies that examined the effect of alcohol price on violence identified above; two used the real price of beer (Matthews et al., 2006, Grossman and Markowitz, 1999), one used the state excise tax rate on beer (Markowitz and Grossman, 1998), one used the weighted average price of beer, wine and liqueur (Markowitz, 2000b), whilst one generated price data using household expenditure, tax revenue and consumption data (Markowitz, 2000a). What is encouraging is that each study found an inverse relationship between alcohol price and violence, even though different measures of both alcohol price and violence were employed.

1.4.4 Violence and deprivation

From a criminological perspective, many studies have sought to investigate the association between economic conditions and crime (including violent crime). Meta-analysis by Hsieh and Pugh (1993), for example, examined the association between violent crime and measures of poverty and income inequality. Using coefficients

from 34 studies, they concluded that both homicide and assault, but not rape or robbery, were closely linked to both poverty and income equality. Macro studies in the UK have shown similar findings in relation to risk of violence-related injury (Howe and Crilly, 2001, Bellis et al., 2008, Bellis et al., 2011, Bellis et al., 2012b, Nasr et al., 2010, Jones et al., 2011). These findings are discussed below.

1.4.4.1 *Violence-related injury and deprivation*

Howe and Crilly (2001), for example, reported a strong positive association between assault patients attending Chorley and South Ribble ED and a composite measure of deprivation based on unemployment, overcrowding and both car and home ownership (Pearson correlation coefficient 0.90; 95% CI: 0.77 to 0.96). Similarly, an examination of trends in emergency hospital admissions for assault (ICD codes X85-Y09), revealed risk of injury was 5.5 times greater for those living in the most deprived communities in England relative to the least deprived (Bellis et al., 2011).

Although a robust relationship has been shown between violence and deprivation in the UK at a macro level, studies have failed to investigate determinants at a micro level; which would be more indicative of why, for example, previous research in South Wales has revealed a significant gender difference in the effect of deprivation on violence-related injury (Nasr et al., 2010). Indeed, examination of violence-related ED attendances between least and most deprived adolescents (aged 11-17 years) living in Cardiff, Swansea and Newport, Nasr and colleagues showed that although injury rates were higher among deprived adolescent males, rate ratios between least and most deprived adolescents were significantly higher for adolescent females (ibid). The authors therefore concluded that deprivation had a heightened impact on rates of violence-related injury among adolescent females relative to adolescent males. Support for this conclusion has also been shown in relation to violent crime committed by adolescent females in the US (Zimmerman and Messner, 2010). Exploring mechanisms which link deprivation with increased risk of violence-related injury at micro level are therefore required in order to better understand reasons for this association at macro level. Mechanisms that may potentially explain the link between deprivation and violence-related injury are discussed below.

1.4.4.2 *Potential mechanisms linking deprivation and risk of adolescent violence-related injury*

1.4.4.2.1 Poor supervision

Poverty has been shown to mediate the effects of informal social control, resulting in harsh discipline, low supervision and poor attachment between child and family (Sampson and Laub, 1994). Similarly, Sampson's study on the association between violence and community collective efficacy, defined as *"social cohesion among neighbours combined with their willingness to intervene on behalf of the common good"* (Sampson et al., 1997: p.917) found that communities with low levels of collective efficacy had higher levels of violence and that 70% of neighbourhood variation in collective efficacy was explained by concentrated disadvantage, immigration concentration, and residential stability. He therefore concluded that communities with low collective efficacy lacked the mutual trust and solidarity needed to maintain the levels of informal social control required to reduce violent behaviour among residents (ibid).

An important mechanism for establishing informal social control, the extent that parents monitor their child's activities has been shown to be one of the strongest and most replicable predictors of youth violence in both the UK and US (Farrington and Ttofi, 2011, Herrenkohl et al., 2000, Pardini et al., 2012). Evidence from the CSDD, for example, revealed that experiencing poor child rearing methods at age 8-10, including poor parental supervision, was a significant predictor of convictions for violence at age 15-20 (Farrington and Ttofi, 2011). Similarly, findings from the PYS have shown that although poor supervision at age 12 was not a significant risk factor for violence at age 15-18, good supervision was found to be a significant protective factor (Pardini et al., 2012). Although evidence presented here is from longitudinal studies examining risk and protective factors for violence among males, socioeconomic and child rearing factors e.g. low family income and poor parental supervision have also been shown as increasingly important risk factors for female offending in the UK (Farrington and Painter, 2004). Therefore, adolescents living in deprived communities may be at an increased risk of violence-related injury due to less parental supervision and low levels of informal social control within the community.

1.4.4.2.2 Alcohol use

Alcohol use is commonplace among UK adolescents by age fifteen (Bellis et al., 2010, Atkinson et al., 2011) and is a strong risk factor for violent victimisation and injury (Cherpitel and Ye, 2010, Shepherd et al., 2006). Although previous UK studies have found no association between youth drinking patterns (including frequent drinking and bingeing) and deprivation (Bellis et al., 2007), likelihood of experiencing alcohol-related violence has been shown to be rise with increasing deprivation (Bellis et al., 2009). Furthermore, an adolescent's risk of experiencing alcohol-related violence is mediated by certain drinking patterns and behaviours. For example, an opportunistic survey of adolescents (aged 15-16 years) living in North West England (n=9,833), revealed that alcohol-related violence was significantly more likely when alcohol was proxy purchased (i.e. bought by someone other than the adolescent or his/her parent) and when spirits or large bottles of cheap cider were consumed (ibid). Therefore, although evidence above suggests the contrary, it remains possible that patterns of alcohol use among more deprived adolescents, including, types of alcohol consumed and drinking locations, may differ from those living in less deprived communities and consequently, place more deprived adolescents at greater risk of violence-related harm.

1.4.4.2.3 Fear of crime

Fear of victimisation has been identified as a motive for weapon carrying (Brennan and Moore, 2009). Research has shown that use of a weapon significantly increases both risk of injury and injury severity (Brennan et al., 2006: discussed further in paragraph 1.7.3). In the UK, a positive association between deprivation and fear of crime has been evidenced (Moore and Shepherd, 2006). Therefore, it is possible that increased fear of crime in deprived communities may result in increased weapon carrying among local residents and thus a heightened risk of sustaining injury through violence. Furthermore, previous victimisation has also been linked with an increased fear of personal harm (Moore and Shepherd, 2007), which may potentially suggest a cycle of vulnerability; where previous victimisation increases fear of future victimisation, which may lead to weapon carrying and as a result, an increased likelihood of violence-related injury.

1.4.4.2.4 Participation in conventional activities

In the UK, some studies have reported evidence which suggest disadvantaged children are less likely to engage in structured activities, such as extra-curricular clubs and sports teams, than least deprived children (Brockman et al., 2009, Sutton, 2008). Involvement in conventional activities has been suggested as an important element at establishing strong social bonds to society and reducing the likelihood of delinquency; for example, "*a person may be simply too busy doing conventional things to find time to engage in deviant behaviour"* (Hirschi, 1969: p.22). Support for this assertion has generally proved mixed. Huebner and Betts (2002), for example, found a negative association between delinquency (including; fighting, carrying weapons, property damage, trouble with police, and alcohol and drug use) and participation in extra-curricular activities (including; after-school clubs, chores, and time spent studying) among US adolescents. In contrast, one study found that while engaging in delinquent activities increased risk of violent victimisation, few conventional activities were found to protect against it (Lauritsen et al., 1992). Nevertheless, from a routine activities perspective - where victimisation occurs due to the convergence in time and space of motivated offenders, appropriate targets, and the lack of effective guardians (Hindelang et al., 1978) - participation in supervised activities, such as after-school clubs, may reduce the risk of victim-offender interaction and thus protect against violence-related injury.

Alternatively, considering that adolescents usually require a time and place free of supervision to engage in risky behaviours such as alcohol use, participation in conventional activities may reduce their window of opportunity (Wichstrøm and Wichstrøm, 2009). Findings from a school-based survey in North West England support this. For example, adolescents (aged 15-16 years) who reported regular involvement in a hobby or sport were significantly less likely to report risky drinking behaviours such as frequent drinking or bingeing (Bellis et al., 2010). Participation in similar activities may therefore reduce likelihood of violence-related injury indirectly by reducing the opportunity for engaging in certain risk behaviours, such as alcohol use or associating with delinquent peers, which have been shown to increase risk of violent victimisation (Shepherd et al., 2006, Schreck et al., 2004).

1.4.4.2.5 Attitudes towards violence

Sub-cultural theories of violence suggest that people within violent sub-cultures have values, norms and expectations that favour the use of violence as a mechanism for resolving conflict and that such values, norms and expectations are intergenerational (Wolfgang and Ferracuti, 1981 cited in, Vold et al., 2002). Although evidence tends not to support the existence of violent sub-cultures (Ball-Rokeach, 1973, Mcgloin et al., 2011), research has shown evidenced that attitudes towards violence may be intergenerational and that such attitudes influence risk of violent behaviour (Herrenkohl et al., 2000) and victimisation (Solomon et al., 2008). For example, longitudinal research has identified those children who have a parent who displays a favourable attitude towards violence, or has a similar pro-violence attitude themselves, are significantly more likely to be involved in violence at age eighteen than those who do not (Herrenkohl et al., 2000). Examining attitudes towards violence from an ED perspective, specifically, whether an association existed between the attitudes of assault injured adolescents (aged 11-17 years) and one of their parents, revealed that parental and adolescent attitudes towards violence were positively related to one another and that parental attitude towards violence was a significant predictor of their child's aggressive behaviour (Solomon et al., 2008). Although it is unclear whether deprivation influences attitudes towards violence, it is not an unreasonable assertion to suggest that it may; especially considering that violence is substantially more common in deprived areas (Bellis et al., 2011).

1.4.5 Other correlates of violent victimization

1.4.5.1 *Age*

Brennan's examination of responses to the BCS (now the CSEW) revealed that likelihood of violent victimisation decreased with age. The study indicated that 20-24 year olds were most at risk of violent victimisation (OR: 0.717, $p<0.001$), while those over the age of 75 were least at risk (Brennan et al., 2010). This corroborates with more recent CSEW estimates, which show young people (aged 16-24 years) were the age group most likely to experience violent victimization once or more in the last 12 months (males, 9.4% and females, 4.6%) (Office for National Statistics, 2014c). Similarly, regression analysis of assault injured patients attending a Cardiff

ED found a negative association between patient age and sustaining injury through violence (Sivarajasingam et al., 2009b). The authors also noted that 16-34 year olds were exceedingly over-represented within their sample. Findings such as these support previous ED-based studies that have evidenced adolescents (11-17 years) and young adults (18-30 years) as having the highest risk of sustaining violence-related injuries in England and Wales (Sivarajasingam et al., 2002, Sivarajasingam et al., 2009a).

1.4.5.2 *Gender*

Along with age, gender is one of the strongest risk factors for violence-related injury. In England, for example, males accounted for 83% (n=27,522) of emergency hospital admissions relating to violence in 2012/13 (Health and Social Care Information Centre, 2013a). From an ED perspective, violence-related attendances in England and Wales have been shown to be three times greater for males relative to females (Sivarajasingam et al., 2014b). Police recorded homicide figures also reveal that males are consistently more likely to fall victim to fatal acts of violence than females (Office for National Statistics, 2014c). In England and Wales, evidence clearly highlights that men have a higher likelihood of being a victim of violence than women. Although the reasons for this over-representation are unclear, previous research has recognized the importance of masculinity in understanding both crime and victimisation (Collier, 1998, Newburn and Stanko, 1994).

1.4.5.3 *Ethnicity*

Whether certain ethnicities are at an increased risk for sustaining violence-related injuries is also unclear. Figures from the CSEW would suggest that they are. Indeed, those who classed their ethnicity as 'non-white' (i.e. mixed race, Asian, Black, Chinese or other) were more likely to report violent victimisation than those who classed their ethnicity as 'white' (Office for National Statistics, 2014c). Matthews and colleagues (2006) did, however, find a positive association between regional rates of violence-related injury and a measure of ethnic diversity; measured as the percentage of ethnic minority residents living within a region. In contrast, research by Brennan et al (2010), in which BCS data was used to explore risk factors for

violent victimization (including violence-related injury and ED attendance), found no association between ethnicity and risk of violent victimisation or injury. However, the study did show an association between ethnicity and seeking ED treatment, with those who classed their ethnicity as 'black' being more likely to attend an ED for treatment of a violence-related injury (ibid). This finding could perhaps offer insight into the results of Matthews et al., (2006), who used rates of violence-related ED attendance as their dependent variable.

1.4.5.4 *Employment status*

Several macro studies have evidenced an association between violent victimisation and employment status. The CSEW, for example, reported greater violent victimisation (including; wounding, assault with minor injury, assault without injury and robbery) among the unemployed compared with those within employment or the economically inactive (for example students, retirees and the long-term sick) (Office for National Statistics, 2014c). Nevertheless, a direct cause and effect association between unemployment and violence has frequently been difficult to prove. A single-centre study on vulnerability to assault injury in Cardiff, for example, found no association between employment status (for example full-time, part-time or unemployed) and assault injury (Sivarajasingam et al., 2009b). Whereas Sivarajasingam et al (2006) and Matthews et al (2006) both identified a significant inverse relationship between violence-related injury and rates of youth unemployment; in so that an increase in youth unemployment would be expected to reduce violence-related ED attendances. Here the authors suggested that higher levels of youth unemployment result in lower levels of disposable income and thus a reduced spending capacity to purchase alcohol; a known risk factor for violence-related injury (ibid). In contrast, results from a recent economic study, which examined the influence of unemployment on violent crime, rather than violent victimisation, identified a positive association (see Bandyopadhyay et al., 2011). Clearly, whether or not a causal association between unemployment and violence-related injury exists, the direction of this association, and whether the association differs with regards to violent crime, remains unclear.

1.4.5.5 *Weapon use*

An association between weapon use and risk of sustaining violence-related injury has been evidenced both nationally and internationally (Brennan et al., 2006, Pickett et al., 2005). In England and Wales, for example, likelihood of injury has been shown to increase significantly when a weapon was involved (OR: 1.448, 1.61 to 1.807, $p<0.001$) (Brennan et al., 2010). Similarly, a cross-national study of seven European and North American countries (Belgium-France, Estonia, Israel, Latvia, Macedonia, Portugal, and the US), revealed that weapon carrying was strongly associated with risk of adolescent injury (Pickett et al., 2005). Findings indicated that this association was especially strong in the US, where risk of sustaining injuries serious enough to require hospitalization were greater when weapons were carried more frequently (ibid). Weapon use has also been associated with injury severity. A single-centre study in Cardiff, for example, tested whether weapon-related violence (excluding firearms) resulted in more severe violence-related injuries among patients attending a local ED (Brennan et al., 2006). Measuring severity of injury using the Manchester Triage Score (categorising patients according to clinical priority i.e. immediate, very urgent, urgent, standard, or non-urgent), results revealed that weapon use significantly increased severity of injury (Adjusted Odds Ratio (AOR): 1.13, 95% CI: 1.17 to 1.70, $p<0.05$); with feet causing the most severe injuries and fists the least (ibid). Brennan and Moore's (2009) review of weapon and violence theory suggests that reasons for weapon carrying relate to fear of victimisation, aggression, early offending and delinquency, psychopathy and the perception of others' weapon carrying. In England and Wales, police recorded incidents of violence against the person offences reveal that 80% of offences involving air weapons and 61% involving non-air weapons resulted in injury in 2012/13 (Office for National Statistics, 2014c).

1.4.5.6 *Sporting events*

An association between violence-related injury and sporting events has also been evidenced. In England, for example, one study found that violence-related ED attendances in the North West increased by 37.5% on days that the England football team played during the 2010 football World Cup (Quigg et al., 2013). Furthermore, a

single-centre study in Cardiff examined the outcome of 74 Welsh national rugby matches and 32 Welsh national football matches on violence-related ED attendance (Sivarajasingam et al., 2005). Findings indicated that violent-related ED attendance was higher when the national sports team won compared to when they lost (ibid). Similar findings have also been evidenced with regards to incidents of domestic violence. Williams and colleagues (2013), for example, found that domestic violence increased in Strathclyde during "old firm" (Celtic versus Rangers) football matches (Williams et al., 2013). Moreover, Brimicombe and Café (2012) found domestic violence rose both when England won (35.4%, $p<0.001$) and when they lost (33.9%, $p<0.001$) during the 2010 football World Cup; relative to the same month of the previous year (Brimicombe and Cafe, 2012). In contrast, however, Bellis and colleagues (2012) found no association between violence-related ED attendances and the Football Association (F.A) Cup final, UEFA Champions League final, or when England played during the Rugby Six Nations Championship.[2] Although sporting events are unlikely to be causally related to violence-related injury, the exact reasons as to why some studies have identified a relationship are unclear. It is possible however that a combination of increased alcohol consumption and the heightened emotion of spectators during these sporting events, may be contributory. The British Beer and Pub Association, for example, attributed a 2.9% increase in beer sales in June 2014 to the 2014 football World Cup (British Beer and Pub Association, 2010); while 50% of assault-related patients during the 2010 football World Cup had consumed alcohol prior to victimisation (Quigg et al., 2013).

1.4.5.7 *Public holidays and annual celebrations*

An examination of night-time assaults in England investigated the influence of public holidays (bank holidays, bank holiday eves, New Year's eve and day, and Christmas eve and day) and other annual celebrations (St. George's day, St. Patrick's day, Halloween, Bonfire night, and Valentine's day) on violence-related ED attendances (Bellis et al., 2012b). For public holidays, findings indicated that although the holiday itself was not related to number of attendances, attendances increased significantly on the eve of such holidays. Increases in ED attendances relating to

[2] Although reported as not statistically significant, the effect of the FA cup final on violence-related injuries was nearing statistical significance, p=0.052 (Bellis et al., 2012b).

violence were greatest on New Year's Eve relative to other bank holidays. Findings also revealed increases in night-time assaults on St. Patrick's Day ($p=0.017$), Bonfire night ($p<0.001$), and Halloween ($p<0.001$) (ibid). Again, similar to sporting events, associations between the eve of public holidays and violence-related injury are likely to result from increased alcohol consumption during these periods.

1.4.5.8 *Seasonal effects*

Likelihood of sustaining violence-related injuries has been shown to be seasonal in England and Wales; with ED attendances for treatment of a violence-related injury higher in the late spring and summer months of May, June, July and August relative to other months (Sivarajasingam et al., 2014b, Bellis et al., 2012b). One explanation suggested for the increase in violence during these months is that the risk of violence increases due to the longer daylight hours resulting in larger amounts of people outside for longer periods of time (Shepherd, 1990). However, a single-centre study in Cardiff found that violence-related ED attendances were not affected by sunlight hours, rainfall or temperature (Sivarajasingam et al., 2004). Reasons for increases in violence during late spring and summer therefore remain unclear.

1.5 Chapter breakdown

As stated at the beginning of this chapter, this thesis has two main aims: to bring clarity to national and local trends in violence in England and Wales using ED data, and to increase understanding of major determinants of violence-related injury in England and Wales at both macro and micro level. Chapter two seeks to address the first aim of the thesis, whilst chapters four and five will address the second aim. The consumption of alcohol and material deprivation have both been shown to be important determinants of violence-related injury. Examining these associations will be the primary focus of chapters four and five.

1.5.1 Chapter two: Trends in community violence in England and Wales between 2005 and 2012

Chapter two addresses limitations of traditional measures of violence (i.e. police records and the CSEW) by determining both national and regional rates and trends in violence-related injury using ED data. Collected prospectively from a convenience sample of 100 EDs (Types 1, 3 and 4) over an eight year period, chapter two seek to triangulate measurement with police and CSEW figures and clarify national trends in violence. Importantly, by investigating regional-specific rates and trends in violence-related injury, chapter two seeks to address the unreliability of police records and the inability of the CSEW to report local trends in violence.

1.5.2 Chapter three: Calculating regional price indices for on-trade and off-trade alcohol in England and Wales

Primarily a methodological chapter, chapter three details the construction of regional price indices for both on-trade and off-trade alcohol in England and Wales, which are to be used in chapter four to model violence-related injury. The decision to create regional price indices for alcohol was taken in light of limitations of both alcohol consumption surveys and alcohol sales data to accurately reflect levels of consumption at regional level and across markets i.e. on-trade and off-trade (discussed further within chapter three). Statistical analysis of the constructed indices is also provided.

1.5.3 Chapter four: Violence-related injury and the real price of alcohol in England and Wales

In chapter four, panel techniques are employed to estimate a statistical model for violence-related injury, in which the influence of both on-trade and off-trade alcohol prices are examined across multiple age and gender combinations. Referred to previously, an association between the real price of beer and rates of violence-related injury has been evidenced in England and Wales (Matthews et al., 2006). However, findings from this study have fallen foul of time: the dependent variable was based on monthly frequency of violence-related injury between May 1995 and April 2000 and the real price of beer was based on the average price of a pint of on-trade beer. Purchase trends have since shifted from the on-trade to off-trade market (Health and

Social Care Information Centre, 2013b), where alcohol tends to be cheaper (Griffith and Leicester, 2010), whilst licensing laws have also been subjected to change (HM Government, 2003). It would be irresponsible, therefore, to presume the findings of Matthews and colleagues are still applicable. Alcohol price elasticities are also reported and the potential impact of an increase in alcohol price on rates of violence-related injury examined.

1.5.4 Chapter five: The risk of violence-related injury among adolescents living in South Wales: a qualitative study

Violence has one of the strongest inequality gradients. Those living in the most deprived communities are substantially more likely to sustain violence-related injury compared to those living in the least deprived communities (Bellis et al., 2008, Bellis et al., 2011, Bellis et al., 2012b). What is less evident however, are mechanisms linking deprivation to increased risk of violence-related injury. Rectifying this, chapter five investigates, qualitatively, mechanisms in which deprivation influences risk of violence-related injury among adolescents living in South Wales. Specifically, the chapter employs thematic analysis to examine gender differences in mechanisms and, as a result, addresses a gap in the empirical literature (including a scarcity of UK-based qualitative studies examining risk factors for violence-related injury). In doing so, chapter five seeks to increase understanding with regards to the effects of gender and deprivation on risk of sustaining violence-related injury, so as to aid in the exploration of targeted interventions in the future.

1.5.5 Chapter six: General Discussion

Chapter six brings the thesis to a close by summarizing the main research findings and discussing their implications for violence prevention in England and Wales. Following the macro to micro approach employed within this thesis, chapter six highlights how findings regarding the association between violence and alcohol price, for example, would impact at both community and individual level. The chapter concludes with a discussion regarding what research should be undertaken in the future based on the findings from this thesis, before offering some concluding remarks on the thesis as a whole.

2 Trends in community violence in England and Wales between 2005 and 2012

2.1 Chapter outline

Chapter two sets out to complete the first aim of the thesis; namely, to bring clarity to national and local trends in violence. This is achieved through the collection and analysis of anonymised violence-related ED data. This chapter details the process of data collection, data cleaning and aggregation, as well as statistical methodology and results. Findings are discussed in relation to other violence measures, regional differences and potential contributing factors.

2.2 Introduction

In the UK, the Coalition Government has prioritised the collection and use of ED derived information for violence prevention purposes. Endorsed by the WHO and previous publications by the NVSN, this harm based measure has been shown to be reliable and objective and is less prone to reporting and recording biases than police measures (see chapter one; paragraph 1.4.2.1). The purpose of the current study is to determine age, gender and region-specific rates of violence in England and Wales, as well as violence trends and seasonality, between January 1st 2005 and December 31st 2012 from an ED perspective. The current study is justified by the need to provide an up-to-date representation of violence at both national and regional level. As a measure of more serious violence, ED derived information can provide a clearer picture of current levels and long term trends by gender, age group and region than can either police recorded data or the CSEW. Understanding levels and trends in serious violence in England and Wales by age and gender, both nationally and regionally, is vitally important to informing policy and directing violence prevention strategies.

2.3 Chapter aims and objectives

Aim:

1) To bring clarity to national trends in violence using ED attendance data.

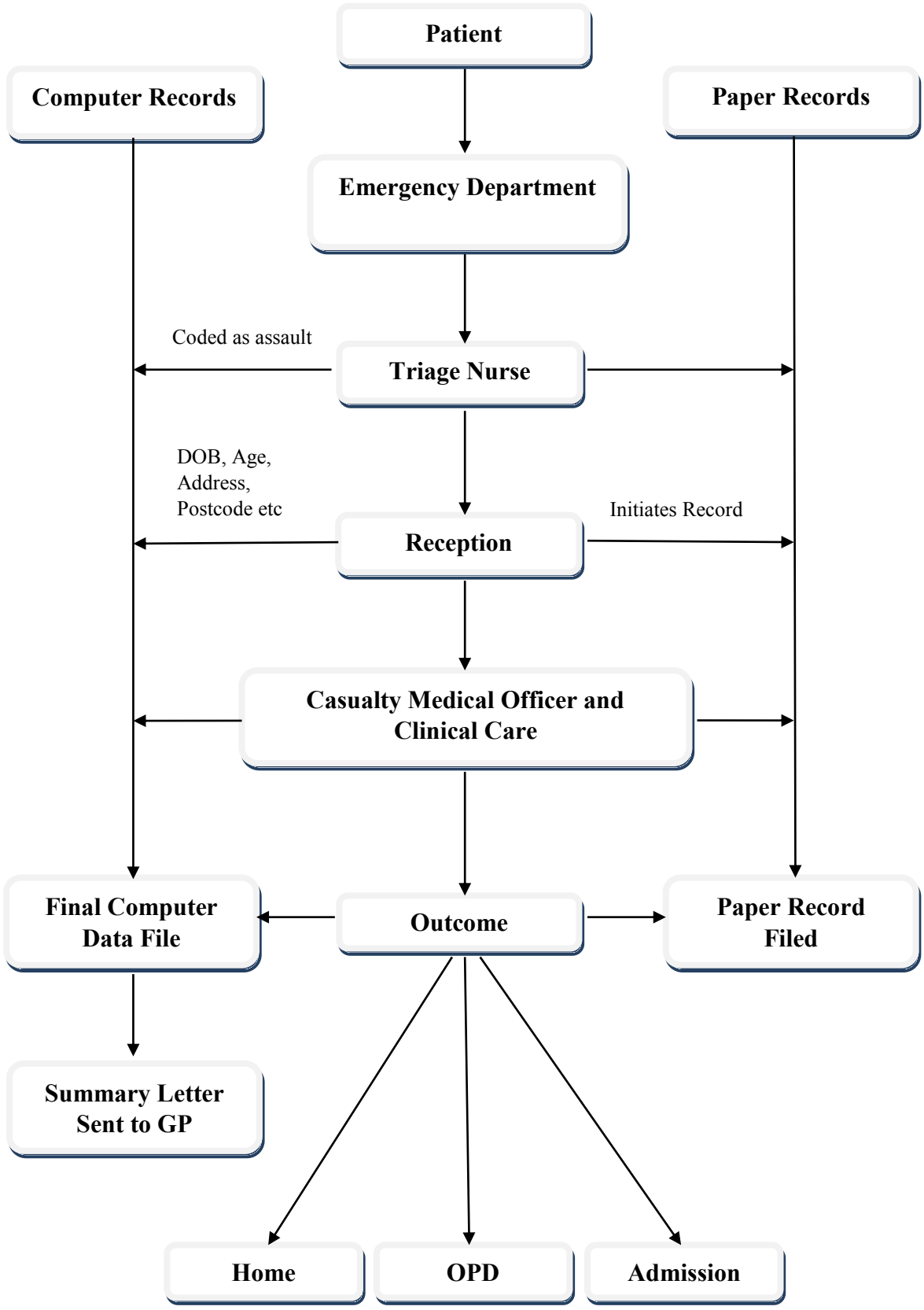
Objectives:

1) To examine age, gender and region-specific rates of violence in England and Wales from an ED perspective from January 1st 2005 to December 31st 2012.
2) To examine age, gender and region-specific trends in violence in England and Wales from an ED perspective from January 1st 2005 to December 31st 2012.
3) To examine seasonality of violence in England and Wales from an ED perspective from January 1st 2005 to December 31st 2012.

2.4 Using ED data

As discussed in chapter one, ED data represents an objective measure of serious violence in England and Wales and is accessible from all local EDs under the Freedom of Information Act (2000). On arrival at the ED, the patient registers with the receptionist and the reason for attendance is recorded, in this case, violence-related injury (see Figure 2.1). Discussed previously, ED attendances are not recorded for the purposes of measuring trends in violence - although the Coalition Government has since prioritized the collection of ED data for this purpose (HM Government, 2010) - and therefore using ED attendance data for this purpose has several limitations which were previously addressed in chapter one (paragraph 1.4.2.5) and briefly recapped at the end of this chapter. Despite such limitations, ED attendance data represent a large available dataset that is well placed to measure trends in violence-related harm at both national and local level and can help direct violence prevention strategies. For example, studies have utilised violence-related ED data when examining the effects of alcohol price (Matthews et al., 2006), deprivation (Bellis et al., 2011), CCTV camera installation (Sivarajasingam et al., 2003), and major sporting events (Bellis et al., 2012b, Quigg et al., 2013, Sivarajasingam et al., 2005) on the occurrence of violence, as well as to measure venue risk (Moore et al., 2011) and identify problematic licensed premises for targeted interventions (Warburton and Shepherd, 2004).

Figure 2.1 Flow of patients through EDs



(Adapted from Sivarajasingam et al., 2002)

2.5 Methods

2.5.1 Sampling

Based at Cardiff University's School of Dentistry, the NVSN is a network of EDs in England and Wales willing to share anonymous violence-related injury data. Attendance records of patients attending Type 1 (consultant led 24 hour service with resuscitation capabilities), Type 3 (other ED/ minor injury unit) and Type 4 (NHS walk-in-centres) EDs for treatment of a violence-related injury between January 1st 2005 and December 31st 2012 were collected from the NVSN database.[3] Patient gender, age and date of attendance were retrieved from what is primarily a convenience sample.

2.5.2 Recruitment

ED attendance data was collected under the Freedom of Information Act (2000). A standard letter detailing the objectives of the network was sent to the clinical directors in EDs in England and Wales. Following this letter, clinical directors were contacted by telephone and information on availability of computerised violence data and their agreement to be part of the network for sharing violence data was sought. In order to become a certified member of the NVSN, EDs must comply with the following criteria; 1) members must be willing to share anonymised attendance data; 2) members must record data electronically; and 3) members must comply with both the Data Protection Act (1998) and Caldicott guidance.[4] The network currently samples approximately one-third of EDs in England and Wales. Patients were automatically recruited to the study if they attended any ED included in the sample for treatment of a violence-related injury during the study period.

[3] No Type 2 (consultant led non-24 hour with no emergency medicine or emergency surgical services) EDs agreed to participate in the study.
[4] Introduced in 1997, the Calidicott guidance ensures that only the minimum amount of personal identifiable information is exchanged when sharing patient information.

2.5.3 Data collection

Violence-related injury is an established category of injury in most ED software. On attending the ED and declaring to reception staff that attendance is the result of injury sustained in violence, an electronic record is made. For each new incident a new record is created. At the end of each year, EDs participating in the study send their anonymised violence-related attendance records, as well as the total number of attendances received at the ED, to the NVSN for analysis.

2.5.4 Data cleaning and aggregation

The initial data received from the NVSN referred to the patient's age and gender, the date of attendance, and the ED attended. Eight individual datasets were received (one for each year between 2005 and 2012) in spreadsheet format, with each row accounting for one violence-related attendance. The data were initially cleaned by removing all incomplete observations from each dataset, for example, where the patient's age or gender were not specified (see paragraph 2.5.7 regarding missing data).

In preparation for aggregation, four categorical variables were defined; 'month', 'year', 'agecat', and 'region'. The variable 'agecat' categorised patients into five age categories (0-10 years, 11-17 years, 18-30 years, 31-50 years or 51 years and over). Age categories were defined roughly in accordance with stages of development i.e. childhood (0-10 years), adolescence (11-17 years), young adults (18-30 years), adults (31-50 years), and those over the age of 51 years. Due to a substantial amount of zeroes in the 51 years and over age category, no attempt was made to create any further age categories.

The variables 'month' and 'year' were disaggregated from the date of attendance in order to enable an examination of both annual and seasonal rates and trends. Prior to 2011, England was classified into nine Government Office Regions reflecting administrative boundaries (i.e. Eastern, East Midlands, London, North East, North West, South East, South West, West Midlands, and Yorkshire and Humberside) (Office for National Statistics, 2012d). Although no longer having officially

devolved functions, Government Office Regions are still the primary classification for presenting regional statistics (ibid). The variable 'region' was therefore used to stipulate which region the ED was located (including Wales). Following this, data were aggregated by month, age category and region (it was not necessary to aggregate by year at this stage as datasets were annual).

Finally, after the above procedures were complete, all eight datasets were combined into one overall dataset spanning eight years from January 1st 2005 to December 31st 2012. See Table 2.1 for an example.

Table 2.1 Construction of dataset; violence-related ED attendances, 2005(1)-2012(12)

year	month	Region	agecat	gender	assaults
2005	January	East	0-10	female	0
2005	January	East	31-50	female	17
2005	January	Wales	0-10	female	4

2.5.5 Calculating violence-related injury rates

2.5.5.1 *Weighting violence-related attendance data*

Since approximately two-thirds of EDs in England and Wales are not certified members of the NVSN, attendance data were weighted in order to account for unequal regional coverage using a series of annually updated, regional specific, coverage ratios. The equation used to calculate the coverage ratio is shown below (Equation 2.1).

$$CR_i = B_i/A_i,\ i = 1, 2, \ldots 10. \qquad \text{(Equation 2.1)}$$

Here, 'B_i' is the annual number of all-cause ED attendance in sampled EDs in region 'i' and 'A_i' is the annual number of all-cause ED attendance for all EDs (including those sampled) in region 'i'. The coverage ratio 'CR_i' for region 'i' is therefore the annual ratio of all-cause ED attendance at EDs sampled ('B') in region 'i' to the total all-cause attendance within all EDs ('A') in region 'i'.

ED activity statistics, containing provider level all-cause ED attendance figures for England, are freely available and were accessed from the Department of Health and NHS websites (Department of Health, 2013, NHS England, 2015). Attendance figures were initially accessed as quarterly activity statistics from the Department of Health between January 2005 and September 2011, before discontinuation of the quarterly figures resulted in the use of weekly activity statistics sourced from the NHS website. Once collected, provider level attendances were aggregated to regional level with quarterly and weekly attendance figures summed to give annual, regional totals. For Wales, monthly all-cause ED attendance figures were accessed from the Welsh Government website as part of its monthly report on ED waiting times in Wales (Welsh Government, 2015). Figures at local health board level were aggregated to form a series of annual totals between 2005 and 2012. See Table 2.2 for a working example of the coverage ratio calculation. A coverage ratio equal to one meant full regional coverage, while a coverage ratio equal to zero meant no regional coverage.

Monthly violence-related attendance figures by year, region, age group, and gender; for example, 18-30 year old males attending EDs in South East England in 2005 were multiplied by the respective regional coverage ratio in order to weight the figures and account for EDs not included within the sample. See Table 2.2 for a working example of the weighting process.

Table 2.2 Coverage ratio calculation; South East, 2005-2012

Region	Year	EDs	Sample attendances (*B*)	Total attendances (*A*)	Coverage Ratio (*CR*)*
South East	2005	2	103981	2323022	0.0448
South East	2006	4	219196	2396273	0.0915
South East	2007	4	228553	2491317	0.0917
South East	2008	5	234210	2612429	0.0897
South East	2009	6	349155	2708627	0.1289
South East	2010	7	459010	2714597	0.1691
South East	2011	2	93875	2722855	0.0345
South East	2012	6	511441	2734679	0.1870

* rounded figures

Table 2.3 Weighting raw ED attendance data

Region	Year	Month	Age	Gender	1/CR*	Raw attendance	Weighted attendance
South East	2005	Jan	18-30	Male	22.34	104	2323.446
South East	2005	Feb	18-30	Male	22.34	80	1787.267
South East	2005	Mar	18-30	Male	22.34	93	2077.697
South East	2005	Apr	18-30	Male	22.34	114	2546.855

* rounded figures

2.5.5.2 *Calculating violence-related injury rates*

Annual population estimates were sourced from the ONS and used to transform the weighted attendance figures into violence-related injury rates per 1000 population. Population estimates were available by all combinations of year, gender, age and region. The overall equation for calculating violence-related injury rates is shown below (Equation 2.2).

$$V_i = ((1/CR) \times n)_i / N_i \times 1000. \qquad \text{(Equation 2.2)}$$

Where 'V_i' is the likelihood of being injured in violence in region '*i*', '(1/CR)' is the coverage ratio for region '*i*', 'n_i' is the number of injured persons attending EDs in region '*i*', and 'N_i' is the total population of region '*i*' (see Sivarajasingam et al., 2002, Sivarajasingam et al., 2009a, Sivarajasingam et al., 2014a for evidence of peer review). See Table 2.4 for a working example of Equation 2.2.

Table 2.4 Calculating violence-related injury rates (per 1000 population)

Region	Year	Month	Age	Gender	Weighted attendance	Population	Violent injury rate
South East	2005	Jan	18-30	Male	2323.446	1,281,090	1.81
South East	2005	Feb	18-30	Male	1787.267	1,281,090	1.40
South East	2005	Mar	18-30	Male	2077.697	1,281,090	1.62
South East	2005	Apr	18-30	Male	2546.855	1,281,090	1.99

2.5.6 Statistical methods

2.5.6.1 *Trend analysis*

Public health research is increasingly interested in examining and understanding health-related trends at both national and local level. Indeed, knowing whether a particular illness or disease is increasing or in decline, nationally or within a particular locality, can direct preventative strategies and inform future policy. Trend analyses are typically conducted at the ecological level, where observations refer to a specific time period rather than to a specific individual. In public health research, trend analysis tends to be used in order to compare geographic areas, compare time periods (i.e. before and after an event), compare populations, and to forecast future occurrences (Rosenberg, 1997). Regression analysis tends to be the most common approach to test whether there is a statistically significant trend over a particular time period. The advantages of employing a regression analysis are that other variables, which may have an important influence on the dependent variable, can also be used within the model (ibid). Furthermore, analysing the data as one unit, rather than multiple time periods, can impose stability and improve estimation (ibid).

In the current study, two separate regressions were employed; a negative binomial regression was conducted on the numerator (violence-related ED attendances) and a log-linear regression on the denominator (population figures). Violence rate and trend coefficients were then estimated from the ratio of these two regression models (Equation 2.5).

Since violence-related injury was measured by count of ED attendances, there were a substantial number of zeroes in the 0-10 years and 51 years and over age groups. A negative binomial regression model was therefore fitted in order to account for any over-dispersion, i.e. when the conditional variance is greater than the conditional mean, using a time trend (month number) with age group, region, month, and gender dummy variables. Interactions between region and time, age category and time, age category and region, gender and age group, month and age group, gender and region, and gender and time were also identified. A log-linear regression was carried out on the population data (also disaggregated by age group, gender and region) in order to account for population change over time.

Numerator (Equation 2.3) and denominator (Equation 2.4) coefficients for a particular subcategory were then calculated by substituting for the appropriate dummy variable in the regression equation. For instance, to retrieve the coefficients for females aged 18-30 years living in London, the following dummy variables would be substituted into both numerator and denominator regressions; gender=1, (age1=0, age2=1, age3=0, age4=0) and (East=0, East Midlands=0, London=1, North East=0….). The overall coefficient is therefore an aggregate calculated as the weighted sum of the selected subgroup i.e., in this case, females aged 18-30 years living in London.

$$\ln(n_{G,A,R}) = a_{G,A,R} + b_{G,A,R}\, t \qquad \text{(Equation 2.3)}$$

$$\ln(N_{G,A,R}) = A_{G,A,R} + B_{G,A,R}\, t \qquad \text{(Equation 2.4)}$$

$$\ln(\text{Rate}_{G,A,R}) = \ln(n_{G,A,R} / N_{G,A,R}) = (a_{G,A,R} - A_{G,A,R}) + (b_{G,A,R} - B_{G,A,R})\, t \qquad \text{(Equation 2.5)}$$

Where '$n_{G, A, R}$' is the violent assault count and '$N_{G, A, R}$' is the population for a given gender (G), age group (A) and region (R), and't' is time. 'A', 'a' are the regression constants and 'B', 'b' are the regression slopes for the populations (denoted by upper case) and violent assault counts (denoted by lower case).

A similar weighted averaging process was also performed over the coefficient covariance matrix for the negative binomial regression, in order to estimate the standard errors of the aggregated coefficients and assess the significance of the trend over time. In equation 2.5 (above), aggregated coefficients are primarily a weighted sum of a subgroup of coefficients (e.g. 18-30 year old females living in London), which are themselves sums of the time trend coefficients for the various basic and interaction terms within the regression. Put simply, the aggregated time trend coefficients for the subgroup expressed above would be t, t x London, t x age3 and t x London x age3 (no gender coefficient would be required as females constituted the gender reference group). It is therefore possible to write out any subgroup as a weighted sum of individual regression coefficients. The variance of the aggregated coefficient can therefore be calculated by applying the same weights (e.g. 18-30 year olds females living in London) to the coefficient covariance matrix, which is part of the standard regression output (see Equation 2.6).

$$Variance(b_{subgroup}) = \sum_i \sum_j C_i C_j Cov(b_i, b_j) \qquad \text{(Equation 2.6)}$$

Where '$b_{subgroup}$' is the aggregated coefficient of the chosen subgroup, '$C_i\, C_j$' are the weights and '$Cov(b_i, b_j)$' are elements of the coefficient covariance matrix.

2.5.6.2 *Calculating 95% confidence intervals*

A jackknife sampling technique was employed in order to calculate 95% confidence intervals for the violence-related injury rates and, in doing so, test the degree to which certain EDs affected the overall rate calculated for a given group or subgroup. A jackknife approach involves recalculating the rates a pre-specified number of times by continuously re-sampling from the sample population. For example, in the current study, the rates were recalculated one thousand times, with three random EDs

dropped from the sample each time. Confidence intervals for the violence-related injury rates were defined by taking the rate at the 2.5 and 97.5 percentiles of these one thousand estimates.

2.5.7 Missing data

Attendance data is collected annually from participating EDs. However, for a particular year there are three main reasons which could prevent an ED from being included in the sample. Firstly, an ED may choose not to share its anonymised attendance data for the purposes of violence prevention. Secondly, the data shared may not meet the necessary standard for inclusion in the sample and therefore must be excluded from further analysis. And thirdly, an ED cannot be included in the study if it fails to provide the total number of all-cause attendances it has received over that year, which is required as input into the regional coverage ratio calculation (failure to exclude violence-related attendances from an ED that has not provided its total number of all-cause attendances would inflate the weighted estimates).

In total, 6915 (1.9%) violence-related ED attendances were excluded from the study as the result of reasons two and three i.e. the data was not of the required standard (e.g. age or gender of patient was not given) or the ED failed to provide their total number of all-cause ED attendances. Moreover, owing to one of the reasons given above, the NVSN may, on occasion, fail to sample EDs from a particular region. This was true of the current study. Indeed, no EDs from the West Midlands region in 2009 or the North East region in 2011 were included in the study.

When performing a regression using the statistical software package R (version 3.0.2), the default setting stipulates that only complete cases are included in the analysis and therefore any missing observations are automatically excluded (R core team, 2013). Owing to missing observations for the West Midlands in 2009 and the North East in 2011, the time series included twenty-four missing observations. These observations were excluded from the regression analysis, as per the default setting,

2.5.8 Analysis software

The statistical software package R (version 3.0.2) was used to clean the ED data and to calculate the violence-related injury rates. The same software was also used for model fitting and trend analysis (R Core Team, 2013).

2.5.9 Ethical considerations

Ethical approval was not required for this study. Information on attendance date, age and gender of patients attending EDs for treatment of a violence-related injury were collected under the Freedom of Information Act (2000). Information sharing to tackle violence (ISTV) is a Coalition Government commitment (HM Government, 2010) and organizations who share such information are required to abide by both the Data Protection Act (1998) and NHS Confidentiality Code of Practice (HM Government, 1998b, Department of Health, 2003). As referred to previously (paragraph 2.5.2), the current study complied with both. Furthermore, as part of the guidance on ISTV (Department of Health, 2012), all data must be thoroughly de-identified in line with the Anonymisation Code of Practice laid out by the Information Commissioner's Office (Information Commissioner's Office, 2012). Compliant with this code of practice, ED attendances were anonymised prior to collection.

2.6 Results

2.6.1 Violence-related attendances

In total, 356,356 violence-related attendances were recorded from 100 EDs across England and Wales between January 1st 2005 and December 31st 2012. Disaggregation by gender and age group indicated that the sample was predominately male (261,047: 73.3%) and aged between 18 and 30 years of age (174,214: 48.9%). This was followed by those aged 31-50 years, 11-17 years, 51 years and over, and those under the age of 10 years (age and gender distributions are shown in Table 2.5). Seasonal variations were also evident with violence-related attendances highest in May (32,171) and lowest in February (26,236, see Figure 2.2).

See Tables 2.6 and 2.7 for regional distribution and names of sampled EDs, as well as Figure 2.3 for a visual representation.

Table 2.5 Age and gender of patients who attended 100 EDs for treatment of a violence-related injury 2005(1)-2012(12)

Age group	Male	Female	Total
0-10 years	2,371	1,157	3,528 (1.0%)
11-17 years	38,150	14,847	52,997 (14.9%)
18-30 years	132,322	41,892	174,214 (48.9%)
31-50 years	73,482	30,662	104,144 (29.2%)
51 years +	14,722	6,751	21,473 (6.0%)
Total	**261,047**	**95,309**	**356,356**

Figure 2.2 Average violence-related ED attendances in England and Wales by month, 2005(1)-2012(12)

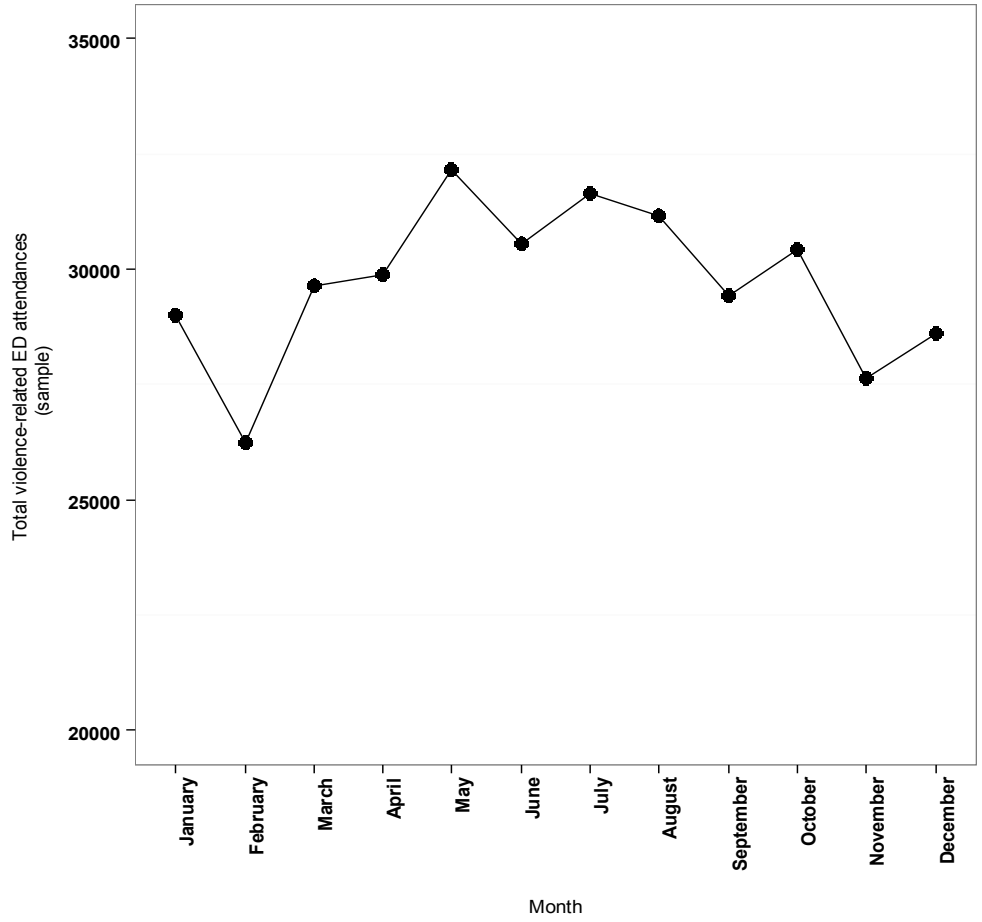


Table 2.6 Regional distributions of sampled EDs (% of all-cause ED attendance sampled in parenthesis), 2005-2012

Region	2005	2006	2007	2008	2009	2010	2011	2012	Mean
Eastern	3 (11.2%)	4 (10.5%)	4 (17.7%)	4 (13.75)	4 (12.6%)	3 (5.6%)	2 (7.1%)	7 (284%)	3.9
East Midlands	2 (15.0%)	2 (7.6%)	2 (7.6%)	9 (42.6%)	1 (8.8%)	4 (23.8%)	6 (16.7%)	2 (13.1%)	3.5
London	2 (4.3%)	2 (4.6%)	2 (4.5%)	4 (9.5%)	6 (14.5%)	6 (13.0%)	5 (9.4%)	6 (16.8%)	4.1
North East	3 (13.1%)	4 (22.8%)	3 (14.0%)	2 (15.0%)	4 (21.1%)	7 (29.8%)	0 (0%)	5 (28.7%)	3.5
North West	5 (10.6%)	5 (11.5%)	4 (9.2%)	10 (19.4%)	9 (17.2%)	10 (18.9%)	9 (17.2%)	5 (11.8%)	7.1
South East	2 (4.5%)	4 (9.1%)	4 (9.2%)	5 (9.0%)	6 (12.9%)	8 (16.9%)	2 (3.4%)	8 (18.7%)	4.9
South West	3 (12.4%)	6 (17.0%)	8 (28.1%)	5 (15.0%)	4 (10.1%)	8 (21.1%)	5 (12.3%)	6 (9.4%)	5.6
Wales	3 (22.1%)	2 (18.3%)	2 (17.0%)	3 (23.9%)	3 (21.9%)	3 (26.1%)	5 (39.3%)	2 (22.4%)	2.9

West Midlands	1 (5.2%)	2 (9.4%)	1 (4.3%)	1 (4.8%)	0 (0%)	2 (6.0%)	3 (10.7%)	1 (4.1%)	1.4
Yorkshire & Humberside	3 (10.1%)	3 (12.3%)	4 (15.6%)	5 (18.6%)	4 (20.9%)	5 (23.1%)	3 (15.4%)	6 (25.7%)	4.1
Total	**27**	**34**	**34**	**48**	**41**	**56**	**40**	**48**	**41**

Table 2.7 Emergency Departments included in study, 2005(1)-2012(12)

1	Accrington Victoria MIU	**25**	Frenchay
2	Andover War Memorial MIU	**26**	Friarage (Northallerton)
3	Basildon University	**27**	Frimley Park
4	Bassettlaw	**28**	General Hospital (Hereford)
5	Bedford	**29**	Glan Clwyd (Rhyl)
6	Bideford MIU	**30**	Gloucestershire Royal
7	Broomfield (Chelmsford)	**31**	Good Hope (Sutton Coldfield)
8	Burnley Urgent Care	**32**	Grantham & District
9	Bury General	**33**	Gwynedd (Bangor)
10	Calderdale Royal	**34**	Heartlands (Birmingham)
11	Cheltenham General	**35**	Heatherwood MIU
12	Chesterfield Royal	**36**	Hexham General
13	Chorley & South Ribble District General	**37**	Hillingdon
14	Clevedon	**38**	Hinchingbrooke
15	Colchester General	**39**	Huddersfield Royal Infirmary
16	Conquest Hospital (St.Leonards-on-sea)	**40**	Ilfracombe MIU
17	Countess of Chester	**41**	Ipswich
18	County Hospital Louth	**42**	James Cook (Middlesbrough)
19	Darlington memorial & Bishop Aukland	**43**	James Paget University
20	Derbyshire Royal Infirmary	**44**	John Coupland
21	District General Hospital Eastbourne	**45**	Johnson Community
22	Doncaster Royal Infirmary	**46**	King George (Goodmayes)
23	Ealing (Southall)	**47**	Kingston (Kingston-upon-Thames)
24	Fairfield General	**48**	Leicester Royal Infirmary
49	Lincoln County	**72**	Royal Devon & Exeter
50	Lister	**73**	Royal Glamorgan
51	Montagu (Mexborough)	**74**	Royal Hampshire County

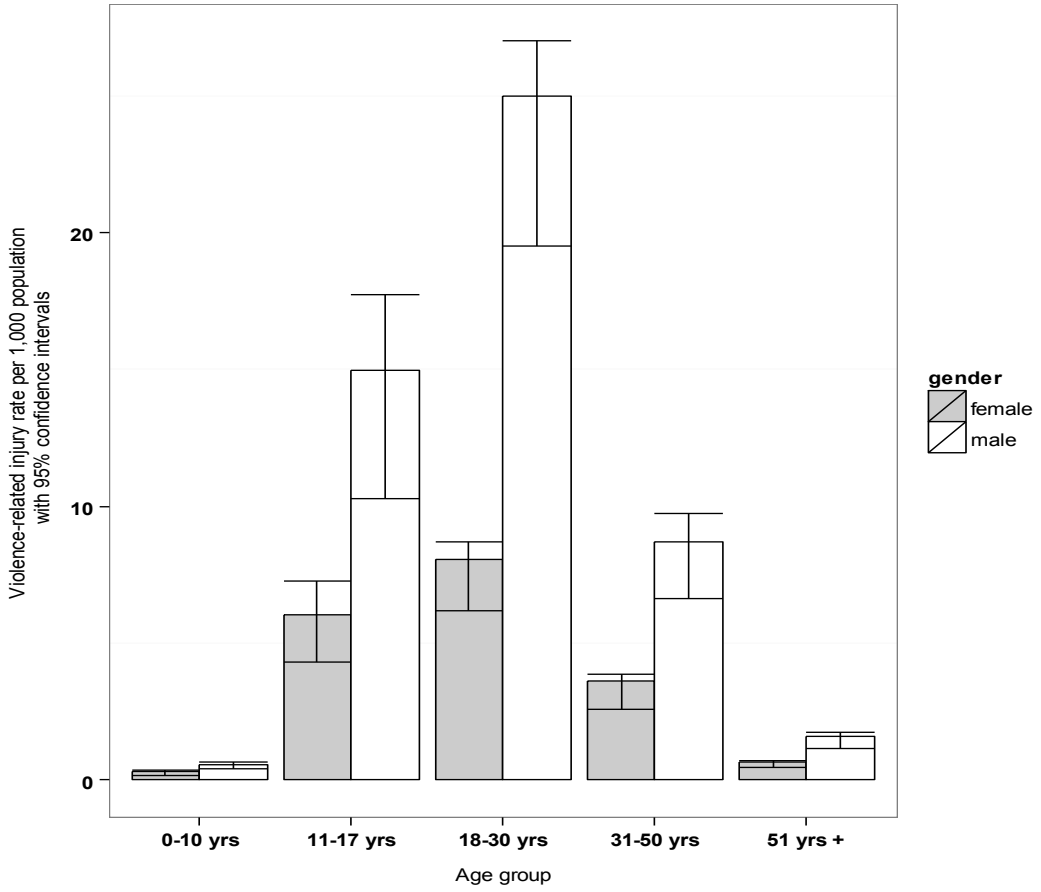
			(Winchester)
52	Morriston (Swansea)	**75**	Royal Oldham
53	Neath Port Talbot	**76**	Royal Preston
54	Norfolk & Norwich University	**77**	Royal Sussex County
55	North Devon District (Barnstaple)	**78**	Russell Hall (Dudley)
56	North Manchester General	**79**	Salisbury District
57	North Tyneside General (North Shields)	**80**	Scunthorpe General
58	Northern General (Sheffield)	**81**	Shotley Bridge (Consett)
59	Peterborough District	**82**	Skegness and District General
60	Pilgrim (Boston)	**83**	Solihull
61	Prince Charles (Merthyr Tydfil)	**84**	South Tyneside District
62	Princess of Wales (Grimsby)	**85**	Southend University
63	Princess Royal (Farnborough)	**86**	St Marys (Isle of Wight)
64	Princess Royal (West Sussex)	**87**	Stepping Hill (Stockport)
65	Queen Elizabeth (Woolwich)	**88**	Stoke Mandiville
66	Queen Mary's Hospital (Sidcup)	**89**	Sunderland Royal
67	Queens (Romford)	**90**	University Hospital Hartlepool
68	Rochdale Infirmary	**91**	University Hospital Lewisham
69	Royal Blackburn	**92**	University Hospital of North Durham
70	Royal Blackburn Urgent Care	**93**	University Hospital Wales (Cardiff)
71	Royal Bournemouth	**94**	Wansbeck General
95	West Middlesex University	**98**	Whiston Hospital (Prescot)
96	West Suffolk	**99**	Wrexham Maelor
97	Wexham Park	**100**	Wycombe

Figure 2.3 Emergency Departments included in study, 2005(1)-2012(12)

2.6.2 Violence-related injury rates

Overall in England and Wales, 5.95 per 1000 residents (95% CI: 4.84 to 6.45) attended EDs annually for treatment of violence-related injury between 2005 and 2012. Disaggregation by gender showed that males (8.86 per 1000 residents, 95% CI: 6.78 to 9.56) were nearly three times more likely than females (3.13 per 1000 residents, 95% CI: 2.35 to 3.38) to have required treatment for violence-related injury: higher rates of violence-related injury were identified for males across all five age groups studied. Analyses by age group indicated that those aged 18-30 years experienced the highest rate of violence-related injury (16.63 per 1000 residents, 95% CI: 13.37 to 17.84), followed by those aged 11-17 years (10.62 per 1000 residents, 95% CI: 7.84 to 11.64), 31-50 years (6.15 per 1000 residents, 95% CI: 5.04 to 6.70), 51 years and over (1.09 per 1000 residents, 95% CI: 0.85 to 1.18), and those under the age of 10 years (0.45 per 1000 residents, 95% CI: 0.31 to 0.51). See Figure 2.4 and Table 2.11 for age and gender distributions.

Figure 2.4 Average violence-related injury rates by gender and age group, 2005(1)-2012(12)



Further disaggregation by region revealed substantial variation between northern and southern regions, with higher rates of violence-related injury identified in the North West (10.82 per 1000 residents), North East (8.04 per 1000 residents) and in Wales (7.36 per 1000 residents).[5] Comparatively, lower rates of violence-related injury were identified in the Eastern (3.34 per 1000 residents) and East Midlands (4.28 per 1000 residents) regions. Violence-related injury rates for the remaining regions were as follows (in ascending order): South West (4.60 per 1000 residents), South East (4.67 per 1000 residents), London (5.32 per 1000 residents), West Midlands (6.02 per 1000 residents), and Yorkshire and Humberside (6.39 per 1000 residents).

[5] 95% confidence intervals are unavailable for regional analyses. For some years there are not enough hospitals sampled from a region to be able to employ the jackknife process.

Table 2.8 highlights a breakdown of rates by age group, gender and region. Interestingly, London was the only region to show similar rates of violence-related injury among 11-17 year olds and 18-30 year olds, as well as higher injury rates among those over 51 years, then would have been expected considering its overall rate. Comparatively, the Eastern region had the lowest rate of violence-related injury for every combination of age and gender.

Table 2.8 Overall annual violence-related injury rate (per 1000 population) by gender, age group and region, 2005(1)-2012(12)

Region	0-10		11-17		18-30		31-50		51+		All
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Total
North West	1.04	0.44	26.02	10.34	44.61	14.71	17.32	6.87	2.85	1.04	**10.82**
North East	1.26	0.75	21.74	9.44	32.57	10.86	11.97	4.90	1.99	0.86	**8.04**
Wales	0.87	0.46	16.58	7.19	33.96	11.46	11.26	4.53	1.66	0.69	**7.36**
Yorkshire & Humberside	0.42	0.17	13.37	6.10	26.27	9.07	9.76	4.23	1.53	0.64	**6.39**
West Midlands	0.49	0.36	16.05	6.00	25.06	8.22	9.21	3.61	1.75	0.62	**6.02**
London	0.41	0.28	17.00	6.70	17.84	5.96	6.60	3.16	2.16	0.89	**5.32**
South East	0.57	0.29	11.99	4.88	21.63	6.05	6.76	2.60	1.24	0.54	**4.67**
South West	0.49	0.28	10.66	4.17	22.51	7.13	6.85	2.80	1.08	0.44	**4.60**
East Midlands	0.51	0.25	9.66	4.00	18.40	6.23	6.44	2.79	1.19	0.53	**4.28**
Eastern	0.28	0.14	8.64	3.12	16.27	4.46	4.83	1.86	0.82	0.33	**3.34**

2.6.3 Trends in violence-related injury

2.6.3.1 *Regression results*

The negative binomial regression and log-linear regression coefficients used to estimate change in violence-related attendances in England and Wales are shown in Table 2.9 and Table 2.10 respectively.

Table 2.9 Negative binomial regression results, violence-related ED attendances, 2005(1)-2012(12)

Variable	Coefficient	Std. Error	z-value	p-value	
Intercept	1.671	0.071	23.435	<0.001	***
Time	-0.013	0.001	-18.194	<0.001	***
February	0.139	0.062	2.249	0.025	*
March	0.303	0.061	4.97	<0.001	***
April	0.466	0.060	7.719	<0.001	***
May	0.552	0.060	9.196	<0.001	***
June	0.467	0.060	7.728	<0.001	***
July	0.427	0.061	7.047	<0.001	***
August	0.287	0.061	4.687	<0.001	***
September	0.389	0.061	6.396	<0.001	***
October	0.080	0.062	1.279	0.201	
November	0.095	0.062	1.527	0.127	
December	-0.098	0.064	-1.533	0.125	
Gender (Male)	0.796	0.041	19.313	<0.001	***
East Midlands	-0.254	0.073	-3.482	<0.001	***
London	0.558	0.070	7.926	<0.001	***
North East	0.447	0.073	6.158	<0.001	***
North West	1.300	0.069	18.84	<0.001	***
South East	1.097	0.070	15.772	<0.001	***
South West	0.233	0.072	3.245	0.001	**
Wales	0.353	0.072	4.924	<0.001	***
West Midlands	0.734	0.072	10.139	<0.001	***
Yorkshire &	-0.017	0.073	-0.227	0.820	

Humberside					
Age1 (11-17)	3.067	0.082	37.416	<0.001	***
Age2 (18-30)	3.820	0.082	46.864	<0.001	***
Age3 (31-50)	3.528	0.082	43.216	<0.001	***
Age4 (51+)	1.932	0.083	23.313	<0.001	***
Time x East Midlands	0.015	0.001	19.104	<0.001	***
Time x London	0.010	0.001	13.587	<0.001	***
Time x North East	0.009	0.001	10.939	<0.001	***
Time x North West	0.004	0.001	5.869	<0.001	***
Time x South East	0.003	0.001	4.279	<0.001	***
Time x South West	0.007	0.001	9.436	<0.001	***
Time x Wales	0.005	0.001	7.026	<0.001	***
Time x West Midlands	0.001	0.001	0.966	0.334	
Time x Yorkshire & Humberside	0.008	0.001	10.25	<0.001	***
Time x 11-17	-0.001	0.001	-2.348	0.019	*
Time x 18-30	0.005	0.001	8.582	<0.001	***
Time x 31-50	0.004	0.001	6.993	<0.001	***
Time x 51+	0.006	0.001	10.853	<0.001	***
East Midlands x 11-17	-0.345	0.075	-4.598	<0.001	***
London x 11-17	0.008	0.073	0.113	0.910	
North East x 11-17	-0.501	0.076	-6.624	<0.001	***
North West x 11-17	-0.053	0.072	-0.743	0.457	
South East x 11-17	-0.375	0.072	-5.193	<0.001	***
South West x 11-17	-0.312	0.074	-4.201	<0.001	***
Wales x 11-17	-0.354	0.074	-4.76	<0.001	***
West Midlands x 11-17	-0.049	0.076	-0.649	0.516	
Yorkshire &	0.257	0.075	3.412	0.001	***

Humberside x 11-17					
East Midlands x 18-30	-0.356	0.074	-4.784	<0.001	***
London x 18-30	-0.188	0.072	-2.591	0.010	**
North East x 18-30	-0.703	0.075	-9.349	<0.001	***
North West x 18-30	-0.126	0.071	-1.762	0.078	.
South East x 18-30	-0.527	0.072	-7.336	<0.001	***
South West x 18-30	-0.238	0.074	-3.226	0.001	**
Wales x 18-30	-0.317	0.074	-4.298	<0.001	***
West Midlands x 18-30	-0.214	0.075	-2.839	0.005	**
Yorkshire & Humberside x 18-30	0.343	0.075	4.595	<0.001	***
East Midlands x 31-50	-0.300	0.075	-4.021	<0.001	***
London x 31-50	-0.103	0.072	-1.418	0.156	
North East x 31-50	-0.659	0.075	-8.755	<0.001	***
North West x 31-50	-0.029	0.071	-0.41	0.682	
South East x 31-50	-0.492	0.072	-6.843	<0.001	***
South West x 31-50	-0.285	0.074	-3.856	<0.001	***
Wales x 31-50	-0.380	0.074	-5.145	<0.001	***
West Midlands x 31-50	-0.171	0.076	-2.265	0.024	*
Yorkshire & Humberside x 31-50	0.370	0.075	4.938	<0.001	***
East Midlands x 51+	-0.255	0.076	-3.366	0.001	***
London x 51+	-0.030	0.073	-0.405	0.685	
North East x 51+	-0.642	0.077	-8.38	<0.001	***

North West x 51+	-0.129	0.072	-1.789	0.074	.
South East x 51+	-0.398	0.073	-5.454	<0.001	***
South West x 51+	-0.255	0.075	-3.392	0.001	***
Wales x 51+	-0.414	0.075	-5.512	<0.001	***
West Midlands x 51+	-0.118	0.077	-1.533	0.125	
Yorkshire & Humberside x 51+	0.224	0.076	2.954	0.003	**
Male x 11-17	0.284	0.032	8.886	<0.001	***
Male x 18-30	0.500	0.032	15.718	<0.001	***
Male x 31-50	0.199	0.032	6.246	<0.001	***
Male x 51+	0.097	0.032	2.992	0.003	**
February x 11-17	-0.259	0.079	-3.27	0.001	**
March x 11-17	-0.188	0.079	-2.395	0.017	*
April x 11-17	-0.454	0.078	-5.812	<0.001	***
May x 11-17	-0.420	0.078	-5.398	<0.001	***
June x 11-17	-0.368	0.078	-4.702	<0.001	***
July x 11-17	-0.366	0.078	-4.665	<0.001	***
August x 11-17	-0.456	0.079	-5.769	<0.001	***
September x 11-17	-0.349	0.079	-4.442	<0.001	***
October x 11-17	0.003	0.080	0.034	0.973	
November x 11-17	-0.088	0.080	-1.104	0.269	
December x 11-17	-0.229	0.081	-2.828	0.005	**
February x 18-30	-0.242	0.079	-3.068	0.002	**
March x 18-30	-0.301	0.078	-3.845	<0.001	***
April x 18-30	-0.435	0.078	-5.597	<0.001	***
May x 18-30	-0.454	0.078	-5.861	<0.001	***
June x 18-30	-0.425	0.078	-5.462	<0.001	***
July x 18-30	-0.333	0.078	-4.276	<0.001	***
August x 18-30	-0.169	0.079	-2.159	0.031	*
September x 18-30	-0.366	0.078	-4.676	<0.001	***
October x 18-30	-0.001	0.079	-0.008	0.994	

November x 18-30	-0.147	0.079	-1.848	0.065	.
December x 18-30	0.116	0.080	1.444	0.149	
February x 31-50	-0.260	0.079	-3.292	0.001	***
March x 31-50	-0.317	0.078	-4.053	<0.001	***
April x 31-50	-0.450	0.078	-5.782	<0.001	***
May x 31-50	-0.473	0.078	-6.097	<0.001	***
June x 31-50	-0.375	0.078	-4.818	<0.001	***
July x 31-50	-0.282	0.078	-3.612	<0.001	***
August x 31-50	-0.147	0.079	-1.868	0.062	.
September x 31-50	-0.362	0.078	-4.627	<0.001	***
October x 31-50	-0.051	0.080	-0.636	0.525	
November x 31-50	-0.132	0.080	-1.658	0.097	.
December x 31-50	0.135	0.081	1.671	0.095	.
February x 51+	-0.265	0.080	-3.314	0.001	***
March x 51+	-0.280	0.079	-3.529	<0.001	***
April x 51+	-0.466	0.079	-5.91	<0.001	***
May x 51+	-0.431	0.079	-5.479	<0.001	***
June x 51+	-0.410	0.079	-5.188	<0.001	***
July x 51+	-0.289	0.079	-3.652	<0.001	***
August x 51+	-0.156	0.080	-1.961	0.050	*
September x 51+	-0.378	0.079	-4.76	<0.001	***
October x 51+	-0.092	0.081	-1.139	0.255	
November x 51+	-0.121	0.081	-1.501	0.133	
December x 51+	0.126	0.082	1.541	0.123	
Male x East Midlands	-0.113	0.042	-2.675	0.007	**
Male x London	-0.168	0.042	-4.024	<0.001	***
Male x North East	-0.149	0.043	-3.42	0.001	***
Male x North West	-0.034	0.041	-0.829	0.407	
Male x South East	-0.065	0.042	-1.556	0.120	
Male x South West	-0.081	0.042	-1.913	0.056	.
Male x Wales	-0.125	0.042	-2.965	0.003	**

Male x West Midlands	-0.097	0.043	-2.24	0.025	*
Male x Yorkshire & Humberside	-0.116	0.042	-2.756	0.006	**
Time x Male	-0.001	<0.001	-2.191	0.028	*
Theta	5.411	0.107			

***significant at 0.1% level; **significant at 1% level; *significant at 5% level

Table 2.10 Log-linear regression results; population of England and Wales, 2005(1)-2012(12)

Variable	Coefficient	Std. Error	t-value	p-value	
Intercept	16.200	0.003	6443.561	<0.001	***
Time	0.001	<0.001	28.767	<0.001	***
February	-0.089	0.002	-40.812	<0.001	***
March	-0.002	0.002	-0.684	0.494	
April	-0.035	0.002	-15.977	<0.001	***
May	-0.003	0.002	-1.368	0.171	
June	-0.037	0.002	-16.654	<0.001	***
July	-0.005	0.002	-2.05	0.040	*
August	-0.005	0.002	-2.391	0.017	*
September	-0.039	0.002	-17.661	<0.001	***
October	-0.007	0.002	-3.072	0.002	**
November	-0.040	0.002	-18.325	<0.001	***
December	-0.008	0.002	-3.75	<0.001	***
Gender (Male)	0.048	0.002	29.491	<0.001	***
East Midlands	-0.291	0.003	-110.118	<0.001	***
London	0.354	0.003	133.914	<0.001	***
North East	-0.848	0.003	-313.556	<0.001	***
North West	0.195	0.003	73.726	<0.001	***
South East	0.375	0.003	141.713	<0.001	***
South West	-0.178	0.003	-67.289	<0.001	***
Wales	-0.676	0.003	-255.862	<0.001	***
West Midlands	-0.019	0.003	-7.047	<0.001	***
Yorkshire & Humberside	-0.105	0.003	-39.898	<0.001	***
Age1 (11-17)	-0.368	0.003	-118.459	<0.001	***
Age2 (18-30)	0.203	0.003	65.261	<0.001	***
Age3 (31-50)	0.838	0.003	269.842	<0.001	***
Age4 (51+)	1.060	0.003	341.523	<0.001	***
Time x East	<0.001	<0.001	-4.321	<0.001	***

Midlands					
Time x London	<0.001	<0.001	15.556	<0.001	***
Time x North East	<0.001	<0.001	-13.42	<0.001	***
Time x North West	<0.001	<0.001	-12.389	<0.001	***
Time x South East	<0.001	<0.001	4.488	<0.001	***
Time x South West	<0.001	<0.001	-5.725	<0.001	***
Time x Wales	<0.001	<0.001	-10.275	<0.001	***
Time x West Midlands	<0.001	<0.001	-4.896	<0.001	***
Time x Yorkshire & Humberside	<0.001	<0.001	-5.651	<0.001	***
Time x 11-17	-0.001	<0.001	-41.865	<0.001	***
Time x 18-30	<0.001	<0.001	16.136	<0.001	***
Time x 31-50	-0.001	<0.001	-30.936	<0.001	***
Time x 51+	<0.001	<0.001	6.388	<0.001	***
East Midlands x 11-17	0.060	0.003	21.541	<0.001	***
London x 11-17	-0.184	0.003	-65.859	<0.001	***
North East x 11-17	0.090	0.003	31.169	<0.001	***
North West x 11-17	0.052	0.003	18.553	<0.001	***
South East x 11-17	0.019	0.003	6.936	<0.001	***
South West x 11-17	0.083	0.003	29.713	<0.001	***
Wales x 11-17	0.087	0.003	31.159	<0.001	***
West Midlands x 11-17	0.024	0.003	8.306	<0.001	***
Yorkshire & Humberside x 11-17	0.053	0.003	18.972	<0.001	***
East Midlands x 18-30	0.090	0.003	32.31	<0.001	***
London x 18-30	0.217	0.003	77.644	<0.001	***
North East x 18-30	0.153	0.003	52.765	<0.001	***

North West x 18-30	0.087	0.003	31.138	<0.001	***
South East x 18-30	0.014	0.003	4.928	<0.001	***
South West x 18-30	0.069	0.003	24.856	<0.001	***
Wales x 18-30	0.073	0.003	26.061	<0.001	***
West Midlands x 18-30	0.032	0.003	11.081	<0.001	***
Yorkshire & Humberside x 18-30	0.143	0.003	51.256	<0.001	***
East Midlands x 31-50	0.030	0.003	10.7	<0.001	***
London x 31-50	0.069	0.003	24.654	<0.001	***
North East x 31-50	0.044	0.003	15.302	<0.001	***
North West x 31-50	-0.007	0.003	-2.411	0.016	*
South East x 31-50	0.010	0.003	3.488	<0.001	***
South West x 31-50	0.040	0.003	14.211	<0.001	***
Wales x 31-50	-0.020	0.003	-7.161	<0.001	***
West Midlands x 31-50	-0.050	0.003	-17.207	<0.001	***
Yorkshire & Humberside x 31-50	-0.003	0.003	-1.083	0.279	
East Midlands x 51+	0.031	0.003	11.074	<0.001	***
London x 51+	-0.412	0.003	-147.213	<0.001	***
North East x 51+	0.080	0.003	27.756	<0.001	***
North West x 51+	-0.016	0.003	-5.653	<0.001	***
South East x 51+	-0.010	0.003	-3.502	<0.001	***
South West x 51+	0.171	0.003	61.006	<0.001	***
Wales x 51+	0.097	0.003	34.592	<0.001	***
West Midlands x 51+	-0.051	0.003	-17.562	<0.001	***

Yorkshire & Humberside x 51+	-0.020	0.003	-7.145	<0.001	***
Male x 11-17	-0.002	0.001	-1.789	0.074	.
Male x 18-30	-0.021	0.001	-16.281	<0.001	***
Male x 31-50	-0.068	0.001	-53.793	<0.001	***
Male x 51+	-0.183	0.001	-144.17	<0.001	***
February x 11-17	0.001	0.003	0.31	0.757	
March x 11-17	0.002	0.003	0.619	0.536	
April x 11-17	0.003	0.003	0.929	0.353	
May x 11-17	0.004	0.003	1.238	0.216	
June x 11-17	0.005	0.003	1.547	0.122	
July x 11-17	0.006	0.003	1.856	0.063	.
August x 11-17	0.007	0.003	2.165	0.030	*
September x 11-17	0.008	0.003	2.473	0.013	*
October x 11-17	0.009	0.003	2.781	0.005	**
November x 11-17	0.010	0.003	3.088	0.002	**
December x 11-17	0.011	0.003	3.395	0.001	***
February x 18-30	<0.001	0.003	-0.119	0.905	
March x 18-30	-0.001	0.003	-0.239	0.811	
April x 18-30	-0.001	0.003	-0.358	0.720	
May x 18-30	-0.001	0.003	-0.477	0.633	
June x 18-30	-0.002	0.003	-0.596	0.551	
July x 18-30	-0.002	0.003	-0.715	0.474	
August x 18-30	-0.003	0.003	-0.834	0.404	
September x 18-30	-0.003	0.003	-0.953	0.341	
October x 18-30	-0.003	0.003	-1.072	0.284	
November x 18-30	-0.004	0.003	-1.19	0.234	
December x 18-30	-0.004	0.003	-1.308	0.191	
February x 31-50	0.001	0.003	0.229	0.819	
March x 31-50	0.001	0.003	0.458	0.647	
April x 31-50	0.002	0.003	0.686	0.493	
May x 31-50	0.003	0.003	0.915	0.360	

June x 31-50	0.004	0.003	1.143	0.253	
July x 31-50	0.004	0.003	1.372	0.170	
August x 31-50	0.005	0.003	1.6	0.110	
September x 31-50	0.006	0.003	1.827	0.068	.
October x 31-50	0.006	0.003	2.055	0.040	*
November x 31-50	0.007	0.003	2.282	0.023	*
December x 31-50	0.008	0.003	2.509	0.012	*
February x 51+	<0.001	0.003	-0.047	0.962	
March x 51+	<0.001	0.003	-0.094	0.925	
April x 51+	<0.001	0.003	-0.142	0.887	
May x 51+	-0.001	0.003	-0.189	0.850	
June x 51+	-0.001	0.003	-0.236	0.813	
July x 51+	-0.001	0.003	-0.283	0.777	
August x 51+	-0.001	0.003	-0.33	0.741	
September x 51+	-0.001	0.003	-0.377	0.706	
October x 51+	-0.001	0.003	-0.424	0.671	
November x 51+	-0.001	0.003	-0.471	0.638	
December x 51+	-0.002	0.003	-0.518	0.604	
Male x East Midlands	0.005	0.002	2.953	0.003	**
Male x London	-0.005	0.002	-2.653	0.008	**
Male x North East	-0.008	0.002	-4.179	<0.001	***
Male x North West	-0.004	0.002	-2.114	0.035	*
Male x South East	0.002	0.002	0.915	0.360	
Male x South West	0.002	0.002	1.283	0.199	
Male x Wales	-0.008	0.002	-4.663	<0.001	***
Male x West Midlands	-0.002	0.002	-1.334	0.182	
Male x Yorkshire & Humberside	-0.001	0.002	-0.485	0.628	
Time x Male	<0.001	<0.001	9.05	<0.001	***

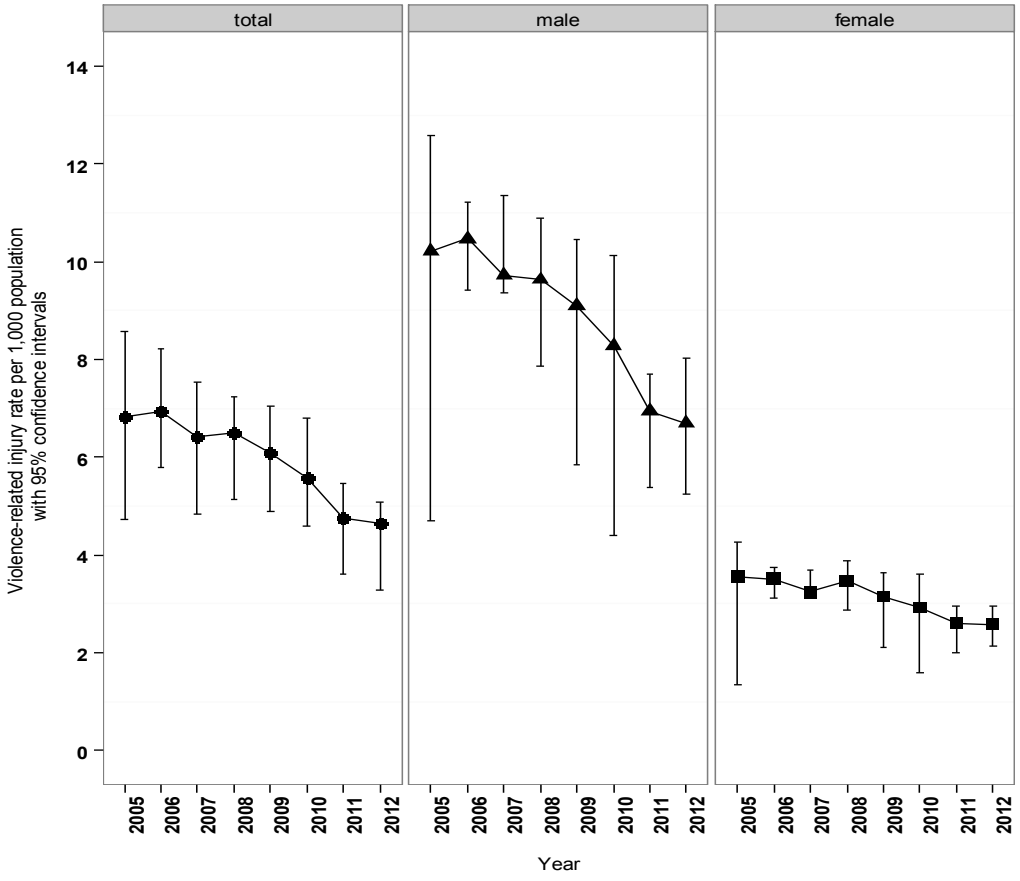
Adj. R-sq	0.999		
F statistic	F(133,9226)=71651		<0.001 ***

***significant at 0.1% level; **significant at 1% level; *significant at 5% level

2.6.3.2 *National trends in violence-related injury*

Overall, violence-related injury decreased by 6.4% (95% CI: -6.9 to -5.8, $p<0.05$) between January 2005 and December 2012. Disaggregation by gender revealed similar trends; males experienced a 6.7% (95% CI: -7.3 to -6.7, $p<0.05$) decline in violence-related injury, whilst females experienced a slightly smaller decline of 5.7% (95% CI: -6.3 to -5.1, $p<0.05$, see Figure 2.5).

Figure 2.5 Trends in violence-related injury; 2005(1)-2012(12)



Trend analysis also indicated that violence-related injury decreased among all five age groups studied. Decreases among under eighteens were largest with 11-17 year

olds (-10.9%, 95% CI: -11.7 to -10.0, p<0.05) and children under 10 years (-10.3%, 95% CI: -11.3 to -9.3, p<0.05) both experiencing a 10% decline in violence-related injury over the study period. Among the remaining age groups, violence-related injury decreased by 5.4% among 18-30 year olds (95% CI: -6.3 to -4.5, p<0.05), 5.1% among 31-50 year olds (95% CI: -6.0 to -4.3, p<0.05) and 3.4% among those aged 51 years and over (95% CI: -4.2 to -2.5, p<0.05). See Table 2.11 for trends by age and gender.

Table 2.11 Rates (per 1000 population) and trends in violence-related injury by age and gender, 2005(1)-2012(12)

	Rate	**95% CI**	**Trend**	**95% CI**
Males				
0-10 years	0.58	(0.45 to 0.66)	-10.7*	(-11.7 to -9.7)
11-17 years	14.96	(10.84 to 16.09)	-11.2*	(-12.0 to -10.3)
18-30 years	24.97	(20.12 to 26.84)	-5.7*	(-6.6 to -4.8)
31-50 years	8.72	(6.84 to 9.55)	-5.5*	(-6.4 to -4.6)
51 years +	1.60	(1.22 to 1.74)	-3.8*	(-4.7 to -2.8)
Females				
0-10 years	0.31	(0.19 to 0.35)	-9.6*	(-10.6 to -8.6)
11-17 years	6.05	(4.76 to 6.81)	-10.1*	(-11.0 to -9.2)
18-30 years	8.04	(6.41 to 8.64)	-4.6*	(-5.5 to -3.7)
31-50 years	3.61	(2.71 to 3.87)	-4.4*	(-5.3 to -3.4)
51 years +	0.65	(0.47 to 0.70)	-2.6*	(-3.6 to -1.7)

*significant at the 5% level

2.6.3.3 *Regional trends in violence-related injury*

Eight of the regions studied experienced a significant decrease in violence-related injury over the period studied: Eastern (-12.1%, 95% CI: -13.3 to -10.9, p<0.05), West Midlands (-11.3%, 95% CI: -12.4 to -10.1, p<0.05), South East (-8.9%, 95% CI: -10.1 to -7.8, p<0.05), North West (-7.0, 95% CI: -8.1 to -5.8, p<0.05), Wales (-5.9%, 95% CI: -7.1 to -4.7, p<0.05), South West (-3.9%, 95% CI: -5.2 to -2.7,

p<0.05), Yorkshire and Humberside (-3.2%, 95% CI: -4.4 to -1.9, p<0.05), and North East (-2.1%, 95% CI: -3.5 to -6.3, p<0.05). Contrastingly, the East Midlands was the only region to experience and increasing trend over the study period (4.9%, 95% CI: 3.5 to 6.3, p<0.05), whilst London was the only region to experience a non-significant decreasing trend (-1.3%, 95% CI: -2.6 to -0.1, p>0.05).

2.7 Discussion

Based on a sample of 100 EDs stratified across England and Wales, this national study revealed significant decreases in violence-related attendances of both males and females, as well as for all five age groups studied and for eight of ten economic regions, between January 1st 2005 and December 31st 2012. Comparison with other violence measures and potential reasons for age, gender and region-specific rates and trends are discussed below.

2.7.1 Triangulation of measurement

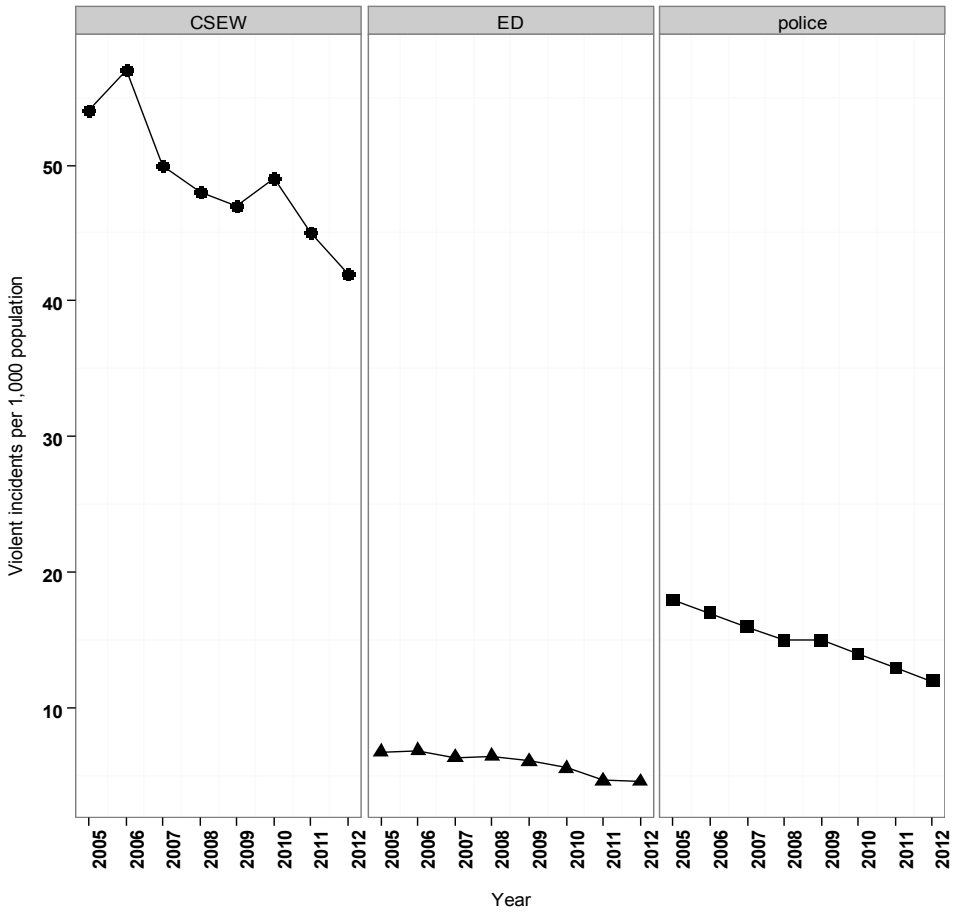
Triangulation with other violence measures is important. Findings from the current study are consistent with hospital admissions data for deliberate harm in England (represented by ICD codes X85-Y09, codes for deliberate external causes) where, apart from an isolated increase in 2006/07, the number of admissions following assault by blunt and sharp objects decreased by 29% between 2005 and 2012 (Health and Social Care Information Centre, 2015). Findings are also are consistent with national decreases in violence measured by both the CSEW and police records over the same period. Although the national decrease in violence identified in this study (-6.4%) was smaller than reductions identified by both the CSEW (-16%) and police (-28%), this is likely to result from differences in recording practices (previously discussed in chapter one; paragraph 1.4.2).

Furthermore, although direct comparisons with police and CSEW figures are problematic, this study estimated that 258,897 patients attended EDs for treatment of a violence-related injury in 2012. When this figure is compared with the 18% of CSEW respondents who claimed to have required some form of medical attention as a result of violence, some 236,160 people, the estimates are not too dissimilar;

especially when considering that the CSEW figure does not include violence experienced by those aged sixteen years and under (Office for National Statistics, 2014c).

This study has shown ED data to be a robust measure of serious community violence, which can be used as an objective method of triangulation with other sources and help bring clarity to national trends. Indeed, comparisons with police, CSEW and hospital inpatient admissions data suggest that, nationally, violence decreased in England and Wales between 2005 and 2012. However, as discussed in chapter one, more recent police figures have suggested a divergence from this downward trend that is inconsistent with CSEW estimates.

Figure 2.6 Trends in violence in England and Wales according to CSEW, ED and police measures, 2005-2012



2.7.2 Violence-related injury rates

In the current study, likelihood of sustaining violence-related injury was found to vary by gender, age group and region. Demographic comparisons with other violence measures are difficult; police recorded incidents of violence fail to disaggregate by age or gender, whilst CSEW figures are only available at national level. Figures from the CSEW do however lend support to the study's findings. In 2012/13, for example, the CSEW reported that men and those aged 16-24 years were most likely to be fall victim to violence (i.e. wounding, assault with minor injury, assault without injury and robbery) in England and Wales (Office for National Statistics, 2014c). Potential reasons for demographic variations in violence-related injury are discussed below.

2.7.2.1 *Gender*

Rates of violence-related injury were consistently higher for males (8.86 per 1000 population, 95% CI: 6.78 to 9.56) compared with females (3.13 per 1000 population, 95% CI: 2.35 to 3.38). This was true across all five age groups studied and was consistent with findings from other ED-based studies (Sivarajasingam et al., 2002, Sivarajasingam et al., 2009a, Bellis et al., 2011). Although reasons for this are unclear, official figures have shown that males are consistently over-represented as both victims and perpetrators of violence; for example, males were responsible for 88% of indictable offences (including VAP) and accounted for 83% of emergency hospital admissions relating to violence in 2013 (Ministry of Justice, 2014a, Health and Social Care Information Centre, 2013a).

Explanations seeking to address the 'maleness' of violence have often focused on how masculine disputes occur and escalate and how this process fits with broader structural, cultural and social conditions and norms. For example, the shame and loss of self-respect born from feelings of worthlessness, failure, embarrassment, weakness and powerlessness, have been suggested as the primary causes of violence among violent male offenders (Gilligan, 2003). Gilligan argues that although many men may experience such feelings, violence occurs when there is a lack of non-violent options available in which to restore both pride and self-respect; and therefore social, economic and cultural pressures that result in feelings of shame and

low self-esteem may lead certain men to violence (ibid). Similarly, in his ethnographic study of Australia's night-time economy, Tomsen (1997) suggests that marginalised young men with limited opportunity and success use violence as a means of establishing a strong masculine identity; which they are unable to do so through alternate, legitimate means. Other studies have also evidenced violence as a mechanism used to protect male honour, impress women and to enhance self-image (Tomsen, 1997, Tomsen, 2005, Polk, 1999).

2.7.2.2 *Age group*

Higher injury rates were also identified among young adults (18-30 year olds) and adolescents (11-17 year olds). Addressed in chapter one, research has consistently shown alcohol to be a risk factor for both violence-related injury and violent offending (Matthews et al., 2006, Bellis et al., 2009, Shepherd et al., 2006). In the UK, drinking alcohol is an established norm by age fifteen; with 90% of adolescents aged 15-16 years having consumed alcohol within their lifetime, 85% have consumed alcohol in the last year, and 65% within the last 30 days (Atkinson et al., 2011). Similarly, research in England and Wales has shown that 18-24 year olds reportedly consume, on average, more units of alcohol per session than any other age group (Mintel, 2009); whilst figures from the CSEW highlight that a person's risk of violent victimisation increases by 4.7% and 10.7% when attending a pub or nightclub once a week or more (Office for National Statistics, 2014c). It is perhaps not an unreasonable assertion, therefore, that higher rates of violence-related injury among young adults and adolescents may result from risky drinking practices, which places them at an increased risk of alcohol-related harm, including, violent victimisation.

2.7.2.3 *Region*

A clear north-south divide in violence-related injury was also evidenced in the current study: higher rates were identified in the North West (10.82 per 1000 population), North East (8.04 per 1000 population) and Wales (7.36 per 1000 population) with lower rates in the East (3.34 per 1000 population) and East Midlands (4.28 per 1000 population) regions respectively. North-south inequalities in health and prosperity are well documented in England and Wales. A recent study

investigating mortality differences between northern and southern England, for example, found that premature deaths were five times more likely in the north and that, on average, there were 13.8% excess deaths compared to the south (Hacking et al., 2011). Similarly, alcohol-related hospital admissions in England (based on primary and secondary diagnoses) in 2013 were higher in the North East (2,500 per 100,000 population) and North West (2,280 per 100,000 population) compared to the South East (1,500 per 100,000) and South West (1,770 per 100,000 population) regions (Health and Social Care Information Centre, 2014).

As discussed in chapter one, a strong association between violence-related ED attendances and area deprivation has been evidenced in England and Wales (Howe and Crilly, 2001, Bellis et al., 2008, Bellis et al., 2011, Bellis et al., 2012b). An ecological study of violence-related ED attendances in England, for example, found that risk of assault injury was five times greater for those living in the most deprived areas of England and that violence accounted for one-fifth of the difference in levels of all-cause ED attendances between affluent and deprived areas (Bellis et al., 2011).

Criminological and sociological explanations for the association between deprivation and crime, including violent crime, tend to focus on the influence of social disorganization (Shaw and McKay, 1942), strain (Merton, 1938) and more recently, collective efficacy (Sampson et al., 1997), which emphasize the influence of community structures on criminal behaviour.[6] Strain theory, for example, argues that the frustration or 'strain' felt when attempting to achieve a level of culturally prescribed success, relative to the means available to achieve it, can drive people to criminal activity (Merton, 1938). A theory suggested to predominantly effect those living in poverty, Merton argued that the strain felt by individuals who were unable to satisfy their want for material wealth and possessions could manifest into four deviant behaviours; one of which, 'innovation', was the negation of legitimate means in favour of methods such as robbery, which enabled them to obtain the wealth they desired (Vold et al., 2002). Considering robbery is a violent crime that may

[6] Social disorganization theory emphasizes that it is the characteristics of the neighbourhood, not the behavioural characteristics of the individual, which most greatly influences criminality and deviance. Crucially, in their analysis of Chicago neighbourhoods, Shaw and McKay showed that after leaving the neighbourhood, juvenile offenders decreased their criminal activity (Vold et al., 2002).

frequently result in injury to the victim, strain remains an applicable theory to better understanding motivations for violence and thus potential causes of injury. Furthermore, more recent interpretations of strain theory have proposed a second aspect, emotional strain, which is argued to compliment traditional understandings of strain (Agnew, 1992). Aptly explained by Vold et al (2002):

> *"The line of argument connecting these two meanings is that people in situations of 'social structural strain' (i.e., people who cannot achieve culturally valued goals through legitimate means provided by the social structure) may feel 'strained' (i.e., may feel stressed, frustrated, anxious, depressed, and angry), and feelings then are the actual cause of higher crime rates associated with those people"* (Vold et al., 2002: p.147).

Support for these conclusions can be drawn for Gilligan's (2003) work with violent offenders (discussed in paragraph 2.7.2.1). Indeed, if violence is the result of feelings of worthlessness, failure, embarrassment, weakness and powerlessness as suggested by Gilligan, social and economic pressures that result in feelings of shame and low self-esteem may increase the likelihood of disadvantaged men engaging in violent behaviours to restore both pride and self-respect (ibid).

2.7.3 Trends in violence-related injury

Overall, a significant decrease in violence-related injury was identified over the study period; with similar trends identified for both males, females and across all five age groups. Regional variations were also evident; significant decreases in violence-related injury were identified in the Eastern, North East, North West, South East, South West, Wales, West Midlands and Yorkshire and Humberside regions, whilst a significant increase in violence-related injury was identified in the East Midlands and a non-significant negative trend was evidenced in London. Reasons for the national decline in violence-related injury over the study period, as well as regional variations, are not clear and are likely multi-factorial and complex; however, there is increasing evidence to suggest that both public health and criminal justice interventions may be contributory. Changes in labour market and consumer trends may also have had an impact.

2.7.3.1 *Information sharing partnerships (ISPs)*

ISPs between health services, police and local government have been shown to substantially reduce violence-related injury (Florence et al., 2011). Implemented nationally following the 1998 Crime and Disorder Act and particularly after the tackling knife crime strategy was implemented in 2008, which placed a legal obligation on police, local government and the NHS to collaborate to develop and implement joint crime reduction strategies, ISPs have altered policing and violence prevention strategies (HM Government, 1998a, HM Government, 2008b). Indeed, ISPs such as those in Cardiff and North West England (evidenced in chapter one; paragraph 1.4.1) showed substantial reductions in violence in the years following implementation; for example, woundings recorded by the police in Cardiff decreased by 42% between 2000 and 2005 (Florence et al., 2011). It is therefore possible that the national decline in violence seen in this study is, to some degree, resulting from the success of ISPs in areas where violence has previously been shown to be greater (Sivarajasingam et al., 2002, Sivarajasingam et al., 2009a). It is important to note, however, that both the extent and quality of information sharing for the purposes of violence prevention, between EDs and Community Safety Partnerships (police, local authority, fire and rescue authority, probation and health representatives), has been shown to differ greatly between the regions (Centre for Public Innovation, 2012). Results from a recent audit of ISPs in England, for example, revealed the percentage of EDs sharing information with Community Safety Partnerships ranged from zero to 56%, with only 36% of ISPs reaching the standard of information sharing recommended by the College of Emergency Medicine and 9% sharing information at the highest level i.e. fully implemented partnership with clear links to violence prevention (ibid).

Although not all regions may have begun sharing information for violence prevention purposes at the beginning of the study period (i.e. January 2005), decreases in violence-related injury identified in the current study tended to be experienced in regions where ISPs were most developed, such as the Eastern and South East regions. Furthermore, the only region identified by this study to have experienced an increase in violence-related injury over the study period was the East Midlands. Revealingly, the East Midlands region was one of only two regions

identified by the audit where EDs are failing to share information for the purposes of violence prevention (see Table 2.12). The North East region was the other region identified by the audit as failing to share ED-derived information. The current study revealed that although a significant decrease in violence-related injury was identified in the North East, it was the lowest recorded decrease of only 2.1%.

Table 2.12 Information sharing to tackle violence: English regions audit of progress

Region[7]	**EDs in sample**	**EDs sharing data**	**% sharing data**
Eastern	8	4	50%
East Midlands	7	0	0%
London	14	7	50%
North East	8	0	0%
North West	19	6	32%
South Central	7	3	43%
South East	9	5	56%
South West	12	5	42%
West Midlands	13	5	38%
Yorkshire & Humberside	6	3	50%
Total	**103**	**38**	**37%**

Source: Centre for Public Innovation (2012)

2.7.3.2 *Police officer strength*

Criminal justice interventions may also contribute to the overall decline in violence-related injury identified in this study. Police officer strength in the 43 English and Welsh Police forces, for example, rose from 72,642 officers in 2005 to 131,837 officers in 2012; an increase of 81.5% over the eight year period (Home Office, 2005, Home Office, 2015). It is therefore possible that the substantial increases in

[7] Here region refers to Strategic Health Authority (SHA), which is why there is a South Central region. SHAs ceased to exist in April 2013.

police officer strength has enabled police forces to provide a more extensive police presence within, for example, the night-time economy and as a result are better placed to deter potential offenders and attend incidents more quickly. It is worth noting, however, that since reaching a peak of 144,353 officers in 2009, police officer strength decreased annually between 2010 and 2012, whilst levels of violence continued to decline. Similarly, offenders found guilty at all courts in England and Wales for violence against the person offences increased from 40,900 in 2005 to 44,794 in 2010, followed by a 12.5% decrease between 2010 and 2012 (Ministry of Justice, 2013). Criminal justice statistics would therefore suggest an association between police officer strength and number of offenders found guilty for VAP offences. From an ED perspective, the significance of police officer strength to overall levels of violence are however unclear.

2.7.3.3 *Closed-circuit television (CCTV) cameras*

Installation of CCTV cameras is thought to deter criminal behaviour by increasing the likelihood of offenders being identified and prosecuted. Evidence on the effect of CCTV at reducing crime is however mixed. Welsh and Farrington (2004), for example, conclude that CCTV is more effective at reducing acquisitive crimes, such as property offences, than it is at deterring violent crimes, such as those occurring in town and city centres; which tend to be more spontaneous and arise in the heat of the moment. However, research in England has shown CCTV implementation to significantly reduce violence-related injury (Sivarajasingam et al., 2003). Indeed, Sivarajasingam et al (2003) revealed a 3% decrease in the number of people attending EDs for treatment of a violence-related injury in intervention cities (CCTV implemented) compared with controls (no CCTV implemented) over a four year period. Interestingly, the study also found that CCTV implementation was associated with an 11% increase in the number of violent offences recorded by the police (ibid). This led the authors to conclude that CCTV may be better understood as a method of harm reduction rather than crime prevention; as violence tends to occur as a result of impulse and alcohol use and therefore CCTV would have a limited deterrent effect when, in such cases, the potential offender is likely to be unaware of its presence. Therefore, by directing police to incidents more quickly, CCTV does not prevent

violence but rather reduce the severity of injuries sustained and consequently the need for medical treatment (ibid).

Home Office figures reveal that £170 million of funding was made available between 1999 and 2003 for investment in CCTV camera deployment schemes as part of the Labour Government's Crime Reduction Programme (Parliamentary Office of Science and Technology, 2002). Measuring the extent of CCTV in the UK is however increasingly difficult. Previous estimates have stood between 1.58 million (including; public space and premise CCTV) and 1.85 million (including; public space, premise and transport CCTV) (Gerrard, 2011, CCTV User Group, 2009). However, a recent report by the British Security Industry Association estimated this number to be closer to five million (including public space, schools, hospitals and care homes) (Barrett, 2013). Whatever the exact figure, there is no doubt that CCTV surveillance has increased substantially in the UK over the last decade. A fact now recognized by the Coalition Government:

> *"We are determined to ensure that the significant increases in State surveillance which have occurred over the last decade should not go unchecked. Our Coalition Agreement sets out a package of measures which will roll back the over-intrusive powers of the State. We are committed to restoring and preserving our historic and valued traditions of freedom and fairness"* (Surveillance Camera Commissioner, 2014: p.6).

It is therefore possible that increased CCTV surveillance in England and Wales over the last decade has aided in the reducing violence-related injury by identifying hot-spots for violence and directing police and other security personnel to intervene and prevent violent incidents from escalating. This may have led to a reduction in injury severity and as a result, may have contributed to the significant reduction in ED attendances identified in the current study.

2.7.3.4 *Youth crime reduction initiatives*

Declining trends in violence-related injury were identified among all five age groups studied. Decreases among those aged 18 and under were largest with 11-17 year olds and children under 10 years experiencing a 10.9% and 10.2% decline respectively. Reasons behind the substantial decline in violence-related injury among those aged 18 and under are unclear. Reductions were however mirrored by a 45% decrease in VAP offences (including common assault) committed by under-eighteens between 2009/10 and 2012/13 (Ministry of Justice, 2014b).

Initiatives aimed at tackling serious violence, addressing youth crime and anti-social behaviour and ending gang violence were implemented during the study period (HM Government, 2011, HM Government, 2008a, HM Government, 2008b).[8][9][10] The Youth Crime Action Plan (launched in 2008), for example, was a national initiative that comprised multiple programmes aimed at reducing youth offending and re-offending rates through a 'triple track' approach of tougher enforcement, early prevention and non-negotiable support (HM Government, 2008c). As a result, knife crime programmes and increased after-school police patrols were established, as well as increased access to health and support services for children and families (including Youth Crime Family Intervention Projects), more powers to tackle under-age drinking (including; alcohol confiscation, revoking alcohol licenses and increased prosecution for alcohol possession) and increased use of reparation orders for young offenders (including; picking litter, painting community centres and environmental work) (ibid).

The extent to which such policies and programmes were attributable to the reductions in violence-related injury identified in the current study are however

[8] The Tackling Violence Action Plan 2008-11 (TVAP) was published in 2008 with the vision to save lives, reduce harm and protect the public. The TVAP framework focused on seriousness, managing risk and support for victims (with a particular focus on violence with injury).

[9] The Tackling Knives Action Plan (TKAP) ran initially from June 2008 until March 2009 and aimed to reduce teenage knife crime in ten police force areas in England and Wales. The programme was re-branded into the Tackling Knives and Serious Youth Violence Action Programme and ran from April 2009 to March 2010 in 16 police force areas and aimed to reduce all serious violence involving 13- to 24-year-olds using a range of enforcement, education and prevention initiatives.

[10] More recently the Ending Gang and Youth Violence: A Cross-Government Report (2011) was published in November 2011 in response to the London riots. It is however most unlikely that this would have had any effect on the results from the current study.

debatable; an evaluation of the impact of the Youth Crime Action Plan in Liverpool failed to conclusively attribute reductions in violence to the strategies implemented (Wood et al., 2011). However, family intervention programmes in England have been associated with a 57% reduction in domestic violence among families who completed the programme between 2007 and 2011 (Lloyd et al., 2011), whilst alcohol use among 15-16 year olds has also decreased since 2007 (Atkinson et al., 2011). It is therefore possible that increased political attention through youth-focused initiatives aimed at reducing crime, violence and anti-social behaviour, combined with continued reductions in alcohol consumption and substance misuse, could have influenced the decline in violence-related injury experienced by those aged 18 years and under.

2.7.3.5 *Labour market and consumer trends*

Labour market and consumer trends may have also impacted upon the national decline in violence-related injury. For example, the UK experienced an 18% decrease in alcohol consumption (litres per capita) between 2005 and 2013 (Sheen, 2013), whilst heavy episodic drinking (drinking more than 8 units per session for males and 6 units per session for females) among 16-24 year olds decreased by 10% for males and females respectively (Opinions and Lifestyle Survey, 2013). Although reasons for such declines in alcohol consumption are unknown, figures have revealed a recent decline in the affordability of alcohol; the first recorded decline since 1990 (Health and Social Care Information Centre, 2014). Although causality cannot be proved, the decline in alcohol consumption reported, which could potentially be due to its reduced affordability, has been coupled with a 51% decrease in alcohol-related assault (ICD codes X85-Y09) in England between 2005/06 and 2012/13 (Health and Social Care Information Centre, 2015).

Furthermore, over the same period, unemployment in the UK (aged 16-64 years) increased from 4.8 per 1000 resident population (2005) to 8.0 per 1000 resident population (2012) (Office for National Statistics, 2015c). Evidenced in chapter one, some studies have identified a negative association between violence-related injury and unemployment in England and Wales; possibly owing to the reduced spending

capacity that such unemployment affords, which may influence a person's ability to purchase alcohol (Matthews et al., 2006, Sivarajasingam et al., 2006). Therefore, it is possible that reductions in both the amount and frequency of alcohol consumed, possibly owing to restrictions on alcohol purchasing born from reduced spending capacity and affordability could have impacted on the national decline in violence-related injury identified in this study.

2.7.3.6 *Seasonal effects*

The current study revealed evidence of seasonal variation in violence-related ED attendances, with attendances higher in the late spring and summer months of May, June, July and August and lower in February and November. These findings correspond with previous estimates within this field, which suggest violence in England and Wales peaks during the summer months (Sivarajasingam et al., 2002, Sivarajasingam et al., 2009a). Addressed in chapter one (paragraph 1.7.4), reasons for higher injury rates during summer are unclear. However, it is possible that large numbers of people outdoors during the summer, as well as the occurrence of major sporting events such as the Football World Cup and European Championship, which are commonly attributed to increased alcohol consumption (British Beer and Pub Association, 2010), may be contributable.

2.7.4 Study limitations

The limitations of using ED data were addressed in chapter one (paragraph 1.4.1). Briefly, limitations include; requiring the presence of injury serious enough to require medical treatment, respondent bias that can lead to coding errors and the possibility of underestimation due to proximity issues. A limitation not previously addressed is that of sampling bias. Since approximately two-thirds of EDs in England and Wales are not certified members of the NVSN, attendance data were weighted in order to account for unequal regional coverage. Termed coverage ratios, weights were the annual representation size of the sample EDs within each region. From 2005 to 2012 the average number of EDs included annually within the sample was 41 (including minor injury units and NHS walk-in-centres) (see Table 2.6). Sampling bias may have occurred if too few EDs were sampled from a particular region for a

given year and if those that were sampled were not representative of the region in its entirety. Over the eight year period, for example, an average of 1.4 EDs were sampled from the West Midlands region in contrast an average of 7.1 EDs sampled from the North West region; suggesting that there is a greater possibility of sampling bias in the West Midlands region, which may impact on the accuracy of the estimated injury rates. Similarly, bias may have occurred if violence-related ED attendance, as a percentage of all-cause ED attendance, was affected by increasing attendance of inappropriate patients at EDs whom would previously have been seen by their general medical practitioner. Although any such bias is likely to be small, increases in inappropriate patients would lessen the proportion of violence-related attendances as a percentage of total attendances and lead to distorted coverage ratios with which to weight the ED data; although there is no evidence to suggest cross-regional variations in inappropriate ED attendances.

2.8 Summary

Overall, the study has shown that, nationally, violence according to ED data has decreased over the study period. This finding mirrored more recent trends in violence according to both police and CSEW figures. Although reasons for this decline are unclear, a decrease in alcohol consumption within the UK, possibly resulting from its reduced affordability, was experienced during the study period. Furthermore, external validation of a successful Cardiff-based ISP, through replication in Cambridge, reported reductions in both violence-related ED attendances and police recorded violence after implementation (Boyle et al., 2013).

Regional variations in rates and trends in violence-related injury were also identified. North-south inequalities in health and prosperity are well recognised in England and Wales. Long-term variations in rates of violent injury are more likely the result of regional differences in structural factors such as poverty, inequality and unemployment, whilst short-term trend changes are more likely the result of regional-level interventions. Indicatively, an audit of ISPs in England highlighted regional variation in the extent and quality of information shared for the purposes of violence prevention (Centre for Public Innovation, 2012).

3 Calculating regional price indices for on-trade and off-trade alcohol in England and Wales

3.1 Chapter outline

Chapter three is a methodological chapter that details the process of calculating regional price indices for alcohol both on-trade (venues where alcohol is sold and consumed) and off-trade (venues where alcohol is sold for consumption off-premise) in England and Wales between 2005 and 2012. Regional price indices for alcohol will be used as an objective proxy for alcohol consumption in chapter four; which aims to model determinants of violence-related injury in England and Wales. This chapter describes alcohol price collection, data cleaning and aggregation, including sourcing and applying expenditure weights. A brief statistical analysis of constructed alcohol price indices is also included

3.2 Introduction

The misuse of alcohol is associated with multiple disease and injury conditions, including 3,370 hospital admissions for alcohol-related assault in England in 2012/13 (Health and Social Care Information Centre, 2014). Accurate measurement of alcohol consumption at both national and local level is necessary in order to direct public health and criminal justice interventions. In the UK, alcohol consumption is measured through information on alcohol sales and self-report surveys; however, both measures are subject to limitations that make them inadequate sources of information on alcohol consumption (see paragraph 3.4 for further detail). Therefore, the aim of this study is to calculate, for the first time, regional price indices for alcohol in England and Wales, which will enable a more accurate reflection of alcohol consumption (including seasonal effects) at both market (i.e. on-trade and off-trade) and regional level. The need to capture the seasonality of alcohol consumption was considered important due to the seasonality of violence-related injury identified in chapter two.

3.3 Chapter aims and objectives

Aim

1) To establish an objective measure of alcohol consumption at regional level in England and Wales.

Objective

1) To calculate regional price indices for on-trade and off-trade alcohol in England and Wales between January 2005 and December 2012.

3.4 Measuring alcohol consumption in the UK

3.4.1 Alcohol sales

Information on alcohol sales is often used as an approximate measure of national alcohol consumption. The British Beer and Pub Association, for example, use figures of total alcohol released into the UK market (sourced from Her Majesty's Revenue and Customs (HMRC) Alcohol Bulletins) to estimate total UK alcohol consumption per capita (British Beer and Pub Association, 2015). In its most recent annual report, British Beer and Pub Association estimates indicate that an average of 7.7 litres per person (aged 15 years and over) were consumed in the UK in 2013 (Sheen, 2013).

The main strength of using alcohol sales data to estimate alcohol consumption is that it is an objective measure based on alcohol purchases and is therefore unaffected by issues of respondent or sampling bias; acknowledged limitations of self-report surveys (see chapter one; paragraph 1.4.2.2). However, as suggested by Midanik (1982), the purchasing of alcohol does not necessarily result in immediate consumption. Alcohol may be stockpiled, cans and/or bottles may break or alcohol may be purchased for cooking purposes; although any bias resulting from the above is likely to be small (Mäkelä, 1971). Moreover, alcohol sales do not account for the consumption of unrecorded alcohol, for example, home-made alcohol, alcohol intended for medical use, illegally smuggled alcohol or alcohol obtained duty free (Goddard, 2001). In the UK, unrecorded alcohol was estimated to stand at 1.2 litres per capita in 2010 (World Health Organization, 2014). If unrecorded alcohol was at a

similar level in 2013, it would mean that alcohol sales fail to account for 15.6% of alcohol consumed (per capita) in the UK.

In addition, information on alcohol sales is usually published at national level and on an annual basis. Although this makes alcohol sales data a useful measure of alcohol consumption nationally, it is unable to identify either regional or seasonal trends in alcohol consumption.

3.4.2 Self-report surveys

Numerous self-report surveys are used in the UK to measure levels of alcohol consumption. For example, the Opinions and Lifestyles Survey measures alcohol consumption among a random sample of addresses; representative of the population distribution of Great Britain for those aged 16 years and over (n=13,000) (Opinions and Lifestyle Survey, 2013). Questions enquire to the respondents drinking behaviour during the week prior to interview, with responses weighted in order to account for potential sampling bias (ibid). The main strength of self-report surveys such as this are that, due to robust weighting based on census data, the surveys are representative of the age, gender, socio-demographic and regional distributions of the Great British population. Moreover, unlike information on alcohol sales, self-report surveys are able to account for unrecorded alcohol (Goddard, 2001).

Self-report surveys are not without limitations however. Self-report surveys have been found to consistently under-estimate overall levels of alcohol consumption when compared with information on alcohol sales (ibid). For example, UK alcohol consumption per capita was estimated at 10.4 litres in 2010; equating to 1040 units of pure alcohol per year at an average of 20 units per week (World Health Organization, 2014). At the same time, self-report estimates from the General Lifestyle Survey (now the Opinions and Lifestyles Survey) estimated average consumption at 11.5 units per week (Office for National Statistics, 2012c). These figures suggest that self-report estimates from the General Lifestyle Survey only accounted for approximately 57.5% of alcohol consumed in the UK in 2010 (adapted from Goddard, 2001).

Similar to the limitations of the CSEW identified in chapter two, reasons for such under-estimation have been attributed to survey design and issues of respondent, interviewer and sampling bias. For example, question type has been shown to influence a respondents reported level of alcohol consumption i.e. questions that inquired to recent consumption (1-7 days) and type of drink consumed (including strength and size) reported 76.8% of alcohol sales, whilst questions inquiring only to the respondents quantity and frequency of alcohol consumption reported just 49.8% of alcohol sales (Stockwell et al., 2004). Furthermore, web surveys have been shown to increase the odds of respondents reporting heavier consumption (drinking five or more alcoholic drinks on at least one occasion in the last month) by 87% compared to a telephone interview (Link and Mokdad, 2005).

Issues of respondent bias are also applicable to self-report surveys on alcohol consumption. For instance, resulting from the corrosive effect of alcohol on both short and long term memory (Jones, 1973), respondents may be unable to accurately recall how much alcohol they consumed over say, the last 12 months. Indeed, research has previously highlighted that more accurate measures of alcohol consumption are achieved when respondents are asked to recall recent consumption, for example, the last 1-7 days (Stockwell et al., 2004). A respondent's inability to accurately recall their consumption, due to, for example, the memory impairing effects of alcohol or the length of the recall period, could therefore affect the accuracy of their response. Moreover, estimating amounts drunk at home are often difficult to measure as drinks are not in standard measures (Goddard, 2001), whilst respondent bias may also occur if someone else is present or equally if the respondent thinks the interviewer may disapprove of his/her response (Phillips and Clancy, 1972).

Self-report surveys are also subject to potential sampling bias. For example, respondents are usually sampled from private households and therefore people living in institutions and those who have no fixed address are excluded (Goddard, 2001). Due to the wide variation in the amounts of alcohol people drink, there is also a high likelihood of sampling error when estimating levels of alcohol consumption among subgroups (ibid). Sampling bias can also occur as a result of non-response bias i.e.

when a significant number of people in the survey sample fail to respond and have relevant characteristics that differ from those who do respond (Dillman, 2000 cited in Lahaut et al., 2002). For example, non-response rates have been shown to be higher among heavier drinkers (Pernanen, 1974), whilst one study found abstainers were significantly unrepresented in their original survey, after conducting a follow-up study of non-respondents in Holland (Lahaut et al., 2002).

Finally, self-report surveys on alcohol consumption are usually conducted annually and are therefore unable to account for any seasonal variation when consumption may peak, for example, during the summer months or over the festive period (Christmas and New Year). A noteworthy criticism, considering research suggests that respondents tend to report median rather than mean levels of alcohol consumption by failing to account for periods of high episodic drinking (Gruenewald and Nephew, 1994).

3.4.3 Alcohol price as proxy for alcohol consumption

Much empirical research has attested to the association between alcohol price and consumption (Wagenaar et al., 2009). Many researchers have come to believe that the enticement of lower alcohol prices have resulted in consumers purchasing more alcohol than they may have done so previously (Foster et al., 2010). Indeed, there is much research to support these suggestions. An experimental analysis of the 'happy hour' by Babor and colleagues (1978), for example, demonstrated how a reduction in the price of alcohol led to a significant increase in overall consumption by both causal and heavy drinkers in the US (Babor et al., 1978). In the UK, research has shown that a 25% saving over the festive period resulted in an estimated 12.5% increase in alcohol purchasing (Adams and Beenstock, 2012). A ban on off-trade price discounts across England and Wales has also been estimated to reduce alcohol consumption by 3% (Purshouse et al., 2010).

In economics, it is understood that when the price of a commodity increases, purchases, and therefore consumption of this commodity, will decrease and vice versa (Parkin et al., 2012). This has been shown to be true with regards to the effect of alcohol price on the consumption of alcohol (Gruenewald et al., 2006, Wagenaar

et al., 2009, Meier et al., 2010). Meta-analysis of findings which compared over one thousand estimates from 112 studies, for example, found a statistically significant relationship between alcohol tax and price measures and levels of consumption (Wagenaar et al., 2009). Although it would be inaccurate to generalize that all consumers of alcohol are equally price elastic (i.e. experience the same % change in consumption after a % increase in price), research has evidenced consumption to be responsive to price change after accounting for age, income, alcohol type (for example, beer, wine or spirit), market type (i.e. on-trade or off-trade) and drinking frequency (for example, light, moderate or heavy) (Gallet, 2007, Meier et al., 2010, Purshouse et al., 2010, Holmes et al., 2014).

Studies examining the effect of alcohol price on the consumption of alcohol among young drinkers have consistently identified an inverse relationship (O'Mara et al., 2009, Coate and Grossman, 1988, Meier et al., 2010). For example, in the UK, Meier et al (2010) found that a 10% increase in the price of alcohol would decrease alcohol consumption among young hazardous drinkers (25 years and under) by 6%. In the US, an association between alcohol price and youth blood alcohol level has also been evidenced; with those with higher blood alcohol levels shown to spend less per drink than those with lower blood alcohol levels and that an increase in the cost per gram of ethanol would reduce the risk of having a dangerous blood alcohol level by as much as 30% (O'Mara et al., 2009). Qualitative evidence highlights young people's preference for cheap alcohol as a probable factor in this relationship (Holloway et al., 2008, Banerjee et al., 2010). Whether young drinkers are more or less price elastic than older drinkers is however debatable and likely influenced by a combination of beverage choice, drinking frequency and income; for example, older drinkers may simply consume more price elastic beverages (Gallet, 2007).

Indeed, the effect of alcohol price on consumption has been shown to vary according to both alcohol type and market choice. Wagenaar et al reports mean price elasticities (% change in consumption after a 1% increase in price) of -0.46 for beer, -0.69 for wine and -0.80 for spirits (Wagenaar et al., 2009). Comparatively, Gallet (2007) reports greater elasticities of -0.83 for beer, -1.11 for wine and -1.09 for spirits (Gallet, 2007). In the UK, price of alcohol has been shown to vary greatly between

on-trade and off-trade markets; with the cheapest alcohol often found in the off-trade (Griffith and Leicester, 2010). Similar effects of price on consumption have however been identified in both markets. For example, a study by HMRC reported price elasticities for wine (on-trade, -0.46; off-trade, -0.54), beer (on-trade, -0.77; off-trade, -1.11), ready-to-drinks (on-trade, -0.91; off-trade, -0.93), spirits (on-trade, -1.15; off-trade, -0.90) and cider (on-trade, -0.85; off-trade, -1.34) respectively (Collis et al., 2010). Although studies may disagree with regards to which alcoholic drink is more or less price elastic, reported elasticites consistently indicate that the consumption of alcohol is inversely related to price (Gallet, 2007, Wagenaar et al., 2009).

Confounding factors have however been identified. For example, heavy drinkers have been shown to be less price elastic than moderate or lighter drinkers (Manning et al., 1995). Wagenaar and colleagues estimate the price elasticity for heavy drinkers to be approximately -0.28, compared with the average price elasticity for alcohol of -0.51 (Wagenaar et al., 2009). These estimates suggest that with a 10% increase in the price of alcohol, consumption would be expected to decrease by 5% for moderate drinkers and by 2.8% for heavy drinkers. However, research has shown heavy drinkers tend to consume the cheapest alcohol (Black et al., 2011) and therefore price elasticities (that are based on a 1% across the board price increase) may not be an effective measure at highlighting responsiveness to price among this subgroup. For example, alcohol minimum unit pricing (MUP) set at £0.50 per unit, which would target the cheapest alcoholic drinks, has been estimated to reduce consumption by 10.3% among harmful drinkers (more than 50/30 units per week for males and females respectively) compared to an expected reduction of 3.5% among moderate drinkers (less than 21/14 units per week for males and females respectively) (Meier et al., 2010, Purshouse et al., 2010). A more detailed overview of alcohol MUP is given in chapter four (paragraph 4.4).

Furthermore, an association has been shown between household income and alcohol consumption (Wagenaar et al., 2009). Findings suggest that households with high incomes (more than £70,000) are more likely to buy alcohol than low income (less than £10,000) households; however variation in prices paid per unit are evident, with

88% of low income households purchasing alcohol for less than 45p per unit (Griffith and Leicester, 2010). Despite these variations, modelling studies have suggested that policies that increase the price of alcohol would have a reductive effect on consumption; albeit to varying degrees, across low and high income groups. For example, a 10% price increase is estimated to reduce consumption by 39.9% and 35.4% among low and high income groups respectively (Holmes et al., 2014).

3.5 Methods

For the first time the ONS has published both the item indices and price quotes that underpin the UK's Consumer Price Index (CPI). These price quotes were utilised in order to construct regional prices indices for alcohol for England and Wales. Price indices are used to measures relative price change between periods (e.g. months, quarters or years) over time as compared with prices in a particular period; often referred to as the 'base' period. The UK's CPI is the main macroeconomic indicator of domestic consumer price inflation in the UK. It measures average inflation based on average household expenditure on a series of representative items (approximately 650 items) often envisaged as a very large shopping basket. When the price of items in the basket vary, so too does the total cost of the basket and therefore the CPI measures this change from month to month (Office for National Statistics, 2012b). A brief description of the sampling procedures and data collection employed by the UK CPI are discussed below.

3.5.1 UK Consumer Price Index (CPI)

The CPI is calculated by deriving aggregate price indices and weighting them together to create higher level indices, for example, from 'classes' (e.g. bitter) to 'groups' (e.g. beer) and from groups to 'divisions' (e.g. alcoholic beverages, tobacco and narcotics). Elementary aggregates are the lowest indices and refer to all prices collected for a particular item in one stratum, for example, a pint of bitter bought in Wales. Weights reflect household expenditure on a particular item and are updated twice a year (ibid).

Rigorous sampling methods are used to calculate the CPI. Prices are collected both centrally by ONS and locally by field workers. For local price collection, the UK is divided into regions i.e. Eastern, East Midlands, London, North East, North West, South East, South West, Wales, West Midlands, Wales, Northern Ireland and Scotland. Locations are selected from within each region with outlets then selected from within each location. Prices for a particular item may therefore be stratified by region, shop type, both or neither. In 2012, 110,000 prices were obtained from outlets in 150 locations. Stringent validation procedures are also employed; including a price change check (where prices sampled are compared to the price for the same product in the previous month) and a min/max check (where prices sampled are compared against a pre-established item min/max price range) (ibid).

The UK CPI is therefore best defined as a fixed base, weighted index, which measures the current price of a basket of representative household items against the price of the same basket at the base period.

3.5.2 Construction of alcohol price indices by economic region

3.5.2.1 *Defining datasets for on-trade and off-trade alcohol price*

Using the statistical software package R (R Core Team, 2013), the quarterly price quotes data were aggregated into in a single dataset containing monthly price data from January 1996 to December 2012, for the nine regions of England, as well as Wales, Scotland and Northern Ireland. A six digit 'item-id' enabled the identification of price quotes relating to alcohol i.e. item-ids for alcoholic drinks began with '310'. Item-ids enabled each price quote to be matched to a corresponding "item description" in the item indices dataset. These descriptions also enabled the disaggregation of the price quotes by market type i.e. 'on-trade' and 'off-trade'. Replication factors (termed 'shop weights') were used to account for the number of times a price from a chain store (both supermarket and non-supermarket) should appear in each region at a given time. This was achieved by multiplying each price quote by its respective replication factor. The five biggest supermarkets are treated as 'regional centrals' and are priced regionally.

3.5.2.2 *Calculating elementary aggregate price indices*

In accordance with the time series of violence-related injury data in chapter two, regional price indices for alcohol were calculated from January 2005 to December 2012. Price quotes from Northern Ireland and Scotland were removed as they did not correspond to the violence-related injury data from the previous chapter. In total, the dataset contained 825,132 individual price quotes over the eight year period from the nine English regions and Wales. When disaggregated by market type this resulted in 405,385 on-trade prices and 419,747 off-trade prices. Both price quotes referring to non-alcoholic drinks, for example, mixers such as 'tonic water' and 'draught coke/ lemonade', as well as items that did not remain constant throughout the time series, were identified and removed from the dataset (n=160,918); for example, a 1-2ltr bottle of cider was excluded as it was replaced mid-way through the sample by a 500-750ml bottle of apple cider. After removal of unwanted variables the dataset consisted of 664,918 price quotes (on-trade, 325,412; off-trade, 339,506). As multiple observations were present for each item for the same time period, geometric means were taken in order to establish single monthly observations for each item for each of the ten regions of England and Wales from January 2005 to December 2012.

Data on household expenditure on alcohol by type and region was retrieved from the annual report on household purchases published by the Department for Environment, Food and Rural Affairs (DEFRA) (Department for Environment, 2013).[11] Expenditure data was available for the following alcohol types; beer; lager and continental beer; cider/perry; champagne and sparkling wine; table wine; spirits with mixer; fortified wine; spirits; liqueurs and cocktails; and alcopops. Using the categories of alcoholic drink defined in DEFRA's annual report, new geometric mean prices that matched these categories were calculated from the previous item prices (see Table 3.1 and Table 3.2)

[11] Figures from DEFRA's annual report are drawn from the Living Costs and Food Survey (LCFS), which collects detailed information on quantity and expenditure on food and drinks at household level. The LCFS is a voluntary survey which uses a stratified random sample design and is continuously conducted throughout the year to account for seasonal purchasing effects. The survey is weighted to account for non-response and population distribution according to census data. In 2013, 4,993 households participated in the survey (Bulman et al, 2014)

Monthly price indices for each alcohol type were calculated on an annual basis using the Laspeyres formula (Silver, 1997, see equation 3.1). Each price index was based at December of the previous year with the exception of the 2005 index, which was based at January 2005. Each index was based at December of the previous year so as to account for the annual change in weights. In order to highlight, visually, the differences between the elementary aggregates for on-trade and off-trade alcohol, indices displayed in Figures 3.1 and 3.2 are based at January 2005; here annual weights have not been accounted for and these indices are therefore referred to as 'unadjusted' price indices.

Table 3.1 On-trade alcohol prices; Wales, January 2006

Item	**Geometric-mean price**	**Category**	**Geometric-mean price**
Draught bitter (pint)	£1.94	Beer	£2.16
Draught stout (pint)	£2.42		
Bottled premium lager 4.3-7.5%	£2.38	Lager	£2.33
Premium lager (pint) 4.3-7.5%	£2.47		
Lager (pint) 3.4-4.2%			
Bottle of wine 70-75cl	£10.98	Wine	£4.99
Wine glass, per 175-250ml	£2.26		
Liqueur, per nip	£1.73	Spirit	£1.70
Vodka, per nip	£1.67		
Whisky, per nip	£1.69		
Alcopop	£2.43	Alcopop	£2.43

Table 3.2 Off-trade alcohol prices; Wales, January 2006

Item	Geometric-mean price	Category	Geometric-mean price
Bitter-4 cans 440-500ml	£3.62	Beer	£3.62
Lager-4 bottles premium	£3.42	Lager	£5.19
Lager-12-24 cans 440-500ml	£7.88		
White wine- European 75cl	£3.62	Wine	£3.98
White wine- New World 75cl	£4.43		
Red wine- European 75cl	£3.57		
Red wine- New world 75cl	£4.39		
Fortified wine-70-75cl	£5.63	Fortified wine	£5.63
Whisky-70cl	£10.55	Spirit	£9.93
Vodka-70cl	£9.89		
Brandy-70cl	£9.40		
Alcopop- 275ml	£1.41	Alcopop	£1.41

Figure 3.1 Unadjusted on-trade price indices by alcohol type, 2005(1)-2012(12); all regions, Jan 2005=100

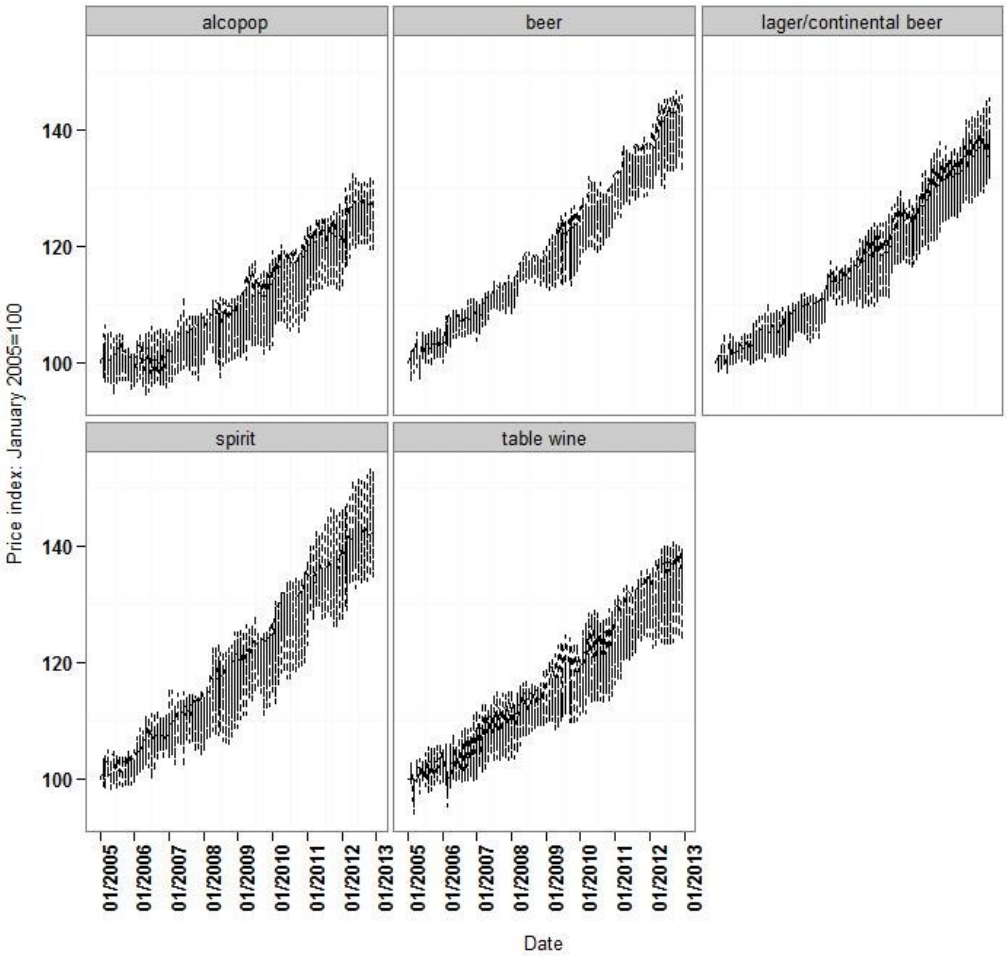
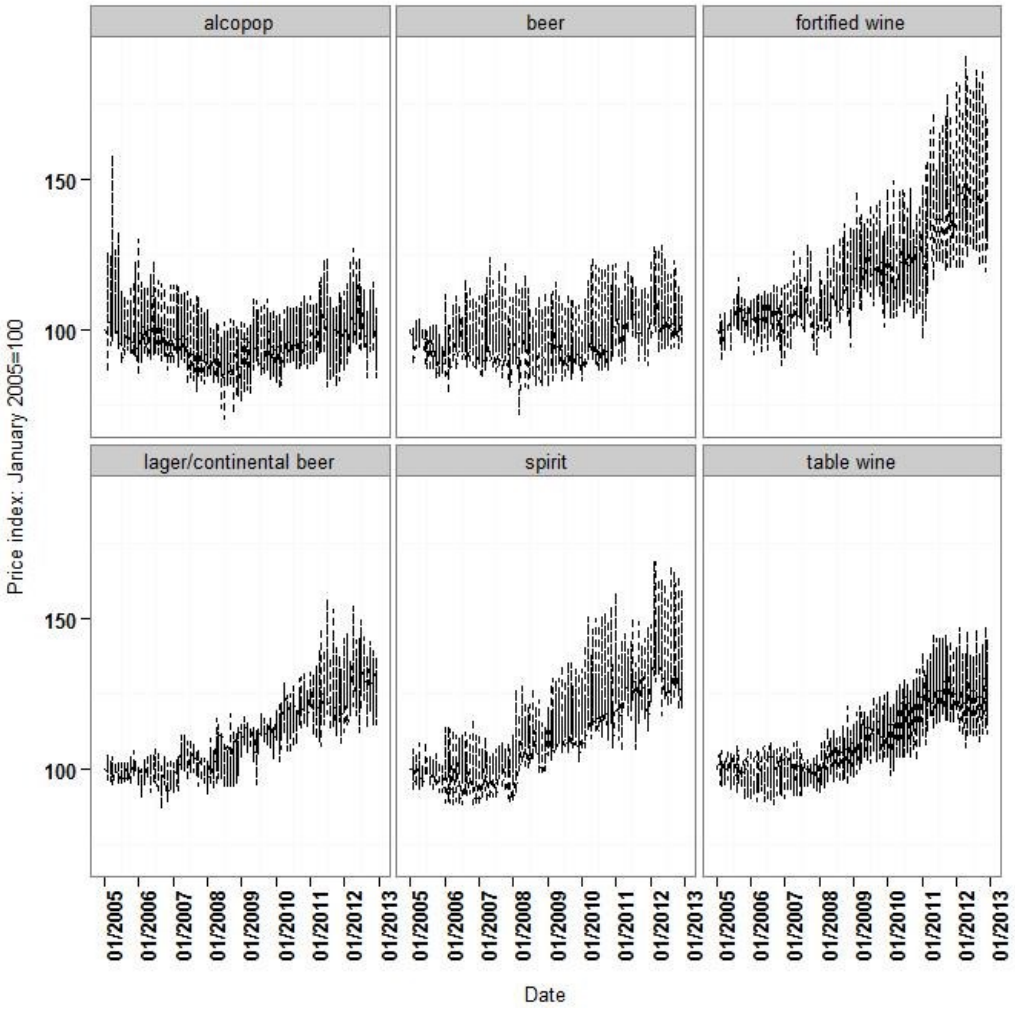


Figure 3.2 Unadjusted off-trade price indices by alcohol type, 2005(1)-2012(12); all regions, Jan 2005=100



3.5.2.3 *Calculating regional price indices from elementary aggregates*

Categories of alcohol price (i.e. beer, wine, spirit, etc.) were aggregated into single regional indices by market type using regional household expenditure data as weights (discussed below). Weighted aggregate price indices were preferred in order to counteract the evidence of multi-collinearity between the price indices by alcohol type (Tables 3.3 and 3.4) in preparation for inclusion in the following chapter. The use of weighted aggregate price indices also negated the need to account for volume of alcohol by calculating indices based on say, unit price. For this reason, direct comparisons between on-trade and off-trade alcohols at basic prices cannot be made; for example, on-trade beer is the geo-metric mean price of a single pint of both bitter and stout, whilst off-trade beer is the geo-metric mean price of four 440-500 ml cans of bitter.

Table 3.3 Correlation matrix of unadjusted on-trade alcohol price indices by alcohol type, 2005(1)-2012(12); all regions

	Alcopop	**Beer**	**Lager / continental beer**	**Spirit**	**Table Wine**
Alcopop	1				
Beer	0.93***	1			
Lager / continental beer	0.94***	0.97***	1		
Spirit	0.93***	0.95***	0.95***	1	
Table wine	0.89***	0.96***	0.92***	0.91***	1

***significant at 0.1% level

Table 3.4 Correlation matrix of unadjusted off-trade alcohol price indices by alcohol type, 2005(1)-2012(12); all regions

	Alcopop	Beer	Fortified wine	Lager/ continental beer	Spirit	Table Wine
Alcopop	1					
Beer	0.13***	1				
Fortified wine	0.13***	0.47***	1			
Lager / continental beer	0.09**	0.48***	0.70***	1		
Spirit	0.08**	0.61***	0.68***	0.79***	1	
Table wine	0.13***	0.29***	0.71***	0.71***	0.63***	1

***significant at 0.1% level; **significant at 1% level

3.5.2.4 *Weights*

Household expenditure on alcoholic drinks by region, year and alcohol type (sourced from DEFRA's annual report) was used to weight the off-trade elementary aggregate indices. The weekly expenditure data was transformed into average monthly figures by multiplying the weekly figures by fifty-two, to account for the number of weeks in the year and then dividing these new figures by twelve. The average monthly expenditure figures for each alcohol type were then summed to give the total regional expenditure on alcohol for that year. The weights used to construct the regional alcohol indices are therefore the average monthly expenditure on an alcohol type as a proportion of the total expenditure on all alcohol types sampled in the region for that year (Table 3.5). Expenditure data for alcohol types that were not included in the indices, for example cider, were not included in the total expenditure figure as this would bias the weights.

Regional expenditure on on-trade alcohol by type was not available. For this reason the assumption was made that the proportion of expenditure on alcohol by type in a

particular region would not alter dramatically between the markets and therefore the same weights could be applied. All weights used were updated annually from DEFRA's annual report on household purchases.

Table 3.5 Weight calculation; Wales 2006

Alcohol type	Avg. monthly expenditure	Weight
Beer	£0.52	0.052
Lager	£2.77	0.278
Wine	£4.07	0.409
Fortified wine	£0.22	0.022
Spirit	£2.12	0.213
Alcopop	£0.26	0.026
Total	**£9.96**	**1**

The regional alcohol indices were calculated by combining the regional elementary price aggregates using the Laspeyres formula (Equation 3.1). Where, wj are the expenditure weights for the product basket, P denotes price and Q denotes quantity.

$$Index = \frac{\sum_{j=1}^{j=N} Q\ base,j\ P\ current,j}{\sum_{j=1}^{j=N} Q\ base,j\ P\ base,j} = \frac{\sum_{j=1}^{j=N} E\ base,j \left(\frac{P\ current,j}{P\ base,j}\right)}{\sum_{j=1}^{j=N} E\ base,j} = \sum_{j=1}^{j=N} wj \left(\frac{P\ current,j}{P\ base,j}\right)$$

(Equation 3.1)

Put simply, the calculation for the overall off-trade index for Wales in January 2006 is as follows; (115.1 x 0.052) + (97.48 x 0.278) + (98.3 x 0.409) + (100.07 x 0.022) + (99.09 x 0.213) + (105.74 x 0.026) = 99.35 (see Table 3.6 for further detail).[12]

[12] Rounded figures used. Calculation may not sum to 99.35.

Table 3.6 Calculating higher level indices from elementary aggregates; off-trade alcohol, Wales 2006

Alcohol type	Weight	Dec 2005	Jan 2006	Feb 2006	Mar 2006	Apr 2006
Beer	0.052	100.00	115.1	102.03	101.33	104.91
Lager	0.278	100.00	97.48	93.06	101.05	102.77
Wine	0.409	100.00	98.30	101.00	101.82	101.86
Fortified wine	0.022	100.00	100.07	93.20	96.82	98.60
Spirit	0.213	100.00	99.09	99.49	99.75	99.03
Alcopop	0.026	100.00	105.74	90.57	85.59	88.94
Index	**1**	**100.00**	**99.35**	**98.08**	**100.61**	**101.26**

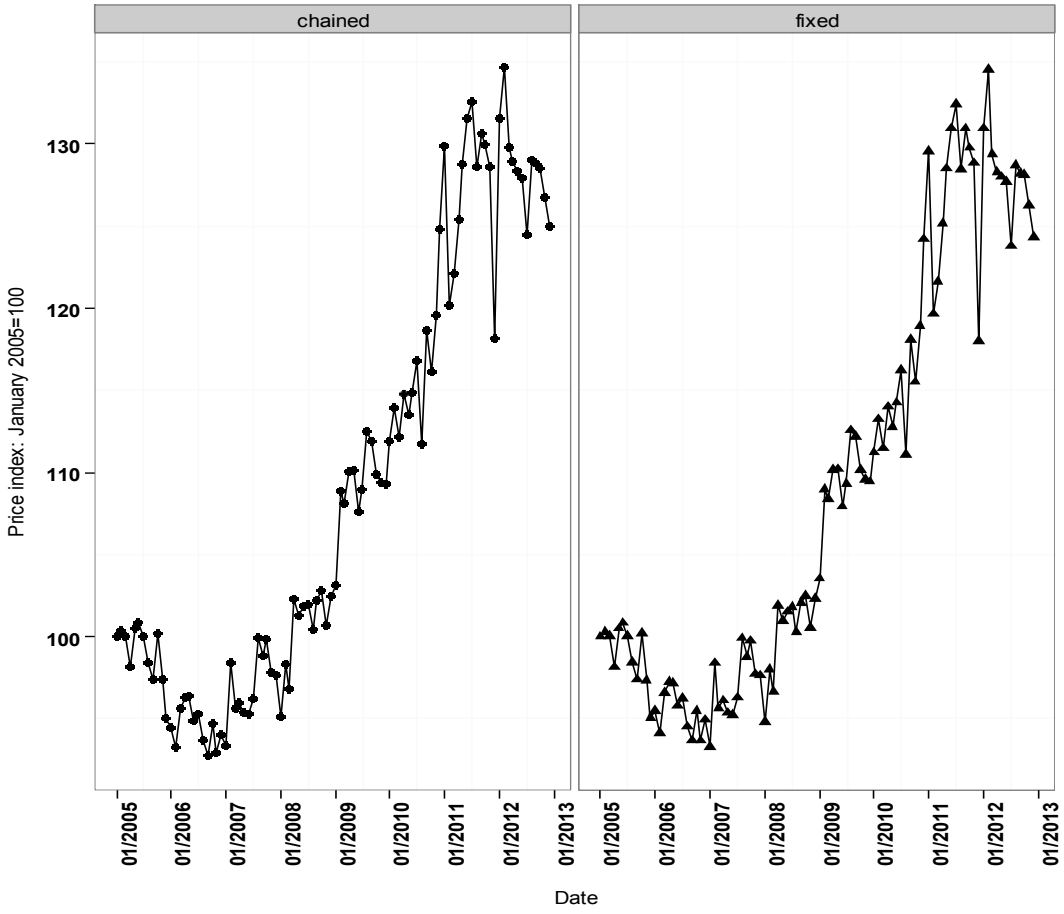
3.5.2.5 *Chaining higher level indices*

Each index was annually chained and referenced back to January 2005 (the base reference period). This was achieved through the use of a series of linking coefficients; where, for example, the linking coefficient for off-trade alcohol in Wales in 2006 was the index number of the previous December divided by one hundred. All index numbers for off-trade alcohol in Wales in 2006 were then multiplied by this linking coefficient to bring them up to the level of the 2005 index (see Table 3.7). This process was completed for each year and accounted for the annual change in weights; however as only matching items were used in the indices, it is likely that the annual weights will remain relatively stable over the time period. Indeed, Figure 3.3 highlights the difference between using the above methodology in contrast to a fixed base methodology. Although both methodological approaches used annually updated weights, a fixed based index, where indices are not chained to account for the annual change in weights, is directly referenced to a fixed reference period (for example, January 2005). As highlighted by Figure 3.3, there is little difference between the methodological approaches in this particular case.

Table 3.7 Annual chaining of price indices; off-trade, Wales

Date	Unchained index	Chained 2006	Chained 2007	Linking coefficient
Dec 2005	95.07 (1)			2006 = 0.9507 (1)
Jan 2006	99.35	94.46		2007 = 0.9402 (2)
Feb 2006	98.08	93.25		2008 = 0.9769 (3)
Mar 2006	100.6	95.65		
Dec 2006	98.89	94.02 (2)		
Jan 2007	99.28		93.34	
Feb 2007	104.64		98.37	
Mar 2007	101.74		95.65	
Dec 2007	103.91		97.69 (3)	

Figure 3.3 Chained vs. fixed unadjusted off-trade price index, 2005(1)-2012(12); Wales



3.5.2.6 *Deriving the real cost of alcohol*

In order to remove the effects of general price inflation over the time series, the higher level indices were deflated by the UK CPI excluding alcohol price and re-based at January 2005 (=100). Adjusting for price inflation is necessary in order to obtain changes in the 'real' price of alcohol between January 2005 and December 2012. The deflated index was termed 'cpixalc' (Equation 3.2) and the re-based index 'cpixalc0' (Equation 3.3).

$$cpixalc_t = cpi_t - cpialc_t \times (alcw_t/1000) \quad \text{(Equation 3.2)}$$

$$cpixalc0_t = (cpixalc_t / cpixalc_0) \times 100 \quad \text{(Equation 3.3)}$$

Where, 'cpi_t' is the UK CPI at time '*t*', '$cpialc_t$' is the monthly consumer price index for alcohol at time '*t*' and '$alcw_t$' is the annual alcohol weight in parts per thousand at time '*t*'. The re-based index, '$cpixalc0_t$' (Equation 2), is then calculated by simply dividing 'cpixalc' at time '*t*', by the base reference period, 'cpixalc0' and multiplying by one hundred.

The real price of alcohol was then established by dividing the chained index for region '*i*' at time '*t*' by the subsequent '$cpixalc0_t$' index number and multiplying by one hundred (see Table 3.8 and 3.9).

Table 3.8 Off-trade alcohol index (deflated by CPI excluding alcohol price); Wales 2005

Date	cpi	cpialc	cpialcw	cpixalc	cpixalc0	Index	Real price
Jan 05	98.6	99.9	20	96.6	100	100	100
Feb 05	98.8	100.3	20	96.8	100.2	100.3	100.1
Mar 05	99.3	99.1	20	97.3	100.7	100	99.3
Apr 05	99.7	99.5	20	97.7	101.2	98.1	97.0
May 05	100	100.5	20	98.0	101.4	100.5	99.1
Jun 05	100	100.5	20	98.0	101.4	100.8	99.4

Table 3.9 On-trade alcohol index (deflated by CPI excluding alcohol price); Wales 2005

Date	cpi	cpialc	cpialcw	cpixalc	cpixalc0	Index	Real price
Jan 05	98.6	99.9	20	96.6	100	100	100
Feb 05	98.8	100.3	20	96.8	100.2	99.8	99.6
Mar 05	99.3	99.1	20	97.3	100.7	96.9	96.2
Apr 05	99.7	99.5	20	97.7	101.2	101.8	100.7
May 05	100	100.5	20	98.0	101.4	98.5	97.1
Jun 05	100	100.5	20	98.0	101.4	101.8	100.3

3.5.3 Regression analysis

Log-linear regressions were conducted on on-trade and off-trade alcohol price indices in order to examine change in alcohol price over time. A linear time trend and a quadratic time trend were fitted, along with both monthly and regional dummy variables, which take the value of 0 or 1 and are used in order to account for the effects of categorical variables or time periods that may be expected to influence the dependent variable, in order to account for any seasonal or region-specific effects. Dummies corresponding to January and the Eastern region were used as base categories against which the other dummies were assessed and therefore, as a result, were not included within the regression. A separate dummy variable accounting for the economic recession experienced during the time series was also included due to its possible impact on alcohol price; the 'recession' dummy covered the period July 2008 to December 2009. Region x Recession, Region x Linear time trend, and Region x Quadratic time trend interaction terms were also included in on-trade and off-trade regression models. Time trends were orthogonalized so as to account for collinearity.[13]

3.6 Results

3.6.1 On-trade alcohol price

At basic prices (i.e. geometric mean price), on-trade alcohol was most expensive in London (mean = £3.42, SD = 1.56) and South East (mean = £3.37, SD = 1.49) regions and cheapest in North West (mean = £3.05, SD = 1.41), Wales (mean = £3.05, SD = 1.31), and North East (mean = £3.06, SD = 1.42) regions respectively (see Table 3.10).

Log-linear regression results revealed that the real price of on-trade alcohol increased significantly between January 2005 and December 2012 ($\beta = 1.206$, $t = 40.624$, $p<0.001$, see Table 3.11). Significant seasonal effects were evident. On-trade alcohol price increased in April and July and decreased in October, November and December relative to January. Regional effects were also apparent (see Figure 3.5). Over the

[13] Orthogonalized time trends are time trends that are perpendicular to one another and therefore completely independent.

time series, greater increases in on-trade alcohol price were experienced in the Eastern, East Midlands and Yorkshire and Humberside regions. Log-linear regression results also indicated that on-trade alcohol price increased significantly during the economic recession (β = 0.011, t = 3.898, $p<0.001$). Significant interactions were identified between Region x Recession, Region x Linear time trend and Region x Quadratic time trend; suggesting regional variation in the effects of both time and the recession on on-trade alcohol price in England and Wales (see Table 3.11 for full regression results). The model explained 92% of the variance and was a good fit of the data (see Figure 3.6).

3.6.2 Off-trade alcohol price

At basic prices, off-trade alcohol was most expensive in the South East (mean = £6.00, SD = 3.91) region and cheapest in Wales (mean = £3.05, SD = 3.21, Table 3.10). Log-linear regression results highlight that the real price of off-trade alcohol decreased significantly between January 2005 and December 2012 (β = -0.353, t = -4.267, $p<0.001$). However, examination of region and time trend interaction terms suggest an overall increase in off-trade alcohol price over the time series (see Figure 3.4 and Table 3.12 for full regression results). Seasonal effects were again evident. Off-trade alcohol price was significantly less in November and December relative to January. Again, regional effects were apparent. Over the time series, off-trade alcohol prices increased significantly across all regions relative to the Eastern region. Log-linear regression results also indicated that off-trade alcohol price was significantly influenced by the recession; off-trade alcohol price increased significantly during this time (β = 0.016, t = 2.083, p=0.042). Significant interactions were identified between Region x Recession, Region x Linear time trend and Region x Quadratic time trend. However in contrast to on-trade alcohol price, less regional variation was identified with regards to the influence of the recession. The model explained 71% of the variance and was a good fit of the data (see Figure 3.7).

Table 3.10 Means and standard deviations, 2005(1)-2012(12) [14]

Region	On-trade		Off-trade	
	Price	**Index**	**Price**	**Index**
Eastern	£3.32 (1.42)	103.7 (4.28)	£5.75 (3.33)	95.4 (3.22)
East Midlands	£3.16 (1.44)	104.4 (3.77)	£5.70 (3.38)	101.7 (5.88)
London	£3.42 (1.56)	101.4 (2.24)	£5.55 (3.35)	97.6 (4.79)
North East	£3.06 (1.42)	102.8 (1.88)	£5.59 (3.48)	99.5 (3.94)
North West	£3.05 (1.41)	101.0 (1.47)	£5.62 (3.48)	99.2 (3.78)
South East	£3.37 (1.49)	103.3 (2.31)	£6.00 (3.91)	98.4 (4.04)
South West	£3.31 (1.48)	102.4 (3.97)	£5.70 (3.51)	99.9 (4.99)
Wales	£3.05 (1.31)	102.5 (3.40)	£5.51 (3.21)	96.9 (5.63)
West Midlands	£3.13 (1.43)	100.9 (2.45)	£5.63 (3.49)	98.6 (3.72)
Yorkshire & Humberside	£3.20 (1.44)	106.0 (3.23)	£5.66 (3.57)	98.4 (4.59)

14 Direct comparisons cannot be made between on-trade and off-trade prices as volume of alcohol was unaccounted for.

Figure 3.4 Real on-trade and off-trade price indices for alcohol for England and Wales, 2005(1)-2012(12); all regions

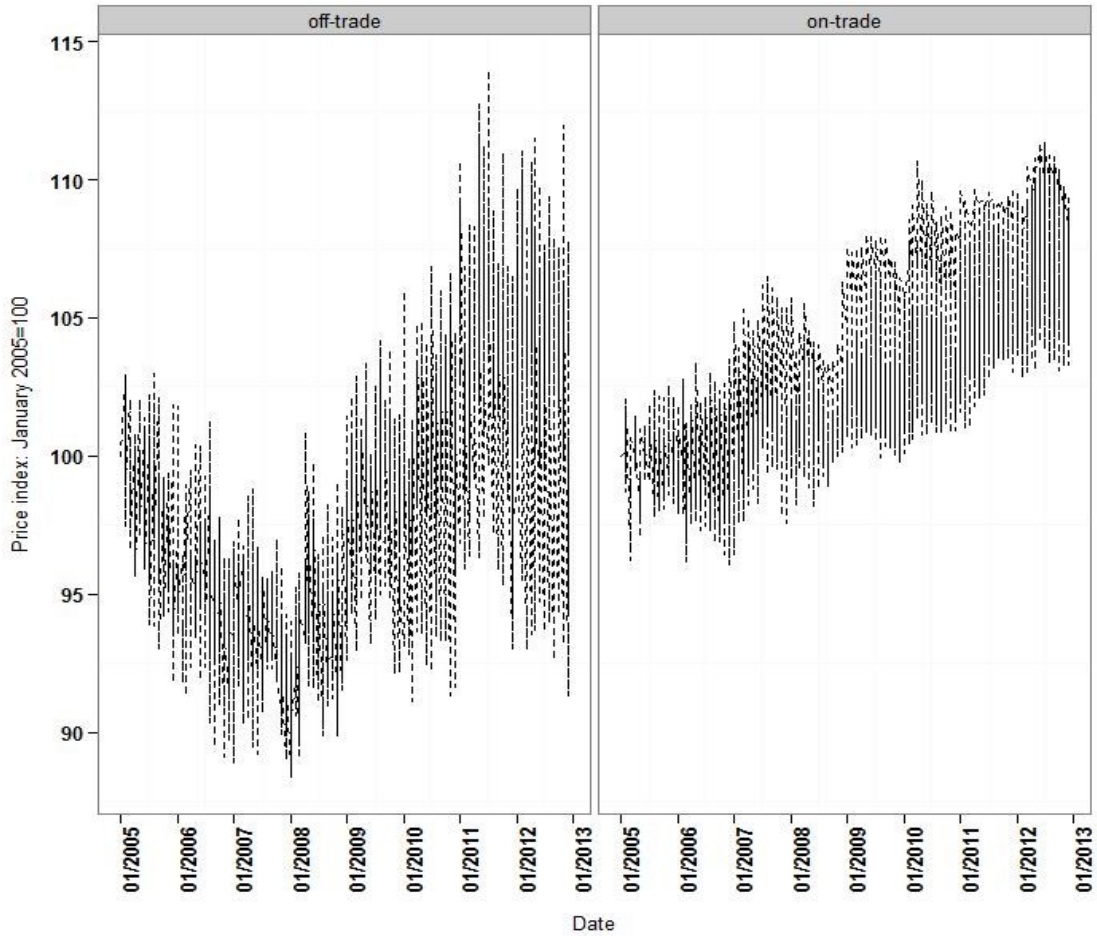


Figure 3.5 Real on-trade and off-trade price indices for alcohol for England and Wales by region, 2005(1)-2012(12)

Table 3.11 Log-linear regression results, 2005(1)-2012(12); on-trade alcohol price

Variable	Coefficient	Std. Error	t-value	p-value	
Intercept	4.641	0.001	3133.386	<0.001	***
Linear time trend[a]	1.206	0.030	40.624	<0.001	***
Quadratic time trend[a]	0.086	0.035	2.500	0.013	*
Recession	0.011	0.003	3.898	<0.001	***
February	0.002	0.001	1.548	0.122	
March	-0.003	0.001	-2.139	0.033	*
April	0.005	0.001	3.095	0.002	**
May	0.001	0.001	0.968	0.333	
June	0.002	0.001	1.516	0.130	
July	0.004	0.001	3.004	0.003	**
August	<0.001	0.001	0.053	0.958	
September	-0.002	0.001	-1.324	0.186	
October	-0.004	0.001	-2.426	0.015	*
November	-0.004	0.001	-2.904	0.004	**
December	-0.007	0.001	-4.874	<0.001	***
East Midlands	0.007	0.002	4.581	<0.001	***
London	-0.020	0.002	-12.718	<0.001	***
North East	-0.004	0.002	-2.802	0.005	**
North West	-0.026	0.002	-16.915	<0.001	***
South East	-0.005	0.002	-3.154	0.002	**
South West	-0.008	0.002	-4.888	<0.001	***
Wales	-0.013	0.002	-8.175	<0.001	***
West Midlands	-0.030	0.002	-19.122	<0.001	***
Yorkshire & Humberside	0.024	0.002	15.344	<0.001	***
East Midlands x Recession	-0.026	0.004	-6.527	<0.001	***
London x Recession	-0.017	0.004	-4.132	<0.001	***
North East x Recession	-0.016	0.004	-3.939	<0.001	***
North West x Recession	-0.009	0.004	-2.191	0.029	*
South East x Recession	-0.015	0.004	-3.814	<0.001	***
South West x Recession	-0.009	0.004	-2.254	0.024	*
Wales x Recession	-0.015	0.004	-3.666	<0.001	***
West Midlands x Recession	-0.004	0.004	-1.061	0.289	
Yorkshire & Humberside x Recession	-0.017	0.004	-4.148	<0.001	***

East Midlands x Linear time trend	-0.299	0.042	-7.137	<0.001	***
East Midlands x Quadratic time trend	0.037	0.049	0.760	0.448	
London x Linear time trend	-0.632	0.042	-15.057	<0.001	***
London x Quadratic time trend	0.120	0.049	2.464	0.014	*
North East x Linear time trend	-0.629	0.042	-15.000	<0.001	***
North East x Quadratic time trend	-0.078	0.049	-1.602	0.109	
North West x Linear time trend	-0.852	0.042	-20.300	<0.001	***
North West x Quadratic time trend	0.046	0.049	0.952	0.341	
South East x Linear time trend	-0.632	0.042	-15.065	<0.001	***
South East x Quadratic time trend	-0.038	0.049	-0.770	0.442	
South West x Linear time trend	-0.076	0.042	-1.812	0.070	
South West x Quadratic time trend	0.157	0.049	3.219	0.001	**
Wales x Linear time trend	-0.288	0.042	-6.870	<0.001	***
Wales x Quadratic time trend	0.187	0.049	3.827	<0.001	***
West Midlands x Linear time trend	-0.531	0.042	-12.658	<0.001	***
West Midlands x Quadratic time trend	0.042	0.049	0.861	0.390	
Yorkshire & Humberside x Linear time trend	-0.300	0.042	-7.155	<0.001	***
Yorkshire & Humberside x Quadratic time trend	-0.246	0.049	-5.037	<0.001	***
Adjusted R-squared	0.916				
F-statistic	F(50,909)=208.9			<0.001	***

***significant at 0.1% level; **significant at 1% level; *significant at 5% level

[a]orthogonal time trends

Table 3.12 Log-linear regression results, 2005(1)-2012(12); off-trade alcohol price

Variable	Coefficient	Std. Error	t-value	p-value	
Intercept	4.556	0.004	1103.200	<0.001	***
Linear time trend[a]	-0.353	0.083	-4.267	<0.001	***
Quadratic time trend[a]	0.703	0.096	7.309	<0.001	***
Recession	0.016	0.008	2.038	0.042	*
February	-0.004	0.004	-0.909	0.363	
March	-0.007	0.004	-1.599	0.110	
April	0.004	0.004	1.015	0.311	
May	0.003	0.004	0.687	0.492	
June	<0.001	0.004	0.005	0.996	
July	<0.001	0.004	0.065	0.948	
August	-0.007	0.004	-1.619	0.106	
September	-0.008	0.004	-1.939	0.053	
October	-0.010	0.004	-2.469	0.014	*
November	-0.020	0.004	-4.701	<0.001	***
December	-0.038	0.004	-9.065	<0.001	***
East Midlands	0.057	0.004	13.100	<0.001	***
London	0.026	0.004	6.013	<0.001	***
North East	0.052	0.004	12.146	<0.001	***
North West	0.043	0.004	9.895	<0.001	***
South East	0.037	0.004	8.518	<0.001	***
South West	0.049	0.004	11.253	<0.001	***
Wales	0.020	0.004	4.603	<0.001	***
West Midlands	0.039	0.004	8.970	<0.001	***
Yorkshire & Humberside	0.041	0.004	9.482	<0.001	***
East Midlands x Recession	-0.026	0.011	-2.341	0.019	*
London x Recession	-0.004	0.011	-0.323	0.747	
North East x Recession	-0.021	0.011	-1.851	0.064	
North West x Recession	0.007	0.011	0.592	0.554	
South East x Recession	-0.033	0.011	-2.951	0.003	**
South West x Recession	0.008	0.011	0.700	0.484	
Wales x Recession	-0.003	0.011	-0.284	0.777	
West Midlands x Recession	-0.006	0.011	-0.547	0.584	
Yorkshire & Humberside x Recession	-0.018	0.011	-1.595	0.111	

East Midlands x Linear time trend	1.552	0.117	13.272	<0.001	***
East Midlands x Quadratic time trend	0.236	0.136	1.738	0.082	
London x Linear time trend	1.506	0.117	12.881	<0.001	***
London x Quadratic time trend	0.103	0.136	0.757	0.449	
North East x Linear time trend	1.435	0.117	12.268	<0.001	***
North East x Quadratic time trend	-0.066	0.136	-0.488	0.626	
North West x Linear time trend	1.108	0.117	9.474	<0.001	***
North West x Quadratic time trend	-0.351	0.136	-2.584	0.010	**
South East x Linear time trend	1.110	0.117	9.487	<0.001	***
South East x Quadratic time trend	-0.282	0.136	-2.073	0.038	*
South West x Linear time trend	1.421	0.117	12.147	<0.001	***
South West x Quadratic time trend	0.047	0.136	0.349	0.728	
Wales x Linear time trend	1.455	0.117	12.442	<0.001	***
Wales x Quadratic time trend	0.111	0.136	0.814	0.416	
West Midlands x Linear time trend	0.938	0.117	8.017	<0.001	***
West Midlands x Quadratic time trend	-0.091	0.136	-0.670	0.503	
Yorkshire & Humberside x Linear time trend	1.377	0.117	11.775	<0.001	***
Yorkshire & Humberside x Quadratic time trend	-0.457	0.136	-3.363	0.001	***
Adjusted R-squared	0.706				
F-statistic	F(50,909)=47			<0.001	***

***significant at 0.1% level; **significant at 1% level; *significant at 5% level

[a]orthogonal time trends

Figure 3.6 Comparison of fitted and actual values; on-trade alcohol price index by region, 2005(1)-2012(12)

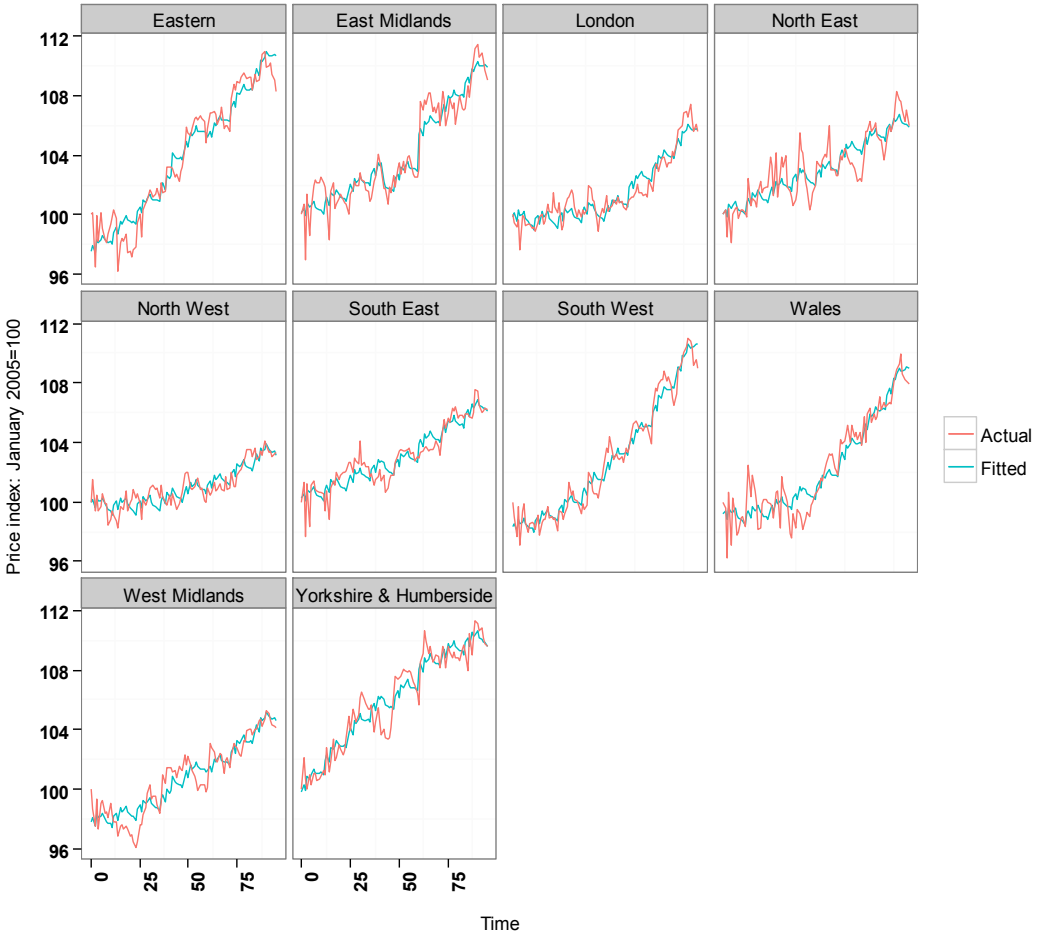
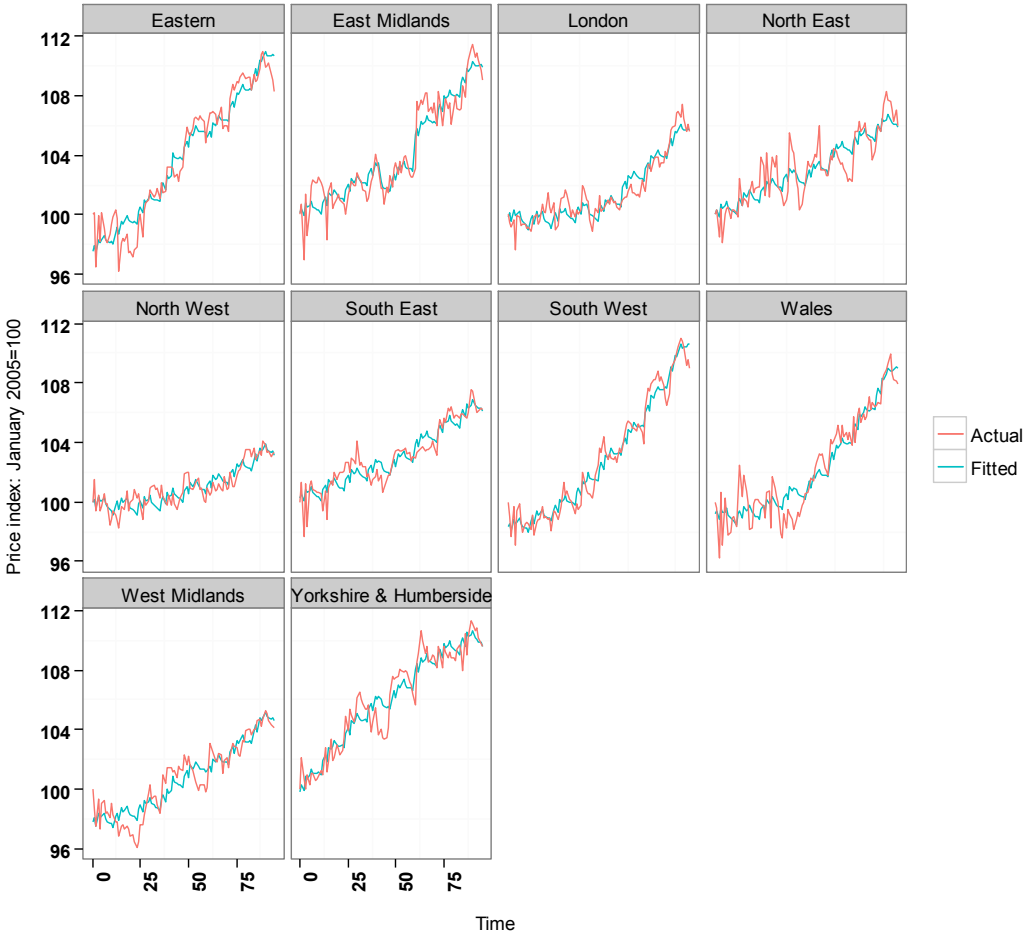


Figure 3.7 Comparison of fitted and actual values; off-trade alcohol price index by region, 2005(1)-2012(12)



3.7 Summary

This is a methodological chapter that has described the processes involved in calculating regional price indices for both on-trade and off-trade alcohol in England and Wales. Analysis of the constructed price indices revealed that the real price of alcohol has increased across both markets between January 2005 and December 2012; although the real price of off-trade alcohol did however decrease between 2005 and 2008 (Figure 3.4). Seasonal effects were also evident with on-trade and off-trade alcohol cheaper in December relative to January in both markets, whilst on-trade alcohol was found to be significantly more expensive in April and July relative to January.

Furthermore, log-linear regression results highlight regional variation in real term increases in alcohol price; for example, at basic prices, alcohol (on-trade and off-trade) was generally found to be cheaper in the northern regions (i.e. North East, North West, Wales, West Midlands and Yorkshire and Humberside). A significant positive association was also identified between the economic recession (July 2008 to December 2009) and the price of alcohol in both markets; although regional variation was greater in the on-trade market. See Appendices (Appendix D) for calculated regional price indices for alcohol for England and Wales.

4 Violence-related injury and the real price of alcohol in England and Wales

4.1 Chapter outline

Using regional price indices for alcohol constructed in chapter three, chapter four examines the influence of 'real' alcohol price (i.e. above inflation), both on-trade and off-trade, as well as socioeconomic and environmental factors, on rates of violence-related ED attendances in England and Wales. In doing so, this chapter begins to address the second aim of the thesis; to better understand major determinants of violence-related injury in England and Wales at macro level. This chapter details the process of data collection, statistical methods, including model construction and validation, and model results. Chapter four concludes with a discussion of the main findings, brief implications for policy and study limitations.

4.2 Introduction

In chapter two, a national decline in violence-related injury was evidenced between January 2005 and December 2012. At the same time, the UK experienced a decline in overall levels of alcohol consumption (Sheen, 2013); possibly due to a decrease in the affordability of alcohol. An association between alcohol and violence has long been acknowledged yet a causal relationship has never been proven outside of experimental conditions. As discussed previously (chapter three; paragraph 3.4.3), there exists a robust literature evidencing how an increase in alcohol price reduces demand and as a result, decreases alcohol consumption (Wagenaar et al., 2009, Gallet, 2007). The economics literature has therefore cut through the causative debate by reporting an association between alcohol price and violence in both the US (Markowitz, 2000b) and UK (Matthews et al., 2006).

This study will, for the first time, examine the influence of both on-trade and off-trade alcohol price on rates of violence-related injury in England and Wales, as well as the relative contribution of alcohol price to rates of violence-related injury when compared against socioeconomic risk factors and seasonal effects. Modelling will

account for regional heterogeneity and analyses will be conducted for both genders and across four age groups (18 years and over, 18-30 years, 31-50 years, and 51 years and over) between January 2005 and December 2012. Importantly, this will enable policy makers to identify which risk factors are most contributory to rates of violence-related injury in England and Wales and how this may differ by gender and across age groups. From a public health perspective, unravelling the different risk/protective factors for violence-related injury would pave the way for targeted interventions and therefore this study has potential implications for violence prevention policy.

4.3 Chapter aims and objectives

Aims

1) To highlight a one-way association between alcohol price and violence-related injury in England and Wales that strengthens the association between alcohol consumption and violence.

2) To contribute to the evidence that alcohol pricing policies can be a legitimate violence prevention strategy in England and Wales.

Objectives

1) To examine the association between violence-related injury and the real price of alcohol, both on-trade and off-trade, across the economic regions of England and Wales.

2) To examine the association between violence-related injury and socioeconomic factors across the economic regions of England and Wales.

3) To examine the association between violence-related injury and seasonality in England and Wales.

4) To examine the relative contribution of alcohol price, socioeconomic factors and seasonal effects to risk of violence-related injury across the economic regions of England and Wales.

4.4 Alcohol pricing policies in England and Wales

The Coalition Government reneged on their commitment put forward in the Alcohol Strategy (2012) to introduce alcohol MUP in England and Wales; instead opting to introduce a ban on the sale of alcohol below cost price i.e. below the cost of duty plus value added tax (VAT) (Home Office, 2014). Whilst still a positive step which will prevent supermarkets selling alcohol as a 'loss leader' (Competition Commission, 2008), model-based estimates suggest that banning the sale of alcohol below cost price will only reduce overall levels of alcohol consumption by as little as 0.04% (Brennan et al., 2014).[15] Furthermore, the 2015 budget saw Chancellor George Osborne cut beer duty by 1p for the third successive year (HM Treasury, 2015); two years after he scrapped the alcohol duty escalator put in place in 2008 to ensure a 2% annual increase in the price of alcohol above the rate of inflation (HM Treasury, 2013). Scrapping the alcohol duty escalator was estimated to cost the exchequer £110 million in 2014; money that could have been used to increase ambulance call outs, ED-based alcohol nurses and inpatient detoxification services (Brown, 2014). Overall, the negative costs to society which result from the consumption of alcohol, estimated at £21 billion per annum, greatly outweighs the £10 billion annual revenue created by alcohol duties (Office for National Statistics, 2013a, HM Government, 2012).

4.4.1 Minimum unit pricing (MUP)

An alternative pricing policy being recommended is MUP; where a single unit of alcohol cannot be sold for less than a pre-determined value. Varying forms of MUP have already been implemented in Canada, Russia, Moldova, Ukraine, Uzbekistan and select states in the USA (Stockwell and Thomas, 2013). Scotland, and more recently Wales, has also stated their intentions to introduce alcohol MUP.[16] However, regardless of both national and international support for MUP, the Government has consistently blamed a lack of evidence that MUP would not unjustly

[15] A 'loss leader' is a low priced good, sometimes priced below cost price, which aims to attract customers to a store in the hope that they purchase other more profitable goods.

[16] The Scottish Government passed, but is yet to implement, a minimum unit price of £0.50 for all alcoholic drinks in Scotland as part of the Alcohol (Minimum Pricing) (Scotland) Act 2012. Similarly, in its recent white paper– 'Listening to you: Your health matters'- the Welsh Government have proposed the introduction of MUP in Wales.

penalize responsible drinkers, as the primary reason for reneging on its proposed implementation (Boseley, 2013). This is simply not true. Model-based estimates from the Sheffield Alcohol Policy Model (hereafter 'Sheffield model') have shown that a minimum unit price of £0.50 would be the most effective pricing policy for reducing consumption among harmful drinkers without disproportionately affecting responsible drinkers (Meier et al., 2010). At this level, MUP would also target the cheapest drinks such as those often found in the off-trade market and favoured by both young (Banerjee et al., 2010) and harmful drinkers (Black et al., 2011). Moreover, the combined financial savings to health care, crime and work-place harms following the introduction of MUP (set at £0.50 per unit) have been estimated at £7.1 billion over ten years (Meier et al., 2010).

4.4.2 Tax-based policy

The WHO claims that, internationally, the revenue producing potential of alcohol taxes are not being exploited (World Health Organisation, 2009). In England and Wales, the social costs of alcohol are twice as much as the revenue produced through alcohol receipts (evidenced above) (HM Government, 2012, Office for National Statistics, 2013a). An association between alcohol taxes and alcohol consumption is evident within the empirical literature. In Switzerland, for example, a 28.6% increase in the consumption of spirits was identified after a large tax reduction (Heeb et al., 2003). Similarly, in the US, a 32% decrease in cirrhosis mortality (used an indicator of heavy drinkers) was associated with a 10% increase in alcohol tax (Cook, 2007). In England and Wales, model-based estimates from the Sheffield model revealed that a 10% increase in the real price of alcohol would be the second most effective policy behind MUP (set at £0.50) at reducing consumption (Meier et al., 2010). Indeed, the Sheffield model suggested that overall levels of alcohol consumption would reduce by 4.4% after a 10% increase in price; a reduction of 3.5%, 4.7%, 4.5% and 6% for moderate, hazardous, harmful, and young hazardous drinkers respectively (Meier et al., 2010). The financial savings achieved from an across the board price increase have been estimated at close to £4 billion after ten years of implementation (ibid), whilst the revenue gained from a tax increase, an estimated £980 million (Griffith et al., 2013a, Griffith et al., 2013b), would be at the Governments disposal and could be used to offset the social cost of alcohol.

4.5 Methods

4.5.1 Data and sample

ED-derived information on attendance date, age and gender of patients reporting injury in violence, which was collected and analysed in chapter two, was used in the current study as a measure of violence-related injury.

Briefly, data were collected from a stratified convenience sample of 100 Types 1, 3 and 4 EDs (Type 1 = consultant led 24 hour service with resuscitation capabilities; Type 3 = other EDs/ minor injury units; Type 4 = NHS walk-in-centres) across England and Wales between January 1st 2005 and 31st December 2012. Type 2 EDs (consultant led single speciality accident and emergency services) were not successfully recruited. Selection criteria for EDs were willingness to share anonymised data, availability of electronically recorded data and that they complied with both the Data Protection Act (1998) (HM Government, 1998b) and Caldicott Guidance. ED attendances were aggregated to regional level (i.e. Eastern, East Midlands, London, North East, North West, South East, South West, Wales, West Midlands and Yorkshire and Humberside). Children were not included in the current study due to the legal restriction prohibiting the sale of alcohol to those under the age of eighteen.

In total, 299,831 adult violence-related ED attendances were identified and included in the sample. Disaggregation by gender and age group indicated that the sample was predominantly male (220,526: 73.5%) and aged between 18 and 30 years of age (174,214: 58%, Table 4.1). Monthly violence-related injury rates per 1000 population were calculated by region, gender and across four age groups (18 years and over, 18-30 years, 31-50 years, and 51 years and over). Rates of violence-related injury were used rather than count of ED attendance so as to enable cross-regional comparisons. In order to account for EDs not included in the sample, regional-specific weights were applied to raw ED attendance figures. Weights accounted for unequal regional coverage and boosted ED attendances to nationally representative level. Methods used to calculate and apply these weights were detailed in chapter two (paragraph 2.4.1.5). Mid-season population estimates from the ONS were used

to transform the weighted attendance figures into violence-related injury rates per 1000 population.

Table 4.1 Violence-related ED attendances, 2005(1)-2012(12)

England & Wales	**Assaults**	**Region**	**Assaults**
Total	299,831	Eastern	18,444
		East Midlands	24,617
Males	220,526	London	26,407
Females	79,305	North East	24,544
		North West	70,560
18-30 years	174,214	South East	25,163
31-50 years	104,144	South West	25,308
51 years and over	21,473	Wales	34,767
		West Midlands	11,607
		Yorkshire & Humberside	38,414

4.5.2 Statistical methods

Panel regression was used to estimate a statistical model for violence-related injury. Panel regression was deemed the most appropriate statistical approach owing to the time series and cross-sectional elements of the data (Brooks, 2008). A brief overview of panel regression, including the two broad types of panel regression (fixed and random effects) and how panel regression differs from ordinary least squares (OLS) regression, is discussed below.

4.5.2.1 *Panel regression*

A panel regression remains faithful to the basic regression framework i.e. it is *"concerned with describing and evaluating the relationship between a given variable and one or more other variables"* (Brookes, 2008: p.27). However, where OLS regression assumes that "*average values and the relationship between them are constant over time and across all cross-sections*" (ibid: p.488), a panel regression

assumes variability between observations on a cross-section. Therefore with panel regression, observations are pooled on a cross-section, for example, by individual, household, county, or in this particular case, economic region: this allows the researcher to control for heterogeneity (variance) between cross-sections; negating the need to run separate regressions, which could result in any underlying, common structure, being lost (ibid). Failure to account for heterogeneity within a regression runs the risk of obtaining biased results (Baltagi, 2008).

4.5.2.1.1 Fixed effects specification

In the fixed effects specification (Equation 4.1), the intercept term varies over cross-sections, whereas the slopes remain fixed over cross-sections and time. For example, in the current study, a fixed effects model would result in each region of England and Wales having its own intercept term but a shared regression slope.

$$yit = \alpha + \beta xit + \mu it + \nu it \qquad \text{(Equation 4.1)}$$

Here, the error term is decomposed into an individual-specific effect (μit) and the remaining error (νit) (which varies cross-sectionally and over time). The individual-specific effect therefore captures the variables which affect the dependent variable cross-sectionally but do not vary over time (Brookes, 2008). For example, in the current study, the individual-specific effect would account for regional variation in violence-related injury across England and Wales. For this reason, the same coefficients would be achieved using a simple OLS specification if regional-specific, cross-sectional dummy variables were included.

4.5.2.1.2 Random effects specification

The random effects specification (Equation 4.2) also assumes that each cross-section has its own intercept term; however, in contrast, the random effects specification assumes that these intercepts come from both a common intercept, as well as a random variable that changes cross-sectionally but not over time. The random variable measures the random deviation of each individuals intercept term from the common intercept term (ibid).

$$yit = \alpha + \beta\, \mathrm{x}it + \omega it,\ \omega it = \epsilon i + vit \qquad \text{(Equation 4.2)}$$

Here, heterogeneity is captured via the cross-sectional error term (ϵi) rather than via dummy variables, as in the fixed effects specification. The random effects specification makes the following assumptions regarding the cross-sectional error term; it must have zero mean; be independent of the individual error term (vit), have constant variance, and be independent of all independent variables ($\mathrm{x}it$). If these assumptions are violated then the fixed effects specification is preferred (ibid).

4.5.2.2 *Model construction*

Variables were selected to represent risk factors for violence previously identified in the literature review (see chapter one). Variance Inflation Factors (VIFs) were used to test for evidence of multi-collinearity between independent variables; VIFs were checked systematically and variables with a VIF>10 removed from the model in line with recommended statistical guidelines (Myers, 1990 cited in, Field et al., 2012). In total, 8 variables were included in the model: real alcohol price (on-trade and off-trade), poverty, youth unemployment, income inequality and three seasonal dummy variables (spring, autumn, and winter).

4.5.2.2.1 Real price of alcohol

Regional price indices for both on-trade and off-trade alcohol were constructed from January 2005 to December 2012 using price quotes sourced from the ONS. A more detailed methodology regarding the construction of the price indices was given in chapter three. Briefly, price quotes were categorised by alcohol type and disaggregated by market type (i.e. on-trade or off-trade). Only items that remained constant throughout the time series were included. Monthly price indices for each alcohol type by region were calculated using the laspeyres formula (Silver, 1997). Price indices by alcohol type were weighted using regional household expenditure on alcoholic drinks accessible from DEFRA's family food datasets and aggregated into ten regional indices for alcohol per market type. Regional expenditure on on-trade alcohol was unavailable. For this reason the assumption was made that the proportion of expenditure on alcohol by type in a particular region would be similar for both on-

trade and off-trade markets and therefore the same weights could be applied when aggregating. The real price of alcohol was obtained by deflating both on-trade and off-trade regional price indices by the UK CPI (excluding alcohol) and re-based at January 2005 (=100).

4.5.2.2.2 Poverty

The association between deprivation and violence is well established in criminology, epidemiology and public health literature (Hsieh and Pugh, 1993, Bellis et al., 2011). A regional measure of child poverty was included in the model as a proxy for regional deprivation; child poverty was defined as the percentage of children (those aged 15 or less) living in households where non-one aged 16 years or over is in employment (Office for National Statistics, 2013b). The main strength of this measure is that it is taken from the Labour Force Survey; a national household survey of private addresses in the UK that provides information on the UK labour market (Office for National Statistics, 2015). Due to rigorous sampling techniques, data drawn from the Labour Force Survey are nationally representative of the population of Great Britain and are accessible at regional level (ibid). A limitation of this measure however, are that data on children living in workless households are collected annually between October and December and therefore annual percentages are simply an average over this three month period. Data were therefore of annual frequency and, for this reason, were not seasonally adjusted. Alternative measures of regional deprivation were tested and included the proportion of households below average income and average regional house price (as a measure of regional wealth); however examination of VIFs revealed evidence of multi-collinearity between both these measures of deprivation and the price of alcohol and therefore neither could be included in the final model. In line with the violence-related injury time series, data on children living in workless households were accessed from the ONS for the nine regions of England and for Wales between 2005 and 2012.

4.5.2.2.3 Income inequality

Some criminological studies have suggested that inequality within a population is a greater indicator of crime and violence than deprivation (Hsieh and Pugh, 1993, Kelly, 2000, Wilkinson, 2006, Wilkinson and Picket, 2006). Considering this, a measure of income inequality was included in the model. Most commonly used as a measure of income inequality, the Gini Coefficient measures the level of income distribution within a country (Organisation for Economic Co-operation and Development (OECD), 2015). Accessible from the OECD, Gini Coefficients are calculated at a national level and therefore were not appropriate for use in this study. Instead, the ratio of median gross weekly pay relative to the lowest quintile, calculated using pay as you earn records from HMRC (retrieved from the Annual Survey of Hours and Earnings, which does not include the self-employed or those not paid in the April reference period), were calculated for each of the nine English regions and for Wales between 2005 and 2012 (Office for National Statistics, 2013). Again, data were of annual frequency and were therefore not seasonally adjusted; although it is unlikely that levels of income inequality would alter dramatically from month to month. Data used to calculate a regional measure of income inequality were accessed from the ONS.

4.5.2.2.4 Youth unemployment

An association between unemployment and violent crime (Bandyopadhyay et al., 2011) and violent victimisation (Office for National Statistics, 2014c) has previously been evidenced in England and Wales. For violence-related injury, this association is particularly pertinent in young adults (Matthews et al., 2006, Sivarajasingam et al., 2006). A measure of youth unemployment was therefore included in the model. Official, quarterly, unemployment figures by economic region are available from the ONS website, however not for the time series required. Claimant count data for adults aged between 18 and 29 years of age claiming for up to two years were retrieved from the ONS (Office for National Statistics, 2015a). Although not an official measure of unemployment, claimant count data is often considered a viable alternative and was therefore used as a proxy for youth unemployment. Rates per 1000 population were calculated using mid-season population estimates also sourced

from the ONS. Data retrieved were of monthly frequency from January 2005 to December 2012 for the nine regions of England and Wales.

4.5.2.2.5 Seasonal effects

Previous research has shown seasonal variation in violence-related injury (Sivarajasingam et al., 2009a). This was supported in chapter two. However, in contrast to previous statistical models reported within this thesis, quarterly seasonal dummy variables were preferred over monthly dummies, in order to reduce the number of insignificant variables included within the model. Violence-related injuries in spring (March, April and May), autumn (September, October and November) and winter (December, January and February) were therefore examined relative to summer (June, July and August). [17]

4.5.2.3 *Model validation*

An F test was used to test whether data should be pooled (OLS specification) or whether a fixed effects specification was preferable. The F test compared a model obtained for the full sample with a model based on an equation for each individual in order to test whether the same estimates could be applied to, in this case, each of the regions of England and Wales; the null hypothesis is that they cannot. Data rejected the pooled OLS specification against the regional fixed effects specification in each of the models (see appendix F for pooled regression results).

The dependent variable in each regression was a measure of violence-related injury (with some models disaggregated by gender, age group or both). However, violence-related ED attendance data from the West Midlands in 2009 and the North East in 2011 were not included in the sample due to failure to recruit EDs from either region to the study in those particular years. This resulted in twenty-four missing observations over the time series and meant each regression was based on an unbalanced panel; 936 observations over ten cross-sections (ninety-six observations

[17] A dummy variable that accounted for both international football and rugby tournaments was tested and subsequently discarded due to statistical insignificance.

per cross-section except for West Midlands and North East which had eighty-four observations respectively).

The Hausman (1978) specification test was used in order to test whether a fixed effects specification was appropriate or whether a random effects specification – which is more efficient and thus preferable under the null hypothesis – should be employed: the test is Chi-square with k-1 degrees of freedom (Hausman, 1978). The Hausman test statistic indicated acceptance of the random effect specification in 9 of the 12 models: fixed effects were preferable for those over the age of 51 years, as well as males aged 31-50 years and males over the age of 51 years.

A high R-square value and a significant F-statistic indicate that a model is a good fit. These test statistics were used to determine model suitability and are presented alongside both the Hausman test statistic and standard regression results in Table 4.4-4.7.

4.5.2.4 *Relative contribution of independent variables*

Standardized coefficients refer to how many standard deviations a dependent variable will change, per standard deviation increase in the independent variable. Standardization of the coefficients (so variances equal 1) reveals which of the independent variables has the greater effect on the dependent variable. Standardizing a coefficient removes its unit of measurement, which enables a comparison of the relative impact of variables which are measured using different units of measurement, such as pounds (£) or households. Standardized coefficients were calculated using Equation 4.3.

$$\frac{\text{std(x)}i}{\text{std(y)}}\ \beta\text{xi} \qquad \text{(Equation 4.3)}$$

Where 'std(x)*i*' is the standard deviation of independent variable '*i*', 'std(y)' is the standard deviation of the dependent variable, and 'βxi' is the coefficient of independent variable '*i*'.

4.5.3 Analysis software

The statistical programme 'R' (version 3.0.2) was used for the collection, cleaning and construction of the violence-related injury rates, as well as both model fitting and testing (R Core Team, 2013). The default setting in R is to exclude missing observations from regression analysis. The twenty-four missing observations were therefore removed under this default.

4.5.4 Ethical considerations

Ethical approval was not required as all violence-related ED attendances were anonymised prior to collection. Violence-related ED attendance data were collected under the Freedom of Information Act (2000), whilst alcohol price, youth unemployment, poverty and income inequality data were accessed from sources within the public domain (HM Government, 1998b).

4.6 Results

4.6.1 Descriptive statistics

4.6.1.1 *Violence-related injury rates*

Overall, monthly injury rates for males (0.74 per 1000 population) were approximately three times greater than for females (0.26 per 1000 population). Higher injury rates were identified among 18-30 year olds compared to 31-50 year olds and those aged 51 years and over. Regional comparisons identified variation between northern and southern regions; with higher rates of violence-related injury identified in the North West, North East and in Wales and lower rates in the Eastern and East Midlands regions respectively (Table 4.2 and Figure 4.1). Once weighted, an estimated 2,137,326 adults attended EDs across England and Wales for treatment following violence-related injury between January 2005 and December 2012. This equated to an average of 319,528 attendances per annum.[18]

[18] A more detailed analysis of violence-related injury rates is presented in chapter two.

Figure 4.1 Average monthly violence-related injury rates by gender and age group, 2005(1)-2012(12)

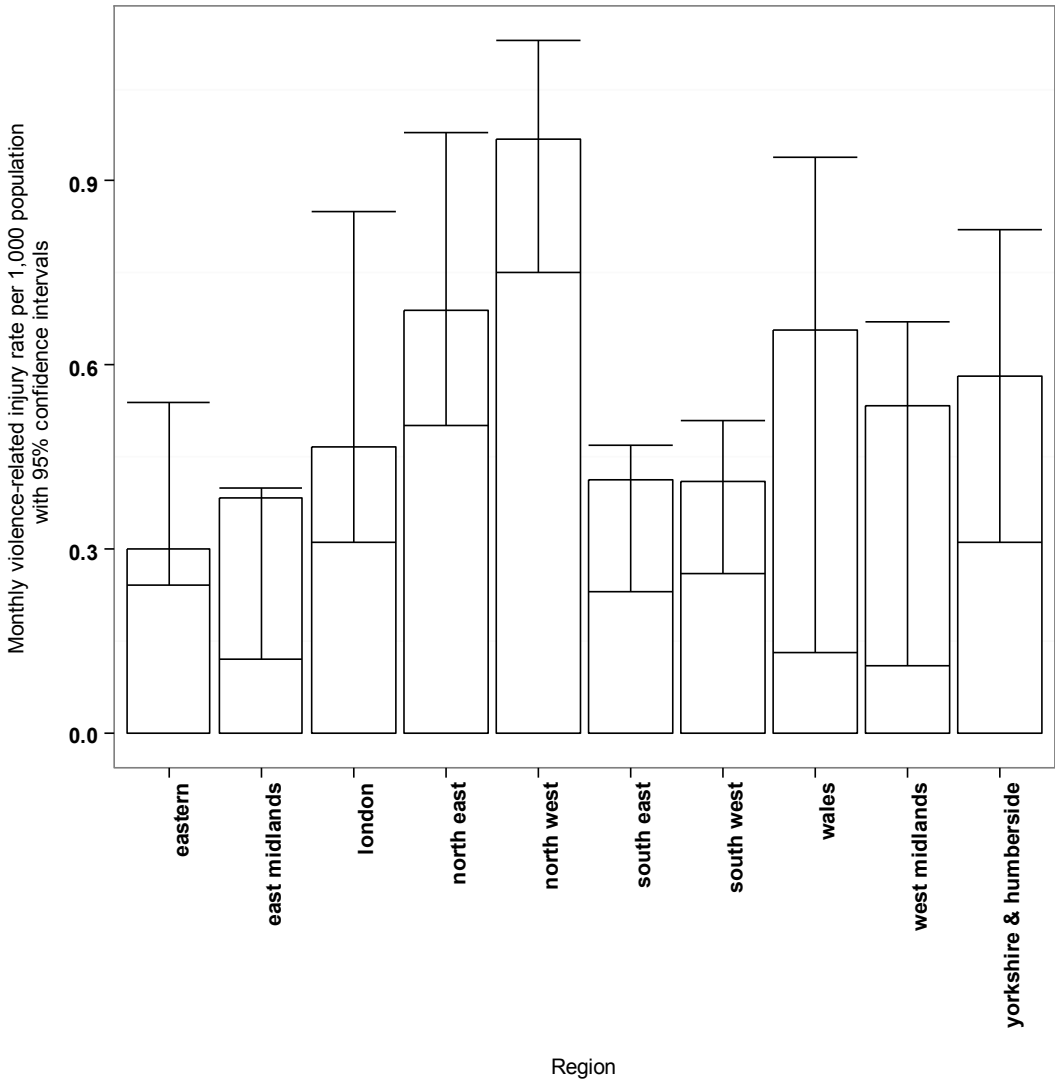


Table 4.2 Means and standard deviations (in parenthesis); monthly violence-related injury rates (per 1000 population) by gender, age group and region, 2005(1)-2012(12)

Region	18 years +	18-30 years	31-50 years	51 years +
	Total			
Eastern	0.30 (0.09)	0.88 (0.28)	0.28 (0.09)	0.05 (0.02)
East Midlands	0.38 (0.10)	1.02 (0.28)	0.38 (0.10)	0.07 (0.03)
London	0.47 (0.09)	0.97 (0.21)	0.40 (0.08)	0.12 (0.04)
North East	0.69 (0.10)	1.82 (0.30)	0.70 (0.12)	0.12 (0.03)
North West	0.97 (0.21)	2.50 (0.60)	1.00 (0.22)	0.16 (0.03)
South East	0.41 (0.12)	1.18 (0.38)	0.39 (0.12)	0.07 (0.03)
South West	0.41 (0.11)	1.26 (0.36)	0.40 (0.11)	0.06 (0.02)
Wales	0.66 (0.12)	1.91 (0.36)	0.65 (0.13)	0.10 (0.03)
West Midlands	0.53 (0.22)	1.40 (0.62)	0.53 (0.22)	0.10 (0.05)
Yorkshire & Humberside	0.58 (0.09)	1.49 (0.27)	0.58 (0.10)	0.09 (0.02)
	Males			
Eastern	0.47 (0.14)	1.37 (0.44)	0.40 (0.14)	0.07 (0.03)
East Midlands	0.57 (0.16)	1.52 (0.44)	0.53 (0.16)	0.10 (0.04)
London	0.68 (0.13)	1.45 (0.33)	0.53 (0.12)	0.17 (0.07)
North East	1.04 (0.15)	2.71 (0.46)	1.00 (0.18)	0.17 (0.05)
North West	1.47 (0.34)	3.74 (0.94)	1.44 (0.33)	0.24 (0.05)
South East	0.64 (0.21)	1.82 (0.62)	0.56 (0.20)	0.10 (0.05)
South West	0.63 (0.17)	1.88 (0.55)	0.57 (0.16)	0.09 (0.03)
Wales	1.00 (0.20)	2.84 (0.60)	0.94 (0.22)	0.14 (0.05)
West Midlands	0.81 (0.36)	2.10 (0.97)	0.77 (0.35)	0.15 (0.09)
Yorkshire & Humberside	0.87 (0.14)	2.40 (0.44)	0.81 (0.15)	0.13 (0.03)
	Females			
Eastern	0.14 (0.05)	0.37 (0.14)	0.16 (0.06)	0.03 (0.02)
East Midlands	0.21 (0.05)	0.52 (0.16)	0.23 (0.07)	0.04 (0.02)
London	0.26 (0.06)	0.49 (0.15)	0.26 (0.08)	0.07 (0.03)
North East	0.36 (0.07)	0.90 (0.22)	0.41 (0.10)	0.07 (0.03)
North West	0.50 (0.11)	1.23 (0.30)	0.57 (0.14)	0.09 (0.03)
South East	0.20 (0.06)	0.51 (0.17)	0.22 (0.07)	0.05 (0.03)
South West	0.20 (0.06)	0.60 (0.20)	0.23 (0.08)	0.04 (0.02)
Wales	0.34 (0.06)	0.96 (0.21)	0.38 (0.08)	0.06 (0.02)
West Midlands	0.27 (0.10)	0.27 (0.10)	0.30 (0.13)	0.05 (0.03)
Yorkshire & Humberside	0.31 (0.05)	0.76 (0.15)	0.35 (0.08)	0.05 (0.02)

4.6.1.2 *Real price of alcohol*

For a more detailed analysis of regional variation in real alcohol price see chapter three. Briefly, at basic prices on-trade alcohol was most expensive in London (mean = £3.42, SD = 1.56) and least expensive in the North East (mean = £3.05, SD = 1.40) and in Wales (mean = £3.05, SD = 1.31) respectively. Comparatively, off-trade alcohol was found to be most expensive in the South East (mean = £6.00, SD = 3.91) and least expensive in Wales (mean = £5.51, SD = 3.21). Direct comparisons between on-trade and off-trade alcohols at basic prices should not be made however; quantity of alcohol was not accounted for by comparing unit price. Measuring regional variation in real price change between January 2005 and December 2012 enabled on-trade and off-trade comparisons.

On average, the price of on-trade alcohol increased in each region over the study period; prices increased most in Yorkshire and Humberside (mean = 106.0, SD = 3.23) and least in West Midlands (mean = 100.9, SD = 2.45) regions respectively. Comparatively, average price of off-trade alcohol decreased in nine regions; decreasing most in the Eastern (mean = 95.4, SD = 3.22) region, while the only price increase was experienced in the East Midlands (mean = 101.7, SD = 5.88). However, closer examination of off-trade alcohol prices highlighted that, in actual fact, off-trade alcohol price increased between 2008 and 2012 (see chapter three, paragraph 3.6, Figure 3.4 and Figure 3.5).

4.6.1.3

4.6.1.4 *Socioeconomic variables*

Cross-regional comparisons of means and standard deviations of socioeconomic measures are presented in Table 4.3. Briefly, income inequality was found to be highest in the South East (mean = 1.54, SD = 0.01) and lowest in the North East (mean = 1.44, SD = 0.01) region respectively. Poverty was shown to be greatest in London (mean = 21.4%, SD = 2.86) and least evident in the Eastern (mean = 11.4%, SD = 0.56) region. Rates of youth (18-29 year olds) unemployment were shown to be highest in the North West (mean = 7.48, SD = 1.97) and lowest in the Eastern (mean = 4.28, SD = 1.17) region. Measures of income inequality, poverty and youth

unemployment tended to be higher in northern regions relative to southern (Table 4.3).

Table 4.3 Variable means and standard deviations (in parenthesis); alcohol price, income inequality, poverty and youth unemployment rates by region, 2005(1)-2012(12)

Region	Alcohol price index (on-trade)	Alcohol price index (off-trade)	Income inequality (ratio)	Poverty (%)	Youth unemployment rate (per month per 1000 population)
Eastern	103.7 (4.28)	95.4 (3.22)	1.53 (0.01)	11.4 (0.56)	4.28 (1.17)
East Midlands	104.4 (3.77)	101.7 (5.88)	1.48 (0.01)	13.1 (1.21)	5.16 (1.45)
London	101.4 (2.24)	97.6 (4.79)	1.52 (0.01)	21.4 (2.86)	4.61 (0.77)
North East	102.8 (1.88)	99.5 (3.94)	1.44 (0.01)	18.3 (1.26)	7.48 (1.97)
North West	101.0 (1.47)	99.2 (3.78)	1.49 (0.01)	18.3 (0.97)	6.16 (1.42)
South East	103.3 (2.31)	98.4 (4.04)	1.54 (0.01)	10.3 (0.52)	3.45 (1.03)
South West	102.4 (3.97)	99.9 (4.99)	1.47 (0.01)	10.8 (0.52)	3.66 (1.18)
Wales	102.5 (3.40)	96.9 (5.63)	1.46 (0.02)	18.2 (2.34)	6.10 (1.50)
West Midlands	100.9 (2.45)	98.6 (3.72)	1.48 (0.01)	17.2 (1.98)	6.74 (1.45)
Yorkshire & Humberside	106.0 (3.23)	98.4 (4.59)	1.48 (0.01)	16.2 (1.40)	6.05 (1.88)

4.6.2 Regression analysis

Estimates from the regression models are reported in Tables 4.4 to 4.7. For the purposes of this analysis, estimates found to be significant at the 10% level were reported as statistically significant.

4.6.2.1 *Alcohol price*

Panel estimates showed that the real price of on-trade alcohol was negatively related to rates of violence-related injury for the adult population (18 years and over) of England and Wales ($\beta = -0.661$, $z = -3.19$, $p<0.001$). This finding was true for both genders, as well as for 18-30 ($\beta = -2.149$, $z = -3.56$, $p=0.001$) and 31-50 year olds ($\beta = -0.707$, $z = -3.27$, $p=0.001$), but not for those over the age of 51 years. This association was greatest for 18-30 year old males. The real price of off-trade alcohol was also found to be negatively related to rates of violence-related injury in England and Wales for adults ($\beta = -0.277$, $z = -2.40$, $p=0.017$) and 18-30 year olds ($\beta = -1.048$, $z = -3.11$, $p=0.002$). Gender differences were however identified; the real price of off-trade alcohol was negatively associated to rates of male, but not female violence-related injury; although a significant positive association was identified between off-trade alcohol and females over the age of 51 years ($\beta = 0.052$, $z = -2.10$, $p=0.036$).

4.6.2.2 *Poverty*

The measure of regional poverty used in this study was positively related to regional variations in violence-related injury ($\beta = 0.013$, $z = 4.75$, $p<0.001$). This finding was consistent for all gender and age group combinations.

4.6.2.3 *Income inequality*

Regional disparity in income was also found to influence rates of violence-related injury among the adult population of England and Wales ($\beta = 1.480$, $z = 4.14$, $p<0.001$). This finding was consistent for all age groups studied. Gender differences were identified however; inequality in income not was found to be a significant risk

factor for violence-related injury for 31-50 year old females or females over the age of 51 years.

4.6.2.4 *Youth unemployment*

Rates of adult violence-related injury were also negatively associated with a measure of youth unemployment ($\beta = -0.011$, $z = -2.45$, $p=0.015$). This finding was consistent for both adult males and females; however, differences were identified after disaggregation by age group and gender. Youth unemployment was not associated to violence-related injury for 18-30 year old males, 31-50 year old females, or females over the age of 51 years.

4.6.2.5 *Seasonal effects*

Seasonal effects were evident. Overall, rates of violence-related injury were greater in the summer months of June, July and August relative to other seasons. However variations were identified across multiple gender and age group combinations. For 18-30 year old females and males over the age of 51 years, violence-related injury was equally as prevalent in spring (March, April and May) compared with summer.

4.6.2.6 *Standardized coefficients*

Standardized 'beta' coefficients are reported alongside standard regression results in Tables 4.4 to 4.7. Estimates indicate that, for the adult population of England and Wales, measures of poverty (beta = 0.224, $z = 4.753$, $p<0.001$) and income inequality (beta = 0.205, $z = 4.143$, $p<0.001$) were much more impactful on rates of violence-related injury than youth unemployment (beta = -0.092, $z = -2.446$, $p=0.015$) or the price of either on-trade (beta = -0.093, $z = -3.193$, $p<0.001$) or off-trade (beta = -0.058, $z = -2.397$, $p=0.017$) alcohol. The large impact of poverty on violence-related injury was true across all age and gender combinations. Although alcohol price was not as influential as measures of poverty and income inequality, the relative importance of alcohol price was found to vary according to gender and age group. For example, the price of on-trade alcohol was found to be more influential for 18-30 year old males compared with other subgroups. Standardized coefficients also

indicated the importance of seasonal effects compared to other independent variables; winter (December, January and February) was shown to influence violence-related injury among the adult population (beta = -0.127, z = -5.598, $p<0.001$) over and above the effects of youth unemployment.

Table 4.4 Regression results, dependent variable = adult violence-related injury rate; sample = 2005(1)-2012(12)

	Coefficient	Std. Error	z-value	Beta	p-value	
Total	*Random effects*					
Intercept	2.563	1.170	2.191	NA	0.029	*
Log(on-trade)	-0.661	0.207	-3.193	-0.093	0.001	**
Log(off-trade)	-0.277	0.115	-2.397	-0.058	0.017	**
Income inequality	1.480	0.357	4.143	0.205	<0.001	***
Poverty	0.013	0.003	4.753	0.224	<0.001	***
Youth unemployment	-0.011	0.005	-2.446	-0.092	0.015	*
Spring	-0.029	0.011	-2.643	-0.056	0.008	**
Autumn	-0.050	0.011	-4.477	-0.094	<0.001	***
Winter	-0.067	0.011	-5.958	-0.127	<0.001	***
Adjusted R-squared	0.1918					
F-statistic	F(8,927)=27.8233				<0.001	***
Hausman	8.4832				0.388	
Male	*Random effects*					
Intercept	4.437	1.874	2.368	NA	0.018	*
Log(on-trade)	-1.089	0.331	-3.285	-0.099	0.001	**
Log(off-trade)	-0.567	0.185	-3.066	-0.077	0.002	**
Income inequality	2.578	0.572	4.508	0.230	<0.001	***
Poverty	0.022	0.004	5.079	0.248	<0.001	***
Youth unemployment	-0.019	0.007	-2.618	-0.102	0.009	**
Spring	-0.041	0.018	-2.301	-0.050	0.022	*
Autumn	-0.069	0.018	-3.865	-0.084	<0.001	***
Winter	-0.096	0.018	-5.333	-0.118	<0.001	***
Adjusted R-squared	0.208					
F-statistic	F(8,927)=30.8141				<0.001	***
Hausman	7.8709				0.446	
Female	*Random effects*					
Intercept	0.884	0.638	1.387	NA	0.166	
log(on-trade)	-0.278	0.113	-2.466	-0.075	0.014	*
log(off-trade)	0.002	0.063	0.037	0.001	0.971	

Income inequality	0.439	0.194	2.259	0.116	0.024	*
Poverty	0.004	0.001	2.895	0.142	0.004	**
Youth unemployment	-0.005	0.002	-1.887	-0.074	0.059	Ψ
spring	-0.018	0.006	-3.033	-0.066	0.002	**
autumn	-0.031	0.006	-5.198	-0.114	<0.001	***
winter	-0.039	0.006	-6.415	-0.142	<0.001	***
Adjusted R-squared	0.1052					
F-statistic	F(8,927)=13.7702				<0.001	***
Hausman	10.3416				0.242	

***significant at 0.1% level; **significant at 1% level; *significant at 5% level;

Ψsignificant at 10% level

Table 4.5 Regression results, dependent variable = violence-related injury rate, 18-30 year olds; sample = 2005(1)-2012(12)

	Coefficient	Std. Error	z-value	Beta	p-value	
18-30 years	*Random effects*					
Intercept	8.769	3.410	2.572	NA	0.010	*
Log(on-trade)	-2.149	0.603	-3.563	-0.112	<0.001	***
Log(off-trade)	-1.048	0.337	-3.113	-0.081	0.002	**
Income inequality	4.768	1.041	4.580	0.244	<0.001	***
Poverty	0.035	0.008	4.480	0.228	<0.001	***
Youth unemployment	-0.025	0.013	-1.880	-0.076	0.060	Ψ
Spring	-0.054	0.032	-1.672	-0.038	0.095	Ψ
Autumn	-0.093	0.032	-2.884	-0.065	0.004	**
Winter	-0.158	0.033	-4.833	-0.111	<0.001	***
Adjusted R-squared	0.1918					
F-statistic	F(8,927)=27.8233				<0.001	***
Hausman	12.4241				0.133	
Male	*Random effects*					
Intercept	16.342	5.355	3.052	NA	0.002	**
Log(on-trade)	-3.645	0.948	-3.847	-0.125	<0.001	***
Log(off-trade)	-1.936	0.529	-3.658	-0.099	<0.001	***
Income inequality	7.378	1.634	4.515	0.249	<0.001	***
Poverty	0.057	0.012	4.614	0.243	<0.001	***
Youth unemployment	-0.032	0.021	-1.550	-0.065	0.121	
Spring	-0.080	0.051	-1.582	-0.037	0.114	
Autumn	-0.124	0.051	-2.445	-0.057	0.015	**
Winter	-0.229	0.051	-4.440	-0.106	<0.001	***
Adjusted R-squared	0.1991					
F-statistic	F(8,927)=29.148				<0.001	***
Hausman	6.4368				0.598	
Female	*Random effects*					
Intercept	1.601	1.928	0.830	NA	0.407	
log(on-trade)	-0.736	0.342	-2.155	-0.073	0.031	*
log(off-trade)	-0.056	0.191	-0.294	-0.008	0.769	

Income inequality	1.809	0.588	3.079	0.176	0.002	**
Poverty	0.012	0.004	2.823	0.154	0.005	**
Youth unemployment	-0.014	0.007	-1.862	-0.081	0.063	Ψ
spring	-0.027	0.018	-1.483	-0.036	0.139	
autumn	-0.062	0.018	-3.370	-0.082	0.001	**
winter	-0.086	0.019	-4.623	-0.114	<0.001	***
Adjusted R-squared	0.0907					
F-statistic	F(8,927)=11.6881				<0.001	***
Hausman	9.1686				0.328	

***significant at 0.1% level; **significant at 1% level; *significant at 5% level;

Ψsignificant at 10% level

Table 4.6 Regression results, dependent variable = violence-related injury rate, 31-50 year olds; sample = 2005(1)-2012(12)

	Coefficient	Std. Error	z-value	Beta	p-value	
31-50 years	*Random effects*					
Intercept	2.425	1.223	1.983		0.048	*
Log(on-trade)	-0.707	0.216	-3.273	-0.093	0.001	**
Log(off-trade)	-0.098	0.121	-0.813	-0.019	0.417	
Income inequality	1.203	0.374	3.219	0.156	0.001	**
Poverty	0.010	0.003	3.660	0.169	<0.001	***
Youth unemployment	-0.013	0.005	-2.833	-0.104	0.005	**
Spring	-0.044	0.012	-3.816	-0.078	<0.001	***
Autumn	-0.068	0.012	-5.845	-0.120	<0.001	***
Winter	-0.076	0.012	-6.515	-0.135	<0.001	***
Adjusted R-squared	0.1660					
F-statistic	F(8,927)=23.3403				<0.001	***
Hausman	13.9781				0.082	
Male	*Fixed effects*		(t-value)			
Intercept	NA	NA	NA	NA	NA	
Log(on-trade)	-0.900	0.337	-2.667	-0.080	0.008	**
Log(off-trade)	-0.234	0.188	-1.244	-0.031	0.214	
Income inequality	2.411	0.589	4.092	0.210	<0.001	***
Poverty	0.016	0.004	3.631	0.177	<0.001	***
Youth unemployment	-0.023	0.007	-3.181	-0.123	0.002	**
Spring	-0.058	0.018	-3.198	-0.069	0.001	**
Autumn	-0.093	0.018	-5.160	-0.111	<0.001	***
Winter	-0.102	0.018	-5.604	-0.122	<0.001	***
Adjusted R-squared	0.1683					
F-statistic	F(8,918)=23.7729				<0.001	***
Hausman	31.3402				<0.001	***
Female	*Random effects*					
Intercept	1.985	0.855	2.323	NA	0.020	*
log(on-trade)	-0.449	0.151	-2.962	-0.098	0.003	**
log(off-trade)	0.015	0.085	0.172	0.005	0.863	

Income inequality	0.225	0.260	0.865	0.048	0.387	
Poverty	0.004	0.002	1.939	0.104	0.053	Ψ
Youth unemployment	-0.005	0.003	-1.461	-0.063	0.144	
spring	-0.031	0.008	-3.783	-0.091	<0.001	***
autumn	-0.043	0.008	-5.261	-0.126	<0.001	***
winter	-0.051	0.008	-6.187	-0.150	<0.001	***
Adjusted R-squared	0.0879					
F-statistic	F(8,927)=11.2881				<0.001	***
Hausman	5.9077				0.658	

***significant at 0.1% level; **significant at 1% level; *significant at 5% level;

Ψsignificant at 10% level

Table 4.7 Regression results, dependent variable = violence-related injury rate, 51 years and over; sample = 2005(1)-2012(12)

	Coefficient	Std. Error	z-value	Beta	p-value	
51 years +	*Fixed effects*		(t-value)			
Intercept	NA	NA	NA	NA	NA	
Log(on-trade)	-0.026	0.052	-0.510	-0.020	0.610	
Log(off-trade)	0.023	0.029	0.785	0.025	0.433	
Income inequality	0.152	0.090	1.690	0.111	0.091	Ψ
Poverty	0.003	0.001	4.043	0.252	<0.001	***
Youth unemployment	-0.002	0.001	-2.220	-0.110	0.037	*
Spring	-0.006	0.003	-2.070	-0.057	0.039	*
Autumn	-0.011	0.003	-3.961	-0.109	<0.001	***
Winter	-0.013	0.003	-4.515	-0.126	<0.001	***
Adjusted R-squared	0.0606					
F-statistic	F(8,918)=7.5599				<0.001	***
Hausman	18.6594				0.017	*
Male	*Fixed effects*		(t-value)			
Intercept	NA	NA	NA	NA	NA	
Log(on-trade)	-0.049	0.088	-0.559	-0.023	0.577	
Log(off-trade)	-0.003	0.049	-0.074	-0.002	0.941	
Income inequality	0.328	0.153	2.137	0.148	0.033	*
Poverty	0.004	0.001	3.791	0.250	<0.001	***
Youth unemployment	-0.004	0.002	-2.278	-0.119	0.023	*
Spring	-0.007	0.005	-1.415	-0.041	0.157	
Autumn	-0.015	0.005	-3.135	-0.091	0.002	**
Winter	-0.018	0.005	-3.801	-0.112	<0.001	***
Adjusted R-squared	0.0610					
F-statistic	F(8,918)=7.6138				<0.001	***
Hausman	16.2671				0.039	*
Female	*Random effects*					
Intercept	-0.002	0.237	-0.009	NA	0.993	
log(on-trade)	-0.032	0.044	-0.730	-0.033	0.466	
log(off-trade)	0.052	0.025	2.097	0.080	0.036	*

Income inequality	-0.037	0.068	-0.542	-0.037	0.588	
Poverty	0.002	0.001	3.723	0.254	<0.001	***
Youth unemployment	-0.001	0.001	-1.152	-0.068	0.250	
spring	-0.005	0.002	-2.076	-0.070	0.038	*
autumn	-0.008	0.002	-3.140	-0.105	0.002	**
winter	-0.008	0.002	-3.192	-0.108	0.001	**
Adjusted R-squared	0.0343					
F-statistic	F(8,927)=4.1628				<0.001	***
Hausman	9.9969				0.265	

***significant at 0.1% level; **significant at 1% level; *significant at 5% level;

$^{\Psi}$significant at 10% level

4.6.3 Price elasticity

In economics, price elasticity refers to the percentage change in consumption after a 1% increase in price (Parkin et al., 2012). Based on the alcohol price coefficients, price elasticities were calculated using a linear-log equation (Equation 4.4). A linear-log equation was required due to the use of logged price indices within the linear regression models.

$$price\ elasticity = \frac{\beta xi}{\bar{y}} \qquad \text{(Equation 4.4)}$$

Where 'βxi' is the regression coefficient for either on-trade or off-trade alcohol price and '$\bar{y}$' is the dependent variable mean (i.e. mean violence-related injury rate per 1000 population). Estimated price elasticities for on-trade and off-trade alcohol are shown in Table 4.8. In this instance, the estimated price elasticities do not indicate a change in consumption, as estimation does not refer to the effect of a 1% price increase on a saleable good per se. Instead, it is presumed (based on empirical evidence) that alcohol price directly influences alcohol consumption and therefore estimation refers to the influence of alcohol price (as a proxy for consumption) on rates of violence-related injury.

The quantifiable impact of alcohol price on rates of violence-related injury is shown in Table 4.9. Here, changes in violence-related injury, measured by monthly violence-related ED attendances by gender and age group, are shown based on a ten percent increase in the real price of alcohol in England and Wales (based only on significant alcohol price coefficients). The equation used to estimate the reductions in ED attendances is shown below (Equation 4.5).

$$price\ change = \sum\big((\beta x1\ 0.10) + (\beta x2\ 0.10)\big)\left(\frac{N}{1000}\right) \qquad \text{(Equation 4.5)}$$

Where 'βx1' and 'βx2' are the regression coefficients for on- and off-trade alcohol price, '0.10' stipulates the 10% price increase, and 'N' is the sample population (for example, males aged 18-30 years). According to the model-based estimates, violence-related ED attendances in England and Wales would reduce by an estimated

5032 patients per month after a 10% increase in the real price of both on-trade and off-trade alcohol (an 18.9% decrease). When disaggregated by gender, estimates indicated a reduction of 4380 male (22.4% decrease) and 758 female (10.9% decrease) patients per month. Further disaggregation by age group revealed that 18-30 year olds would experience the largest reduction in violence-related ED attendances after an increase in real alcohol price. Model-based estimates suggest a reduction of 2971 ED attendances per month. Reductions were also estimated for 31-50 year olds but not for those over the age of 51 years. Estimated reductions were greater for males than females across all gender and age group combinations. Interestingly, the only age group to exhibit a significant positive association between violence-related injury and the real price of alcohol were females over the age of 51 years. Here a 10% increase in the real price of off-trade alcohol was estimated to increase violence-related ED attendances by 49 patients per month; an estimated increase of 9.7%.

Table 4.8 Model-based price elasticities for alcohol by gender, age group and market type

	18 years +			18-30 years		
	Total	Male	Female	Total	Male	Female
On-trade alcohol price elasticities	-1.322**	-1.472**	-1.069*	-4.298***	-4.923***	-2.831*
Off-trade alcohol price elasticities	-0.554**	-0.766**	0.008	-2.096**	-2.616***	-0.215

	31-50 years			51 years +		
	Total	Male	Female	Total	Male	Female
On-trade alcohol price elasticities	-1.414**	-1.216**	-1.727**	-0.052	-0.066	-0.123
Off-trade alcohol price elasticities	-0.196	-0.316	0.058	0.046	-0.004	0.200*

***significant at 0.1% level; **significant at 1% level; *significant at 5% level;

Table 4.9 Model-based estimates of violence-related ED attendances after a 10% increase in real alcohol price

	18 years +			18-30 years		
	Total	Male	Female	Total	Male	Female
Average monthly rate per 1000 population	0.50	0.74	0.26	1.39	2.08	0.67
Monthly change in assaults after 10% increase[b]	-5032	-4380	-758	-2971	-2631	-337
New average monthly rate per 1000 population	0.40	0.57	0.23	1.07	1.52	0.60
% change	-18.9%	-22.4%	-10.7%	-23.1%	-26.8%	-11.0%

	31-50 years			51 years +		
	Total	Male	Female	Total	Male	Female
Average monthly rate per 1000 population	0.51	0.73	0.30	NS	NS	0.05
Monthly change in assaults after 10% increase[b]	-1073	-679	-342	NS	NS	+49
New average monthly rate per 1000 population	0.44	0.64	0.26	NS	NS	0.06
% change	-13.8%	-12.4%	-14.9%	NS	NS	+9.7%

[b]based on significant coefficients only; NS = non-significant alcohol price coefficients

4.7 Discussion

According to this national study, the real price of both on-trade and off-trade alcohol was negatively related with rates of violence-related injury among the adult population of England and Wales after controlling for the influence of poverty, income inequality, youth unemployment and seasonal effects. Gender and age group differences were identified; the real price of off-trade alcohol was negatively related to rates of male but not female violence-related injury, whilst a significant positive association was found between off-trade alcohol price and violence-related injury among females over the age of 51 years.

In recent years, the UK has experienced a decline in overall levels of alcohol consumption; from 10.8 litres per capita in 2008 to 7.7 litres per capita in 2013 (Sheen, 2013). Reasons for this decline are unknown; although during this time alcohol has become less affordable owing to an increase in the real price of alcohol and a reduction in real disposable income (Health and Social Care Information Centre, 2014). Since alcohol has become less affordable both alcohol-related deaths in the UK (ibid) and rates of violence-related injury (see chapter two) in England and Wales have fallen. Previous studies have identified a robust inverse relationship between alcohol price and consumption (see chapter three; paragraph 3.3). Evidencing a causal association between alcohol consumption and violence is however more difficult. Indeed, while a number of studies have attempted to explain this association, no consensus has yet been reached with regards to causality (see chapter one; paragraph 1.4.3.2). The current study has cut through the causative argument by reporting a link between the price of alcohol and violence-related injury in England and Wales.

4.7.1 On-trade alcohol price

The price of on-trade was shown to exert a greater influence over rates of violence-related injury for both males and females alike. Considering that crime survey figures indicate that half of all violent offences take place within or close to a pub or club and that a person's likelihood of violent victimisation is greater the more nights actively spent within the night-time economy (Office for National Statistics, 2014c),

this is perhaps not an unsurprising finding. Previous research has identified a relationship between the psychopharmacological effects of alcohol and the environment in which it is consumed (Hughes et al., 2011). Environmental characteristics most frequently associated with aggression are predominantly found within the on-trade drinking environment; for example, overcrowded venues (Graham and Homel, 1997) and inaccessible bar and toilet facilities (Tomsen, 1997). It is therefore possible that certain situational aspects of the on-trade drinking environment, which are not present in the off-trade, may increase the likelihood of offender-victim interaction during periods of intoxication.

The negative association between on-trade alcohol price and violence-related injury was most pronounced among 18-30 year olds. Again, this is perhaps not unexpected. Research has shown evidence of an association between binge drinking and violent crime (Richardson and Budd, 2003) and as referred to in chapter two (paragraph 2.6), figures show 18-24 year olds in England and Wales consume, on average, more alcohol per session than any other age group (Mintel Oxygen, 2009). Furthermore, research aimed at understanding alcohol use among young adults (18-25 years) concluded that *"the price of alcohol made both a quantitative and qualitative difference to the way young adults drank. It influenced both the amount consumed and the style in which it was consumed"* (Seaman and Ikegwuonu, 2010: p.6). Findings also revealed that this association was greatest for 18-30 year old males. Although the exact reasons for this are unknown, figures indicate that young adult males (16-24 years) drink alcohol more frequently (Opinions and Lifestyle Survey, 2013) and consume more units per drinking session than young adult females (Health and Social Care Information Centre, 2014). Discussed previously, experimental studies have also shown intoxicated young males are increasingly sensitive to provocation and other aggression enhancing cues (Giancola, 2002, Giancola et al., 2011), whilst the presence of a social audience and the presence of alcohol have been suggested to be the two most influential facilitators for male violence (Polk, 1999).

The study found no association between the price of on-trade alcohol and violence-related injury among those over the age of 51 years. Some support for this finding can be found from a recent modelling study, which suggested the introduction of

alcohol MUP in England would have no effect of the number of assaults (ICD codes X85-Y09) experienced by the over sixty-fives (Purshouse et al., 2010). Reasons for this finding could relate to the fact that the majority of licensed premises in the UK are aimed towards 18-24 year olds (Mintel, 2004 cited in, Roberts, 2006). Pursuing a state of intoxication has become a well-recognised motivation for alcohol consumption among young adults (Seaman and Ikegwuonu, 2010). Therefore, while city centres are filled with intoxicated young adults moving between licensed premises, older adults have been suggested to actively avoid these areas (Bromley et al., 2000). Indeed, a report examining lifestyles and social participation in England found that those aged 45 years and over were much less likely to have attended a pub or nightclub in the last year compared to either 16-24 year olds or 25-34 year olds (Seddon, 2011). Furthermore, while ONS figures reveal those aged 45 years and over drink alcohol more frequently than their younger counterparts, the same figures also suggest they consume less units per drinking session; suggesting a more relaxed drinking style (Opinions and Lifestyle Survey, 2013).

4.7.2 Off-trade alcohol price

The current study also found that the price of off-trade alcohol was associated with rates of violence-related injury but only among adult and 18-30 year old males. In recent years the UK has experienced a shift in purchase trend with regards to alcohol, with the majority of alcohol now purchased from the off-trade market (Health and Social Care Information Centre, 2014). Studies have suggested that reasons for this shift most likely involve issues of cost and convenience (Foster et al., 2010). Pre-drinking (i.e. drinking prior to entering the night-time economy, for example, at home or at a friend's house) is a regular aspect of most young people's drinking habits (Ostergaad and Andrade, 2014) and has been linked with the availability of cheap off-trade alcohol (Forsyth, 2010) and an increased risk of alcohol-related violence (Hughes et al., 2007). Reasons why this association was found solely among adult and young adult males is unclear; research in the UK has shown however that, on average, male pre-drinkers (aged 18-35 years) consume more units of alcohol than female pre-drinkers (Ostergaad and Andrade, 2014), while men who drink prior to and during a typical night out report significantly higher levels of alcohol consumption than females who do the same (Hughes et al., 2007). Price of off-trade

alcohol may therefore effect overall levels of intoxication among males entering the night-time economy to a greater extent than females; simultaneously increasing the amount of time males spend intoxicated within the drinking environment and in doing so, potentially increasing their sensitivity towards and likelihood of experiencing aggression enhancing cues (Giancola, 2002, Giancola et al., 2011).

Interestingly, the results from this study also uncovered an unexpected finding: rates of violence-related injury among females over 51 years of age were positively associated with the real price of off-trade alcohol. Put simply, as the real price of alcohol in the off-trade market increases, more females over the age of 51 are attending EDs for treatment of a violence-related injury. This was clearly an unexpected finding. Recent figures have shown that women of this age group are more frequently consuming alcohol than their younger counterparts. Indeed, figures from the Opinions and Lifestyle Survey (2013) have shown that 11% of females aged 45-64 years and 14% of females over the age of 65 years consumed alcohol on five or more days in the week prior to the survey (Opinions and Lifestyle Survey, 2013). When compared with females aged 16-24 years (2%) and 25-44 years (5%), these figures are quite astonishing.

One reason for this finding could be the increased consumption among women with managerial and professional employment. Indeed, figures highlight that women with managerial positions consume more alcohol more frequently than women in immediate or manual employment; with 64% having drunk alcohol in the last week and 12% consuming on five or more days in the last week (Opinions and Lifestyle Survey, 2013). It could therefore be that affluent middle-aged females are increasingly price inelastic and are therefore unaffected by changes in alcohol price as they can simply afford to absorb it. As to why this finding was discovered solely for the price of off-trade alcohol, figures highlight that wine is the most popular alcoholic drink among females (ibid); females are more likely to purchase wine from the off-trade market (Ritchie, 2009); and wine accounts for approximately half of the total expenditure on off-trade alcohol in England and Wales (Department for Environment, 2013). However, although this cohort may be increasingly price

inelastic, it is unclear why an increase in alcohol price would increase their risk of violence-related injury.[19]

4.7.3 Socioeconomic risk factors

Alcohol and violence cannot be considered in isolation. As discussed in chapter one, there exists a robust literature evidencing an association between poverty, inequality and incidents of violence (see Hsieh and Pugh, 1993). In England, for example, one study found 70.2% of intentional injuries were assault-related and over half (58.8%) of intentional injury patients lived in the most deprived areas (Quigg et al., 2011). In the current study, a measure of poverty was positively associated with rates of violence-related injury. This finding was consistent across all gender and age group combinations and as a result, supported the empirical literature. Similarly, inequality in income was also positively associated with rates of violence-related injury; although 31-50 year old females and females over the age of 51 years were unaffected, which may indicate that the effects of financial inequality are felt more severely by males and young adult females.

Sociological theories have examined associations between deprivation, inequality and crime (including violence crime); often emphasising the impact of community structures on social control and social relations. For example, material inequalities in wealth (relative deprivation) and thwarted ambition (anomie) have been suggested to lead to feelings of frustration which can subsequently drive more deprived people to criminal activity (Merton, 1968). Findings from this chapter support assertions made in chapter two, that regional variation in violence-related injury is likely associated with long term structural factors such as regional poverty and financial inequality, which, as stated above, have been suggested to influence the quality of community social relations and in doing so, levels of community violence (Wilkinson, 2006). Importantly, standardized beta coefficients revealed measures of poverty and income inequality were most contributory to rates of violence-related injury in England and Wales; far outweighing the combined impact of on-trade and off-trade alcohol prices.

[19] Caution should therefore be taken when interpreting results based on violence-related injury rates for those aged 51 years and over. Although weighted in order to account for un-sampled hospitals (see chapter 2; section 2.4.2), attendances were based on a small number of actual ED attendances; 21,473 attendances between 1st January 2005 and 31st December 2012.

A direct cause and effect association between unemployment and violence is often assumed but has frequently been difficult to prove. In England and Wales, a positive association between levels of violent crime and rates of unemployment has however been shown in a recent economic study (see Bandyopadhyay et al., 2011). In contrast, two previous studies examining risk factors for violence-related injury failed to show such an association; instead finding youth unemployment to be negatively related to violence-related ED attendance rates (Sivarajasingam et al., 2006, Matthews et al., 2006). The authors therefore concluded that higher levels of youth unemployment would result in lower levels of disposable income and thus reduce spending capacity with which to purchase alcohol. Understood as such, unemployment and alcohol price would have a similar effect on violence-related injury; as increases in either would be expected to reduce the consumption of alcohol by decreasing its demand. Findings from this study show support for these conclusions.

An interesting finding in the current study was that youth unemployment was not associated with violence-related injury among young adult males. This was an unexpected finding due to the highly significant effects of alcohol price (both on-trade and off-trade) on violence-related injury among this cohort. Although the exact reason for this finding is unclear, it is possible that young adult males with lower disposable incomes may choose to reduce another outgoing cost in order to supplement their alcohol use. Also, claimant count data used in this study does not include the student population, whose income is loan based and whose spending capacity is therefore unaffected by levels of unemployment. Youth unemployment was not found to be a significant indicator of violence-related injury in females aged 31-50 years or females over the age of 51 years. Reasons for these particular findings are however unclear.

4.7.4 Seasonality and sporting events

In support of the findings in chapter two, seasonal variations in violence were shown with violence-related injuries more prevalent in the summer months (June, July and August) compared to autumn (September, October and November), winter (December, January and February) and spring (March, April and May). Potential

reasons behind seasonal variations in violence have been discussed in chapters one and two. In the current study, age and gender differences were also evident with risk of violence-related injury similar in spring compared to summer for the adult male and young adult populations. Reasons for seasonal differences across age and gender combinations are unclear however.

Discussed previously, research has shown an association between violence-related ED attendances and sporting events in England and Wales (Sivarajasingam et al., 2005, Bellis et al., 2012b, Quigg et al., 2013). However, contrary to previous findings, an association between violence-related injury and major sporting events (international football and rugby tournaments) was not found in this study. It is possible that the use of monthly aggregate data on violence-related injury instead of daily rates may have masked the link between sporting events and injury sustained in violence. Where a monthly measure can be roughly compared to the duration of a major international tournament, it cannot be compared with specific sporting events such as the F.A. Cup Final or when England and Wales play during the Rugby Six Nations Championship, which may potentially have a greater impact on violence-related injury in England and Wales.

4.7.5 Study limitations

4.7.5.1 *Violence-related ED attendances*

The use of ED derived data as a measure of violence is not without its limitations and these limitations have been adequately addressed in chapter two, i.e. not all patients attending EDs for treatment of a violence-related injury may declare as such; ED data is a measure of serious violence and therefore only accounts for people who have sustained injuries serious enough to require medical treatment; and proximity to an ED is likely to affect attendances in rural areas (Baker et al., 2011). Recent crime survey figures do suggest, however, that 53% of violent incidents result in injury, which suggests that this measure of more serious violence accounts for just over half of the violence in England and Wales (Office for National Statistics, 2014b). Comparisons between ED, CSEW and police data indicate that all three national measures have reported similar trends in violence since 2006.

4.7.5.2 *Alcohol price indices*

Regional expenditure on on-trade alcohol was unavailable. Therefore, the assumption was made that the proportion of expenditure on alcohol by type in a particular region would be similar in both on-trade and off-trade markets and therefore that the same weights could be applied when aggregating. This was considered a justifiable assumption. However, this approach could result in the on-trade indices being inaccurately weighted if the percentage of household expenditure by alcohol type differed greatly between the markets.

4.7.5.3 *Ecological fallacy*

Aggregate measures of regional poverty, income inequality and youth unemployment were used to explain regional variation in violence-related injury. However, as socioeconomic data were not extracted from the patients themselves, the study assumes that an individual who is injured in Wales for example, experiences the same level of poverty and income inequality as other residents of Wales. Ecological fallacy is the error of assuming that inferences made about individuals can be made from analyses of aggregate data (Freedman, 1999); relationships that hold for aggregate data may not hold for individuals.

4.8 Summary

Results have shown evidence of an association between alcohol price and violence-related injury among the adult population of England and Wales. This association was most pronounced with regards to the price of on-trade alcohol and most greatly influenced violent injury among 18-30 year old males. The price of off-trade alcohol was found to only influence frequency of violence-related injuries among the adult male and young adult male populations. Overall, reductions in violence-related ED attendances after a 10% increase in the real price of alcohol in both on-trade and off-trade markets are estimated at over 60,000 per annum.

Evidence from this study clearly demonstrates that a policy intent on raising the real price of alcohol would have a reductive effect on overall levels of violence across the regions of England and Wales. Understood as such, it is imperative that the UK

Government build upon its initial foray into the world of alcohol pricing, after banning the sale of alcohol below cost price (Home Office, 2014), and follow the examples of both Wales (Welsh Government, 2014a) and Scotland (Scottish Government, 2012) in striving to implement a policy that will benefit the NHS, Criminal Justice System and the health of its public. Based on the results of this study, a policy which impacts on the price of both on-trade and off-trade alcohol would be more effective at reducing violence-related injury across England and Wales.

5 The risk of violence-related injury among adolescents living in South Wales: a qualitative study

5.1 Chapter outline

Chapter five seeks to examine, qualitatively, mechanisms by which deprivation influences risk of violence-related injury among adolescents living in South Wales. In doing so, this chapter completes the second aim of thesis; to better understand major determinants of violence-related injury in England and Wales at micro level. This chapter details the process of sample selection, recruitment, data collection, analysis and results. Chapter five concludes with a discussion of the main findings.

5.2 Introduction

Addressing risk behaviours before they result in violence-related harm is an important aspect of the public health approach to violence prevention. Previous research in the UK has shown risk of violence-related injury increases sharply during adolescence and peaks at age eighteen (Bellis et al., 2011, Bellis et al., 2012b). This is true for both genders and across deprivation quintiles (ibid). In chapter four, statistical modelling revealed that, of the variables studied, measure of poverty and income inequality had the greatest influence on rates of violence-related injury in England and Wales. Following on from the findings of chapter four, this chapter seeks to investigate potential mechanisms by which deprivation may influence risk of violence-related injury among adolescents. By focusing on risk of victimisation during adolescence rather than young adulthood, this study will aid in the exploration of targeted interventions aimed at reducing violence-related injuries before they peak. Furthermore, previous research in South Wales has shown that community deprivation influences risk of sustaining injury in violence among adolescent females to a greater degree than adolescent males (Nasr et al., 2010). In line with this, the current study will also examine how these mechanisms differ according to an adolescent's gender. By investigating, qualitatively, causal pathways to violence-related injury among adolescents living in deprivation, the study will also address a gap in the academic literature and help to increase understanding regarding the

impact that gender and socioeconomic background has in relation to risk of sustaining violence-related injury.

5.3 Chapter aims and objectives

Aim

1) To better understand causal links between deprivation and violence-related injury risk for adolescents.

Objective

1) To investigate, qualitatively, mechanisms which link deprivation to risk of violence-related injury among adolescents in South Wales and how these mechanisms differ according to gender.

5.4 Methods

5.4.1 Focus group rationale

The current study uses qualitative methods, namely focus groups, to investigate mechanisms which link deprivation to risk of violence-related injury among adolescents and how these mechanisms differ according to gender. In the previous chapters, quantitative research methods were employed to investigate both trends and determinants of violence-related injury in England and Wales. However, quantitative research methods fail to provide an understanding of the mechanisms by which causal relationships occur. Qualitative research methods can, however, address this failure by providing additional insights to a problem by focusing on the *"understanding of the social world through an examination of the interpretation of the world by its participants"* (Bryman, 2004: p.266). Indeed, it has been suggested by researchers investigating risk and protective factors for youth violence that; *"qualitative and cross-sectional designs can provide important information on young people's lives, and their perspectives are invaluable"* (Bright et al., 2011: p.66).

Focus groups were therefore preferred to one-on-one interviews because they enable the researcher to illicit a greater range of perspectives from participants in a shorter

amount of time (Berg and Lune, 2004) and allow the researcher *"the opportunity to study the ways in which individuals collectively make sense of a phenomenon and construct meaning around it"* (Bryman, 2012: p.504). Importantly, focus groups allow participants to challenge the views of others, which can either stimulate debate or cause participants to self-reflect on their answers and consider an alternative viewpoint (ibid).

5.4.2 Focus group design

Participant demographics such as age, gender, ethnicity, and social status have been identified as important confounders when conducting a focus group (Krueger and Casey, 2009). Single-sex focus groups were therefore preferred in order to increase the homogeneity of each focus group and encourage smoother discussions (Hollander, 2004). Moreover, it has been suggested that *"when interest is high in the opposite sex, such as with adolescents, combined sex groups may negatively affect group productivity"* (Heary and Hennessy, 2002, Peterson-Sweeney, 2005: p.106). Single-sex focus groups should account for these possible confounders, while stratifying focus groups can also *"establish whether there is any systematic variation in the ways in which different groups discuss a matter"* (Bryman, 2012: p.590). Single-sex focus groups were therefore considered a necessity due firstly, to the study's interest in investigating gender differences in risk of violence-related injury and secondly, because community interpersonal violence is more likely to be within rather than between sexes (Office for National Statistics, 2014c).

The number of participants required for a successful focus group is debateable. Consensus among practitioners generally suggests however that the optimum number of participants is between six and eight (Stewart and Shamdasani, 2014); although others have suggested that it can be successful with as little as four participants or as many as twelve (Krueger and Casey, 2009). Therefore, according to recommended practice, the current study recruited between five and eight participants to each focus group. Furthermore, when conducting focus groups with adolescents, researchers should be mindful that school-aged participants are used to changing location every 45-60 minutes in response to normal school timetabling procedures (ibid). Mindful

of this, focus groups lasted for no longer than one hour or the nearest equivalent allowed by the timetabling procedures of each school.

Schools have been suggested as a good location for conducting focus groups with children as it is their territory and can reduce the imbalance of power between researcher and participant (Morgan, 2002). Therefore, focus groups always took place on school grounds between 9am and 3pm (not including either break-time or lunch-time periods) and were conducted in a location jointly agreed upon by both researcher and school. In line with the recommendations of Gill et al (2008), focus groups were conducted in a location that was *"accessible, comfortable, private, quiet and free from distraction"* (Gill et al., 2008: p.294). Locations included; empty classrooms, meeting rooms and a school library.

5.4.3 Sample

5.4.3.1 *Participants*

Adolescents aged between 14 and 16 years (school years 10 and 11) were recruited to the study. This age group was considered most appropriate owing to previous research which identified adolescents aged 14-15 years accept both violence and alcohol misuse as part of teenage culture (Honess et al., 2000). Moreover, as previously evidenced, 65% of UK adolescents aged 15-16 years have consumed alcohol in the last 30 days (Atkinson et al., 2011). Therefore, accepting that a high proportion of this age group partake in risky behaviours such as alcohol use, which is associated with increased risk of violence-related injury (Cherpitel and Ye, 2010), adolescents aged 14-16 years were considered an appropriate age group for communicating views and experiences of violence and risk to the researcher. Furthermore, in England, previous research has identified a steep gradient in risk of violence-related injury between early and late adolescence (Bellis et al., 2011, Bellis et al., 2012b). Recruiting adolescents aged 14-16 years to the study, rather than young adults, the research can enable the exploration of targeted interventions aimed at reducing violence-related injuries before they peak.

5.4.3.2 *Schools*

Wales is divided into 881 small geopolitical areas called electoral wards, which are then nested in 22 unitary authorities. Four secondary schools were recruited from within two of these unitary authorities in South Wales (Cardiff and Rhondda Cynon Taf; RCT) were recruited to the study. Secondary schools from Cardiff and RCT were selected due to their close proximity to one another and to the researcher; limiting both time and cost of travel. Moreover, differences in violence-related ED attendances have previously between identified between cities and their feeder towns (Jones et al., 2011). Inclusion of secondary schools from Cardiff and RCT accounted for these potential differences.

Secondary schools were chosen based on the level of deprivation of the electoral ward in which the school was located. The Townsend Index of Material Deprivation is a valid and reliable measure of deprivation based on the UK census and derived from four variables; unemployment, over-crowding, non-car ownership and non-home ownership rates (Asthana et al., 2002). Although alternative measures of deprivation are available, the Townsend Index is widely used in public health research and strongly correlates with standardised illness and mortality ratios (ibid).[20] Townsend scores have been generated for the Welsh electoral wards and based on these scores, electoral wards have been divided into deprivation fifths (i.e. most affluent, next most affluent, median, next most deprived and most deprived). Therefore, the current study attempted to recruit two schools from the least deprived deprivation fifth (1 Cardiff and 1 RCT) and two schools from the most deprived deprivation fifth (1 Cardiff and 1 RCT). There are, however, only a finite amount of secondary schools within each deprivation fifth that met the relevant inclusion criteria i.e. state schools that were not same-sex, faith, or welsh speaking and/or wished to participate in the study. Private, same-sex, faith and welsh speaking schools were not included in the study in order to enable better cross-school comparisons.

[20] An alternative measure of deprivation in Wales is the Welsh Index of Multiple Deprivation (WIMD). However, the WIMD has been subject to a number of criticisms, including, questions regarding the quality of data and a lack of transparency regarding index construction (Deas et al., 2003).

5.4.3.3 *Recruitment*

5.4.3.3.1 Schools

Initially, seven secondary schools were approached using a headed letter addressed to the head teacher. However, this approach proved an ineffective method at establishing a dialogue between researcher and school; five secondary schools choose not to participate in the study, whilst two ignored all correspondence.

The Welsh Network of Healthy School Schemes (WNHSS) is part of the Schools for Health in Europe Network (see Burgher et al., 1992) and encourages the development of schemes across Wales which promote health in local schools (Welsh Government, 2012).[21] Health topics include food and fitness, mental and emotional health and wellbeing, environment, personal development and relationships, substance use and misuse, safety and hygiene.

Both Cardiff and RCT have Healthy School Schemes accredited by the Welsh Government. It was thought that this study would be of interest to schools participating in the WNHSS and therefore the schemes in-house coordinators (teachers responsible for delivering the scheme) were approached directly using a headed letter sent via email. This new approach proved much more effective at recruiting secondary schools to the study. WNHSS in-house co-ordinators from three new secondary schools and three secondary schools which rejected the initial approach were contacted. Using this new method of approach, four secondary schools agreed to meet the researcher in order to discuss the possibility of participation. Interestingly, of the four secondary schools that met with the researcher, two had previously rejected the initial approach, highlighting the important influence of the WNHSS in-house co-ordinators. After meeting with the researcher, all four secondary schools agreed to participate with the study.

[21] The Schools for Health in Europe network support the development and sustainability of health promotion in schools across Europe.

5.4.3.3.2 Participants

The study fitted into the Personal and Social Education (PSE) aspect of the Welsh curriculum. The PSE Framework (2008) is the key document for providing guidance regarding the planning and implementation of PSE. One of the main themes covered by PSE is entitled 'health and emotional wellbeing' and relates to a pupil's ability to successfully manage and understand his or her feelings and emotions in order to increase their *"ability to cope with conflict, stress, loss and change"* (Welsh Government, 2008: p.12). Moreover, the framework explicitly states, in the 'working with others' section, that pupils in key stage 4 (14-16 year olds) should be given the opportunity to develop their communication skills (ibid). This was communicated to the in-house coordinators and resulted in focus group interviews being conducted during PSE lessons.

The date and time of each focus group was organized to correspond to the date and time that year 10 and 11 pupils were taught PSE. Convenience sampling was used to recruit participants from within these PSE lessons. Overall, approximately 240 participants were approached across the four secondary schools. Participants were approached regarding participation via a research information sheet, with their parents also being sent both an approach letter and separate information sheet. Separate consent forms were also provided with both requiring signatures in order for participation to be agreed. All recruitment documentation was presented to the WNHSS in-house co-ordinator during the initial meeting and, after approval, copies intent for distribution sent to them electronically via email. Parental approach letter, parent and participant research information sheets and parent and participant consent forms were distributed by the school with the explicit instruction that participants read the information provided and take the information home to their parents. A two week time period was considered an appropriate timeline for receipt and response of the recruitment documentation.

5.4.3.4 *Interview schedule*

A semi-structured interview was designed for use in the focus groups based the guidelines outlined by Krueger and Casey (2009). Questions included were based on risk factors associated with violence-related injury previously identified in chapter one. Open-ended questions were used to enable freedom of response and piloted in order to test for suitability (Table 5.1).

Table 5.1 Focus group interview schedule (pilot study)

1	**Views and experiences of violence**
	What first comes to your mind when you think of violence? Is violence ever acceptable? What do you think puts young people at risk of violence? Do you see / hear of much violence in your neighbourhood?
2	**Neighbourhood attachment**
	Describe what you like and dislike about your neighbourhood? Do you feel safe in your neighbourhood? Are there a lot of unsupervised young people hanging around the neighbourhood? Is there a visible police presence in your neighbourhood?
3	**Leisure activities**
	What do you do for fun at evenings and weekends? Where do you normally hang out with friends? Do you think there are enough available leisure activities for young people in your neighbourhood? Would you spend time at a youth club if one existed?
4	**Alcohol use**
	Do you think most young people your age regularly drink alcohol? How old were you when you first drank alcohol? Have you and your parents ever discussed the risks associated with alcohol? On average, how many alcoholic drinks do you drink per month? Is alcohol easy to obtain? Where do you usually drink alcohol?
5	**Family bonds**
	Do you spend much quality time with your family during evenings and at weekends? Do your parents regularly ask where you are going? What you are doing? Who you are spending time with?

6	**Ending question**
	What do you think can be done to prevent violence among young people in your neighbourhood?

5.4.3.5 *Pilot study*

The interview schedule was piloted in a local Cardiff-based secondary school located in the 'next most affluent' fifth of electoral wards in Wales. The school was selected based on two main criteria; it was neither in the 'most affluent' or 'most deprived' deprivation fifth and was therefore not originally in contention for inclusion in the main study; and secondly, the intake of pupils due to the closure of a nearby, more deprived secondary school, meant that the school had pupils of varying socioeconomic backgrounds. The school was approached via a letter sent directly to the head teacher.

Focus group interviews, one male (n=7) and one female (n=8), were piloted at the school. Both participants and parents signed the consent forms provided and in doing so agreed to the discussion being audio-recorded. Each focus group lasted for approximately 45 minutes and was held in the school library. Confidentiality in a focus group setting is difficult, however the researcher was assured by the school that during lessons the library would be both quiet and private: this was shown to be the case.

5.4.3.5.1 Analysis of responses

5.4.3.5.1.1 Views and experiences of violence

Although participants were not overly verbal at first, they began to participate more freely in the discussion as time passed and a rapport was established. Considering this, it became apparent that it was unwise to begin the focus group with questions relating to the participants views and experiences of violence, as this resulted in an increasingly disjointed ebb and flow to the opening minutes. It was also evident that the questions relating to violence were not resulting in the type of discussion envisaged. The questions were seemingly too broad and therefore difficult for the

participants to engage with. These problems were resolved in the main study by altering the order in which topics were raised, re-writing the piloted questions and including more specific questions. The assumption was that altering the order of topics enabled participants to become more comfortable with both the researcher and research setting by answering potentially less sensitive, but equally important, research questions first. Whilst introducing questions such as – *"what would make you resort to violence?"*- were intended to increase the likelihood of participants engaging in the discussion at a more individual level.

5.4.3.5.1.2 Neighbourhood attachment

Participants engaged fully with the questions relating to neighbourhood attachment; responding especially well to questions inquiring to their personal views about their local environment. However, some questions lacked the scope for greater discussion and prompted little more than yes or no answers, when more in-depth discussion was intended. For this reason, some of the questions on neighbourhood attachment were rewritten and new questions included in an attempt to create a more expansive discussion on the topic. It is worth noting that question four – *"is there a visible police presence in your neighbourhood?"* - was dropped from the main study as it became apparent that opinions on police practice were gained without the need to inquire as to them directly. The term 'area' seemed to be used more frequently amongst participants than 'neighbourhood' and was therefore preferred in the main study.

5.4.3.5.1.3 Leisure activities

Participants responded well to questions regarding their leisure activities. It is worth noting, however, that question four - *"would you spend time at a youth club if one existed?"* - was dropped after completion of the pilot. Focus was instead shifted onto what leisure activities were available to participants, as this allowed the researcher to make connections between the activities available and how participants spent their leisure time.

5.4.3.5.1.4 Alcohol use

Considering the nature of the topic, the majority of participants engaged well with questions relating to alcohol use. Those who contributed little to this particular discussion may have done so for one or a combination of the following; little to no experience of drinking alcohol, uncomfortable discussing their views on alcohol use in a group setting and/or due to fear of reprisals. The following questions were included in the main study in an attempt to resolve the problems potentially restricting participation in the discussion:

1) Why do you think young people your age drink alcohol?
2) What do you think your parents would say if you came home drunk?

It was thought that the inclusion of the above questions would potentially enable those participants with limited experience of alcohol use and those who did not wish to disclose any personal drinking habits to still contribute to the discussion in a meaningful way, albeit more generally.

5.4.3.5.1.5 Family bonds

Participants appeared to respond openly about their relationships with both parents and siblings. Due to the nature of the topics included in the questionnaire, mentions of family relationships arose throughout various stages of the discussion. Considering this, questions inquiring as to what the participant thought a parent would do or say were included more frequently within topics such as alcohol use and their views and experiences of violence; for example, *"what do you think your parents would say if you came home drunk?"* and *"what would your parents say if you were in a fight?"*. For this reason, there are only a few questions included in the family bonds section of the questionnaire.

Taking the above analysis into consideration, the questionnaire was updated and the new version is presented in Table 5.2.

Table 5.2 Focus group interview schedule (main study)

1	**Leisure activities**
	What do you do for fun at evenings and weekends? Where do you normally spend time with friends? What leisure activities are there for young people in the area? Do you think there are enough available leisure activities for young people in the area?
2	**Neighbourhood attachment**
	Do you like the area that you live in? Describe what you like or dislike about the area? Do you feel part of the community? Do you think young people have a bad reputation where you live? Do you feel safe walking alone at night? Why /why not? Are there any areas that you would avoid going at night? Do you ever see or hear of any violence?
3	**Views and experiences of violence**
	In your own words, how would you define 'violence'? Are there times when violence is necessary? What would make you resort to violence? Have you or any of your friends ever had to attend an Accident and Emergency Department (A&E) as a result of a violent incident? Why do you think young people fight? What would your parents say if you were in a fight? Have your parents ever spoken with you about violence / fighting? Have you or any of your friends ever been involved in a violent incident /fight or been a victim of a violent incident?
4	**Alcohol use**
	Do you think most young people your age regularly drink alcohol? Why do you think young people your age drink alcohol? Where do young people your age usually drink alcohol? Have you ever drunk alcohol? How old were you when you first drank alcohol?

	Is alcohol easy to obtain? What do you think your parents would say if you came home drunk? Have you and your parents ever discussed the risks of drinking alcohol?
5	**Family bonds**
	Do you spend much quality time with your family during evenings and weekends? What type of activities do you do as a family? Do your parents regularly ask where you are going? What you are doing? And who you are spending time with? - How does that make you feel? Do you have a curfew?
6	**Ending question**
	What do you think can be done to prevent violence among young people where you live?

5.4.4 Recording and transcription

Each focus group was audio-recorded using a DS7000 Digital Voice Recorder. Two moderators (researcher and notary) conducted the focus groups; the first conducting the interview and facilitating the flow of discussion, and the second acting as notary. It was the role of the second moderator (notary) to control the audio-device, which was placed in the centre of the table and switched-on after basic ground rules had been established and switched-off after completion of the focus group.

Each focus group was transcribed verbatim with only the participant's age and gender retained as well as the level of area deprivation. Confidentiality within a focus group is problematic and relies on the discretion of the participants within the group (Krueger and Casey, 2009). In order for confidentiality to be established outside of the group setting, personal identification codes were used, for example, LDM1 (least deprived male 1) and MDF1 (most deprived female 1) when transcribing and analysing responses.

5.4.5 Focus group procedures

Based on the recommendations of Heary and Hennessey (2002), chairs were arranged around a table before the focus groups began, in order to make participants feel less self-conscious. Once seated, both moderators introduced themselves to the group and each participant was then provided with a name badge and asked to introduce him or herself. Consent forms were then retrieved by the first moderator and once checked, a brief verbal introduction to the study was provided. In accordance with recommended practices, basic ground rules were stated and participants were reminded that the session was being audio-recorded (Krueger and Casey, 2009). Participants were informed that the audio-recording would be destroyed after transcription and that their views and opinions would remain anonymous outside of the group setting. Participants were also asked to treat all information shared within the group as confidential.

5.4.6 Ethical Considerations

Ethical approval was obtained from the Dental School Research Ethics Committee (DSREC reference 12/05) on April 12th 2012. In line with the DSREC guidance which states, *"...applicants who intend to work with children in schools must obtain written approval from the Head teacher of the school, from the Local Education Authority or any other person who is in loco parentis"* (Cardiff University, 2015: p.9) – written approval was obtained from all relevant stakeholders. Moreover, in line with the 1998 Data Protection Act, which prohibits schools from passing out parental information to external parties, all recruitment documentation was distributed by the school using their normal distribution procedure. Also, in line with the legal requirement for working with children, both moderators successfully completed a DBS check from the Disclosure and Barring Service.

5.4.6.1 *Child protection issues*

In accordance with the child protection procedures stated in All Wales Child Protection Procedures (All Wales Child Protection Procedures, 2008), the divulgence of any information regarding a participants own experiences of neglect, physical abuse, emotional abuse, and/or sexual abuse were passed onto the school. Moreover,

in line with the same child protection procedures, the moderator enquired as to each schools procedure for dealing with the disclosure of such sensitive information, so that the moderator was informed of appropriate school procedure and could act accordingly. Participants were made aware that any information indicating prior experience of abuse or neglect would be passed onto the school in accordance with the child protection procedures outlined above. No information of this nature was however disclosed to the moderator during any of the focus groups conducted.

5.4.7 Data analysis

Thematic analysis was used to analyse data elicited from focus group transcripts. Described as a method for "*identifying analysing and reporting patterns (themes) within data"*, thematic analysis is considered an accessible form of qualitative analysis for researchers who are in the early stages of their research careers (Braun and Clarke, 2006: p.79). In the current study, thematic analysis was used to investigate the influence that both gender and material deprivation have on risk factors for violence-related injury among UK adolescents at an individual level. Themes were generated in accordance with the guidance of Braun and Clarke (2006), namely; 1) data were transcribed; 2) initial codes were generated; 3) codes were sorted into potential themes and subthemes; 4) themes and sub-themes were reviewed; and finally 5) themes and subthemes were defined and labelled.

When conducting a thematic analysis, it is important that the theoretical position in which the analysis is undertaken is made clear (ibid). Therefore the current analysis employed a theoretical approach to data coding, where codes were created in relation to research questions and in accordance with the researcher's theoretical interest in the research area. This is in contrast to an inductive approach, where research questions would evolve from the codes themselves (ibid). A theoretical approach to data coding was preferred due to the availability of a seemingly robust literature on risk factors for youth violence, which, as a result, provided ample resources to construct relevant research questions; negating the need for research questions to evolve from the data, which may be required when relevant literature is sparse. Transcripts were analysed at a semantic level; where *"themes are identified within*

the explicit or surface meanings of the data" (ibid: p.84). Understood as such, meaning was derived from the data by attempting to theorize the significance of identified patterns and their broader implications in reference to the pre-existing literature (Patton, 1990).

5.5 Results

5.5.1 Focus group demographics

Eight single-sex focus groups were undertaken with fifty adolescents (24 males and 26 females) aged between 14 and 16 years (mean age = 14.8 years) from four secondary schools across South Wales. Considering there are a finite amount of secondary schools within each deprivation fifth that met the inclusion criteria, the study failed to recruit a secondary school from the least deprived deprivation fifth in either unitary authority. A secondary school from the next least deprived deprivation fifth was instead recruited in Cardiff, while a school from the median deprivation fifth was recruited in RCT (see Table 5.3).[22]

Table 5.3 Focus group information and participant demographics

Gender	Unitary authority	Deprivation fifth	Participants	Age (mean)	Duration (minutes)
Male	Cardiff	Next least deprived	6	14.5	46
		Most Deprived	5	14.5*	36
	RCT	Median	7	14.7	28
		Most Deprived	6	15.5	41
Female	Cardiff	Next least deprived	6	14.3	52
		Most Deprived	6	14.3	43
	RCT	Median	8	14.9	50
		Most Deprived	6	15.5	31

*one participant did not state his age

[22] In RCT there are no secondary schools in the least deprived fifth and only one in the next least deprived fifth. The school recruited was therefore the school with the second lowest Townsend Score of Material Deprivation in RCT.

5.5.2 Thematic analysis

5.5.2.1 *Adolescent females*

The key differences identified between adolescent females living in less deprived electoral wards (least deprived female, LDF) compared to those living in most deprived (most deprived female, MDF) are presented in the following themes and subthemes (in parenthesis):

1) Leisure activities (availability, quality/relevance, accessibility and aspirations);
2) Alcohol regulation (access to alcohol, types of alcohol and drinking environment);
3) Consequences of alcohol misuse;
4) Ability to avoid risk;
5) Trust and communication;
6) Gender roles.

5.5.2.1.1 Leisure activities

A difference between how LDF's and MDF's spent their leisure time was identified. Where LDF's spent their leisure time participating in organised activities such as, dance and theatre clubs and undertaking the Duke of Edinburgh Award; MDF's tended not to participate in organised activities and instead tended to 'hang out' at local takeaways, for example, MacDonald's or Subway.[23]

> *"I do a lot of singing and acting and stuff, so like I rehearse outside school a lot. If I don't go to the gym or I don't have rehearsals then I just go to town, or I just play music at my house"* (LDF, Cardiff).
>
> *"We go to Subway; loads of people do"* (MDF, RCT)

[23] Organised activities; a term used to describe activities undertaken outside of the school curriculum, for example, community organisations, youth development programs and school-based extracurricular activities (Bohnert, et al., 2010)

Subthemes relating to availability, quality/relevance, accessibility and aspirations are discussed below.

5.5.2.1.1.1 Availability

One reason for the stark contrast between how affluent and deprived adolescent females spend their leisure time could result from differences regarding the perceived availability of leisure activities. For example, where LDF's suggested that there were quite a lot of extra-curricular activities to participate in both inside and outside of school; MDF's suggested that there were no available leisure activities for young people their age. Interestingly, LDF's suggested that after school clubs tended to be mostly sports based and that if they are not interested in sport then there is little in the way of alternative after school activities.

> *"There is quite a lot of stuff outside of school; like I train hockey like most of my time"* (LDF, Cardiff).
>
> *"There's nothing for our age. We all just walk around"* (MDF, Cardiff)
>
> *"The school has loads of after school clubs but they're mostly sport…if you don't like sport then you're a bit…there's nothing really to do"* (LDF, Cardiff).

5.5.2.1.1.2 Quality / relevance

Although MDF's claimed that there were not any available leisure activities, further discussion revealed that this was not necessarily true. MDF's referred to local football fields, libraries, youth clubs, and after school clubs. However, what was evident was how MDF's felt that the quality of such facilities were poor and, in some cases, not relevant to young people of their age.

> *"Yeah but it's [library] really rubbish and it's always covered in litter…and there's always like little kiddie books in there or really like old books they won't let you go near"* (MDF, Cardiff).
>
> *"I had to take my sister there [youth club] the other day and there was just little kids running round and I was like 'ah I'm going'. It was rubbish!"* (MDF, Cardiff).

Interestingly, no reference was made to the quality of facilities among LDF's, although it was suggested that many of the available leisure activities are aimed at younger children.

> *"I think they're [E3 activities] aimed more at year seven"* (LDF, RCT).
>
> *"Yeah but it's kind of like a stereotype…it's more…younger kids do it than older kids"* (LDF, RCT).

5.5.2.1.1.3 Accessibility

Accessing more costly leisure activities such as the local cinema for example, was also a greater problem for MDF's compared to LDF's. Where LDF's considered the cinema to be relatively affordable for young people and would often take the bus or arrange lifts with parents in order to access it; MDF's (especially those outside of Cardiff) would struggle to afford the combined cost of both the cinema ticket and the required transport cost and therefore found access to such an activity limited.

> *"It's [cinema] quite affordable…and like a quarter of an hour drive…sometimes we'd organise lifts from parents"* (LDF, Cardiff).
>
> *"And if you go down there [Cardiff], say you want to go cinema, you'll probably spend like £7 on the train and then you've got to pay like another £7 for the ticket"* (MDF, RCT).

5.5.2.1.1.4 Aspirations

A final contrast between LDF's and MDF's, with regards to how they spend their leisure time, involved the importance placed on school work. With MDF's, not one participant referred to school work as a regular activity. This of course could have resulted if MDF's didn't associate school work with their own leisure time; however, both focus groups with LDF's referred to time spent completing homework and exam preparation as constituting part of their extracurricular activities.[24]

> *"I don't really have a social life. I just stay in and revise cos I have my exams in January, so I don't go out much unless it's like a one off weekend where I'll go to town with my friends"* (LDF, Cardiff).
>
> *"You get to like year ten and your work is more important than going to E3, so you don't really bother"* (LDF, RCT).

5.5.2.1.2 Alcohol regulation

Alcohol consumption is a known risk factor for violence (Bushman and Cooper, 1990, Cherpitel and Ye, 2010, Shepherd, 2006). Although the majority of both LDF's and MDF's who participated in the focus groups openly admitted to having previously consumed alcohol, differences were identified with regards to how this alcohol use was regulated. These differences were split into the following three

[24] However, references to exam preparation could have been influenced by the time of year that some focus groups were conducted and this should therefore be taken into consideration when drawing on these findings.

subthemes; access to alcohol, alcohol type and the drinking environment. Although subcategorized in this way, there were clear associations between each subtheme and they should not be considered mutually exclusive from one another.

5.5.2.1.2.1 Access to alcohol

Throughout the focus groups it became evident that, for LDF's, the main method for obtaining alcohol was from their parents. In contrast, MDF's suggested that there were three available methods for obtaining alcohol; get their parent's to purchase it on their behalf, get older friends or siblings to purchase it on their behalf, or purchase it themselves.

> *"They can just go to [supermarket removed] cos they don't ask for ID. They didn't ask me and I bought Caribbean Twist"* (MDF, Cardiff).
>
> *"My parent's would never go and get it [alcohol] for me. I used to…I can get served but I choose not to just in case. So I get…I'm friends with older people…so they get it"* (MDF, Cardiff).

The most convenient method for MDF's, and the only method for LDF's, was to have their parents purchase their alcohol for them. However, this enabled parents to regulate their child's alcohol consumption by controlling both alcohol type and quantity of alcohol purchased. Where LDF's accepted these terms, understanding that this was their only realistic method of obtaining alcohol, MDF's were not subjected to the same restrictions, as they had two further methods available by which to prove alcohol.

> *"I don't think it's easy [to obtain alcohol]. Like if I was going to a party my mum would allow me to take alcohol but it would be within reason, like it wouldn't be masses, it would be like a WKD"* (LDF, Cardiff).

Therefore, whilst LDF's alcohol use was regulated by their parents, meaning they were required to stay within the boundaries their parents had set them in order to continue this arrangement, MDF's were under no such obligation and this seemingly impacted on the types of alcohol they consumed.

5.5.2.1.2.2 Alcohol type

LDF's tended to drink lower alcohol content beverages such as alcopops, which most likely reflected the fact that their parents tended to be their main source for obtaining alcohol. In contrast, MDF's, who had multiple methods for obtaining alcohol, drank a more diverse range of alcohols, including; alcopops, ciders, spirits and wine.

> *"My mum doesn't allow spirits. So it's alcopops basically…a WKD [alcopop] or like a bottle"* (LDF, RCT).
>
> *"Vodka…any drink you can get hold of really"* (MDF, RCT).

5.5.2.1.2.3 Drinking environment

It has been made apparent above, that contrasts existed between LDF's and MDF's access to alcohol and, possibly as a result, the types of alcohol they consume. A third contrast between how LDF's and MDF's alcohol use is regulated was also identified in relation to the environment in which alcohol is consumed. For example, LDF's tended to only drink alcohol at parties or on a special occasion i.e. Christmas, birthdays, or weddings (subsequently parties tended to be on a friend's birthday or associated with an occasion such as Halloween). Such parties were described by some LDF's as a 'controlled environment, where parents were aware of the party's location, the presence of alcohol and the party's duration; with pick up and drop off times arranged in advance.

> *"It's in like a controlled environment…we don't like drink on the streets"* (LDF, RCT).
>
> *"As long as they pick me up after then they let me, they'll buy it [alcohol]"* (LDF, RCT).

Importantly, although parties were not always supervised directly, for example a parent may babysit nearby, some LDF's suggested that it was not in their interest to flaunt the responsibility given to them by their parents, especially where parties and alcohol were concerned, as pushing these boundaries could potentially harm their future prospects of experiencing both.

> *"If your parents have given you the drink then you know not to go over that, cos you're just going to push your luck for later on in life if you ask again"* (LDF, RCT).

Similarly to LDF's, MDF's tended to drink alcohol at parties; although in contrast to LDF's, MDF's also drank alcohol more generally with friends. Importantly, LDF's described their parties as a 'controlled environment' with an adult aware and situated nearby; whereas, in contrast, MDF's suggested that their parties could be either supervised (i.e. a parent present) or a 'free house' (i.e. unsupervised).

> *"Both [either supervised or a 'free house']…it all depends on what type of person it is. Like some parents don't care and others do, so they'd just rather you do it when they're not there"* (MDF, RCT).

5.5.2.1.3 Consequences of alcohol misuse

Another contrast between LDF's and MDF's related to their appreciation of the potential consequences of alcohol misuse at an individual level. For example, where MDF's made no reference to the negative consequences of alcohol; LDF's responses suggested that they were mindful that, in the age of social media, evidence of alcohol misuse could damage their future job prospects or a place at university.

> *"Cos that will affect you getting a job, cos if they [employers] can get onto your Facebook and scroll down and see that you've done something; surely they're not gonna' want like someone who's getting drunk like that"* (LDF, RCT).
>
> *"If you drink you got consequences, like you'll be sick or you'll have a headache in the morning… But if you do rubbish in an exam then…you can't get into the college you want"* (LDF, RCT).

As suggested in the above quotation, LDF's were also aware of the negative, short term effects of alcohol, such as hangovers and vomiting; suggesting that they didn't understand why young girls their age would want to become so intoxicated.

> *"I don't really see the need. It's embarrassing more than anything isn't it. You see all the photos and like there's people being sick down the toilets, their hairs all over their face and their make-ups running"* (LDF, RCT).

5.5.2.1.4 Ability to avoid risk

Differences were also identified in regards to the ability of LDF's and MDF's to avoid risk. For example, LDF's employed risk avoidance tactics such as not walking alone whenever possible, always having their mobile phones with them and avoiding known high risk areas.

> *"Yeah if I have to walk around to Tesco's and it's quicker for me to go through the park, I'd rather walk around cos I know like people can see me"* (LDF, RCT).

In contrast, MDF's suggested that, although they could identify known high risk areas, it wasn't enough to avoid these areas as the people who inhabited them tended to move around the locality; a problem that was identified as especially bad at night.

> *"It's the people though; they go round like everywhere though, don't they"* (MDF, RCT).
>
> *"The worst thing is that when it hits like half six, seven o'clock, you don't go outside. That's the worst thing. The fact I've grown up here all my life, yet when it gets dark, I don't want to go out on my own because of all the frickin' gangs"* (MDF, Cardiff).

5.5.2.1.5 Trust and communication

Another contrast between LDF's and MDF's related to their relationships with their parents, specifically, the perceived level of trust and communication between child and parent. Not to be considered in isolation from other themes, perceptions of trust and communication between child and parent were shown to directly influence LDF's attitudes towards alcohol use and indirectly influence their use of risk avoidance tactics. For example, LDF's suggested that because their parents trusted them with small quantities of alcohol, they felt compelled to act responsibly.

> *"Like because my parents let me [drink alcohol], within reason, I don't want to go and do it behind their back. Because they trust me, I don't want to break their trust. They're big enough to allow me to do this and allow me to go out and they trusted me with it, so I don't want to break the boundaries"* (LDF, RCT).

Moreover, LDF's suggested that their parents were happy for them to spend time outside of the home as long as they kept them informed regarding their whereabouts via phone call or text, whilst curfews were happily extended in the interests of safety; for example, if it meant having someone to walk home with.

> *"I'll say, 'well everyone else is staying out until nine and I can walk home with someone' and they'll say, 'you can come back then but don't be late': you haggle"* (LDF, RCT).

In contrast, MDF's suggested that they often lied to their parents regarding where they were going and what they were doing in order to further their own self-interests because they thought their parents were too strict; suggesting they were shown little leniency with regards to curfews and little responsibility with regards to alcohol.

> *"I give my parents hints and if I get a bad response, I won't tell em…because I know they won't let me do half the things that I want to do. They're too strict!"* (MDF, Cardiff).
>
> *"Oh my parents are so strict. I'm not allowed to drink; I have to home at a certain time; they have to know everything about me. I still get shouted at even if I'm like two minutes late [home]"* (MDF, Cardiff).

5.5.2.1.6 Gender role

Another theme identified related to the contrast between LDF's and MDF's attitudes towards violence; specifically, how the attitudes of LDF's tended to conform to stereotypical gender roles in that they could be perceived at overtly feminine compared to the attitudes of MDF's, which could be perceived as overtly masculine. For example, LDF's tended to express a more negative attitude towards violence; suggesting that girls who fight are "*chavy*" and that violence should never be the answer unless in self-defence.

> *"…if someone punched [name removed] they'd have it worse. Not by getting punched back, but by what everyone would say. It is just so chavy to fight: especially girls! If…one of you [referring to the other focus group participants] punched me and it was a girl fight, then everyone would just turn against them, cos I think it's just disgusting"* (LDF, RCT).

Some LDF's also suggested that violence was predominantly associated with disputes among adolescent boys rather than girls; with whom verbal confrontations were much more likely. LDF's also identified their male friends as their protectors

from violence; reinforcing stereotypical gender roles by suggesting that violence, both participatory or in defence of others, was inherently male.

> *"I think it's different with girls and boys though cos boys will be more physical with it and the girls, I don't know, the girls do it more verbally"* (LDF, Cardiff).
>
> *"If we get upset we cry; we don't fight"* (LDF, RCT)
>
> *"If someone started the boys would remove them from the situation. They'd save us basically"* (LDF, RCT).

In contrast, the attitudes expressed by MDF's could be considered overtly masculine. For example, although MDF's suggested that violence is wrong, some participants openly admitted to having been previous involved in violence, whilst others expressed views that suggested they too would become violent if provoked.

> *"I had a fight with someone and I grabbed their ear and it ripped and they had to have stitches"* (MDF, Cardiff).
>
> *"I will always respond violence with violence though. If somebody hits me, I will always hit them back. Somebody has a go at me; I will always have a go back; if you don't stick up for yourself they will just keep coming back"* (MDF, Cardiff).

5.5.2.2 *Adolescent males*

The key differences identified between adolescent males living in less deprived electoral wards (less deprived male, LDM) compared to those living in most deprived wards (most deprived male, MDM) are presented within the following themes and subthemes (in parenthesis):

1) Alcohol regulation (age of onset, access to alcohol and drinking environment);
2) Community bonds (feelings of safety and feelings of marginalisation);
3) Quality of available leisure facilities.

5.5.2.2.1 Alcohol regulation

Again, differences were identified with regards to how alcohol use was regulated among LDM's and MDM's. These differences were split into the following three subthemes; age of onset, access to alcohol and the drinking environment. Again, there were clear associations between each subtheme and, therefore, they should not be considered mutually exclusive from one another.

5.5.2.2.1.1 Age of onset

On average, MDM's reported earlier onset alcohol use than LDM's; for example, the age of MDM's first alcoholic drink ranged from nine to fifteen years of age, whilst, in comparison, LDM's first alcoholic drink tended to be around fourteen or fifteen years of age. Interestingly, differences were reported with regards to the circumstances surrounding age of onset. For example, where LDM's tended to be given tasters of beer or champagne by their parents, one MDM suggested that his first alcoholic drink was a two litre bottle of Strongbow which he drank with his friends.

> *"This year [age of onset]…I've tried like a sip of my dad's. My parents said that that was fine"* (LDM, Cardiff).
>
> *"I was thirteen [age of onset]…two litre bottle of Strongbow with my mates"* (MDM, RCT).

5.5.2.2.1.2 Access to alcohol

Similar to LDF's, LDM's also obtained alcohol primarily from their parents. Again this meant that parents were able to better regulate both the types and quantities of alcohol consumed. In contrast, MDM's, similar to MDF's, suggested that there were multiple methods of obtaining alcohol, including through parents or approaching strangers to purchase it on their behalf.

> *"The only time I drink is if my dad was in a good mood with me and it was like a party…he'd let me have maybe one bottle of beer or one glass of champagne but he would never let me drink enough [to get drunk]"* (LDM, Cardiff).
>
> *"Well most people wait outside like. In [name removed] there's like a lane…and there's a Spar and people just wait and say like, 'will you just run in the shop for me like quick?' and if they are like, 'why?', you just say like, 'I'm banned' or something like that and they just go in and get it for you"* (MDM, RCT).

5.5.2.2.1.3 Drinking environment

Again, similar to LDF's, LDM's tended to only drink alcohol either at home, under parental supervision and usually in the form of tasters, or when attending a family celebration or a friend's party. Here, alcohol is again consumed within a 'controlled environment'; where alcohol use is supervised by a parent or a parent is in close proximity. Indeed, this seemed to constitute an accepted practice by affluent parents, with one LDM suggesting that although his parents would not be pleased if he returned home drunk, he believed they would be happier knowing that he had been drinking at a party, rather than unsupervised outdoors.

> *"My mum and dad would probably be more pleased if I…well not pleased but be happier if I came home drunk from a party…than if I'd gone out drinking at the park just to get drunk, cos they know it's in a controlled environment…and there's adults around"* (LDM, Cardiff).

In contrast, although MDM's suggested that they also drank alcohol at parties, they also suggested that many local people their age drank unsupervised outdoors.

> *"All people from [name removed] go to the cricket pitch. It's like, it's like not in the middle of nowhere like but you don't walk through it unless you're, you know, going to that bit. And all them lot just go down there and drink"* (MDM, RCT).

5.5.2.2.2 Community bonds

A further difference identified between LDM's and MDM's related to how participants perceived their local environment and their place within it. LDM's from both Cardiff and RCT stated that they liked the area that they lived in, whereas responses from MDM's were less clear cut. For example, some MDM's did not like the area they lived in, while others suggested that it wasn't the area so much as it was the local people whom they disliked. Two subthemes were therefore established in order to capture these differences; feelings of safety and feelings of marginalisation.

5.5.2.2.2.1 Feelings of safety

A stark contrast between LDM's and MDM's were how safe they felt within their local area; particularly at night. LDM's suggested that their local area was predominantly peaceful and that exposure to crime, including violence, was very rare. As a result, LDM's did not worry about going out alone as they felt increasingly safe in their local area.

> *"You never see any like crime… or vandalism. There's no graffiti or anything like that: you never worry about going out on your own"* (LDM, Cardiff).

In contrast, some MDM's suggested that they did not feel safe in their local area, whilst others suggested that, although they didn't feel unsafe, they were aware of the many potential risks of going out locally at night. Whether they openly stated their

feelings of safety or not, much discussion on the potential risks of going out locally at night, generally focused on past experiences; either their own or those of others.

> *"No cos it's like stuff…a couple of stuff has like happened in like the past, like stabbings like, some people just going around like running over people for no reason and that; just don't outside at night"* (MDM, Cardiff).

5.5.2.2.2.2 Feelings of marginalisation

Another contrast between LDM's and MDM's related to feelings of marginalisation. As referred to above, LDM's felt safe within their local area. Some also stated that they felt part of the local community as they and their family had lived in their local area for an extended period of time and knew many of the local people.

> Interviewer: Do you feel part of the community?
>
> *"Yeah, cos, where I live there's just a few houses and I've lived there for a few years...I know everyone"* (LDM, Cardiff).

Comparatively, MDM's responses throughout both focus groups suggested feelings of marginalisation within their local areas. For example, participants referred to being treated like children rather than young men, whilst others stated that some local people will often cross the road in order to avoid passing them when they are together.

> ***"****Like teenagers, like frowned upon like and like we're just walking around the street they like assume you're doing drugs or something. It's like if you're walking with your hood up or something and then they're walking down [the road] they'll always cross the street to avoid you"* (MDM, RCT).

5.5.2.2.3 Quality of available leisure facilities

The perceived quality of available leisure facilities was a further difference identified between LDM's and MDM's. Indeed, where LDM's never sought to comment on the quality of their local leisure facilities, MDM's were frequently aggrieved by the poor quality of the leisure facilities available to them. For example, MDM's who regularly played football or rugby suggested that local parks and sports pitches were in poor condition and frequently affected by adverse weather conditions and/or vandalism.

> *"People like ruin stuff and that...like burn parks and stuff. Like, like set fire to stuff in the parks. Melt swings and stuff, like plastic. And, like, every time when we do rugby or something, if there's a bit of rain then they call it off, it's really pathetic!"* (MDM, RCT).

5.6 Discussion

Adolescent's likelihood of experiencing violence-related injury has been shown to increase with increasing levels of deprivation (Jones et al., 2011, Bellis et al., 2011, Bellis et al., 2012b); adolescent females have been found to be increasingly sensitive to these effects (Nasr et al., 2010). Mechanisms linking deprivation to risk of violence-related injury and how such mechanisms differ according to gender have not been investigated qualitatively. This was addressed in the current study: findings indicated key differences in the ways in which adolescents from different socioeconomic backgrounds were exposed to factors that may potentially increase or reduce their risk of sustaining injury in violence. In support of the findings of Nasr et al (2010), differences were more apparent between adolescent females than adolescent males; suggesting that material deprivation has a heightened effect on risk of sustaining violence-related injury among adolescent females.

5.6.1 Adolescent females

5.6.1.1 *Leisure activities*

Routine activity theorists argue that victimization occurs due to the convergence in time and space of motivated offenders, appropriate targets and the lack of effective guardians (Hindelang et al., 1978). Considering this, the routine activities of adolescents, including how and where they spend their leisure time and who they spent that time with, can potentially increase or decrease their risk of violent victimisation (Schreck and Fisher, 2004). Indeed, participating in clubs and organizations has been suggested, by children living within deprived areas in the UK, as a mechanism to avoid victimization (Turner et al., 2006). Furthermore, participation in extracurricular activities has been shown to protect against violent behaviour among a sample (n=124) of female adolescents in the US (Linville and Huebner, 2005). In the current study, LDF's indicated that a large proportion of their leisure time was spent completing school work (i.e. homework and exam revision) and participating in organised activities (for example sports and arts clubs). In contrast, most MDF's did not engage in organized activities or refer to school work as constituting part of their weekly routine, but instead spent much of their leisure time socialising locally with peers; most often around local fast-food restaurants. Reasons for not participating in organized activities were given by MDF's and reflected perceptions regarding availability, quality/relevance and accessibility.

Figures from the Sport Wales scheme '5x60', which aims to increase opportunities for secondary school pupils to participate in extra-curricular sport, show substantially more boys (key stages 3 and 4) were registered to activities in 2013/14 than girls (40,090 boys compared with 27,432 girls) (Sports Wales, 2014).[25] In addition, between key stage 3 (ages 11-13 years) and 4 (ages 14-16 years), figures indicate an 80% decrease in registrations among girls in Cardiff and RCT (ibid). Although findings from the current study suggest MDF's aged 14-16 years do not participate in organised activities, it is unlikely that such a large reduction in registrations are solely due to them; however, Sports Wales have suggested that adolescents living in deprived communities are less likely to participate in sport (Sports Wales, 2015).

[25] Sport Wales are responsible for developing and promoting physical activity in Wales and are one of the main advisers to the Welsh Government on all sporting matters.

Nevertheless, it is possible that LDF's who decide not to participate further in organised activities may perhaps turn their attentions to academic achievements and future aspirations, which requires them to spend more time indoors completing homework and preparing for exams; therefore affording them much the same protection as continued participation in organized activities. In contrast, research has shown that academic achievement is considered less important among adolescents living in deprived communities (Communities and local government, 2008). Therefore, MDF's who do not participate in organized activities and are less worried about school work, are not afforded the risk reducing protection that such activities may provide; potentially increasing their risk of violent victimization through increased unstructured socializing with peers, the possibility of delinquent peer association, and reduced supervision by a parent or guardian (Maimon and Browning, 2010, Losel and Farrington, 2012, Schreck and Fisher, 2004).

5.6.1.2 *Alcohol regulation and consequences of alcohol misuse*

An established norm by age fifteen, alcohol use has been shown to increase vulnerability to violent victimisation among adolescents (Shepherd et al., 2006) and is a salient risk factor for violence-related injury (Cherpitel and Ye, 2010). In the current study, findings suggest that differences in risk of violence-related injury between adolescent females from different socioeconomic backgrounds may partly be explained by the ways in which their alcohol use is regulated. For example, although not all LDF's drank alcohol, those that did, drank indoors and had their alcohol purchased by their parents. This enabled parents to supervise the amount and types of alcohol consumed; usually alcopops or fruit ciders. Furthermore, alcohol was predominantly drunk at parties in celebration of a birthday or special event. Attending parties and drinking alcohol, all be it small quantities, was considered a rare but enjoyable social activity. Importantly, LDF's suggested that they were only provided with alcohol and allowed to attend parties, if they adhered to their parents' strict rules on alcohol use. Evidence of parental influence on alcohol consumption has previously shown that strict alcohol-specific rules can reduce alcohol use during adolescence (Van Der Vorst et al., 2005). In addition, adolescents whose parents provide them with alcohol, have been shown to report significantly less alcohol-

related violence than those who purchase their own alcohol or have others (excluding parents) purchase it on their behalf (Bellis et al., 2009).

In comparison, MDF's also accessed alcohol through parents; however, failing this, would purchase alcohol themselves or get others to purchase it on their behalf. Therefore, without proper regulations by parents or guardians, MDF's were more likely to consume unsupervised and consume stronger alcohols. Research has shown that risk of alcohol-related violence is more likely among adolescents who drink spirits or cheap bottled cider (ibid), whilst drinking alcohol without parental knowledge is associated with more frequent drinking among adolescents (Marsden et al., 2005); also a risk factor for alcohol-related violence (Bellis et al., 2009). MDF's whose parents do not allow them to drink alcohol may, therefore, resort to alternative methods of obtaining alcohol and consequently, consume stronger alcohols in an unsupervised and unsafe environment. Behaviours such as these may potentially increase the risk of violence-related injury among MDF's relative to LDF's; who are provided with small quantities of alcohol, a safe environment and clear alcohol-specific rules. Indeed, a systematic review of longitudinal studies revealed that delayed alcohol initiation and reduced levels of later drinking were associated with limiting availability, parental monitoring, parent-child relationship quality and general communication (Ryan et al., 2010).

A further difference between LDF' and MDF's with regards to alcohol was there appreciation for the potential consequences of misuse. Where MDF's made no reference to the potential negative effects of drinking alcohol, LDF's referred to both short-term consequences such as hangovers and vomiting, as well as long-term consequences such as damaging career and university prospects. Although reasons for this distinction are unclear, differences in alcohol socialization and future aspirations may be contributory.

5.6.1.3 *Risk avoidance*

Although females experience less violent victimisation than males, research has shown that females have a heightened fear of experiencing physical harm (Moore and Shepherd, 2007). This fear may result from having less physical strength relative to men and thus an increased vulnerability to physical harm and sexual assault (Smith and Torstensson, 1997). Therefore, in order to reduce their risk of victimisation, some females employ risk avoidance strategies such as avoiding public places at night or relying on the company of others for protection (Cobbina et al., 2008). Findings from the current study revealed LDF's frequently employed risk avoidance strategies such as purposely avoiding perceived risky areas at night (for example dark alleyways or troublesome estates), walking in groups whenever possible and, if forced to walk alone, talking on the phone with a friend or family member. In contrast, although MDF's suggested that they were able to identify potentially risky areas, simply avoiding such areas were not always practical or possible. For example, local takeaway restaurants were identified as places to meet friends and "hang out" as well as areas of potential risk.

Previous findings have shown that LDF's are substantially less likely to be injured in violence than MDF's (Nasr et al., 2010, Jones et al., 2011). Furthermore, in the current study, LDF's suggested that they generally felt safe within their respective communities. However, irrespective of both these facts, findings indicated that LDF's were increasingly risk aware. It is therefore possible that an increasing awareness of risk among LDF's, combined with the reduced capability of MDF's to avoid victimisation, may in some part explain why MDF's experience significantly more violence-related injuries in South Wales than LDF's.

5.6.1.4 *Gender role*

A difference in attitudes towards violence, which could be perceived as either conforming to or rejecting stereotypical definitions of femininity, was revealed in this study. The responses of LDF's suggested that violence was abhorrent, that girls who perpetrated violence were *"chavy"* and that they would only become violent in extreme circumstances. Similarly, most MDF's also expressed negative views

regarding violence; although some openly stated that they had or would resort to violence if provoked. Criminological perspectives of violent girls have tended to view them as similar to violent boys, in that they have adopted a particular type of masculinity. However, feminist researchers disagree with this argument and instead argue that gender is *"flexible, negotiated and achieved variously in different contexts"* (Irwin and Chesney-Lind, 2008: p.847). Understood as such, girls construct their femininity around their social environment; a concept that may be particularly pertinent in areas of deprivation where exposure to violence and risk of victimisation are higher (Bellis et al., 2011). For example, it has been suggested that violence can be used by some girls to create a tough femininity in order to ward off potential attackers (Morash and Chesney-Lind, 2006, Ness, 2004). Moreover, considering that girls are generally weaker physically than boys, expressing frustration and aggression towards males is more likely to end in victimisation, which may explain why girls take out their frustration and aggression on other girls (Irwin and Chesney-Lind, 2008). It has been suggested, therefore, that in order *"to fully understand community distress, disadvantage, or disorganization, scholars must understand that gender is one among many inequalities complicating childhood and adolescence"* (Irwin and Chesney-Lind, 2008: p.847).

5.6.1.5 *Trust and communication*

Research has shown that parenting has an important influence on risk-taking behaviour during adolescence (see Leather, 2009). In the current study, findings indicated that perceived levels of parental trust seemingly affected child-parent communication which, in turn, influenced risk-taking behaviours that could increase likelihood of sustaining violence-related injury. First proposed by Hirschi (1969), strong attachment to parents has been shown to protect against violent behaviour (Benda and Corwyn, 2002) and violent victimisation (Schreck and Fisher, 2004, Tillyer et al., 2011). Considering girls tend to place greater value on close relationships with caregivers than boys (Gilligan, 1993 cited in, Bright et al., 2011), strong attachment to parents is likely to be an important protective factor against girls perpetrating or falling victim to violence (Ryder, 2007). In the current study, LDF's believed their parents trusted them and that this trust was earned through prior good

behaviour. Perceiving high levels of parental trust meant that LDF's felt compelled to act responsibly so as not to disappoint their parents and risk losing the trust they had earned and the rewards which that trust provided, for example, drinking alcohol or participating in social activities with friends.

It is well documented that poverty can place a great deal of strain on the family structure and as a result, can inhibit family processes of social control, such as consistent discipline, good supervision and strong attachment (Sampson and Laub, 1994). Research has also shown that parents who perceive their community to be unsafe are more likely to employ stricter parenting practices (Hill and Herman-Stahl, 2002 cited in Herrenkohl et al., 2011). Evidence of this was clear in the current study; MDF's tended to perceive their parents as untrusting and overly strict and this led to them being frequently dishonest to their parents in order to further their own self-interests regarding, for example, alcohol use and time spent with friends or their boyfriend. Consequently, adolescents who have weak attachments to family are more likely to associate with delinquent peers (Benda and Corwyn, 2002). A strong risk factor for violent victimisation (Schreck et al., 2004), associating with delinquent peers is thought to increase risk taking behaviours in order to prove self-worth and increase feelings of acceptance and belonging amongst peers (Benda and Corwyn, 2002).

5.6.2 Adolescent males

5.6.2.1 *Alcohol regulation*

Similar to adolescent females, findings from this study revealed differences with regards to the ways in which MDM's and LDM's alcohol use was regulated. Much like LDF's, not all LDM's had drunk alcohol; however, those that had were more likely to drink small quantities of alcohol provided by and under the supervision of a guardian (evidenced to protect adolescents against experiencing violence; see Bellis et al., 2009). In contrast, MDM's generally drank unsupervised either at parties or outdoors (evidenced as increasing an adolescent's risk of experiencing violence) (ibid). Potentially as a result of these contrasts, MDM's were more likely to report drinking at an earlier age than LDM's. Age at onset of first alcoholic drink is

associated with harmful outcomes in adulthood such as heavy drinking (Pitkänen et al., 2005) and alcohol dependence (Hingson et al., 2006). Moreover, as referred to previously, an association between alcohol use and vulnerability to violent victimisation (Shepherd et al., 2006) and violence-related injury (Cherpitel and Ye, 2010) has been evidenced. Therefore, differences regarding age at onset of first alcoholic drink may potentially explain why a greater number of MDM's experience violence-related injury compared to LDM's. Furthermore, unlike adolescent females, no difference regarding the types of alcohol consumed was identified between MDM's and LDM's. Instead findings supported that of a previous UK survey which suggested that adolescent males predominantly drank beer, lager and cider (Fuller and Hawkins, 2014).

5.6.2.2 *Community bonds*

Findings suggested that exposure to crime and anti-social behaviour was rare for LDM's and as a result, LDM's felt safe within their community. In contrast, findings revealed that MDM's generally did not feel safe within their community. Although this was not true of all MDM's, all respondents openly spoke about the risks of going out locally at night; referring to incidents of violent assaults and stabbings. Fear of victimisation and the perception that others are carrying weapons have been identified as motivations for weapon carrying (Brennan and Moore, 2009), whilst the use of a weapon is significantly associated with increased severity of injury (Brennan et al., 2006). Although respondents were not directly asked whether weapon use was common in their local area, respondents were asked whether they or any of their friends had ever had to attend an ED for treatment of a violence-related injury; with details surrounding the circumstances that led to such attendance, including the presence of a weapon, enquired to further. In the current study, findings indicated that very few respondents had experienced victimisation serious enough to require ED attendance, whilst no respondent suggested weapon use was common in discussions of community violence. However, feelings of safety may still represent an important indicator of whether or not adolescent males may feel the need to carry a weapon in order to protect them self, which, for those that do, may contribute to their increased risk of sustaining injury in violence. For example, responses to a

national youth survey previously revealed that 61% of UK adolescents who carried a weapon had experienced prior victimisation (Anderson et al., 2010).

Findings also revealed that MDM's felt marginalized by the local members of their community. Attachment to the community has been suggested as an important predictor of male juvenile delinquency (Hirschi, 1969); although recent longitudinal studies have found no significant association between male violence and community attachment after accounting for other risk factors (Herrenkohl et al., 2012). It is possible, however, that marginalization does not influence risk of violence-related injury directly but rather adolescents may take such feelings into adulthood, which may influence future levels of community collective efficacy; a significant predictor of community violence (Sampson et al., 1997).

5.6.2.3 *Quality of leisure facilities*

Unlike adolescent females, who differed regarding the availability, quality/relevance and accessibility of leisure activities, adolescent males differed regarding the quality of available leisure facilities. For example, MDM's were frequently aggrieved at the poor quality of the facilities available to them; especially with regards to sports facilities such as football and rugby pitches, which were adversely affected by vandalism and unable to cope with wet weather conditions. This led to regular postponements and left MDM's with little available alternatives on weekends when other leisure activities such as after school clubs were unavailable. As discussed previously, participating in organized activities may act as a protective mechanism against violence (Huebner and Betts, 2002) by reducing the likelihood of adolescent's engaging in risky behaviours which may increase their risk of violence, such as unstructured socialising with peers (Schreck et al., 2004, Maimon and Browning, 2010) and heavy, frequent and unsupervised alcohol consumption (Bellis et al., 2010). Poor quality facilities, which frequently frustrate MDM's and hinder their participation in structured activities, may therefore increase their likelihood of engaging in behaviours such as those evidenced above and place MDM's at an increased risk of violence-related injury.

5.6.3 Study limitations

This study has three main limitations. Firstly, the aim of the study was to better understand potential mechanisms linking deprivation with increased risk of violence-related injury amongst adolescents living in South Wales. However, focus group participants were recruited from local secondary schools using convenience sampling (i.e. pupils attending PSE lessons) and therefore no attempt was made to specifically recruit most deprived adolescents who had previously sustained violence-related injury or least deprived adolescents who had not. Instead, the assumption was made that area of residence carried equal risk of violence-related injury for all adolescents who lived there. Failing to make a distinction between adolescents who had previously been injured in violence and those who had not, could potentially bias the findings if, for example, there were significant behavioural and lifestyle differences between them, irrespective of deprivation.

Secondly, by excluding private, single-sex, faith and Welsh speaking schools, the study's findings lack external validity and therefore fail to accurately represent Welsh adolescents in their entirety. However, as qualitative research typically focuses on depth rather than breadth of analysis, Bryman (2004) suggests that *"the issue of validity would seem to have little bearing on such studies"* (p.272). Instead, qualitative researchers argue that transferability of research findings is more important in this context i.e. how others are able to interpret the findings and apply them accordingly (Guba and Lincoln, 1994).

Thirdly, the study failed to recruit a secondary school from within the 'next most affluent' deprivation fifth of electoral wards in RCT. Instead, a school from within the 'median' deprivation fifth, which had the lowest available Townsend Score, was recruited as the best possible alternative. Again, if there are substantial differences between these pupils and those who attend a secondary school in the 'next most affluent' deprivation fifth in RCT, comparisons with most deprived adolescents may prove inaccurate and distinctions between the groups may be blurred.

5.7 Summary

This study revealed several lifestyle and behavioural differences between adolescents from different socioeconomic backgrounds, which may potentially explain why adolescents living in the most deprived communities are at an increased risk of violence-related injury. Although differences in risk exposure were identified among both genders, differences were more apparent between adolescent females. This conclusion offers support to the quantitative findings of Nasr et al (2010), whilst a similar gender gap in violent crime has also been identified among adolescent females living in economically deprived communities in the US (Zimmerman and Messner, 2010).

Although multiple themes have been identified in this study, which may aid in explaining why MDF's are more likely to experience violence-related injury than LDF's these themes should not be considered in isolation and are likely interrelated. For example, females have a greater fear of physical harm than males (Moore and Shepherd, 2007) and are more likely to perceive their environment as dangerous (Smith and Torstensson, 1997). Living in deprivation, MDF's are more likely to witness or experience violence and therefore their fear of physical harm is likely to be greater. This may lead to some MDF's to form a tough femininity in order to ward off potential attackers and protect themselves from physical harm (Ness, 2004, Morash and Chesney-Lind, 2006). Similarly, in an attempt to protect their children from succumbing to harm in an unsafe community, parents place strict rules on their children's social activities (Hill and Herman-Stahl, 2002). Consequently, findings from this study suggest that punitive parenting practices result in poor child-parent trust and communication. Poor trust and communication, which when combined with a lack of supervised leisure facilities that interests them could potentially lead to an increase in unstructured socialising with peers and risky behaviours such as unsupervised alcohol use and lying to parents about their location. Therefore, a combination of the factors identified in this study may increase the likelihood of MDF's experiencing violence-related injury by frequently placing them in unsupervised situations, in unsafe environments, both with alcohol and without parental knowledge. Several policy implications can be drawn from these findings in relation to violence prevention and these will be discussed in chapter six.

6 General discussion

Interpersonal violence can cause fatal and non-fatal injuries, psychological distress and result in substantial financial costs to both health and criminal justice services (Krug et al., 2002, Shepherd et al., 1990a, Bellis et al., 2012b). For these reasons, interpersonal violence is a major public health issue (Shepherd and Farrington, 1993, Krug et al., 2002). In England and Wales, over half of all violent incidents result in injury to the victim and almost one-fifth require medical treatment (Office for National Statistics, 2014c). Considering this, health practitioners have championed the use of information derived from EDs as both a robust measure of violence and an important contributor to violence prevention strategies (Shepherd and Sivarajasingam, 2005).

As discussed throughout this thesis, the public health approach to violence prevention focuses on collecting reliable information on violence, identifying risk and protective factors, developing and evaluating interventions and subsequently, implementing effective violence prevention policies (Krug et al., 2002). Historically, public health research that provides the most valuable information on the extent and causes of disease and which have successfully resulted in interventions leading to harm reduction, have followed the disease from macro to micro level i.e. from large scale aggregate data to information sourced at an individual level. A good example of this is Snow's investigation into London's cholera outbreak in the mid nineteenth century. Due to a lack of unequivocal evidence, Snow had found it difficult to gain support for his theory that cholera was water born. He had mapped out where the outbreaks occurred, however he lacked the local knowledge required to integrate his research at a community level. Snow's analysis therefore remained incomplete. By obtaining information on local residents, Snow was then able to link those who contracted the disease with the use of the Broad Street water pump, thus allowing Snow to conclude that the occurrence of cholera was associated with areas in which water pumps were located (Daniel and Markoff, 2015).

Parallels between the anecdote presented above and the public health approach to violence prevention are clearly evident and the strengths of such an approach were utilized in the current thesis. Indeed, the current thesis sought to investigate trends and determinants of violence-related injury in England and Wales by firstly examining the problem from a macro perspective before narrowing the focus to a micro level.

The thesis had two main aims: to bring clarity to national and local trends in violence in England and Wales through the use of ED data and to help better the understanding of major determinants of violence-related injury in England and Wales at both macro and micro level. These aims were accomplished in chapters two, three, four and five. A brief summary of the main research findings is presented below. The main implications of these findings will be discussed later within this chapter (paragraph 6.2).

6.1 Summary of research findings

In chapter two, age, gender and region-specific rates and trends in violence-related injury in England and Wales were determined using ED attendances between January 2005 and December 2012. Findings revealed that males, young adults (18-30 year olds) and those living in northern regions (for example, North West, North East and Wales) had the greatest risk of sustaining violence-related injury. From an ED perspective, violence was shown to have decreased nationally by 6.4% (95% CI: -6.9 to -5.8, $p<0.05$) over the study period, as well as for both genders and across all five age groups studied; although regional variations in violence-related injury were identified. For example, between 2005 and 2012, ED attendances following injury in violence in the Eastern region decreased by 12.1% (95% CI: -13.3 to -10.9, $p<0.05$) compared to a 4.9% increase in the East Midlands region respectively.

In chapter three, regional price indices for on-trade and off-trade alcohol, which included prices for beer, lager, spirits, wine and alcopops were constructed for England and Wales. Brief analysis of the price indices revealed that the real price of alcohol (adjusting for inflation) increased across both markets between January 2005

and December 2012 (although off-trade alcohol prices did decrease between 2005 and 2008). Seasonal effects were also evident with both on-trade and off-trade alcohol prices cheaper in December compared to other months. Significant interactions were also found between the economic recession and regional alcohol prices; although variations by region were again identified. For example, no association was found between the economic recession and the price of on-trade alcohol in the West Midlands region, whilst the East Midlands and South East regions were the only two regions to show a significant negative association between the economic recession and the price of off-trade alcohol. At basic prices, alcohol was generally found to be cheaper in the northern regions of England and in Wales.

Using the regional price indices for alcohol constructed in chapter three, chapter four examined the influence of the real price of alcohol on regional rates of violence-related ED attendances in England and Wales. Findings revealed that, nationally, rates of violence-related injury were negatively related to the real price of alcohol in both the on-trade and off-trade market. Gender and age group differences were also identified. Standardized beta coefficients revealed that regional differences in poverty and income inequality were substantially more impactful on rates of violence-related injury than the combined effect of alcohol price. Model-based estimates indicated, however, that increasing the real price of alcohol would still substantially reduce the number of people attending EDs for treatment of violence-related injuries in England and Wales; it was estimated that a 10% increase in alcohol price (above inflation) would lead to 60,000 fewer ED attendances per annum.

Having highlighted the importance of structural factors on violence-related injury in chapter four, chapter five built on these findings and that of previous studies (Nasr et al., 2010, Jones et al., 2011) by investigating how deprivation influences risk of violence-related injury at an individual level. With risk of violence-related injury increasing sharply during adolescence (Bellis et al., 2011), chapter five specifically examined the influence of deprivation on adolescents aged 14-16 years. Evidence was presented that supported the macro-level findings of Nasr et al (2010) by suggesting that material deprivation has a heightened influence on the risk

behaviours of adolescent females. In particular, poor alcohol regulation by parents and a lack of structured and appealing leisure activities may increase the risk of violent victimisation among this cohort.

6.2 Implications for violence prevention

The clarification of trends in violence is crucial for directing violence prevention strategies. This thesis has provided robust evidence supporting the national decline in violence identified by both the CSEW and police between 2005 and 2012. Owing to the limitations of both CSEW and police measures to accurately portray levels of violence, this finding should give confidence to policy makers that violence is decreasing in England and Wales. Furthermore, the identification of rates and trends in violence at regional level will enable policy makers to target violence prevention strategies at regions with higher violence-related injury rates and where violence is increasing. Further investigation into regions where violence-related injury is decreasing may also result in better informed preventative strategies. Moreover, unlike CSEW and police data, ED data can provide information on the seasonality of violence. Findings from this thesis revealed violence-related injury to be greater in the late spring and summer months of May and July. Strategies seeking to reduce violence should therefore look to target violent behaviour during these months when risk of victimization is greater. In addition, findings suggest a possible association between regional trends in violence-related injury and the extent of ISPs in England (see chapter two; paragraph 2.7.3.1). Measuring regional trends in violence using data derived from EDs may potentially prove a useful source for demonstrating the effectiveness of regional data sharing partnerships at reducing violence-related injuries in England and Wales.

Evidence of a north-south divide in health and prosperity is well established in England (Hacking et al., 2011). Findings from this thesis have added further support to this realisation; high rates of violence-related injury were identified in the northern regions compared to the southern (i.e. North West, North East, West Midlands, Yorkshire and Humberside and Wales). Modelling violence-related injury in chapter four revealed that, of the factors studied, poverty and income inequality were most

contributory to regional rates of violent injury. Policies that aim to reduce regional poverty and income inequality would therefore be most effective at reducing violence-related ED attendances in England and Wales. Recently, in an attempt to bridge this divide, the government announced plans to establish a *"northern powerhouse of jobs, investment, prosperity and bright futures"* by creating more than 100,000 jobs, investing in transport and bringing more than £18 billion to the north by 2030 (BBC, 2015). Evidence from this thesis suggests that policies such as these, which seek to address the north-south divide in health and prosperity, may lead to substantial reductions in violence nationally; although such policies would need to be implemented long-term and, therefore, are unlikely to result in immediate reductions in violence.

One policy option that could be implemented immediately would be to increase the real price of alcohol. Indeed, findings from this thesis have attested to the potential reductive impact that increasing the price of alcohol could have on rates of violence-related injury in England and Wales. Increasing the real price of alcohol is therefore a legitimate violence prevention policy that could be introduced nationally and would have an immediate influence on rates of violence. Modelling studies in England suggest that MUP would be most effective at reducing alcohol use among harmful drinkers, without disproportionately penalising more moderate drinkers, including, those on lower incomes (ibid, Meier et al., 2010). However, in order for an increase in alcohol price to be most effective at reducing violence, it must raise the real price of alcohol in both markets. Therefore, while much of the focus on alcohol pricing has been in relation to MUP, findings from this thesis suggest that MUP may not be the most effective policy for reducing violence. MUP targets the cheapest alcohol which is most commonly found in the off-trade market and would therefore have little impact on the price of on-trade alcohol; shown within this thesis to be more influential on rates of violence-related injury. Therefore, to effectively reduce violence-related injury in England and Wales, policy makers should seek to reform the current alcohol taxation system so that all types of alcohol are taxed according to their strength (similar to beer), as suggested by both the British Medical Association and Institute for Fiscal Studies (British Medical Association, 2012, Griffith et al., 2013b). Not only would such a policy impact on the price of alcohol in both markets,

evidence suggests it would reduce consumption by heavier drinkers to a greater extent than a £0.45 minimum unit price and would raise close to £1 billion in additional tax revenue (ibid). The substantial tax revenue gained through such a policy, in comparison to the £290 million that would be lost through MUP (ibid), would be at the government's disposal and could be used to offset the costs to the NHS, police and criminal justice services that result from the misuse of alcohol.

At micro level, findings from this thesis suggest that increasing the price of alcohol may also reduce risky drinking behaviours among adolescents. Indeed, findings from chapter five revealed that deprived adolescents were more likely to buy alcohol themselves or get others (excluding parents) to buy it on their behalf. Consequently, deprived adolescents were more likely to drink stronger alcohols and drink unsupervised (particularly most deprived adolescent females); most often to avoid detection by parents. Previous research in England has also shown adolescents (aged 15-16 years) with incomes over £30 a week were significantly more likely to experience violence when drunk compared to those on incomes equal to or less than £10 (Bellis et al., 2009). Therefore, increasing the price of alcohol, particularly cheap high strength alcohols, would reduce its affordability and make purchasing alcohol more difficult for adolescents; most of whom are likely to have minimal disposable income. However, although alcohol pricing policies may make purchasing alcohol more difficult for some adolescents, it is less likely to impact those who obtain alcohol from their parents. Therefore, pricing policies alone may not have the desired effect at reducing violence-related harm among adolescents when price is less of an obstacle to obtaining alcohol. In order to effectively reduce violence-related harm among adolescents, alcohol pricing policies should therefore be used in conjunction with family and community interventions.

The consumption of alcohol is an established norm for most adolescents by age fifteen (Bellis et al., 2011, Atkinson et al., 2011). Findings from this thesis suggest that improving alcohol socialisation among adolescents could prove an effective intervention at reducing alcohol-related harms, including violence-related injuries. For example, findings from chapter five suggest that being provided with small quantities of alcohol by parents, within a supervised environment, may protect adolescents from experiencing violence-related injury and other alcohol-related

harms. Support for this conclusion can be found in England, where studies have shown parental provision of alcohol significantly reduced likelihood of binge drinking, drinking unsupervised, experiencing alcohol-related violence and having alcohol-related regretted sex (Bellis et al., 2007, Bellis et al., 2009, Bellis et al., 2010). In Wales, school-based alcohol education is delivered as part of the PSE framework, which focuses on increasing awareness among adolescents regarding the effects and risks of consuming alcohol (Welsh Government, 2008). Previous research has suggested, however, that alcohol socialization is more effective when done by parents (Foxcroft and Lowe, 1997). In line with the recommended guidance on alcohol consumption among children, interventions seeking to reduce risky drinking behaviours among adolescents, such as heavy episodic drinking and drinking in unsupervised locations, both of which are associated with an increased risk of violence (Bellis et al., 2009), should aim to better promote the role of parents in their child's alcohol socialization (Donaldson, 2009). For example, applying strict alcohol-specific rules (Van Der Vorst et al., 2005) and limiting the availability of alcohol (Ryan et al., 2010) are but a few examples of parenting strategies that have been evidenced to significantly reduce alcohol consumption among adolescents. Based on the findings from this thesis, encouraging parents to promote safe and responsible alcohol consumption within a supervised environment, could be an effective method of reducing alcohol-related harm if targeted at families living in deprived communities; where alcohol regulation is poor and risk of injury is greater.

Boredom is one of the main motivations for alcohol consumption among adolescents (Coleman and Cater, 2005) and has been associated with an increased likelihood of engaging in risky drinking practices such as frequent, heavy or unsupervised alcohol consumption (Bellis et al., 2010). Victimization is said to occur when motivated offenders meet appropriate targets in the absence of effective guardians (Hindelang et al., 1978). Some studies have suggested, therefore, that regular participation in activities which result in increased adult supervision (for example, attending church, participating in sports clubs, engaging with hobbies or undertaking part-time employment) may protect adolescents from experiencing alcohol-related harms (Bellis et al., 2010), engaging in violent behaviours (Huebner and Betts, 2002, Heller, 2014) and witnessing community violence (Gardner and Brooks-Gunn,

2009). Findings from chapter five suggest that deprivation may disproportionately influence risk of violence-related injury among adolescent females compared with adolescent males; potentially due to the limited availability of appealing leisure activities that increase the amount of time spent socialising with peers in an unstructured and unsupervised manner, which has previously been shown to increase risk of violent victimisation (Maimon and Browning, 2010). Several studies in the US have reported similar findings. For example, Linville and Huebner identified a negative association between participation in extra-curricular activities and fighting amongst adolescent females but not adolescent males (Linville and Huebner, 2005). Molnar and colleagues, who compared longitudinal data with responses to sixty-one semi-structured interviews seeking to identify ways in which girls protected themselves from violence, found that nearly 30% of the sample cited after-school activities as a mechanism used to prevent victimization (Molnar et al., 2005). Findings from this thesis suggest, therefore, that interventions that aim to provide deprived adolescents with access to structured and supervised activities, particularly most deprived adolescent females, could potentially reduce violence-related harm among this cohort.

A major Government programme in England, 'myplace' centres have been established in disadvantaged communities with the aim of providing *"world class youth facilities driven by the active participation of young people and their views and needs"* (Spence et al., 2011: p.7). Although the impact of these centres at reducing community violence is unknown, a recent evaluation revealed that centres had attracted significant use from local young people *"as a place for socialising, relaxing, doing homework or participating in structured programmes and workshops"* (ibid: p.8). In Wales, local authorities have a statutory duty to both assess and, where necessary, secure sufficient play opportunities for children (Welsh Government, 2014b). Policy makers should therefore seek to examine the feasibility of introducing a similar scheme in Wales and should place particular emphasis on targeting adolescent females living in the most deprived communities. An important aspect of the myplace programme is the engagement of young people in the planning and design of centres (Spence et al., 2011). Involving adolescents in decision making processes may prove vital to the success of similar schemes. In addition, the

development of similar schemes in Wales may increase levels of community attachment among most deprived adolescent males by providing them with a supervised location to spend time with friends without fearing for personal safety or feeling marginalized by other members of the community.

6.3 Future research

Findings from this thesis have clarified national and local trends in violence and have helped improve understanding of determinants of violence at both macro and micro level. Based on these findings, a number of additional areas of investigation have been identified which require further exploration in order to better understand correlates and causes of violence-related injuries in England and Wales.

Based on the findings from chapter two, a better understanding of the causes of regional variations in both rates and trends in violence are needed. Future studies should seek to investigate the reasons behind falling violence trends in particular regions, in order to better inform future violence prevention strategies. In doing so, prevention efforts can be targeted in regions with higher rates of violence and where violence is increasing. Well implemented ISPs, for example, have been shown to reduce violence in Cardiff relative to fourteen similar control cities where ISPs were not implemented (see Florence et al., 2011). Examination of violence trends presented in this thesis revealed that the East Midlands was the only region to experience a significant increase in violence over the study period and was one of only two regions that were failing to share information for violence prevention purposes; the second being the North East of England, which had the lowest estimated reduction in violence over the study period (Centre for Public Innovation, 2012).

Violence has been shown to be seasonal in England and Wales (Sivarajasingam et al., 2002, Sivarajasingam et al., 2009, Sivarajasingam et al., 2014). This was supported by findings from chapters two and four. To date, few studies have sought to investigate why rates of violent injury are higher in the summer months. Although some scholars have attributed higher rates of violence to longer daylight hours that

result in more people spending longer outdoors (Shepherd, 1990), research has shown violent injuries are not linked to ambient conditions such as temperature, rainfall or number of sunlight hours (Sivarajasingam et al., 2004). Therefore, future research should seek to investigate the reasons behind the seasonality of violence. In doing so, this could lead to the exploration of targeted interventions aimed at reducing violence-related injuries during the summer months when risk of violence is significantly greater in comparison with other seasons and could lead to substantial reductions in serious violence.

This thesis has revealed an association between the price of alcohol and rates of violence-related injury in England and Wales; findings suggest an annual reduction of over 60,000 ED attendances following a 10% increase in both on-trade and off-trade alcohol prices (above inflation). This finding is consistent with previous research which estimated that the introduction of alcohol MUP would lead to a reduction in assault-related hospital admissions in England (Purshouse et al., 2010). Future research should therefore seek to investigate the impact that different national alcohol pricing policies would have on the number of people attending EDs for treatment following injury in violence. Although some studies have begun to estimate this, they have done so using assault-related hospital admissions data; which are less common than ED attendances and therefore represent much smaller numbers of patients. Removing a substantial proportion of violence-related ED attendances per annum, especially during peak times (for example, Friday and Saturday nights when violence-related attendances are highest, see Sivarajasingam et al., 2014b), could significantly ease the flow of patients through EDs; potentially decreasing waiting times and freeing up resources.

Some studies in the US have shown that adolescents who engage in regular organised activities (for example, attend church, participate in sports clubs or have part-time employment) are less likely to fall victim to violence (see Huebner and Betts, 2002, Heller, 2014, Linville and Huebner, 2005, Molnar et al., 2005). In England, research has shown a similar association with regards to engaging in risky drinking behaviours (Bellis et al., 2010). As discussed in chapter one, participation in organised activities has been suggested to reduce an adolescent's 'window of

opportunity' for such behaviours (Wichstrøm and Wichstrøm, 2009). Previous research undertaken in South Wales has shown that, with regards to the risk of sustaining violence-related injury, adolescent females are increasingly sensitive to the effects of deprivation (Jones et al., 2011, Nasr et al., 2010). In this thesis, findings presented in chapter five suggest that deprived adolescent females living in South Wales tended not to participate in organised activities; due to issues surrounding availability, quality/relevance and accessibility. Future research should seek to examine the possible link between risk of violence victimisation and participation in organised activities, especially in relation to the potential mechanisms involved i.e. does participation offer protection from violence purely through increased supervision by an adult or can participation result in other benefits such as better conflict resolution skills for example. A better understanding of this potential link could lead to the exploration of targeted interventions and may be particularly effective at reducing violence-related injuries among deprived adolescent females.

6.4 Concluding remarks

This thesis has illustrated the benefits of employing a macro to micro approach to investigating trends and determinants of violence-related injury in England and Wales. It has shown that information derived from EDs can be used to triangulate measurement with police and crime survey data in order to clarify national trends in violence. The thesis revealed that violence-related injury in England and Wales was significantly associated with the real price of alcohol and that a price increase in both markets would substantially reduce violence-related harm. Although increasing the real price of alcohol could lead to an immediate reduction in violence-related injury, evidence from this thesis suggested that policies that reduced regional poverty and income inequality would be more impactful on violence-related harm in the long-term. In addition, evidence was presented that suggested material deprivation has a heightened influence on the risk behaviours of adolescent females. In particular, poor alcohol regulation by parents and a lack of structured and appealing leisure activities may increase risk of violence-related injury among this cohort.

7 References

ADAMS, J. & BEENSTOCK, J. 2012. Price discounts on alcohol in a city in northern England. *Alcohol and Alcoholism,* 47**,** 187-190.

AGNEW, R. 1992. Foundation for a general strain theory of crime and delinquency. *Criminology,* 30**,** 47-88.

ALL WALES CHILD PROTECTION PROCEDURES. 2008. Available: http://www.awcpp.org.uk/wp-content/uploads/2014/03/All-Wales-Child-Protection-Procedures-2008.pdf [Accessed 4th July 2012].

ANDERSON, F., WORSLEY, R., NUNNEY, F., MAYBANKS, N. & DAWES, W. 2010. Youth survey 2009: research conducted for the Youth Justice Board for England and Wales.

ARIEL, B., WEINBORN, C. & BOYLE, A. 2013. Can routinely collected ambulance data about assaults contribute to reduction in community violence? *Emergency Medicine Journal*.

ASTHANA, S., HALLIDAY, J., BRIGHAM, P. & GIBSON, A. 2002. *Rural deprivation and service need: a review of the literature and an assessment of indicators for rural service planning*, South West Public Health Observatory Bristol.

ATKINSON, A., SUMNALL, H. & BELLIS, M. 2011. Substance use among 15-16 year olds in the UK: Key findings from the 2011 European School Survey Project on Alcohol and other Drugs. Available: http://www.cph.org.uk/wp-content/uploads/2012/08/substance-use-among-15-16-year-olds-in-the-uk.pdf [Accessed 5th June 2013].

BABOR, F., MENDELSON, J., GREENBERG, I. & KUEHNLE, J. 1978. Experimental Analysis of the 'Happy Hour': Effects of Purchase Price on Alcohol Consumption. *Psychopharmacology,* 58**,** 35-41.

BAKER, R., BANKART, M., RASHID, A., BANERJEE, J., CONROY, S., HABIBA, M., HSU, R., WILSON, A., AGARWAL, S. & CAMOSSO-STEFINOVIC, J. 2011. Characteristics of general practices associated with emergency department attendance rates: a cross-sectional study. *BMJ Quality & Safety,* 20**,** 953-958.

BALL-ROKEACH, S. 1973. Values and violence: a test of the subculture of violence thesis. *American Sociological Review***,** 736-749.

BALTAGI, B. 2008. *Econometric analysis of panel data,* Chichister, John Wiley & Sons Ltd.

BANDYOPADHYAY, S., BHATTACHARYA, S. & SENSARMA, R. 2011. An analysis of the factors determining crime in England and Wales: a quantile regression approach. Birmingham University: Department of Economics.

BANERJEE, J., SQUIRES, J. & PARKINSON, T. 2010. Public perceptions of alcohol pricing: market research report.

BARRETT, D. 2013. One surveillance camera for every 11 people in Britain, says CCTV survey. *The Telegraph*, 10 July.

BBC. 2007. 7 July Bombings: overview. Available: news.bbc.co.uk/1/shared/spl/hi/uk/05/london_blasts/what_happend/html/ [Accessed 2nd January 2015].

BBC. 2015. George Osborne: northern powerhouse vital for UK. Available: http://www.bbc.co.uk/news/uk-politics-30730632 [Accessed 1st February 2015].

BELLIS, M., HUGHES, K., ANDERSON, Z., TOCQUE, K. & HUGHES, S. 2008. Contribution of violence to health inequalities in England: demographics and trends in emergency hospital admissions for assault. *Journal of Epidemiology and Community Health,* 62**,** 1064-1071.

BELLIS, M., HUGHES, K., MORLEO, M., TOCQUE, K., HUGHES, S., ALLEN, T., HARRISON, D. & FE-RODRIGUEZ, E. 2007. Predictors of risky alcohol consumption in schoolchildren and their implications for preventing alcohol-related harm. *Substance Abuse Treatment, Prevention, and Policy,* 2**,** 15.

BELLIS, M., HUGHES, K., PERKINS, C. & BENNETT, A. 2012a. Protecting people, promoting health: a public health approach to violence prevention fo England. Liverpool.

BELLIS, M., HUGHES, K., WOOD, S., WYKE, S. & PERKINS, C. 2011. National five-year examination of inequalities and trends in emergency hospital admission for violence across England. *Injury Prevention,* 17**,** 319-325.

BELLIS, M., LECKENBY, N., HUGHES, K., LUKE, C., WYKE, S. & QUIGG, Z. 2012b. Nighttime assaults: using a national emergency department monitoring system to predict occureence, target prevention and plan services. *BMC Public Health,* 12**,** 746-58.

BELLIS, M., MORLEO, M., HUGHES, K., DOWNING, J., WOOD, S., SMALLTHWAITE, L. & COOK, P. 2010. A cross-sectional survey of compliance with national guidance for alcohol consumption by children: measuring risk factors, protective factors and social norms for excessive and unsupervised drinking. *BMC Public Health,* 10.

BELLIS, M., PHILLIPS-HOWARD, P., HUGHES, K., HUGHES, S., COOK, P., MORLEO, M., HANNON, K., SMALLTHWAITE, L. & JONES, L. 2009. Teenage drinking, alcohol availability and pricing: a cross-sectional study of risk and protective factors for alcohol-related harms in school children. *BMC Public Health,* 9.

BENDA, B. & CORWYN, R. 2002. The effect of abuse in childhood and in adolescence on violence among adolescents. *Youth & Society,* 33**,** 339-365.

BERG, B. & LUNE, H. 2004. *Qualitative research methods for the social sciences*, Pearson Boston, MA.

BERNAT, D., OAKES, J., PETTINGELL, S. & RESNICK, M. 2012. Risk and direct protective factors for youth violence: results from the National Longitudinal Study of Adolescent Health. *American Journal of Preventive Medicine,* 43**,** S57-S66.

BLACK, H., GILL, J. & CHICK, J. 2011. The price of a drink: levels of consumption and price paid per unit of alcohol by Edinburgh's ill drinkers with a comparison to wider alcohol sales in Scotland. *Addicition,* 106**,** 729-736.

BODEN, J., FERGUSSON, D. & HORWOOD, L. 2012. Alcohol misuse and violent behaviour: Findings from a 30-year longitudinal study. *Drug and Alcohol Dependence,* 122**,** 135-141.

BOHNERT, A., FREDRICKS, J. & RANDALL, E. 2010. Capturing unique dimensions of youth organized activity involvement theoretical and

methodological considerations. *Review of Educational Research,* 80**,** 576-610.
BOSELEY, S. 2013. Minimum unit price for alcohol proposal shelved. *The Guardian*, 17th July. Available: http://www.theguardian.com/society/2013/jul/17/minimum-unit-price-alcohol-shelved [Accessed 22nd June 2015].
BOYLE, A., SNELLING, K., WHITE, L., ARIEL, B. & ASHELFORD, L. 2013. External validation of the Cardiff model of information sharing to reduce community violence: natural experiment. *Emergency Medicine Journal,* 30**,** 1020-1023.
BOYLE, A. & TODD, C. 2003. Incidence and prevalence of domestic violence in a UK emergency department. *Emergency Medicine Journal,* 20**,** 438-442.
BRAGA, A. & BOND, B. 2008. Policing crime and disorder hot spots: A randomized controlled trial. *Criminology,* 46**,** 577-607.
BRAUN, V. & CLARKE, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology,* 3**,** 77-101.
BRENNAN, A., MENG, Y., HOLMES, J., HILL-MCMANUS, D. & MEIER, P. 2014. Potential benefits of minimum unit pricing for alcohol versus a ban on below cost selling in England 2014: modelling study. *British Medical Journal,* 349**,** g5452.
BRENNAN, I. & MOORE, S. 2009. Weapons and violence: a review of theory and research. *Aggression and Violent Behavior,* 14**,** 215-225.
BRENNAN, I., MOORE, S. & SHEPHERD, J. 2006. Non-firearm weapon use and injury severity: priorities for prevention. *Injury Prevention,* 12**,** 395-399.
BRENNAN, I., MOORE, S. & SHEPHERD, J. 2010. Risk factors for violent victimisation and injury from six years of the british crime survey. *International Review of Victimology,* 17**,** 209-229.
BRIGHT, C., WILLIAMS, J. & PETERSEN, G. 2011. Gender differences in risk and protective factors associated with youth violence. *In:* T. HERRENKOHL, E. AISENBERG, J. WILLIAMS, & J. JENSEN (eds.) *Violence in context: current evidence on risk, protection, and prevention.* New York: Oxford University Press.
BRIMICOMBE, A. & CAFE, R. 2012. Beware, win or lose: Domestic violence and the World Cup. *Significance,* 9**,** 32-35.
BRITISH BEER AND PUB ASSOCIATION. 2010. *Cheer for beer, as World Cup and weather boosts beer sales* [Online]. Available: http://www.beerandpub.com/news/cheer-for-beer-as-world-cup-and-weather-boosts-beer-sales [Accessed 11th April 2014].
BRITISH BEER AND PUB ASSOCIATION. 2015. *Alcohol consumption data* [Online]. British Beer and Pub Association. Available: http://www.beerandpub.com/industry-briefings/alcohol-consumption-data [Accessed 5th January 2015].
BRITISH MEDICAL ASSOCIATION. 2012. Reducing the affordability of alcohol: a briefing from the BMA Board of Science. Available: bma.org.uk/-/media/files/pdfs/.../alcoholreducingaffordability.pdf [Accessed 18th May 2013].
BROCKMAN, R., JAGO, R., FOX, K., THOMPSON, J., CARTWRIGHT, K. & PAGE, A. 2009. Get off the sofa and go and play": family and socioeconomic

influences on the physical activity of 10-11 year old children. *BMC public health,* 9**,** 1-7.
BROMLEY, R., THOMAS, C. & MILLIE, A. 2000. Exploring safety concerns in the night-time city: revitalising the evening economy. *Town Planning Review,* 71**,** 71-96.
BROOKS, C. 2008. *Introductory econometrics for finance,* Cambridge, Cambridge university press.
BROWN, K. 2014. The UK chancellor should resist industry lobbying to scrap annual rise in alcohol duty. *British Medical Journal,* 348.
BRYMAN, A. 2004. *Social research methods,* New York, Oxford University Press.
BRYMAN, A. 2012. *Social research methods,* New York, Oxford University Press.
BULMAN, J., KUBASCIKOVA-MULLEN, J. & WHITING, S. 2014. Living costs and food survey technical report for survey year: January – December 2013. Available: http://www.ons.gov.uk/ons/guide-method/method-quality/specific/social-and-welfare-methodology/living-costs-and-food-survey/index.html [Accessed 1st February 2014].
BURGHER, M., RASMUSSEN, V. & RIVETT, D. 1992. The European network of health promoting schools: the alliance of education and health. Copenhagen.
BUSHMAN, B. 1997. Effects of alcohol on human aggression: validity of proposed explanations. *In:* M. GALANTER (ed.) *Recent developments in alcoholism.* New York: American Society of Addiction Medicine.
BUSHMAN, B. & COOPER, H. 1990. Effects of alcohol on human aggression: an integrative research review. *Psychological Bulletin,* 107**,** 341-354.
BUSHMAN, B., GIANCOLA, P., PARROTT, D. & ROTH, R. 2012. Failure to consider future consequences increases the effects of alcohol on aggression. *Journal of Experimental Social Psychology,* 48**,** 591-595.
CARDIFF UNIVERSITY 2015. Dental school ethical guidance. Available: http://www.cardiff.ac.uk/dentistry/research/ethics [Accessed 9th January 2012].
CCTV USER GROUP. 2009. *"Exploding the Myths about Public Area CCTV" : The CCTV User Group Public Area CCTV Camera Survey – January 2009* [Online]. CCTV User Group. Available: https://www.cctvusergroup.com/downloads/file/Exploding%20the%20Myths%20CCTV%20User%20Group%20Survey.pdf [Accessed 11th March 2013].
CENTRE FOR PUBLIC INNOVATION. 2012. Information Sharing to tackle violence: audit of progress on delivering the Coalition Commitment 2012. Available: http://www.publicinnovation.org.uk/wp-content/uploads/2013/01/AE-Data-Sharing-Audit-2012.pdf [Accessed 23rd June 2013].
CHERPITEL, C. & YE, Y. 2010. Alcohol and violence-related injuries among emergency room patients in an international perspective. *Journal of the American Psychiatric Nurses Association,* 16**,** 227-235.
CLARKSON, C., CRETNEY, A., DAVIS, G. & SHEPHERD, J. 1994. Assaults: the relationship between seriousness, criminalisation and punishment. *Criminal Law Review,* 4**,** 4-20.
COATE, D. & GROSSMAN, M. 1988. Effects of alcoholic beverage prices and legal drinking ages on youth alcohol use. *Journal of Law and Economics,* 31**,** 145.

COBBINA, J., MILLER, J. & BRUNSON, R. 2008. Gender, neighborhood danger, and risk-avoidance strategies among urban African-american youths. *Criminology,* 46**,** 673-709.

COLEMAN, L. & CATER, S. 2005. Underage 'binge' drinking: a qualitative study into motivations and outcomes. *Drugs: Education, Prevention, and Policy,* 12**,** 125-136.

COLLIER, R. 1998. *Masculinities, crime and criminology*, London, Sage.

COLLIS, J., GRAYSON, A. & JOHAL, S. 2010. Econometric analysis of alcohol consumption in the UK. London: HM Revenue and Customs.

COMMUNITIES AND LOCAL GOVERNMENT. 2008. Aspiration and attainment amongst young people in deprived communities. Available: http://webarchive.nationalarchives.gov.uk/20090114000528/http:/cabinetoffice.gov.uk/media/109339/aspirations_evidence_pack.pdf [Accessed 17th January 2015].

COMPETITION COMMISSION 2008. The supply of groceries in the UK market investigation. Available: http://webarchive.nationalarchives.gov.uk/20140402141250/www.competition-commission.org.uk/our-work/directory-of-all-inquiries/groceries-market-investigation-and-remittal/final-report-and-appendices-glossary-inquiry [Accessed 22nd November 2013].

COOK, P. 2007. *Paying the tab: the costs and benefits of alcohol control,* Princeton, Princeton University Press,.

DANIEL, P. & MARKOFF, D. 2015. *Dr John Snow and reverend Whitehead* [Online]. City of Westminster Archives. Available: www.choleraandthethames.co.uk/cholera-in-london/cholera-in-soho/ [Accessed 10th December 2014].

DEAS, I., ROBSON, B., WONG, C. & BRADFORD, M. 2003. Measuring neighbourhood deprivation: a critique of the index of multiple deprivation. *Environment and Planning C,* 21**,** 883-904.

DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS. 2013. Family food datasets. Available: http://webarchive.nationalarchives.gov.uk/20130103014432/http://www.defra.gov.uk/statistics/foodfarm/food/familyfood/datasets/ [Accessed 4th May 2014].

DEPARTMENT OF HEALTH. 2003. Confidentiality NHS code of practice. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/200146/Confidentiality_-_NHS_Code_of_Practice.pdf [Accessed 17th May 2014].

DEPARTMENT OF HEALTH. 2012. Information sharing to tackle violence: guidance for community safety partnerships on engaging with the NHS. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212949/CSP-Guidance-September-Final.pdf [Accessed 11th October 2013].

DEPARTMENT OF HEALTH. 2013. *A&E attendances* [Online]. The National Archives. Available: http://webarchive.nationalarchives.gov.uk/20130107105354/http://www.dh.gov.uk/en/Publicationsandstatistics/Statistics/Performancedataandstatistics/AccidentandEmergency/index.htm [Accessed 3rd October 2013].

DILLMAN, D. 2000. Introduction to tailored design. *In:* D. DILLMAN (ed.) *In Mail and Internet Surveys: The Tailored Design Method.* New York: Wiley.

DONALDSON, L. 2009. Guidance on the consumption of alcohol by children and young people. Available: http://www.cph.org.uk/wp-content/uploads/2013/09/Guidance-on-the-consumption-of-alcohol-by-children-and-young-people.pdf [Accessed 8th August 2013].

DUKE, A., GIANCOLA, P., MORRIS, D., HOLT, J. & GUNN, R. 2011. Alcohol dose and aggression: another reason why drinking more is a bad idea. *Journal of Studies on Alcohol and Drugs,* 72**,** 34.

FAGAN, J. 1990. Intoxication and aggression. *Crime and Justice: A Review of Research,* 13**,** 241-320.

FAGAN, J. 1993. Interactions among drugs, alcohol, and violence. *Health Affairs,* 12**,** 65-79.

FARRINGTON, D. & PAINTER, K. 2004. *Gender differences in risk factors for offending, Home Office Findings 196.* London. Home Office.

FARRINGTON, D. & TTOFI, M. 2011. Bullying as a predictor of offending, violence and later life outcomes. *Criminal Behaviour and Mental Health,* 21**,** 90-98.

FIELD, R., MILES, J. & FIELD, Z. 2012. *Discovering statistics using R,* London, Sage.

FLORENCE, C., SHEPHERD, J., BRENNAN, I. & SIMON, T. 2011. Effectiveness of anonymised information sharing and use in health service, police, and local government partnership for preventing violence related injury: experimental study and time series analysis. *British Medical Journal,* 342:d3313.

FORSYTH, A. 2010. Front, side, and back-loading: patrons' rationales for consuming alcohol purchased off-premises before, during, or after attending nightclubs. *Journal of substance use,* 15**,** 31-41.

FOSTER, J., READ, D. & KARUNANITHI, S. 2010. Why do people drink at home? *Journal of Public Health,* 32**,** 512-518.

FOXCROFT, D. R. & LOWE, G. 1997. Adolescents' alcohol use and misuse: the socializing influence of perceived family life. *Drugs: Education, Prevention, and Policy,* 4**,** 215-229.

FREEDMAN, D. A. 1999. Ecological inference and the ecological fallacy. *International Encyclopedia of the social & Behavioral sciences,* 6**,** 4027-4030.

FULLER, E. & HAWKINS, V. 2014. Smoking, drinking and drug use among young people in England in 2013. Available: http://www.hscic.gov.uk/catalogue/PUB14579/smok-drin-drug-youn-peop-eng-2013-rep.pdf [Accessed 17th November 2014].

GALLET, C. 2007. The demand for alcohol: a meta-analysis of elasticities. *Australian Journal of Agricultural and Resource Economics,* 51**,** 121-135.

GARDNER, M. & BROOKS-GUNN, J. 2009. Adolescents' exposure to community violence: are neighborhood youth organizations protective? *Journal of Community Psychology,* 37**,** 505-525.

GERRARD, G. 2011. *The police chiefs blog* [Online]. Association of Chief Police Officers. Available: http://www.acpo.police.uk/ThePoliceChiefsBlog/20110303GraemeGerrardsCCTVblog.aspx [Accessed 4th My 2013].

GIACOMANTONIO, C., SUTHERLAND, A., BOYLE, A., SHEPHERD, J., KRUITHOF, K. & DAVIES, M. 2014. Injury surveillance: using A&E data for crime reduction: guidance for police analysts and practitioners. Available: http://www.college.police.uk/About/What-do-we-offer/Documents/RR-851-CoP_AE_Guidance_report_final.pdf [Accessed 20th January 2015].

GIANCOLA, P. 2002. Irritability, acute alcohol consumption and aggressive behavior in men and women. *Drug and Alcohol Dependence,* 68**,** 263-274.

GIANCOLA, P. 2006. Influence of Subjective Intoxication, Breath Alcohol Concentration, and Expectancies on the Alcohol- Aggression Relation. *Alcoholism: Clinical and Experimental Research,* 30**,** 844-850.

GIANCOLA, P., DUKE, J. & RITZ, K. 2011. Alcohol, violence, and the myopia model: preliminary findings and implications for prevention. *Addictive Behaviours,* 36**,** 1019-1022.

GILL, P., STEWART, K., TREASURE, E. & CHADWICK, B. 2008. Methods of data collection in qualitative research: interviews and focus groups. *British Dental Journal,* 204**,** 291-295.

GILLIGAN, C. 1993. In a different voice: psychological theory and women's development. *In:* A. DOBRIN (ed.) *Being good and doing right: readings in moral development.* Lanham, MD: University Press of America.

GILLIGAN, J. 2003. Shame, guilt, and violence. *Social Research***,** 1149-1180.

GODDARD, E. 2001. *Obtaining information about drinking through surveys of the general population*, London: Office for National Statistics.

GOODWIN, V. & SHEPHERD, J. 2000. The development of an assault patient questionnaire to allow accident and emergency departments to contribute to Crime and Disorder Act local crime audits. *Journal of Accident & Emergency Medicine,* 17**,** 196-198.

GRAHAM, K. 1980. Theories of intoxicated aggression. *Canadian Journal of Behavioural Science,* 12**,** 141-158.

GRAHAM, K. & HOMEL, R. 1997. Creating safer bars. *In:* M. PLANT, E. SINGLE, & T. STOCKWELL (eds.) *Alcohol: Minimising the Harm - What Works?* London: Free Association.

GRAHAM, K., LEONARD, K., ROOM, R., WILD, T., PIHL, R., BOIS, C. & SINGLE, E. 1998. Current directions in research on understanding and preventing intoxicated aggression. *Alcohol and Aggression,* 93**,** 659-676.

GRAHAM, K. & WELLS, S. 2001. Aggression among young adults in the social context of the bar. *Addicition Research and Theory,* 9**,** 193-219.

GRIFFITH, R. & LEICESTER, A. 2010. The impact of introducing a minimum price on alcohol in Britain: IFS Briefing Note 109. London. Institute for Fiscal Studies.

GRIFFITH, R., LEICESTER, A. & O'CONNELL, M. 2013a. Price-based measures to reduce alcohol consumption. *IFS Briefing Note BN138.* Institute for Fiscal Studies.

GRIFFITH, R., LEICESTER, A. & O'CONNELL, M. 2013b. Reforms to alcohol taxes would be more effective than minimum unit pricing. Institute for Fiscal Studies.

GROSSMAN, M. & MARKOWITZ, S. 1999. Alcohol regulation and violence on college campuses. *NBER Working Paper 7129*.

GRUENEWALD, P. & NEPHEW, T. 1994. Drinking in California: theoretical and empirical analyses of alcohol consumption patterns. *Addiction,* 89**,** 707-723.

GRUENEWALD, P., PONICKI, W., HOLDER, H. & ROMELSJÖ, A. 2006. Alcohol prices, beverage quality, and the demand for alcohol: quality substitutions and price elasticities. *Alcoholism: Clinical and Experimental Research,* 30**,** 96-105.

GUBA, E. & LINCOLN, Y. 1994. Competing paradigms in qualitative research. *In:* DENZIN, N. & LINCOLN, Y. (eds.) *Handbook of qualitative research.* California: Sage.

HAUSMAN, J. 1978. Specification tests in econometrics. *Econometrica,* 46**,** 1251-1271.

HEALTH AND SOCIAL CARE INFORMATION CENTRE 2013a. Hospital episode statistics: admitted patient care, England 2012-13. Health and Social Care Information Centre.

HEALTH AND SOCIAL CARE INFORMATION CENTRE 2013b. Statistics on alcohol: England, 2013. Available: http://www.hscic.gov.uk/catalogue/PUB10932/alc-eng-2013-rep.pdf [Accessed 3rd October 2014].

HEALTH AND SOCIAL CARE INFORMATION CENTRE. 2014. Statistics on alcohol: England, 2014. Available: http://www.hscic.gov.uk/catalogue/PUB14184/alc-eng-2014-rep.pdf [Accessed 26th July 2014].

HEALTH AND SOCIAL CARE INFORMATION CENTRE. 2015. *Hospital episodic statistics* [Online]. Health and Social Care Information Centre. Available: http://www.hscic.gov.uk/hes [Accessed 20th November 2013].

HEARY, C. & HENNESSY, E. 2002. The use of focus group interviews in pediatric health care research. *Journal of Pediatric Psychology,* 27**,** 47-57.

HEEB, J., GMEL, G., ZURBRÜGG, C., KUO, M. & REHM, J. 2003. Changes in alcohol consumption following a reduction in the price of spirits: a natural experiment in Switzerland. *Addicition,* 98**,** 1433-1446.

HELLER, S. 2014. Summer jobs reduce violence among disadvantaged youth. *Science,* 346**,** 1219-1223.

HENRY, D., TOLAN, P., GORMAN-SMITH, D. & SCHOENY, M. 2012. Risk and direct protective factors for youth violence: results from the centers for disease control and prevention's multisite violence prevention project. *American Journal of Preventive Medicine,* 43**,** S67-S75.

HERRENKOHL, T., AISENBERG, E., WILLIAMS, J. & JENSON, J. 2011. *Violence in context: current evidence on risk, protection, and prevention,* New York, Oxford University Press.

HERRENKOHL, T., LEE, J. & HAWKINS, J. 2012. Risk versus direct protective factors and youth violence: Seattle social development project. *American Journal of Preventive Medicine,* 43**,** S41-S56.

HERRENKOHL, T. I., MAGUIN, E., HILL, K. G., HAWKINS, J. D., ABBOTT, R. D. & CATALANO, R. F. 2000. Developmental risk factors for youth violence. *Journal of Adolescent Health,* 26**,** 176-186.

HERTTUA, K., MÄKELÄ, P., MARTIKAINEN, P. & SIRÉN, R. 2008. The impact of a large reduction in the price of alcohol on area differences in interpersonal violence: a natural experiment based on aggregate data. *Journal of Epidemiology and Public Health,* 62**,** 995-1001.

HILL, N. & HERMAN-STAHL, M. 2002. Neighborhood safety and social involvement: associations with parenting behaviors and depressive symptoms

among African-American and Euro-American mothers. *Journal of Family Psychology,* 16**,** 209.
HINDELANG, M., GOTTFREDSON, M. & GAROFALO, J. 1978. *Victims of personal crime,* Cambridge, MA, Ballinger.
HINGSON, R., HEEREN, T. & WINTER, M. 2006. Age at drinking onset and alcohol dependence: age at onset, duration, and severity. *Archives of Pediatrics & Adolescent Medicine,* 160**,** 739-746.
HIRSCHI, T. 1969. *Causes of delinquency,* Berkley, University of California Press.
HM GOVERNMENT 1998a. Crime and Disorder Act. London: The Stationery Office.
HM GOVERNMENT 1998b. Data Protection Act 1998. London: The Stationey Office.
HM GOVERNMENT 2003. Licensing Act 2003. London: The Stationery Office.
HM GOVERNMENT 2008a. Saving lives. Reducing harm. Protecting the public: an action plan for tackling violence 2008-11. London: Home Office.
HM GOVERNMENT 2008b. Tackling knives action programme. London: Home Office.
HM GOVERNMENT 2008c. Youth crime action plan 2008. London: Home Office.
HM GOVERNMENT 2010. The Coalition: our programme for government. London: Cabinet Office.
HM GOVERNMENT 2011. Ending gang and youth violence: a cross-government report including further evidence and good practice case studies. London: Home Office.
HM GOVERNMENT 2012. The Government's alcohol strategy. London: The Stationery Office.
HM INSPECTORATE OF CONSTABULARLY. 2014. Crime-recording: making the victim count. Available: www.justiceinspectorate.gov.uk/hmic/wp-content/uploads/crime-recording-making-the-victim-count.pdf [Accessed December 20th 2014].
HM TREASURY 2013. Budget 2013. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/221885/budget2013_complete.pdf [Accessed 12th July 2015].
HM TREASURY 2015. Budget 2015. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/416331/47881_Budget_2015_PRINT.pdf [Accessed 12th July 2015].
HOLLANDER, J. 2004. The social contexts of focus groups. *Journal of Contemporary Ethnography,* 33**,** 602-637.
HOLLOWAY, S., JAYNE, M. & VALENTINE, G. 2008. 'Sainsbury's is my local': English alcohol policy, domestic drinking practices and the meaning of home. *Transactions of the Institute of British Geographers,* 33**,** 532-547.
HOLMES, J., MENG, Y., MEIER, P., BRENNAN, A., ANGUS, C., CAMPBELL-BURTON, A., GUO, Y., HILL-MCMANUS, D. & PURSHOUSE, R. 2014. Effects of minimum unit pricing for alcohol on different income and socioeconomic groups: a modelling study. *The Lancet,* 383**,** 1655-1664.
HOME OFFICE. 2005. *Police service strength: England and Wales, 31st March 2005* [Online]. London: Home Office. Available: http://webarchive.nationalarchives.gov.uk/20110218135832/http://rds.homeoffice.gov.uk/rds/pdfs05/hosb1205.pdf [Accessed 11th January 2012].

HOME OFFICE. 2014. Guidance on banning the sale of alcohol below the cost of duty plus VAT: for suppliers of alcohol and enforcement authorities in England and Wales. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/311735/Guidance_on_BBCS_3.pdf [Accessed 6th November 2014].

HOME OFFICE. 2015. *Police workforce England and Wales statistics* [Online]. Home Office. Available: https://www.gov.uk/government/collections/police-workforce-england-and-wales [Accessed 3rd January 2015].

HONESS, T., SEYMOUR, L. & WEBSTER, R. 2000. *The social contexts of underage drinking,* London, Home Office.

HOWE, A. & CRILLY, M. 2001. Deprivation and violence in the community: a perspective from a UK accident & emergency department. *Injury,* 32**,** 349-351.

HSIEH, C. & PUGH, M. 1993. Poverty, income inequality and violent crime: a meta-analysis of recent aggregate data studies. *Criminal Justice Review,* 18**,** 182-202.

HUEBNER, A. & BETTS, S. 2002. Exploring the utility of social control theory for youth development issues of attachment, involvement, and gender. *Youth & Society,* 34**,** 123-145.

HUGHES, K., ANDERSON, Z., MORLEO, M. & BELLIS, M. 2007. Alcohol, nightlife and violence: the relative contributions of drinking before and during nights out to negative health and criminal justice outcomes. *Addicition,* 103**,** 60-65.

HUGHES, K., QUIGG, Z., ECKLEY, L., BELLIS, M., JONES, L., CALAFAT, A., KOSIR, M. & VAN HASSELT, N. 2011. Environmental factors in drinking venues and alcohol-related harm: the evidence base for European intervention. *Addicition,* 106**,** 37-46.

HULL, J. & BOND, C. 1986. Social and behavioural consequences of alcohol consumption and expectancy: a meta-analysis. *Psychological Bulletin,* 99**,** 347-360.

INFORMATION COMMISSIONER'S OFFICE. 2012. Anonymisation: managing data protection risk code of practice. Available: https://ico.org.uk/media/for-organisations/documents/1061/anonymisation-code.pdf [Accessed 12th October 2014].

IRWIN, K. & CHESNEY-LIND, M. 2008. Girls' violence: beyond dangerous masculinity. *Sociology Compass,* 2**,** 837-855.

JENNINGS, W., PIQUERO, A. & FARRINGTON, D. 2013. Does resting heart rate at age 18 distinguish general and violent offending up to age 50? Findings from the Cambridge study in delinquent development. *Journal of Criminal Justice,* 41**,** 213-219.

JONES, B. 1973. Memory impairment on the ascending and descending limbs of the blood alcohol curve. *Journal of Abnormal Psychology,* 82**,** 24.

JONES, S., SIVARAJASINGAM, V. & SHEPHERD, J. 2011. The impact of deprivation on youth violence: a comparison of cities and their feeder towns. *Emergency Medicine Journal,* 28**,** 496-9.

KELLY, M. 2000. Inequality and crime. *Review of Economics and Statistics,* 82**,** 530-539.

KRUEGER, R. & CASEY, M. 2009. *Focus groups: a practical guide for applied research,* London, Sage.

KRUG, E., DAHLBERG, L. & MERCY, J. 2002. World report on violence and health. W.H. Organisation. Available: http://www.who.int/violence_injury_prevention/violence/world_report/en/ [Accessed 17th January 2012].

LAHAUT, V., JANSEN, H., VAN DE MHEEN, D. & GARRETSEN, H. 2002. Non-response bias in a sample survey on alcohol consumption. *Alcohol and Alcoholism,* 37**,** 256.

LAURITSEN, J., LAUB, J. & SAMPSON, R. 1992. Conventional and delinquent activities: implications for the prevention of violent victimization among adolescents. *Violence and Victims,* 7**,** 91-108.

LEVI, M. & MAGUIRE, M. 2002. Violent crime. *In:* M. MAGUIRE, R. MORGAN, & R. REINER (eds.) *The oxford handbook of criminology.* 3rd ed. Oxford: Oxford University Press.

LINK, M. & MOKDAD, A. 2005. Effects of survey mode on self-reports of adult alcohol consumption: a comparison of mail, web and telephone approaches. *Journal of Studies on Alcohol and Drugs,* 66**,** 239.

LINVILLE, D. C. & HUEBNER, A. J. 2005. The analysis of extracurricular activities and their relationship to youth violence. *Journal of Youth and Adolescence,* 34**,** 483-492.

LLOYD, C., WOLLNY, I., WHITE, C., GOWLAND, S. & PURDON, S. 2011. Monitoring and evaluation of family intervention services and projects between February 2007 and March 2011. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/184031/DFE-RR174.pdf [Accessed 13th April 2014].

LONDON BOROUGH OF BEXLEY. 2014. *Take part in the big Bexley crime survey 2014* [Online]. London: London Borough of Bexley. Available: www.bexley.gov.uk/index.aspx?articleid=18307 [Accessed 2 July 2014].

LOSEL, F. & FARRINGTON, D. 2012. Direct Protective and Buffering Protective Factors in the Development of Youth Violence. *American Journal of Preventive Medicine,* 43**,** S68-S83.

LYNN, P. & ELLIOT, D. 2000. The british crime survey: a review of methodology. Available: http://webarchive.nationalarchives.gov.uk/20110218135832/http:/rds.homeoffice.gov.uk/rds/pdfs08/bcs-methodology-review-2000.pdf [Accessed 19th May 2012].

MACANDREW, C. & EDGERTON, R. 1969. *Drunken comportment: a social explanation,* Chicago, Aldine.

MAIMON, D. & BROWNING, C. 2010. Unstructured socializing, collective efficacy, and violence behaviour among urban youth. *Criminology,* 48**,** 443-474.

MÄKELÄ, K. 1971. *Measuring the consumption of alcohol in the 1968-1969: alcohol consumption study*, Alko.

MANNING, W., BLUMBERG, L. & MOULTON, L. 1995. The demand for alcohol: the differential response to price. *Journal of Health Economics,* 14**,** 123-148.

MARKOWITZ, S. 2000a. Criminal violence and alcohol beverage control: evidence from an international study. *NBER Working Papers: 7481.* National Bureau of Economic Research.

MARKOWITZ, S. 2000b. The price of alcohol, wife abuse, and husband abuse. *Southern Economic Journal,* 67**,** 279-303.

MARKOWITZ, S. & GROSSMAN, M. 1998. Alcohol regulation and domestic violence towards children. *Contemporary Economic Policy,* 16**,** 309-320.
MARSDEN, J., BOYS, A., FARRELL, M., STILLWELL, G., HUTCHINGS, K., HILLEBRAND, J. & GRIFFITHS, P. 2005. Personal and social correlates of alcohol consumption among mid-adolescents. *British Journal of Developmental Psychology,* 23**,** 427-450.
MATTHEWS, K., SHEPHERD, J. & SIVARAJASINGAM, V. 2006. Violence-related injury and the price of beer in England and Wales. *Applied Economics,* 38**,** 661-670.
MCGLOIN, J., SCHRECK, C., STEWART, E. & OUSEY, G. 2011. Predicting the violent offender: the discriminant validity of the subculture of violence. *Criminology,* 49**,** 767-794.
MEIER, P., PURSHOUSE, R. & BRENNAN, A. 2010. Policy options for alcohol price regulation: the importance of modelling population heterogenity. *Addicition,* 105**,** 383-393.
MENG, Y., BRENNAN, A., HOLMES, J., HILL-MCMANUS, D., ANGUS, C., PURSHOUSE, R. & MEIER, P. 2013. Modelled income group-specific impacts of alcohol minimum unit pricing in England 2014/15: policy appraisals using new developments to the Sheffield alcohol policy model. Sheffield.
MERTON, R. 1938. Social structure and anomie. *American Sociological Review,* 3**,** 672-682.
MERTON, R. 1968. *Social theory and social structure,* New York, Free Press.
MIDANIK, L. 1982. The validity of self-reported alcohol consumption and alcohol problems: a literature review. *British Journal of Addiction,* 77**,** 357-382.
MINISTRY OF JUSTICE. 2013. *Criminal justice statistics quarterly - December 2012* [Online]. Home Office. Available: https://www.gov.uk/government/statistics/criminal-justice-statistics-quarterly-update-to-december-2012 [Accessed 13th July 2013].
MINISTRY OF JUSTICE. 2014a. *Criminal justice statistics: quarterly update to June 2014* [Online]. Home Office. Available: https://www.gov.uk/government/statistics/criminal-justice-system-quarterly-statistics-june-2014 [Accessed 17th November 2014].
MINISTRY OF JUSTICE. 2014b. Youth justice annual statistics 2012-2013: England and Wales, Youth Justice Board / Ministry of Justice Statistics bulletin. Available: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/278549/youth-justice-stats-2013.pdf [Accessed 4th August 2014].
MINTEL 2004. High street pubs and bars - UK - April 2004. London. Mintel Oxygen.
MINTEL 2009. Binge drinking: special report. London. Mintel Oxygen.
MOLNAR, B., ROBERTS, A., BROWNE, A., GARDENER, H. & BUKA, S. 2005. What girls need: recommendations for preventing violence among urban girls in the US. *Social Science & Medicine,* 60**,** 2191-2204.
MOORE, S., BRENNAN, I. & MURPHY, S. 2011. Predicting and measuring premises-level harm in the night-time economy. *Alcohol and Alcoholism,* 46**,** 357-363.
MOORE, S. & SHEPHERD, J. 2006. The cost of fear: shadow pricing the intangible costs of crime. *Applied Economics,* 38**,** 293-300.

MOORE, S. & SHEPHERD, J. 2007. The elements and prevalence of fear. *British Journal of Criminology,* 47**,** 154-162.
MORASH, M. & CHESNEY-LIND, M. 2006. Girls' violence in context. *OJJDP girls study group volume*.
MORGAN, D. 2002. Focus group interviewing. *Handbook of Interview Research: Context and Method***,** 141-159.
MURPHY, C., WINTERS, J., O'FARREL, T. & FALS-STEWART, W. 2005. Alcohol consumption and intimate partner violence by alcoholic men: comparing violent and nonviolent conflicts. *Psychology of Addictive Behaviors,* 19**,** 35-42.
MYERS, R. 1990. *Classical and modern regression with applications,* Boston, Duxbury.
NASR, I., SIVARAJASINGAM, V., JONES, S. & SHEPHERD, J. 2010. Gender inequality in the risk of violence: material deprivation is linked to higher risk for adolescent girls. *Emergency Medicine Journal,* 27**,** 811-4.
NESS, C. 2004. Why girls fight: female youth violence in the inner city. *The Annals of the American Academy of Political and Social Science,* 595**,** 32-48.
NEWBURN, T. & STANKO, E. 1994. When men are victims. *Just boys doing business? Men, masculinities and crime*.
NHS ENGLAND. 2015. *A&E attendances and emergency admissions* [Online]. NHS England. Available: http://www.england.nhs.uk/statistics/statistical-work-areas/ae-waiting-times-and-activity/ [Accessed 5th October 2013].
O'MARA, R., THOMBS, D., WAGENAAR, A., ROSSHEIM, M., MERVES, M. & HOU, W. 2009. Alcohol price and intoxication in college bars. *Alcoholism: Clinical and Experimental Research,* 33**,** 1973-1980.
OFFICE FOR NATIONAL STATISTICS. 2012a. The 2012/13 crime survey for England and Wales: technical report. Available: http://www.ons.gov.uk/ons/guide-method/method-quality/specific/crime-statistics-methodology/2012-13-crime-survey-for-england-and-wales-technical-report---volume-one.pdf [Accessed 17th July 2014].
OFFICE FOR NATIONAL STATISTICS. 2012b. Consumer price indices: technical manual 2012. Available: http://www.ons.gov.uk/ons/rel/cpi/consumer-price-indices---technical-manual/2012-edition/index.html [Accessed 11th March 2013].
OFFICE FOR NATIONAL STATISTICS. 2012c. General lifestyle survey overview: a report on the 2010 general lifestyle survey. Available: www.ons.gov.uk/ons/rel/ghs/general-lifestyle-survey/2010/index.html [Accessed 9th April 2013].
OFFICE FOR NATIONAL STATISTICS. 2012d. *Guidance and methodology* [Online]. Office for National Statistics. Available: http://www.ons.gov.uk/ons/guide-method/geography/beginner-s-guide/administrative/england/government-office-regions/index.html [Accessed 2nd January 2015].
OFFICE FOR NATIONAL STATISTICS. 2013a. *HMRC tax and NIC receipts 2012/13* [Online]. Available: www.hmrc.go.uk.
OFFICE FOR NATIONAL STATISTICS 2013b. Statistical bulletin: workless households for regions for the uk, 2012. Available: http://webarchive.nationalarchives.gov.uk/20130103014432/http://www.defra

.gov.uk/statistics/foodfarm/food/familyfood/datasets/ [Accessed 9th December 2013].
OFFICE FOR NATIONAL STATISTICS. 2013. *Annual survey of hours and earnings* [Online]. Office for National Statistics. Available: https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=30# [Accessed 12th April 2014].
OFFICE FOR NATIONAL STATISTICS 2014b. Crime in England and Wales: year ending December 2013. Available: http://www.ons.gov.uk/ons/rel/crime-stats/crime-statistics/period-ending-december-2013/stb-crime-stats-dec-2013.html [Accessed 11 May 2014].
OFFICE FOR NATIONAL STATISTICS 2014c. Crime statistics: focus on violent crime and sexual offences, 2012/13. Available: http://www.ons.gov.uk/ons/rel/crime-stats/crime-statistics/focus-on-violent-crime-and-sexual-offences--2013-14/index.html [Accessed 20th April 2015].
OFFICE FOR NATIONAL STATISTICS 2014d. Crime statistics: period ending June 2014. London. Office for National Statistics.
OFFICE FOR NATIONAL STATISTICS 2014e. Crime Statistics: period ending March 2014. London. Office for National Statistics.
OFFICE FOR NATIONAL STATISTICS 2015a. Claimant count: age and duration. Available: https://www.nomisweb.co.uk/query/construct/summary.asp?mode=construct&version=0&dataset=4 [Accessed 11th June 2013].
OFFICE FOR NATIONAL STATISTICS 2015b. Labour market profile: North West. Available: https://www.nomisweb.co.uk/reports/lmp/gor/2013265922/report.aspx [Accessed 29th December 2014].
OFFICE FOR NATIONAL STATISTICS 2015c. Labour Market Statistics, February 2015. London. Office for National Statistics.
OPINIONS AND LIFESTYLE SURVEY 2013. Drinking habits among adults, 2012. London. Office for National Statistics.
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD). 2015. *Income inequality (indicator)* [Online]. Available: http://stats.oecd.org/index.aspx?queryid=66670 [Accessed 26 June 2015].
OSTERGAAD, J. & ANDRADE, S. 2014. Who drinks before a night out and why? Socio-economic status and motives behind young people's drinking in the United Kingdom. *Journal of Substance Use,* 19**,** 229-238.
PARDINI, D., LOEBER, R., FARRINGTON, D. & STOUTHAMER–LOEBER, M. 2012. Identifying direct protective factors for nonviolence. *American Journal of Preventive Medicine,* 43**,** S28-S40.
PARKIN, M., POWELL, M. & MATTHEWS, K. 2012. *Economics,* Essex, Pearson Education Limited.
PARLIAMENTARY OFFICE OF SCIENCE AND TECHNOLOGY. 2002. Postnote: cctv, number 175. Available: www.parliament.uk/briefing-papers/POST-PN-175.pdf [Accessed 14th September 2013].
PATTON, M. 1990. *Qualitative evaluation and research methods*. California. Sage.
PERNANEN, K. 1974. Validity of survey data on alcohol use. *Research Advances in Alcohol and Drug Problems,* 1**,** 355-374.
PETERSON-SWEENEY, K. 2005. The use of focus groups in pediatric and adolescent research. *Journal of Pediatric Health Care,* 19**,** 104-110.

PHILLIPS, D. L. & CLANCY, K. J. 1972. Some effects of "social desirability" in survey studies. *American Journal of Sociology*, 77, 921-940.
PICKETT, W., CRAIG, W., HAREL, Y., CUNNINGHAM, J., SIMPSON, K., MOLCHO, M., MAZUR, J., DOSTALER, S., OVERPECK, M. & CURRIE, C. 2005. Cross-national study of fighting and weapon carrying as determinants of adolescent injury. *Pediatrics,* 116, e855-e863.
PITKÄNEN, T., LYYRA, A. & PULKKINEN, L. 2005. Age of onset of drinking and the use of alcohol in adulthood: a follow-up study from age 8–42 for females and males. *Addiction,* 100, 652-661.
POLK, K. 1999. Males and honor contest violence. *Homicide Studies,* 3, 6-29.
PURSHOUSE, R., MEIER, P., BRENNAN, A., TAYLOR, K. & RAFIA, R. 2010. Estimated effect of alcohol pricing policies on health and health economic outcomes in England: an epidemiological model. *Lancet,* 375, 1355-1364.
QUIGG, Z., HUGHES, K. & BELLIS, M. 2011. Data sharing for prevention: a case study in the development of a comprehensive emergency department injury surveillance system and its use in preventing violence and alcohol-related harms. *Injury Prevention*, 1-6.
QUIGG, Z., HUGHES, K. & BELLIS, M. 2013. Effects of the 2010 World Cup football tournament on emergency department assault attendances in England. *European Journal of Public Health,* 23, 383-385.
QUIGLEY, B. & LEONARD, K. 2006. Alcohol expectancies and intoxicated aggression. *Aggression and Violent Behaviour,* 11, 484-496.
QUIGLEY, B., LEONARD, K. & COLLINS, L. 2003. Characteristics of Violent Bars and Bar Patrons. *Journal of Studies on Alcohol*, 765-772.
R CORE TEAM 2013. R: a language and environment for statistical computing.
RICHARDSON, A. & BUDD, T. 2003. Alcohol, crime and disorder: a study of young adults. London: Home Office.
RITCHIE, C. 2009. The culture of wine buying in the UK off-trade. *International Journal of Wine Business Research,* 21, 194-211.
ROBERTS, J. 2009. Race hate crime in Cardiff 2009. Available: http://wales.gov.uk/docs/caecd/research/091022-race-hate-crime-cardiff-2009-en.pdf [Accessed 11th December 2014].
ROBERTS, M. 2006. From 'creative city' to 'no-go areas': the expansion of the night-time economy in British towns and city centres. *Cities,* 23, 331-338.
ROSENBERG, D. 1997. Trend analysis and interpretation: key concepts and methods for maternal and child health professionals. Maryland: Maternal and Child Health Bureau.
ROTH, J. A. 1994. *Psychoactive substances and violence*, US Department of Justice, Office of Justice Programs, National Institute of Justice.
RUTHERFORD, A., ZWI, A., GROVE, N. & BUTCHART, A. 2007. Violence: a priority for public health?(part 2). *Journal of Epidemiology and Community Health,* 61, 764-770.
RYAN, S., JORM, A. & LUBMAN, D. 2010. Parenting factors associated with reduced adolescent alcohol use: a systematic review of longitudinal studies. *Australian and New Zealand Journal of Psychiatry,* 44, 774-783.
RYDER, J. 2007. 'I wasn't really bonded with my family': attachment, loss and violence among adolescent female offenders. *Critical Criminology,* 15, 19-40.

SAMPSON, R. & LAUB, J. 1994. Urban poverty and the family context of delinquency: a new look at structure and process in a classic study. *Child Development,* 65**,** 523-540.

SAMPSON, R., RAUDENBUSH, S. & EARLS, F. 1997. Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science,* 277**,** 918-924.

SCHRECK, C. & FISHER, B. 2004. Specifying the influence of family and peers on violent victimization extending routine activities and lifestyles theories. *Journal of Interpersonal Violence,* 19**,** 1021-1041.

SCHRECK, C., FISHER, B. & MILLER, J. 2004. The social context of violent victimization: a study of the delinquent peer effect. *Justice Quarterly,* 21**,** 23-47.

SCOTTISH GOVERNMENT. 2012. Alcohol (Minimum Pricing) (Scotland) Act 2012. Available: http://www.legislation.gov.uk/asp/2012/4/pdfs/asp_20120004_en.pdf [Accessed 18th September 2013].

SEAMAN, P. & IKEGWUONU, T. 2010. Young people and alcohol: influences on how they drink. York.

SEDDON, C. 2011. Lifestyle and social participation. Social trends 41 ed. Newport: Office for National Statistics.

SHAW, C. & MCKAY, H. 1942. *Juvenile delinquency and urban areas,* Chicago, University of Chicago Press.

SHEEN, D. 2013. *British beer and pub association statistical handbook 2013,* London, Brewing Publications Limited.

SHEPHERD, J. 1990. Violent crime in Bristol: an accident and emergency department perspective. *British Journal of Criminology,* 30**,** 289-305.

SHEPHERD, J. & FARRINGTON, D. 1993. Assault as a public health problem: discussion paper. *Journal of the Royal Society of Medicine,* 86**,** 89-92.

SHEPHERD, J., QURESHI, R., PRESTON, M. & LEVERS, B. 1990a. Psychological distress after assaults and accidents. *British Medical Journal,* 301**,** 849.

SHEPHERD, J., SHAPLAND, M., PEARCE, N. & SCULLY, C. 1990b. Pattern, severity and aetiology of injuries in victims of assault. *Journal of the Royal Society of Medicine,* 83**,** 75-78.

SHEPHERD, J. & SIVARAJASINGAM, V. 2005. Injury research explains conflicting violence trends. *Injury Prevention,* 11**,** 324-325.

SHEPHERD, J., SUTHERLAND, I. & NEWCOMBE, R. 2006. Relations between alcohol, violence and victimization in adolescence. *Journal of Adolescence,* 29**,** 539-553.

SILVER, M. 1997. *Business statistics,* Maidenhead, McGraw-Hill.

SIMMONS, J., LEGG, C. & HOSKING, R. 2003. *National crime recording standard (NCRS): an analysis of the impact on recorded crime: companion volume to crime in England and Wales 2002/2003,* London, Home Office.

SIVARAJASINGAM, V., CORCORAN, J., JONES, D., WARE, A. & SHEPHERD, J. 2004. Relations between violence, calendar events and ambient conditions. *Injury,* 35**,** 467-473.

SIVARAJASINGAM, V., MATTHEWS, K. & SHEPHERD, J. 2006. Price of beer and violence-related injury in England and Wales. *Injury,* 37**,** 388-394.

SIVARAJASINGAM, V., MOORE, S. & SHEPHERD, J. 2005. Winning, losing, and violence. *Injury Prevention,* 11**,** 69-70.

SIVARAJASINGAM, V., MORGAN, P., MATTHEWS, K., SHEPHERD, J. & WALKER, R. 2009a. Trends in violence in England and Wales 2000-2004: an accident and emergency persepctive. *Injury,* 40**,** 820-825.

SIVARAJASINGAM, V., MORGAN, P., SHEPHERD, J. & MATTHEWS, K. 2009b. Vulnerability to assault injury: an emergency department perspective. *Emergency Medicine Journal,* 26**,** 711-714.

SIVARAJASINGAM, V., PAGE, N., MORGAN, P., MATTHEWS, K., MOORE, S. & SHEPHERD, J. 2014a. Trends in community violence in England and Wales 2005-2009. *Injury,* 45**,** 592-598.

SIVARAJASINGAM, V., SHEPHERD, J. & MATTHEWS, K. 2003. Effect of urban closed circuit television on assault injury and violence detection. *Injury Prevention,* 9**,** 312-6.

SIVARAJASINGAM, V., SHEPHERD, J., MATTHEWS, K. & JONES, S. 2002. Trends in violence in England and Wales 1995–2000: an accident and emergency perspective. *Journal of Public Health,* 24**,** 219-226.

SIVARAJASINGAM, V., WELLS, J., MOORE, S., PAGE, N. & SHEPHERD, J. 2014b. Violence in England and Wales in 2013: an accident and emergency perspective. Available: http://www.cardiff.ac.uk/news/resource/12846.35244.file.eng.pdf [Accessed 6th May 2014].

SMITH, W. & TORSTENSSON, M. 1997. Gender differences in risk perception and neutralizing fear of crime: toward resolving the paradoxes. *British Journal of Criminology,* 37**,** 608-634.

SOLOMON, B., BRADSHAW, C., WRIGHT, J. & CHENG, T. 2008. Youth and parental attitudes toward fighting. *Journal of Interpersonal Violence,* 23**,** 544-560.

SPENCE, J., SMITH, M., HODGSON, T., FROST, S. & CALLAGAHAN, G. 2011. Myplace evaluation: final report. Available: https://www.gov.uk/government/publications/myplace-evaluation-final-report [Accessed 11th November 2014].

SPORTS WALES 2014. 5x60 registrations sessions analysis 2013-14. Available: http://moodle.flintshire.gov.uk/la/pluginfile.php/3985/mod_resource/content/0/5x60_report_2013-14.pdf [Accessed 17th January 2015].

SPORTS WALES. 2015. *Tackling child poverty and promoting equality* [Online]. Available: http://sportwales.org.uk/community-sport/sporting-communities/tackling-child-poverty-and-promotion-equality.aspx [Accessed 17th January 2015].

STEELE, C. & JOSEPHS, R. 1990. Alcohol myopia: its prized and dangerous effects. *American Psychologist,* 45**,** 921-933.

STEWART, D. & SHAMDASANI, P. 2014. *Focus groups: theory and practice*, London. Sage.

STOCKWELL, T., DONATH, S., COOPER-STANBURY, M., CHIKRITZHS, T., CATALANO, P. & MATEO, C. 2004. Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated-frequency and recent recall. *Addiction,* 99**,** 1024-33.

STOCKWELL, T. & THOMAS, G. 2013. Is alcohol too cheap in the UK? The case for setting a Minimum Unit Price for alcohol. Available: http://www.ias.org.uk/uploads/pdf/News%20stories/iasreport-thomas-stockwell-april2013.pdf [Accessed 12th March 2014].

SURVEILLANCE CAMERA COMMISSIONER. 2014. Annual report 2013/14. Available: https://www.gov.uk/government/publications/surveillance-camera-commissioner-annual-report-2013-to-2014 [Accessed 25th January 2015].

SUTHERLAND, I. & SHEPHERD, J. 2002. A personality-based model of adolescent violence. *British Journal of Criminology,* 42**,** 433-441.

SUTHERLAND, I., SIVARAJASINGAM, V. & SHEPHERD, J. 2002. Recording of community violence by medical and police services. *Inj Prev,* 8**,** 246-7.

SUTTON, L. 2008. The state of play: disadvantage, play and children's well-being. *Social Policy and Society,* 7**,** 537-549.

SWANSON, J., HOLZER, C., GANJU, V. & JONGO, R. 1990. Violence and psychiatric disorder in the community: evidence from the epidemiologic catchment area surveys. *Hospital and Community Psychiatry,* 41**,** 761-770.

TAYLOR, S. & LEONARD, K. 1983. Alcohol and human physical aggression. *In:* R. GREEN & E. DONNERSTEIN (eds.) *Aggression: Theoretical and Empirical Reviews.* New York: Academic Press.

TEDESCHI, J. & QUIGLEY, B. 2000. A further comment on the construct validity of laboratory paradigms: a response to Giancola and Chermack. *Aggression and Violent Behavior,* 5**,** 127-136.

TILLYER, M., TILLYER, R., MILLER, H. & PANGRAC, R. 2011. Re-examining the correlates of adolescent violent victimization: The importance of exposure, guardianship, and target characteristics. *Journal of Interpersonal Violence,* 26, 2908-2928.

TOMSEN, S. 1997. A top night: social protest, masculinity and the culture of drinking violence. *British Journal of Criminology,* 37**,** 90-102.

TOMSEN, S. 2005. 'Boozers and bouncers': masculine conflict, disengagement, and the contemporary governance of drinking-related violence and disorder. *The Australian and New Zealand Journal of Criminology,* 38**,** 283-297.

TURNER, K., HILL, M., STAFFORD, A. & WALKER, M. 2006. How children from disadvantaged areas keep safe. *Health Education,* 106**,** 450-464.

UK STATISTICS AUTHORITY 2014. Assessment of compliance with the code of practice for official statistics: statistics on crime in England and Wales. *Assessment Report,* 268. Available: http://webcache.googleusercontent.com/search?q=cache:sW_PhwdEpIgJ:www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/assessment-report-268---statistics-on-crime-in-england-and-wales.pdf+&cd=1&hl=en&ct=clnk&gl=uk [Accessed 22nd February 2015].

VAN DER VORST, H., ENGELS, R., MEEUS, W., DEKOVIĆ, M. & VAN LEEUWE, J. 2005. The role of alcohol-specific socialization in adolescents' drinking behaviour. *Addiction,* 100**,** 1464-1476.

VOLD, G., BERNARD, T. & SNIPES, J. 2002. *Theoretical criminology,* New York, Oxford University Press.

WAGENAAR, A., SALOIS, M. & KOMRO, K. 2009. Effects of beverage alcohol price and tax levels on drinking: a meta-analysis of 1003 estimates from 112 studies. *Addiction,* 104**,** 179-190.

WARBURTON, A. & SHEPHERD, J. 2004. Development, utilisation, and importance of accident and emergency department derived assault data in violence management. *Emergency Medicine Journal,* 21**,** 473-477.

WELSH, B. & FARRINGTON, D. 2004. Surveillance for crime prevention in public space: Results and policy choices in Britain and America. *Criminology & Public Policy,* 3**,** 497-526.

WELSH GOVERNMENT. 2008. Personal and social education framework for 7 to 19-year-olds in Wales. Available: http://learning.wales.gov.uk/docs/learningwales/publications/130425-personal-and-social-education-framework-en.pdf [Accessed 2nd May 2012].

WELSH GOVERNMENT 2012. Welsh network of healthy school schemes. Available: http://wales.gov.uk/topics/health/improvement/schools/?lang=en [Accessed 3rd January 2015].

WELSH GOVERNMENT. 2014a. Listening to you: your health matters. Available: http://wales.gov.uk/docs/phhs/consultation/140402consultationen.pdf [Accessed 11th November 2014].

WELSH GOVERNMENT. 2014b. Wales: a play friendly country. Available: http://wales.gov.uk/docs/dsjlg/publications/cyp/141007-wales-a-play-friendly-country-en.pdf [Accessed 1st February 2015].

WELSH GOVERNMENT. 2015. *Time spent in NHS accidenct and emergency departments* [Online]. Welsh Government. Available: http://wales.gov.uk/statistics-and-research/time-spent-nhs-accident-emergency-departments/?lang=en#/statistics-and-research/time-spent-nhs-accident-emergency-departments/?tab=previous&lang=en [Accessed 4th October 2013].

WICHSTRØM, T. & WICHSTRØM, L. 2009. Does sports participation during adolescence prevent later alcohol, tobacco and cannabis use? *Addiction,* 104**,** 138-149.

WILKINSON, R. 2006. Why is violence more common where inequality is greater. *Annals of the New York Academy of Sciences,* 1036**,** 1-12.

WILKINSON, R. & PICKET, K. 2006. Income inequality and population health: a review and explanation of the evidence. *Social Science and Medicine,* 62**,** 1768-1784.

WILLIAMS, D., NEVILLE, F., HOUSE, K. & DONNELLY, P. 2013. Association between old firm football matches and reported domestic (violence) incidents in Strathclyde, Scotland. *Sage,* 3**,** 1-7.

WOLF, A., GRAY, R. & FAZEL, S. 2014. Violence as a public health problem: An ecological study of 169 countries. *Social Science & Medicine,* 104**,** 220-227.

WOLFGANG, M. & FERRACUTI, F. 1981. *The subculture of violence,* Beverly Hills, CA, Sage.

WOOD, S., ECKLEY, L., STUART, J., HUGHES, K., KELLY, D., HARRISON, D. & QUIGG, Z. 2011. Evaluation of the youth crime action plan in liverpool. Liverpool. Liverpool John Moores University.

WOOD, S., FORD, K., QUIGG, Z. & HUGHES, K. 2014. A short guide to using health data to inform local violence prevention. Available: http://www.cph.org.uk/wp-content/uploads/2014/12/Using-health-data-to-inform-local-violence-prevention-a-short-guide.pdf [Accessed 20th February 2015].

WORLD HEALTH ORGANISATION. 2009. Evidence for the effectiveness and cost–effectiveness of interventions to reduce alcohol-related harm. Available: http://www.euro.who.int/__data/assets/pdf_file/0020/43319/E92823.pdf [Accessed 17th July 2013].

WORLD HEALTH ORGANISATION 2014. Global health estimates 2014 summary tables: DALY by cause, age and sex, 2000-2012. Available: http://www.who.int/healthinfo/global-burden-disease/en/ [Accessed 23rd December 2014].

WORLD HEALTH ORGANIZATION. 2014. Global status report on alcohol and health 2014. Available: http://www.who.int/substance_abuse/publications/global_alcohol_report/msb_gsr_2014_2.pdf?ua=1 [Accessed 23rd January 2015].

ZHANG, L., WELTE, J. & WIECZOREK, W. 2002. The role of aggression-related alcohol expectancies in explaining the link between alcohol and violent behaviour. *Substance Use and Misuse,* 37**,** 457-471.

ZIMMERMAN, G. & MESSNER, S. 2010. Neighborhood context and the gender gap in adolescent violent crime. *American Sociological Review,* 75**,** 958-980.

8 Appendices

8.1 Appendix A: regional coverage ratios (CRs), 2005(1)-2012(12)*

	2005	2006	2007	2008	2009	2010	2011	2012
Eastern	8.92	6.68	5.66	7.30	7.91	10.05	14.13	3.52
East Midlands	6.67	13.13	13.23	2.35	11.32	3.52	4.74	7.64
London	23.44	21.83	22.23	10.51	6.89	7.67	10.67	5.95
North East	7.61	4.39	7.14	6.67	4.73	3.35	NA	3.49
North West	9.42	8.71	10.92	5.17	5.81	5.30	5.81	8.46
South East	22.34	10.93	10.90	11.15	7.76	5.91	29.01	5.35
South West	8.06	5.90	3.56	6.65	9.86	4.74	8.16	10.61
Wales	4.53	5.45	5.87	4.18	4.57	3.83	2.55	4.46
West Midlands	19.30	10.61	23.38	20.89	NA	16.72	9.36	24.34
Yorkshire & Humberside	9.95	8.15	6.42	5.37	4.79	5.04	8.10	3.89

*rounded figures

8.2 Appendix B: raw violence-related ED attendances by gender, age group and region, 2005(1)-2012(12)

Region	0-10		11-17		18-30		31-50		51+	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Eastern	114	57	2399	830	8641	2284	4489	1744	883	403
East Midlands	217	96	2775	1101	10723	3478	6017	2504	1286	609
London	168	107	3657	1406	11068	3833	6479	2902	1452	673
North East	284	160	3519	1475	10724	3496	5989	2541	1194	600
North West	531	216	9250	3503	30157	9757	18290	7425	3484	1447
South East	276	128	3483	1283	11658	3099	6074	2422	1288	622
South West	203	105	3059	1145	11776	3472	5888	2405	1208	559
Wales	312	155	4166	1734	15708	5234	8074	3420	1575	756
West Midlands	89	59	1772	624	4993	1597	2932	1188	634	263
Yorkshire & Humberside	177	74	4070	1746	16874	5642	9250	4111	1718	819

8.3 Appendix D: regional on-trade and off-trade alcohol price indices for England and Wales, 2005(1)-2012(12); CPI deflated, January 2005=100

Year	Month	Region	Real off-trade alcohol price index	Real on-trade alcohol price index
2005	1	Eastern	100.000	100.000
2005	2	Eastern	102.945	100.120
2005	3	Eastern	102.041	96.497
2005	4	Eastern	100.184	99.964
2005	5	Eastern	102.034	98.227
2005	6	Eastern	100.782	100.094
2005	7	Eastern	100.516	99.057
2005	8	Eastern	99.686	98.293
2005	9	Eastern	102.113	98.089
2005	10	Eastern	99.050	98.676
2005	11	Eastern	99.350	99.371
2005	12	Eastern	99.934	99.870
2006	1	Eastern	97.158	100.288
2006	2	Eastern	96.199	99.727
2006	3	Eastern	98.940	96.168
2006	4	Eastern	99.483	98.074
2006	5	Eastern	95.139	98.373
2006	6	Eastern	100.344	98.259
2006	7	Eastern	95.647	98.682
2006	8	Eastern	98.694	97.467
2006	9	Eastern	94.704	97.566
2006	10	Eastern	94.371	97.147
2006	11	Eastern	90.844	97.655
2006	12	Eastern	91.282	97.817

2007	1	Eastern	93.493	99.508
2007	2	Eastern	94.501	100.075
2007	3	Eastern	95.943	98.505
2007	4	Eastern	94.202	100.340
2007	5	Eastern	91.838	100.802
2007	6	Eastern	92.095	100.999
2007	7	Eastern	92.076	101.694
2007	8	Eastern	92.579	101.495
2007	9	Eastern	93.260	101.210
2007	10	Eastern	92.220	101.389
2007	11	Eastern	90.874	101.775
2007	12	Eastern	88.969	101.055
2008	1	Eastern	88.761	102.118
2008	2	Eastern	91.668	101.465
2008	3	Eastern	89.506	101.581
2008	4	Eastern	93.397	103.165
2008	5	Eastern	93.728	103.213
2008	6	Eastern	93.603	103.204
2008	7	Eastern	91.065	103.080
2008	8	Eastern	90.169	102.504
2008	9	Eastern	91.824	102.730
2008	10	Eastern	92.748	102.224
2008	11	Eastern	91.598	102.900
2008	12	Eastern	91.510	103.186
2009	1	Eastern	92.593	104.562
2009	2	Eastern	95.842	105.868
2009	3	Eastern	92.941	105.493
2009	4	Eastern	95.931	105.360
2009	5	Eastern	97.495	105.837

2009	6	Eastern	93.168	106.458
2009	7	Eastern	95.257	106.554
2009	8	Eastern	95.003	106.396
2009	9	Eastern	96.817	106.676
2009	10	Eastern	94.765	106.466
2009	11	Eastern	92.094	106.314
2009	12	Eastern	92.127	104.864
2010	1	Eastern	93.111	105.822
2010	2	Eastern	92.840	106.802
2010	3	Eastern	91.089	106.810
2010	4	Eastern	93.625	106.898
2010	5	Eastern	93.541	106.757
2010	6	Eastern	92.426	106.105
2010	7	Eastern	92.210	106.597
2010	8	Eastern	93.447	107.264
2010	9	Eastern	93.302	105.747
2010	10	Eastern	93.263	105.989
2010	11	Eastern	91.294	105.979
2010	12	Eastern	91.621	105.589
2011	1	Eastern	96.862	107.810
2011	2	Eastern	95.921	108.809
2011	3	Eastern	96.372	108.367
2011	4	Eastern	99.188	108.950
2011	5	Eastern	96.310	108.907
2011	6	Eastern	97.719	109.286
2011	7	Eastern	99.648	109.556
2011	8	Eastern	97.135	109.335
2011	9	Eastern	95.873	109.151
2011	10	Eastern	95.301	109.247

2011	11	Eastern	98.460	109.212
2011	12	Eastern	93.038	108.418
2012	1	Eastern	98.870	109.476
2012	2	Eastern	95.481	109.002
2012	3	Eastern	92.976	109.079
2012	4	Eastern	93.520	109.783
2012	5	Eastern	93.711	110.773
2012	6	Eastern	94.743	110.958
2012	7	Eastern	93.665	109.921
2012	8	Eastern	93.963	109.983
2012	9	Eastern	92.593	110.231
2012	10	Eastern	94.244	109.462
2012	11	Eastern	93.195	109.038
2012	12	Eastern	91.327	108.308
2005	1	East Midlands	100.000	100.000
2005	2	East Midlands	101.458	100.734
2005	3	East Midlands	97.726	96.950
2005	4	East Midlands	98.178	101.412
2005	5	East Midlands	99.426	98.607
2005	6	East Midlands	101.400	100.326
2005	7	East Midlands	102.202	101.918
2005	8	East Midlands	101.934	102.365
2005	9	East Midlands	98.391	102.171
2005	10	East Midlands	98.113	102.122
2005	11	East Midlands	98.828	102.553
2005	12	East Midlands	101.853	102.183
2006	1	East Midlands	101.797	101.833
2006	2	East Midlands	96.349	100.935
2006	3	East Midlands	96.871	98.323

2006	4	East Midlands	92.334	101.569
2006	5	East Midlands	96.226	102.117
2006	6	East Midlands	97.783	100.383
2006	7	East Midlands	99.262	100.719
2006	8	East Midlands	95.564	101.105
2006	9	East Midlands	95.500	101.370
2006	10	East Midlands	97.807	100.977
2006	11	East Midlands	96.316	100.781
2006	12	East Midlands	96.318	100.729
2007	1	East Midlands	95.662	100.028
2007	2	East Midlands	95.431	101.379
2007	3	East Midlands	93.781	101.806
2007	4	East Midlands	94.064	102.278
2007	5	East Midlands	92.952	101.980
2007	6	East Midlands	94.296	101.918
2007	7	East Midlands	95.535	102.811
2007	8	East Midlands	95.602	102.323
2007	9	East Midlands	94.874	102.234
2007	10	East Midlands	92.304	101.647
2007	11	East Midlands	94.145	101.541
2007	12	East Midlands	90.632	100.944
2008	1	East Midlands	90.890	101.096
2008	2	East Midlands	93.133	102.277
2008	3	East Midlands	93.480	102.493
2008	4	East Midlands	93.374	104.054
2008	5	East Midlands	97.251	103.630
2008	6	East Midlands	97.568	103.113
2008	7	East Midlands	95.539	101.802
2008	8	East Midlands	93.725	101.736

2008	9	East Midlands	91.943	100.681
2008	10	East Midlands	94.580	101.887
2008	11	East Midlands	92.857	101.474
2008	12	East Midlands	93.399	102.668
2009	1	East Midlands	97.762	101.842
2009	2	East Midlands	97.828	103.137
2009	3	East Midlands	96.817	103.462
2009	4	East Midlands	94.797	102.769
2009	5	East Midlands	96.350	103.618
2009	6	East Midlands	96.409	102.819
2009	7	East Midlands	97.367	103.851
2009	8	East Midlands	97.394	103.988
2009	9	East Midlands	98.382	103.564
2009	10	East Midlands	100.162	102.707
2009	11	East Midlands	98.567	102.488
2009	12	East Midlands	96.010	102.536
2010	1	East Midlands	99.077	103.129
2010	2	East Midlands	99.003	107.573
2010	3	East Midlands	97.077	107.084
2010	4	East Midlands	103.105	107.693
2010	5	East Midlands	104.349	107.380
2010	6	East Midlands	100.510	108.149
2010	7	East Midlands	101.398	108.188
2010	8	East Midlands	101.129	106.984
2010	9	East Midlands	102.319	107.205
2010	10	East Midlands	103.779	106.876
2010	11	East Midlands	102.064	107.498
2010	12	East Midlands	101.823	106.029
2011	1	East Midlands	103.539	108.293

2011	2	East Midlands	103.906	107.713
2011	3	East Midlands	108.374	105.995
2011	4	East Midlands	106.787	106.838
2011	5	East Midlands	111.372	107.821
2011	6	East Midlands	108.080	107.113
2011	7	East Midlands	113.971	107.497
2011	8	East Midlands	108.879	106.038
2011	9	East Midlands	107.074	107.329
2011	10	East Midlands	110.968	107.976
2011	11	East Midlands	106.833	107.180
2011	12	East Midlands	106.503	107.064
2012	1	East Midlands	109.687	107.138
2012	2	East Midlands	110.338	108.630
2012	3	East Midlands	107.137	107.868
2012	4	East Midlands	109.493	109.701
2012	5	East Midlands	111.526	110.435
2012	6	East Midlands	109.792	111.180
2012	7	East Midlands	105.214	111.422
2012	8	East Midlands	106.753	110.623
2012	9	East Midlands	106.767	110.827
2012	10	East Midlands	106.430	110.369
2012	11	East Midlands	111.975	109.691
2012	12	East Midlands	107.780	109.017
2005	1	London	100.000	100.000
2005	2	London	97.481	99.502
2005	3	London	96.630	99.186
2005	4	London	96.946	99.699
2005	5	London	97.050	97.668
2005	6	London	95.796	99.902

2005	7	London	95.345	99.890
2005	8	London	93.839	99.254
2005	9	London	95.963	99.398
2005	10	London	96.433	99.335
2005	11	London	95.741	99.061
2005	12	London	91.759	99.150
2006	1	London	94.307	98.894
2006	2	London	95.336	99.497
2006	3	London	91.333	99.815
2006	4	London	94.960	100.083
2006	5	London	93.417	99.400
2006	6	London	94.509	99.565
2006	7	London	95.274	100.678
2006	8	London	92.802	100.227
2006	9	London	92.695	100.155
2006	10	London	93.202	101.457
2006	11	London	93.483	100.512
2006	12	London	93.639	100.179
2007	1	London	94.977	100.812
2007	2	London	92.872	98.976
2007	3	London	90.855	99.235
2007	4	London	92.841	100.457
2007	5	London	91.976	101.067
2007	6	London	91.985	101.214
2007	7	London	91.267	101.710
2007	8	London	92.564	101.379
2007	9	London	92.313	100.548
2007	10	London	91.902	99.880
2007	11	London	89.924	100.338

2007	12	London	90.157	99.850
2008	1	London	92.252	100.370
2008	2	London	90.739	100.071
2008	3	London	90.368	100.371
2008	4	London	95.885	101.917
2008	5	London	95.131	101.736
2008	6	London	94.917	101.019
2008	7	London	95.470	100.908
2008	8	London	93.440	99.688
2008	9	London	94.753	98.908
2008	10	London	94.031	99.748
2008	11	London	90.919	100.451
2008	12	London	91.755	100.128
2009	1	London	97.753	101.329
2009	2	London	97.022	100.277
2009	3	London	96.634	100.396
2009	4	London	96.423	100.581
2009	5	London	97.040	100.974
2009	6	London	95.755	100.695
2009	7	London	97.529	101.145
2009	8	London	97.834	100.759
2009	9	London	100.021	100.875
2009	10	London	95.434	100.493
2009	11	London	97.754	100.296
2009	12	London	94.403	100.699
2010	1	London	99.002	100.978
2010	2	London	96.337	101.227
2010	3	London	96.441	101.219
2010	4	London	99.388	101.616

2010	5	London	99.174	102.087
2010	6	London	98.600	101.515
2010	7	London	98.789	101.487
2010	8	London	97.741	101.286
2010	9	London	98.857	101.350
2010	10	London	101.797	101.170
2010	11	London	101.409	102.320
2010	12	London	97.538	101.826
2011	1	London	102.695	101.596
2011	2	London	99.000	103.376
2011	3	London	100.234	103.425
2011	4	London	104.869	102.883
2011	5	London	104.257	103.648
2011	6	London	105.645	103.920
2011	7	London	104.933	103.860
2011	8	London	101.381	103.246
2011	9	London	103.401	103.524
2011	10	London	102.578	103.466
2011	11	London	103.743	104.273
2011	12	London	99.595	103.999
2012	1	London	102.783	104.804
2012	2	London	108.445	105.666
2012	3	London	104.823	105.917
2012	4	London	106.534	105.957
2012	5	London	103.513	106.814
2012	6	London	105.877	106.918
2012	7	London	105.145	106.546
2012	8	London	104.325	107.469
2012	9	London	107.267	106.432

2012	10	London	107.082	105.642
2012	11	London	105.660	106.099
2012	12	London	103.876	105.610
2005	1	North East	100.000	100.000
2005	2	North East	100.141	100.371
2005	3	North East	96.582	98.483
2005	4	North East	98.040	100.420
2005	5	North East	97.128	98.079
2005	6	North East	97.475	100.077
2005	7	North East	98.976	100.451
2005	8	North East	98.136	100.505
2005	9	North East	97.553	99.739
2005	10	North East	98.219	100.320
2005	11	North East	94.389	100.349
2005	12	North East	94.212	100.154
2006	1	North East	98.249	99.841
2006	2	North East	96.378	102.458
2006	3	North East	98.501	100.578
2006	4	North East	98.186	101.050
2006	5	North East	100.395	100.914
2006	6	North East	96.815	100.474
2006	7	North East	97.724	101.465
2006	8	North East	98.250	102.257
2006	9	North East	95.925	101.457
2006	10	North East	97.599	101.734
2006	11	North East	95.157	101.876
2006	12	North East	95.601	101.866
2007	1	North East	96.613	103.873
2007	2	North East	94.214	103.259

2007	3	North East	95.975	101.250
2007	4	North East	98.394	104.118
2007	5	North East	98.147	101.173
2007	6	North East	95.425	102.798
2007	7	North East	95.324	103.829
2007	8	North East	95.176	103.241
2007	9	North East	94.941	103.973
2007	10	North East	93.999	101.835
2007	11	North East	93.631	101.603
2007	12	North East	93.409	101.164
2008	1	North East	91.006	100.579
2008	2	North East	94.173	100.996
2008	3	North East	95.732	101.583
2008	4	North East	96.013	105.500
2008	5	North East	97.516	104.378
2008	6	North East	94.083	104.117
2008	7	North East	94.106	102.275
2008	8	North East	92.327	101.808
2008	9	North East	91.936	100.353
2008	10	North East	91.860	100.665
2008	11	North East	90.846	101.443
2008	12	North East	95.155	101.909
2009	1	North East	97.092	103.556
2009	2	North East	99.930	103.307
2009	3	North East	99.828	103.188
2009	4	North East	100.885	103.712
2009	5	North East	100.070	104.105
2009	6	North East	99.599	103.884
2009	7	North East	99.796	105.985

2009	8	North East	102.585	102.971
2009	9	North East	99.871	103.030
2009	10	North East	99.736	102.991
2009	11	North East	97.904	102.665
2009	12	North East	96.941	102.630
2010	1	North East	97.732	103.932
2010	2	North East	99.319	103.647
2010	3	North East	100.455	104.402
2010	4	North East	100.986	104.246
2010	5	North East	102.947	103.899
2010	6	North East	103.561	103.411
2010	7	North East	104.213	103.503
2010	8	North East	101.860	103.093
2010	9	North East	105.971	102.758
2010	10	North East	103.584	102.280
2010	11	North East	105.383	102.421
2010	12	North East	99.172	102.265
2011	1	North East	108.887	104.094
2011	2	North East	101.290	105.558
2011	3	North East	103.728	105.597
2011	4	North East	103.899	106.224
2011	5	North East	101.856	105.598
2011	6	North East	104.679	105.932
2011	7	North East	106.635	106.179
2011	8	North East	102.715	105.308
2011	9	North East	103.456	105.009
2011	10	North East	102.816	104.987
2011	11	North East	102.142	103.719
2011	12	North East	102.683	104.274

2012	1	North East	105.944	105.043
2012	2	North East	111.018	105.988
2012	3	North East	108.354	105.630
2012	4	North East	110.656	106.228
2012	5	North East	108.197	107.427
2012	6	North East	106.616	108.250
2012	7	North East	107.078	107.725
2012	8	North East	109.391	107.623
2012	9	North East	107.927	107.043
2012	10	North East	107.579	106.286
2012	11	North East	106.359	107.050
2012	12	North East	104.191	105.993
2005	1	North West	100.000	100.000
2005	2	North West	99.017	101.530
2005	3	North West	98.924	99.433
2005	4	North West	95.857	100.490
2005	5	North West	98.409	99.429
2005	6	North West	98.110	99.637
2005	7	North West	97.348	100.575
2005	8	North West	98.433	99.829
2005	9	North West	97.960	99.892
2005	10	North West	97.973	98.463
2005	11	North West	97.686	98.830
2005	12	North West	96.201	99.380
2006	1	North West	94.960	99.142
2006	2	North West	93.756	98.771
2006	3	North West	96.459	98.237
2006	4	North West	99.171	99.688
2006	5	North West	96.722	99.599

2006	6	North West	97.551	99.518
2006	7	North West	96.826	100.739
2006	8	North West	101.204	99.382
2006	9	North West	97.064	99.960
2006	10	North West	96.577	100.139
2006	11	North West	93.294	100.809
2006	12	North West	95.389	100.276
2007	1	North West	95.125	100.571
2007	2	North West	93.030	99.878
2007	3	North West	96.751	98.788
2007	4	North West	92.390	100.206
2007	5	North West	95.201	99.753
2007	6	North West	96.438	100.026
2007	7	North West	93.181	100.950
2007	8	North West	92.286	101.054
2007	9	North West	95.835	101.097
2007	10	North West	93.653	100.847
2007	11	North West	95.994	100.902
2007	12	North West	93.293	100.224
2008	1	North West	92.150	101.085
2008	2	North West	92.927	100.365
2008	3	North West	95.248	99.993
2008	4	North West	96.216	99.814
2008	5	North West	98.773	100.462
2008	6	North West	99.086	99.795
2008	7	North West	95.788	100.589
2008	8	North West	97.170	99.914
2008	9	North West	97.960	99.477
2008	10	North West	97.048	99.899

2008	11	North West	99.050	100.215
2008	12	North West	94.885	100.622
2009	1	North West	99.353	101.867
2009	2	North West	102.137	101.958
2009	3	North West	102.871	101.999
2009	4	North West	99.642	100.886
2009	5	North West	101.594	100.798
2009	6	North West	100.101	101.041
2009	7	North West	102.318	101.331
2009	8	North West	103.398	101.618
2009	9	North West	100.686	100.834
2009	10	North West	101.530	100.949
2009	11	North West	101.314	100.032
2009	12	North West	99.850	99.965
2010	1	North West	102.647	100.950
2010	2	North West	98.755	100.428
2010	3	North West	100.710	100.629
2010	4	North West	103.011	101.312
2010	5	North West	100.227	100.773
2010	6	North West	100.021	100.789
2010	7	North West	103.705	101.208
2010	8	North West	101.731	100.878
2010	9	North West	102.267	100.767
2010	10	North West	102.741	101.724
2010	11	North West	103.696	100.805
2010	12	North West	99.882	100.918
2011	1	North West	104.860	101.976
2011	2	North West	103.408	101.000
2011	3	North West	97.846	101.042

2011	4	North West	102.039	101.784
2011	5	North West	103.089	102.108
2011	6	North West	104.355	102.194
2011	7	North West	105.544	102.791
2011	8	North West	101.732	103.062
2011	9	North West	103.705	103.547
2011	10	North West	103.305	103.549
2011	11	North West	101.340	103.478
2011	12	North West	94.207	103.014
2012	1	North West	99.919	103.647
2012	2	North West	110.033	102.842
2012	3	North West	102.823	103.058
2012	4	North West	107.416	103.439
2012	5	North West	105.114	103.096
2012	6	North West	99.631	104.136
2012	7	North West	104.379	103.848
2012	8	North West	103.343	103.340
2012	9	North West	102.228	103.443
2012	10	North West	102.752	103.071
2012	11	North West	99.913	103.265
2012	12	North West	98.011	103.282
2005	1	South East	100.000	100.000
2005	2	South East	99.935	101.291
2005	3	South East	97.919	97.679
2005	4	South East	97.579	101.247
2005	5	South East	99.231	98.304
2005	6	South East	96.800	101.123
2005	7	South East	99.686	101.408
2005	8	South East	97.815	100.809

2005	9	South East	96.508	100.775
2005	10	South East	94.080	100.619
2005	11	South East	96.163	100.648
2005	12	South East	93.738	100.563
2006	1	South East	95.898	99.420
2006	2	South East	93.836	100.773
2006	3	South East	93.470	98.846
2006	4	South East	96.314	100.941
2006	5	South East	94.876	101.389
2006	6	South East	97.562	101.079
2006	7	South East	96.524	101.991
2006	8	South East	96.515	101.497
2006	9	South East	95.133	101.775
2006	10	South East	96.899	102.029
2006	11	South East	93.447	102.004
2006	12	South East	92.447	102.060
2007	1	South East	94.780	102.634
2007	2	South East	96.130	102.649
2007	3	South East	96.643	101.997
2007	4	South East	98.153	102.981
2007	5	South East	95.766	102.776
2007	6	South East	94.033	102.610
2007	7	South East	95.369	104.063
2007	8	South East	95.368	102.444
2007	9	South East	94.455	102.671
2007	10	South East	97.019	102.409
2007	11	South East	92.609	102.365
2007	12	South East	88.981	101.658
2008	1	South East	93.992	101.921

2008	2	South East	93.249	101.081
2008	3	South East	94.962	101.467
2008	4	South East	95.809	101.746
2008	5	South East	97.272	102.145
2008	6	South East	99.773	101.441
2008	7	South East	95.363	101.763
2008	8	South East	95.544	100.623
2008	9	South East	95.076	100.969
2008	10	South East	91.214	101.544
2008	11	South East	89.875	101.822
2008	12	South East	91.942	101.796
2009	1	South East	94.164	102.689
2009	2	South East	94.268	103.125
2009	3	South East	94.597	103.452
2009	4	South East	96.643	103.538
2009	5	South East	98.052	103.472
2009	6	South East	97.491	103.422
2009	7	South East	94.039	103.537
2009	8	South East	97.391	103.611
2009	9	South East	95.311	103.203
2009	10	South East	97.786	103.366
2009	11	South East	96.712	102.778
2009	12	South East	96.616	103.033
2010	1	South East	101.023	102.982
2010	2	South East	96.536	103.291
2010	3	South East	98.185	103.435
2010	4	South East	99.298	103.634
2010	5	South East	96.808	103.698
2010	6	South East	99.574	103.447

2010	7	South East	97.892	103.477
2010	8	South East	98.696	103.476
2010	9	South East	98.092	103.694
2010	10	South East	101.242	104.078
2010	11	South East	99.400	103.692
2010	12	South East	95.669	103.146
2011	1	South East	104.089	104.890
2011	2	South East	102.490	105.551
2011	3	South East	103.417	104.963
2011	4	South East	108.298	105.590
2011	5	South East	105.722	105.342
2011	6	South East	111.223	106.262
2011	7	South East	103.429	106.066
2011	8	South East	101.513	106.411
2011	9	South East	103.119	105.647
2011	10	South East	103.132	105.820
2011	11	South East	101.464	105.830
2011	12	South East	97.919	105.618
2012	1	South East	103.545	105.875
2012	2	South East	104.365	105.951
2012	3	South East	102.785	105.684
2012	4	South East	103.993	105.653
2012	5	South East	100.001	106.017
2012	6	South East	103.755	107.512
2012	7	South East	102.257	107.492
2012	8	South East	100.932	106.527
2012	9	South East	104.486	106.012
2012	10	South East	103.597	106.143
2012	11	South East	102.571	106.305

2012	12	South East	94.354	106.249
2005	1	South West	100.000	100.000
2005	2	South West	102.809	99.004
2005	3	South West	101.168	97.709
2005	4	South West	100.791	99.701
2005	5	South West	99.256	97.103
2005	6	South West	100.575	99.437
2005	7	South West	100.682	99.835
2005	8	South West	102.978	98.666
2005	9	South West	101.285	97.970
2005	10	South West	99.207	98.559
2005	11	South West	96.997	98.619
2005	12	South West	96.546	98.575
2006	1	South West	95.532	98.132
2006	2	South West	91.902	99.150
2006	3	South West	95.024	97.796
2006	4	South West	94.890	98.604
2006	5	South West	94.665	98.850
2006	6	South West	96.044	98.807
2006	7	South West	96.859	99.715
2006	8	South West	95.786	98.946
2006	9	South West	95.682	99.017
2006	10	South West	95.126	98.854
2006	11	South West	92.143	98.915
2006	12	South West	92.247	98.014
2007	1	South West	92.360	99.396
2007	2	South West	91.689	99.321
2007	3	South West	95.921	98.774
2007	4	South West	95.790	99.252

2007	5	South West	92.476	99.642
2007	6	South West	94.404	101.337
2007	7	South West	95.703	100.452
2007	8	South West	92.867	100.707
2007	9	South West	95.571	100.203
2007	10	South West	93.897	100.043
2007	11	South West	93.581	99.780
2007	12	South West	94.240	99.162
2008	1	South West	92.575	99.894
2008	2	South West	91.456	99.484
2008	3	South West	92.118	99.759
2008	4	South West	93.158	102.000
2008	5	South West	96.873	101.574
2008	6	South West	97.326	100.762
2008	7	South West	95.006	100.557
2008	8	South West	93.151	100.516
2008	9	South West	98.259	100.218
2008	10	South West	93.210	100.840
2008	11	South West	96.357	101.830
2008	12	South West	93.724	102.449
2009	1	South West	101.446	103.594
2009	2	South West	100.753	103.363
2009	3	South West	102.715	104.406
2009	4	South West	100.515	103.442
2009	5	South West	103.364	102.880
2009	6	South West	98.471	103.210
2009	7	South West	102.527	102.918
2009	8	South West	104.146	102.870
2009	9	South West	102.111	103.033

2009	10	South West	103.855	102.667
2009	11	South West	96.383	103.572
2009	12	South West	101.503	103.323
2010	1	South West	106.001	103.585
2010	2	South West	95.765	104.736
2010	3	South West	100.717	105.226
2010	4	South West	103.223	105.448
2010	5	South West	96.053	105.277
2010	6	South West	100.298	104.962
2010	7	South West	102.879	104.997
2010	8	South West	103.668	104.792
2010	9	South West	100.598	105.212
2010	10	South West	104.423	105.033
2010	11	South West	106.606	104.643
2010	12	South West	102.472	103.900
2011	1	South West	106.352	106.348
2011	2	South West	106.853	107.685
2011	3	South West	105.816	107.475
2011	4	South West	107.400	107.962
2011	5	South West	112.757	108.194
2011	6	South West	106.335	108.213
2011	7	South West	108.312	108.756
2011	8	South West	106.166	108.138
2011	9	South West	105.005	108.391
2011	10	South West	104.691	107.848
2011	11	South West	104.496	106.959
2011	12	South West	100.890	106.462
2012	1	South West	107.221	107.229
2012	2	South West	107.617	108.920

2012	3	South West	103.057	109.225
2012	4	South West	109.519	109.598
2012	5	South West	106.043	110.002
2012	6	South West	104.050	110.405
2012	7	South West	107.630	111.040
2012	8	South West	104.154	110.856
2012	9	South West	107.722	110.413
2012	10	South West	105.191	109.216
2012	11	South West	105.576	109.531
2012	12	South West	100.645	108.947
2005	1	Wales	100.000	100.000
2005	2	Wales	100.107	99.596
2005	3	Wales	99.289	96.202
2005	4	Wales	97.022	100.659
2005	5	Wales	99.069	97.065
2005	6	Wales	99.415	100.307
2005	7	Wales	98.526	99.055
2005	8	Wales	96.641	97.746
2005	9	Wales	95.417	97.969
2005	10	Wales	98.071	98.963
2005	11	Wales	95.283	98.994
2005	12	Wales	92.739	98.376
2006	1	Wales	93.465	100.481
2006	2	Wales	91.763	102.447
2006	3	Wales	93.978	100.366
2006	4	Wales	94.040	101.800
2006	5	Wales	93.520	100.782
2006	6	Wales	91.890	99.998
2006	7	Wales	92.356	98.172

2006	8	Wales	90.346	98.218
2006	9	Wales	89.450	99.855
2006	10	Wales	91.012	100.182
2006	11	Wales	89.075	100.149
2006	12	Wales	89.711	99.965
2007	1	Wales	88.897	99.846
2007	2	Wales	93.290	99.663
2007	3	Wales	90.271	98.929
2007	4	Wales	90.449	100.623
2007	5	Wales	89.472	100.769
2007	6	Wales	89.185	98.267
2007	7	Wales	90.681	101.720
2007	8	Wales	93.837	100.932
2007	9	Wales	92.688	100.332
2007	10	Wales	93.114	99.993
2007	11	Wales	90.958	97.840
2007	12	Wales	90.339	97.560
2008	1	Wales	88.324	99.222
2008	2	Wales	90.620	98.221
2008	3	Wales	89.038	99.480
2008	4	Wales	93.155	99.225
2008	5	Wales	91.684	98.834
2008	6	Wales	91.597	98.159
2008	7	Wales	91.829	98.791
2008	8	Wales	89.872	99.269
2008	9	Wales	90.964	99.053
2008	10	Wales	91.592	99.767
2008	11	Wales	89.920	99.968
2008	12	Wales	91.812	100.512

2009	1	Wales	93.939	100.663
2009	2	Wales	98.090	101.006
2009	3	Wales	97.383	101.573
2009	4	Wales	98.727	101.407
2009	5	Wales	98.236	102.227
2009	6	Wales	95.904	102.636
2009	7	Wales	97.258	103.222
2009	8	Wales	99.688	103.160
2009	9	Wales	99.263	103.257
2009	10	Wales	97.297	102.275
2009	11	Wales	96.472	102.121
2009	12	Wales	95.817	101.813
2010	1	Wales	97.322	104.174
2010	2	Wales	98.614	103.910
2010	3	Wales	96.577	104.069
2010	4	Wales	98.194	104.585
2010	5	Wales	96.970	105.170
2010	6	Wales	98.038	103.988
2010	7	Wales	100.008	105.112
2010	8	Wales	95.095	104.382
2010	9	Wales	101.091	104.687
2010	10	Wales	98.646	104.216
2010	11	Wales	101.156	104.626
2010	12	Wales	104.502	103.763
2011	1	Wales	109.164	105.761
2011	2	Wales	99.976	104.004
2011	3	Wales	101.372	105.873
2011	4	Wales	103.325	106.279
2011	5	Wales	105.930	105.384

2011	6	Wales	108.010	105.890
2011	7	Wales	109.249	105.506
2011	8	Wales	105.337	105.724
2011	9	Wales	106.664	107.083
2011	10	Wales	105.582	106.182
2011	11	Wales	104.649	106.672
2011	12	Wales	95.400	106.433
2012	1	Wales	106.371	106.489
2012	2	Wales	108.665	106.715
2012	3	Wales	104.168	106.544
2012	4	Wales	102.685	108.019
2012	5	Wales	102.561	108.515
2012	6	Wales	102.692	108.846
2012	7	Wales	99.414	109.277
2012	8	Wales	102.843	109.910
2012	9	Wales	102.129	108.594
2012	10	Wales	101.487	108.224
2012	11	Wales	99.809	108.148
2012	12	Wales	97.724	107.909
2005	1	West Midlands	100.000	100.000
2005	2	West Midlands	102.321	98.681
2005	3	West Midlands	100.647	97.538
2005	4	West Midlands	100.233	99.358
2005	5	West Midlands	100.057	97.335
2005	6	West Midlands	100.874	99.069
2005	7	West Midlands	98.513	99.253
2005	8	West Midlands	99.822	98.343
2005	9	West Midlands	99.390	98.492
2005	10	West Midlands	97.438	98.061

2005	11	West Midlands	97.813	99.045
2005	12	West Midlands	95.536	98.296
2006	1	West Midlands	96.050	97.812
2006	2	West Midlands	93.697	97.808
2006	3	West Midlands	96.692	96.874
2006	4	West Midlands	96.407	97.503
2006	5	West Midlands	94.415	97.610
2006	6	West Midlands	97.870	97.312
2006	7	West Midlands	97.381	97.476
2006	8	West Midlands	98.545	97.301
2006	9	West Midlands	96.676	96.864
2006	10	West Midlands	97.035	96.905
2006	11	West Midlands	95.031	96.432
2006	12	West Midlands	94.036	96.085
2007	1	West Midlands	96.890	96.451
2007	2	West Midlands	97.754	97.569
2007	3	West Midlands	96.190	97.601
2007	4	West Midlands	98.536	98.240
2007	5	West Midlands	98.790	98.803
2007	6	West Midlands	96.726	99.688
2007	7	West Midlands	95.434	100.246
2007	8	West Midlands	94.069	99.316
2007	9	West Midlands	94.695	99.555
2007	10	West Midlands	93.514	99.519
2007	11	West Midlands	91.160	98.977
2007	12	West Midlands	90.813	98.375
2008	1	West Midlands	92.781	99.159
2008	2	West Midlands	95.239	100.946
2008	3	West Midlands	92.602	100.393

2008	4	West Midlands	96.243	101.422
2008	5	West Midlands	97.563	101.453
2008	6	West Midlands	95.667	101.469
2008	7	West Midlands	96.432	101.120
2008	8	West Midlands	93.345	101.266
2008	9	West Midlands	91.227	100.727
2008	10	West Midlands	92.947	101.492
2008	11	West Midlands	93.567	101.361
2008	12	West Midlands	93.457	101.235
2009	1	West Midlands	98.503	102.321
2009	2	West Midlands	99.600	101.659
2009	3	West Midlands	96.613	102.236
2009	4	West Midlands	101.455	101.625
2009	5	West Midlands	99.589	101.237
2009	6	West Midlands	98.850	100.880
2009	7	West Midlands	99.843	100.510
2009	8	West Midlands	99.705	99.926
2009	9	West Midlands	102.027	100.331
2009	10	West Midlands	99.503	100.322
2009	11	West Midlands	97.511	100.325
2009	12	West Midlands	96.150	99.807
2010	1	West Midlands	99.140	100.113
2010	2	West Midlands	96.341	103.108
2010	3	West Midlands	99.364	102.779
2010	4	West Midlands	98.981	102.522
2010	5	West Midlands	97.258	101.963
2010	6	West Midlands	99.348	101.821
2010	7	West Midlands	100.677	102.364
2010	8	West Midlands	98.631	102.315

2010	9	West Midlands	100.922	101.052
2010	10	West Midlands	100.668	101.896
2010	11	West Midlands	101.718	102.114
2010	12	West Midlands	97.043	101.410
2011	1	West Midlands	105.176	102.199
2011	2	West Midlands	98.764	103.116
2011	3	West Midlands	99.108	102.848
2011	4	West Midlands	101.391	102.747
2011	5	West Midlands	105.830	102.263
2011	6	West Midlands	100.729	102.185
2011	7	West Midlands	108.096	103.235
2011	8	West Midlands	101.689	103.200
2011	9	West Midlands	101.686	103.904
2011	10	West Midlands	99.453	104.005
2011	11	West Midlands	100.828	104.028
2011	12	West Midlands	94.228	103.685
2012	1	West Midlands	105.102	104.030
2012	2	West Midlands	103.734	104.029
2012	3	West Midlands	105.570	104.630
2012	4	West Midlands	103.961	104.689
2012	5	West Midlands	104.624	104.263
2012	6	West Midlands	101.934	104.721
2012	7	West Midlands	102.653	105.280
2012	8	West Midlands	106.800	105.075
2012	9	West Midlands	102.313	104.609
2012	10	West Midlands	104.838	104.303
2012	11	West Midlands	100.247	104.202
2012	12	West Midlands	98.319	104.116
2005	1	Yorkshire &	100.000	100.000

		Humberside		
2005	2	Yorkshire & Humberside	98.976	102.080
2005	3	Yorkshire & Humberside	97.320	100.667
2005	4	Yorkshire & Humberside	95.546	100.023
2005	5	Yorkshire & Humberside	97.550	100.971
2005	6	Yorkshire & Humberside	96.092	100.323
2005	7	Yorkshire & Humberside	93.916	101.032
2005	8	Yorkshire & Humberside	97.273	101.102
2005	9	Yorkshire & Humberside	93.001	100.601
2005	10	Yorkshire & Humberside	94.375	100.715
2005	11	Yorkshire & Humberside	95.023	100.853
2005	12	Yorkshire & Humberside	93.918	101.278
2006	1	Yorkshire & Humberside	94.889	100.921
2006	2	Yorkshire & Humberside	94.490	102.824
2006	3	Yorkshire & Humberside	96.424	101.198
2006	4	Yorkshire & Humberside	95.867	101.847
2006	5	Yorkshire & Humberside	94.905	103.394
2006	6	Yorkshire & Humberside	96.397	101.939

2006	7	Yorkshire & Humberside	93.906	102.151
2006	8	Yorkshire & Humberside	95.064	103.019
2006	9	Yorkshire & Humberside	94.103	102.719
2006	10	Yorkshire & Humberside	95.548	102.350
2006	11	Yorkshire & Humberside	93.526	102.608
2006	12	Yorkshire & Humberside	93.658	103.489
2007	1	Yorkshire & Humberside	95.890	104.894
2007	2	Yorkshire & Humberside	95.049	103.938
2007	3	Yorkshire & Humberside	94.248	105.332
2007	4	Yorkshire & Humberside	95.346	104.990
2007	5	Yorkshire & Humberside	94.222	104.517
2007	6	Yorkshire & Humberside	94.062	104.947
2007	7	Yorkshire & Humberside	95.625	106.162
2007	8	Yorkshire & Humberside	94.184	106.484
2007	9	Yorkshire & Humberside	93.889	106.090
2007	10	Yorkshire & Humberside	91.904	105.761
2007	11	Yorkshire & Humberside	91.763	105.363
2007	12	Yorkshire &	91.546	105.354

		Humberside		
2008	1	Yorkshire & Humberside	90.585	105.701
2008	2	Yorkshire & Humberside	93.451	103.867
2008	3	Yorkshire & Humberside	94.287	104.473
2008	4	Yorkshire & Humberside	100.838	105.471
2008	5	Yorkshire & Humberside	96.615	104.550
2008	6	Yorkshire & Humberside	97.778	103.681
2008	7	Yorkshire & Humberside	95.605	104.031
2008	8	Yorkshire & Humberside	95.144	103.443
2008	9	Yorkshire & Humberside	92.598	103.389
2008	10	Yorkshire & Humberside	94.821	103.427
2008	11	Yorkshire & Humberside	96.411	104.089
2008	12	Yorkshire & Humberside	98.206	106.308
2009	1	Yorkshire & Humberside	98.020	107.558
2009	2	Yorkshire & Humberside	98.583	107.347
2009	3	Yorkshire & Humberside	99.242	107.530
2009	4	Yorkshire & Humberside	100.654	107.559
2009	5	Yorkshire & Humberside	99.328	108.055

2009	6	Yorkshire & Humberside	99.581	107.917
2009	7	Yorkshire & Humberside	99.621	107.828
2009	8	Yorkshire & Humberside	97.125	107.992
2009	9	Yorkshire & Humberside	100.466	107.847
2009	10	Yorkshire & Humberside	98.351	107.149
2009	11	Yorkshire & Humberside	99.132	107.028
2009	12	Yorkshire & Humberside	94.949	106.434
2010	1	Yorkshire & Humberside	99.934	105.692
2010	2	Yorkshire & Humberside	99.955	108.569
2010	3	Yorkshire & Humberside	101.332	109.081
2010	4	Yorkshire & Humberside	104.770	110.678
2010	5	Yorkshire & Humberside	104.908	110.023
2010	6	Yorkshire & Humberside	104.120	109.130
2010	7	Yorkshire & Humberside	106.879	109.582
2010	8	Yorkshire & Humberside	102.709	108.526
2010	9	Yorkshire & Humberside	103.239	108.729
2010	10	Yorkshire & Humberside	103.796	109.048
2010	11	Yorkshire &	106.686	108.896

		Humberside		
2010	12	Yorkshire & Humberside	100.720	108.124
2011	1	Yorkshire & Humberside	110.686	109.574
2011	2	Yorkshire & Humberside	101.141	109.231
2011	3	Yorkshire & Humberside	102.060	108.111
2011	4	Yorkshire & Humberside	101.424	109.625
2011	5	Yorkshire & Humberside	104.197	109.192
2011	6	Yorkshire & Humberside	102.432	108.847
2011	7	Yorkshire & Humberside	105.565	109.188
2011	8	Yorkshire & Humberside	103.530	108.858
2011	9	Yorkshire & Humberside	104.452	108.810
2011	10	Yorkshire & Humberside	103.702	108.646
2011	11	Yorkshire & Humberside	100.901	109.440
2011	12	Yorkshire & Humberside	97.550	109.655
2012	1	Yorkshire & Humberside	99.792	109.212
2012	2	Yorkshire & Humberside	102.742	107.978
2012	3	Yorkshire & Humberside	102.599	110.475
2012	4	Yorkshire & Humberside	102.787	109.049

2012	5	Yorkshire & Humberside	105.965	110.308
2012	6	Yorkshire & Humberside	102.098	111.363
2012	7	Yorkshire & Humberside	103.525	111.088
2012	8	Yorkshire & Humberside	102.828	110.612
2012	9	Yorkshire & Humberside	101.669	110.849
2012	10	Yorkshire & Humberside	103.782	110.141
2012	11	Yorkshire & Humberside	106.300	109.750
2012	12	Yorkshire & Humberside	99.364	109.556

8.4 Appendix E: correlation matrix of independent variables for violence and alcohol price model

	on-trade alcohol price (log)	off-trade alcohol price (log)	poverty	income inequality	youth unemployment	spring	autumn	winter
on-trade alcohol price (log)	1							
off-trade alcohol price (log)	0.49***	1						
poverty	-0.18***	-0.03	1					
income inequality	-0.12***	-0.21***	-0.29***	1				
youth unemployment	0.23***	0.36***	0.38***	-0.51***	1			
spring	-0.02	0.05	0.00	0.00	0.01	1		
autumn	0.01	-0.02	0.00	0.00	0.00	-0.33***	1	
winter	-0.05	-0.09**	0.00	0.00	0.02	-0.33***	-0.33***	1

***significant at 0.1% level, **significant at 1% level, *significant at 5% level

8.5 Appendix F: Violence-related injury and the real price of alcohol; OLS regression results

Dependent variable = adult violence-related injury rate (18+ years)

	Coefficient	Std. Error	t-value	p-value	
Total					
Intercept	13.915	1.197	11.628	<0.001	***
Log(on-trade)	-2.528	0.245	-10.326	<0.001	***
Log(off-trade)	-0.052	0.155	-0.338	0.736	
Income inequality	-1.180	0.226	-5.220	<0.001	***
Poverty	0.017	0.002	8.308	<0.001	***
Youth unemployment	0.022	0.005	4.106	<0.001	***
Spring	-0.041	0.017	-2.407	0.016	*
Autumn	-0.056	0.017	-3.286	0.001	**
Winter	-0.079	0.017	-4.611	<0.001	***
Adjusted R-squared	0.3516				
F-statistic	F(8,927)=64.39			<0.001	***
Male					
Intercept	23.011	1.882	12.228	<0.001	***
Log(on-trade)	-4.075	0.385	-10.586	<0.001	***
Log(off-trade)	-0.261	0.243	-1.075	0.283	
Income inequality	-1.744	0.355	-4.906	<0.001	***
Poverty	0.023	0.003	7.324	<0.001	***
Youth unemployment	0.035	0.009	4.130	<0.001	***
Spring	-0.060	0.027	-2.232	0.026	*
Autumn	-0.079	0.027	-2.960	0.003	**
Winter	-0.117	0.027	-4.313	<0.001	***
Adjusted R-squared	0.3377				
F-statistic	F(8,927)=59.09			<0.001	***
Female					
Intercept	5.668	0.619	9.161	<0.001	***
Log(on-trade)	-1.114	0.127	-8.805	<0.001	***
Log(off-trade)	0.136	0.080	1.698	0.090	Ψ
Income inequality	-0.697	0.117	-5.960	<0.001	***
Poverty	0.010	0.001	9.995	<0.001	***

Youth unemployment	0.010	0.003	3.503	<0.001	***
Spring	-0.024	0.009	-2.670	0.008	**
Autumn	-0.034	0.009	-3.864	<0.001	***
Winter	-0.044	0.009	-4.992	<0.001	***
Adjusted R-squared	0.3708				
F-statistic	F(8,927)=69.87			<0.001	***

***significant at 0.1%; **significant at 1% level; *significant at 5% level;

$^{\Psi}$ significant at 10% level

8.6 Appendix G: *"Trends in community violence in England and Wales 2005-2009"* (peer-reviewed journal article)

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Trends in community violence in England and Wales 2005–2009

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ABSTRACT

Purpose: Injury records from Emergency Departments (EDs) have been studied over the last decade as part of the work of the National Violence Surveillance Network (NVSN) and provide information about local, regional and national violence levels and trends in England and Wales. The purpose of the current study is to evaluate overall, gender, age-specific and regional trends in community violence in England and Wales from an ED perspective from January 2005 to December 2009.
Methods: Violence-related injury data were collected prospectively in a stratified sample of 77 EDs (Types 1, 3 and 4) in the nine Government Office Regions in England and in Wales. All 77 EDs were recruited on the basis that they had implemented and continued to comply with the provisions of the 1998 Data Protection Act and Caldicott guidance. Attendance date, age and gender of patients who reported injury in violence were identified using assault-related attendance codes, specified at the local level. Time series statistical methods were used to detect both regional and national trends.
Results: In total 221,673 (163,384 males: 74%) violence-related attendances were identified. Overall estimated annual injury rate was 6.5 per 1000 resident population (males 9.8 and females 3.4 per 1000). Violence affecting males and females decreased significantly in England and Wales over the 5-year period, with an overall estimated annual decrease of 3% (95% CI: 1.8–4.1%, $p < 0.05$). Attendances decreased significantly for both genders across four out of the five age groups studied. Attendances were found to be highest during the months of May and July and lowest in February. Substantial differences in violence-related ED attendances were identified at the regional level.
Conclusions: From this ED perspective overall violence in England and Wales decreased over the period 2005–2009 but increased in East Midlands, London and South West regions. Since 2006, overall trends according to Crime Survey for England and Wales (CSEW), police and ED measures were similar, though CSEW and ED measures reflect far greater numbers of violent incidents than police data. Causes of decreases in violence in regions need to be identified and shared with regions where violence increased.

Introduction

In the UK the Coalition Government has prioritised the collection and use of Emergency Department (ED) derived information for violence prevention purposes [1]. Endorsed by the World Health Organisation (WHO) and previous publications by the National Violence Surveillance Network (NVSN), this harm based measure has been shown to be a reliable and objective measure that is less prone to reporting and recording biases than police measures and has, through routine collection and analysis, led to substantial and significant reductions in violence-related hospital admissions [2–4].

Although levels and trends in violence in England and Wales have traditionally been measured using the two official Home Office sources of data, the Crime Survey for England and Wales (CSEW: formerly the British Crime Survey, BCS) and police records, official statistics have often been contradictory. For example, the number of BCS violent incidents resulting in injury in 2009/2010 revealed a 29% decrease compared with the same figure in 2001 and police recorded incidents of violence against the person and its subcategory, violence against the person with injury (which includes all assault with minor injury and incidents of wounding), increased over the first half of the decade (between 2002 and 2005). However, by 2009/2010 both violence against the person and violence against the person with injury recorded by the police had fallen by 18% and 27% respectively [5].

In addition to the official publications, injury records from EDs have been studied over the last decade as part of the work of

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the NVSN and provide information about local, regional and national violence levels and trends in England and Wales. The network has shown injury data to be a robust and alternative source of information on levels and trends in violence and has brought clarity to national trends by triangulating measurement. According to NVSN there were significant decreases in violence for both males and females and for all age groups studied between 1st January 2000 and 31st December 2004 (decreases of 20% in Wales and 13% in England) [6]. However, despite these decreases, the rate of violence was found to differ greatly among economic regions, with higher rates identified in the Northern regions. Regional inequalities in health and prosperity are well documented in England and Wales. Disparity in earnings, educational achievement, mortality rates, childhood obesity, lung cancer and alcohol-related harm are but a few examples that highlight the existence of such inequality [7]. It is therefore likely that violence, with its strong inequality gradient, would also be more prevalent in regions where levels of health and prosperity are low [8].

In this study, trends in violence according to ED data in England and Wales, over the 5-year period, 1st January 2005–31st December 2009 were investigated. The purpose of the study was to determine age, gender and region-specific rates of violence and violence trends and violence seasonality.

Methods

ED departments and injury records

Information on attendance date, age and gender of patients who reported injury in violence were collected from a stratified sample of 77 Types 1, 3 and 4 EDs (Type 1 = consultant led 24 h service with full resuscitation facilities; Type 3 = other types of ED/minor injury units; Type 4 = NHS walk-in centres) in the nine

Fig. 1. Distribution of EDs in the study sample by Government Office Regions.

Government Office Regions (GORs) in England (Eastern, East Midlands, London, North East, North West, South East, South West, West Midlands, Yorkshire & Humberside) and in Wales over 5 years, January 1st 2005–31st December 2009 (Fig. 1). No Type 2 EDs (consultant led single speciality accident and emergency service) were successfully recruited to the study. Violence-related injury is an established category for attendance in all ED software packages and is recorded electronically by reception staff; the most appropriate staff to record such data [9]. For every new incident a new record was created and at all times during data retrieval patient confidentiality was maintained. All 77 EDs were certified members of the NVSN and were recruited on the basis that they were willing to share electronic data, had implemented and continued to comply with the provisions of the 1998 Data Protection Act and Caldicott guidance and that access to ED computer systems was restricted to a limited number of ED staff. The data is retrieved annually and has been since 1995 (see Fig. 2).

Violence-related attendance data and statistical methods

ED attendances were categorised by gender and five age groups: 0–10, 11–17, 18–30, 31–50 and 51+ years: identical categorisation to that reported in previous NSVN publications [6]. To reduce biases in the sample due to inclusion criteria used to recruit EDs, with GORs being over or under-represented, the sample population was weighted so that regional comparisons could be made. The methods used for deriving appropriate weights for individual regions have been detailed in previous publications [6]. In summary, the representation size of the sample EDs within each GOR was calculated and was termed the coverage ratio (CR);

$$\mathrm{CR}_i = \frac{B_i}{A_i}, \quad i = 1, 2, \ldots 10.$$

where B is the total regional annual attendance at EDs in the sample, A is the total annual attendance at all EDs (including Minor Injury Units and Walk-in Centres) within each GOR. Thus, a CR equal to one indicates full coverage and CR equal to zero indicates no coverage. Comparative GOR violence statistics were obtained by multiplying the number of persons injured in each region by 1/CR. As the total resident population by Government Office Region and by age is known, it was possible to stratify the regions according to the proportion of persons injured in violence [10]. A measure of the likelihood of being injured in violence within a region was given by

$$V_i = \frac{((1/\mathrm{CR}_i) \times n)_i}{N_i}$$

where V_i is the likelihood of being injured in violence in region i, n_i is the number of injured persons attending EDs in region i, and N_i is the total resident population of region i. Violence injury rates (number of injured per 1000 resident population) for all ten regions were computed. This calculation was carried out for both genders and for the five age categories.

Since violence is measured by count of attendances, there were a substantial proportion of zeroes in the 0–10 years and 51 years and over age groups. A negative binomial regression model (to account for any over-dispersion) was therefore fitted using a time trend (month number) with age category, region, month and gender dummy variables. Interactions between region and time, age category and time, age category and region, gender and age category, month and age category, gender and region and gender and time were also identified. In total, there were 5880 observations from 1st January 2005 to 31st December 2009. The study did not have access to the 2009 attendance data for the West Midlands region and resulted in 120 missing observations within the sample. The violence count used as the dependent variable was, as described above, an estimate obtained by grossing up the actual violence count recorded in EDs, using a coverage ratio based upon the annual attendance at EDs and attendances at all EDs in the region.

Since regional population vary with time, a log-linear regression was carried out and modelled on person-days (an exposure variable taking account of month length) from census data across the same time period. Violence rate and trend coefficients for individual regions, for example, were estimated from the ratio of these two regression models. This was done using expressions for these aggregate coefficients which are essentially weighted averages over the demographic subcategories within that region. A similar weighted averaging process was also performed over the coefficient covariance matrix for the negative binomial regression to estimate the standard errors of these aggregated coefficients. Seasonality was investigated by a similar process of aggregating over, say, region, gender, etc. to establish average rates for each month using January as the reference. More detailed methods have been published previously [6].

All data were processed in the 'R' statistical programming language both for collection and cleaning of the ED data as well as the model fitting [11].

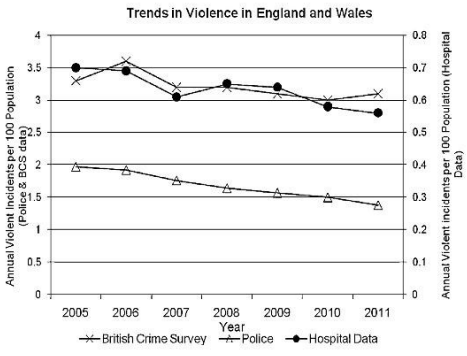

Fig. 2. Trends in violence in England and Wales.

Results

Violence-related injury rates

In total, there were 221,673 violence-related attendances in the 77 EDs over 5 years between 2005 and 2009. Age and gender distributions are shown in Table 1: similar to ED attendances during the previous 5 years. A quarter of attendances were of females (58,289, 26%). Those aged 18–30 years made up approximately 45% of attendances (n = 98,832). This was followed, in order, by those aged 11–17 years, 31–50 years, 51 years and over, and those aged 10 years and under.

Table 2 shows injury rates by gender by age groups and GORs. Overall in England and Wales, 6.5 per 1000 residents attended EDs annually (between 2005 and 2009) for treatment following injury in violence. Male to female ratio was three to one; 9.8 per 1000 male residents (95% CI: 7.6–10.6) and 3.4 per 1000 female residents (95% CI: 2.6–3.7). The highest injury rates were identified in the Northern regions; where the rates ranged from a low of 6.5

Table 1
Age and gender of patients who attended 77 EDs for treatment following violence-related injury between 1st January 2005 and 31st December 2009.

Age groups	Males	Females	Total
0–10	2404	977	3381 (1.5%)
11–17	34,564	12,664	47,228 (21.3%)
18–30	75,533	23,299	98,832 (44.6%)
31–50	43,184	17,887	43,184 (27.6%)
50+	7653	3508	11,161 (5.0%)
Total	163,384 (73.7%)	58,289 (26.3%)	221,673

per 1000 residents (95% CI: 4.6–9.8) in the Yorkshire and Humberside region to a high of 12.3 per 1000 residents (95% CI: 10.5–15.2) in the North West region. The lowest injury rates were identified in the Eastern region (3.9 per 1000 residents, 95% CI: 3.1–4.7).

Analyses by age group and gender showed that those aged 18–30 years had the highest injury rates per 1000 population (males 27.4, 95% CI: 21.6–29.7; females 8.6, 95% CI: 6.8–9.3) followed by those aged 11–17 years (males 17.3, 95% CI: 12.9–21.3; females 6.9, 95% CI: 5.4–8.6), those aged 31–50 years (males 9.4, 95% CI: 7.3–10.6; females 3.9, 95% CI: 3.0–4.2), those aged 51 years and over (males 1.7, 95% CI: 1.3–1.9; females 0.67, 95% CI: 0.5–0.7) and those aged 10 years and younger (males 0.65, 95% CI: 0.5–0.7; females 0.3, 95% CI: 0.2–0.4).

National trends and seasonality

Table 3 shows trends in violence-related attendances at EDs by gender and age groups in England and Wales over the 5-year period. Violence affecting males and females decreased substantially, with an overall estimated annual decrease of 3% (95% CI: 1.8–4.1%, $p < 0.05$). Violence affecting males and females aged 10 years and under, 11–17 years, 31–50 years and those aged 51 years and over decreased substantially over the study period. Violence affecting males and females aged 18–30 years did not change. Violence-related ED attendances were highest in May (7.0 per 1000 population; 95% CI: 5.7–8.0) and July (7.0 per 1000 population; 95% CI: 5.8–7.8) and lowest in February (5.6 per 1000 population; 95% CI: 4.6–6.4). There was little difference between seasonal variation of male and female ED attendances over the 5-year period. The largest rate ratio between male and female ED attendances was identified in December (3.2).

Trends by regions

Trends in violence related ED attendances by GOR showed significant differences between regions (Table 4). Decreases were identified in four of the English regions (Eastern, South East, North East and North West) and in Wales, with the Eastern region experiencing the most substantial decline. Comparatively, significant increases were identified in the East Midlands, London and South West regions. Yorkshire and Humberside and West Midlands regions did not experience a significant change over the study period. Age group analyses showed variability within and between GORs. Violence related attendances of those aged 0–10 years decreased in eight regions (except in Eastern and East Midlands, which showed no change). Amongst the regions which showed decreases in overall violence, almost all age groups (except those aged 0–10 years in Eastern and 18–30 years in North East) showed decreases in ED attendances over the 5 years. In Yorkshire and Humberside attendance of males and females did not change over the study period. However, age group analyses showed increases in ED attendances of those aged 18–30 years and decreases in those aged 0–17 years and 31–50 years.

Table 3
Trends in violence-related ED attendances in England and Wales by gender and age group for period 1st January 2005 to 31st December 2009.

Gender and age group	% annual change in attendance
Regression based trends	
Females 0–10	−13.3 (−11.2 to −15.2)**
Male 0–10	−13.3 (−11.3 to −15.2)**
Females 11–17	−6.2 (−4.3 to −8.0)**
Males 11–17	−6.2 (−4.4 to −8.1)**
Females 31–50	−2.9 (−1.0 to −4.8)**
Males 31–50	−2.9 (−1.0 to −4.8)**
Females	−3.2 (−1.9 to −4.5)**
All	−3.0 (−1.8 to −4.1)**
Males	−2.9 (−1.6 to −4.2)**
Females 50+	−2.6 (−0.6 to −4.5)*
Males 50+	−2.6 (−0.7 to −4.6)*
Females 18–30	−1.7 (−3.6 to 0.3)
Males 18–30	−1.7 (−3.6 to 0.2)

95% confidence intervals in parenthesis.
* Significant at the 10% level.
** Significant at the 5% level.

Discussion

This national study, based on a sample of 77 EDs, stratified by ten GORs in England and Wales, showed substantial decreases in violence-related attendances of both males and females in the 5 years, 2005–2009. All age groups, except those aged 18–30 years, showed significant decreases. Previous ED based investigations on national violence trends showed that between 1995 and 2000 there was no significant change in overall violence-related attendances followed by a substantial decrease in violence-related ED attendances between 2000 and 2004 [6,12]. However, a substantial increase in attendance rates from 2004 to 2006 means that, in fact, such attendances have only decreased since 2006. This

Table 2
Overall annual violence-related injury rate (per 1000 resident population) by gender, age group and Government Office Region.

Region	0–10		11–17		18–30		31–50		51+		
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	All
North West	1.2	0.5	11.9	29.8	51.5	16.4	19.5	7.6	3.1	1.1	12.3
North East	1.3	0.8	23.1	9.9	32.7	10.6	11.8	4.8	2.0	0.9	8.1
Wales	0.9	0.5	19.0	8.2	36.8	12.0	12.1	4.7	1.7	0.7	7.9
West Midlands	0.6	0.4	19.6	7.1	31.8	10.1	11.5	4.3	2.2	0.7	7.5
Yorkshire and Humberside	0.6	0.2	15.5	7.3	26.4	6.8	9.8	4.1	1.4	0.6	6.5
South East	0.6	0.3	14.8	5.7	24.6	6.8	7.7	2.9	1.4	0.6	5.4
London	0.4	0.3	18.1	7.3	16.9	5.6	6.0	3.2	2.0	0.9	5.3
South West	0.9	0.4	17.1	6.5	23.7	7.3	7.2	2.9	1.1	0.5	5.2
East Midlands	0.5	0.2	4.1	10.2	17.8	5.9	6.0	2.6	1.0	0.4	4.1
Eastern	0.4	0.2	10.8	4.0	18.4	5.1	5.6	2.1	1.0	0.4	3.9

Table 4
Trends in violence-related ED attendances by Government Office Region for period 1st January 2005 to 31st December 2009.

Government Office Region	% annual change in attendance
Regression based trends	
Eastern	−12.6 (−10.3 to −14.8)**
Wales	−7.4 (−5.0 to 9.7)**
South East	−7.4 (−5.1 to 9.7)**
North West	−4.9 (−2.5 to −7.2)**
North East	−3.8 (−1.4 to −6.2)**
Yorkshire and Humberside	−0.8 (−3.3 to 1.7)
West Midlands	1.8 (−1.7 to 5.3)
London	3.6 (1.1–6.2)**
South West	9.8 (7.1–12.6)**
East Midlands	12.1 (9.3–15.0)**

95% confidence intervals in parenthesis.
** Significant at the 5% level.

finding is consistent with hospital admissions data for deliberate harm in England (represented by ICD codes X85 to Y09, codes for deliberate external causes) where, apart from an isolated increase in 2006/2007, the number of admissions following assault by blunt and sharp objects decreased by 11% between 2005 and 2009 [13].

This decline in violence according to hospital data is similar to trends identified from the BCS; overall BCS violence in England and Wales has been in decline since the mid 1990s [14]. When compared to BCS levels of violence in 1995, the number of violent incidents in 2010/2011 was around half (47%) and at a similar level to 1981 – this amounts to two million fewer incidents in 2010/2011 and around 750,000 fewer victims compared with the 1995 BCS. Since 1995, according to the BCS, violence with injury has fallen by 50% and violence without injury by 44%. However, inconsistent with this downward trend were a 38% increase in assault with minor injury between the 2009/2010 and 2010/2011 BCS. This may be the result of better targeted policing, for example, there is evidence to suggest CCTV surveillance directs police to incidents more quickly and more frequently, therefore allowing police to interfere and prevent assault escalating [15].

Comparison with violence trends according to police records is more difficult however. Police records tend to underestimate violence levels mainly because of lack of police ascertainment reflecting low reporting rates which in turn reflect fear of reprisals, inability to identify assailants, lack of benefit for the injured and an unwillingness to have one's conduct scrutinised [16]. Data matching studies in other European countries have also shown consistency in the extent to which serious violence is under ascertained by police services [17]. Police records have also been subject to significant changes in recording practices. For example, the introduction of NCRS in April 2002 led to a rise in recording in 2002/2003, particularly in relation to less serious violent crime in the following years, as forces continued to improve compliance with the new standard. This led to a considerable divergence in trends according to police records and both BCS violence and ED injury records – violence against the person recorded by the police increased between 2002/2003 and 2005/2006 [14]. Since 2005/2006 however, following adaptation of NCRS counting rules by police forces, violence trends have become more consistent across the three sources; numbers of offences against the person recorded by the police decreased by 22% between 2005/2006 and 2010/2011 during which period trend lines according to the three measures were similar.

Despite similarities in trends in violence in England and Wales over the last 5 years disparity in numbers of violent incidents especially according to BCS and police estimates remain. According to the 2009/2010 BCS there were 2,087,000 violent offences against adults in England and Wales [5]. This compares with 871,712 offences of violence against the person recorded by the police in the same period. Both BCS and police recorded incidents of violence can be classified according to whether or not the victim sustained any form of injury as a result of the incident. Most injuries reported to the BCS are relatively minor, such as a black eye, cuts, severe bruising and scratches. According to the 2009/2010 BCS in 17% of violent incidents the victim received some form of medical attention – an estimated 354,790 individuals [5]. Although BCS estimates do not include violent injury in children, this compares remarkably well with NVSN estimates of violence-related injury; according to ED records there were an estimated 350,010 people who attended EDs in England and Wales for treatment following violence in 2009 [18]. This also strongly suggests that most people injured in violence sought treatment in EDs rather than in primary care and provides further evidence of the objectivity of the ED measure. It is a key Government target to make primary care – GPs, opticians, dentists, pharmacists and community health services – more accessible to patients. Although the NHS Plan (2000) set a target where all patients should have the opportunity to be seen by a GP within two working days and by a primary care professional within one working day, the immediacy of treatment need following injury makes EDs more accessible to such patients compared to primary care [19]. EDs should therefore be the focus for NHS efforts to prevent violence in communities.

Although the reasons for decreases in violence nationally are not clear, there is increasing evidence to suggest that both public health and criminal justice interventions may be contributory. Information sharing partnerships between health services, police and local government have been shown to substantially reduce violent injury [3]. Implemented in all regions in England and Wales following the 1998 Crime and Disorder Act and particularly after the tackling knife crime strategy was implemented in 2008 – which placed a legal obligation on police, local government and the National Health Service to collaborate to develop and implement joint crime reduction strategies – information partnerships have altered policing and violence prevention strategies [20,21]. For example, the Cardiff Violence Prevention Programme (CVPP): a data sharing strategy that included police officials, health practitioners, and local government representatives (and later included representatives of education, transport and ambulance services, and local licensees), led to a 35% decrease in assault-related ED attendances between 2000 and 2005, as well as a 31% decrease in the prevalence of assaults occurring within licensed premises in Cardiff, relative to similar cities where this information was not shared [3]. The sharing of ED derived data for the purposes of violence prevention have also shown to be effective in the North West of England [22].

In addition, police officer strength in the 43 English and Welsh Police forces continued to increase, with an estimated increase of over 36,000 officers from 2000 to 2009 (this figures includes a further 16,800 Police Community Support Officers (PCSO), from 2002) [23]. At the same time offenders found guilty at all courts in England and Wales for indictable offences such as violence against the person rose from 40,900 in 2005 to 43,500 in 2009 [24]. It is possible that the continued increases in police officer numbers over the last decade, coupled with the increase in convictions for violent crime over the 5 year period, may also have contributed to decreases in violence in England and Wales. Moreover, the Home Office has stated that from 1999 to 2003, £170 million of capital funding was made available for investment in CCTV development schemes as part of the then Labour Government's Crime Reduction Programme [25]. The effects of CCTV on reducing violence in England have previously been associated with a substantial decrease in the number of people attending EDs for treatment following assault, as well as a substantial increase in violent offences recorded by the police [15]. In 2011 the Association of Chief Police Officers (ACPO) estimated the UK's CCTV to stand at

approximately 1.85 million [26]. It is therefore also possible that increased CCTV surveillance in England and Wales over the last decade has also impacted upon the overall reduction in violence identified in this study.

In this national study all age groups except those aged 18–30 years experienced a significant decrease in violence-related ED attendances – males and females within all age groups, showed similar decreasing trends. However, age and gender-related trends masked regional differences. There were decreases in five regions, increases in three and no change in two GOR's. The North West region and Wales continued to show decreasing violence trends over the 10 years between 2000 and 2009, surprisingly perhaps, given the concentrations of deprivation in these areas. Eastern and South East regions, following a plateau in violence over the previous 5 years, showed decreases in violence between 2005 and 2009 and violence in the North East decreased between 2005 and 2009 after increasing between 2000 and 2004. Violence in East Midlands and London increased between 2005 and 2009 despite decreasing during the previous 5 years. Surprisingly given its socioeconomic profile, the South West region showed year on year increases in violence over the 10 years, 2000–2009. Violence in Yorkshire and Humberside and West Midlands regions did not change over the study period after increasing and decreasing respectively over the previous 5 years.

Reasons for such regional variation in trends in violence are unclear, but may be multi-factorial and complex – short term trend changes are less likely to be due to changes in structural factors such as unemployment rate, poverty, inequality and more likely related to public health and criminal justice interventions at the regional level. Indeed, results from a recent audit on information sharing for the purposes of violence prevention in England, revealed that only one-third of partnerships are reaching the standard of information sharing recommended by the College of Emergency Medicine (CEM) [27]. It is therefore possible, even probable, that Regional (national in Wales) efforts to implement information sharing, where successful, may have introduced and sustained a culture of prevention to a greater extent than in other regions. In this context it is noticeable that decreases in violence did occur in health regions where ED information sharing was most developed [3,28–30]. Injury rate calculations also showed regional variations in violence rates in England and Wales.

In the previous NVSN study of violence trends, a clear pattern emerged with northern and western regions in England and Wales having the highest violent injury rates compared to regions in the south and east. Similar violent injury patterns were also demonstrated in this study. For example, north–south divides in health and prosperity are well documented, for example in relation to mortality for both sexes and among all age groups. A recent study found that the north–south disparity over the period 2000–2008 (excluding Wales) was the worst it had been for over four decades [31]. Other factors such as educational, environmental and lifestyle influences which may act over the whole life course and possibly over generations may also determine north and west regional excess in violent injury.

Overall, males and those aged 18–30 years were most at risk of sustaining violent injury; and were the only group not to experience a significant trend over the 5 years. This finding is not surprising as males and those aged 18–30 years demonstrate higher rates of delinquency, adult criminality and violent behaviour. Also, violence-related injury as a result of alcohol consumption has been found to be five times greater than any other type of injury [32]. In England and Wales, it is reported that those aged between 18 and 24 years consume, on average, more units of alcohol per session than any other age group [33]. The association between alcohol misuse and violence is well documented in epidemiology, criminology, psychology and public health literature. BCS estimates indicate an upward trend in alcohol-related violence since 1995; with 50% of violent offences, 19% of all violent incidents, and 31% of stranger violence estimated to have taken place in or around a pub or club in 2009 [5]. Visits to ED resulting from alcohol misuse cost England and Wales £645.7 million in 2006/2007 [34]. Studies in both the UK and US have however found an inverse relationship between alcohol price and violence [35,36]. A UK ED based study found that the real price of beer in England and Wales was negatively correlated with rates of violence-related ED attendances [35].

According to this study violence-related injury in England and Wales was seasonal, with highest ED attendances during the late spring and summer months of May, June, July and August – and the lowest attendances during February and November. Findings from previous NVSN publications on violence seasonality found that violence-related ED attendances peaked during summer months and in December between 2000 and 2004 [6]. Reasons for such a peak in ED violence attendances in the summer have been attributed to larger numbers of people being outdoors over a long period of time. The occurrence of major sporting events during the summer months, e.g. the football world cup has also been shown to result in increased violence-related ED attendances [35,37]. In contrast, despite festive celebrations in December, violence levels fell for both men and women during this month between 2005 and 2009 and the reasons for this, over such a sustained period, are unclear. It is possible that concentrated police and other agency effort over the Christmas/New Year period, for example, drink driving and safety campaigns, have actually reversed the traditional harm peaks of this time. However, findings from this study also reveal that the ratio of male to female violence-related ED attendances was highest in this month over the 5-year period.

Conclusion

Overall, according to all three measures, violence in England and Wales decreased over the 5-year period 2005–2009. Policy makers should, drawing on evidence from regions where violence is falling, focus violence prevention measures such as information sharing by EDs, in regions with higher violent injury rates and where violence is increasing.

Bias in ED data

This study makes three main assumptions about the data; that all those injured in violence seek treatment at EDs; that those patients declare that they have been injured in violence; and that all violence-related attendances are recorded electronically. ED data represents the most serious forms of violence, which results in injury deemed to require medical treatment and therefore does not include violence which results in minor injuries deemed not to require hospital treatment or violence which results in no injury. As proximity of the injured to an ED affects likelihood of ED attendance, violence in rural areas is likely to be underestimated [38].

Recommendations

Violence prevention efforts should be extended so that the December drink driving and safety campaigns are implemented in the period May–July.

Future research

Further research is needed to investigate and identify local factors that impact on the regional variation in current trends in violence in England and Wales.

Conflict of interest statement

The following statement confirms that there is no conflict of interest present for any of the contributing authors with regards to the article.

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References

[1] Government HM. The coalition: our programme for government. London: Cabinet Office; 2010.
[2] Krug E, Dahlberg L, Mercy J.In: World report on violence and health; 2002.
[3] Florence C, Shepherd J, Brennan I, Simon T. Effectiveness of anonymised information sharing and use in health service, police, and local government partnership for preventing violence related injury: experimental study and time series analysis. Br Med J 2011;342:d3313.
[4] Sutherland I, Sivarajasingam V, Shepherd J. Recording of community violence by medical and police services. Inj Prev 2002;8:246–7.
[5] Flatley J, Kershaw C, Smith K, Chaplin R, Moon D. Crime in England and Wales 2009/10: findings from the British Crime Survey and police recorded crime. London: Home Office; 2010.
[6] Sivarajasingam V, Morgan P, Matthews K, Shepherd J, Walker R. Trends in violence in England and Wales 2000–2004: an accident and emergency perspective. Injury 2009;40:820–5.
[7] www.healthprofiles.info.
[8] Bellis MA, Hughes K, Wood S, Wyke S, Perkins C. National five-year examination of inequalities and trends in emergency hospital admission for violence across England. Inj Prev 2011;17:319–25.
[9] Goodwin V, Shepherd J. The development of an assault patient questionnaire to allow accident and emergency departments to contribute to Crime and Disorder Act local crime audits. J Accid Emerg Med 2000;17:196–8.
[10] http://www.ons.gov.uk/ons/rel/regional-trends/regional-trends/index.html.
[11] http://cran.r-project.org/.
[12] Sivarajasingam V, Shepherd J, Matthews K, Jones S. Trends in violence in England and Wales 1995–2000: an accident and emergency perspective. J Public Health 2002;24:219–26.
[13] http://www.hesonline.nhs.uk/Ease/servlet/ContentServer?siteID=1937&categoryID=211.
[14] Flatley J, Kershaw C, Smith K, Chaplin R, Moon D. Crime in England and Wales 2010/11: findings from the British Crime Survey and police recorded crime. London: Home Office; 2011.
[15] Sivarajasingam V, Shepherd J, Matthews K. Effect of urban closed circuit television on assault injury and violence detection. Inj Prev 2003;9:312–6.
[16] Clarkson C, Cretney A, Davis G, Shepherd J. Assaults: the relationship between seriousness, criminalisation and punishment. Crim Law Rev 1994;4:4–20.
[17] Sivarajasingam V, Shepherd J, Newcombe R. Why public health must contribute to reduce violence. Br Med J 2011;343:d4453.
[18] Sivarajasingam V, Wells J, Moore S, Shepherd J. Violence in England and Wales 2009: an accident and emergency perspective [http://www.vrg.cf.ac.uk/nvit/NVIT_2009.pdf].
[19] The NHS Plan. A plan for investment. A plan for reform. London: Stationery Office; 2000.
[20] HM Government. Crime and Disorder Act 1998.
[21] Government HM. Tackling knives action programme. London: Home Office; 2008.
[22] http://tiig.info.
[23] Sigurdsson J, Mulchandani R. Police service strength, England and Wales, 30 September 2009. London: Home Office; 2010.
[24] http://www.justice.gov.uk/statistics/criminal-justice/criminal-justice-statistics.
[25] https://www.gov.uk/government/publications/cost-of-cctv.
[26] http://www.acpo.police.uk/ThePoliceChiefsBlog/GraemeGerrardsCCTVblog.aspx.
[27] The Centre for Public Innovation. Information Sharing to tackle violence: audit of progress on delivering the Coalition Commitment 2012; 2012;p. 1–80.
[28] www.balancenortheast.co.uk/.
[29] Boyle A, Snelling K, White L, Ariel B, Ashelford L. External validation of the Cardiff model of information sharing to reduce community violence: natural experiment. Emerg Med J 2012;107:1–4.
[30] Dines C. Using A&E data to prevent violence in communities. Nurs Times 2011;107:16–8.
[31] Hacking J, Muller S, Buchan I. Trends in mortality from 1965 to 2008 across the English north–south divide: comparative observational study. Br Med J 2011;342:d508.
[32] Borges B, Cheriptel C, Orozco O, Bond J, Ye Y, Macdonald S, et al. Multicentre study of acute alcohol use and non-fatal injuries: data from the WHO collaborative study on alcohol and injuries. Bull World Health Organ 2006;84:453–60.
[33] Mintel Oxygen. Binge drinking, special report; 2009.
[34] NHS Information Centre. Statistics on Alcohol. England; 2012.
[35] Matthews K, Shepherd J, Sivarajasingam V. Violence-related injury and the price of beer in England and Wales. Appl Econ 2006;38:661–70.
[36] Markowitz S. The price of alcohol, wife abuse, and husband abuse. Southern Econ J 2000;67:279–303.
[37] Bellis MA, Leckenby N, Hughes K, Luke C, Wyke S, Quigg Z. Nighttime assaults: using a national emergency department monitoring system to predict occurrence, target prevention and plan services. BMC Public Health 2012;12:746–58.
[38] Baker R, Bankart M, Rashid A, Banerjee J, Conroy S, Habiba M, et al. Characteristics of general practices associated with emergency department attendance rates: a cross-sectional study. BMJ Qual Saf 2011;20:953–8.