Analysing the Relationship Between Victimisation and Worry about Crime, and the Effects of

Personal and Neighbourhood Characteristics on this Relationship

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Abstract

Crime has fallen in England and Wales since the mid-1990s (Office for National Statistics, 2021) and has become more concentrated on certain individual and households (Hunter & Tseloni, 2016; Ignatans & Pease, 2016). Despite this the majority of the population believe crime to be rising nationally (Office for National Statistics, 2017), this is known as the fear/victimisation paradox (Lee, 2011). Victimisation is commonly found to increase risk of fear of crime (Brunton-Smith & Sturgis, 2011; Hale et al., 1994; Krulichova, 2019; Weitzer & Kubrin, 2004), however results vary when crime type specific measures are used.

Crime Survey for England and Wales data is analysed in this study. Chi-square tests of association are first used to establish a significant relationship between victimisation and worry within three crime type categories: household; vehicle; and personal. Bivariate Multilevel Modelling is then employed to analyse the relationship between victimisation and worry about crime at the individual and neighbourhood level, identifying how individual, household and neighbourhood characteristics affect victimisation risk, risk of being worried about crime, and the relationship between them.

Significant positive associations were found between victimisation and worry for all crime categories, the increased odds of worry associated with a victimisation experience were greatest for vehicle crime (OR=2.84), followed by household crime (OR=2.40), and lowest for personal crime (OR=1.84). Low to moderate positive correlations were also confirmed between victimisation and worry at the individual level across crime types, which were not accounted for by individual, household and neighbourhood characteristics included in the model. A positive correlation was initially found between victimisation and worry at the neighbourhood level for household and vehicle crime, whilst no such correlation was found for personal crime. The correlation persisted for vehicle crime despite accounting for

individual, household, and neighbourhood characteristics, whilst these characteristics

explained the relationship for household crime.

Individual level analysis offers support for the victimisation theory of fear of crime

across crime types, whereas neighbourhood level analysis offers support for indirect

victimisation theory only in the case of vehicle crime. The effects of individual, household and

neighbourhood characteristics on victimisation are well explained by opportunity theories of

crime, including the lifestyle/exposure model. Individual and neighbourhood characteristics

are well explained by vulnerability theory and ideas of social and physical disorder, and social

networks, whereas household characteristics are less well explained. This is attributed to the

limited evidence of such characteristics affecting fear of crime in the literature.

1.0 Introduction

This thesis explores the relationship between victimisation and fear of crime, the effects of personal and neighbourhood characteristics on both victimisation and fear of crime, and their effect on the relationship between them, through examining victimisation and fear within the crime type categories of household, vehicle and personal crime, with a view to attaining a deeper understanding of the relationship between victimisation and fear of crime, and therefore developing a knowledge base upon which informed and targeted crime reduction and fear reduction policy could be developed.

This chapter provides evidence of the research problem, alongside the academic context of this research. The concept of the so called "perception gap" between public perceptions of the current state of crime, and actual trends, is introduced (Lee, 2011; Duffy et al., 2008) whereby individuals perceive crime to be higher than it truly is, introducing the fundamental concept of fear of crime. Whilst fear remains vastly more prevalent in the population than victimisation (Office for National Statistics, 2017), evidence on the relationship between victimisation and fear of crime remains somewhat mixed (Brunton-Smith & Sturgis, 2011; Hale et al., 1994; Reid & Konrad, 2004). A summary of the types of individuals, and contexts within which individuals reside, which are at increased risk of victimisation, and being fearful of crime is then presented to highlight similarities and differences between the correlates of victimisation and fear of crime. Having presented the research problem, the overarching research aims and the research questions to be answered are then presented, followed by an outline of the structure of the thesis.

1.1 The Research Problem

The following section first presents evidence of the perception gap found between crime rates and perceptions of crime, followed by a discussion of the related concepts of victimisation and fear of crime, including an exploration of the multifaceted nature of fear of

crime, the working definition of fear of crime for this thesis is explored. An overview of the

factors affecting risk of victimisation and fear of crime is then provided. Throughout

discussion of the literature, the implications of this on the present research is discussed,

highlighting gaps in the current knowledge.

1.1.1 The Perception Gap, and the Relationship between Victimisation and Fear of Crime

The international crime drop is now well documented (Office for National Statistics,

2021; Tseloni et al., 2010), with volume crime following an overall downwards trend since

1995 in England and Wales, and across the Western world (Farrell et al., 2014; Knepper, 2012;

Van Dijk et al., 2012). Since the 1995 peak in recorded victimisation, an estimated 70% drop

in the total number of crimes occurring in England and Wales per year has occurred (Office for

National Statistics, 2020). Alongside this, the percentage of adults who are victims of crime

each year has reduced from 40% at the 1995 peak, to 14% in the year ending March 2020

(Office for National Statistics, 2020). Additionally, the total number of crimes each household

experiences on average has dropped, including for the most victimised households, however,

the proportion of all crime experienced by the most victimised households has increased over

time (Hunter & Tseloni, 2016; Ignatans & Pease, 2016), with crime now more concentrated on

particular individuals and households. Knowing that crime is not randomly distributed, rather

that it is concentrated on certain individuals and neighbourhood contexts, suggests that

targeted crime reduction strategies are required, as has previously been discussed in the

literature (Bullock & Tilley, 2012; Ratcliffe, 2004).

Despite the extensive and persistent drop in volume crimes (Office for National

Statistics, 2020), the majority of the population (60%) believe crime in England and Wales has

increased over the past few years, with a smaller proportion (31%) believing crime has risen in

their local area (Office for National Statistics, 2017), this perception gap is known as the 'fear

of crime-victimisation paradox' (Lee, 2011). Within these statistics, two perception gaps are

evident: the first being the perception of rising crime rates, despite them being in consistent

decline; and the second is the differing perceptions of rising crime at the national level, and at

the local level (Duffy et al., 2008). Personal experiences, or those of friends or relatives, and

word of mouth most commonly inform perceptions of local crime rises (Office for National

Statistics, 2017), in which exposure will most commonly be of less frequent experiences of

less serious crimes. In contrast, national newspapers, television and radio news, and

documentaries are associated with the perception of national crime rates (Office for National

Statistics, 2017), with such media covering the most serious crimes of serial murder and

terrorism with apparent frequency (Cummins et al., 2019), guiding perceptions of increases in

serious crime. With different sources found to influence perceptions of crime at the local level,

compared to the national level, some of the disparity between local and national perceptions is

explained. The first perception gap presented here forms the basis of the research problem

presented here, as it presents incongruence between the true threat of victimisation, and

individual's perceptions of it. Further engagement with the literature further informs the

development of the research problem. Within this perception gap two criminological concepts

are identified, victimisation, and fear of crime, with fear of crime being a criminological

phenomenon situated within the umbrella concept of "threat of victimisation" (Rader, 2004).

Despite the perception gap, at the individual level, there has been a body of evidence

which most commonly finds a positive relationship between victimisation and fear of crime,

with victims of crime found to be at higher risk of, or to have higher levels of, fear of crime

than non-victims (Brunton-Smith & Sturgis, 2011; Hale et al., 1994; Krulichova, 2019;

Weitzer & Kubrin, 2004). Whilst continuing to find a positive relationship, within this body of

literature, different conclusions about the strength and significance of the relationship between

victimisation and fear of crime have been reached when examining crime type specific

victimisations (Brunton-Smith & Sturgis, 2011; Weitzer & Kubrin, 2004), crime type specific

fears (Hale et al., 1994); Weitzer & Kubrin, 2004) and across different operationalisations of fear of crime (Reid & Konrad, 2004). These findings inform the hypothesis that a positive relationship between victimisation and fear of crime is expected to be found, although the strength of this is expected to differ between crime types explored. Inconsistencies in studies using crime type specific measures informs the crime type specific structure of the research.

The effects of victimisation have also been found to span further than the direct victim of a crime, with individuals known as indirect victims, those with a family member or friend who has been victimized, also more commonly experiencing fear of crime than those not knowing a victim (Covington & Taylor, 1991; Hale et al., 1994). The 'indirect victimisation' model suggests that news of a criminal event passes through local community networks, allowing the relatively rare phenomenon of crime victimisation to incite fear more widely across communities, in effect acting as a "multiplier" to the fear incited by an individual's victimisation experience (Taylor & Hale, 1986, p. 156). Another neighbourhood level mechanism through which fear of crime is theorised to spread is through the community concern model, which relates to resident perceptions of community dynamics (Taylor & Hale, 1980). This suggests that at the neighbourhood level, lack of social ties or ties to local power structures, alongside a high crime rate can generate concerns about local problem, resulting in concern for the state of the future community, expected to result in fear of crime (Lewis & Salem, 1981; Taub et al., 1984). These models suggest fear of crime is likely to be higher in a neighbourhood where victimisation levels are higher, this informs the neighbourhood level aspect of this research.

The discussed literature therefore suggests that (a) victims of crime are more likely to be worried about crime than non-victims; (b) in neighbourhoods where there are more victims, a higher rate of fear of crime would be present.

Within the literature reviewed in the following section and throughout the literature review, there is an evident lack of consistency in the operationalisation of fear of crime. This is a multifaceted concept covering multiple conceptually distinct operationalisations such as: amount of worry about experiencing a potential victimisation; frequency of fearful episodes related to crime; perceived victimisation risk; and general feelings of unsafety. Therefore, the forthcoming literature review chapters make particular effort to delineate which element of fear of crime is measured in each study to gain a clarified understanding of what is already known about the relationship between victimisation and fear of crime, prior to expanding upon this in the original research within this thesis. Another observation drawn from the literature is the variation in findings when crime type specific victimisations and fears are examined, the literature review aims to clarify understanding of what is already known across operationalisations. This observation informs the use of crime specific fear and worry measures in the original research within this thesis.

1.1.2 Defining Fear of Crime

Both theoretical enquiry (Hale, 1996; LaGrange & Ferraro, 1987) and empirical research (Gray et al., 2011; LaGrange et al., 1992) have defined "fear of crime" in a variety of ways. Fear of crime, as defined by Ferraro (1995, p. 4), is "… an emotional response of dread or anxiety to crime or symbols that a person associates with crime". This is a very highly cited definition of fear of crime, with the book in which this definition originated having 2047 citations on google scholar at the time of writing. This definition accounts for fear of crime being more than an immediate and momentary response to a threatening situation, but rather something more enduring (Farrall et al., 2007) whilst specifically relating to fear of criminal occurrences.

The concept of fear of crime covers a number of conceptually distinct, but related (Rader, 2004) categories as follows: (1) concerns or worries about becoming a victim of crime

which may be referred to as concrete fear of crime; (2) general feelings of unsafety, for example, feeling unsafe being alone in your neighbourhood after dark, which may be referred to as abstract fear of crime; (3) perceived risk of victimisation (Russo & Roccato, 2010; Visser et al., 2013); and (4) behavioural responses to fear, for example employing security measures and avoidance behaviours (Buil-Gil et al., 2019; Gabriel & Greve, 2003). These concepts which fall within the umbrella concept of fear of crime are often simply referred to as "fear of crime" in research, terms are sometimes used interchangeably, and to proxy one another.

Drawing upon psychological literature on the measurement of anxiety (Catell & Scheier, 1961; Spielberger, 1966) adds further depth to understanding the measurement of fear of crime through differentiating between ways in which fear of crime is experienced by the individual: (1) dispositional fear of crime, the personal characteristics or traits which are somewhat permanent in an individual, and affect the fearful response to a criminal victimisation; and (2) situational fear of crime, which is the fearful response to seeing, experiencing, or perhaps even hearing about a criminal interaction (Gabriel & Greve, 2003).

Due to the multidimensional nature of fear of crime as a concept, and the multiple operationalisations of "fear of crime" which are not always expressly defined across empirical research, the necessity of providing conceptual clarity has long been (Hale, 1996), and continues to be recognised (Buil-Gil et al., 2019). Whilst this research does not seek to redefine fear of crime in any way, it aims to understand the different dimensions of the concept and use correct terminology in line with recent research to avoid further confusion in the literature. In agreement with Ferraro's (1995) definition, Rader (2004) argues that the measurement of fear of crime should focus on the *emotion,* felt over a possible threat of victimisation, rather than simply focusing on the perceived risk or abstract fears. This

research will follow this guidance, using the working variable "**dispositional worry about crime**", defining this as **measuring concerns or worries about victimisation as a personal trait which will moderate an individual's response to an actual criminal event**. In the analytical chapters of this thesis the operationalised variables are true to the above definition, whereby respondents are asked "how worried are you about [crime specific question]", see section 4.2.1 in the methodology chapter for full questions. This question directly measures an individual's level of worry about a crime event happening, whilst not referring to any specific sights or threats they may have seen. This is a "concrete" measure of fear of crime as described by Rader (2004) due to its direct reference to crime events, rather than general feelings of unsafety.

Throughout the literature review multiple operationalisations of fear of crime are discussed, as these are all referred to as fear of crime by their authors. Additionally, due to the established relationships between the underlying concepts of fear of crime, it is likely that covariates which have a significant impact on one operationalisation will have an impact on another. Therefore, reviewing all the literature will allow for the development of a more complete picture of the effects of a wider number of covariates on the overall fear of crime concept. Within the empirical literature review, effects of multiple individual and neighbourhood characteristics on "fear of crime" are explored, in which results are categorised by dispositional worry about crime (the operationalisation used in the analytical chapters of this research), frequency of situational worries about crime, and alternative fear measures, which includes general feelings of unsafety, and other more nuanced measures of fear of crime. Whilst a relationship between these categories has been established, this is not a perfect correlation, therefore the inclusion of these articles also allows for the identification of any inconsistencies in effects of individual and neighbourhood characteristics on the different operationalisations of fear of crime, increasing knowledge in the understanding of the concept

as a whole and in the relationships between the multiple operationalisations. A discussion of

relationships found between the various operationalisations within the umbrella concept of

fear of crime is found in section 3.1.2.

1.1.3 Who Experiences Victimisation and Fear of Crime?

Within the body of literature which has provided evidence of a relationship between

victimisation and fear, a number of individual and neighbourhood characteristics have been

demonstrated to affect an individual's fear of crime and victimisation risk. Some

characteristics are found to increase the likelihood of both, whilst some have oppositional

effects, and others affect risk of one, whilst not affecting risk of the other. Consistency in the

characteristics cooccurring with both victimisation and fear of crime, may provide some

explanation for the positive relationship found between the two concepts.

Common predictors include age and gender, with older individuals and females

generally found to be at increased risk of, or having higher fear of crime, but decreased

victimisation risk across crime types (Brennan et al., 2010; Brunton-Smith & Sturgis, 2011;

Hale et al., 1994, 2004; Park & Fisher, 2017; Reid & Konrad, 2004; Trickett et al., 1995;

Tseloni & Pease, 2003;2004). These factors are commonly associated with perceptions of

vulnerability (Killias & Clerici, 2000). Other factors which are generally associated with an

increase in both risk of victimisation and fear of crime include; being non-white (LaGrange et

al., 1992; Park & Fisher, 2017; Scarborough et al., 2010); and being either single, separated or

divorced (Brennan et al., 2010; Brunton-Smith & Sturgis, 2011; Oh & Kim, 2009; Wilsem et

al., 2006). Other factors include education, which is commonly found to reduce risk of fear,

but to increase risk of victimisation (Brunton-Smith & Sturgis, 2011; Wilsem et al., 2006), as

well as factors linked to target desirability, such as higher income (Kanan & Pruitt, 2002; Park

& Fisher, 2017), working in professional or managerial roles (Brunton-Smith & Sturgis, 2011;

Tseloni, 2006), being a homeowner (Millard & Flatley, 2010), and owning more cars (Tseloni

& Pease, 2003; 2004) which are commonly associated with increased victimisation risk, whilst having mixed effects on fear of crime.

Another important factor in predicting an individual's victimisation risk is their routine activities, with those going out more (Wilsem et al., 2006), particularly to establishments associated with alcohol consumption (Brennan et al., 2010) at more risk of multiple types of victimisation than those not engaging in such activities. The relationship is less clear with fear of crime, whilst fear of crime has been found to have a direct negative association with routine activities with those engaging more in more evening activities having lower risk of fear, however this may be explained in part by the fact that those who engage in nighttime leisure activities were also found to have a lower perceived risk of victimisation (Mesch, 2000).

Neighbourhood factors also affect both fear of crime and victimisation risk, these most often are found to affect risk of victimisation and fear of crime similarly, for example, higher perceived physical and social disorder increase risk of victimisation and fear of crime, (Kuo et al., 2012; Scarborough et al., 2010), as well as living in inner city/urban areas (Hale et al., 1994; Brennan et al., 2006), areas characterized by higher ethnic heterogeneity and higher population turnover (Brunton-Smith & Sturgis, 2011; Wilsem et al., 2006).

This brief examination of the literature on risk factors of victimisation and fear of crime demonstrates the similar, and differential effects of some characteristics on the risk of experiencing these phenomena. The present research builds upon this body of knowledge to present a synthesised examination of the effects of individual and neighbourhood characteristics on risk of both victimisation and worry about crime. This can assist in developing a knowledge base, upon which recommendations can be made to reduce the risk of individuals experiencing victimisation and fear of crime.

1.2 Original Contribution to Knowledge, Research Problem & Scope

Whilst a vast body of literature has examined risk factors of victimisation, and risk factors of many operationalisations of the umbrella concept of fear of crime, and have examined the relationship between these concepts to an extent, a study has not been conducted which combines all of this information. This research provides the following original contributions to knowledge:

1. Increased knowledge of the personal and neighbourhood characteristics which contribute to a person's risk of victimisation and fear of crime, through examining the existing literature.

2. An assessment of the baseline (i.e. not accounting for contributary factors) relationship between dispositional worry about crime and victimisation at both the individual and neighbourhood level, for crime specific fear and victimisation measures.

3. An assessment of the effects of a number of individual and neighbourhood characteristics on victimisation and dispositional worry about crime, for crime specific fear and victimisation measures.

4. An assessment of the effects of those characteristics on the relationship between crime specific measures of dispositional worry about crime and victimisation, to confirm whether any apparent relationship can be accounted for by characteristics known to affect each concept.

Overall, through using crime specific measures, a well-defined operationalisation of fear of crime, and the novel application of a statistical technique, this thesis aims to expand the current knowledge base on the relationship between victimisation and fear of crime, which can be used to inform targeted policy aiming to reduce both victimisation and fear of crime.

In order to develop this knowledge, this research examines the relationship between victimisation and dispositional worry about crime both within individuals and neighbourhoods. Four years of the nationally representative data source, the Crime Survey for England and Wales (CSEW) of 2014/15 to 2017/18, and the 2011 Census, are used to address the research questions presented overleaf. Fear of crime is operationalised as dispositional worry about crime, defined as measuring concerns or worries about victimisation as a personal trait which will moderate an individual's response to an actual criminal event. Crime is examined under three categories: household; vehicle; and personal, pairing crime type specific measures of both worry and victimisation within these three crime categories. The research initially establishes whether associations between victimisation and dispositional worry about crime exists within each crime category at the individual level, subsequently extending this to assess the strength of the relationship at both the individual and neighbourhood level. To gain a deeper understanding of the relationship, the effects of individual, household and area level contextual characteristics on this relationship are examined. Additionally, the effects of neighbourhood incivilities are assessed on the relationship between worry and victimisation for both household and vehicle crime, and the effects of routine activity variables assessed for personal crime.

1.3 Research Aims

This research aims to investigate the relationship between victimisation and fear of crime within individuals and within neighbourhoods. Fear of crime is operationalised as dispositional worry about crime, for three crime type categories: (1) household; (2) vehicle; and (3) personal, to identify the effects of a number of covariates on both victimisation and dispositional worry about crime individually, and on the relationship between them.

1.3.1 Research Aim 1- Establishing a Relationship between Victimisation and Worry

about Crime at the Individual and Neighbourhood Level

To identify whether a relationship exists between: (1) household victimisation and dispositional worry about household crime; (2) vehicle victimisation and dispositional worry about vehicle crime; and (3) personal victimisation and dispositional worry about personal crime, at both the individual and neighbourhood level. Two research questions will be addressed to achieve this research aim.

Research Question 1   Does a significant association exist between (a) household victimisation and dispositional worry about household crime; (b) vehicle victimisation and dispositional worry about vehicle crime; and (c) personal victimisation and dispositional worry about personal crime?

Research Question 2   How strong are associations between victimisation and dispositional worry about crime for the three crime categories within (a) individuals; and (b) within neighbourhoods?

1.3.2 Research Aim 2-Understanding the Effects of Individual and Neighbourhood

Characteristics on the Relationship Between Victimisation and Dispositional Worry

about crime

Following establishing a baseline relationship exists between crime type specific victimisation and dispositional worry about crime, the research then aims to identify the effects of a number of individual, household and neighbourhood characteristics on both victimisation and dispositional worry about crime individually, and their effects on the relationship between them.

Research Question 3a How do: (a) individual and household characteristics; (b) neighbourhood contextual variables; and (c) independently rated

incivilities, affect risk of becoming a victim of household, and vehicle crime, and worry about household and vehicle crime respectively.

Research Question 3b How much of the estimated association between household victimisation and worry about household crime, and between vehicle victimisation and worry about vehicle crime at both the individual and neighbourhood level is accounted for by each additional set of explanatory variables?

Research Question 4a How do: (a) individual and household characteristics; (b) routine activities; and (c) neighbourhood contextual variables affect risk of becoming a victim of personal crime and worry about personal crime?

Research Question 4b How much of the estimated association between personal crime victimisation risk and dispositional worry about personal crime is accounted for by each additional set of explanatory variables?

1.4 Thesis Overview

This chapter has so far presented the research problem to be addressed and having discussed the background and context of this research, defined the research problem and scope, as well as outlining the aims and research questions this thesis will address, an in-depth critical literature review will follow.

The first literature review chapter, Chapter 2, introduces theory relevant to the thesis, which will provide a framework within which the findings will be discussed. First, victimisation theories are explored, focusing on opportunity theories of crime, exploring the development of the ingrained rational choice perspective of the classicists, to the more refined

perspectives of rational choice theory, routine activity theory, and situational crime prevention,

highlighting the practical application of these theories in crime reduction programmes.

Demonstrating the importance of situational characteristics in a crime event allows the

findings of this research to have great utility in practically reducing crime. Discussion then

moves on to theories relevant to fear of crime, focusing on the positivist strain of theory within

the body of literature, including vulnerability theory, ideas of social and physical disorder,

victimisation theory, and social integration theory which all focus on explaining why

individuals of certain characteristics or experiences are at increased risk of being worried

about crime. Victimisation theory and the indirect victimisation model provide a theoretical

base for assessing findings where the relationship of victimisation and worry about crime is

examined.

The second literature chapter, Chapter 3, provides a summary, and synthesis, of

existing knowledge regarding the relationship between victimisation and fear of crime, and

factors associated with experiencing criminal victimisation and fear of crime. The relationship

between victimisation and fear is first explored in further detail, examining more complex

efforts to model the relationship between the various concepts falling under the fear of crime

umbrella. Effects of a number of personal and household characteristics; perceptions of one's

neighbourhood; security levels; media influence; and characteristics of the neighbourhood an

individual lives in, on both victimisation risk and fear of crime risk are then discussed. This

review provides a master summary of characteristics expected to affect victimisation and

worry about crime, and informs expectations of the relationship between victimisation and

worry about crime.

Having examined the existing literature, the methods and methodology of this research

are discussed. The methodology chapter, Chapter 4, first outlines the methodological approach

of this research, presenting its aims and objectives; the research strategy; and data sources

which will be utilised to address these. This chapter also discusses the decision-making

processes and justifications for selecting and preparing data and variables for inclusion in the

analysis, and the methods of analysis employed to address each research aim.

This includes model specifications and a discussion of the application of Bayesian methods.

Original empirical findings are then presented over two chapters, the first of these

chapters, Chapter 5, focuses on the baseline relationship between victimisation and worry

about crime. It reports on the investigation into the relationship between having been a victim

of crime in the previous year and reporting being worried about crime. This chapter initially

presents descriptive statistics of victimisation and worry experienced by

individuals, examining frequencies of the underlying crime subtypes which make up

the analytical crime type categories of household, vehicle and personal crime for both

victimisation and worry. Following this, whether victimisation experiences and worries are

significantly associated at the individual level is investigated, with crosstabulations presented

alongside chi-square tests of association. Odds ratios quantify the differing odds of victims

and non-victims experiencing worry about crime. Analysis will then move on to reporting on

inferential statistics in the form of bivariate multilevel models to estimate the strength of the

correlation between worry and victimisation at both the individual and neighbourhood levels.

Bivariate multilevel models are a multilevel modelling framework, with a structure which

accounts for two dependent variables, estimating the correlation between the dependent

variables.

The second empirical chapter, Chapter 6, reports findings from multilevel regression

models with 2 dependent variables of increasing complexity, predicting risk of victimisation

and worry about household, vehicle, and personal crime. Initially, descriptive statistics are

presented to define the sample upon which the analysis has been undertaken, acknowledging

that working samples have some deviation from the general population. Household,

vehicle, and personal crime models are then examined in turn. Following an exploration of
MCMC diagnostics and assessment of residuals to determine adherence to model assumptions,
the results of the models are discussed, highlighting whether certain characteristics affected an
individual's risk of being victimised, or experiencing worry about crime. The random part of
the model is then discussed, where the effects of certain groups of covariates on the estimated
relationship between victimisation and worry about crime are discussed. Within each crime
type, a final summary is then made to clarify the most at-risk groups to experience
victimisation or worry about crime. To conclude, a final summary is made of the effects of
covariates on the relationship between victimisation and worry.

The discussion chapter, Chapter 7, follows which summarises effects of covariates on
both victimisation and worry about crime across crime types and interprets the results of the
statistical analyses presented in the prior two chapters. Initially a summary of the baseline
relationship between victimisation and worry is discussed across crime types, results are
discussed with reference to existing literature, and the support of the results for the
victimisation theory of fear of crime. Effects of characteristics are then compared between
victimisation risk and worry about crime, and across the analytical crime types, again these are
discussed with reference to previous literature discussed earlier in the thesis, and theoretical
explanations and implications are considered. The effects of covariates on the relationship
between victimisation and worry about crime are then discussed. Finally, limitations of the
study are discussed.

The conclusion chapter, chapter 8, provides clear statements to answer the research
questions presented in the methodology chapter of this thesis, including a summary of the
baseline relationship between victimisation and worry about crime for each crime type, a
summary of the risk and protective factors which affect risk of victimisation and worry about
each crime type, followed by a summary of the effects of these characteristics on the

relationship between victimisation and worry. The theoretical implications of the findings are

then outlined, highlighting agreements and disagreements between the original findings and

existing theory exposed in the discussion chapter. Recommendations for both policy and

future work are made to address gaps in the knowledge exposed in this research.

2.0 Theoretical Background: The Rational Choice Perspective and Theories of Fear of Crime

This chapter introduces the theoretical frameworks through which the empirical literature review, and original works in this thesis will be analysed. Initially, victimisation theories are explored, focusing on opportunity theories of crime, exploring the development of the ingrained rational choice perspective developed within the classical school, to the more refined perspectives of rational choice theory, routine activity theory, and situational crime prevention, highlighting the practical application of these theories in crime reduction efforts. The opportunity framework is often the lens through which large quantitative criminological studies are examined due to the actionable outcomes of such analyses which can reduce crime (Wilcox et al., 2018). Discussion then moves on to theories relevant to fear of crime, focusing on the positivist strain of theory within the body of literature, as such theory was developed upon quantitative studies of similar style to this one (Hale, 1996). Theories of fear of crime are discussed with focus on vulnerability theory, ideas of social and physical disorder, victimisation theory, and social integration theory, all of which aim to explain why individuals of certain characteristics are more fearful of crime.

2.1 Opportunity Theories of Crime

2.1.1 History of the Rational Choice Perspective

Theory relating to criminal behaviour and punishment has existed since classicists in philosophy, economics, politics as well as other schools of social thought began to apply principles of social contract theories and utilitarianism to the penal system (Hopkins-Burke, 2014). Cesare Beccaria's writings (Taylor, 1981; Beccaria, 1764) implied criminal conduct was conducted on the basis of a rational choice made by the social actor (Hopkins Burke, 2014). He suggested that individuals engage in "hedonistic calculation and social causation" (Draper, 2000, p.181), meaning the utilitarian system of evaluating the pleasures and pains of undertaking an action are evaluated by the individual, whereby actions resulting in the most

pleasure are taken. Proportionality of punishment in relation to each crime was considered

central to effective deterrence within the social contract, with punishments required to be

harsh enough "to make the most efficacious and lasting impression on the minds of men"

(p.31), yet as unharmful as possible for those who have committed criminal acts (Beccaria,

1764).

Following implementation of these principles across many Western nations (Brown et

al., 2019), punishments were issued solely based on the social harm of a crime, without

consideration of the intention and circumstances (Draper, 2000). Mounting criticism emerged

from the neoclassical school, where a more developed consideration of certain individuals'

ability, or lack thereof, to exercise rational choice was made (Hopkins Burke, 2014). Within

these modified legal systems, more value was placed on evidence from a variety of relevant

scientific disciplines such as psychiatry, and medicine (Becker, 2018). The emergence of

scientific thought within the criminological discourse, and thoughts of individuals such as

Enrico Ferri, under the tutelage of Lombroso, Garafolo, Garraud and other contemporaries, led

the transition of the focus to understanding what about an individual causes them to engage in

crime (Nye, 1976). In complete contrast to previous theorising, predestined actor theories

suggested certain individuals were predestined to committing criminal behaviour due to their

characteristics or circumstances (Tierney, 2013). Whilst such theories offered an efficacious

explanation of criminal behaviour, based upon evidence from the social world, biology or

psychology, they largely did not offer pragmatic solutions to reduce offending behaviour by

those "predetermined" to offend (Hopkins Burke, 2014).

This school of criminology informed the modern rational choice perspective through

its focus on empirical evidence, within the positivist school there was an emphasis on data

informing theoretical developments. Quetelet and Guerry, founders of the Cartographic School

(Kindynis, 2014), are considered largely responsible for the positivist movement in

criminology. Guerry's 2002 [1833]) Quetelet's (1831;1835) effort to map crime occurrences

uncovered that that crime and other "moral statistics" such as suicide, instruction

(education/literacy) and poverty were not evenly distributed across space, and concentrated in

locations of certain characteristics (Beirne, 1987; Friendly, 2007). Progress made by these

researchers informed the social positivism approach of works of the Chicago school, and their

influence is evident in contemporary work within the field of environmental criminology or

crime science.

A multidisciplinary re-interest in the role of choice and free will occurred in the 1960s,

this is attributed to developments in exchange theory in sociology and economics, particularly

the adoption of rationalist philosophies of social behaviour in these subjects by Homans, Blau,

and the Chicago School of economics, where rational behaviour of social actors was central

(Paternoster & Fisher, 2018). Following the application of these ideas to crime data in the

1970s, an emerging body of evidence emerged which demonstrated that differing

opportunities precipitated behaviour change (Tilley, 2009; Mayhew et al., 1976). Within this

research trajectory, key authors Cornish & Clarke (1975; 1983) and Clarke & Martin (1975)

studied the efficacy of residential treatment programmes designed to address delinquent and

criminal behaviour. These studies found delinquency to reduce whilst within the therapeutic

environment, however reoffending was prevalent once released, evidencing the importance of

the opportunity structure of the immediate environment on whether a delinquent or crime

event will occur. Within this research strand there was also critique of the "passive nature" of

criminals within the deterministic theories, where individuals were entirely driven by external

processes without accounting for their own agency, which was not considered useful in

explaining the occurrence of particular criminal acts within their immediate temporal and

spatial environment (Clarke & Cornish, 1985). These advances and considerations led to the

development of the modern rational choice perspective, which provided a conceptual

framework for situational crime prevention (Cornish & Clarke, 2017), as well as routine

activities theory (Miró, 2014).

2.1.2 The Opportunity Structure of Crime

The above section has outlined the early theoretical underpinnings of the opportunity

structure of crime and offers evidence of the impact of the immediate spatial and temporal

environment on the likelihood of a crime event occurring, modern developments of the theory

are now discussed to identify concepts and characteristics which are theorised to increase or

decrease an individual's risk of victimisation, and the situations in which a crime event is most

likely to occur. Drawing upon this knowledge, situational crime prevention techniques are

examined as a method of reducing opportunities for crime. Clarke (1995) models the

opportunity structure of crime, showing links between rational choice-based theories to assist

in the solid application of situational crime prevention with respect to wider social structures.
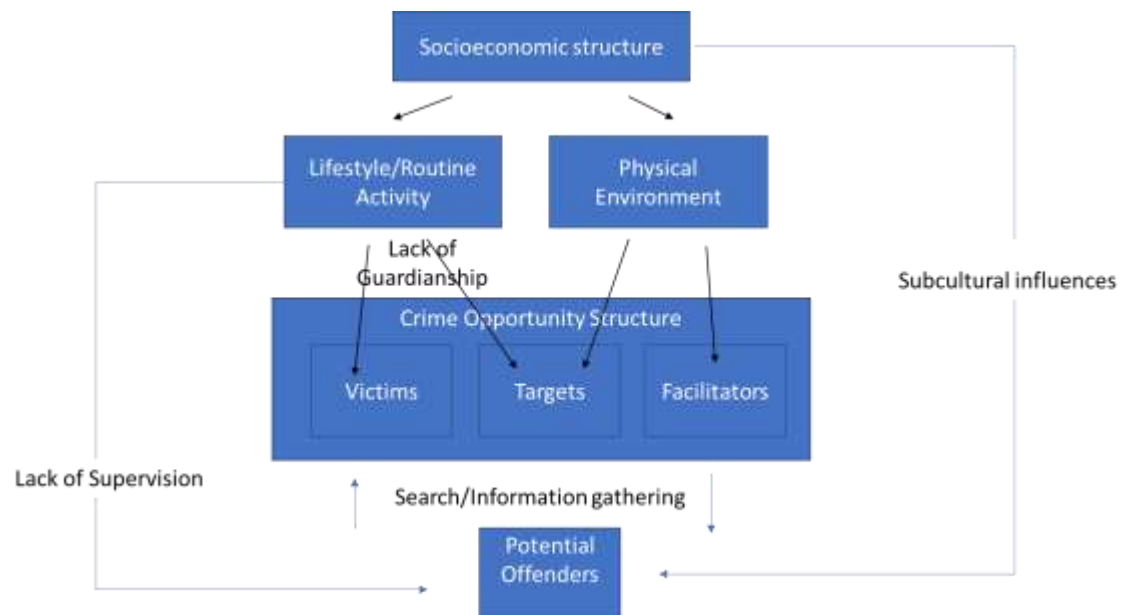
Figure 1 Opportunity Structure of Crime (Clarke, 1995, p.103)

Clarke's (1995) model considers the multiple processes through which an individual may become a potentially motivated offender, and ultimately engage in a crime event:

a) The socioeconomic structure within which an individual exists is considered enough to produce a motivated offender where certain negative subcultural influences co-occur, such as those explored in predestined actor models of crime as well as strain theory and social learning theories, which, dependent upon situational information available to them, may result in them searching for a victim or target.

b) Another simple mechanism through which a motivated offender results is the socioeconomic structure within which they live contributing to the lifestyle, and routine activities an individual has, which through a lack of supervision can result in a motivated offender looking for, or perceiving, crime opportunities.

c) Alternatively, the socioeconomic structure in which an individual is located may influence their routine activities and/or the physical environment they interact with, within which crime opportunities may present themselves, resulting in motivation to offend.

In all routes to a potentially motivated offender, the same crime opportunity structure is met by the potential offender, where they select an appropriate target. The following theories explore elements of this model in more depth, to understand the offender's decision-making process in selecting a certain target in space and time, and to understand how to manipulate the opportunity structure to reduce opportunities for crime. Understanding the characteristics which make an individual, household, or vehicle be perceived as a suitable target can inform recommendations for targeted behaviour change or situations which require increased guardianship to reduce the perceived suitability of a target.

2.1.2 Rational Choice Theory

The rational choice perspective states potential offenders undertake a level of conscious consideration of whether to engage in criminal activity, this was not considered to be a full weighing up of evidence from the first emergence of the theory but is considered rational decision making limited by the potential offenders "underlying cognitive mechanisms by which information about the world is selected, attended to, and processed" (Clarke & Cornish, 1985, p. 147), this is understood as making rational choices within "bounded rationality". The theory built upon multiple relevant concepts to develop the most complete understanding of offender decision making at each stage of the crime event. Relevant concepts include: the sociology of deviance; criminological advances; economics of choice; and psychological studies (Clarke & Cornish, 1985). From the available evidence, a number of models were developed to demonstrate the decision-making process from initial involvement, the characteristics of the crime event, and an offenders' potential continuance or desistance from crime. For this research, which in part aims to identify characteristics which affect victimisation risk, some considerations under the models of initial involvement, and event decisions are of primary importance.

In the initial engagement model, an individual is perceived to make many considerations, including about their background and needs, their experience and learning, as well as the possible solutions available to them which may result in needs being satisfied. Should criminal activity be considered a viable method for achieving their goal, the individual is either has a more considered readiness to commit crime or is ready to positively react to a chance event (Clarke & Cornish, 1985). In this state of readiness, further decisions are then made to determine the particular location in time and space for the crime event based upon environmental factors to reduce risk of being caught, and to increase gains from the crime event (Clarke & Cornish, 1985). Understanding the characteristics of individuals and

properties which have been victimised, and which are more commonly perceived to be

"suitable" targets is of huge utility in efforts to prevent crime. The following section breaks

down elements of Rational Choice Theory which will aid the interpretation of empirical

review of the following chapter, and of the results of statistical analyses in Chapter 6.

2.1.2.1 Goals & Gains

Within the initial involvement model (Clarke & Cornish, 1985), a number of possible

legitimate and illegitimate solutions to achieving goals and rewards are evaluated, with

considerations of the risks if opting for illegitimate solutions to those goals. The perceived

benefits of engaging in crime are wide ranging (Farrell, 2010), and whilst monetary and

material gains of acquisitive crime are obvious, more consideration has been required to

demonstrate the rational goals of "expressive and irrational crimes" (Farrell, 2010, p. 40) such

as joyriding, drug use, and fighting (Hayward, 2007).

Farrell (2010, p.51) offers a summary of the many tangible and intangible costs and

benefits would influence an offenders' decision of whether to engage in crime. Whilst

monetary benefits of crime are obvious, including cash and goods gained from crime,

intangible benefits include factors such as thrill, kudos from peers, feelings of power and

control, and saving time and effort. Negative considerations consist of obtaining the required

tools, getting to the crime location, physical efforts of engaging in crime, and negative feelings

associated with offending such as shame and guilt, and concerns of punishment if caught.

Money as a motivation for burglary and other household theft offences is a common

finding (Bennett & Wright, 1984; Nee & Taylor, 2000; Palmer et al., 2002; Taylor & Nee,

1988), however it is not always the primary goal, with some burglars reporting less tangible

outcomes (Nee & Meenaghan, 2006). From interviews with 50 experienced residential

burglars, the primary goal for over 75% of the sample, and the secondary goal for the

remaining quarter, was monetary, in the minority of cases where money was the secondary

goal, the pursuit of excitement and the influence of others was primary (Nee & Meenaghan, 2006). Within the household crime category, the non-acquisitive crime of home vandalism has received limited empirical academic attention in comparison to its acquisitive counterparts, however research which has investigated vandals/graffiti artists who operate in public spheres suggests offenders gain multiple intangible benefits from engagement, such as alleviation of boredom, adrenaline rushes, as well as retaliation (Taylor, 2010), which could all reasonably be applied to home vandalism, with the potential of achieving additional feelings of control over others due to the targeted nature of home vandalism.

Similarly, vehicle and personal crime are each made up of acquisitive and non-acquisitive offence types, with the tangible gains made through vehicle and personal acquisitive crime obvious, and intangible rewards including control of others, retribution, to deter others from behaviour unfavourable to the offender, and to enhance self-importance (Athens, 2005). Farrell (2010) observes that the choice to violently offend certainly may include, but is not limited to, acquisitive gain. Benefits can encompass a plethora of intangible psychological rewards, including gaining power over others and kudos amongst peers, as well as the pursuit of excitement (Athens, 2005; Cartwright, 2002; Farrell, 2010; Morleo et al., 2007; Tedeschi & Felson, 1994).

Under the rational choice framework, offenders are understood to operate within "bounded rationality", rather than assumed to make perfect decisions based upon sounds analysis of all the available information (Clarke & Cornish, 1985). Originating in economics, the concept of bounded rationality was introduced as a more realistic representation of individual's economic behaviour compared to the previously conceived idea of utility maximization, which was considered impossibly complex for the human mind (Simon, 1957). To situate this in the criminal decision-making process, the offender can only make decisions based on the information immediately available to them, whilst suffering conscious and

unconscious bias in what is absorbed from the world around them, and within the limits of

their information processing bias, capacities, and competencies (Clarke & Cornish, 1985).

2.1.2.2 Target and Location Selection

Within the event model (Clarke & Cornish, 1985), the individual has already made the

decision to engage in a crime event, the characteristics of the event are then determined, with

considerations made in selecting a target and location. Considerations include the offender's

knowledge of an area, and features of the immediate environment within which the crime

event would occur. Offenders tend to commit crime relatively close to home and within a

particular area (Block et al., 2007; Townsley & Sidebottom, 2010), with fewer crimes

committed further from home and further from the offender's awareness space, this

phenomenon is known as distance decay (Brantingham & Brantingham, 1991). The offender's

knowledge of the area in which they are operating is seen to benefit them through reducing the

effort of identifying an "ideal" crime opportunity, whilst reducing the risks of engaging in it

through knowledge of locations to offload goods (Townsley & Sidebottom, 2010), or areas

with lower surveillance (Block et al., 2007).

Having entered their chosen crime area, a specific location and target is selected based

upon their perceivable characteristics, and immediate spatial and temporal influences

(Brantingham & Brantingham, 1993). Specifically developed from information regarding the

most commonly stolen items, and therefore most relevant to acquisitive crimes, the CRAVED

model portrays desirable elements of goods an offender may choose to steal. 'Hot products'

are those which are concealable, removable, available, valuable, enjoyable, and disposable

(Clarke & Webb, 1999). This acronym has also been adapted by Felson (2002) for application

to violent crime, identifying analogous characteristics between "hot products" and "suitable"

victims. Felson (2002) noted that "a violent offender generally needs to **c**onceal the violent

act, as well as the steps before and after it. He must **r**emove himself safely from the scene;

avail himself of a convenient human target for violent attack; find a target of **v**alue in his own

mind; **e**njoy the criminal act, or at least avoid pain to himself, and **d**ispose of incriminating

evidence, even the victim" (Felson, 2002, p. 32).

Having reviewed historical and more contemporary contributions to the rational choice

perspective, it is clear that a level of rational choice making, and a weighing up of risks and

rewards occurs throughout numerous stages of a would-be offender's criminal act. This ranges

from whether to engage in crime at all, the location of the offence, and the target. With this

knowledge, targeted activities can be undertaken with a view to altering the information

available to offenders, to shift the balance of the risks and rewards and make offending

behaviour less likely.

2.1.3 Routine Activity Theory

In a shift in focus away from the offender's decision-making process, routine activity

theory focuses on the convergence of certain factors in time and space which present an

opportunity for a crime event. Routine activity theory has relevance to all "direct contact

predatory violations" which are all criminal acts whereby "someone definitely and

intentionally takes or damages the person or property of another" (Glaser, 1971, p.4). First

published by Cohen & Felson (1979) in an effort to explain rising crime rates despite

improvements in social conditions considered to contribute to offending, routine activities

focused on the structure of a crime opportunity, identifying the increasingly frequent

presentation of these crime opportunities given the changes in people's routine activities since

the 1960s.

Within the theory, Cohen and Felson (1979, p.589) posit that for a crime opportunity to

occur "(1) motivated offenders, (2) suitable targets, and (3) the absence of capable

guardianship" must converge in time and space. Acknowledged by Cohen and Felson (1979)

to be the *minimal elements* required for a crime opportunity, continuous expansion of the

"routine activities triangle" has taken place (Felson, 1995; Sampson et al., 2010). Additions

include handlers or controllers, which consist of guardianship for the potential victim or target,

handlers to reduce the likelihood of a potentially motivated offender offending, and place

managers to negate the lack of capable guardianship (Felson, 1995). A further expanded

model, as shown in figure 2 below, makes the addition of super controllers for each of the

three points of the triangle. A super controller is any person, organization, or institution which

provides incentive for handlers, guardians, or place managers to handle their offender, target,

or place to reduce opportunities for crime (Sampson et al., 2010). These factors are discussed

in more detail in the following three subsections.

Figure 2 Routine Activities Crime Triangle

(Sampson, Eck & Dunham, 2010, p.40)

2.2.3.1 Motivated Offender

A motivated offender is one of three necessary elements of a crime opportunity.

Routine activity theory places little concern on the reasons for a potential offender's

motivation, instead acknowledging their constant existence, only able to act on their

motivations when a suitable opportunity presents itself (Cohen & Felson, 1979). As seen in the

model presented above, a handler's purpose is to influence a motivated offender away from

committing crime. Handlers are introduced through Felson's (1986) reflections on Hirschi's

(1969; 1986) work on social control, where it is recognised that 'a handle is a necessary

condition for informal social control to occur' (Felson, 1986, p.121), where a handle is social

bond which encourages prosocial, legitimate activities, facilitating effective social control

(Tillyer & Eck, 2011). In theory, effective handlers will reduce the supply of motivated

offenders available to commit crime, thus reducing opportunities for crime, resulting in lower

crime rates.

Given the acknowledgement of a steady supply of motivated offenders, theoretical

developments in routine activities theory have somewhat set aside the motivations of offenders

and their handlers until recently (Tillyer & Eck, 2011), leaving this to traditional

criminological theory (Clarke, 2004), with environmental criminology focusing more on

victims and their guardians, as well as place managers (Tillyer & Eck, 2011). Tillyer & Eck

(2011) propose a model of handler effectiveness to modernise Hirschi's control theory in line

with opportunity theory. The model proposes a handler's effectiveness depends on their level

of closeness to the potential offender, their willingness to intervene, based upon their

emotional or economic investment in the offenders non-offending behaviour, their opportunity

to intervene, and their knowledge of the environments which allow the potential offender to

offend (Tillyer & Eck, 2011).

Knowledge of the motivations of offenders is not of primary importance for this thesis

however, however, acknowledgement of the steady supply of potentially motivated offenders

is a necessary part of the theoretical framework in understanding crime. The following

sections discuss target suitability and the absence of capable guardianship which have more

direct application to the analyses presented later in the thesis.

2.2.3.2 Suitable Target

The considerations made by a potential offender when identifying a suitable target with relation to CRAVED goods as well as other tangible and intangible gains, discussed in the previous section are also relevant here, however the VIVA model offers contributions specific to routine activity theory (Miró, 2014). The VIVA model states a suitable target is one which is high **v**alue from the offender's perspective, of appropriate **i**nertia such that the physical aspects of target will not impede the crime process, is physically **v**isible to the offender, and **a**ccessible (Cohen & Felson, 1979; Burke, 2005).

Security measures can increase capable guardianship of potential targets of crime, reducing their perceived suitability to the offender (Tilley et al., 2015). Tilley et al. (2015) propose characteristics of quality security, noting the effectiveness of unobtrusive, elegant security, in their acronym, DAPPER. Quality security is secure by **d**efault to avoid user error, is **a**esthetically pleasing or neutral, has a powerful **p**reventative mechanism which is not easily circumvented, is **p**rincipled and considered acceptable, is **e**ffortless to activate, and brings preventive **r**ewards greater than its cost (Tilley et al., 2015). Examples of "DAPPER" security include modern security features of cars, such as often automated central locking, or security lights on a timer or sensor at a household (Farrell & Tilley, 2020).

The lifestyle/exposure model, introduced by Hindelang, Gottfredson & Garafolo (1978), offers an explanation for why certain individuals are more commonly victims of personal crime based upon their demographic characteristics and the associated structural constraints and role expectations present in their lives. Characteristics such as age, gender, ethnicity, socioeconomic status, and financial situations form a foundation upon which role expectations are formed, for individuals to meet these financial and lifestyle expectations within the context of their structural constraints, subcultural adaptations may be formed which result in individuals finding themselves located within risky situations at relatively high

frequency, therefore increasing their victimisation opportunities (Engstrom, 2020). The

following chapter discusses in depth the sociodemographic, routine activities, and

neighbourhood contexts of those found to be most at risk of victimisation, therefore this is not

discussed at length here.

2.2.3.3 Absence of Capable Guardianship

A capable guardian is someone, or something, which can impede a crime occurrence

(Cohen & Felson, 1979), defined as 'the physical or symbolic presence of an individual (or

group of individuals) that acts (either intentionally or unintentionally) to deter a criminal

event' (Hollis-Peel et al., 2011). Within the developed crime problem triangle, there are three

types of capable guardians, with handlers of offenders, target guardians, and place managers

preventing crime (Hollis-Peel et al., 2011), with place managers theorised to be the most

important source of guardianship (Felson, 1995). Felson (1995) updates Clarke's (1992) levels

of responsibility for crime discouragement, distinguishing between four different types of

responsibility for places, which shows how formal and informal surveillance, and security

measures can work together to establish capable guardianship over a location or individual.

Primarily, individuals are expected to take personal responsibility for places they own, for

example, utilising effective door and window locks. Those with assigned responsibilities

include employees who are contractually obliged to protect a property, such as a security

guard or a building receptionist not allowing non-employees into a building, this is more

formal surveillance/guardianship. Other employees of a place will have diffuse job

responsibility, offering less formal surveillance/guardianship, and the least informal

guardianship type is the general responsibility taken by bystanders or visitors whose presence

may discourage crime, or who may report offending behaviour to others with more specific

responsibility (Felson, 1995).

Measures of guardianship have been included in a number of studies to assess their

effectiveness against crime, including physical security, occupancy of a home, target

hardening measures, formal security including police and security guards, as well as natural

surveillance, and collective crime prevention enterprises (Hollis-Peel et al., 2011). In a review

of the effectiveness of different types of guardianship, different measures were found to have

differing efficacy, whereby the least informal type of guardianship, informal guardianship has

been identified as the most important for of guardianship to prevent crime, with the presence

of bystanders being the primary deterrence of criminal activity (Hollis-Peel et al., 2011).

2.2.4 Situational crime prevention

Situational crime prevention was first defined by Clarke (1983) as "comprising

measures directed at highly specific forms of crime that involve the management, design, or

manipulation of the immediate environment in as systematic and permanent a way as possible

to reduce the opportunities for crime and increase its risks as perceived by a wide range of

offenders" (Clarke, 1983, p.255). Since its establishment, developments in rational choice

theory and routine activity theory have strengthened the theoretical underpinnings of

situational crime prevention, resulting in its successful application to a variety of crime

contexts (Clarke, 1995), as well as more recent evidence showing the limited displacement

effect which it was critiqued for in its early days (Clarke, 1992; Guerette & Bowers, 2009).

Early criminological developments identified various situational strategies of crime prevention

which were categorised as (1) surveillance measures; (2) target hardening measures; and (3)

environmental management measures (Clarke,1983). These then developed into the 12

Figure 3 25 Techniques of Situational Crime Prevention (Cornish & Clarke, 2003, p.90)

techniques of situational crime prevention (Clarke, 1992), and later into the 25 techniques of

situational crime prevention (Cornish & Clarke, 2003), as presented below.

Increase the Effort	Increase the Risks	Reduce the Rewards	Reduce Provocations	Remove Excuses
1. **Target harden** • Steering column locks and immobilisers • Anti-robbery screens • Tamper-proof packaging	6. Extend guardianship • Take routine precautions: go out in group at night, leave signs of occupancy, carry phone • "Cocoon" neighborhood watch	11. Conceal targets • Off-street parking • Gender-neutral phone directories • Unmarked bullion trucks	16. Reduce frustrations and stress • Efficient queues and polite service • Expanded seating • Soothing music/muted lights	21. Set rules • Rental agreements • Harassment codes • Hotel registration
2. Control access to facilities • Entry phones • Electronic card access • Baggage screening	7. Assist natural surveillance • Improved street lighting • Defensible space design • Support whistleblowers	12. Remove targets • Removable car radio • Women's refuges • Pre-paid cards for pay phones	17. Avoid disputes • Separate enclosures for rival soccer fans • Reduce crowding in pubs • Fixed cab fares	22. Post instructions • "No Parking" • "Private Property" • "Extinguish camp fires"
3. Screen exits • Ticket needed for exit • Export documents • Electronic merchandise tags	8. Reduce anonymity • Taxi driver IDs • "How's my driving?" decals • School uniforms	13. Identify property • Property marking • Vehicle licensing and parts marking • Cattle branding	18. Reduce emotional arousal • Controls on violent pornography • Enforce good behavior on soccer field • Prohibit racial slurs	23. Alert conscience • Roadside speed display boards • Signatures for customs declarations • "Shoplifting is stealing"
4. Deflect offenders • Street closures • Separate bathrooms for women • Disperse pubs	9. Utilize place managers • CCTV for double-deck buses • Two clerks for convenience stores • Reward vigilance	14. Disrupt markets • Monitor pawn shops • Controls on classified ads. • License street vendors	19. Neutralize peer pressure • "Idiots drink and drive" • "It's OK to say No" • Disperse troublemakers at school	24. Assist compliance • Easy library checkout • Public lavatories • Litter bins
5. Control tools/ weapons • "Smart" guns • Disabling stolen cell phones • Restrict spray paint sales to juveniles	10. Strengthen formal surveillance • Red light cameras • Burglar alarms • Security guards	15. Deny benefits • Ink merchandise tags • Graffiti cleaning • Speed humps	20. Discourage imitation • Rapid repair of vandalism • V-chips in TVs • Censor details of modus operandi	25. Control drugs and alcohol • Breathalyzers in pubs • Server intervention • Alcohol-free events

Figure 3 25 Techniques of Situational Crime Prevention (Cornish & Clarke, 2003, p. 90)

The 25 techniques are situated under five categories which aim to reduce incentives and opportunities for crime through a variety of mechanisms, which must be applied to crime specific problems based upon empirical evidence of their contributors (Clarke, 2013). Whilst initially only perceived to be applicable to opportunist property offences, such as vehicle theft, burglary and vandalism, following advancing theoretical developments and empirical work, it's applicability to personal and violent crime has been realized (Clarke, 2009).

2.1.4 Summary

In this thesis the rational choice perspective is used to understand victimisation, by exploring the characteristics of victims of household, vehicle and personal crime types, and identifying those most at risk, situational crime prevention techniques can be enacted to reduce this risk. Analysis of both risk and protective characteristics through the rational choice framework allows for understanding of *why individuals of certain characteristics are more*

attractive to offenders, with the expectation there is scope to reduce the victimisation risk of individuals or households matching elements of the risk profile.

Rational decision making of offenders has persisted in the criminological literature since the classicist's began theorising about crime and the penal system (Hopkins Burke, 2013), following the establishment of new evidence which demonstrated the importance of the immediate environment in controlling offending behaviour, theoretical focus returned to rational choice perspectives (Tilley, 2009). The opportunity structure of crime was further developed to account for the background of offenders, their routine activities, as well as situations they may face which may encourage, or allow them to commit crime (Clarke, 1995). The rational choice perspective developed models of crime involvement, separating the offender's decision of whether to engage in crime at all, then considers the characteristics of locations and potential targets when deciding specifically when and where they will engage in crime (Clarke & Cornish, 1985). Rational choice theory further examines the specific characteristics of a crime event, stating that a crime can only occur under the circumstances of a motivated offender, a suitable target coming together in time and place with a lack of capable guardianship (Cohen & Felson, 1979). Within this theory more specific characteristics of crime events are considered with relation to identifying a suitable target and methods of exercising capable guardianship. Drawing on both rational choice theory and routine activity theory, methods of situation crime prevention were developed (Clarke, 1983). This offers 25 specific techniques to reduce the offender's motivation, reduce the perceived suitability of the target, and to exercise capable guardianship over a place (Cornish & Clarke, 2003).

These theories offer a framework within which to understand the effects of certain individual and neighbourhood characteristics on victimisation risk, and importantly, having identified risk factors of victimisation, situational crime prevention techniques can be utilised in efforts to reduce the effects of riskier characteristics and therefore reduce crime.

2.2 Theories of Fear of Crime

Research on fear of crime has traditionally been within a data analysis trajectory, driven by the measurement of the concept in victimisation surveys upon which statistical methods have been employed to determine the prevalence of, and characteristics associated with fear of crime (Lee, 2007). From this earlier literature, and remaining in the contemporary literature, alongside the victimisation theory of fear of crime, three main models for explaining fear of crime have persisted, two of which focus on facilitators of fear of crime: the vulnerability model; and the disorder model, and one which inhibits fear of crime: the social integration model (Franklin et al., 2008). An alternative trajectory of theory also explores the meaning and operationalisation of fear of crime, aiming to explore and delineate the multitude of concepts within the fear of crime conceptual network where qualitative techniques prevail (Lorenc et al., 2014). Elements from this strain are touched upon in the introduction chapter of this thesis and consulted to ensure a pertinent definition of fear of crime is decided upon for the original research, in line with recent theoretical developments.

2.2.1 Vulnerability

The vulnerability model of fear of crime suggests that individuals with higher physical or social vulnerabilities are more likely to be fearful of crime due to their reduced ability to physically resist a victimisation attempt, or due to the increased harm a victimisation would cause as a result of factors such as low income, and limited access to social resources (Franklin et al., 2008). To understand the impact of these factors on fear of crime, Hale (1996) explores them through an analytical framework of different dimensions of vulnerability. Killias (1990) proposes fear of crime to be dependent upon the following factors: (1) exposure to risk; (2) lack of effective deterrence, protective measures, or means of escape; and (3) anticipation of serious consequences. It is argued that a combination of these are required for fear to be provoked, with their *sensitivity* to risk responsible, (i.e. if they were to be victimised

they believe it would be very harmful to them), for their increased fear, rather than simply

their perceived risk of victimisation (Warr, 1984).

Gender, age, and socioeconomic factors are often considered in the vulnerability

theory literature, with females, and older individuals often found to be at increased risk of fear,

whilst at lower risk of victimisation, and individuals, or individuals living in areas

characterised by lower socioeconomic classification at higher risk of both victimisation and

fear of crime (Hale, 1996). Whilst an individual's perceived relative and absolute risk are of

primary importance in informing their worries about crime, supporting the idea of the

sensitivity to risk being responsible for fear of crime, other elements of individual's appraisal

of risk, including their judgements about their ability to control a victimisation experience, and

of the expected consequences of it are informative of their level of worry (Jackson, 2009).

Females have been found to perceive their gender and age group to be at higher risk of

victimisation compared to other groups (Jackson, 2009), increasing the evidence base that

females perceive their risk of victimisation as higher than it really is, accounting for their

higher reported fear. Health is another factor attributed to vulnerability, whereby individuals

with perceived poorer health have an increased risk of being worried, interestingly their

perception of their health, rather than their actual health status, was a more significant

predictor of fear of crime (Cossman & Rader, 2011), highlighting the importance of the

individual's appraisal of their risk, rather than their actual characteristics.

Increased fear experienced by those of lower socioeconomic standing may be

attributed in part to residing in areas of higher incivilities, thus they are at increased risk of

victimisation, whilst their economic and social resources are likely to be lower, leaving such

individuals less able to purchase security to protect their possessions, and to recover

materially, and psychologically following any crime occurrence (Hale, 1996). Poverty related

factors, including low income are found to increase worry, even when accounting for other

characteristics which likely contribute to an individual's perception of their vulnerability,

including a measure of a person's perceived ability to defend themselves (Pantazis, 2000). A

further consideration to explain higher fear among those of lower socioeconomic standing is

the variety of other concerns present in their life, such as job loss, financial, and health issues,

and how this existing level of general concern in an individual may correlate with fear of

crime (Pantazis, 2000).

2.2.2 Victimisation

The victimisation perspective suggests that fear of crime is the result of a direct

victimisation experience (Hale, 1996), or of neighbourhood criminal behaviour, as well as by

news of crime, whether through personal contacts or the media (Bennett, 1990). In the

literature mixed findings have been reported on the relationship between victimisation and fear

of crime (Hale, 1995), however many positive associations between victimisation and fear

have been concluded across general and crime specific measures[1] (Escholz et al., 2003; Kanan

& Pruitt, 2002; May et al., 2006; Rountree & Land, 1996). Statistical studies have somewhat

clarified this relationship, and it is evident in the majority of the literature that having been a

victim of crime increases the risk of fear of crime, however inconsistencies and arguments

remain in the measurement of victimisation, Agnew (1985) argues global indicators of fear are

the most valid measurements of fear of crime, however this is refuted by Hale (1996), with

measures specifically mentioning crime favoured, crime specific measures of fears are more

recently considered the most accurate way of measuring fear of crime (Box et al., 1987; Hale,

1995, Hale et al., 1994; LaGrange & Ferraro, 1989; Maxfield, 1987). It is noted that a number

of more open-ended measurements of fear of crime specifically relate to feeling unsafe *at*

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[1] Evidence of the relationship between victimisation and fear found in regression based
statistical studies is discussed in more detail in the following chapter.

home, or *out in the neighbourhood* alone and thus exclude important crime types by default

(Hale et al., 1994).

Whilst increased fear is hypothesised for victims, an individual's reaction to a

victimisation experience has also been found to contribute to its "fear inducing" results,

whereby individuals who have been victimisation feel that their victimisation experience was

not too damaging for them, or if they feel they know how to avoid such a victimisation in the

future, known as "neutralisation techniques", are less fearful of crime after a victimisation

experience (Hale, 1996). The relationship between fear of crime and indirect experiences of

crime has been found to be stronger in some studies (Arnold, 1991). One reason considered

for this is that "neutralization techniques" are not applicable without the lived experience,

whilst the imagination of the consequences is unlimited (Hale, 1996). Within the consideration

of indirect victims being more fearful of crime, the potential solution of reducing crime or

reducing perceptions of crime is considered as a possibility to reduce fear of crime, with

individual's perceptions of crime found to be relatively accurate in comparison to recorded

crime (Warr, 1982).

2.2.3 Social and Physical Disorder & Social Integration

Further to an individual's characteristics and interactions with crime events, the

neighbourhood and community within which they reside have been found to better explain

individuals' fears (Hale, 1996). A number of studies (Brunton-Smith & Sturgis, 2011; Hale et

al., 1994; Krulichova, 2019; LaGrange et al., 1992) have found those living within urban

neighbourhoods of larger cities, to be more fearful of crime than those in other locations, with

both the physical and social characteristics of such neighbourhoods theorised to mediate the

relationship between crime experiences and an individual's fear of crime (Hale, 1996). Social

incivilities include the uncivil behaviours of people, such as inconsiderate or disruptive

neighbours, unsupervised youths, people making excessive noise, and alcohol and drug misuse

in public (LaGrange et al., 1992). Physical incivilities refer to the material deterioration of a

location, including littering, dogs running loose, graffiti and vandalism, and abandoned cars or

debris (LaGrange et al., 1992). Whilst incivilities are generally considered indicative of higher

crime rates, higher risk of crime, and therefore higher fear of crime, there are some conflicting

ideas which suggest a muting effect of incivilities once residents become familiar with them

(Riger et al., 1981).

There have also been attempts to objectively measure incivilities within a

neighbourhood, for example through the use of independently trained reviewers or by

interviewers, such measures have produced mixed results, however certainly appear to be

substantially less strongly related to fear of crime than perceived incivilities (Hale, 1996). The

stronger effect on fear of crime found when comparing effects of perceived incivilities, to

independently rated incivilities, is reflective of results on perceived health discussed in the

previous section, and offers support for the idea that an individual's perception of an issue is

more important in determining fear of crime than an independent measure. The reduced

evidence in support of an effect of independently rated incivilities on fear of crime may

equally offer support for the idea of a "muting effect" of the effects of disorder.

It is theorised that high population neighbourhoods, or neighbourhoods which have

high traffic flow are synonymous with a high volume of strangers, both socially and culturally,

with the fear of crime interpreted at the "fear of strangers" (Hale, 1996, p.113). With the fear

of strangers considered akin to the fear of crime, social ties are expected to have a mediating

effect on the impact of a place's incivilities on an individual's fear of crime (Hale, 1996).

Social ties are expected to reduce fear of crime through the attachments to the neighbourhoods

which develops alongside strengthening social ties, within this, an increased trust among

neighbours to enforce social control is expected to emerge (Gibson et al., 2002), thus this may

reduce an individual's perceived risk of becoming a victim of crime, as well as improving their

perceived prospects in dealing with a victimisation experience.

2.2.4 Summary

 This section presented three models for explaining fear of crime. Vulnerability theory

of fear of crime suggests the social and physical vulnerabilities of an individual, and

particularly how they perceive this vulnerability, increase the likelihood of being fearful of

crime due to the perceived particular harm it would cause them (Jackson, 2009). The

victimisation theory of fear of crime posits that victims of crime will be more worried about

crime, this is extended to those who hear about crime occurring within their neighbourhood

through other means, however neutralisation techniques may be employed by the victim after

a victimisation which can negate the fear response (Hale, 1996). Perceived social and physical

incivilities are expected to incite fear of crime in individuals due to them being indicative of

an increased crime rate, however muting effects may be experienced by those frequently

exposed to incivilities, reducing their impact on fear of crime (Riger et al., 1981). Social

networks are also expected to reduce the effects of neighbourhood incivilities on fear of crime

(Gibson et al., 2002).

 The literature on theory of fear of crime is more recent in its development compared to

the opportunity framework discussed in the previous chapter, and to theories of crime in

general. The theories of interest for this thesis are borne out of modern empirical analyses

using regression techniques and are fairly well dispersed throughout journals. These factors

mean the literature on these theories at present is somewhat disjointed, however efforts of Hale

(1996), and more recently of Farrall et al. (2011) have worked to align the current knowledge.

3.0 The Relationship between Victimisation and Fear of Crime, and the Individual, Household,

and Neighbourhood Characteristics which Influence their Risk

This chapter provides a summary, and synthesis of existing knowledge regarding the

relationship between victimisation and fear of crime, and factors associated with experiencing

criminal victimisation and fear of crime. The relationship between victimisation and fear is

first explored in further detail, examining more complex efforts to model the relationship

between the various concepts falling under the fear of crime umbrella. Effects of a number of

personal and household characteristics; perceptions of one's neighbourhood; security levels;

media influence; and characteristics of the neighbourhood an individual lives in, on both

victimisation risk and fear of crime risk are then discussed.

Literature included was obtained from google scholar searches, to identify as many

research articles as possible which had used regression modelling to predict either

victimisation or fear of crime. This was not conducted in a systematic manner due to the large

number of articles published of this type. With regard to fear of crime, articles which

measured dispositional worry about crime were prioritised over frequency of situational fear,

and abstract measures of fear of crime, due to the large amount of information found across

the studies included in this review. This review provides a summary of characteristics

expected to affect victimisation and worry about crime and informs expectations of the

relationship between victimisation and worry about crime. The characteristics identified to

affect either victimisation or fear of crime within this chapter inform the covariates selected

from the CSEW for inclusion in analysis.

3.1 The Relationship Between Victimisation and Fear of Crime, and Operationalisations

of Fear of Crime

A number of empirical studies have found a statistically significant relationship

between victimisation experiences and fear of crime, with higher risk of fear, levels of fear,

and frequency of feeling fear more commonly found among those who have experienced a

victimisation than those who have not (Brunton-Smith & Sturgis, 2011; Hale et al., 1994;

Weitzer & Kubrin, 2004), some exceptions to this are discussed later. These relationships

persist despite the inclusion of a wide variety of covariates, including personal and area

sociodemographic characteristics (Brunton-Smith & Sturgis, 2011), information regarding

media consumption (Weitzer & Kubrin, 2004), indicators of target attractiveness (Rountree &

Land, 1996), social integration (Oh & Kim, 2009), neighbourhood perceptions of physical and

social disorder (Hale et al., 1994; Scarborough et al., 2010), and other neighbourhood

structural characteristics (Brunton-Smith & Sturgis, 2011; Hale et al., 1994).

3.1.1 The Impact of Victimisation Experiences on an Individual's Fear of Crime

The following section discusses the relationship found between victimisation and fear

of crime in a number of quantitative studies using regression methods to predict risk of being

fearful of crime. The effects of victimisations are considered on different operationalisations

of fear of crime, and the duration of impact of a victimisation experience on fear of crime is

discussed. The section closes with a discussion of the relationship found between different

operationalisations of fear of crime.

3.1.1.1 The Relationship between Victimisation and Dispositional Worry about

Crime

Dispositional worry about crime has been found to be higher among those who

experienced a victimisation prior to being asked about their worry about crime (Brunton-Smith

& Sturgis, 2011; Eschholz et al., 2003; Kanan & Pruitt, 2002; May et al., 2010). Limiting

reporting of crime experience to those occurring within the 6 months prior to interview,

victims have been found to have a level of fear 0.4 standard deviations higher than non-

victims (Eschholz et al., 2003).

A number of studies differentiated between property and personal victimisations, with mixed findings regarding whether property or household victimisations were more impactful upon fear of crime. Experiencing a single personal victimisation has been found to increase risk of worry about crime by 0.23 standard deviations, compared to non-victims, this is almost twice that of the impact of a single household victimisation, repeat victimisations increased worry about crime further, with repeat personal victimisations increasing fear by 0.35 standard deviations, and by 0.25 for household repeat victimisations (Brunton-Smith & Sturgis, 2011). In contrast to this, when focusing the measure of worry about crime to an individual's own neighbourhood, whilst a property crime victimisation was found to increase the odds of worry twofold compared to a non-victim, personal crime victimisations were not found to influence risk of worry about becoming a victim within one's own neighbourhood (Kanan & Pruitt, 2002). Equally, violent victimisations were not found to increase the level of fear of crime when measured using a combination of crime specific fear statements, however males who were victims of a sexual offence had highly increased levels of fear compared to non-victims, whilst property was also found to increase males' levels of fear of crime victimisation, with no effect of victimisation experiences found on a female's level of fear (May et al., 2010).

Throughout the mixed findings presented here although general measures of worry about crime are used the composition of them is quite different with Bruton-Smith & Sturgis' (2011) measure only including worry about personal crimes, whereas May et al., (2010) also included worry about household crimes, and Kanan & Pruitt (2002) focused their measure only on worry in the neighbourhood, varying constructions of a general fear of crime measure may be in part responsible for the varied findings between studies.

In examining the effects of experiencing a victimisation, or knowing a victim of crime, on worry about two personal crime types, mugging and assault, and on worry about burglary, victimisation experiences only significantly increased the risk of being worried about burglary,

with direct victims almost twice as likely to be worried, and indirect victims one and a half

times as likely to be worried (Hale et al., 1994). Having been a victim of any crime in the 12

months prior to reporting fear of crime, and having ever been a victim of violent crime are

found to have mixed results of an individuals level of fear of burglary, sexual assault, and

robbery. Lifetime violence has not been found to impact fear of burglary or robbery, and whilst

a victimisation experience in the last 12 months appeared to increase the level of worry about

both of these crime types, this effect was mediated by the individual's perception of risk to

victimisation (Reid & Konrad, 2004). In contrast, whilst a recent victimisation of any type was

not found to affect risk of worry about sexual assault, lifetime violence was associated with

increased worry, however a significant effect of lifetime violence was only estimated once

gender had been controlled for in the model (Reid & Konrad, 2004), this increased the

evidence of victimisation experiences affecting females and males differently as found in the

previous literature (May et al., 2010).

Information taken from the above studies clearly demonstrates a positive relationship

exists between victimisation and dispositional worry about crime, however the differing

effects of various crime types of the varied operationalisations and strategies for developing a

worry about crime measure reveal a more complex relationship, with certain types of

victimisations affecting worry about certain crime types more strongly than others. Other

factors including gender and perceived victimisation risk are also shown to important in

estimating the relationship between victimisation and fear of crime.

3.1.1.2 The Relationship between Victimisation and Frequency of Situational Fear of Crime

Victimisation experience is found to increase the frequency at which individuals worry

about crime, with victims of either burglary or violence found to experience worry at a greater

frequency than non-victims, having a frequency of experiencing worry score approximately

0.3 points higher on a 4 point scale than those experiencing no victimisations (Krulichová, 2019), equally experiencing a burglary victimisation has also been associated with increased risk of worrying about burglary once a week (Rountree & Land, 1996). Measuring the intensity of fear of crime in terms of the frequency in which it is experienced is a less common method, however this research continues to show a positive relationship between victimisation and fear, particularly for household crime.

3.1.1.3 The Relationship between Victimisation and Alternative Fear Measures

Predicting worry group membership, Gray et al. (2010) found having experienced any type of victimisation in the 12 months prior to interview to increase risk of being assigned to the dysfunctionally anxious, the functionally and dysfunctionally worried groups, compared to being "unworried". Victims of crime were found to have 66% higher odds of being in the category of dysfunctionally anxious than non-victims, meaning victims were more likely *to not be able to recall* a recent episode of feeling fearful and took measures to reduce their fear which negatively impacted upon their quality of life. Victims were almost equally likely to be assigned dysfunctionally worried, meaning they *could recall* a previous incident of feeling fear and took measures to reduce their fear which interfered with their quality of life. Victims also had 83% higher odds of being functionally worried than non-victims, meaning they were more likely to be able to recall a recent episode of feeling fearful and took measures to reduce their fear which make them feel safer and do not interfere with quality of life, however victims were not found to have increased risk of being functionally anxious compared to unworried (Gray et al., 2011).

General feelings of unsafety have been found to be higher for victims than non-victims (Oh & Kim, 2009), this has been attributed to property crime victimisations rather than personal crime victimisations, with only property crimes significantly increasing feelings of

unsafety (Rountree & Land, 1996; Weitzer & Kubrin, 2004), further evidencing the increased

effects of property victimisation compared to personal or violent victimisations.

3.1.1.4 Duration of Impact of a Victimisation Experience on Fear of Crime

When undertaking survey which measure fear of crime, victimisation experiences

within the 12 months prior to victimisation are often also collected, some studies have reduced

this period to 6 months (Eschholz et al., 2003), whilst some included lifetime measures of

victimisation (Reid & Konrad, 2004). The effects of a victimisation which occurred within the

12 months prior to measuring fear of crime has been found to significantly increase risk of fear

of crime, whilst a victimisation event which occurred within the 12-24 months prior was not

found to affect fear, suggesting the "fear inducing" effects of a victimisation may degrade after

the 12-month period (Russo & Roccato, 2010). Some aforementioned studies found a

significant increase in fear of crime with victimisations occurring within 12 months (Brunton-

Smith and Sturgis, 2011), to five years (Krulichová, 2019) prior to data collection, as well as

violence occurring at any point in the lifetime (Reid & Konrad, 2004), therefore whilst some

studies suggest the effects of victimisation of fear reduces after at least 12 months, this is

disputed in the literature.

3.1.2 The Relationship Between Different Operationalisation of Fear of Crime

This section discusses the relationship between more generalised and abstract

operationalisations of fear of crime, including general feelings of unsafety and perceived risk

of victimisation, and dispositional worry about crime, which is the working operationalisation

of fear of crime within this thesis. General feelings of unsafety, and risk of victimisation are

found to be measured in the same way in some research, with the general feelings of unsafety

question used to proxy victimisation risk, rather than a direct question of perceived

victimisation risk (Krulichová, 2019; Reid & Konrad, 2004).

Perceived risk of victimisation, when operationalised as a derived measure of perceived risk of multiple crime types, has been found to be associated with increased risk of fear of crime, with each additional level of fear for a crime type corresponding to a 0.7 point increase in the fear of crime scale (scale from 10 to 100) (LaGrange et al., 1992), showing a very strong correlation. Findings of higher fear of crime among individuals with higher perceived risk of victimisation are replicated in further studies (Eschholz et al., 2003; May et al., 2010). Higher perceived risk of property crime has been associated with higher levels of both general feelings of unsafety, and higher levels of fear of crime, with property crime risk perception affecting both concepts similarly, however perceptions of violent crime risk were not found to be associated with general feelings of unsafety or fear of crime (Wetzer & Kubrin, 2004).

General feelings of unsafety have also been found to have a positive association with frequency of experiencing fear of crime, with each point increase in the scale of general feelings of unsafety increasing frequency of fear of crime (Krulichova, 2019). The effect of general feelings of unsafety has been found to affect fear of different crime types differently, with general feelings of unsafety not associated with increased frequency of experiencing fear of sexual assault, whereas frequency of burglary increased with higher feelings of unsafety (Reid & Konrad, 2004). The effect of feelings of unsafety on fear of robbery was different for males and females, whereby females are more often fearful of robbery than males when their feelings of unsafety are lower, and however similar frequency of fear is experienced by both genders when feelings of unsafety are at their highest (Reid & Konrad, 2004).

The above literature has shown that there is commonly a positive correlation found between various measures of fear of crime, as such factors which affect one operationalisation are likely to affect others and vice versa, this demonstrates the utility of examining the effects of covariates on all operationalisations of fear of crime.

3.2 Characteristics associated with Risk of victimisation and Fear of Crime

This section draws upon a number of research papers which have presented regression models predicting either victimisation risk, or rates, or concepts under the fear of crime umbrella. The models utilise a number of personal characteristics, indicators of socioeconomic classification, characteristics of the household in which they reside, their routine activities, and characteristics of the neighbourhoods in which they reside to predict an individual's victimisation risk, or risk of fear of crime. Throughout the literature measures of the dependent variables of victimisation and fear of crime, as well as the covariates are developed in a multitude of ways, this review therefore aims to synthesise and summarise the existing knowledge of the characteristics which have been found to affect either concept of interest. To increase ease of readership, characteristics effects on victimisation and fear of crime are presented in separate sections. Within each victimisation section information is divided by crime type, and within each fear of crime section information is divided by operationalisation of fear of crime.

3.2.1 Individual Characteristics

This section discusses the effects of individual characteristics, including age, gender, race and ethnicity, marital status, and illness and disability on both risk of victimisation and fear of crime.

3.2.1.1 Age

Victimisation

Personal and Violent Victimisation

Older age has consistently been found to be associated with lower risk of personal and violent victimisation (Hope et al., 2001). Individuals aged between 16 and 19 have been found to have the highest risk of experiencing a violent victimisation, with risk reducing as age increases (Brennan, 2010; Wilsem et al., 2006). The risk of victimisation was predicted to

reduce by 3% per year increase in age, equating to 75-year-olds having 165% lower odds of

victimisation than a 20-year-old in a Dutch study (Wilsem et al. 2006), and in a British study

those aged 75 or older were predicted to have 95% lower odds of violent victimisation

compared to those aged between 16 and 19 (Brennan et al., 2010).

Investigating personal crime, which additionally includes non-violent personal

acquisitive crime and threats compared to the previously discussed category of violent crime,

older individuals have been found to experience fewer victimisations (Tseloni & Pease, 2003;

2004). The number of personal victimisations an individual is expected to experience within a

year time period reduces by 4% per year increase in age, this equates to a 75-year-old

expecting 220% fewer personal victimisations per year than a 16-year-old.

The reduction in risk of violent and personal victimisation are substantial, with only

1.8% of the population experiencing a violent crime and even lower proportions experiencing

other types of personal crime (Office for National Statistics, 2021a) and the number of

victimisations predicted on average for an individual well below one (Tseloni & Pease, 2003;

2004). Whether the effect of age on the expected number of crimes an individual will

experience differs between neighbourhoods has also been examined, but no evidence was

found to support this (Tseloni & Pease, 2004). This means that the effect of age within a

neighbourhood is independent of the crime level experienced there.

Property and Household Victimisation

The age of the head of household has been found to significantly reduce the risk of

property crime victimisation (Hope et al, 2001), with the risk of reducing by approximately

1.5% with each year increase in age (Trickett et al., 1995). Examining the components of

household crime individually reveals a slightly stronger effect of age of the head of household

on burglary in comparison to overall property crime, a slightly weaker effect on household

theft, with no significant effect of age on experiencing criminal damage found (Trickett et al.,

1995). When examining the respondent's age, a weaker effect is found in comparison to the age of the head of household, with a 1% decrease in the odds of experiencing burglary, other vandalism, vehicle related theft, and car vandalism prediction with each additional year of age (Wilsem et al., 2006).

Age of the respondent has also been found to reduce the number of household victimisations a household is expected to experience, with the number of victimisations to reduce by just under 1% per additional year of age when estimated in a negative binomial regression model (Park & Fisher, 2017). Modelling the same data using zero-inflated negative binomial modelling, a technique which accounts for the high number of non-victims in the population considered to have a zero probability of victimisation through estimating two equations, one for those with a zero probability of victimisation, and one for those with a non-zero probability, in order to better fit the data (Hilbe, 2011-put into footnote). Age was not found to affect household victimisation on the "high risk" side of the model, however the odds of being "immune" to victimisation increased by almost 6% per year increase in age (Park & Fisher, 2017) this suggests that the effect of age may be overestimated in studies when the zero-inflation is not accounted for.

Age has also been found to reduce how many types of property victimisations a household is expected to experience, with the predicted number of victimisations reducing by approximately 13.5% for each additional 10-years of age of the respondent (Outlaw et al., 2002). This would be slightly higher than the finding from Park & Fisher's study, however any repeat victimisation of the same property victimisation type are not counted in the dependent measure here, therefore the number of victimisations a household has experienced will be undercounted for some. Age was found to have a particularly strong effect on the risk of multiple victimisation, operationalised as whether the individual had experienced both a property and personal victimisation within the two years prior to survey, with the odds of

being multiply victimised reducing by almost 25% for each 10-year age interval (Outlaw et al.,

2002).

Fear of Crime

Dispositional Worry about Crime

As age increases, the odds of being worried about becoming a victim of crime within

their neighbourhood have been found to increase, with the odds increasing by 2% with each

year increase in age (Kanan & Pruitt, 2002). In contrast, studies which have measured the

level of dispositional worry about crime have found the level of fear to reduce as age

increases, the extent of this has been estimated at a reduction of between 0.07 and 0.14 points

on a 10-point fear scale (Lagrange et al.1992; Eschholz et al., 2003). The disagreement in

findings here may suggest that the relationship between age and fear is not linear, whilst more

older individuals may fall within the higher worry category in Kanan and Pruitt's (2002)

dichotomisation of their fear variable, older individuals may not necessarily have the highest

levels of fear. The findings of a significant quadratic effect of age appears to confirm this. A

negative effect of age was estimated, predicting older individuals to have lower levels of fear

overall, however the significant negative quadratic coefficient also means that the *reduction in*

fear associated with each year increase in age reduces as age increases (Brunton-Smith &

Sturgis, 2011), or levels of fear reduce more slowly as older ages are reached. The effect of

age on dispositional worry about crime appears to be affected by gender, with a significant

effect of age only found within the female analysis subset, whilst no effect is found in analysis

containing only male subjects. (May et al., 2010).

The previously discussed results do not use a crime specific measure of fear of crime,

either asking about an individual's level of worry about becoming a victim of crime in general

or combining results of worries about a number of crime types, however studies which have

examined worry about certain fear types separately have found differing effects of age on

different crime types. Predicting the level of dispositional worry about burglary, a reduction in

worry, of approximately half a point on a five-point scale, has been found for those aged 50+,

compared to all other age groups (Reid & Konrad, 2004), however when predicting risk of

dispositional worry about burglary, no significant effect of age was found (Hale et al., 1994),

this difference in findings may be attributed to there being greater conceptual distinction

between the categories of a binary measure, compared to a 10% increase on a scale .

Individuals aged over 60 were found to have almost twice the odds of being worried about

mugging, compared to all other age groups (Hale et al., 1994), some evidence was found for

age increasing the level of dispositional worry about robbery, with those aged over 50

expected to have a dispositional worry about robbery score approximately half a point higher

than other age groups, however this became non-significant following the inclusion of an

interaction term between gender and perceived risk of victimisation (Reid & Konrad, 2004). A

particularly strong effect of being aged between 31 and 60 was found on the risk of having

dispositional worry about assault, with such individuals having almost 3 times the odds (Hale

et al., 1994). Dispositional worry about sexual assault was not found to be affected by age

(Reid & Konrad, 2004).

Frequency of Situational Worry about Crime

Differing effects of age have been found on the frequency of experiencing situational

fear of crime, age has been found to slightly increase the frequency of experiencing fear, with

each year increase in age expected to increase the frequency of experiencing fear by 0.001

points on a four-point-scale (Krulichová, 2019). Conversely, when focusing on burglary, a

2.5% decrease in the odds of being fearful at least once per week were associated with each

decade increase in age (Rountree & Land, 1996).

Alternative Fear Measures

Gray, Jackson & Farrall (2010) grouped individuals into fear groups, grouping

individuals as unworried if an individual reported no worry about crime, anxious if the

individual reported worry, but could not remember a recent event which made them

experience worry, and worried if they reported being worried and could recall a recent event

which made them feel this way. The anxious and worried groups were then further divided

into functioning, when individuals took beneficial action to reduce their worry or anxiety, and

dysfunctioning (when individuals took non-beneficial actions to reduce their worry or anxiety,

but these negatively affected their quality of life. Age was found to increase the odds of being

functionally anxious compared to being unworried, with each unit increase in age

(measurement unspecified) associated with almost a 15% increase in odds of being

functionally anxious. This means older adults are more likely to report worry about crime but

are taking beneficial steps to reduce their levels of worry (Gray et al., 2011).

Studies which operationalised fear of crime as general feelings of unsafety commonly

found older individuals to feel more unsafe than younger individuals, (Oh & Kim, 2009;

Scarborough et al., 2010), and a quadratic effect of age was also found (Weitzer & Kubrin,

2004).

3.2.1.2 Gender

Victimisation

Personal and Violent Victimisation

Being male has consistently been found to be associated with an increased risk of

violent victimisation, with a British based study predicting males to have 36% higher odds of

violent victimisation than females (Brennan et al., 2010), and a Dutch study estimating almost

double this effect, predicting males to have 68% higher odds of victimisation (Wilsem et al.

2006). Being male was also associated with experiencing a higher number of violent

victimisations, with analysis carried out on the US National Crime and Victimisation Survey

(NCVS) predicting males to experience 40% more victimisations (Tseloni & Pease, 2003;

2004). A very similar result to this was also found in a Taiwanese study focusing on assault

specifically, predicting males would experience approximately 37% more assaults than

females (Kuo et al., 2012). Whilst being male was consistently found to increase both risk of

experiencing a personal victimisation, and the number of victimisations expected, no evidence

was found of more serious injuries being inflicted upon males than females (Brennan et al.,

2010).

The effect of being male varies significantly between households, with the increased

risk associated with being male being reduced for those in a household with a lower predicted

number of victimisations, compared to those in households with higher victimisation rate

(Tseloni & Pease, 2004).

In a Taiwanese study, males have been found to experience 26% more larceny

victimisations than females, and 16% more robbery victimisations (Kuo et al. 2012). The

effects of gender for these crime types were initially much higher, however reduced following

the inclusion of routine activity variables in the model, suggesting that the differing routine

activities of males and females account for a large proportion of their differential victimisation

risk. These results should be interpreted with caution in the British context due to the data

being collected in Taiwan, however as the effects of gender on assault were similar in analysis

on this dataset and the BCS analysis they may be plausible.

Property & Household Victimisation

Limited evidence of gender influencing property crime risk is found in the literature,

with the only evidence for this found in this review being a 7% increase in risk of burglary

victimisation in a Dutch study (Wilsem et al., 2006). This study also tested the effects of

gender on vehicle related theft, car vandalism and other vandalism and found no significant

effects, several other studies also found no significant effect of gender on property crimes

(Outlaw et al., 2002; Park & Fisher, 2017; Trickett et al., 1995; Tseloni et al., 2004).

Fear of Crime

Dispositional Worry About Crime

Gender has been found to increase the risk of having dispositional worry about crime,

although other covariates in the model influence the effects substantially (Kanan & Pruitt,

2002). Females were initially predicted to have just over 70% higher odds of experiencing

worry compared to males when only sociodemographic variables and victimisation status are

controlled for, however including measures of perceived neighbourhood conditions and

guardianship reduced the apparent effect of gender to insignificance, significance was

regained when neighbourhood integration measures were introduced, although the effect was

smaller, predicting females to have just over 50% higher odds of experiencing worry than

males (Kanan & Pruitt, 2002). Females have been found to experience worry more strongly

than males, they are estimated to have a worry score just over 11 points higher than males on a

scale ranging between 10 (lowest fear level) and 100 (highest fear level), equating to females

having a score of approximately one quarter of a standard deviation higher than males, a

finding also matched in another study (Eschholz et al., 2003; Lagrange & Supancic, 2002).

Females have been found to have almost 35% higher odds of being worried about

burglary than males (Hale et al., 1994), although in contrast, a further study found no

significant difference in risk of worry about burglary between males and females, despite

females being at increased risk of worry about both robbery and sexual assault (Reid &

Konrad, 2004). Females were substantially more likely to have dispositional worry about

mugging, having almost three and a half times the odds of being worried compared to males

(Hale et al., 1994), and were initially predicted to have a worry score approximately half a

point higher than males on a five-point-scale measuring amount of worry about robbery (Reid

& Konrad, 2004). Females were at particularly high risk of having dispositional worry about

assault, having over 5 times the odds of worry compared to males (Hale et al., 1994). Females

were found to have higher levels of dispositional worry about sexual assault, expected to have

a worry score of half a point higher than males (Reid & Konrad, 2004).

Frequency of Situational Worry about Crime

Examining the frequency of experiencing fear of crime, females have been found to

experience fear of crime more frequently than males (Dowler, 2003), with females estimated

to have a frequency of fear score almost 25% higher than males (Krulichová, 2019). Despite

the aforementioned studies suggesting an increased frequency of experiencing fear for

females, Rountree & Land (1996) found no evidence for females being at higher risk of

experiencing worry about burglary more than once a week than males.

Alternative Fear Measures

Females have been found to have approximately 1.6 times higher odds than males of

being either functionally worried or anxious compared to unworried, almost 1.4 times higher

odds of being dysfunctionally anxious, and just over two times higher odds of being

dysfunctionally worried than unworried (Gray et al., 2011). This means females were more

likely to experience worry and anxiety about crime than males and were more likely to employ

fear reducing tactics that were both productive and counterproductive. When operationalizing

fear of crime as general feelings of unsafety, evidence continues to suggest males are less

fearful than females, with two studies finding females to have a feelings of unsafety score 0.2

standard deviations higher than males (Scarborough et al., 2010; Weitzer & Kubrin, 2004), and

one study found the effect of being female to be twice as strong as this at 0.4 standard

deviations (Covington & Taylor, 1999).

Age and Gender Interaction Terms

The effect of gender on victimisation has been found to be dependent upon age, for both genders, fear is found to reduce as age increases, however this reduction in fear is stronger for females than males, meaning that the increased level of fear experienced by females compared to males reduces as individuals get older (Brunton-Smith & Sturgis, 2011). Significant interaction terms were also found between gender and age when predicting risk of worry about mugging and assault. With regard to assault, a very strong initial effect of gender was found with females having over 400% higher odds of being worried about being mugged, for those in the older age category the effect of this was marginally reduced by a negative interaction term, thus being female was associated with a larger increase in fear for those of young and middle age, than those in older age groups (Hale et al., 1994). With regard to mugging, females were found to have almost 250% higher odds of experiencing worry about mugging, again the negative interaction term reduced the effect of gender on these in the older age category (Hale et al., 1994).

3.2.1.3 Race and Ethnicity

Victimisation

Personal and Violent Victimisation

There is limited evidence for the effect of ethnicity on the expected number of personal crimes an individual may experience. Analysis undertaken on US data estimated those of an Asian, or Pacific Islander background to experience 40% more crimes than white individuals (Tseloni & Pease, 2003; 2004), in contrast with this, in a British based study non-white individuals were estimated to experience 60% fewer personal crimes than white individuals (Tseloni & Pease, 2015), whereas a Dutch study found no significant effect of ethnicity on violence (Wilsem et al., 2006).

Property and Household Victimisation

Some evidence of ethnicity influencing risk of experiencing a property victimisation has been found, but findings both between and within studies have been conflicting. Those of African-Caribbean ethnicity have been found to have just over 40% lower odds of experiencing a property crime than white individuals, although they were not found to be at reduced risk of experiencing property crime components of burglary, household theft and criminal damage when modelled separately (Trickett et al., 1995). Indian individuals were also found to have 65% higher odds of burglary victimisation and 87% higher odds of experiencing criminal damage than white individuals, whereas this characteristic has no effect on risk of overall property crime (Trickett et al., 1995). Distinguishing only between white and non-white individuals, those of a minority ethnic background were found to have just over 25% lower odds of being a victim of car vandalism than non-ethnic minorities, however no significant effects of ethnicity were found on burglary, vehicle related theft, and other vandalism (Wilsem et al., 2006). The lack of significant results here may be due to the grouping of ethnic minorities, as the results reported from the previous study show conflicting effects of being African Caribbean and Indian on risk of property crime.

Inconsistencies were also found when estimating the number of property or household victimisations an individual is expected to experience. US based analysis predicted non-white individuals to experience 34% more household victimisations (Park & Fisher, 2017), whereas analysis on Seattle based data predicted non-white individuals to experience 17% fewer property victimisations (Outlaw et al., 2002). Both studies give reason to be cautious to conclude any effect of being non-white on the number of household or property victimisations a person would experience. When Park & Fisher (2017) employed their zero-inflated negative binomial model on this data, no significant effect of being non-white was found within the model, and this model was concluded to better fit the data, therefore providing a more accurate representation of the population. In Outlaw et al.'s paper, the standalone increased risk

associated with being white became non-significant following the addition of multiple

interaction terms in the model, including interactions between race, and both incivilities and

ethnic heterogeneity.

Fear of Crime

Dispositional Worry about Crime

Those of non-white ethnicity have been found to have higher dispositional worry about

crime than those of white ethnicity (Brunton-Smith & Sturgis, 2011). The highest levels of

worry have been found for Asian individuals, with a worry score 0.33 standard deviations

higher than White individuals, followed by those of mixed, or "other" ethnicities, and Black

individuals who were all at increased risk compared to white individuals (Brunton-Smith &

Sturgis, 2011). Assessing the risk of having dispositional worry about certain crime types,

including burglary, assault and mugging confirms the increased risk of worry among non-

white individuals (Hale et al., 1994). Being non-white had a particularly strong effect on

having dispositional worry about assault, with non-whites having two and quarter times the

odds of being worried than white individuals, the increase in risk was somewhat smaller for

both burglary and mugging, with non-whites having between 70% and 80% higher odds than

white individuals (Hale et al., 1994).

Frequency of Situational Worry about Crime

Specifically examining risk of worrying about burglary more than once per week,

Rountree and Land (1996) found those of a non-white ethnicity to have almost 10% lower

odds of worrying about burglary at least once per month than white individuals. Therefore,

whilst non-white individuals are more likely to have dispositional fear about crime, and likely

to have higher levels of dispositional fear, this evidence does not suggest they experience fear

(specifically of burglary) more often than white individuals.

Alternative Fear Measures

A study which operationalised fear of crime as general feelings of unsafety found those of "other" ethnicities, neither white nor black, to have the lowest feelings of unsafety score, at half a point lower than those of white ethnicity on a scale of between 1 (least unsafe) and 4 (most unsafe), although other evidence suggests Black individuals to feel the most unsafe, with a score 0.3 points higher than white individuals (Weitzer & Kubrin, 2004). The inclusion of a number of neighbourhood effects substantially affected the estimated increased risk of general feelings of unsafety experienced by Black individuals (Scarborough et al., 2010). Prior to the inclusion of neighbourhood variables, including social and physical disorder; police satisfaction; social cohesion; and disadvantage, black individuals were estimated to have a feelings of unsafety score 0.1 standard deviations higher than all other ethnic groups. However, following the inclusion of the neighbourhood effects this effect reversed to Black individuals having a feelings of unsafety score 0.1 standard deviations lower than all other individuals. This suggests that black individuals feel safer than all other ethnicities within neighbourhoods which have the same levels of social and physical disorder, police satisfaction, social cohesion and disadvantage (Scarborough et al., 2010).

3.2.1.4 Marital Status

Victimisation

Marital status has been found to effect risk of experiencing personal crime, and more limited evidence suggests it affects vehicle crime, however in this review no evidence of marital status on experiencing household crime was found.

Personal and Violent Victimisation

Single individuals have been found to have 15% higher odds of experiencing violent crime compared to people of all other marital statuses (Wilsem et al., 2006), when marital status groups were looked at in more detail, a more complex picture arises. Compared to single individuals, married individuals are found to have 60% lower odds of being violently

victimised and were the least likely group to experience this type of victimisation (Brennan et al., 2006). Those who were separated or divorced were found to have 60% and 43% higher odds of experiencing violent victimisation, respectively, with separated individuals the most likely to experience violent victimisations (Brennan et al., 2006). This more detailed investigation suggests that the use of single versus not single is unlikely to best represent the data, and give the most useful policy recommendations, given the highest and lowest risk members of society would be grouped together.

In agreement with Brennan and colleagues' work (2006), married individuals are also estimated to experience the lowest estimated number of personal victimisations (Tseloni, 2003; 2004), whilst divorced individuals are predicted to experience the highest number of victimisations, with single and widowed individuals also experiencing more personal victimisations than married individuals. The effect of being single varies between households, with the additional risk associated with being single reduced in households with lower victimisation rates, and stronger in households with higher predicted numbers of victimisations (Tseloni & Pease, 2003; 2004). Somewhat contrastingly, non-married individuals have been estimated to experience 15% fewer larceny victimisations, with married individuals commonly found to experience fewer personal crimes, and with greater support for the previous literature, non-married individuals are expected to experience 80% more assault victimisations than married people (Kuo et al., 2012).

Property and Household Victimisation

Single individuals are predicted to have 20% lower odds of experiencing car related theft, and 25% lower odds of experiencing car vandalism compared to all other marital statuses (Wilsem et al., 2006), marital status is not found to affect the risk of experiencing burglary or other vandalism.

Fear of Crime

Dispositional Worry about Crime

Only one study has demonstrated a significant effect of marital status on dispositional worry about crime, finding married individuals to have the highest levels of worry of all marital statuses (Brunton-Smith & Sturgis, 2011). Those either separated or divorced were found to have the lowest levels of fear, predicting their fear score to be 0.07 standard deviations lower than married individuals, widowed individuals were predicted to have a score 0.04 standard deviations lower and single people 0.01 standard deviations lower than married individuals (Brunton-Smith & Sturgis, 2011).

Alternative Fear Measures

Operationalising fear of crime as a combined measure of feelings of unsafety and perceived risk of victimisation, married individuals were again found to be the most worried, having a predicted feeling of unsafety score of almost 0.1 standard deviations higher than non-married individuals (Oh & Kim 2009).

3.2.1.5 Illness and Disability

The effects of illness and disability were not found to have been studies on victimisation risk in the literature reviewed for this thesis, however some evidence was found to evidence its effects on fear of crime.

Dispositional Worry about Crime

Individuals with a longstanding illness or disability have been found to have higher levels of dispositional worry about crime, with disabilities which impact on daily life having a greater effect (Brunton-Smith & Sturgis, 2011). Those whose long standing, illness or disability is non-limiting, have been estimated to have a fear score 0.1 standard deviations higher than those without any long-standing illness or disability, the effect of having a long-term illness is stronger when this limits daily life, with those individuals having a fear score of 0.17 standard deviations higher (Brunton-Smith & Sturgis, 2011).

Alternative Fear Measures

Gray et al. (2010) also examined the effect of having a life-limiting health issue or disability, although found less support for its effect. Predicting membership to a "worry group", the authors found having a life limiting health issue or disability to only have a significant effect on predicting people to be within the "dysfunctionally worried" group compared to unworried, however the apparent effect of this reduced following the inclusion of neighbourhood disorder and collective efficacy, and concerns about social change and moral decline the effect of disability was not estimated to significantly affect worry or anxiety about crime (Gray et al., 2011).

3.2.2 Indicators of Socioeconomic Status

3.2.2.1 Education

Victimisation

Mixed evidence has been found for the effect of educational achievement on victimisation risk. Higher educational attainment has been found to increase the risk of experiencing a number of property, and violent crimes in the Netherlands, however these findings are contrasted in a Taiwanese study.

Personal & Violent Victimisation

Higher educational attainment has been associated with increased risk of personal victimisation. In the Netherlands, each additional qualification level increased the odds of being a victim of both violent crime and burglary by 6% (Wilsem et al., 2006). Oppositional results are found in a Taiwanese study, where higher educational attainment was associated with reduced risk of personal victimisations. In contrast, analysis of Taiwanese data showed increased victimisations for those with lower level qualifications, those holding qualifications below college level were expected to experience just over 70% more assault victimisation, and 20% more larceny victimisations, than those with college level education (Kuo et al., 2012).

Property and Household Victimisation

Higher educational attainment has been found to significantly increase the risk of experiencing a number of property crimes. Each additional qualification level reached is associated with an expected 6% increase in the odds of being a victim of burglary, a 4% increase in the odds of being a victim of car vandalism, and 13% higher odds of being a victim of other vandalism (Wilsem et al., 2006). Individuals holding a university degree are predicted to experience the highest number of burglaries in both the UK and the Netherlands, however educational attainment was not found to have any significant effect on burglary in the US (Tseloni et al., 2004). Dutch data showed the strongest relationship between education and burglary, with the number of victimisations predicted continuously increasing by between 10% and 15% with each additional educational level. No such relationship was found in the UK data, with those with lower high school level education expected to experience more crimes than those who had completed high school (Tseloni et al., 2004)

Fear of Crime

Dispositional Worry about Crime

Higher levels of education have been associated with lower levels of dispositional worry about crime (LaGrange et al, 1992; Brunton-Smith & Sturgis, 2011). Individuals without any formal educational qualifications are found to have the highest level of dispositional worry about crime, with the level of fear decreasing with each higher-level educational qualification achieved (Lagrange et al., 1992). Individuals without formal qualifications are found to be at the highest risk of being worried about crime. Those with either GCSEs or "other" qualifications as their highest qualifications are estimated to have a fear score 0.05 standard deviations lower than those without any qualifications, those with A-levels to have a fear score almost 0.1 standard deviations lower, and those with a degree almost 0.2 standard deviations lower (Brunton-Smith & Sturgis, 2011). Despite these findings

when examining a continuous worry about crime measurement, when examining this as a binary variable, predicting whether an individual is worried about becoming a victim of crime specifically within their neighbourhood, no significant effect of the numbers of completed years of education was found (Kanan & Pruitt, 2002).

Worry about becoming a victim of burglary and sexual assault was found to be associated with low educational levels, defined as not having any education past high school level (Reid & Konrad, 2004). In early modelling stages no significant effect of education was found, however following the addition of both gender and perceived risk of victimisation to the model, those of low education were estimated to have a dispositional worry about burglary score 0.35 points higher on a five-point scale, and a frequency of worry about sexual assault victimisation almost 0.5 points higher, although no effect was found on worry about robbery (Reid & Konrad, 2004).

Frequency of Situational Fear of Crimes & Alternative Fear Measures

Contrasting evidence has been found when examining the frequency of experiencing fear of crime and general feelings of unsafety, with more highly educated people at increased risk. The frequency at which an individual experiences fear is estimated to increase by 0.003 points on a 1 to 4 scale with each additional completed year of education (Krulichova, 2019). In agreement with Krulichova's (2019) study, higher levels of education were also found to be associated with higher general feelings of unsafety (Scarborough et al., 2010).

3.2.2.2 Employment

Victimisation

Personal and Violent Victimisation

Working part-time, compared to full-time, has been found to increase the number of personal victimisations a person is expected to experience by approximately 60%, whereas individuals who are out of work and school pupils are not estimated to have differing risk to

those working full-time (Tseloni & Pease, 2003; 2004). Simply distinguishing between being in paid employment, and not, no significant difference in risk of experiencing violence was found (Wilsem et al., 2006), the less detailed categorisations operationalised in this study, which groups all paid workers together, may be suppressing the effect found in Tseloni and Pease's work.

Property and Household Victimisation

Employment status has been found to affect both household and vehicle victimisation risk, with individuals in paid employment at increased risk of experiencing these crime types. Those in paid labour have been found to have 10% higher odds of being burgled, 20% higher odds of experiencing vehicle related theft, and 12% higher odds of experiencing car vandalism (Wilsem et al., 2006). Employment status was not found to affect other types of vandalism. Showing some inconsistency with the previous findings, in Taiwan, unemployed individuals, or those in daily labour, are expected to experience the highest number of assaults of all employment categories (Kuo et al., 2012). The unemployed, or daily labourers are predicted to experience 70% more assaults expected than homemakers or the retired, and 46% more assaults than students, or those in employment (Kuo, et al., 2012).

The association between employment status and personal acquisitive crime appears to be weaker, and the evidence here also suggests an opposite effect to assaults. Students and the employed are expected to experience approximately 25% more larceny victimisations than the unemployed, however, no significant difference in the predicted number of robberies victimisations a person would expect to experience was found between differing employment statuses (Kuo et al., 2012).

Evidence to suggest students and individuals in lower-skilled occupations were at different risk of dispositional fear of crime than those of other occupations (Brunton-Smith &

Sturgis, 2011), this is discussed in the following section in relation to socioeconomic

classification.

3.2.2.3 Socioeconomic Classification

Victimisation

Property and Household Victimisation

Being of a higher socioeconomic classification has been found to increase the risk, and

number of property victimisations an individual or household may experience. Living in a

house in which the household reference person is in a professional or higher managerial

position, the highest socioeconomic classification, has been found to increase the odds of a

property victimisation by 50% compared to the HRP being in any lower skilled occupation

(Trickett et al., 1995). Such households have also been predicted to experience 90% fewer

household victimisations than those with an unclassified HRP, and those with a manual HRP

to experience 11% fewer victimisations (Tseloni, 2006). The amount by which having an HRP

in the highest socioeconomic classification increased the odds of victimisation differed

between household crime subcategories. The strongest effect was upon the odds of being

burgled, with the odds of victimisation increasing by almost 80%, reducing to a 46% increase

in the odds of experiencing household theft, and a 13% increase for criminal damage (Trickett

et al. 1995).

Fear of Crime

Dispositional Worry about Crime

Evidence suggests that socioeconomic classification, measured as an individual's

occupation type, has been found to effect dispositional fear of crime. Individuals working for a

small employer, not dependent on their role in the company, are estimated to have the lowest

levels of dispositional worry about crime, with a fear score 0.05 standard deviations lower

than those working in professional or managerial roles (Brunton-Smith & Sturgis, 2011).

Lower socioeconomic classifications are found to have higher worry than those in professional

or managerial roles, with those in intermediate or lower supervisory roles expected to have a

higher fear score, and those in routine or semi-routine occupations having even higher fear.

Students were found to have the highest levels of worry. Despite individuals in lower

socioeconomic classifications having higher fear of crime, those who were either long term

unemployed or had never worked did not have a significantly different fear score than those in

professional or managerial roles (Brunton-Smith & Sturgis, 2011).

3.2.2.4 Income

Victimisation

Property and Household Victimisation

Some levels of income have been found to be at increased risk of property crime than

others. Higher income has been found to be associated with experiencing more property

crimes, due to the income variable being operated as a continuous variable, a linear

relationship was estimated between income and victimisation (Outlaw et al., 2002). Including

income as a series of dummy variables showed a more complex, non-linear relationship

between income and household victimisation. Individuals with the highest earnings (over

£30,000) were predicted to experience almost 20% more household victimisations than the

median income group (£10,000-£29,999), with no other income levels estimated to experience

significantly different risks from the median group (Tseloni, 2006). Further detail is found

when breaking down the household victimisation category, initial findings suggested both

earning under £5,000 are expected to experience 20% more burglaries and household thefts

than those of the median income, however these findings reduce to non-significance following

the introduction of interaction terms (Tseloni, 2006).Contrasting findings, which estimate the

expected number of household victimisations to reduce with increasing income have been

found in a US based study, with the number of victimisations decreasing by between 2% and

3.5% per unit increase in income (income operationalised as a 28 point ordinal variable),

dependent upon the method of analysis (Park & fisher, 2017).

An alternative measure employed to assess the effect of income on household crime,

was how well the household was managing on their income, predicting a 22% increase in the

number of household victimisations, and burglary and theft victimisations (Tseloni, 2006). The

inclusion of this variable alongside the direct measure of the household income may have

reduced the significance of the effect of household income and may be a mediating factor.

Personal and Violent Victimisation

In contrast to the effects of income on household crime, low incomes have been

associated with increased risk of personal crimes. Individuals living in a household with an

annual income below £10,000 have the highest risk of violent victimisation, with those

earning between £10,000 and £20,000 having 18% lower odds of victimisation, and those

earning more than £20,000 having between 26% and 34% lower odds of being victimised

(Brennan et al., 2010), although the relationship is not linear. Similarly, in a US study, those

living in a household with an annual income of less than $10,000 are expected to experience

just over 20% more personal victimisations than those earning any amount over $10,000

(Tseloni & Pease, 2003; 2004). Another category found to affect the risk of violent

victimisation was whether the respondent did not declare their annual household income, those

not declaring had 25% higher odds of victimisation than those earning less than £10,000

(Brennan et al., 2010), this is a very similar effect to earning between £20,000 and £30,000,

and £40,000 to £50,000, therefore it is expected that a number of higher earners are not

declaring their income.

Comparing those on low, medium and high income in Taiwan, in contrast to the

previous findings, those on the lowest incomes were found to have the lowest risk of

becoming a victim of larceny, experiencing almost 40% fewer than those on the highest

incomes, and those on a medium income experiencing 20% fewer (Kuo et al., 2012), however this victimisation type is a personal *acquisitive* crime rather than expressive crime, therefore committing this offence against a person with higher income may be more desirable. Whilst this study found no evidence of those on low and high incomes experiencing differing numbers of assaults, those on a medium income were predicted to experience 45% fewer assaults (Kuo et al., 2012).

3.2.2.4 Car Ownership

Victimisation

Personal and Violent Victimisation

Owning a large number of cars (four or more) is estimated to increase the number of personal victimisations an individual is expected to experience by almost 40%, compared to owning three or fewer cars (Tseloni, 2003; 2004), however no significant effect of car ownership was found on violent victimisation risk when car ownership was measured as a continuous variable (Wilsem et al., 2006), differences in findings may be attributable to differing operationalisations, another consideration is that the difference may be due to the personal crime measure including non-violent acquisitive crimes, with more cars potentially acting as an indicator of wealth, thus increasing the desirability of the target. This difference may also be due to the different measurements of vehicle ownership, ordinal versus continuous, with Tseloni and Pease (2003; 2004) only finding evidence for owning more than four cars affecting personal crime experiences, the number of individuals owning that number of cars in Wilsem's study is likely to be low, and if they are at increased risk of experiencing violent victimisation, there may not be enough individuals in the dataset to produce a significant coefficient.

Property and Household Victimisation

Owning more cars was found to significantly increase the number of property victimisations a person would expect to experience, a measure which includes theft of, or from, a vehicle a person is expected to experience, as well as all household crimes (Tseloni, 2006). Those with three or more cars were predicted to experience the highest number of household victimisations, 30% more than households with two cars, whilst households with a car are predicted to experience 54% fewer victimisations, and those with one car predicted to experience 20% fewer victimisations than those who own two cars (Tseloni 2006). The risk of experiencing vehicle crime specifically has been found to substantially increase with higher car ownership, with each additional car owned, the odds of experiencing car related theft increased by 113%, and the odds of experiencing car vandalism increased by almost 90% (Wilsem et al. 2006).

Wilsem and colleagues' study found no significant effect of the number of cars owned on burglary or other vandalism, evidencing that the number of vehicles is particularly strongly correlated with vehicle crime, therefore the effect found in Tseloni's study may be largely due to the inclusion of vehicle crimes within the dependent variable, rather than the household crimes included.

No evidence of car ownership affecting risk of fear of crime was found within the existing literature.

3.2.3 Household Characteristics

3.2.3.1 Tenure Type

Victimisation

Property and Household Victimisation

Differing levels of risk of a number of household and property crime types are found between those who own their home, and those who rent socially, either from the local authority or a housing association, or privately. Renters, both private and social, have been

found to be at increased risk of experiencing a property crime (Trickett et al., 1995). When analysing data including all property offences that had happened in the previous twelve months (including those occurring at a previous residence), those in rented accommodation were estimated to have 25% higher odds of property victimisation than homeowners, increasing to 70% higher odds when excluding offences which had occurred in a previous residence (Trickett et al., 1995). This change in result suggests that those moving into rented accommodation are at a very high risk of experiencing property victimisations. In analysis separating property crime into burglary, household theft and criminal damage, being a renter was not found to significantly affect risk of being burgled, however the odds of experiencing theft were over 30% higher for renters, and approximately 25% higher for criminal damage (Trickett et al., 1995).

Specifically examining burglaries in England and Wales, those in rented accommodation were predicted to experience 50% more burglaries than homeowners, however opposite effects were found in the Netherlands, with renters expected to experience 15% fewer crimes, whilst no significant difference in the expected number of burglary victimisations was estimated between those in owned or rented accommodation found in the US. (Tseloni et al., 2004). Contrasting this finding, Wilsem and colleagues' (2006) study, also based in the Netherlands, did not find any significant increase in the odds of experiencing burglary for renters compared to homeowners. Differing results may be accounted for due to dependent variables differing between studies, with one being a risk model and one predicting the number of victimisation, as well as the differing covariates between models which may account for the apparent effects of tenure type, with Wilsem and colleagues' study focusing on socioeconomic characteristics of the neighbourhood, and Tseloni and colleagues' work focusing on household characteristics and routine activities.

Vehicle crimes are also found to be affected by tenure type, with risk of experiencing car related theft being 10% lower for homeowners than renters, and risk of car vandalism being almost 25% lower (Wilsem et al., 2006). Whilst Trickett and colleagues (1995) found criminal damage to increase risk of criminal damage, Wilsem and colleagues (2006) found no evidence of homeownership affecting their risk of experiencing vandalism. One study has found a strong relationship between tenure type and violence, predicting homeowners to have 40% lower odds of experiencing violence than renters (Wilsem et al., 2006).

Significant differences in risk have also been found between social renters and private renters, with private renters and homeowners not found to have significantly different risk of household crime, but social renters expected to experience almost 50% more household victimisations, and 40% more burglaries and household thefts (Tseloni, 2006).

Tenure type was not included in any of the studies examining fear of crime reviewed in this study.

3.2.3.2 Housing Type

Victimisation

Property and Household Victimisation

Evidence suggests that different types of property are associated with differing risks of certain property and household crimes. When examining property crime as a whole, those living in accommodation which is not self-contained have been found to be at the lowest risk of victimisation, followed by those living in terraced accommodation, with their odds of victimisation 40% and 15% lower, respectively, compared to those living in either detached or semi-detached housing (Trickett et al., 1995). Reducing the scope of study to just household crimes, the results differed somewhat from examining property crime, with those in detached housing, as well as flats, predicted to experience the fewest household crimes (Tseloni, 2006). Those in terraced housing were expected to experience the most household victimisations,

almost 40% more than those in detached housing, and those in semi-detached accommodation

expected to experience approximately 15% more crimes (Tseloni, 2006). Living in detached

housing is estimated to reduce the risk of experiencing vehicle crime, with the odds of

experiencing car related theft 33% lower, and the odds of experiencing car vandalism over

50% lower than those living in other accommodation types (Wilsem et al., 1995).

Investigating more specific crimes, mixed effects of accommodation type are found.

Those detached housing have neem found to have 60% higher odds of being burgled, than

other accommodation types (Wilsem et al., 2006), however in Trickett and colleagues' (1995)

study no significant effect of housing type was found on burglary. Contrasting findings

continue when looking at criminal damage and vandalism, with Trickett and colleagues (1995)

finding those in terraced housing to have almost 35% lower odds of victimisation, whilst

Wilsem and colleagues (2006) find no significant association. These findings may differ due to

variations in variable operationalisation between studies, with Trickett and colleagues using a

wider variety of household type categories.

The effects of housing type on fear of crime were not studied in any of the reviewed

literature, therefore no evidence was found to suggest they affect fear of crime.

3.2.3.3 Household Composition

Victimisation

Household and Property Victimisation

Household structure and having a house occupied by a lone parent has consistently

been associated with increased risk of victimisation, of both property and personal crimes.

With regard to both personal and household crime, lone parents have been predicted to

experience between a third and three quarters more victimisations than any other household

structure (Tseloni & Pease, 2003; 2004; Tseloni, 2006). The effect of lone parenthood was

slightly lower when just examining the burglary rate, predicting 56% more victimisations for

lone parents compared to other household structures (Tseloni et al., 2004). However, when

household theft was combined with burglary, lone parents were predicted to experience almost

300% more victimisations than other household structures (Tseloni, 2006), suggesting lone

parents to be particularly at risk of experiencing household theft. Burglary and theft

victimisations were also expected to increase by approximately 17% in households with 3 or

more adults (Tseloni, 2006)

　　　The majority of the research discussed above was undertaken on CSEW data, with the

exception of the personal crime finding occurring in a US based study (Tseloni & Pease, 2003;

2004). Regarding the burglary rate findings (Tseloni et al., 2004), some differences were found

in the effect of lone parenthood across nations, with the effect being slightly smaller in the

Netherlands, with a 45% increase in victimisations predicted, and despite the finding in

relation to personal crime presented earlier, no significant increase in burglary victimisation

was predicted for lone parents within the US (Tseloni et al., 2004).

　　　The effects of household structure and lone parenthood on fear of crime were not

studied in any of the reviewed literature, therefore no evidence was found to suggest they

affect fear of crime.

3.2.3.4 Length of Residence

Victimisation

Property and Household Crime

Individuals who had lived in their property for more than 10 years were found to be at

the lowest risk of experiencing property crime, with those having lived in a house for between

5 and 10 years, or between 1 and 2 years not found to have significantly different levels of risk

from those living in a house for more than 10 years (Trickett et al., 1995). Individuals who

have resided in their house for between 2 and 5 years had almost 40% higher odds of

experiencing property crime than the lowest risk group, such individuals were the highest risk

group when only crimes occurring at all respondents present residences were included in the

analysis (Trickett et al., 1995). Whilst excluding crimes occurring at previous residences from

the analysis, those residing in their household for less than one year were estimated to have

45% lower odds than the previously described lowest risk group, this finding is also replicated

in Tseloni and colleagues (2004) analysis of burlgary. However, as respondents had on average

resided in their house for approximately half the reference period, this reduction in risk is not

concluded to be due to the length of residence, but simply the time spent within that residence

(Trickett et al., 1995). When victimisations from all residences were analysed, those who had

moved within the reference period were estimated to have almost 80% higher odds of

victimisation. This finding, alongside the finding which did not include all residences in the

analysis, suggests property victimisations may have been a driver for a number of those who

moved within the recall period.

Only modelling victimisations which occurred in the respondent's current residence,

the risk of experiencing burglary, theft and criminal damage was predicted. The odds of

experiencing burglary, theft and criminal damage was predicted to be 53%, 35% and 41%

higher, respectively, for those who had lived in a residence for between 2 and 5 years,

compared to more than 10 years. A consistent protective effect was also found of living in a

residence for less than one year, with the odds of experiencing burglary, theft and criminal

damage 64%, 48% and 61% lower than those who had resided in the accommodation for more

than 10 years (Trickett et al. 1995). Living in a house for between one and two years was only

found to significantly affect burglary, increasing risk by almost 50% compared to those

residing for more than 10 years (Trickett et al., 1995).

The effects of length of residency on fear of crime were not studied in any of the

reviewed literature, therefore no evidence was found to suggest they affect fear of crime.

Personal Victimisation

Individuals who have lived at the same address for two years or less are at increased risk of personal victimisation (Tseloni & Pease, 2003; 2004). the estimated number of personal crimes an individual is expected to experience is greatest for those who have lived at the same address for less than 6 months, with such individuals expected to experience twice as many crimes as those living at an address for eleven or more years, followed by a 60% increase for those living at an address for between six and eleven months, and then by a 30% increase for those who have resided at the same address for one to two years (Tseloni & Pease, 2004).

3.2.4 Routine Activities

Victimisation

Property and Household Victimisation

Individual's routine activities can result in reduced guardianship over the house, as such, those whose households are left unoccupied more often are at increased risk of burglary victimisation, car-related theft and vandalism (Wilsem et al., 2006), and those who are away from home more nights per week are expected to experience a greater number of property victimisations (Outlaw et al., 2002), however, is not found to affect risk of multiple victimisations.

Personal and Violent Victimisation

A number of routine activities which individual engage in are found to increase their risk of personal victimisation, with individuals visiting establishments which sell alcohol regularly at increased risk of larceny (Kuo et al., 2012) and violent victimisation (Brennan et al., 2006; 2010), the risk continues to increase as frequency of visitation increases (Brennan et al., 2006; 2010). Whilst other evening activities, including visiting friends, shopping, and dining out are associated with an expected increase in personal victimisations (Tseloni & Pease, 2004) and larceny, or assault victimisations by approximately 10% to 25%, the effect of

visiting NTE venues was much stronger with the number of larceny victimisations expected to be almost 80% higher for individuals visiting such establishments (Kuo et al., 2012).

Fear of Crime

Whilst there has been some modelling of the effects of routine activities on victimisation risk, and the literature external to the focus of this review frequently discusses the effects of routine activities on fear of crime, and the effects of fear of crime on an individual's routine activities, in the search for this literature review no significant effects of routine activities were found on fear of crime.

3.2.5 Perceptions and Media Influence

3.2.5.1 Perceived Incivilities

The level of incivilities an individual perceives within their neighbourhood has consistently been found to increase the likelihood or level of fear of crime an individual experiences.

Dispositional Worry about Crime

The odds of an individual having dispositional worry about crime were found to be 45% higher with each unit increase in the indexed rating of a number of neighbourhood problems (Kanan & Pruitt, 2002). The effects of the perceived level of incivilities within a neighbourhood on dispositional worry about crime are found to differ between crime types, with higher incivilities associated with lower levels of worry about mugging and burglary, whilst not affecting the risk of having dispositional worry about assault (Hale et al., 1994).

Frequency of Situational Worry about Crime

Higher levels of incivilities perceived in the neighbourhood has also been found to increase the frequency at which individuals experience fear of crime, with each increase in the level of perceived seriousness of one of eight neighbourhood problems (scale 8 to 32), estimated to increase the frequency of fear by 0.3 on a 1 to 4 scale (Dowler, 2003). The risk of

being worried about burglary more than once per week has been found to increase with higher

perceived neighbourhood incivilities. with the odds increasing by 2.5% with each unit increase

in the average number of incivilities reported by neighbourhood residents (Rountree & Land,

1996). The effects of neighbourhood incivilities have also been found to be affected by

burglary victimisation status, with the negative interaction term suggesting the increased risk

of fear associated with higher levels of perceived incivilities is stronger for individuals who

have not experienced burglary victimisation (Rountree & Land, 1996).

Alternative Fear Measures

Physical neighbourhood disorder was also found to affect the type of fear of crime an

individual experienced, for each point increase in perceived disorder (on a 10-point scale),

individuals had 20-25% higher odds of reporting worry or anxiety about crime (Gray et al.,

2011). The effects of social disorder varied more between the type of worry or fear an

individual experiences, increased concerns about social disorder were not found to increase

the risk of being anxious, however increased the odds of being worried, either functionally or

dysfunctionally by 12% and 19% respectively (Gray et al., 2011). Meaning those reporting

higher levels of social disorder are more likely to report worry than not, and particularly likely

to report using measures to reduce fear which negatively impact upon the individual's quality

of life.

Perceived incivilities, in the form of both social and physical disorder are also found to

increase general feelings of unsafety, with physical disorder increasing feelings of unsafely

more than social disorder (Scarborough et al., 2010).

3.2.5.2 Perceptions of Crime and Criminal Justice Agencies

An individual's perception of crime rates, both at the community and country level, has

been found to increase their dispositional worry about crime. Perceptions of crime rates,

measured on a 5-point scale, from believing crime has decreased a lot, to increased a lot, are

found to increase worry about crime, with each standard deviation increase in perceptions of crime in the country, worry is estimated to increase by approximately 0.4 standard deviations (Eschholz et al., 2003). When examining the effect of neighbourhood perceptions of crime, analysis was undertaken on male and female subsets, perceptions of crime were only found to significantly affect females' level of dispositional worry about crime (May et al., 2010). With each unit increase in perceptions of neighbourhood crime, females were expected to have a worry score just over 0.3 points higher on the 6–24-point worry scale, however males dispositional worry about crime was not found to be affected by their perceptions of crime in the community (May et al., 2010). A relationship between perceptions of criminal justice agencies and dispositional fear of crime was also found, however only for males, with higher levels of satisfaction associated with marginally lower levels of dispositional fear, however no relationship between these variables was found for females (May et al., 2010).

3.2.6 Social Networks

Within this review, evidence of an impact of social networks, collective efficacy, and the number of friends an individual has were found on dispositional worry about crime, and alternative measures of fear.

Dispositional Worry about Crime

The number of friends an individual has, has been found to affect their risk of having dispositional worry about crime, for all crime types individuals reporting to have "many" friends locally were at the lowest risk of having dispositional worry about any crime type, however the effects of the number of friends reported differed between crime types (Hale et al., 1994). With regard to dispositional worry about assault, individuals without any friends are estimated to have the highest risk of worry, having over double the odds of being worried compared to those with many friends, those reporting few friends, having 28% higher odds, and those reporting some friends, having 58% higher odds (Hale et al., 1994). For both

burglary and mugging, reporting to have either some, or no, friends increased the odds of

being worried similarly, increasing the odds by approximately 20% and 50% respectively,

having few friends also affected worry about these crime types similarly, increasing risk by

35% and 40% (Hale et al., 1994).

The effect of the number of friends was found to vary between neighbourhoods based

upon their acorn classification, a measure of neighbourhood crime risk based upon

sociodemographic characteristics of the neighbourhood (Hough & Mayhew, 1986). Significant

negative interaction terms were found between a number of friend and acorn classification

dummy variables, the collective interpretation of these interaction terms is that residents of

neighbourhoods with a high crime risk are more likely to have higher dispositional worry

about mugging and assault if they report having more friends locally (Hale et al., 1994).

Alternative Fear Measures

Social cohesion and integration within the neighbourhood has also been found to affect

general feelings of unsafety, with increased cohesion and integration associated with lower

levels of feeling unsafe (Oh & kim, 2009; Rountree & Land, 1996b; Scarborough et al, 2010).

Measuring social integration by averaging the number of closeness and cohesion measures

each respondent within the neighbourhood reports, for example whether they recognise

strangers in the neighbourhoods, watch their property etc., the risk of an individual reporting

that they perceive their neighbourhood to be either somewhat, or very, unsafe from crime was

found to decrease by approximately 3% with each unit increase in social integration (Rountree

& Land, 1996b). Using a more simply measure of social integration, the level of feelings of

unsafety an individual experiences was found to reduce by approximately 6% (on a 1-5 scale)

with each additional non-family member that an individual knows within the community

(Scarborough et al., 2010).

To further understand this relationship, Oh & Kim (2009) included multiple competing measures of neighbourhood attachment, in their predictive model of general feelings of unsafety. Of the five measures tested, including friendship; neighbouring; social cohesion; social control; and inclusion in a neighbourhood watch programme, social control, social cohesion and neighbouring were found to significantly reduce the levels of feelings of unsafety experienced. Friendship, measured as the number of friends the respondent has within the neighbourhood, and membership of a neighbourhood watch scheme were not found to significantly affect the level of feelings of unsafety in this model (Oh & Kim, 2009). Showing some contrast with previous studies, having higher perceived collective efficacy, measured as a combination of neighbourhood closeness, and information social control, has been found to increase risk of being both dysfunctionally anxious, and dysfunctionally worried, compared to unworried, by approximately 20% (Gray et al., 2010). This means the higher perception of collective efficacy is associated with an increase in the likelihood that individuals would have their quality of life reduced by either their worries about crime, or by the precautions they take with a view to reduce their worries or anxieties around crime.

3.3 Neighbourhood Characteristics Which Affect Risk of Victimisation and Fear of Crime

3.3.1 Location, Population Density and Size of Neighbourhood

The size of the area an individual resides in contributes to an individual's risk of being a victim of personal crime, with the number of personal victimisations expected increasing by approximately 20% for those living in an area with a population of more than 25,000 residents compared to smaller areas (Tseloni & Pease, 2003; 2004; Wilsem et al. 2006). Risk of household and vehicle victimisation has also been found to be higher among those in larger cities, with each unit increase in the log of number of inhabitants associated with risk of violent victimisation increased by 22%, the risk of burglary victimisation increased by 24%,

the risk of car vandalism increased by 26%, and the risk or car related theft increased by 46%

(Wilsem et al., 2006).

Population density has also been identified to affect risk of household crime, whilst no

effect of population density was found on household victimisation risk, differential effects of

population density were found on component parts of household victimisation, with risk of

burglary victimisation increasing by 15% for each standard deviation increase in people per

hectare, whilst the odds of household theft decreasing by 12% for each unit increase (Trickett

et al., 1995). The number of household victimisations expected also increases for those in

areas with higher population density, with each standard deviation increase in population

density associated with a 34% increase in the expected number of victimisations, and 12%

increase in the expected number of burglaries and thefts (Tseloni, 2006).

Those residing in urban areas have frequently been found to be at increased risk of

victimisation (Brennan, Moore & Shepherd, 2010; Park & Fisher, 2007; Brennan, Moore &

Shepherd, 2006; Tseloni & Pease, 2003; Tseloni, 2006). Across property and personal crimes,

those in urban areas are expected to experience approximately 30% more crimes than those

living in rural areas (Tseloni, 2006; Tseloni & Pease, 2003; 2004; Park & Fisher, 2017). When

examining more specific crime type the effects were approximately 50% weaker, with those in

urban areas expected to experience 16% more burglaries and thefts (Tseloni, 2006), and 13%

more violent victimisations (Brennan et al., 2010). The effect of living in an urban location on

household victimisation risk was estimated to be particularly strong when in a zero-inflated

negative binomial model, with those determined to be at risk of household victimisation

expected to experience 60% more victimisations that those in rural locations (Park & Fisher,

2017). Those living in inner city areas have been found to be at further increased risk of

property victimisations, with those in inner cities expected to experience almost 50% more

crimes than those in rural locations, however no significantly different risk was found for

when examining burglaries and household thefts exclusive of other property crime (Tseloni et al., 2004; Tseloni, 2006).

The effects of neighbourhood characteristics on fear of crime have been less frequently studied, and the research shows a much smaller breadth than the victimisation literature, however living in areas of high urbanisation has been found to increase risk of worry about crime (Brunton-smith & Sturgis, 2011), with those in inner cities at increased risk of worry about crime in general compared to those in rural locations (Krulichová, 2019; LaGrange et al., 1992), as well as at increased risk of both mugging and burglary (Hale et al., 2004).

3.2.1.1 Regions of England and Wales

Which region of England and Wales an individual resides in has been found to affect risk of victimisation across household and vehicle crime. With regard to risk of property crime, those in East Anglia have been found to be at the lowest risk of the following crimes compared to the rest of the country, having approximately 40% lower risk of becoming a victim of household crime, and 55% lower risk of becoming a victim of theft (Trickett et al., 1995). In contrast, those in the North West have been found to be at the highest risk of poperty crime, with risk 38% higher for property crime, and 80% higher for burglary (Tricket et al., 1995). Those in the East Midlands, East Anglia, the South East, the South West and in Wales are expected to experience 32.5%, 56%, 46%, 33% and 28% fewer burglaries that those in greater London, respectively (Tseloni et al., 2004). In agreement with the above findings, the North East has been found to have a lower household crime incidence rate of 0.11 points lower, whilst the North West had an incidence rate 0.13 points higher, both the North West and Yorkshire & Humberside had a burglary incidence & prevalence rate 2-3% higher than other locations, with the East midlands also experiencing this higher prevalence (Kershaw & Tseloni, 2005). Compared to the South East, where the number of expected household crimes

is 55% to 60% lower than for those residing in London, those in the North East, West

midlands, and East Anglia are expected to experience 60%, 83% and 55% more household

crimes respectively, and 66%, 77%, and 61% more burglaries and thefts than those in the

South East (Tseloni, 2006). Risk of vehicle victimisation has also been found to be higher in

the North West, with prevalence 4% higher, and incidence 7% higher in the North West

compared to London (Kershaw & Tseloni, 2005).

3.2.2 Neighbourhood Contextual Variables

3.2.2.1 Aggregated Individual Characteristics

Age & Gender

A number of individual level characteristics, when aggregated up to the neighbourhood

level are found to affect risk of victimisation. Lower risk of property crime is found among

those who live in neighbourhoods where a higher proportion of the population are over state

retirement age, however the effects varied between property crime types (Trickett et al., 1995).

Whilst risk of burglary was not affected by the proportion of the population above state

retirement age, contrasting effects are found between theft and criminal damage, whereby with

increases in the proportion of those in the neighbourhood of state retirement age, risk of theft

is found to increase, whilst risk of criminal damage is found to decrease. In contrast, increases

in household, vehicle, and personal crime victimisation risk is found among those living in a

neighbourhood with higher proportions of the population aged between 16 and 24 (Trickett et

al., 1995; Kershaw & Tseloni, 2005; Wilsem et al. 2006). Dividing property victimisation into

its component parts again reveals a lack of effect of the age structure of a neighbourhood on

burglary, however positive effects are found on both theft and criminal damage (Trickett et al.,

1995). Effects of the age structure of a neighbourhood were found on burglary in other studies,

with the risk of burglary, car related theft, car vandalism and other vandalism all increasing at

a similar rate with increased concentration of young adults in the population, whilst no effect

was found on violence victimisation (Wilsem et al., 2006).

The proportion of single adults, below pension age is associated with increased risk of

personal crime, household crime, vehicle crime, with the effects on household and vehicle

crime almost twice as strong as the effect on personal crime (Kershaw & Tseloni, 2005).

Effects of the proportion of the adult female population are also found on property crime, with

risk of property crime, household theft and criminal damage all found to increase for those in a

neighbourhood with a higher proportion of adult females (Trickett at al., 1995).

The effects of neighbourhood composition in terms of age and gender on fear of crime

were not well studied, however one study has found neighbourhoods with a higher proportion

on young people to be more worried about assault, mugging and burglary (Hale et al., 1994).

Ethnicity

The proportion of a neighbourhood made up by some ethnic groups has been found to

affect both victimisation risk and fear of crime, with individuals living in a neighbourhood

with a higher proportion of Afro-Caribbean individuals found to be at reduced risk of

experiencing household acquisitive crime (Tseloni, 2006), equally those living in a

neighbourhood with a higher proportion of black people are at reduced risk of household

crime, however at increased risk of vehicle victimisation (Kershaw & Tseloni, 2005). Mixed

effects of living in a neighbourhood with a higher proportion of Indian, Bangladeshi, or

Pakistani individuals are found on prevalence and incidence of household and vehicle crimes,

with lower household and vehicle incidence estimated where the proportion of Indian,

Bangladeshi, and Pakistani individuals is higher, however increase burglary and vehicle

prevalence is found (Kershaw & Tseloni, 2005). Grouping all ethnic minorities together, risk

of several crime types was found to increase for those living in neighbourhoods with higher

proportions of ethnic minorities in the neighbourhood, risk of burglary, violence, car-related

theft, and other vandalism were all found to increase (Wilsem et al., 2006).

Effects of ethnic minority within the neighbourhood are more well studies in the

literature than the previously discussed characteristics. Higher levels of ethnic heterogeneity

are found to increase risk of general fear of crime (Brunton-Smith & Sturgis, 2011), as well as

those in neighbourhoods with a high proportion of black people (Covington & Taylor, 1991),

and non-white individuals (Oh & Kim, 2009).

3.2.2.2 Vulnerability Characteristics

A number of measures are operationalised within the literature to represent

disadvantage and vulnerabilities of the community, these include factors of transience,

vulnerability and poverty. Measures which address the socioeconomic status of the

neighbourhood include more complete measures such as poverty, ranks of neighbourhoods by

deprivation, as well as other proxies for disadvantage, including social housing prevalence and

overcrowding.

Living in a household within a neighbourhood with higher poverty levels, measured

with an aggregate factor which included a variety of indicators of economic deprivation, was

associated with an expected increase in the number of household crimes a household is

expected to experience, as well as the number of burglaries and household thefts they are

expected to experience (Tseloni, 2006). Further evidence confirms economic deprivation to

increase both the risk of being a victim, and the number of victimisations an individual is

expected to experience across household and vehicle crime (Kershaw & Tseloni, 2005). Living

in an area of neighbourhood disadvantage was also found to increase risk of being fearful of

crime, using a general fear of crime measure (Brunton-Smith & Sturgis, 2011; Scarborough et

al., 2010).

Whilst the above measures operationalised aggregated measures of socioeconomic disadvantage, earlier studies investigated these factors separately and found mixed results. Both the proportion of households in the neighbourhood which are socially rented, and the proportion of households that are overcrowded have been associated with reduced risk of property victimisation (Trickett et al., 1995), whilst another study found the proportion of households which are socially rented to be associated with higher risk of burglary victimisation, however, to have no effect on personal crime or vehicle crime (Kershaw & Tseloni, 2005). Higher prevalence of other indicators of neighbourhood socioeconomic disadvantage including household vulnerability, a measure which combines the proportion of single parent households and the proportion of households living in non-self-contained housing, and the proportion of households with no car, increases the risk of property victimisation (Trickett et al., 1995) whilst the proportion of adults with a professional socioeconomic classification reduced the risk of property crime (Trickett et al., 1995). Housing profile, which measures areas with a lower proportion of flats, and higher terraced housing, and with more vacant households in a neighbourhood, was associated with a reduced level of fear of crime (Brunton-Smith & Sturgis, 2011), whilst no significant effect of neighbourhood tenure has been found on crime type specific measures of fear of crime, the proportion living in apartments or flats has been found to increase risk of worry about mugging, assault and burglary (Hale et al., 1994).

Mixed findings of the levels of residential mobility and transience have been found. Whilst increased residential mobility, measured as the ratio of inward to outward migration, was found to increase risk of victimisation across household and vehicle crimes (Wilsem et al., 2006), in another study a variable which combined measures of the proportion of households privately rented, and the proportion of residents who moved in the previous year, was found to reduce risk of property crime in general, and of burglary and household theft specifically

(Trickett et al., 1995). Using a complex measure of population mobility, combining both

migration statistics and some household characteristics, individuals living in neighbourhoods

with higher population mobility are suggested to have higher worry about crime, however the

effect size is not highly significant (Brunton-Smith & Sturgis, 2011), whilst when simply

measuring mobility as the proportion of households in the neighbourhood that moved within

the previous twelve month, a reduced risk of being worried about assault, mugging and

burglary was found among those in neighbourhoods with increased mobility (Hale et al.,

1994).

3.4 Summary

This chapter has provided an overview of the effects of a large number of individual,

household, and neighbourhood characteristics which affect either victimisation risk, risk of

being worried about crime, or both. Throughout the literature review there are contrasts found

between the effects of characteristics on victimisation and fear of crime, but also within the

various methods of measuring victimisation, including contrasting findings between binary

measures of non-victims and victims, and measures which contain the number of

victimisations experienced. Findings are even further varied within the fear of crime literature

when examining the multitude of ways in which fear of crime can be measured, including

general measures of fear of crime, compared to crime specific measures of fear of crime, as

well as intensities of fear of crime compared to frequencies of fear of crime. One element that

appeared understudied in the literature was in the effects of victimisation on fear of crime,

rarely were crime type specific victimisations assessed for their effects on a fear of crime

measure specific to that crime type.

This literature review has confirmed that, overall, numerous characteristics which

affect victimisation, are also related to fear of crime, whether they have a similar or

oppositional effect, these findings inform the variable selection process which is outlined in

the following methodology chapter. A further key finding from this review is the differences in

the impacts of a number of characteristics on different crime types both within victimisation

and fear of crime studies. These finding informs the well-defined measure of fear of crime in

this study, as well as the use of crime type specific measures of victimisation paired with

crime type specific measures of worry about crime.

4.0 Methodology

This research uses quantitative methods to analyse Crime Survey for England and Wales data (2014/15 to 2018/19) and 2011 UK Census data to examine the relationship between victimisation and dispositional worry about crime. Victimisation and worry are examined within three crime type categories: household; vehicle; and personal crime, first establishing whether a relationship exists between them, followed by examination of the effects of a number of individual, household and neighbourhood variables on both worry and victimisation, for each crime type category, and an assessment of the effect of these characteristics on the relationship between them. This chapter first outlines the methodological approach of this research, presenting the aims and questions; the research strategy; and discussing the data sources which will be utilised to address these. This chapter also discusses the decision-making processes for selecting and preparing data and variables for inclusion in the analysis, and the methods of analysis employed to address each research aim. This includes model specifications and a justification and discussion of the application of Bayesian estimation methods.

Initially, quantitative data analysis techniques are used to determine whether a significant association exists between individuals experiencing a victimisation and reporting dispositional worry about crime within three crime type categories: household; vehicle; and personal. Upon confirmation that significant relationships exist between these variables at the individual level, inferential modelling is used to estimate the correlation between victimisation and dispositional worry about crime at both the individual, and neighbourhood level for each

crime type category. Following this baseline[2] estimation of correlations, covariates are added

into the model using a nested modelling strategy, to assess their role in explaining both the

covariance of worry and victimisation, and the variation in worry and victimisation within

individuals and between neighbourhoods. Covariates included in household and vehicle crime

models comprised of individual and household characteristics; neighbourhood contextual

variables; and perceived incivilities, and for personal crime: individual and household

characteristics; routine activity variables; and neighbourhood contextual variables.

4.1 Methodological Approach

A number of studies over the previous thirty years have employed generalised linear

models on victimisation survey data to investigate the effects of a number of characteristics,

including: demographic; socioeconomic; routine activities; and area level contextual variables,

on either fear of crime (Brunton-Smith & Sturgis, 2011; Covington & Taylor, 1991; Gray et

al., 2010; Hale et al., 2004; Krulichova, 2019; LaGrange et al., 1992), or victimisation

(Brennan et al., 2010; Park & Fisher, 2017; Trickett et al., 1995; Tseloni & Pease, 2003; 2004;

Wilsem et al., 2006;). These studies allow for the identification of characteristics of both

individuals and neighbourhood contexts indicative of higher risk of victimisation or

experiencing fear of crime. Developing this knowledge base can inform targeted policies to

both increase the safety of, and to increase the feelings of safety of, those most at risk.

Many studies which have examined the relationship between such characteristics and

fear of crime have also included measures of the victim status of an individual as a covariate

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[2] Calculated using a null bivariate mutlilevel regression model. This means no covariates are included which may be associated with, and therefore explain away the covariance between the two variables of interest.

in regression models to estimate the effects of victimisation experiences on fear of crime

(Brunton-Smith & Sturgis, 2011; Hale et al., 1994; Reid & Konrad, 2004; May et al., 2010).

Another body of research examines the relationship between fear of crime and

victimisation status using structural equation modelling (SEM). SEM models have been used

to estimate causal pathways between multiple concepts such as victimisation, worry about

crime, perceived risk of victimisation, as well as some individual characteristics and/or

neighbourhood contextual variables, however such models generally include fewer

sociodemographic variables than research using generalised linear modelling techniques. This

technique relies on theory to assume causal pathways between concepts (Hoyle, 1995a),

however due to the fact it is often based upon cross-sectional data, this method is associated

with some critiques regarding the validity of inferences made (Davcik, 2014; Hayduck et al.,

2007; Hoyle, 1995b). Due to this research focusing on understanding the relationship between

victimisation and fear of crime, and how many covariates affect each concept differently, and

account for the relationship between them, SEM is not considered the most appropriate

method to reach the research aims. Additionally, this research would be using cross-sectional

data and would therefore be subject to the aforementioned critiques.

To gain the benefit of being able to examine a larger number of covariates in a

regression model, whilst also being able to estimate the relationship between victimisation and

worry about crime, as well as the impact of the covariates on this relationship, bivariate

multilevel regression modelling will be used (Goldstein, 2011; Rabash et al., 2020). Drawing

upon the use of victimisation surveys in previous research which has investigated

victimisation and fear of crime separately, this research will follow the precedent of many UK

based studies in using the Crime Survey for England and Wales (formerly the British Crime

Survey) (Brennan et al., 2010; Brunton-Smith & Sturgis, 2011; Hale et al., 1994; Tseloni et al.,

2004). Due to prior research estimating differing effects of covariates on different crime types

on both fear and victimisation as demonstrated in the literature review chapters, this research

will model household, vehicle, and personal crime as three distinct pairs.

4.1.1 Research Aims and Questions

This research investigates the relationship between victimisation and worry about

crime, operationalised as dispositional worry about crime, for three crime type categories: (1)

household; (2) vehicle; and (3) personal, at both the individual and neighborhood level, as well

as to identify the effects of covariates on victimisation and worry about crime individually, and

on the relationship between them. The following section presents the research aims and

questions this research strategy will address.

4.1.1.1 Research Aim 1- Establishing a Relationship between Victimisation and Worry at the Individual and Neighbourhood Level

To identify whether a relationship exists between: (1) household victimisation and

dispositional worry about household crime; (2) vehicle victimisation and dispositional worry

about vehicle crime; and (3) personal victimisation and dispositional worry about personal

crime, at both the individual and neighbourhood level. Two research questions will be

addressed to achieve this research aim.

<u>Research Question 1</u>   Does an association exist between (a) household victimisation
and dispositional worry about household crime; (b) vehicle
victimisation and dispositional worry about vehicle crime; and
(c) personal victimisation and dispositional worry about
personal crime?

<u>Research Question 2</u>   Does a correlation exist between victimisation and worry about
crime for each of the three crime categories between (a)
individuals; and (b) neighbourhoods?

4.1.1.2 Research Aim 2-Understanding the Effects of Individual, Household and

Neighbourhood Characteristics on the Relationship Between Victimisation and Worry

Following an examination of the baseline relationship between crime type specific victimisation and fear of crime, the research then aims to identify the effects of a number of individual, household and neighbourhood contextual variables on both victimisation and worry about crime individually, and their effects on the relationship between them.

Research Question 3a How do: (a) individual and household characteristics; (b) neighbourhood contextual variables; and (c) independently rated incivilities, affect risk of becoming a victim of household crime and vehicle crime, and risk of worry about household and vehicle crime respectively.

Research Question 3b How much of the estimated correlation between household victimisation and worry about household crime, and vehicle victimisation and worry about vehicle crime is accounted for by each additional set of explanatory variables?

Research Question 4a How do: (a) individual and household characteristics; (b) routine activities; and (c) neighbourhood contextual variables affect risk of becoming a victim of personal crime and worry about personal crime?

Research Question 4b How much of the estimated correlation between personal victimisation and worry about personal crime is accounted for by each additional set of explanatory variables?

4.1.2 Data Sources

Two data sources were used for analysis in this research: the CSEW; and the 2011

Census. This section outlines the contents of, and provides brief methodological summaries of,

the data sources and discusses their merits, justifying their use in this research.

4.1.2.1 The Crime Survey for England and Wales

The primary data source analysed in this research is the CSEW, using four years of

data covering the period between 14/15 and 17/18 (UK Data Service Study Numbers 7889,

8140, 8321, 8464), this survey is regarded as a "gold-standard survey of its kind" (Flatley,

2014, p.199) due to the rigorous survey methodology and consistently high response rate,

maintained at 75%. The CSEW is a nationally representative victimisation survey of adults

aged 16 and above living within private residences across England and Wales. Initially

introduced to simply "count crime", and to supplement police recorded crime statistics, the

scope of the survey has expanded to not only record victimisation experiences occurring

within the year prior to interview, but also whether crimes were reported to the police,

satisfaction levels with criminal justice agencies, perceptions about crime, including worry

about crime, respondent's routine activities, and a plethora of sociodemographic information

about individuals, households and the neighbourhoods in which they live (Tseloni & Tilley,

2016; UK Data Service, 2019). Most of the survey, and all modules of interest for this

research, are administered through computer administered personal interviewing

(CAPI/CAMI), in which the interviewer asks the respondent survey questions face to face, and

inputs them into a computer system (UK Data Service, 2019).

This survey was selected for multiple reasons, one being that statistics produced from

CSEW datasets are the primary source of "National Statistics" on crime published by the

Office for National Statistics following the removal of national statistics accreditation of

Police Recorded Crime Data (excluding data on homicide informing The Homicide Index)

(UK Statistics Authority, 2014). As well as having official accreditation, academic research

using this data source has informed crime prevention policy at the national level (Tseloni &

Tilley, 2016), with publications created by collaborators within academic institutions and

within the Home Office and the Office for National Statistics to tackle matters such as repeat

victimisation (Pease, 1998) and the prediction and prevention of those at risk of victimisation

(Pease & Tseloni, 2014). The inclusion of both non-victims and victims in a survey of this

kind allows for the comparison of behaviours and characteristics between those victimised and

those not, allowing the development of risk profiles which can be used to inform relevant

crime reduction and public reassurance policy.

There have also been wide ranging academic benefits resulting from the use of this

survey, particularly in testing and supporting criminological theory (Tseloni & Tilley, 2016).

Examples of this are Sampson & Groves' (1989) first empirical test of social disorganisation

theory, and the early modelling of routine activity theory (Maxfield, 1987; Sampson &

Woodredge, 1987). The national coverage of this survey, including a combination of urban and

rural areas, increases the possible scope of tests of theory and the wider application of

potentially beneficial recommendations to a national level, in comparison to the city or county

level, which is commonly the focus in similarly structured studies (e.g. Covington & Taylor,

1991; Eschholz et al., 2003; Kanan & Pruitt, 2002).

Whilst the CSEW is a well-respected survey, it does have some limitations and its use

is associated with some caveats. Of relevance to this research is the potential sampling error

inherent within the sampling design, with some groups of individuals remaining outside of the

survey's coverage. Excluded groups include "students in university accommodation,

pensioners in old people's care homes, disabled people in care homes, permanent residents in

hotels or motels, members of staff and their families living in hospitals, prisons, schools etc.,

people living in trailers, homeless and children under the age of 10^3" (Tilley & Tseloni, 2016,

p. 83). Some of these populations may be at increased risk of victimisations including

prisoners (De Viggiani, 2007), the homeless (Scurfield et al., 2009), and those residing in other

risky facilities (Eck et al., 2007), and therefore their exclusion means a particularly important

section of society is excluded from the analysis. Some proportions of the population, whilst

included within the sampling frame, are less likely to respond to the survey, or have lower

probability of sampling selection, booster samples and weights are provided to alleviate this as

far as possible (Tseloni & Tilley, 2006), however the use of weights is not recommended when

using discrete response models in MLWiN due to the recommendation to use MCMC which

does not take into account any weighting specified (Pillinger, 2011). Although no further

practical steps can be taken to alleviate this risk, the interpretation and conclusions drawn

from the analysis are sensitive to known limitations.

4.1.2.2 2011 Census

The 2011 Census was used to gather contextual information about neighbourhoods.

This data source, conducted every 10 years, is a count of all people and households within the

UK which also gathers detailed sociodemographic information about the whole population

(Office for National Statistics, 2016a). In contrast to most surveys which gather information

about the population, the Census does not rely upon sampling strategies to gain a

representative sample of the population, instead it is administered to all households across the

UK using the national address register (Office for National Statistics, 2016b). The national

address register was updated and refined over five years prior to the survey being administered

to ensure maximum population coverage, with particular focus on addresses of multiple

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[3] Data on children aged 10-15 is not included in this research.

occupancy, communal establishments, and transient populations (Office for National Statistics, 2016b).

Census data has routinely been used alongside victimisation surveys to portray neighbourhood characteristics in quantitative studies of crime with a neighbourhood focus over the previous three to four decades, both in the UK (e.g Brunton-Smith & Sturgis, 2011; Osborn, Trickett & Elder, 1992; Tseloni, 2006), and worldwide, particularly in the USA and the Netherlands (Bruinsma et al., 2013; Tseloni, 2000; Wilsem et al., 2006). It is acknowledged that the census data used for this research is between three and seven years older than the CSEW data, however due to censuses only occurring every ten years it is commonplace to utilise them despite this lag (Brunton-Smith & Sturgis, 2011; Osborn et al., 1992; Tseloni, 2006).

4.1.2.3 Secure Access Low Level Geographical CSEW Data

Due to this research situating individuals within their neighbourhoods, and the requirement to use both CSEW and Census data, low-level geographical CSEW data was required. This data source (UK Data Service Study Number 7311) provides identifying codes of the geographical region in which the respondent resided at the time of interview, at varying levels of statistical geography. Of interest for this research was the middle layer super output area (MSOA). This dataset falls under "controlled" designation (UK Data Service, 2021) due to this data source situating individuals within geographical areas as small as the lower super output area (LSOA). This raises potential issues of respondents' anonymity being compromised; therefore researchers wishing to access and utilise this data must meet certain requirements and adhere to certain protocols. Initially, all researchers wishing to gain access to the project must gain 'Approved Researcher Status' from the ONS, this requires researchers to evidence a certain level of statistical capability, attendance at a UK Data Service training course focusing on issues of statistical disclosure (UK Data Service, 2021).

This process can cause substantial delay, however approved researcher status was gained by myself and Director of Studies prior to the commencement of this project which minimised the risk of delay. The project itself also had to be approved by the UK Data Service and Office for National Statistics prior to access to the data being permitted. This application required the "public good" of undertaking the research to be justified, in this case the research seeks to provide an evidence base upon which public policy decisions could be made, as well as to inform decisions for public service delivery (Stokes, 2016). Approval was gained without delay, with the final application being submitted on 04/06/2018 and access to data being secured on 23/08/2018. The form submitted is included in Appendix A, please note that the scope of the project has changed since submission so does not fully reflect the research presented in this thesis.

Access to this data is only available through the UKDS secure lab system, consequently all data preparation, analysis, and writing up of results must be done within the secure lab environment (UK Data Service, 2021). The secure lab portal is only accessible on certain devices under restricted conditions, including working on an institutional computer within a designated office, with limited network connections, further details are outlined on the UKDS website (UK Data Service, 2021).

4.1.2.3 Merging of Datasets

Table 1 Dataset Merging Key

Dataset Number	Contest
Dataset 1	All 4 years merged of EUL NVF[4] CSEW dataset
Dataset 2	All 4 years merge of secure access CSEW dataset, containing geographical identifiers
Dataset 3	Merge of dataset 1 and 2, includes all 4 years of data with respondents EUL records and geographical identifier
Dataset 4	Sociodemographic variables from the Census

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[4] End-User License, Non-Victim form

Dataset Number	Contest
Final Dataset	Merge of dataset 3 and dataset 4

For this analysis, multiple steps were taken to merge together four years of NVF CSEW EUL data (14/15, 15/16, 16/17, 17/18), with four years of secure access CSEW data, and selected data from the 2011 Census. The CSEW EUL data contains all information collected from participants during the survey (excluding details on specific victimisations collected in the victim-form element of the survey), alongside a 9-digit unique identifier. The secure access CSEW data also contains this 9-digit unique identifier alongside the code of the MSOA (and other statistical geographies) within which the respondent resided at the point of interview. Relevant aggregate census data was extracted via InFuse through the UK Data Service website, each row, or unit of analysis, in this dataset is identified with the MSOA identifier code, as appears in the secure access dataset.

Initially, all years of CSEW EUL data were merged, creating dataset 1 as defined in the table above. This was done using the "add cases" function under "data merges" on the "data" tab of SPSS. This process was also repeated for each year of the secure CSEW dataset, creating dataset 2. This resulted in two separate datasets containing data from all respondents surveyed between April 2014-March 2018, with dataset 1 containing all participant information, and dataset 2 containing all geographic identifiers. Using the 9-digit unique identifier present within both the CSEW EUL dataset (dataset 1) and secure access CSEW dataset (dataset 2), these datasets were matched using this unique identifier, producing dataset 3. Dataset 3 contained location information, in the form of the MSOA identifier code, added to each respondent's record.

Having combined all years of CSEW datasets and matched the location identifier to each respondent's record, census data (dataset 4) was then merged into this dataset to create the final dataset containing all required information. This relied on matching census data

(dataset 4) to dataset 3 using the MSOA identifier. As each MSOA contained several

respondents this required a slightly more complex "one-to-many" match to ensure all

respondents within each MSOA hold the appropriate neighbourhood level information. This

matching method duplicates MSOA information for each participant resident within the

MSOA, to produce a complete dataset containing all four years of data with geographical

identifier and neighbourhood level information for each respondent.

4.1.2.4 Determining a "Neighbourhood" in the Data

Both theoretical and statistical considerations were made when deciding how to define

a neighbourhood within this research. Information was drawn from studies which investigated

the effects of social disorganisation, social capital and collective efficacy which commonly

had a neighbourhood focus. Previous studies have defined a neighbourhood to have a

population of 4000-5000 residents (Bruinsma et al., 2013), neighbourhood clusters are

commonly the unit of analysis for Chicago based studies which have an average population of

approximately 8000 residents (Browning, 2002; Browning et al., 2004; Maimon & Browning,

2010; Morenoff et al., 2001; Sampson et al., 1997). These previous definitions of a

neighbourhood closely match the MSOA level of statistical geography for the UK, these areas

have a minimum population of 5,000 and a maximum population of 15,000 (Office for

National Statistics, undateda). Output areas were created out of socially homogenous areas,

particularly with regard to household tenure and type, and within obvious boundaries of the

environment (Office for National Statistics, undateda), such factors are considered in deciding

the ecological validity of the area of study in previous studies (Bruinsma et al., 2013;

Morenoff et al., 2001). Preliminary analyses demonstrated that MLWiN was capable of

estimating significant between neighbourhood variation in worry about crime across all crime

types, and in victimisation for household and vehicle crime, and the literature confirmed the

sample size was acceptable for the planned analyses (Gelman, 2003).

4.1.3 Research Strategy

The first stage of analysis relies on the CSEW and uses crosstabulations and chi-square tests of associations to make an initial assessment of the relationship between victimisation and worry about crime for the three crime type categories: (1) household; (2) vehicle; and (3) personal. As these are relatively broad crime categories, associations between the more detailed victimisation and worry variables were also explored to confirm associations existed between the underlying variables. This process answers Research Question 1 by identifying whether a significant association exists at the individual level between victimisation and worry for each crime type. Odds ratio calculations were also undertaken using data from crosstabulations. This allows for the comparison of the odds of a victim of crime having dispositional worry, to a non-victim.

Following confirmation of significant associations between victimisation and worry about crime for each crime type category, BVML modelling was used to estimate the correlation between victimisation and dispositional worry about crime at the individual and neighbourhood level. At this stage, no covariates are added into the model, called the "null-model", this provides the baseline correlations to which later models, which include covariates, will be compared. This modelling stage will also allow for confirmation of whether victimisation and worry covary within the same neighbourhoods, as well as whether levels of victimisation and worry vary between neighbourhoods for each crime type. This stage of the modelling answers to Research Question 2.

To address the research questions under Research Aim 2, covariates will be added into each of the three BVML models in stages. Household and vehicle crime will follow the same nested modelling progressions, initially adding individual and household characteristics, should a number of covariates affect worry and victimisation in the same way (e.g. either positive or negative estimates on *both* sides of the model) the individual level correlation

estimates would be expected to reduce. Neighbourhood contextual variables are then added

into the model, it is expected that the inclusion of these variables would result in reductions in

the estimates of the unexplained variance of worry and victimisation between neighbourhoods,

and reduce the covariance, and therefore the correlation estimates for worry and victimisation

at the neighbourhood level. The final modelling stage adds independently rated incivilities into

the model and is expected to affect both individual and neighbourhood level random

coefficients. When modelling the relationship between experiencing personal crime and worry

about personal crime, the first set of nested variables are also individual and household,

followed by routine activities variables, which may reduce both the level of unexplained

variation of both worry and victimisation within individuals and between neighbourhoods,

followed by the addition of contextual variables, which are again expected to reduce the

unexplained relationship at the neighbourhood level. These stages will answer to Research

Questions 3a, 3b, 4a and 4b.

4.2 Variable Selection & Preparation

This section introduces variables selected for inclusion within the multivariate

analysis. Initially, the dependent variables, consisting of measures of worry about crime and

victimisation, are outlined, and the operationalisation of these concepts for analysis, as three

crime type categories: household; vehicle; and personal, is explained. Covariates included in

analysis are then introduced in the sections in which they will be introduced into the models.

4.2.1 Operationalising Worry about Crime and Victimisation

The CSEW asks individuals how worried they are about becoming a victim of nine

offences, with possible responses ranging from very worried, through fairly worried, not very

worried, to not at all worried (TNS UK, 2015, p.27). Not all questions are asked to all

respondents, this section of the survey divides the sample into quarters, referred to as modules,

and worries about different crime types are asked to different modules of the sample. This is

structured as follows:

Table 2 Worry about Crime Questions and Modules

Module	Question
B	How worried are you about having your car stolen?[5]
	How worried are you about having things stolen from your car?[6]
C	How worried are you about having your home broken into?
	How worried are you about being mugged and robbed?
D	How worried are you about being raped?
	How worried are you about being physically attacked by strangers?
	How worried are you about being subject to a physical attack because of your skin colour, ethnic origin or religion?

(TNS UK, 2015, p.27)

4.2.1.1 Dependent Variable Coding

As previously stated, answers to these questions ranged from very worried, to not at all

worried, these were dichotomized for this research to allow for specification of the

multivariate structure in MlWin as follows. Those answering that they were either very

worried or fairly worried were categorised as having dispositional worry about crime (coded

as 1 in the dichotomous variables), and those stating they were either not very, or not at all

worried were categorised as not having dispositional worry about crime (coded as 0 in the

dichotomous variables).

Alternative coding options were considered, including:

(1) Grouping not very worried, fairly worried and very worried as having dispositional

worry about crime, and those not at all worried, as not having dispositional worry

about crime

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[5] Only asked to respondents who report either owning or having regular use of a vehicle
[6] Only asked to respondents who report either owning or having regular use of a vehicle and did not report the previous question to be not applicable

(2) An ordinal variable with not at all worried, categorized as not having dispositional worry about crime; not very worried, and fairly worried grouped as low/medium dispositional worry about crime, and very worried as high dispositional worry about crime

(3) An ordinal variable with not at all worried and not very worried categorised as not having dispositional worry about crime, not very worried categorised as low dispositional worry about crime, and very worried categorised as high dispositional worry about crime

For both ordinal variable categorisations an ordinal repeat victimisation variable was also coded, to represent (0) non-victims; (1) single victims; (2) repeat victims. Both ordinal variable options were not considered viable for the BVML modelling strategy due to the very low number of individuals in the single and repeat victim categories for each victimisation variable. The alternative dichotomous variable solution was considered less optimal than the one opted for, due to those reporting being not very worried considered to be more considerably different to those reporting being fairly worried about crime, than those reporting being not at all worried, or not very worried.

4.2.1.2 Selecting Crime Type Specific Victimisation and Worry Variable Pairs

When generating a measure of fear of crime, using responses to worry about multiple crime types has been deemed preferable to more general measures (Visser et al., 2013), and this technique is applied in studies measuring non-crime-type-specific worry (Brunton-Smith & Sturgis, 2011; LaGrange et al., 1992). Due to the structure of this section of the survey this is not possible, instead, crime category specific worry measures are generated, with dual measures combined for both vehicle and personal worries. Findings from the literature review suggest that certain characteristics affect worry about certain crime types differently from others, or from non-crime specific worry measures. Therefore, this crime type specific

measure is expected to give more detailed insights into the differences between characteristics

associated with worry about different crime types. To make crime type groups, module B's

measures were examined to generate a worry about vehicle crime measure, module C's

measures were divided to generate two separate measures: worry about household crime; and

worry about personal crime. To check the validity of combining more specific crime types into

the household, vehicle, and personal crime groupings for the proposed variables pairings, a

number of crosstabulations and chi-square tests of association were examined.

All household victimisation types, including burglary, home vandalism and other

household theft, are grouped to make the household victimisation variable to be paired with

worry about burglary, because the strongest association was found when all three household

crime types were grouped together (χ^2 (1, N=34201) = 340.618, p =0.000). Each household

victimisation crime subtype was significantly associated with worry about burglary when

tested separately (home vandalism (χ^2 (1, N=34201) = 73.460, p =0.000); burglary (χ^2 (1,

N=34201) = 218.359, p =0.000); and other household crime (χ^2 (1, N=34201) = 114.652, p

=0.000), so there was no reason found to exclude any household crime type in the

victimisation measure.

Personal victimisation included all personal victimisation types except sexual violence,

because this measure is known to be unreliable in the main body of the CSEW and therefore

not used in official statistics[7], this variable was most strongly associated with a merged

variable of worry about physical attack and mugging (χ^2 (1, N=34213) = 110.659, p = 0.000).

Significant associations were also found when crime types were separated into: (a) worry

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[7] The ONS exclude sexual offences from its crime estimates given the expected inaccuracies and
sensitivities around collecting this information in a face-to-face interview (Office for National
Statistics, Undatedb).

about mugging and being a victim of personal acquisitive crime ($\chi2$ (1, N=34168) = 48.059, p

=0.000); (b) worry about mugging and being a victim of assault ($\chi2$ (1, N=34168) = 5.157, p

=0.023); (c) worrying about physical attack and being a victim of assault ($\chi2$ (1, N=34175) =

71.674, p =0.000); and (d) worry about physical attack and being a victim of personal

acquisitive crime ($\chi2$ (1, N=34175) = 60.175, p =0.000), This slightly lower level of

confidence in the relationship between worry about being mugged and personal acquisitive

victimisation is likely due to the fact that the percentage difference of being worried about

mugging was much smaller between victims and non-victims of assault (26.2% of non-victims

worried, 30.5 of victims worried), than the difference, for example, in worry about physical

attack, between victims and non-victims of personal acquisitive crime (26.0% of non-victims

worried, 37.5% of victims worried), the overall personal crime variable (excluding sexual

victimisation) and worry about mugging and physical attack will be paired in analysis.

The crosstab and chi-square test of association between vehicle victimisation (vehicle

theft, vandalism, theft from vehicle, bike theft and attempts and worry about vehicle

victimisation (worry about theft of and from car) revealed a very strong association ($\chi2$ (1,

N=27597) = 548.657, p =0.000). As the association between these variables is so highly

significant, these were not split down into smaller crime types for testing.

Variables were generated in SPSS, syntax was used for variable preparations due to its

many advantages over using the graphical user interface (GUI), including allowing the

researcher to identify and address any errors in the coding which may go unnoticed when

using the GUI, and allows for easy replication of similar code, saving time compared to

executing multiple recodes using the GUI (Grotenhuis & Visscher, 2014). It also works to

maintain a log of variable manipulation which can be examined by others to identify any

errors, and to be used in the future when using similar data.

4.**2.2 CSEW Model Covariates**

The following section presents descriptions of the variables to be used in the multivariate

regression models, and justifications for their inclusion based upon the literature review.

Variables are grouped as they will be entered into the nested models. The specific

measurement and categories of these variables is evident from the tables of descriptive

statistics in the forthcoming chapters.

4.2.2.1 Individual and Household Characteristics

The literature review demonstrated that several individual and household

characteristics had a significant effect on risk of experiencing fear of crime and victimisation,

including age, sex, ethnicity, marital status, income, education and employment (Brunton-

Smith & Sturgis, 2011; Hale et al., 2004; Reid & Konrad, 2004; Trickett et al., 1995; Tseloni

& Pease, 2003; 2004; Wilsem et al., 2006). These concepts represent areas of opportunity

theories of crime, such as vulnerability (Sampson & Lauritsen, 1990), target desirability

(Wilsem et al., 2006) or the indication of ownership of more desirable goods (Trickett et al.,

1995), and lower levels of guardianship (Park & Fisher, 2017; Outlaw et al., 2002).

To identify variables for inclusion, the survey questionnaire and data were scanned,

with particular focus on the demographic module, to identify all available variables discussed

in the literature review. A larger number of variables than appear in the final models were

initially examined, however some were removed following no evidence of having a significant

effect on either victimisation or fear of crime at the 90% significant level when building

exploratory models using RIGLS estimation.

Individual Characteristics

Table 3 Description of Individual Characteristic Variables

Variable	Description
Age	Age of the respondent in years

Variable	Description
Gender	Gender of the respondent, does not offer wider response set than male or female, interviewers instructed to assess gender based on name/visuals and to ask if unsure
Ethnicity	Respondent's ethnic group
Marital status	Respondent's marital status
Socioeconomic classification	Respondent's socioeconomic classification according to their employment role
Disability and illness	Whether the respondent suffers from a longstanding disability or illness, and how substantially this limits the individual's life

Household Characteristics

Table 4 Description of Household Characteristic Variables

Variable	Description
HRP Age	Age in years of the household reference person
HRP Gender	Gender of HRP (as in above table)
HRP Ethnicity	Ethnicity of HRP (as in above table)
HRP Marital Status	Marital status of HRP (as in above table)
HRP socioeconomic classification	Socioeconomic status of the HRP according to their employment role (as in above table)
Household income	Total household income of all household members including from salaries, benefits, other sources such as investments or interest from savings
Tenure type	Whether the respondent's household is owner occupied, private rented or social rented
Accommodation type	What type of accommodation the respondent lives in, e.g terraced, semi-detached house, flat etc.
Hours house unoccupied	How many hours the home is usually left unoccupied on an average weekday
Years lived in the area	How many years the respondent has lived within the area, defined as within a 15-minute walk of the current residence
Household relative condition	Interviewer's assessment of the home's physical condition in comparison to others within the area, better, worse, or about the same
Car ownership	Number of cars the household owns or has regular use of

Routine Activities

A number of routine activities were found to affect individuals' risk of being

victimised, and to be associated with different levels of worry about crime, these included both

mandatory and voluntary routine activities which result in the individual being out of the

house at certain times, for longer periods, and engaging with riskier facilities Brennan et al.,

2006; 2010; Kanan & Pruitt, 2002; Mesch, 2000; Outlaw et al., 2002; Tseloni & Pease, 2003;

2004). Individuals out of the house for longer times encounter more opportunities for crime,

and those attending night-time economy establishments potentially increase their vulnerability

through the consumption of alcohol (Moore & Foreman-Peck, 2009), and other disinhibitory

substances (Torok et al., 2011), as well as entering environments with more permissive social

norms (Fileborn, 2016).

To identify variables for selection within this category, the "Perceptions of Crime

Module" was studied, in particular the subsection "Going Out".

Table 5 Routine Activity Variables

Variable	Description
Time out of the house	How many hours the respondent spends out of the house on an average weekday
Visiting pubs	How many times the respondent visited a pub in the month prior to interview
Visiting clubs	How many times the respondent visited a club in the month prior to interview

Neighbourhood Incivilities

A number of studies found effects of individuals perceptions of their local area to

affect both victimisation risk and worry about crime (Gray et al., 2010; Hale et al., 1994;

Kanan & Pruitt, 2002; Kuo et al., 2012; Outlaw et al., 2002). This survey measures

neighbourhood disorder in two ways: (1) the interviewer makes a judgement of the disorder

within the area based on prompts in the survey; and (2) respondents are asked how much of

problem certain incivilities are within the neighbourhood. Consistent positive effects of higher

perceived incivilities are found on victimisation and worry about crime for general fear of

crime measures, as well as personal (Hale et al., 1994) and property specific worries (Rountree

& Land, 1996). This study, therefore, opted to assess the effect of independently rated

incivilities as it offers more opportunity for building knowledge.

Table 6 Independently Rated Incivilities

Variable	Description
Incivilities	Interviewer assessment of how common litter/rubbish and vandalism/graffiti is in immediate area and how common it is for houses to be in poor condition or run down in the area

The CSEW provides a variety of derived variables, containing multiple variables for each piece of information (e.g gender, age, socioeconomic status) with differing levels of detail. Initially the specific derivation of a variable was selected to allow the research to reflect as many categories observed throughout the literature review as possible. Where no suitable variable derivation was found, these were recoded from more detailed variables.

4.2.2.2 Census Data Covariates

To include a wealth of contextual information within the models, a number of variables were taken from the 2011 Census and merged with the CSEW. A number of early studies which have included area level data in their modelling of victimisation noticed issues of multicollinearity when using multiple area level indicators, resorting to carrying out dimension reduction techniques in the form of principal components analysis to alleviate problems associated with multicollinearity within regression models (Osborn et al., 1992; Trickett et al., 1995). This analysis draws upon Brunton-Smith & Sturgis' (2011) research (using the 2001 Census), where having drawn upon previous analyses (e.g. Morenoff et al., 2001; Sampson & Raudenbush, 1999; Sampson et al., 1997) the authors hypothesised that neighbourhood characteristics were 'multiple indicators of a few principle dimensions of neighbourhoods' (Brunton-Smith & Sturgis, 2011, p.345) and therefore carried out a principle components analysis (PCA).

For this research, as many of the variables included in Brunton-Smith & Sturgis' (2011) research as possible were located within the 2011 Census, and an exploratory factor analysis (EFA) carried out on them in order to determine the underlying dimensions of the

data. EFA was chosen instead of PCA because this method determines which variable groups

represent a *latent variable* through examining shared common variance-covariance

characteristics, whereas PCA examines all variance (Schumacker & Lomax, 2016) which can

result in inflated values of variance accounted for, whilst disregarding the underlying latent

variable structure (Costello & Osborne, 2005).

Due to this being an exploratory factor analysis, a number of possible solutions were

examined, and the most interpretable result selected for further analysis. The results of the

final factor solution are presented below. To explore various solutions, SPSS was instructed to

extract varying numbers of factors between 3 and 5, and to extract all factors above

eigenvalues of between 0.9 and 1.3. Based upon results of initial exploratory factor solutions,

and particularly upon those which could not converge, some variables were removed from the

analysis to allow for more meaningful and interpretable factors. Variables removed were those

with the lowest communalities, these included migration in and out of the MSOA, the

proportion of vacant properties and population density.

Factor Analysis Results

Preliminary Testing

Initial checks on the data demonstrate suitability for factor analysis to be undertaken.

Common sample size recommendations prescribe that factor analyses should only be carried

out on datasets with a sample greater than 200 as an absolute minimum, with above 1000

denoted as excellent (Comrey & Lee, 1992), this analysis was carried out on 7201 cases, well

exceeding the best recommendation. The Kaiser-Mayer-Olkin measure of sampling adequacy

result was 0.649, with values above 0.6 acceptable, and those nearing one optimal, suggesting

a low proportion of common variance compared to all variance, as is ideal for factor analysis.

Bartlett's test of sphericity result of 119968.835 on 91 degrees of freedom, resulting in a

significance value of 0.000 allows the null hypothesis that the correlation matrix is an identity

matrix to be rejected. Communalities were also examined to ensure no values were below 0.5,

with approximately 80% of commonalities having a value of 0.8 or above.

Factor Extraction

Factors were extracted using maximum likelihood extraction due to all variables

included showing approximately normal distributions (Costello & Osborne, 2005). SPSS was

instructed to retain three factors based upon previous explorations of solutions and scree plots.

The factor solution was rotated to allow for easier interpretation, oblique, direct Oblimin

rotation was used due to expected and evidenced correlation between factors. Table @ below

shows the factor loading and eigenvalues for the rotated solutions.

Table 7 Factor Analysis Extraction Results

Factor/ Variable	Pre rotation			Post Oblimin Rotation[2]		
	Socioeconomic Disadvantage	Professional Life	Settled Living	Socioeconomic Disadvantage	Professional Life	Settled Living
Lone parents	0.653	-0.287	0.262	0.712	-0.280	-0.054
Car free households	0.999	0.003	0.005	0.812	0.098	-0.369
Social renters	0.756	-0.254	0.050	0.657	-0.187	-0.289
Under 24s	0.482	0.098	0.102	0.455	0.117	-0.062
Single person households	0.739	0.312	0.376	0.837	0.285	0.149
Economically inactive 16-74 years olds	0.469	0.083	0.299	0.577	0.054	0.128
Terraced housing	0.415	-0.192	0.259	0.520	-0.209	0.052
Flats	0.788	0.370	-0.237	0.461	0.492	-0.444
Level 4 qualifications	0.141	0.947	-0.200	-0.065	0.984	-0.045
Professionals	-0.088	0.987	0.006	-0.113	0.952	0.247
Overcrowding	0.635	0.097	-0.364	0.264	0.242	-0.565
Home ownership	-0.457	0.505	0.667	0.056	0.288	0.916
Over 65s	-0.312	0.304	0.698	0.203	0.100	0.848
Population density	0.673	0.084	-0.372	0.291	0.235	-0.590

Factor/ Variable	Pre rotation			Post Oblimin Rotation[2]
Eigenvalue	4.977	2.670	1.677	
Sample size (n)=7022				

Factor Summaries

Socioeconomic disadvantage was characterised by higher levels of lone parents, car free households, social renters, under 24s, single person households, economic inactivity and terraced housing.

Professional living was characterised by higher levels of people living in flats, having high levels of education and working in professional roles.

Settled living was characterised by low levels of overcrowding and population density, with high levels of home ownership and an aging population.

Neighbourhood Level Contextual Variables Excluded from the Factor Analysis

Also included in the regression analysis but excluded from the factor solution due to low communalities, were inward and outward migration rates, this measure is the rate per 1000 residents who moved into or out of the MSOA within the year prior to the Census date, the proportion of properties within the MSOA vacant, and the population density, measured as the number of persons per hectare. Additionally, a measure to state whether an individual has been victimised within their local area of residence was included, therefore at least one of their victimisation experiences was occurring within the setting of the neighbourhood characteristics of their MSOA, and these are assumed to have contributed to the risk of this victimisation occurring.

Ethnic heterogeneity was also included in the regression models, this was measured using the diversity statistic, Blau's index (1977). Blau's index is calculated as followed:

Equation 1 Blau's Index (1977)

$$Blau = 1 - \sum_{i=1}^{k} p_i^2$$

Where p_i is the proportion of category i in the group (Biemann & Kierney, 2010,

p.584).

4.3 Statistical Methods

This section discusses the methods used to address each element of the research aims

and questions.

4.3.1 Research Aim 1: Examining the Relationship between Victimisation and Worry about Crime

This research initially seeks to establish whether a relationship exists between worry

about crime and victimisation within the crime type specific variable pairs of household,

vehicle and personal crime at the individual level, and to quantify this relationship at the

individual and neighbourhood level.

4.3.1.1 Crosstabulations, Chi-Square Tests of Independence and Odds Ratios Calculations

The first stage of analysis relies on crosstabulations and chi-square ($\chi2$) tests of

independence to assess whether significant associations exist between victimisation

experiences and dispositional worry about crime for each crime type pairing. The

crosstabulations allow for visual observation of whether a pattern or relationship appears to

exist between two variables, with the chi-square tests of independence allowing for assessment

of whether results can be generalized to the wider population (Chamberlain, 2013).

Crosstabulations show the distribution of an independent variable, in this case

dispositional worry about crime, within the dependent variable, whether the individual has

been victimised or not, with percentage values allowing for comparison between the

proportion of victims of crime who are worried, compared to non-victims who are worried.

Odds ratios are also calculated from crosstabulations to quantify the relative odds of victims being worried about crime, compared to non-victims. The formula used to calculate the odds ratio is as follows:

Equation 2 Odds Ratio Calculation

$$OR = \frac{P(A)/(1 - P(A))}{P(B)/(1 - P(B))}$$

To interpret the odds ratio:

- OR>1 the odds of being worried about crime are higher for victims than non-victims

- OR=1 the odds of being worried about crime are equal for victims and non-victims

- OR<1 the odds of being worried about crime are lower for victims than non-victims

Chi square tests of independence are used once a relationship has been observed within the data, this test allows for the assessment of whether the apparent findings are likely due to random variation arising from sampling procedures or whether they would likely be evident in the population (Argyrous, 1997). Should the test be satisfied, this allows for generalisation of the results to the population from which the sample was drawn (Chamberlain, 2013). The test works to reject the null hypothesis, that the two variables are independent. The test statistic is calculated using the formula presented below, calculating the difference between expected (f_e) and observed (f_o) frequencies. The test result is then assessed against the chi-square $(\chi2)$ distribution for examination of whether it reaches the critical value for the appropriate degrees of freedom and significance level. Due to exclusively using 2x2 tables in this research this is

always 1 degree of freedom, and the results will be assessed at the 95% confidence level,

commonly used in social science research (Chamberlain, 2013).[8]

Equation 3 Formula to Calculate Chi Square

$$X^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

4.3.1.2 Null Bivariate Multilevel Modelling

To gain a more in depth understanding of the relationship between fear and

victimisation multivariate multilevel modelling (MVML) (Goldstein, 2011) will be used to

determine the correlation between fear and victimisation at both the individual and

neighbourhood level. This is an extension of regression modelling which allows for multiple

correlated dependent variables, whereby correlation between the dependent variables is

estimated at each level of the data structure (Rsabash et al., 2020). Further to this, explanatory

variables can then be added into the model, which are estimated separately for each outcome

variable, the model then estimates the proportion of the correlation between the dependent

variables that is accounted for by the covariates (Tseloni & Zarafonitou, 2008). This method

allows for a deeper understanding of the relationship between the dependent variables, whilst

also gaining understanding of the effects of the independent variables on each dependent

variable separately.

As stated in section 4.2.1.1, a binary response model was considered most appropriate

for this research, with the probit link function utilised. Initially this was selected due to the

model struggling to converge when using the logit link function due to the higher

computational demands associated with the logit link function. The logit link function was

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[8] f_o=observed frequency; f_e=expected frequency

initially considered preferable to the probit link due to ease of model interpretation when

utilising odds ratios. Whilst logit and probit, as well as cloglog link functions have been found

to estimate largely comparable results in univariate response models (Rsabash et al., 2020), the

same has not been found for multivariate response models (Hahn & Soyer, 2005). Examining

model fit, using the deviance information criterion (DIC), of comparable binary response

multivariate models using the probit and logit link functions, better model fit was achieved

when using the probit link function when random effects were estimated in the model (Hahn &

Soyer, 2005). Therefore, despite the probit link function offering a less intuitive interpretation,

this should be outweighed by the expected improvement in model fit. A further benefit to

probit modelling over probit is, that although the worry about crime measure is operationalised

as a dichotomous variable, it is likely representing an underlying continuous variable, with

worry about crime actually ranging from not at all, to very intense worry within the population

with individuals falling along the spectrum. Within probit modelling the link function is based

on the normal distribution, therefore estimating the value of the underlying latent variable of

worry about crime (Newsom, 2021).

The Null Bivariate Multilevel Probit Model of Victimisation and Worry about Crime

$Y_{ijk}, i = 1,2$ indicates the response variables of victimisation (Y_{1jk}) and worry about crime

(Y_{2jk}). Index $j = 1,2, ..., N$ indicates the jth respondent, index $k = 1,2, ..., N$ indicates the kth

neighbourhood, in each case N denotes the sample size, i.e. the number of respondents and the

number of neighbourhoods. Y_{ijk} indicates the observed response of the jth respondent within

the kth neighbourhood. Observed responses are dichotomous, with 0 indicating a negative

response and 1 a positive response, these variables follow the binomial distribution of

$Y_{ijk} \sim Bin (1, \pi_{ijk})$ where π_{ijk} indicates the probability that individual j within neighbourhood

k has a positive response to independent variable i. β_{oi} denotes the level 1 intercept of the

regression equation for response variable i.

The data have a three-level hierarchical structure, one for the response variable i, a

second for respondent j, and a third for neighbourhood k. The lowest level solely establishes

the multivariate structure, without offering random variation to the regression model. Random

variation is introduced for the intercept between respondents j, and for neighbourhoods k via:

Equation 4 Random Intercept Estimate

$$\beta_{0ijk} = \beta_{0i} + u_{0ik} + e_{0ijk}$$

Where u_{0ijk} represents the level 3 inter-neighbourhood random effect capturing level 3

(co)variation, and e_{0ijk} represents the level 2inter-respondent random effect capturing level 2

(co)variation. When estimating the covariance structure at the second and third levels,

diagonal terms are constrained to follow the binomial variance $\pi_{ijk}(1 - \pi_{ij}k)$.

The variable:

Equation 5 Dependent Dummy Variables to Define Multilevel Probit Structure

$$Z_{sijk} \begin{cases} 0, s \neq i \\ 1, s = i \end{cases}, s, i = 1,2$$

Denotes the two dependent dummy variables which assumed the value 1 when $s = i$,

and 0 other wise. This variable configuration ensures that only relevant terms are retained

within the each of the regression models estimates. The BVML probit model is written:

Equation 6 Probit BVML Multilevel Regression Equation

$$probit(\pi_{ijk}) = \sum_{s=1}^{2} z_{sijk} \beta_{0s} + u_{sk} + e_{sjk}$$

Bayesian Inference and Estimation

Markov Chain Monte Carlo (MCMC) estimation techniques are used in this analysis,

this is a Bayesian estimation technique. Bayesian estimation is employed due to the structure

of the data used in the analysis, which includes a low number of level 1 units (individuals)

within level 2 units (MSOAs/neighbourhoods). Gelman (2007) states that having low

observations per group, with just one level one observation in many groups is sufficient to fit a

multilevel model (Gelman, 2007), however this modelling is not without disadvantages.

Modelling with low numbers of level 1 units holds the risk that the level 2 variance may not be

estimated precisely, and that there may also be issues of estimating zero level 2 variance, the

use of MCMC estimation over IGLS.

An additional benefit to using MCMC estimation in this case, is that the covariate

estimates are estimated as a normal distribution with a mean and a standard deviation, giving

an estimate of the increased/reduced risk of a victimisation experience or having fear of crime

within a range, i.e. an upper and lower estimate of the effect is calculated in the model. This

gives additional information over a quasi-likelihood predictor which relies on p-value testing

to determine whether a specific covariate has a statistically significant effect on victimisation

or fear of crime.

Initially, models are estimated using IGLS (Iterative Generalised Least Squares)

estimation methods, specifically the 1st order MQL (maximum quasi-likelihood) estimator,

models must be run with IGLS estimators initially to generate starting values for parameters in

the model.

Bayesian statistics rely upon the largely uncontroversial Bayes's Theorem (Jackman,

2009), which articulates the process by which prior beliefs about parameters and hypotheses

are updated following consultation with the data to inform updated, posterior beliefs

(Jackman, 2009). This reasoning draws upon the rule of conditional probability:

Equation 7 Rule of Conditional Probability

$$P(A|B) = \frac{P(B \mid A)P(A)}{P(B)}$$

whereby the conditional probability of event B occurring given event A, equals the

sum of the conditional probability of B occurring given event A and the probability of event A,

divided by the probability of B (Gelman et al., 2013). Bayes rule modifies this to make a

statement about the posterior distribution, drawing upon the relationship between an estimated

parameter θ and the observed value in the data of *y* upon which it is based,

Equation 8 Bayes's Theorem

$$P(\theta|y) = \frac{p(\theta,y)}{p(y)} = \frac{p(\theta)p(y|\theta)}{p(y)} \text{ (Gelman et al., 2013).}$$

This equation displays the estimated parameters as a conditional probability, with the

probability of the estimated parameter conditional upon the observed value in the dataset.

When making inferences about a population based upon a statistical model using

Bayesian techniques, statistical conclusions about an estimated parameter take the form of

probability statements (Gelman et al., 2013). Each parameter, or Bayes estimate, is estimated

multiple times based on the number of iterations the model is set to run through, should the

model have been run appropriately, this multitude of estimates forms a normally distributed

posterior distribution with a mean and standard deviation. From this the most probable

estimate can be identified, the mean or Bayes estimate, and values within, for example, 1.96,

or 1.645 standard deviations of the mean form the 95% and 90% credible region respectively.

From these it can be inferred that values falling within the 95% or 90% credible region are

highly plausible for the population of interest (Jackman, 2012). In the presentation of results

for this analysis, Bayes estimates, as well as 95% and 90% credible intervals are included to

provide a satisfactory summary of the inferential result.

Markov chain Monte Carlo (Markov chain simulation, or MCMC) is a simulation

method which through repeated and sequential sampling of the available data continually

estimates the value of θ using a chain whereby the most recently estimated posterior

distribution is dependent upon the previous estimate, but not upon any estimates reached prior

to that (Gelman et al., 2013). With each sequential sample, the approximate distributions are

improved, allowing the model to reach convergence resulting in reliable results for

hierarchical models (Gelman et al., 2013). Within the MCMC simulation algorithm a sampler

is used, with Metropolis Hastings being the default option on MLWiN, and Gibbs sampling

also available (Browne, 2019). In this research the Gibbs sampling method was used due to

better diagnostics when examining coefficient trajectories following exploratory modelling.

Gibbs sampling estimates each parameter as a conditional probability given the values of all

other parameters present in the model, based upon the assumption that other estimates in the

model are correct, this creates dependence between estimates, and some correlation within the

chain of estimate, however less so than Metropolis Hastings sampling (Browne, 2019).

A number of diagnostics were used to assess the suitability of model fit as well as to

determine the suitability of the MCMC chain length and sampling settings to ensure the best

possible models are achieved from the data (Browne, 2019).

Table 8 MCMC Diagnostics Descriptions

Diagnostic	Description
Deviance (MCMC)	This is a classical model comparison diagnostic, (-2log(likelihood)) of model fit.
Parameter trace	Plots the posterior mean of each iteration allowing for an assessment of autocorrelation, ideally should be random, resembling white noise
Kernel density plot	A smoothed plot of the estimated posterior distribution, should approximate the normal distribution
Autocorrelation function (ACF)	Allows for assessment of whether the chain approximates independently identically distributed data, ideally suggests autocorrelation of 0

Partial autocorrelation function (PACF)	Assessment of partial autocorrelation, may have a spike at 1 which suggest Gibbs sampling operates similarly to a first order autoregressive time series
Monte Carlo standard error (MCSE)	Indicates the accuracy of the posterior mean estimate with respect to the number of iterations run, MCSE=SD/ √ n (n=number of iterations). The MCSE is plotted against the number of iterations to allow for calculation of how long to run a chain to reach a desired MCSE value
Raftery-Lewis	The Nhat diagnostic estimates the required Markov Chain length required to estimate a particular quantile (usually 2.5th and 97.5th quantiles) to a particular accuracy to form the credible interval (Raftery & Lewis, 1992)
Brooks-Draper	Estimates the length of Markov Chain length required to estimate the mean of the posterior distribution to a given accuracy (in significant figures)
Effective sample size	A measure of the number of stored iterations divided by the autocorrelation time /which assesses the independence of the chain of iteration. Where the ESS equals the actual chain length, there is an independent chain.

Prior Distribution Specification

All unknown parameters in the model are specified with a prior distribution, default priors were utilised in the models run in this thesis. Default prior distributions are "flat" or "diffuse" for all parameters. Fixed parameters have the prior distribution $p(\beta) \propto 1$. This is an improper uniform prior, which is not a true probability distribution as it does not integrate to 1, however in MlwiN only the posterior distribution is required to be a true or proper distribution. Variance parameters have the prior distribution $p(\Omega{-1}) \sim Wishartp(p, p, \Omega)$ where ˆ p is the number of rows in the variance matrix and Ω is an estimate for the true value ˆ of Ω. The estimate is the value upon which the parameter converged when running the model in IGLS/RIGLS. This is considered a weakly informed prior (Browne, 2019, p.4). Default priors were used in this analysis due to the little information known about the parameter prior to modelling, default priors are indicative of this knowledge deficit (Browne, 2019).

Markov Chain Length Justification

The following sections outline the decision-making process in determining the appropriate Markov Chain Length for each crime category model. Prior to running a model using MCMC estimation starting values must be obtained using quasi-likelihood estimation methods, for all models, first order maximum-quasi likelihood was used to obtain starting values, followed by MCMC estimation using the default setting of 5000 iterations using the Gibbs sampling algorithm.

Household Crime Model

Following the default run, diagnostics were examined, based upon the highest Raftery-Lewis diagnostic statistic for the between neighbourhood worry estimate, and within neighbourhood level worry and victimisation covariance, it was decided to run the model with 100,000 iterations. Despite Raftery-Lewis and Brooks-Draper statistics being above 100,000 for all neighbourhood level variance estimates, this was deemed a large enough initial increase in iterations at this stage. Having reviewed the diagnostics after running the model with 100,000 iterations, based on the highest Raftey-Lewis Nhat statistics, neighbourhood level victimisation variance estimate, the model was re-run with 247,900 iterations. Within this model the Raftery Lewis diagnostic Nhat statistic reduced the expected estimated number of iterations required to 184277. The model was re-run with a Markov Chain length of 185,000, following running this model all coefficients were compared to coefficients from the 247,900 iteration model and were found to be very similar. The deviance MCMC statistic was also almost identical between the 185,000 and 247,900 iteration models, suggesting the additional computational demand of running the model for an additional 65,000 iterations was not resulting in improved model fit (deviance MCMC=178972.534 in 247900 iteration model compared to 178971.700 in 185000 model) therefore a 185,000 iteration Markov chain length is used throughout all household crime models presented in this thesis.

Vehicle Crime Model

This model was also initially run with the default setting of 5000 iterations, based on the diagnostics from this initial model, the model was re-run at 100,000 iterations, this is just above the highest Raftery Lewis diagnostic recommendation (for neighbourhood level worry variance). When analysing diagnostics for the model run on 100,000 iterations, the Raftery Lewis diagnostic for neighbourhood level victimisation variance increased substantially, recommending 126,480 iterations. The model was then run with 126,480 iterations, upon re-examination of the diagnostics in this model, all Raftery Lewis highest diagnostics had been met. There was also a good improvement in the model fit statistic deviance MCMC from 144636.998 to 144578.963. Therefore a 126,480 iteration Markov Chain length is used throughout all vehicle crime models presented in this thesis.

Personal Crime Model

This model was also initially run with default settings of 5000 iterations, followed by re-running this model with 100,000 iterations, although this was somewhat lower than the recommended number of iterations based upon the Raftery-Lewis diagnostics for victimisation and worry covariance, this number of iterations was run due to very high run recommendations particularly for neighbourhood level variance coefficients to see if this number of iterations was necessary. Having run the model with 100,000 iterations and examined the diagnostics, based on the highest Raftery Lewis Nhat diagnostic 283210 iterations were recommended; a model was run with 283,000 iterations. Model coefficients were then compared between the models run with 100,000 and 283,000 iterations and were very similar, there was also no notable difference between the deviance (MCMC) between the two models (179,134.745 in the 100,000 iteration model and 179,134.110 in the 283,210 iteration model), therefore to save computational demand the 100,000 iteration chain length will be used.

Tables summarising diagnostic results which informed the above decisions are included in appendix B.

4.3.2 Research Aim 2: Examining the Effect of Covariates on the Relationship between Victimisation and Worry about Crime

This research aim expands the analysis of the relationship between victimisation and worry about crime, to include the effects of personal, household, and neighbourhood characteristics on both victimisation and worry about crime, and on the relationship between them.

4.3.2.1 The Developed Bivariate Multilevel Probit Model of Victimisation and Worry about Crime

To expand the model as previously described, covariates are introduced into the equation. $x_{pjk}, p = 1,2, \dots, P$ denotes each P covariate in the analysis for respondent j within neighbourhood k. $\beta_{pi}, p = 1,2, \dots, P$ denotes slope coefficients. The expanded model is written as follows:

$$probit(\pi_{ijk}) = \sum_{s=1}^{2} z_{sijk} \, \beta_{0s} + \sum_{p=1}^{P} \beta_{s} x p_{jk} \, u_{0k} + e_{0jk}$$

4.3.2.2 Nested Modelling Strategy

In section 4.2.2 variables selected for inclusion in models are listed in groups, tables 7 and 8 below show the structure of the nested modelling strategy, which will introduce covariates in the formerly presented blocks to gradually increase model complexity. Table 6 shows the model building strategy for household and vehicle crime, and Table 7 shows the model building strategy for the personal crime model.

Table 9 Nested Modelling Strategy for Household and Vehicle Crime Models

Model Stage	Variable Block Entered

1	Null model
2	Individual and household characteristics
3	Contextual variables, region, area types
4	Incivilities rating
5	Interaction terms

Table 10 Nested Modelling Strategy for Personal Crime Model

Model Stage	Variable Block Entered
1	Null model
2	Individual and household characteristics
3	Routine Activities
4	Contextual variables, region, area types
5	Interaction terms

Due to the multilevel structure of the modelling, random effects of covariates were examined, and would have been included in an additional model, however upon the testing of a number of variables, there was no evidence that the effects of these variables differed between neighbourhoods, i.e. no significant random variables were estimated whilst experimenting, using maximum quasi likelihood estimation methods.

4.4 Ethical and Practical Considerations of Secondary Data Analysis

This project did not require ethical approval from the School of Social Science Research Ethics Committee due to being desk-research using only secondary sources and not considered special risk research, as the research does not require the acquisition of security clearances (NTU BLSS CREC, 2019). Although this does not mean an appropriate assessment of probable risks, both ethical and practical must be undertaken. Documentation to confirm this research did not require evaluation by the ethics committee is included in Appendix C.

An initial practical risk involved in this research was the possibility that access to the controlled data (UK Data Service SN 7311) required to define the neighbourhood and merge the 2011 Census data with the CSEW EUL data may not have been achieved. The risk of this hindering the research was considered relatively low due to already having gained approved researcher status from the ONS, and having previously worked responsibly with, and

published research using, secure access CSEW datasets. Should this have not been achieved, the higher statistical geography available in EUL datasets of the Government Office Region was considered, as although the neighbourhood focus is lost, social capital research has used similar larger area sizes.

Having gained approval to use low-level geographical CSEW data considerations must be made due to the data being potentially identifiable through locating individuals within small geographical regions, alongside providing a detailed profile of an individual including identifiable characteristics such as gender, age and income. In theory, the use of this data could lead to identification of a particular individual, unintentionally or otherwise. Respondents to the survey are assured that "statistics produced will not identify you or anyone in your household" (Kantar, 2015, para. 1), to alleviate the risk of this occurring, and the publication of potentially disclosive information, access to this data and the outputs made from it are closely regulated. Prior to release of the data to researchers within the secure lab environment the data is examined and treated to protect any confidentiality concerns, and all outputs produced within the secure lab environment are subject to statistical disclosure control to confirm that the results are non-identifiable before release to the researcher. These processes negate risk to the survey respondents.

For the researcher, all considered risks are not above those of using a workstation with display screen equipment, for which appropriate training to ensure safe set up has been undertaken.

5.0 Analysing the Relationship Between Victimisation and Worry about Crime, and the

Effects of Personal and Neighbourhood Characteristics on this Relationship

This chapter reports on the baseline relationship between having been a victim of

crime and being worried about crime. This chapter initially presents information on the

prevalence of victimisation and worry, dividing this into the underlying crime subtypes which

make up the analytical crime type categories of household, vehicle and personal crime for both

victimisation and worry. Following this, whether victimisation experiences and worries are

significantly associated at the individual level is investigated, with the relative odds of victims

being worried about crime compared to non-victims. Inferential statistics are then used to

estimate the relationship between victimisation and worry within individuals and between

neighbourhoods.

5.1 The Prevalence of Victimisation and Worry about Crime in England and Wales

between 2014 and 2018

This section presents the counts and proportions of respondents experiencing

victimisation and worry about each crime type. These crime types are also broken down into

the subtypes underlying the analytical variables.

5.1.1 Victimisation

This section provides an overview of victimisation via descriptive statistics based on

relevant CSEW data.

Table 11 overleaf shows that, overall, a small minority of the population experience

victimisation. Examining the results from the full dataset, the most prevalent victimisation

type is vehicle victimisation, with 6.3% of the sample victimised, followed by household

victimisation, with 5.3% of the sample victimised. The least prevalent crime type is personal

crime, with just 3.6% of the sample victimised. Proportions differed slightly between results

from the full dataset compared to analysis subdatasets. Statistics from the analysis subdatasets

show that vehicle victimisation remained the most prevalent crime type experienced, the

proportion of victims increased from 6.3% to 7.4%, this is hypothesised to be due to the worry

about vehicle crime questions only being asked to those who reported vehicle ownership

within the survey, who would of course be exposed to vehicle crime. Smaller changes in

proportions occurred in household and personal crime subdataset, with household crime

having a prevalence rate of 5.4% (compared to 5.3%), and personal crime having a prevalence

rate of 3.4% (compared to 3.6%). The proportion of the population victimised is also presented

as a mean with a standard deviation, this is to allow direct comparability with the regression

model output presented later in this chapter.

Table 11 Proportion of the Sample Experiencing Household, Vehicle and Personal Victimisation

Crime Type	Full dataset		Analysis subdatasets		
	Victims (%)	Non-victims (%)	Victims (%)	Non-victims (%)	Mean (s.d)
Household	7325 (5.3)	131482 (94.7)	1708 (5.4)	30151 (94.6)	0.054 (0.223)
Vehicle	8755 (6.3)	130052 (93.7)	1908 (7.4)[9]	23943 (92.6)	0.074 (0.261)
Personal	4995 (3.6)	133812 (96.4)	1087 (3.4)	30632 (96.6)	0.034 (0.182)
n=138,807 for full dataset. n= 31,859 (household crimes sub-dataset), 25,851 (vehicle crimes sub-dataset), 31,719 (personal crimes sub-dataset)					

Household victimisation was formed by merging the crime subtypes: burglary; home

vandalism; and other household theft, Table 12 overleaf presents statistics on this. Of these

crime subtypes, other household theft was the most prevalent, with 3.0% of respondents

experiencing this crime subtype, followed by burglary which was experienced by 1.6% of

respondents, and finally home vandalism, experienced by 1.1%. Vehicle victimisation was

formed by merging the subtypes: theft of vehicle; theft from vehicle; bike theft; attempted

theft; and vehicle criminal damage. The most prevalent vehicle victimisations were criminal

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[9] Questions of worry about car being stolen/having something stolen from car only asked to those who stated they had access to a car within the year prior to interview.

damage and theft from a vehicle, experienced by 3.1% and 2.8% of the sample, respectively.

0.9% of respondents experienced bike theft, 0.7% experienced attempted thefts, and the least

prevalent crime type experienced was theft of a vehicle, at just 0.3% of respondents. Personal

victimisation was formed by merging the crime subtypes: wounding; common assault; theft

from the person; robbery; and other acquisitive crime. The most prevalent personal crimes

experienced were other acquisitive crime and common assault, both experienced by 1.2% of

respondents, followed by theft from the person, experienced by 0.6% of the sample, and

wounding, experienced by 0.4% of respondents. The least prevalent type of personal crime

was robbery, experienced by just 0.2% of the sample.

Table 12 *Proportion of the Sample Experiencing Underlying Crime types within Household, Vehicle,*
and Personal Victimisation

Crime Type	Victims (%)	Non-victims (%)
Household	1708 (5.4)	30151 (94.6)
Burglary	497 (1.6)	31362 (98.4)
Home vandalism	340 (1.1)	31519 (98.9)
Other household theft	948 (3.0)	30911 (97.0)
Vehicle	1908 (7.4)	23943 (92.6)
Theft of Vehicle	71 (0.3)	25780 (99.7)
Theft from vehicle	729 (2.8)	25122 (97.2)
Bike theft	232 (0.9)	25619 (99.1)
Attempted thefts	176 (0.7)	25675 (99.3)
Vehicle criminal damage	813 (3.1)	25038 (96.9)
Personal	1087 (3.4)	30632 (96.6)
Wounding	130 (0.4)	31589 (99.6)
Common Assault	371 (1.2)	31348 (98.8)
Theft from the Person	205 (0.6)	31514 (99.4)
Robbery	58 (0.2)	31661 (99.8)
Other acquisitive crime	381 (1.2)	31338 (98.8)

n=31859 (household crime sub-dataset), 25851 (vehicle crime sub-dataset), 31719 (personal
crime sub-dataset)

Note the percentages and counts here do not add up to those within the victims (%)

column of the analysis subdataset in Table 1, due to some respondents experiencing more than

one subtype of household, vehicle, or personal victimisation. These individuals are therefore

repeat victims.

5.1.2 Worry about Crime

This section discusses the prevalence of worry about victimisation found within the

CSEW.

Table 13 Proportion of the Sample Worried about Household, Vehicle, and Personal Crime

	Worried (%)	Not worried (%)	Mean (s.d)
Household	11203 (35.2)	20656 (64.8)	0.352 (0.477)
Vehicle	7867 (30.4)	17984 (69.6)	0.304 (0.460)
Personal	10190 (32.1)	21529 (67.9)	0.321 (0.467)
n=31859 (household crime sub-dataset), n=25851 (vehicle crime sub-dataset), n=31719 (personal crime sub-dataset)			

Table 13 above presents descriptive statistics regarding worry about crime. The crime

type which respondents with the highest prevalence of worry was household crime, with

35.2% of respondents reporting to be either very or fairly worried. This was followed by

personal crime, with 32.1% of the survey being worried about personal crime. The crime type

which respondents were least commonly worried about was vehicle crime, with 30.4% of

respondents stating they were worried. Again, the proportion is also presented as a mean with

standard deviation to allow direct comparability with the regression model output.

Table 14 Worry about Crime Descriptives Breakdown

	Worried (%)	Not worried (%)
Household	11203 (35.2)	20656 (64.8)
Burglary	11203 (35.2)	20656 (64.8)
Vehicle	7867 (30.4)	17984 (69.6)
Theft of car	5561 (21.5)	20287 (78.5)
Theft from car	6413 (24.8)	19407 (75.1)[10]
Personal	10190 (32.1)	21259 (67.9)
Physical assault	7938 (25.0)	23750 (74.9)
Mugging	8307 (26.2)	23378 (73.7)
n=31859 (household crime sub-dataset), n=25851 (vehicle crime sub-dataset), n=31719 (personal crime sub-dataset)		

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[10] A small number of respondents had missing data for either worry about car theft or worry about theft from car. These persons had answered other vehicle worry question, therefore remained within the analysis dataset due to the merging of the composite variable.

The only worry about crime question regarding household crime in the CSEW asked individuals how worried they were about becoming a victim of burglary; therefore this crime type cannot be broken down further. With regard to vehicle victimisation, respondents were asked how worried they were about: having their car stolen; or having something stolen from their car. More individuals were worried about theft from their car, at 24.8% of respondents, than theft of a car, at 21.5% of respondents. With regard to personal victimisation, respondents were asked how worried they were about: physical assault; and mugging. A similar proportion of respondents were worried about each of these, with 25% of the population worried about being physically assaulted, and 26.2% worried about being mugged.

Note here that the proportions of individuals being worried about the more specific crime types under vehicle and personal crime categories are somewhat lower than when grouped together, evidencing that a number of individuals were worried about having their car stolen, but not worried about having items from their car stolen, and vice versa, and worried about being a victim of physical assault, but not mugging, and vice versa. The proportion of individuals specifically worried about burglary was substantially higher than those worried about specific elements of vehicle and personal crime, therefore should individuals have been asked whether they were worried about other types of household crime, particularly home vandalism, the proportion worried about overall household crime may have been higher.

5.2 Examining the Association between Victimisation and Worry about Crime at the Individual Level

This section presents data showing the distribution of worry about crime within victimisation status of household, vehicle and personal crime variable pairs, as well as for the underlying variables making up the analytical variables. The Chi-square test of association and associated p-value are reported to determine whether a statistically significant relationship

exists between the victimisation type and worry type. Odds ratios are presented to quantify the

differing odds of being worried about crime between victims, someone who **has been**

victimised in the year prior, and non-victims, someone who **has not** *been victimised* in the year

prior.

5.2.1 Household Crime

Table 15 below shows a crosstabulation of the relationship between household

victimisation and worry about household crime. Table 16 breaks down the household crime

type into subtypes, with crosstabulations showing the relationship between worry about

burglary, and each household victimisation subtype.

Table 15 Crosstabulation to examine the relationship between household victimisation and worry about household crime

	Not worried about household crime	Worried about household crime
Not a victim of household crime	19892 (66.0%)	10259 (34.0%)
Victim of household crime	764 (44.7%)	944 (55.3%)
Chi-square	(χ2 (1, N=31,859) = 319.971, *p* =0.000)	
Odds-ratio	2.40	

The chi-square test of association confirms a very highly statistically significant

association between household victimisation and worry about household crime, meaning the

results are generalisable to the adult population of England and Wales. 34% of victims were

worried about household crime, compared to 55.3% of non-victims. The odds ratio calculation

estimates victims of household crime to have almost 2 and a half times the odds of being

worried than non-victims.

Table 16 Crosstabulation to examine the relationship between household victimisation and worry about household crime

	Not worried about burglary	Worried about burglary
Not a victim of burglary	20483 (65.3)	10879 (34.7)
Victim of burglary	173 (34.8)	324 (65.2)
Chi-square (p-value)	(χ2 (1, N=31,859) = 199.658, p =0.000)	
Odds-ratio	3.53	
Not a victim of home vandalism	20510 (65.1)	11009 (34.9)
Victim of home vandalism	146 (42.9)	194 (57.1)
Chi-square (p-value)	(χ2 (1, N=31,859) =72.259, p =0.000)	
Odds-ratio	2.47	
Not a victim of other household theft	20192 (65.3)	10719 (34.7)
Victim of other household theft	464 (48.9)	484 (51.1)
Chi-square (p-value)	(χ2 (1, N=31,859) =108.215, p =0.000)	
Odds-ratio	1.96	

Chi-square tests of association demonstrated highly statistically significant relationships between worry about burglary and all household crime subtypes: burglary; home vandalism; and other household theft. 34.7% of non-victims were worried about burglary, compared to 65.2% of victims, this is a substantially higher proportion of victims worried in comparison to other household crime subtypes, and overall household crime. This resulted in an odds ratio of victims of burglary having approximately 3 and a half times the odds of being worried about burglary than non-victims. Vandalism and other household theft victimisation had slightly smaller effects on experiencing worry about burglary, with victims of home vandalism having approximately 2 and a half times the odds of being worried than non-victims, and victims of other household theft having just under twice the odds of experiencing worry about burglary than non-victims.

5.2.2 Vehicle Crime

Table 17 overleaf shows a crosstabulation of the relationship between vehicle

victimisation and worry about vehicle crime. Tables 18 and 19 break down vehicle crime

victimisation and worry measures into their subtypes. Each crosstabulation in Table 18 shows

the relationship between worry about *theft of* vehicle, and each vehicle victimisation subtype,

and each crosstabulation in Table 19 shows the relationship between worry about *theft from*

vehicle, and each vehicle victimisation subtype.

Table 17 Crosstabulation to examine the relationship between vehicle victimisation and worry about vehicle crime

	Not worried about vehicle crime	Worried about vehicle crime	Total
Not a victim of vehicle crime	17091 (71.4)	6852 (28.6)	
Victim of vehicle crime	893 (46.8)	1015 (53.2)	
Chi-square	(χ2 (1, N=25,851) =504.279, *p* =0.000)		
Odds-ratio	2.84		

The chi-square test of association confirms a highly statistically significant relationship

between vehicle victimisation and worry about vehicle crime. 53.2% of victims of vehicle

crime were worried about vehicle crime, compared to the much lower proportion of 28.6% of

non-victims. The odds ratio calculation estimates victims of vehicle crime to have almost three

times the odds of being worried about vehicle crimes than non-victims.

A highly statistically significant relationship (p=0.000) was found between all vehicle

victimisation crime subtypes and worry about vehicle theft, confirming results can be

generalised to the adult population of England and Wales. Victims of vehicle theft are

estimated to have almost two and three quarters times the odds of being worried about vehicle

theft compared to non-victims. A similar odds ratio (2.73) was found between attempted theft

victimisation and worry about vehicle theft. Being a victim of theft from a vehicle had a

smaller effect on the odds of being worried, estimated to have approximately two and a quarter

times higher odds than non-victims. The effect of being a victim of vehicle criminal damage

was smaller still, with victims having just over double the odds of being worried about vehicle

theft. Victims of bike theft had the smallest odds increase on being worried about vehicle theft,

estimated to have almost 70% higher odds of being worried than non-victims.

Table 18 Crosstabulation to examine the relationship between worry about theft of vehicle and vehicle
theft, theft from vehicle, bike theft, attempted theft, and vehicle criminal damage

	Not worried about theft of vehicle	Worried about theft of vehicle
Not a victim of vehicle theft	20246 (78.5%)	5531 (21.5%)
Victim of vehicle theft	41 (57.7%)	30 (42.3%)
Chi-square	(χ2 (1, N=25,848) =18.135, p =0.000)	
Odds-ratio	2.68	
Not a victim of theft from vehicle	19380 (78.9%)	5289 (21.1%)
Victim of theft from vehicle	457 (62.7%)	272 (37.3%)
Chi-square	(χ2 (1, N=25,848) =110.865, p =0.000)	
Odds-ratio	2.23	
Not a victim of bike theft	20128 (78.6%)	5488 (21.4%)
Victim of bike theft	159 (68.5%)	73 (31.5%)
Chi-square	(χ2 (1, N=25,848) =13.729, p =0.000)	
Odds-ratio	1.68	
Not a victim of attempted theft	20186 (78.6%)	5486 (21.4%)
Victim of attempted theft	101 (57.4%)	75 (42.6%)
Chi-square	(χ2 (1, N=25,848) =46.720, p =0.000)	
Odds-ratio	2.73	
Not a victim of vehicle criminal damage	19762 (78.9%)	5273 (21.1%)
Victim of vehicle criminal damage	525 (64.6%)	288 (35.4%)
Chi-square	(χ2 (1, N=25,848) =96.187, p =0.000)	
Odds-ratio	2.06	

A highly statistically significant relationship (p=0.000) was found between all vehicle victimisation crime subtypes and worry about vehicle theft, confirming results can be generalised to the adult population of England and Wales. Victims of vehicle theft are estimated to have almost two and three quarters times the odds of being worried about vehicle theft compared to non-victims. A similar odds ratio (2.73) was found between attempted theft victimisation and worry about vehicle theft. Being a victim of theft from a vehicle had a smaller effect on the odds of being worried, estimated to have approximately two and a quarter times higher odds than non-victims. The effect of being a victim of vehicle criminal damage was smaller still, with victims having just over double the odds of being worried about vehicle theft. Victims of bike theft had the smallest odds increase on being worried about vehicle theft, estimated to have almost 102% higher odds of being worried than non-victims.

Table 19 Crosstabulation to examine the relationship between worry about theft from a vehicle and vehicle theft, theft from vehicle, bike theft, attempted theft, and vehicle criminal damage

	Not worried about theft from vehicle	Worried about theft from vehicle
Not a victim of vehicle theft	19363 (75.2%)	6386 (24.8%)
Victim of vehicle theft	44 (62.0%)	27 (38.0%)
Chi-square	(χ2 (1, N=25,820) =6.636, *p* =0.010)	
Odds-ratio	1.86	
Not a victim of theft from vehicle	19096 (76.1%)	5997 (23.9%)
Victim of theft from vehicle	311 (42.8%)	416 (57.2%)
Chi-square	(χ2 (1, N=25,820) =420.238, *p* =0.000)	
Odds-ratio	4.26	
Not a victim of bike theft	19268 (75.3%)	6321 (24.7%)
Victim of bike theft	139 (60.2%)	92 (39.8%)
Chi-square	(χ2 (1, N=25,820) =28.053, *p* =0.000)	
Odds-ratio	2.02	
Not a victim of attempted theft	19332 (75.4%)	6312 (24.6%)
Victim of attempted theft	75 (42.6%)	101 (57.4%)
Chi-square	(χ2 (1, N=25,820) =100.566, *p* =0.000)	
Odds-ratio	4.12	
Not a victim of vehicle criminal damage	18945 (75.8%)	6062 (24.2%)

	Not worried about theft from vehicle	Worried about theft from vehicle
Victim of vehicle criminal damage	462 (56.8%)	351 (43.2%)
Chi-square	($\chi2$ (1, N=25,820) =151.179, p =0.000)	
Odds-ratio	2.38	

A very highly statistically significant relationship (p=0.000) was found between most vehicle victimisation crime subtypes and worry about theft from vehicle, whilst still statistically significant, evidence for a relationship between vehicle theft victimisation and worry about theft from vehicle was slightly weaker (p=0.010).

The effects of victimisation differed substantially between crime subtypes. Victims of vehicle theft, and victims of bike theft are estimated to have approximately double the odds of being worried about theft from a vehicle, than non-victims, the increase in odds was slightly smaller (1.86) for theft of vehicle, than theft of bike (2.02). Victims of vehicle criminal damage are expected to have almost two and half times the odds of being worried about theft from a vehicle compared to non-victims. Being a victim of theft from a vehicle, and being a victim of attempted theft, either of or from a vehicle, was associated with highly increased odds of being worried about theft from vehicle, with victims of these crimes having over four times the odds of being worried than non-victims.

5.2.3 Personal Crime

Table 20 below shows a crosstabulation of the relationship between household victimisation and worry about household crime. Tables 11 and 12 divide the personal crime type into subtypes, with each crosstabulation showing the relationship between worry about physical attack, and each victimisation subtype, and worry about mugging, and each victimisation subtype.

Table 20 Crosstabulations to examine the relationship between worry about personal crime and personal crime victimisation

	Not worried about personal crime	Worried about personal crime
Not a victim of personal crime	20942 (68.4)	9690 (31.6)
Victim of personal crime	587 (54.0)	500 (46.0)
Chi-square (p-value)	(χ2 (1, N=31,719) =99.337, p =0.000)	
Odds-ratio	1.84	

The chi-square test of association confirms a very highly statistically significant association between personal victimisation and worry about personal crime, confirming results are generalisable. 31.6% of non-victims of personal crime were found to be worried about experiencing personal crime, the percentage of victims who reported being worried about experiencing personal crime was higher, at 46%. The odds ratio estimates that victims of personal crime have almost double the odds of being worried than non-victims.

Table 21 Crosstabulations to examine the relationship between worry about physical attack and being a victim of wounding, common assault, theft from the person, robbery, and other acquisitive crime

	Not worried about physical attack	Worried about physical attack
Not a victim of wounding	23682 (75.0%)	7876 (25.0%)
Victim of wounding	68 (52.3%)	62 (47.7%)
Chi-square	(χ2 (1, N=31,688) =35.642, p =0.000)	
Odds-ratio	2.74	
Not a victim of common assault	23524 (75.1%)	7793 (24.9%)
Victim of common assault	226 (60.9%)	145 (39.1%)
Chi-square	(χ2 (1, N=31,688) =39.374, p =0.000)	
Odds-ratio	1.94	
Not a victim of theft from the person	23627 (75.0%)	7856 (25.0%)
Victim of theft from the person	123 (60.0%)	82 (40.0%)
Chi-square	(χ2 (1, N=31,688) =24.561, p =0.000)	
Odds-ratio	2.00	
Not a victim of robbery	23723 (75.0%)	7907 (25.0%)
Victim of robbery	27 (46.6%)	31 (53.4%)
Chi-square	(χ2 (1, N=31,688) =24.958, p =0.000)	
Odds-ratio	3.44	

	Not worried about physical attack	Worried about physical attack
Not a victim of other personal acquisitive	23496 (75.1%)	7811 (24.9%)
Victim of other personal acquisitive	254 (66.7%)	127 (33.3%)
Chi-square	(χ2 (1, N=31,688) =14.091, p =0.000)	
Odds-ratio	1.50	

A highly statistically significant (p=0.000) relationship was found between all personal

victimisation crime subtypes and worry about physical attack. Having been a victim of a

robbery had the strongest effect on being worried about physical attack, with 53.4% of victims

worried, compared to 25% of non-victims. The odds ratio estimates victims of robbery to have

almost three and a half times the odds of being worried about physical attack than non-victims.

Victims of wounding also had substantially higher odds of being worried than non-victims,

with victims having approximately two and three quarters times higher odds of being worried.

Both being a victim of common assault and theft from the person increased the odds of being

worried about physical attack twofold in comparison to non-victims. The victimisation type

which had the smallest effect on risk of being worried about physical attack was other personal

acquisitive crime, victims of which had 50% higher odds of being worried than non-victims.

Table 22 Crosstabulations to examine the relationship between worry about mugging and being a victim of wounding, common assault, theft from the person, robbery, and other acquisitive crime

	Not worried about mugging	Worried about mugging
Not a victim of wounding	23290 (73.8%)	8265 (26.2%)
Victim of wounding	88 (67.7%)	42 (32.3%)
Chi-square	(χ2 (1, N=31,685) =2.503, p =0.114)	
Odds-ratio	1.34	
Not a victim of common assault	23121 (73.8%)	8193 (26.2%)
Victim of common assault	257 (69.3%)	114 (30.7%)
Chi-square	(χ2 (1, N=31,685) =3.948, p =0.047)	
Odds-ratio	1.25	
Not a victim of theft from the person	23254 (73.9%)	8226 (26.1%)

	Not worried about mugging	Worried about mugging
Victim of theft from the person	124 (60.5%)	81 (39.4%)
Chi-square	($\chi2$ (1, N=31,685) =18.853, p =0.000)	
Odds-ratio	1.85	
Not a victim of robbery	23356 (73.8%)	8271 (26.2%)
Victim of robbery	22 (37.9%)	36 (62.1%)
Chi-square	($\chi2$ (1, N=31,685) =38.610, p =0.000)	
Odds-ratio	4.62	
Not a victim of other personal acquisitive	23121 (73.9%)	8183 (26.1%)
Victim of other personal acquisitive	257 (67.5%)	124 (32.5%)
Chi-square	($\chi2$ (1, N=31,685) =7.984, p =0.005)	
Odds-ratio	1.36	

Excluding having been a victim of wounding (p=0.114), a statistically significant relationship was found between being a victim of all other personal crime subtypes and being worried about mugging, although the results of the chi-square test of associations between crime subtypes and worry about mugging were substantially lower then between the crime subtypes and worry about physical attack.

As was the case with worry about physical attack, having been a victim of robbery had the strongest effect on risk of worry, with 62.1% of robbery victims worried about being mugged, compared to 26.2% of non-victims. The odds ratio estimates robbery victims to have over 4 and a half times the odds of being worried than non-victims. All other subtypes of personal victimisation had a smaller effect on the odds of being worried about victimisation, with victims of theft from the person estimated to have almost twice the odds of being worried about mugging than non-victims, victims of other personal acquisitive crime are expected to have 36% higher odds of being worried than non-victims, and victims of common assault were expected to have 25% higher odds than non-victims. Victims of wounding were estimated to have almost 35% higher odds of being worried than non-victims, however there was not sufficient evidence to generalise to the wider population.

Findings on the relationship between victimisation and worry are discussed in relation

to the victimisation theory of fear of crime in section 7.1.1 in the discussion chapter.

5.3 Null Bivariate Multilevel Models

This section presents findings on the relationship between victimisation and worry

about crime at the individual and neighbourhood level. The multilevel and bivariate dependent

variable structure allows for the estimation of the variance in victimisation and worry between

neighbourhoods, as well as the covariance and correlation of victimisation and worry within

neighbourhoods and estimates of the correlation between victimisation and worry at the

individual level.

5.3.1 Household Crime

Table 23 overleaf presents the results of the null bivariate model examining the

relationship between household victimisation and worry about household crime. The constants

are presented for both dependent variables within the model, presented as the mean and

standard deviation of the posterior distribution of estimates throughout the Markov Chain,

95% and 90% credible intervals are also presented based on these posterior distributions, these

represent the range within which the most likely values of the coefficient lie. Due to this

model using the probit link function, constant coefficients are presented in probits, to assist in

the understanding of these, predicted probabilities are also presented.

Table 23 Null model to estimate correlation between household victimisation and worry about household crime at the neighbourhood and individual level

	Posterior mean (S.D)	95% Credible interval	90% credible interval	Predicted Probability
Victim constant	-1.645 (0.018)	-1.681, -1.613	-1.675, -1.617	5.0%
Worry constant	-0.388 (0.008)	-0.404, -0.372	-0.401, -0.375	34.9%
Neighbourhood level				
Victim variance	0.044 (0.016)	0.018, 0.081	0.021, 0.074	
Worry variance	0.056 (0.008)	0.041, 0.072	0.043, 0.072	
V/W covariance	0.026 (0.008)	0.011, 0.041	0.013, 0.038	
V/W correlation	0.513			

	Posterior mean (S.D)	95% Credible interval	90% credible interval	Predicted Probability
Individual Level				
V/W Covariance	0.237 (0.016)	0.206, 0.268	0.211, 0.263	
V/W correlation	0.237			
Deviance	178971.700			
Estimation	MCMC 185000 Gibbs			
n=31859 (within 7088 neighbourhoods) mean no. level 1 units=4.49, s.d=2.45[11]				

The model predicts the risk of being a victim of household crime to be 5.0% and the risk of being worried about household crime at 34.9%, these closely coincide with the proportions presented in Table 11 of section 5.1.1 and Table 13 of section 5.1.2 (5.4% of the sample victimised, and 35.2% of the sample worried), which demonstrated the model is representing the data with high accuracy. The 90% and 95% credible intervals are also relatively small, given the small standard deviation of the posterior distribution in relation to the mean.

At this stage of the analysis, of most interest in the model is the random part. The model estimates the between neighbourhood variance in victimisations to be 0.044, examining the standard deviation of the posterior distribution (0.008) and the 90% (0.043, 0.072) and 95% (0.041, 0.072) credible intervals, it can be said with good certainty that household victimisation does vary between neighbourhoods. With even greater certainty, due to the higher posterior mean, lower standard deviation of the posterior distribution and smaller credible intervals, it can be concluded that worry about household crime varies between neighbourhoods. Having concluded that both household victimisation and worry about

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[11] This research clusters individuals within their neighbourhood to allow for estimates of the correlation between victimisation and worry about crime at the neighbourhood level. For the household model the dataset contained 31859 individuals grouped within 7088 neighbourhoods. The average (mean) number of individuals within each neighbourhood is 4.49, with a standard deviation of 2.45. Minimum and maximum number of people sampled within a neighbourhood are not shown due to not reaching the minimum required cell counts to pass statistical disclosure control.

household crime vary between neighbourhoods, the covariance between these is then

examined to determine whether victimisation and worry are clustered within the same

neighbourhoods. The estimates suggest that victimisation and worry about household crime do

co-vary within neighbourhoods, the standard deviation of the posterior distribution is small

(0.008) relative to the mean (0.026), and the lower value of the credible intervals (95%

0.011,0.041/90% 0.013,0.038) remain well above 0. This result means that in the

neighbourhoods where there are higher levels of worry, there are also higher levels of

victimisation. The model estimates the correlation between victimisation and worry within the

neighbourhoods to be 0.513. This estimate is based on the posterior mean rather than the

credible interval, so the correlation could be somewhat higher or lower in the population.

At the individual level, the covariance between household victimisation and worry

about household crime was estimated at 0.237, due to the specification of level one of this

model, the covariance and correlation estimate are the same. The standard deviation of the

posterior distribution (0.016) is very small relative to its mean (0.237), therefore it can be

concluded with confidence that the correlation between experiencing a household

victimisation and being worried about household crime is close to this 0.237 estimate in the

population.

5.3.2 Vehicle Crime

Table 24 below presents the results of the null bivariate model examining the

relationship between vehicle victimisation and worry about vehicle crime. Constants are

presented for both dependent variables within the model, presented as the posterior mean and

standard deviation of the posterior distribution of estimates throughout the Markov Chain,

95% and 90% credible intervals are also presented based on these posterior distributions, these

represent the 95% and 90% most likely values of the coefficient. Constant coefficients are

presented in probits, to assist in the understanding of these, predicted probabilities are also

presented.

Table 24 Null model to estimate correlation between vehicle victimisation and worry about vehicle crime at the neighbourhood and individual level

	Posterior mean (S.D)	95% Credible interval	90% credible interval	Predicted Probability
Victim constant	-1.483 (0.015)	-1.515, -1.482	-1.509, -1.458	6.9%
Worry constant	-0.521 (0.009)	-0.538, -0.503	-0.536, 0.506	30.1%
Neighbourhood level				
Victim variance	0.057 (0.015)	0.032, 0.090	0.035, 0.083	
Worry variance	0.061 (0.010)	0.042, 0.080	0.045, 0.076	
V/W covariance	0.048 (0.009)	0.031, 0.065	0.034, 0.062	
V/W correlation	0.807			
Individual Level				
V/W Covariance	0.282 (0.016)	0.251, 0.313	0.256, 0.308	
V/W correlation	0.282			
Deviance	144578.963			
Estimation	MCMC 126480 Gibbs			
n=25851 (within 6819 neighbourhoods) mean no. level 1 units=3.791, s.d=2.30				

The model predicts the risk of being a victim of vehicle crime to be 6.9%, and the risk

of being worried about vehicle crime to be 30.1%, this closely matches the proportions in the

dataset presented in Tables 11 and 13 (7.4% of respondents victimised, 30.4% worried). The

90% and 95% credible intervals are also relatively small, given the small standard deviation of

the posterior distribution.

This model estimates allow for the conclusion that levels of vehicle victimisation do

vary between neighbourhoods, due to the standard deviation of the posterior distribution

(0.015) being small relative to the posterior mean (0.057), the lower value of the credible

interval is also well above 0 (95% 0.032,0.090/ 90% 0.034,0.062). The estimate for the

between neighbourhood variation in worry (0.061) is very similar to victimisation, and it can

be concluded that the prevalence of worry differs between neighbourhoods due to the

comparatively low standard deviation (0.010) of the posterior distribution of this parameter

estimate. The covariance between vehicle victimisation and worry about vehicle crime is also

relatively high (0.048) compared to the standard deviation of the posterior distribution (0.009).

The correlation estimate here is very high at 0.807, although this could be lower or higher in

the population given the spread of the 90% (0.031,0.065) and 95% (0.034,0.062) credible

intervals. At the individual level, victimisation and worry are found to be relatively highly

correlated at 0.282, examining the standard error of the posterior distribution (0.016), and the

credible intervals (90% 0.251,0.313/90% 0.256,0.308), it is highly likely that this estimate is

close to the true value within the population.

5.3.3 Personal Crime

Table 25 below presents the results of the null bivariate model examining the

relationship between personal victimisation and worry about personal crime. Constants are

presented for both dependent variables within the model, presented as the posterior mean and

standard deviation of the posterior distribution of estimates throughout the Markov Chain,

95% and 90% credible intervals are also presented based on these posterior distributions, these

represent the 95% and 90% most likely values of the coefficient. Constant coefficients are

presented in probits to assist in the understanding of these, predicted probabilities are also

presented.

Table 25 Null model to estimate correlation between personal victimisation and worry about personal crime at the neighbourhood and individual level

Coefficient	Posterior mean (S.D)	95% Credible interval	90% credible interval	Predicted Probability
Victim constant	-1.843 (0.018)	-1.882, -1.810	-1.874, -1.815	3.2%
Worry constant	-0.476 (0.008)	-0.493,-0.460	-0.490,-0.463	31.7%
Neighbourhood level				
Victim variance	0.025 (0.013)	0.007, 0.057	0.009, 0.049	
Worry variance	0.082 (0.009)	0.065, 0.100	0.068, 0.097	
V/W covariance	0.008 (0.009)	-0.009, 0.025	-0.007,0.022	
V/W correlation	0.168			
Individual Level				
V/W Covariance	0.166 (0.019)	0.129-0.202	0.134, 0.197	

Coefficient	Posterior mean (S.D)	95% Credible interval	90% credible interval	Predicted Probability
V/W correlation	0.166			
Deviance	179134.745			
Estimation	MCMC 100000 Gibbs			
N=31719 (within 7088 neighbourhoods) mean no. Level 1 units=4.475, s.d=2.45				

This model predicts the risk of being a victim of personal crime to be 3.2%, and the

risk of being worried about personal crime to be 31.7%, closely matching the frequencies

presented in Tables 11 and 13 of section 5.1 (victim % 3.4, worry % 32.1), suggesting the

model is representing the data well.

In contrast to the previous models, the estimates within this model do not provide very

strong evidence for there being substantial variation in victimisation between neighbourhoods,

with a substantially lower posterior mean (0.025) of the variance estimate, and much larger

standard deviation (0.013), and the lower value of the credible intervals falling close to zero

(95% **0.007**,0.057/90% **0.009**,0.049). There is good evidence for variation in levels of worry

about personal crime between neighbourhoods, with a high posterior mean (0.082) and low

standard deviation (0.009), the credible intervals (95% 0.065,0.100/90% 0.068,0.097) suggest

it is highly likely that a good amount of variation in levels of worry exists between

neighbourhoods, as these remain quite high and close to the posterior mean. The posterior

mean (0.008) of the estimate for covariance between victimisation and worry does not suggest

there is any covariance between victimisation and worry within neighbourhoods due to the

standard deviation of the posterior distribution (0.009) being higher than the posterior mean.

The negative lower bounds of the credible intervals (95% -0.009,0.025/90% -0.007,0.022)

demonstrate that the true value of this parameter may well be zero or below. The estimate for

the correlation between experiencing a personal victimisation and worry is quite low at 0.168,

however given the credible intervals for the posterior mean from which the correlation is

estimated, the population correlation may be much lower, possibly a negative correlation, or somewhat higher.

At the individual level the correlation coefficient (0.166) is very similar to the neighbourhood level, however the credible intervals for the associated covariance coefficient are much closer to the coefficient estimate (95% 0.129,0.202/ 95% 0.134,0.197), evidencing this is a much more accurate estimate, although the correlation between personal victimisation and worry about personal crime remains relatively low.

5.4 Summary of Findings

Descriptive statistics demonstrated that the vast majority of individuals are not victims of crime. The most prevalent victimisation was vehicle victimisation, at 6.3%, followed by household at 5.3%, and finally, personal at 3.6%. Approximately one-third of individuals reported being worried about each crime type, the crime type for which worry was most prevalent was household, followed by personal, and then vehicle. A highly statistically significant relationship was found between victimisation and worry for all crime types, with victims having between 2- and 3-times higher odds of being worried than non-victims in all cases. Relationships found between worry and victimisation for each crime type were overwhelmingly supported by statistically significant relationships between underlying variables, with only one exception. In all cases victims had higher odds of being worried than non-victims, with effect size ranging from 50% higher odds, to 462% higher odds.

All BVML models are concluded to well represent the data, with percentage predictions calculated from the model constants near duplicating the descriptive statistics for both worry and victimisation. In the random part of the models, at the neighbourhood level, good evidence was found of variation in household and vehicle victimisation prevalence between neighbourhoods, however not for personal victimisation. Strong evidence was found for variation in prevalence of worry between neighbourhoods for all crime types, where all

means are substantially higher than standard deviations in the posterior distributions of these coefficient estimates.

Estimates of covariance and correlation between victimisation and worry varied widely between crime types. The strongest evidence for neighbourhood level covariance of worry and victimisation was found in vehicle crime, with an estimated correlation of 0.807. Diagnostics suggest the true value would be close to this in the population. Good, although weaker, evidence was provided for covariance between worry and victimisation was found in the household model, estimated at 0.513, however there is more variability around this estimate for where the true population value lies. No good evidence of any correlation between victimisation and worry was found for personal crime. At the individual level, strong evidence of a low to moderate correlation between worry and victimisation was found for all crime types, estimated at 0.166 for personal crime, 0.237 for household crime, and 0.282 for vehicle crime. in all cases there is some variability around these estimates in which the true population value would most likely fall, however this variability is not substantial.

Further discussion of these results in relation to victimisation theory of fear of crime, and the indirect victimisation model is found in section 7.1.2 of the discussion.

6.0 Analysing the Relationship Between Victimisation and Worry about Crime, and the Effects

of Personal and Neighbourhood Characteristics on this Relationship

6.1 Introduction

Having previously confirmed statistically significant relationships are present between

victimisation and worry about crime within all crime type pairings studied in this thesis, and

having examined the strength of these relationship at the individual and neighbourhood levels,

this chapter reports on results of regression models of increasing complexity to examine the

effects of a number of covariates on the relationship between victimisation and worry, and on

each of these concepts individually. Initially, statistics are presented to define the sample upon

which the analysis has been undertaken, acknowledging that working samples have some

deviation from the complete CSEW sample. Household, vehicle, and personal crime models

are then examined in turn. Following an exploration of MCMC diagnostics and an assessment

of residuals with relation to model assumptions, the results of the models are discussed,

highlighting whether certain characteristics affected an individual's risk of being victimised, or

experiencing worry about crime. The random part of the model is then discussed, where the

effects of covariates on the estimated relationship between victimisation and worry about

crime are discussed. Within each crime type, a final summary is then made to clarify the

characteristics which affect an individual's risk of experiencing victimisation or worry about

crime. To conclude, a final summary is made which synthesises the effects of covariates on the

relationship between victimisation and worry about crime for all crime types studied.

6.2 Sample Characteristics

The following section presents statistics for all dependent and independent variables to

be included within the forthcoming regression models. Dependent variables of worry about

crime and victimisation status are presented first, followed by independent variables grouped

into personal characteristics, household characteristics, routine activities, independently rated

incivilities, and neighbourhood characteristics. As discussed in the methodology chapter, and

demonstrated in the previous chapter, the sample has been divided into the relevant modules of

the survey for analysis. Descriptive statistics below are presented for the whole sample, as

well as all analytical subsamples to demonstrate any differences between the full sample and

analytical subsamples which have been subject to listwise deletion. For categorical variables

the base category, to which the effects of all other categories are compared to, is underlined.

6.2.1 Prevalence of Victimisation and Worry about Crime

Table 26 Dependent Variable Descriptive Statistics

		Analytical subsamples		
	All respondents	Household Crime	Vehicle Crime	Personal Crime
Worry about crime	Worried (%)	Worried (%)	Worried (%)	Worried (%)
Household	12024 (35.2)[12]	11203 (35.2)	-	-
Vehicle	8398 (30.4)[13]	-	7867 (30.4)	-
Personal	11017 (32.2)[14]	-	-	10190 (32.1)
Sample size (n)	138807	31859	25851	31719
Victimisation	Victims (%)	Victims (%)	Victims (%)	Victims (%)
Household	7325 (5.3)	1708 (5.4)	-	-
Vehicle	8755 (6.3)	-	1908 (7.4)	-
Personal	4995 (3.6)	-	-	1087 (3.4)
Sample size (n)	138807	31859	25851	31719

Table 26 above, shows the number, and proportion of, individuals who stated they were

worried about crime, and victimised within the full CSEW sample 2014-2018, and within

crime specific analytical subsamples, where listwise deletion had been undertaken. Worry

about crime questions were each asked to a quarter of the sample, the sample sizes for these

modules are included in the table, with additional information in the footnote where relevant

to the table.

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[12] Module n=34201 This sample is the full module to which the relevant questions were asked,
prior to listwise deletion being carried out.
[13] Module n=27597
[14] Module n=34213

Proportions of those found to be victimised or worried about each crime type did not differ substantially, if at all, between the full sample and analytical subsamples which had undergone listwise deletion. Within the analysis subsamples, just over a third of respondents (35.2%) reported being worried about household crime, just under a third of respondents (32.1%) reported being worried about personal crime, and 30.4% of respondents reported being worried about vehicle crime. 5.4% of the household crime subsample had been a victim of at least one household crime in the year prior to interview, 7.4% of individuals in the vehicle crime subsample were a victim of at least one vehicle crime in the year prior to interview, slightly higher than the 6.4% found in the main dataset, suggesting those victimised more commonly provided complete information than non-victims. Personal victimisation was the least common victimisation type experienced, with 3.4% of this subsample victimised.

6.2.2 Sample Year Distribution

Table 27 Sample Year Distribution

		Analytical subsamples		
	All respondents	Household Crime	Vehicle Crime	Personal Crime
Year	Count (%)	Count (%)	Count (%)	Count (%)
2014	26531 (19.1)	6095 (19.1)	4859 (18.8)	6069 (19.1)
2015	34581 (24.9)	7901 (24.8)	6369 (24.6)	7849 (24.7)
2016	35584 (25.6)	8169 (25.6)	6651 (25.7)	8128 (25.6)
2017	34767 (25.0)	7974 (25.0)	6549 (25.3)	7959 (25.1)
2018	7344 (5.3)	1720 (5.4)	1423 (5.5)	1714 (5.4)
Sample size (n)	138807	31859	25851	31719

Analysis was undertaken on a merged dataset, comprising 4 survey years of data (April-March), across 5 calendar years. As levels of victimisation and worry change year on year, variables denoting the year of survey were included in models to control for this variation. Sampling years each represent approximately 25% of the dataset. Year indicators were included to control for variation in crime and worry levels across survey years.

6.2.3 Personal Characteristics

Table 28 Personal Characteristics

	Analytical Subsamples			
	All respondents Count (%)/ Mean (min,max: sd)	Household Crime Count (%)/ Mean (min,max: sd)	Vehicle Crime Count (%)/ Mean (min,max: sd)	Personal Crime Count (%)/ Mean (min,max: sd)
LA victim *Missing*	-	-	1524 (5.9)	365 (1.2)
Age	51.71 (16,100:18.4)	-	52.1766 (16,100:18.25)	52.6849 (16,100:17.89)
Missing	549 (0.4)			
Gender		-		
Male	63715 (45.9)		12280 (47.5)	14531 (45.8%)
Female	75092 (54.1)		13571 (52.5)	17188 (54.2%)
Missing	0 (0.0)			
Ethnicity		-		
White	124853 (90.1)		23740 (91.8)	28843 (90.9)
Mixed race	1418 (1.0)		211 (0.8)	305 (1.0)
Asian	7408 (5.3)		1290 (5.0)	1577 (5.0)
Black	3798 (2.7)		466 (1.8)	779 (2.5)
Chinese/other	1125 (0.8)		144 (0.6)	215 (0.7)
Missing	205 (0.1)			
Marital Status				
Single	30717 (22.1)	-	3946 (15.3)	6220 (19.6)
Married	62758 (45.2)		14174 (54.8)	14824 (46.7)
Cohabiting	14231 (10.3)		3014 (11.7)	3421 (10.8)
Widowed	13991 (10.1)		1801 (7.0)	3334 (10.5)
Divorced/separated	16707 (12.0)		2916 (11.3)	3920 (12.4)
Missing	403 (0.3)			
SES				
Professional	48425 (34.9)	-	10616 (41.1)	11487 (36.2)
Intermediate	32165 (23.2)		6625 (25.6)	7635 (24.1)
Routine & Manual	47769 (34.4)		8084 (31.3)	11416 (36.0)
Long-term unemployed	5073 (3.7)		526 (2.0)	1181 (3.7)
Missing	5375 (3.8)			
Disability/long-term illness				
None	97597 (70.3)	22361 (70.2)	18971 (73.4)	22162 (69.9)
Does not affect daily life	12404 (8.9)	2862 (9.0)	2552 (9.9)	2875 (9.1%)
Affects daily life a little	15507 (11.2)	3599 (11.3)	2522 (9.8)	3615 (11.4)
Affects daily life a lot	12926 (9.3)	3037 (9.5)	1806 (7.0)	3067 (9.7)
Missing	373 (0.3)			

	Analytical Subsamples		
Education			
Degree	41098 (29.6)	12511 (39.3)	11337 (43.9)	12602 (39.7)
A Levels	25005 (18.0)	5554 (17.4)	4893 (18.9)	5454 (17.2)
GCSE	24695 (17.8)	5853 (18.4)	4651 (18.0)	5673 (17.9)
No qualifications	41697 (30.0)	6668 (20.9)	4067 (15.7)	6700 (21.1)
Other	5795 (4.2)	1273 (4.0)	903 (3.5)	1290 (4.1)
Missing	517 (0.4)			
Sample size (n)	138807	31859	25851	31719

All samples had an average age of approximately 52 years, with females slightly overrepresented, comprising approximately 54% of the samples, although marginally less so in the vehicle crime subsample. Samples were predominantly white (approximately 90%), with a slight underrepresentation of black people in the vehicle crime subsample (2.7% in main dataset versus 1.8% in subsample). Just under half of the full sample and personal crime subsample were married (45-47%), and single people made up approximately 20% of these samples, these proportions were skewed within the vehicle subset to 54.8% and 15.3% respectively. This is likely due to regular car usage or ownership being more or less common for individuals of certain characteristics. Just over one third of the full sample was of professional (34.9%); or routine and manual (34.4%) employment types. Professional individuals were overrepresented in the vehicle (41.1%) and personal (36.2%) crime subsamples. The majority of respondents across all samples did not report having any disability (70%+). Having degree level education was overrepresented in all analytical subsamples, with about 30% of the full sample having a degree level qualification, and approximately 40% of each subsample. Having no formal educational qualifications was underrepresented by 15-20% within subsamples, suggesting those without qualifications less commonly answered the survey completely. The first variable in this Table is described in Section 4.2.2.1 of the methodology, this is included to situate an individual's crime experience within their neighbourhood, therefore maintaining relevance of the contextual variables to the victimisation experience for personal and vehicle victimisations.

6.2.4 Household Characteristics

Table 29 Household Characteristics Descriptive Statistics

	Analytical Subsamples			
	All respondents Count (%)/ Mean (min,max: sd)	Household Crime Count (%)/ Mean (min,max: sd)	Vehicle Crime Count (%)/ Mean (min,max: sd)	Personal Crime Count (%)/ Mean (min,max: sd)
HRP Age	53.69 (16,100:17.07)	54.0 (16,100:16.9)	-	-
Missing	651 (0.5)			
HRP Gender			-	-
Male	82932 (59.7)	19214 (60.3)		
Female	55875 (40.3)	12645 (39.7)		
Missing	0 (0.0)			
HRP Marital Status			-	-
Single	24510 (17.7)	5305 (16.7)		
Married	67001 (48.3)	15642 (49.1)		
Cohabiting	14484 (10.4)	3413 (10.7)		
Widowed	14406 (10.4)	3391 (10.6)		
Divorced/separated	17957 (13.0)	4108 (12.9)		
Missing	449 (0.3)			
HRP Ethnicity			-	-
White	125088 (90.1)	28986 (91.0)		
Mixed race	1210 (0.9)	268 (0.8)		
Asian	6687 (4.8)	1476 (4.6)		
Black	3817 (2.7)	800 (2.5)		
Chinese/other	1752 (1.3)	329 (1.0)		
Missing	253 (0.2)			
HRP SES			-	-
Professional	53433 (38.5)	12595 (39.5)		
Intermediate	30845 (22.2)	7242 (22.7)		
Routine & Manual	47275 (34.1)	11098 (34.8)		
Long-term unemployed	4127 (3.0)	924 (2.9)		
Missing	3127 (2.2)			
Tenure				
Owner Occupier	89834 (64.7)	21150 (66.4)	19361 (74.9)	21083 (66.5)
Private renter	25467 (18.3)	5510 (17.3)	3951 (15.3)	5436 (17.1)
Social renter	22702 (16.4)	5199 (16.3)	2539 (9.8)	5200 (16.4)
Missing	804 (0.6)			
House type				
Detached	35139 (25.3)	8226 (25.8)	7936 (30.7)	8142 (25.7)
Semi-detached	42754 (30.8)	10131 (31.8)	8593 (33.2)	10062 (31.7)
Terraced	39965 (28.8)	9042 (28.4)	7075 (27.4)	9011 (28.4)
Flat, maisonette or other	20187 (14.6)	4460 (14.0)	2247 (8.7)	4504 (14.2)

	Analytical Subsamples			
Missing	762 (0.5)			
No. of adults				
1 adult	46057 (33.2)	10525 (33.0)	6500 (25.1)	10666 (33.6)
2 adults	71784 (51.7)	16810 (52.8)	15423 (59.7)	16871 (53.2)
3+ adults	20966 (15.1)	4524 (14.2)	3928 (15.2)	4182 (13.2)
Missing	0 (0.0)			
Lone parenthood				
Lone parents	6806 (4.9)	1585 (5.0)	1017 (3.9)	-
Not lone parents	131530 (94.8)	30274 (95.0)	24834 (96.1)	
Missing	471 (0.3)			
No. of cars				
0	29440 (21.2)	6582 (20.7)	161 (0.6)	6629 (20.9)
1	59559 (42.9)	13710 (43.0)	13979 (54.1)	13727 (43.3)
2	38306 (27.6)	8965 (28.1)	9020 (34.9)	8855 (27.9)
3+	11502 (8.3)	2602 (8.2)	2691 (10.4)	2508 (7.9)
Missing	0 (0.0)			
Income				
No information/refused	17877 (12.9)	3757 (11.8)	2922 (11.3)	3750 (11.8)
Less than £10,000	17600 (12.7)	3902 (12.2)	1821 (7.0)	3857 (12.2)
£10,000-£19,999	28434 (20.5)	6587 (20.7)	4725 (18.3)	6582 (20.8)
£20,000-£29,999	21421 (15.4)	11677 (36.7)[15]	4407 (17.0)	5031 (15.9)
£30,000-£49,999	27722 (20.0)	-	6077 (23.5)	6603 (20.8)
£50,000+	25753 (18.6)	5936 (18.6)	5899 (22.8)	5896 (18.6)
Missing	0 (0.0)			
Relative house condition				
Better	9427 (6.8)	2135 (6.7)	1874 (7.2)	2118 (6.7)
About average	121129 (87.3)	28186 (88.5)	22897 (88.6)	28079 (88.5)
Worse	6864 (4.9)	1538 (4.8)	1080 (4.2)	1522 (4.8)
Missing	653 (0.5)			
Time in area				
Less than 12 months	8161 (5.9)	-	1246 (4.8)	1819 (5.7)
12 months – 2 years	7298 (5.3)		1226 (4.7)	1625 (5.1)
2-5 years	17494 (12.6)		3162 (12.2)	3985 (12.6)
5-10 years	17672 (12.7)		3348 (13.0)	4081 (12.9)
10 years+	88151 (63.5)		16869 (65.3)	20209 (63.7)
Missing	31 (0.0)			
Time at address			-	-
Less than 12 months	13019 (9.4)	2817 (8.8)		
12 months – 2 years	10245 (7.4)	2357 (7.4)		
2-5 years	23995 (17.3)	5525 (17.3)		
5+ years	91457 (65.9)	21160 (66.4)		

[15] £20,000-£29,999 and £30,000-£49,999 were combined for the base category in the household crime model

	Analytical Subsamples		
Missing	91 (0.0)		
Time household unoccupied		-	-
Less than 1 hour	31152 (22.4)	6964 (21.9)	
1-3 hours	32378 (23.3)	7629 (23.9)	
3+ hours	74538 (53.7)	17266 (54.2)	
Missing	739 (0.6)		
Sample size (n)	138807	31859	25851	31719

The first group of variables in Table 29 above define the HRP, these characteristics are included in the household model in place of the comparable individual characteristics presented in table 28, as household crimes are experienced by the whole household, not just the individual respondent. The average age of HRPs was marginally higher than all respondents at 54 years, and were primarily male, at approximately 60% of the sample. Approximately half of HRPs were married, and in 90% of cases, these were white individuals. Just under 40% of HRPs were in professional or managerial type employment.

Across all samples, the majority of households were owner occupied (65%), with a fairly even split (approximately 25%-30%) of respondents living in detached, semi-detached and terraced houses, both owner occupiers and those living in detached housing were overrepresented in the vehicle crime dataset. The majority of households had 2 adult occupants (approximately 50%), single adult households represented just under one third of the sample, and lone parents approximately 5% of the sample. Approximately 80% of the sample owned cars, with the majority of those having just one car[16]. The modal household

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[16] Vehicle ownership or regular usage of vehicle in the year prior to interview was a pre-requisite to inclusion in the vehicle subset, a small number of respondents (161) reported that either themselves or another individual within their household has had regular use of a car, van or motor vehicle in the year prior to interview, however when asked how many cars they own or have had regular use of *for most of the 12 months prior to interview* they have stated 0. Having checked for potential errors in the dataset, following the logic of the questionnaire, these 161 individuals have either owned or had regular use of at least one vehicle in the previous year, however this has not been for the *majority* of the year.

incomes were between £10,000 and £19,999, and between £30,000 and £49,999, with approximately 12% of the sample providing no information on their income, either through refusal to answer or a "don't know" response. The vast majority (approximately 90%) of households were considered to be of similar condition to others within their local area by the interviewer. The majority of respondents (63.5% in the full sample) have lived within the same local area for more than 10 years, and within the same address for more than 5 years (35.9%). Just over half (53.7%) of households are left unoccupied for three or more hours per day.

6.2.5 Routine Activities

Table 30 Routine Activity Descriptive Statistics

		Analytical Subsamples		
	All respondents Count (%)	Household Crime Count (%)	Vehicle Crime Count (%)	Personal Crime Count (%)
Time away from home		-		
Less than 1 hour	10559 (7.6)		1454 (5.6)	2421 (7.6)
1-3 hours	31440 (22.7)		5631 (21.8)	7453 (23.5)
3+ hours	96213 (69.3)		18766 (72.6)	21845 (68.9)
Missing	595 (0.4)			
Pub Visits		-	-	
Never	72127 (52.0)			16542 (52.2)
1-3 times	41331 (29.8)			9418 (29.7)
4-8 times	19495 (14.0)			4479 (14.1)
9+ times	5776 (4.2)			1280 (4.0)
Missing	78 (0.0)			
Clubbing		-	-	
Does not visit clubs	129951 (93.6)			29894 (94.2)
Clubber	8567 (6.2)			1825 (5.8)
Missing	289 (0.2)			
Sample size (n)	138807	31859	25851	31719

The majority of respondents (approximately 70%) reported being out of the house for more than three hours a day. Just over half (52.0%) of the sample reported never visiting pubs, followed by almost a third (29.8%) who visit the pub between one and three times per month. The vast majority of respondents (approximately 94%) reported that they did not visit nightclubs.

6.2.6 Incivilities

Table 31 Independently Rated Incivilities Descriptive Statistics

	All respondents Mean (min,max: sd)	Analytical Subsamples		
		Household Crime Mean (min,max: sd)	Vehicle Crime Mean (min,max: sd)	Personal Crime Mean (min,max: sd)
Incivilities	4.34 (3,12: 1.70)	4.31 (3,12: 1.67)	4.13 (3,12: 1.54)	4.31 (3,12: 1.69)
Missing	0 (0.0)			
Sample size (n)	138807	31859	25851	31719

Incivilities recorded remained mostly consistent between the full sample, and analytical subsamples. The minimum score of 3 is interpreted to mean that problems with litter, vandalism, and homes being in poor condition are all very uncommon within the local area, and a maximum score of 12 suggests all of these problems are very common. The average score of just above 4 means most areas were not rated by the interviewer to have a number of common problems.

6.2.7 Regional & Neighbourhood Characteristics

Table 32 Region & Neighbourhood Level Descriptive Statistics

	All respondents Count (%)/ Mean (min,max: sd)	Analytical Subsamples		
		Household Crime Count (%)/ Mean (min,max: sd)	Vehicle Crime Count (%)/ Mean (min,max: sd)	Personal Crime Count (%)/ Mean (min,max: sd)
Region				
North East	8416 (6.1)	1927 (6.0)	1434 (5.5)	1922 (6.1)
North West	16734 (12.1)	3854 (12.1)	3058 (11.8)	3824 (12.1)
Yorkshire & Humber	12492 (9.0)	2855 (9.0)	2342 (9.1)	2852 (9.0)
East Midlands	12873 (9.3)	3004 (6.4)	2519 (9.7)	3005 (9.5)
West Midlands	12956 (9.3)	3036 (9.5)	2437 (9.4)	3008 (9.5)
East of England	16239 (11.7)	3843 (12.1)	3327 (12.9)	3793 (12.0)
London	15235 (11.0)	3219 (10.1)	2077 (8.0)	3217 (10.1)
South East	17991 (13.0)	4124 (12.9)	3552 (13.7)	4108 (13.0)
South West	14973 (10.8)	3515 (11.0)	3012 (11.7)	3506 (11.1)
Wales	10826 (7.8)	2482 (7.8)	2093 (8.1)	2484 (7.8)

	Analytical Subsamples		
Missing	72 (0.0)		
Area Type			
Rural	46081 (33.2)	10697 (33.6)	9283 (35.9)	10647 (33.6)
<u>*Urban*</u>	80240 (57.8)	21162 (66.4)	16568 (64.1)	18327 (57.8)
Inner City	12486 (9.0)			2745 (8.7)
Missing	0 (0.0)			
Socioeconomic disadvantage	0.0619 (-1.80,5.40: 0.99)	0.0465 (-1.80,5.41: 0.98)	-0.0833 (-1.80,5.41: 0.90)	0.0482 (-1.80,5.41: 0.98)
Missing	0 (0.0)			
Professional living	0.0556 (-1.76,7.08: 0.99)	-0.0416 (-1.76,7.08: 0.97)	0.0581 (-1.76,5.89: 0.93)	0.0411 (-1.76,7.08: 0.97)
Missing	0 (0.0)			
Settled living	0.1750 (-3.65,4.01: 0.97)	0.2051 (-3.65,4.01: 0.95)	0.3327 (-3.65,4.01: 0.88)	0.2039 (-3.62,4.01: 0.95)
Missing	0 (0.0)			
In migration (rate per 1000)	98.3333 (31.92,638.27: 55.02)	96.3311 (31.92,638.27: 51.05)	9137273 (31.92,638.27: 45.54)	96.3255 (31.92,638.27: 51.02)
Missing	0 (0.0)			
Out migration (rate per 1000)	88.6692 (35.29,449.76: 38.01)	87.3356 (35.29,449.76: 35.74)	84.0931 (35.29,449.76: 32.18)	87.3306 (35.29,449.76: 35.73)
Missing	0 (0.0)			
Percent of properties vacant	4.2800 (0.37,46.79: 3.14)	4.2716 (0.37,46.79: 3.14)	4.2546 (0.37,46.79: 3.17)	4.2682 (0.37,46.79: 3.14)
Missing	0 (0.0)			
Ethnic heterogeneity	0.1692 (0.01,0.76: 0.16)	0.1636 (0.01,0.76: 0.16)	0.1444 (0.01,0.76: 0.16)	0.1635 (0.01,0.76: 0.18)
Missing	0 (0.0)			
Sample size (n)	138807	31859	25851	31719

Table 32 above shows the distribution of the sample within the regions of England and Wales, region level representation remains constant throughout the full sample and all analytical subsamples. Approximately 60% of respondents lived in urban locations, and a further 9% in inner city locations, for household and vehicle analyses these categories are combined. Socioeconomic disadvantage, professional living, and settled living show

approximately normal scores due to the factor analysis undertaken[17], as reported in section

4.2.2.2 of the methodology Chapter. The average inward and outward migration rates in the

year prior to undertaking the Census were approximately 100 per 1000 residents within an

MSOA. The average percentage of vacant properties within an MSOA is just over 4%, ranging

from between 0.37% and 46.8%. The average result of the ethnic heterogeneity index was

0.17, this represents the probability of 2 randomly selected individuals within the

neighbourhood being of different races.

6.3 Household Crime

This section first discusses the assessment of MCMC diagnostics of both the fixed and

random parts of the household BVML model, as well as an assessment of model assumptions

by examining residuals. Results of the fixed part of the model are then discussed, within the

sections of the nested modelling strategy, indicating characteristics which either increase, or

decrease individual's risk of either experiencing worry about household crime or household

victimisation or both. Discussion then moves to the random part of the model, where the

relationship between victimisation and worry about household crime is examined, as well as

the effect of different characteristics on this relationship. A final summary clarifies the

common? risk and protective factors of worry about household crime and victimisation.

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[17] Socioeconomic disadvantage, professional living and settled living were z-scored on the MSOA level data, thus conformed to mean=0, standard deviation=1 prior to execution of factor analyses. Due to the full dataset and data-subsets having varying representation of each MSOA within them, the normalisation of these scores is somewhat skewed, with means diverging from 0 a small amount and standard deviations diverging from 1 a small amount.

6.3.1 MCMC diagnostics, Assumptions & Residuals

6.3.1.1 MCMC Diagnostics

For each covariate included in the model, diagnostics were examined to assess the reliability and accuracy of estimates. The same Markov chain length was run for all levels of model complexity, equal to that of the null models presented in the previous chapter. In some cases, particularly in the random part of the model at the neighbourhood level, and for covariate coefficients where the standard error was large in relation to estimated posterior mean with an estimated value close to 0, acceptable diagnostics were not met. With regard to covariate coefficients, it was not considered appropriate to extend the chain length in an attempt to meet "acceptable diagnostics", instead it is considered that there is no clear evidence in the data of an effect of those independent variables on the dependent variable. Similarly, when examining random part diagnostics, particularly at the neighbourhood level, it is considered that there is not sufficient evidence of neighbourhood level variance or covariance within the data, and increased chain length would not remedy this. These considerations are discussed further in relation to potential future research. These considerations are relevant to the household crime model discussed here, as well as vehicle and personal models discussed in the forthcoming sections 6.4 and 6.5.

Acceptable diagnostics were met for all covariate estimates where independent variables were concluded to affect risk of being worried about crime, or risk of experiencing victimisation. Diagnostics examined included: the parameter trace which resembled white noise; with low autocorrelation confirmed by the ACF measure, and the PACF showing a spike at one which suggests the Gibbs sampling method employed is operating similarly to a first order autoregressive time series as expected; kernel density plots showed the posterior distribution to be normally distributed about the mean; Raftery-Lewis and Brooks-Draper diagnostic statistics were met, meaning the number of iterations run was greater than the

estimated chain-length required to accurately measure the boundaries of the 95% credible

interval; and to accurately estimate the mean of the posterior distribution to two significant

figures.

   With regard to estimating neighbourhood level variation in both victimisation and

worry, and their neighbourhood level covariance, in model 5 presented in tables 8 and 9 of

section 6.3.2, Brooks-Draper and Raftery-Lewis diagnostics were largely not met, with the

exception of the estimated required chain length for the 97.5th quantile of the Raftery-Lewis

diagnostic. These suggest the posterior mean estimate may not be accurate to two significant

figures, and the lower (2.5%) quantile of the 95% credible interval may not be accurate. The

kernel density plot showed a negative skew, with the tail stretching over lower estimates (0

and below) for the posterior mean. The parameter trace, ACF and PACF, and ESS suggest a

high level of autocorrelation within the chain. This is expected to be due to the small number

of individuals within each neighbourhood reporting being worried about household

victimisation, which would be approximately one third of the average neighbourhood sample

size of approximately four individuals, and the even lower proportion of individuals within a

neighbourhood reporting a household victimisation. This results in limited opportunity for

individuals within a neighbourhood to have been a victim of crime and have reported being

worried about crime., This data has the advantage of a large number of neighbourhood units to

offset this limitation as much as possible.

   The estimation of covariance/correlation between household victimisation and worry

about household crime at the individual level better met acceptable diagnostics. The kernel

density plot presented a normal distribution, and Raftery-Lewis and Brooks-Draper estimates

were lower than the number of iterations within the chain. The parameter trace, ACF and

PACF show significantly less evidence of substantial autocorrelation or partial autocorrelation

than neighbourhood level estimates, this is accompanied by a much higher ESS.

6.3.1.2 Checking Assumptions

Assumption 1-Linearity

The primary assumption of linear regression is a linear relationship between dependent and independent variables. As previously discussed in the methods chapter, the binary generalised linear model was employed for this analysis, accounting for the violation of this assumption.

Assumption 2-Independence of Errors

The second assumption considered was independence of observations, errors, or residuals. This means having information about one respondent's residual provides no information about another respondent's residual. Whilst this is not tested statistically, there is assumed to be some correlation in observations of sociodemographic variables for individuals living within the same local area, this is supported by early factor analysis inspections. For this reason, multilevel modelling, which has clustered individuals by local area, has been used to account for this non-compliance with this assumption. Analysis in chapter 5 also confirms geographic clustering of victimisation and worry.

Assumption 3-Normally Distributed Residuals

The third assumption is that of normally distributed residuals. To assess this statistically at the neighbourhood level, standardised residuals were plotted against normal scores. Figure 1 below shows that on the worry side of the model this assumption is conformed to very well through the strong diagonal line, and on the victimisation side of the model there is an approximately diagonal line suggesting the assumption has been met, however these is evidence there would be some level of skewness to the distribution. In linear

models this is also tested at level 1, however due to the binary probit specification of this model, this assumption is not present at level 1.

Figure 4 Plot of Standardised Residuals against Normal Scores
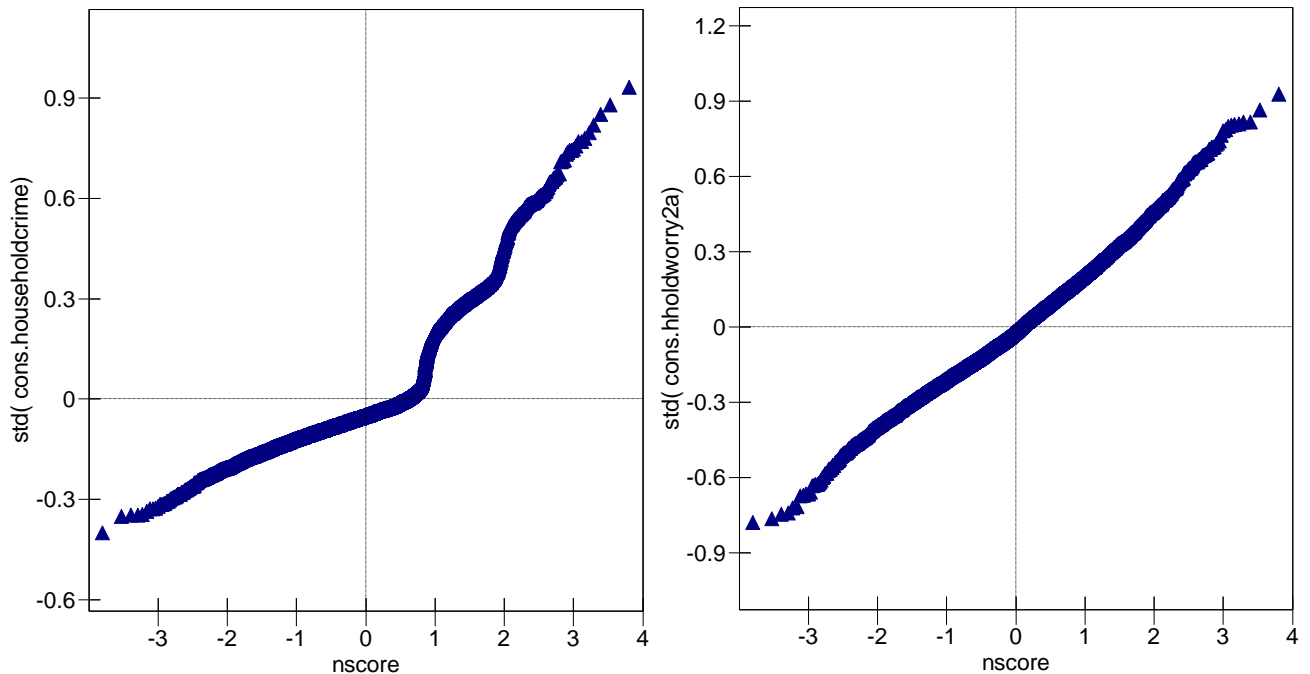
Assumption 4-Homoskedasticity

The fourth and final assumption considered is homoskedasticity, the assumption that the residual variance is constant for all values of each continuous dependent variable. A number of charts are presented in the appendix which inform the assessment of whether the assumption of homoskedasticity is met for each continuous variable included in this model. These charts plot the standardised residual against all values of the independent variable. A number of variables showed some evidence of heteroskedasticity, whereby the value of the residual is not entirely independent of the value of the independent variable. However, it is known that homoskedasticity is violated with the utilisation of a binary outcome variable (as opposed to a linear one) (Gomila, 2021), and is often violated within the social world (Angrist & Pischke, 2009). Violations of the assumption of homoskedasticity impact upon the accuracy

of standard errors (Angrist & Pischke, 2009), however the use of MCMC estimation should

alleviate the impact of this, due to the robust standard error estimates it produces.

6.3.2 Household BVML Model Results-Fixed Part

The following section discusses the results of the household BVML model. Initially,

the reference person in defined, and their baseline risk reported, this is the

individual/household to which all others are compared to when determining risk and protective

factors. Risk and protective factors are then identified, working through each additional level

of model complexity. The random part of the model is then discussed, covering the effect of

each covariate set on the remaining unexplained variance at the neighbourhood and individual

level.

6.3.2.1 Reference Individual, Household and Neighbourhood

The reference person and household to which all estimated percentage risks are

compared to in determining risk and protective factors was: interviewed in 2016; has a HRP

aged 54 years old; who is female, white, single, and of professional socioeconomic

classification; they have no life limiting illness or disability, and degree level education; the

household is owner occupied, and detached; and is occupied by a single adult, without

children; the household owns one car; has an annual income of between £20,000 and £49,999;

the house itself is in average condition compared to other households in the neighbourhood,

has been occupied by the respondent for more than five years, and is located in an urban area

within the South East. The reference neighbourhood has: average levels of socioeconomic

disadvantage; professional living; and settled living; and minimum levels of inward and

outward migration; vacant properties; ethnic heterogeneity; and incivilities.

The baseline risk of household victimisation for the reference household/person is

estimated at 2.6%, and the baseline risk of worry about household crime is estimated at 25.9%.

These percentages are lower than those presented from the null models in the previous chapter

due to the reference household/person possessing a higher number of protective characteristics

than the average household/person.

Results tables are presented overleaf.

Table 33 Fixed Part Results Household BVML Models

	1		2		3		4		5	
	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry
Cons	-1.657 (0.026)	-0.425 (0.015)	-1.865 (0.061)	-0.631 (0.037)	-1.884 (0.090)	-0.671 (0.056)	-1.972 (0.095)	-0.695 (0.059)	-1.942 (0.095)	-0.645 (0.060)
Year (16)										
14	0.031 (0.036)	0.049 (0.022)	0.026 (0.036)	0.041 (0.022)	0.051 (0.039)	0.081 (0.024)	0.052 (0.039)	0.081 (0.024)	0.052 (0.039)	0.080 (0.024)
15	0.032 (0.033)	0.047 (0.021)	0.037 (0.034)	0.047 (0.021)	0.043 (0.034)	0.060 (0.021)	0.045 (0.034)	0.060 (0.021)	0.045 (0.034)	0.060 (0.021)
17	-0.004(0.034)	0.059 (0.021)	-0.000 (0.034)	0.061 (0.021)	-0.001 (0.034)	0.059 (0.021)	-0.002 (0.034)	0.059 (0.021)	-0.003 (0.034)	0.058 (0.021)
18	-0.043(0.058)	0.029 (0.035)	-0.028 (0.059)	0.041 (0.035)	-0.033 (0.059)	0.038 (0.035)	-0.039 (0.059)	0.036 (0.035)	-0.041 (0.059)	0.034 (0.035)
HRP Age (GM centred)			-0.007 (0.001)	-0.004 (0.001)	-0.006 (0.001)	-0.003 (0.001)	-0.005 (0.001)	-0.003 (0.001)	-0.005 (0.001)	-0.003 (0.01)
HRP Gender (Female)										
Male			-0.081 (0.028)	-0.069 (0.017)	-0.088 (0.027)	-0.076 (0.017)	-0.088 (0.028)	-0.077 (0.017)	-0.087 (0.028)	-0.075 (0.017)
HRP Ethnicity (White)										
Mixed race			-0.043 (0.128)	0.194 (0.081)	-0.070 (0.128)	0.103 (0.080)	-0.075 (0.129)	0.102 (0.080)	-0.071 (0.128)	0.105 (0.080)
Asian			-0.063 (0.060)	0.596 (0.036)	-0.116 (0.063)	0.433 (0.038)	-0.118 (0.063)	0.431 (0.038)	-0.122 (0.064)	0.421 (0.038)
Black			-0.097 (0.079)	0.318 (0.047)	-0.164 (0.081)	0.110 (0.049)	-0.168 (0.082)	0.108 (0.049)	-0.158 (0.082)	0.311 (0.110)
Chinese/other			0.047 (0.113)	0.324 (0.072)	0.030 (0.114)	0.201 (0.073)	0.025 (0.115)	0.198 (0.073)	0.026 (0.114)	0.192 (0.073)
HRP Marital Status (Single)										
Married			-0.004 (0.052)	0.115 (0.034)	0.001 (0.052)	0.138 (0.034)	0.004 (0.052)	0.139 (0.034)	0.000 (0.052)	0.131 (0.034)
Cohabiting			-0.014 (0.059)	0.075 (0.038)	-0.017 (0.059)	0.098 (0.038)	-0.014 (0.059)	0.099 (0.038)	-0.015 (0.059)	0.092 (0.038)
Widowed			-0.050 (0.058)	-0.034 (0.035)	-0.046 (0.058)	-0.026 (0.035)	-0.041 (0.058)	-0.025 (0.034)	-0.046 (0.058)	-0.034 (0.035)
Divorced/separated			0.069 (0.044)	0.031 (0.029)	0.069 (0.044)	0.040 (0.029)	0.072 (0.044)	0.040 (0.029)	0.070 (0.044)	0.032 (0.029)
HRP SES (Professional)										
Intermediate			0.004 (0.034)	0.083 (0.021)	-0.002 (0.034)	0.076 (0.021)	-0.004 (0.034)	0.075 (0.021)	-0.004 (0.034)	0.075 (0.021)
Routine & Manual			0.020 (0.033)	0.103 (0.021)	-0.004 (0.034)	0.095 (0.021)	-0.007 (0.034)	0.094 (0.020)	-0.008 (0.034)	0.093 (0.022)
Long-term unemployed			0.094 (0.071)	-0.049 (0.048)	0.070 (0.071)	-0.062 (0.048)	0.063 (0.071)	-0.064 (0.048)	0.064 (0.071)	-0.081 (0.048)
Disability (None)										
Does not affect daily life			0.146 (0.043)	0.049 (0.027)	0.141 (0.043)	0.054 (0.027)	0.142 (0.043)	0.053 (0.027)	-0.057 (0.116)	0.055 (0.027)
Affects daily life a little			0.219 (0.038)	0.106 (0.025)	0.212 (0.038)	0.110 (0.024)	0.211 (0.038)	0.109 (0.024)	0.211 (0.038)	0.110 (0.025)
Affects daily life a lot			0.355 (0.041)	0.231 (0.027)	0.342 (0.041)	0.233 (0.027)	0.339 (0.041)	0.232 (0.027)	0.340 (0.041)	0.059 (0.067)
Education (Degree)										
A Levels			0.004 (0.036)	0.086 (0.022)	-0.004 (0.036)	0.083 (0.022)	-0.004 (0.036)	0.083 (0.022)	-0.003 (0.036)	0.086 (0.022)
GCSE			0.015 (0.036)	0.140 (0.022)	0.004 (0.036)	0.136 (0.022)	0.002 (0.036)	0.135 (0.022)	0.001 (0.036)	0.136 (0.022)
No qualifications			-0.057 (0.040)	0.159 (0.024)	-0.079 (0.040)	0.140 (0.025)	-0.085 (0.041)	0.138 (0.024)	-0.085 (0.041)	0.136 (0.025)
Other			-0.089 (0.068)	0.133 (0.040)	-0.112 (0.068)	0.111 (0.040)	-0.116 (0.068)	0.109 (0.040)	-0.116 (0.068)	0.114 (0.040)
Tenure (Owner Occupier)										
Private renter			0.006 (0.038)	-0.094 (0.024)	0.012 (0.038)	-0.084 (0.024)	0.008 (0.038)	-0.085 (0.024)	0.009 (0.038)	-0.086 (0.024)
Social renter			0.126 (0.039)	0.008 (0.025)	0.123 (0.039)	0.006 (0.025)	0.115 (0.039)	0.004 (0.025)	0.111 (0.039)	-0.003 (0.025)
House type (Detached)										
Semi-detached			0.004 (0.035)	0.024 (0.021)	-0.033 (0.035)	-0.032 (0.021)	-0.042 (0.035)	-0.034 (0.021)	-0.044 (0.036)	-0.040 (0.021)
Terraced			0.076 (0.037)	-0.016 (0.023)	0.020 (0.038)	-0.090 (0.023)	0.003 (0.038)	-0.094 (0.024)	-0.003 (0.039)	-0.102 (0.024)
Flat, maisonette or other			-0.081 (0.048)	-0.215 (0.030)	-0.126 (0.052)	-0.309 (0.032)	-0.138 (0.052)	-0.312 (0.032)	-0.140 (0.052)	-0.313 (0.032)
No. Of adults (1 adult)										
2 adults			0.009 (0.050)	0.019 (0.032)	0.003 (0.050)	-0.011 (0.032)	0.001 (0.050)	-0.011 (0.032)	0.003 (0.050)	-0.005 (0.032)
3+ adults			0.064 (0.057)	0.012 (0.037)	0.042 (0.057)	-0.052 (0.037)	0.038 (0.057)	-0.053 (0.037)	0.041 (0.057)	-0.046 (0.037)
Lone parent			0.160 (0.057)	0.082 (0.039)	0.159 (0.057)	0.076 (0.039)	0.157 (0.056)	0.075 (0.039)	0.157 (0.057)	0.132 (0.050)
No. of cars (1)										
0			0.079 (0.035)	0.067 (0.022)	0.050 (0.036)	0.029 (0.023)	0.046 (0.036)	0.028 (0.023)	0.075 (0.038)	0.081 (0.024)

	1	2		3		4		5	
2		0.072 (0.034)	-0.036 (0.020)	0.089 (0.034)	-0.006 (0.021)	0.090 (0.034)	-0.006 (0.020)	0.092 (0.034)	-0.003 (0.021)
3+		0.132 (0.051)	0.025 (0.032)	0.156 (0.052)	0.073 (0.032)	0.156 (0.052)	0.073 (0.032)	0.160 (0.052)	0.077 (0.032)
Income (£20,000-£49,999)									
No information/refused		0.044 (0.042)	0.044 (0.026)	0.044 (0.043)	0.038 (0.026)	0.045 (0.042)	0.038 (0.026)	0.042 (0.042)	0.035 (0.026)
Less than £10,000		0.029 (0.044)	0.047 (0.028)	0.021 (0.045)	0.052 (0.028)	0.020 (0.045)	0.052 (0.028)	0.016 (0.045)	0.048 (0.028)
£10,000-£19,999		0.036 (0.036)	0.057 (0.022)	0.028 (0.036)	0.057 (0.022)	0.026 (0.036)	0.057 (0.022)	0.024 (0.036)	0.057 (0.022)
£50,000+		0.057 (0.037)	-0.021 (0.023)	0.081 (0.037)	-0.024 (0.023)	0.084 (0.037)	-0.024 (0.023)	0.080 (0.037)	-0.036 (0.023)
Relative house condition (av.)									
Better									
Worse		0.143 (0.046)	0.109 (0.030)	0.116 (0.046)	0.091 (0.030)	0.107 (0.046)	0.089 (0.030)	0.108 (0.046)	0.089 (0.030)
		0.153 (0.051)	-0.003 (0.035)	0.154 (0.051)	0.003 (0.035)	0.131 (0.051)	-0.002 (0.035)	0.134 (0.051)	-0.214 (0.099)
Time at address (5+ years)									
Less than 12 months		0.139 (0.044)	-0.110 (0.030)	0.149 (0.044)	-0.087 (0.030)	0.153 (0.045)	-0.086 (0.030)	0.156 (0.045)	-0.082 (0.030)
12 months – 2 years		-0.043 (0.050)	-0.118 (0.031)	-0.039 (0.050)	-0.102 (0.031)	-0.036 (0.050)	-0.101 (0.031)	-0.036 (0.050)	-0.099 (0.031)
2-5 years		-0.022 (0.035)	-0.073 (0.022)	-0.014 (0.035)	-0.056 (0.022)	-0.012 (0.035)	-0.055 (0.022)	-0.012 (0.035)	-0.056 (0.022)
Time household unoccupied (3+ hours)									
Less than 1 hour		0.042 (0.033)	-0.029 (0.020)	0.043 (0.032)	-0.034 (0.020)	0.042 (0.032)	-0.034 (0.020)	0.040 (0.032)	-0.038 (0.020)
1-3 hours		-0.029 (0.032)	-0.014 (0.019)	-0.024 (0.032)	-0.009 (0.019)	-0.024 (0.032)	-0.009 (0.019)	-0.024 (0.032)	-0.010 (0.019)
Area Type (Urban)									
Rural				-0.044 (0.030)	-0.079 (0.018)	-0.045 (0.030)	-0.078 (0.018)	-0.044 (0.030)	-0.077 (0.018)
Region (South East)									
North East				-0.090 (0.066)	-0.039 (0.040)	-0.086 (0.066)	-0.038 (0.040)	-0.093 (0.066)	-0.047 (0.040)
North West				-0.106 (0.053)	0.053 (0.032)	-0.099 (0.052)	0.055 (0.032)	-0.102 (0.052)	0.051 (0.032)
Yorkshire & Humber				0.052 (0.053)	0.050 (0.034)	0.058 (0.053)	0.051 (0.034)	0.054 (0.053)	0.048 (0.034)
East Midlands				0.028 (0.052)	0.107 (0.033)	0.032 (0.053)	0.107 (0.033)	0.032 (0.053)	0.111 (0.033)
West Midlands				-0.010 (0.053)	0.103 (0.033)	-0.005 (0.053)	0.104 (0.033)	-0.006 (0.053)	0.100 (0.033)
East of England				-0.036 (0.050)	0.102 (0.031)	-0.033 (0.050)	0.102 (0.030)	-0.033 (0.050)	0.102 (0.031)
London				-0.032 (0.065)	0.163 (0.040)	-0.023 (0.064)	0.165 (0.040)	0.032 (0.053)	0.260 (0.043)
South West				-0.067 (0.053)	0.004 (0.032)	-0.057 (0.053)	0.008 (0.032)	-0.055 (0.053)	-0.027 (0.037)
Wales				0.022 (0.058)	0.006 (0.037)	0.025 (0.058)	0.007 (0.036)	0.023 (0.058)	0.008 (0.037)
Socioeconomic disadvantage				0.072 (0.015)	0.030 (0.009)	0.064 (0.015)	0.028 (0.009)	0.067 (0.015)	0.050 (0.013)
Professional living				-0.078 (0.019)	-0.071 (0.012)	-0.073 (0.019)	-0.070 (0.011)	-0.067 (0.015)	-0.063 (0.012)
Settled living				0.016 (0.023)	0.023 (0.014)	0.019 (0.023)	0.024 (0.014)	0.010 (0.023)	0.013 (0.015)
In migration (rate per 1000)				-0.001 (0.001)	-0.000 (0.000)	-0.001 (0.001)	-0.000 (0.000)	-0.001 (0.001)	-0.001 (0.000)
Out migration (rate per 1000)				0.002 (0.001)	0.001 (0.001)	0.002 (0.001)	0.001 (0.001)	0.002 (0.001)	0.001 (0.001)
% vacant properties				-0.004 (0.004)	-0.020 (0.003)	-0.004 (0.004)	-0.020 (0.003)	-0.004 (0.004)	-0.020 (0.003)
Ethnic heterogeneity				0.154 (0.116)	0.526 (0.073)	0.143 (0.113)	0.521 (0.073)	0.135 (0.114)	0.535 (0.074)
Incivilities						0.025 (0.008)	0.007 (0.005)	0.021 (0.008)	-0.001 (0.005)
Ethnic heterogeneity x HRP Black									-0.430 (0.220)
South west x HRP routine/manual									0.108 (0.051)
Incivilities x disability no effect								0.045 (0.024)	
London x no car								-0.190 (0.087)	-0.312 (0.053)
Incivilities x worse condition									0.040 (0.017)
Incivilities x disability large effect									0.037 (0.013)

	1	2	3	4	5
Lone parent x HRP routine/manual					-0.168 (0.069)
Lone parent x household income £50,000+					0.395 (0.176)
Socioeconomic disadvantage x male					-0.030 (0.015)
Sample size (n)=31859					

Table 34 Final Model of Household Victimisation and Worry Credible Intervals and Percentage Predictions

	Victimisation				Worry about Crime			
	Coefficient	95% credible interval	90% credible interval	Coef. % prediction	Coefficient	95% credible interval	90% credible interval	Coef. % prediction
Cons	-1.942 (0.095)	(-2.130,-1.756)	(-2.099,-1.785)	2.6%	-0.645 (0.060)	(-0.762,-0.528)	(-0.743,-0.547)	25.9%
Year (16)								
14	0.052 (0.039)	(-0.025,0.128)	(-0.012,0.116)	2.9%	0.080 (0.024)	(0.033,0.127)	(0.040,0.120)	28.6%
15	0.045 (0.034)	(-0.021,0.111)	(-0.011,0.101)	2.9%	0.060 (0.021)	(0.019,0.101)	(0.025,0.094)	27.9%
17	-0.003 (0.034)	(-0.070,0.063)	(-0.059,0.053)	2.6%	0.058 (0.021)	(0.017,0.099)	(0.024,0.093)	27.9%
18	-0.041 (0.059)	(-0.157,0.073)	(-0.139,0.055)	2.4%	0.034 (0.035)	(-0.036,0.103)	(-0.024,0.092)	27.1%
HRP Age (GM centred)	-0.005 (0.001)	(-0.008,-0.003)	(-0.007,-0.003)	2.6% (3.9|1.5)	-0.003 (0.001)	(-0.004,-0.002)	(-0.004,-0.002)	25.9% (29.6|21.5)
HRP Gender (Female)								
Male	-0.087 (0.028)	(-0.141,-0.033)	(-0.132,-0.041)	2.1%	-0.075 (0.017)	(-0.108,-0.041)	(-0.103,-0.041)	23.6%
HRP Ethnicity (White)								
Mixed race	-0.071 (0.128)	(-0.329,0.174)	(-0.286,0.136)	2.2%	0.105 (0.080)	(-0.053,0.262)	(-0.027,0.237)	29.5%
Asian	-0.122 (0.064)	(-0.322,-0.001)	(-0.295,-0.026)	2.0%	0.421 (0.038)	(0.347,0.496)	(0.359,0.484)	41.1%
Black	-0.158 (0.082)	(-0.322,-0.001)	(-0.295,-0.026)	1.8%	0.311 (0.110)	(0.094,0.527)	(0.129,0.492)	36.9%
Chinese/other	0.026 (0.114)	(-0.203,0.244)	(-0.164,0.210)	2.8%	0.192 (0.073)	(0.049,0.335)	(0.072,0.312)	32.5%
HRP Marital Status (Single)								
Married	0.000 (0.052)	(-0.100,0.103)	(-0.084,0.086)	2.6%	0.131 (0.034)	(0.065,0.197)	(0.076,0.187)	30.4%
Cohabiting	-0.015 (0.059)	(-0.130,0.100)	(-0.112,0.082)	2.5%	0.092 (0.038)	(0.017,0.168)	(0.029,0.155)	29.0%
Widowed	-0.046 (0.058)	(-0.160,0.068)	(-0.142,0.050)	2.3%	-0.034 (0.035)	(-0.101,0.034)	(-0.090,0.023)	24.9%
Divorced/separated	0.070 (0.044)	(-0.016,0.155)	(-0.002,0.141)	3.1%	0.032 (0.029)	(-0.024,0.089)	(-0.015,0.080)	27.0%
HRP SES (Professional)								
Intermediate	-0.004 (0.034)	(-0.071,0.063)	(-0.060,0.052)	2.6%	0.075 (0.021)	(0.034,0.115)	(0.041,0.109)	28.4%
Routine & Manual	-0.008 (0.034)	(-0.074,0.058)	(-0.063,0.047)	2.6%	0.093 (0.022)	(0.050,0.135)	(0.057,0.128)	29.0%
Long-term unemployed	0.064 (0.071)	(-0.077,0.202)	(-0.054,0.181)	3.0%	-0.081 (0.048)	(-0.175,0.014)	(-0.160,-0.001)	23.4%
Disability (None)								
Does not affect daily life	-0.057 (0.116)	(-0.285,0.169)	(-0.248,0.132)	2.3%	0.055 (0.027)	(0.003,0.108)	(0.011,0.099)	27.8%
Affects daily life a little	0.211 (0.038)	(0.135,0.286)	(0.147,0.274)	4.2%	0.110 (0.025)	(0.062,0.158)	(0.070,0.150)	29.6%
Affects daily life a lot	0.340 (0.041)	(0.260,0.420)	(0.273,0.407)	5.5%	0.059 (0.067)	(-0.072,0.190)	(-0.051,0.169)	27.9%
Education (Degree)								
A Levels	-0.003 (0.036)	(-0.075,0.067)	(-0.063,0.056)	2.6%	0.086 (0.022)	(0.042,0.129)	(0.049,0.122)	28.8%
GCSE	0.001 (0.036)	(-0.070,0.071)	(-0.058,0.060)	2.6%	0.136 (0.022)	(0.092,0.180)	(0.100,0.173)	30.5%
No qualifications	-0.085 (0.041)	(-0.166,-0.006)	(-0.152,-0.019)	2.1%	0.136 (0.025)	(0.088,0.184)	(0.095,0.176)	30.5%
Other	-0.116 (0.068)	(0.252,0.016)	(-0.230,-0.005)	2.0%	0.114 (0.040)	(0.036,0.192)	(0.048,0.180)	29.8%
Tenure (Owner Occupier)								
Private renter	0.009 (0.038)	(-0.065,0.084)	(-0.053,0.072)	2.7%	-0.086 (0.024)	(-0.133,-0.039)	(-0.125,-0.046)	23.2%
Social renter	0.111 (0.039)	(-0.133,-0.039)	(-0.125,-0.046)	3.4%	-0.003 (0.025)	(-0.052,0.047)	(-0.044,0.039)	25.8%
House type (Detached)								
Semi-detached	-0.044 (0.036)	(-0.114,0.026)	(-0.103,0.014)	2.4%	-0.040 (0.021)	(-0.081,0.002)	(-0.074,-0.005)	24.7%
Terraced	-0.003 (0.039)	(-0.078,0.073)	(-0.066,0.061)	2.6%	-0.102 (0.024)	(-0.148,-0.056)	(-0.141,-0.063)	22.8%
Flat, maisonette or other	-0.140 (0.052)	(-0.242,-0.038)	(-0.226,-0.054)	1.9%	-0.313 (0.032)	(-0.376,-0.251)	(-0.366,-0.261)	16.9%

	Victimisation				Worry about Crime			
No. Of adults (1 adult)								
2 adults	0.003 (0.050)	(-0.095,0.100)	(-0.079,0.085)	2.6%	-0.005 (0.032)	(-0.068,0.057)	(-0.058,0.047)	25.8%
3+ adults	0.041 (0.057)	(-0.071,0.153)	(-0.053,0.135)	2.9%	-0.046 (0.037)	(-0.118,0.026)	(-0.107,0.014)	24.5%
Lone parent	0.157 (0.057)	(0.046,0.268)	(0.064,0.251)	3.7%	0.132 (0.050)	(0.033,0.231)	(0.049,0.215)	30.4%
No. Of cars (1)								
0	0.075 (0.038)	(0.000,0.150)	(0.013,0.138)	3.1%	0.081 (0.024)	(0.033,0.129)	(0.041,0.121)	28.6%
2	0.092 (0.034)	(0.026,0.158)	(0.037,0.148)	3.2%	-0.003 (0.021)	(-0.044,0.037)	(-0.037,0.030)	25.8%
3+	0.160 (0.052)	(0.058,0.260)	(0.074,0.244)	3.7%	0.077 (0.032)	(0.014,0.140)	(0.024,0.130)	28.5%
Income (£20,000-£49,999)								
No information/refused	0.042 (0.042)	(-0.042,0.124)	(-0.028,0.112)	2.9%	0.035 (0.026)	(-0.015,0.085)	(-0.007,0.077)	27.1%
Less than £10,000	0.016 (0.045)	(-0.071,0.103)	(-0.057,0.089)	2.8%	0.048 (0.028)	(-0.007,0.102)	(0.002,0.094)	27.5%
£10,000-£19,999	0.024 (0.036)	(-0.047,0.095)	(-0.035,0.084)	3.1%	0.057 (0.022)	(0.014,0.100)	(0.020,0.093)	27.8%
£50,000+	0.080 (0.037)	(0.006,0.143)	(0.018,0.141)	3.1%	-0.036 (0.023)	(-0.081,0.010)	(-0.074,0.003)	24.8%
Relative house condition (av.)								
Better								
Worse	0.108 (0.046)	(0.016,0.197)	(0.031,0.183)	3.3%	0.089 (0.030)	(0.031,0.148)	(0.041,0.138)	28.9%
	0.134 (0.051)	(0.032,0.234)	(0.049,0.218)	3.5%	-0.214 (0.099)	(-0.109,-0.020)	(-0.377,-0.051)	19.5%
Time at address (5+ years)								
Less than 12 months	0.156 (0.045)	(0.068,0.242)	(0.082,0.229)	3.7%	-0.082 (0.030)	(-0.141,-0.023)	(-0.132,-0.033)	23.4%
12 months – 2 years	-0.036 (0.050)	(-0.135,0.061)	(-0.118,0.046)	2.4%	-0.099 (0.031)	(-0.160,-0.038)	(-0.150,-0.048)	22.8%
2-5 years	-0.012 (0.035)	(-0.081,0.057)	(-0.071,0.046)	2.5%	-0.056 (0.022)	(-0.099,-0.014)	(-0.092,-0.021)	24.2%
Time household unoccupied (3+ hours)								
Less than 1 hour	0.040 (0.032)	(-0.023,0.104)	(0.013,0.094)	2.9%	-0.038 (0.020)	(-0.078,0.002)	(-0.071,-0.004)	24.7%
1-3 hours	-0.024 (0.032)	(-0.087,0.039)	(-0.077,0.029)	2.5%	-0.010 (0.019)	(-0.048,0.028)	(-0.042,0.022)	25.6%
Area Type (Urban)								
Rural	-0.044 (0.030)	(-0.103,0.015)	(-0.093,0.005)	2.5%	-0.077 (0.018)	(-0.113,-0.041)	(-0.107,-0.047)	23.5%
Region (South East)								
North East	-0.093 (0.066)	(-0.221,0.036)	(-0.201,0.015)	2.1%	-0.047 (0.040)	(-0.127,0.032)	(-0.114,0.019)	24.4%
North West	-0.102 (0.052)	(-0.098,0.045)	(-0.086,0.033)	2.0%	0.051 (0.032)	(-0.012,0.113)	(-0.002,0.103)	27.6%
Yorkshire & Humber	0.054 (0.053)	(-0.051,0.158)	(-0.034,0.142)	3.0%	0.048 (0.034)	(-0.019,0.114)	(-0.008,0.104)	27.5%
East Midlands	0.032 (0.053)	(-0.071,0.135)	(-0.054,0.119)	2.8%	0.111 (0.033)	(0.046,0.175)	(0.056,0.165)	29.7%
West Midlands	-0.006 (0.053)	(-0.110,0.098)	(-0.093,0.081)	2.6%	0.100 (0.033)	(0.036,0.165)	(0.046,0.154)	29.3%
East of England	-0.033 (0.050)	(-0.131,0.065)	(-0.113,0.049)	2.4%	0.102 (0.031)	(0.042,0.162)	(0.052,0.152)	29.4%
London	0.032 (0.053)	(-0.104,0.167)	(-0.082,0.145)	2.8%	0.260 (0.043)	(0.177,0.344)	(0.190,0.330)	35.0%
South West	-0.055 (0.053)	(-0.159,0.048)	(-0.143,0.032)	2.3%	-0.027 (0.037)	(-0.098,0.045)	(-0.086,0.033)	25.1%
Wales	0.023 (0.058)	(-0.091,0.136)	(-0.072,0.118)	2.7%	0.008 (0.037)	(-0.064,0.080)	(-0.053,0.033)	26.2%
Socioeconomic disadvantage	0.067 (0.015)	(0.038,0.096)	(0.042,0.091)	2.6% (2.0|5.7)	0.050 (0.013)	(0.024,0.076)	(0.028,0.071)	26.0% (23.1|35.4)
Professional living	-0.067 (0.015)	(-0.105,-0.030)	(-0.099,-0.036)	2.6% (3.4|0.1%)	-0.063 (0.012)	(-0.086,-0.40)	(-0.082,-0.043)	26.0% (29.7|13.8)
Settled living	0.010 (0.023)	(-0.036,0.056)	(-0.028,0.049)	2.6% (2.4|2.9)	0.013 (0.015)	(-0.016,0.041)	(-0.011,0.037)	26.0% (24.4|27.7)
In migration (rate per 1000)	-0.001 (0.001)	(-0.002,0.001)	(-0.002,0.000)	2.1% (2.4|0.05)	-0.001 (0.000)	(-0.001,0.000)	(-0.001,0.000)	22.9% (24.9|1.0)
Out migration (rate per 1000)	0.002 (0.001)	(-0.004,0.004)	(0.000,0.004)	3.9%	0.001 (0.001)	(-0.000,0.003)	(0.000,0.002)	28.9%

	Victimisation				Worry about Crime			
				(3.1|14.9)				(27.1|42.3)
% vacant properties	-0.004 (0.004)	(-0.012,0.005)	(-0.011,0.004)	2.5% (2.6|1.7)	-0.020 (0.003)	(-0.025,-0.014)	(-0.024,-0.015)	23.3% (25.7|5.7%)
Ethnic heterogeneity	0.135 (0.114)	(-0.090,0.359)	(-0.054,0.323)	2.7% (2.6|3.3%)	0.535 (0.074)	(0.390,0.680)	(0.413,0.656)	28.9% (26.1|40.6)
Incivilities	0.021 (0.008)	(0.005,0.036)	(0.007,0.034)	3.2% (3.0|4.6)	-0.001 (0.005)	(-0.012,0.010)	(-0.010,0.008)	25.8% (25.8|25.6)
Ethnic heterogeneity x HRP Black					-0.430 (0.220)	(-0.861,0.002)	(-0.792,-0.068)	
South west x HRP routine/manual					0.108 (0.051)	(0.009,0.208)	(0.025,0.192)	
Incivilites x disability no effect	0.045 (0.024)	(-0.003,0.093)	(0.005,0.086)					
London x no car	-0.190 (0.087)	(-0.360,-0.020)	(-0.332,-0.047)		-0.312 (0.053)	(-0.415,-0.208)	(-0.399,-0.225)	
Incivilities x worse condition					0.040 (0.017)	(0.005,0.074)	(0.011,0.068)	
Incivilities x disability large effect					0.037 (0.013)	(0.011,0.063)	(0.015,0.059)	
Lone parent x HRP routine/manual					-0.168 (0.069)	(-0.303,-0.033)	(-0.281,-0.055)	
Lone parent x household income £50,000+					0.395 (0.176)	(0.051,0.740)	(0.106,0.685)	
Socioeconomic disadvantage x male					-0.030 (0.015)	(-0.060,0.000)	(-0.055,-0.004)	
Sample size (n)=31859								

6.3.2.2 Individual and Household Characteristics

HRP Characteristics

Households with an older HRP were found to have both a lower risk of being victimised and being worried about victimisation, with the oldest individuals having a 1.5% risk of being victimised and 21.5% risk of being worried, compared to 3.9% and 29.6% respectively for the youngest individuals. Households with a male HRP were found to have both lower risk of being victimised and being worried about crime, with male led households having half a percentage lower risk of victimisation than female led households, and a 23.6% victimisation risk compared to the baseline risk of 25.9%.

There was not sufficient evidence of differing victimisation risk for households with a Mixed race HRP, Chinese HRP, or an HRP from an "other" ethnic group, compared to White led households. Asian and Black led households are estimated to have lower risk of victimisation than White led households, with a predicted average risk of 2.0% and 1.8% respectively. However, there was substantial error surrounding these estimates meaning the true value in the population could vary from this estimate, but credible intervals show that risk of household victimisation for Asian and Black led households is highly likely to be below that of the risk for White led households. This effect became evident following the addition of area level covariates to the model, with the estimate for Asian led households approximately doubling between model 2 and 3, and the estimate for Black led households increasing by more than 50%. When are differences were account for in the model, the effects of ethnicity on household victimisation risk became more pronounced, to ignore neighbourhood characteristics lowers the apparent variation in victimisation risk across different ethnicities. HRP ethnicity had a much stronger effect on worry than victimisation, with individuals in all non-white led households having higher risk of being worried than those in White led households. Respondents in Asian and Black led households were most likely to be worried about household victimisation, at 41% and

37% respectively, those in a Chinese or any "other" ethnicity led household were also at increased risk, at 32.5%.

Marital status of the HRP had limited effect on victimisation risk, there was evidence of increased risk of victimisation for divorced or separated people compared to single led households, with the risk estimated at 3.1% compared to the baseline risk of 2.6%, although there was some amount of variation in the posterior distribution of this estimate, showing there is a small probability this does not have any effect. Those living in households with a widowed, divorced, or separated HRP did not have a different risk of being worried than those with a single HRP; however, individuals with a married or cohabiting HRP had increased risk of being worried about household crime, at 30.4% and 29.0% respectively, compared to the base risk of 25.9%.

The socioeconomic status of the HRP was not found to affect risk of being a victim of household crime, however the risk of being worried about household crime was increased for those living in a house with a HRP working in an intermediate, or routine or manual occupation, with risk increased from the base risk by 2-3% to 28.4% and 29.0% respectively. Individuals least at risk of being worried about household crime are those in households in which the HRP is long-term unemployed, reducing the base risk by approximately 2.5% to 23.4%. The estimated effect of having a HRP who is long-term unemployed continuously rose throughout increasing model complexity. The effect of long-term unemployment becomes increasingly more important in explaining risk of worry about household crime once the individual and neighbourhood profile develops in the model.

Individual/Respondent Characteristics

Those with either no life limiting illness or disability, or those with one which does not affect their daily life have the lowest risk of becoming a victim of household crime. Those whose illness or disability does not affect their daily life were estimated to have

increased risk of victimisation throughout models 2 to 4, however following the estimation

of the interaction term between this covariate and independently rated incivilities, the

stand-alone effect became inconclusive, suggesting the effect of an illness or disability

which does not affect daily life to be highly dependent upon area incivilities. Those whose

illness or disability which affects daily life a little are estimated to have an increased risk of

victimisation of 4.2%, and for those whose disability affects their daily life a lot, risk is

more than doubled from the base level risk to 5.5%. Individuals with a life limiting illness

or disability which either did not affect their daily life, or affected their daily life a little,

were more likely to be worried about household victimisation than those with no disability,

with the baseline risk of 25.9% increasing to 27.8%, and 29.6%, respectively. The model

suggests an increased risk of being worried for those who have a life limiting illness or

disability which affects daily life a lot, however the large standard error in relation to the

mean of the posterior distribution for this variable disallows for any conclusion of the true

effect size in the population. The strength of this predictor decreased following its

inclusion in an interaction term with independently rated incivilities, suggesting the effect

of having a disability or illness which affects daily life a lot is somewhat dependent on

incivilities.

Those with either no qualifications, or "other" qualifications, were found to have

lower risk of household victimisation than those whose highest qualification is GCSE level

or above, with risk reduced to approximately 2%, from 2.6% for both of these groups.

There was much stronger evidence of an effect of education on worry about household

crime, with a higher risk estimated for all individuals whose highest qualification is below

degree level. Those with A levels as their highest qualification are estimated to have

increased risk of being worried from the base of 25.9% to 28.8%, and all those whose

highest qualification is GCSE level or below had a similarly increased risk of worry of

approximately 30%.

Household Characteristics

Those residing in owner occupied housing are not estimated to have increased risk of victimisation than those in privately rented housing, however those in socially rented housing had a higher risk of household victimisation of 3.4%, compared to the base on 2.6%. Private renters were estimated to be at the lowest risk of being worried about household victimisation, estimated at 23.2%, just over a 2 and a half percent reduction from the base risk of 25.9%.

There was no evidence of household victimisation risk differing from the baseline risk for those in detached, semi-detached, or terraced housing, however those in flats are estimated to have a lower risk at 1.9%. Prior to the inclusion of area level variables in model 3, those in terraced housing were estimated to be at increased risk of household victimisation, however this effect size diminished in model 3. This suggests area level variables better accounted for the differing risk between households of different types, than the household type itself. In contrast, the estimated protective effect of living in a flat or maisonette rose with increasing model complexity, suggesting this house type became more important in explaining victimisation risk when area level characteristics were accounted for. Compared to detached houses, individuals living in all other housing types are estimated to be at reduced risk of being worried about household crime. Those in semi-detached housing had an estimated risk of being worried of 24.7%, risk reduced to 22.8% for those living in terraced housing, and to 16.9% for those living in flats, or "other" types of accommodation.

There was some evidence that households with 3 or more adult residents were at increased risk of both household victimisation and worry, however there was substantial variation in the posterior distribution of coefficient estimates on both sides of the model, which disallows for conclusion of the likely effect size within the population. The estimated effect of a household having 3 or more adults rose throughout increasing model

complexity, suggesting the protective effect of having this characteristic became more important in explaining variation in victimisation risk when area level variables are considered. Lone parents were found to be at increased risk of both victimisation and being worried, with the risk of being victimised increasing by just over 1% from the baseline risk to 3.7%, and the risk of being worried increasing by almost 5% to 30.4%. The effect of lone parenthood on worry about household crime increased substantially from model 4 to model 5, where it was included in two interaction terms, with having a HRP in routine or manual employment, and having a household income over £50,000.

Car ownership affected risk of both victimisation and worry. With regard to victimisation, households without access to cars, and households with access to more cars were at increased risk of victimisation compared to those with 1 car. Households with access to either 0, or 2 cars had an increased risk of 3.1% and 3.2% respectively, those with three or more cars had the highest risk of victimisation, at 3.7%. The estimated increase in risk of having no access to a car increased in model 5, following its inclusion with an interaction term with the regional dummy variable, London. This suggests the effect of not having a car is somewhat dependent on whether an individual lives within or outside of London. Having access to two cars did not affect risk of being worried when compared to those owning one car, however those with access to either 0 or 3 or more cars had a similarly increased risk of approximately 28.5% compared to the base of 25.9%. In model 2 no effect of owning 3 or more cars was estimated, with the estimate increasing to show effect from model 3 onwards. This suggests that owning 3 or more cars better explains the variance in the risk of being worried about household crime once area level characteristics are accounted for.

Households with the highest income levels, above £50,000, were at the highest risk of being a victim of household crime, at 3.1%. There was no evidence that household with any other income levels differed from the baseline risk. There is some evidence to suggest

those in households with a household income below the base level have marginally

increased risk of being worried about household crime, however standard errors were

commonly large in comparison to the mean of posterior distributions. Those with a

household income of £10,000-£19,999 had a predicted increase in risk from 25.9% to

27.8%. had the strongest evidence of an effect on worry about household crime.

Households that were in better or worse condition than average for the

neighbourhood were at increased risk of victimisation than those of average condition,

with those in houses in better condition having an estimated risk of 3.3%, and those in

houses in worse condition having an estimated risk of 3.5%. Those living in households in

better condition than average for their area were also at increased risk of being worried

about household crime, with an estimated increase of 3% from the baseline to 28.9%.

Those living in household in worse condition were at reduced risk of being worried about

household crime, estimated at 19.5%. In models 2 to 4 no conclusive effect of living in a

household in worse condition was estimated. However, following the inclusion of this

variable in an interaction term with independently rated incivilities, a strong independent

effect was estimated, suggesting the effect of living in a house in worse condition on worry

about household crime was dependent upon the independently rated level of incivilities in

the area. Did it increase / decreased with more incivilities?

Compared to all individuals who had resided within their current household for a

year or more, those who have lived there for less than 12 months were at increased risk of

household victimisation, at 3.7%. Victimisation risk was not estimated to differ between

different categories of residence length between 1 year and 5 years. The effects of length

of residency were more pronounced on the risk of being worried about household

victimisation. Those living in their residence for either less than 12 months, or 12 months

to 2 years, had a reduced risk of approximately 23%, and those who have lived in their

residence for between 2 and 5 years, risk was reduced to just over 24%, compared to those

who had lived in their household for 5 years or more. The length of time a household was left unoccupied on an average weekday did not appear to affect the risk of household victimisation, however those in houses left unoccupied for less than one hour per day were at reduced risk of being worried about household crime compared to houses unoccupied for 3 or more hours per day, with an estimated risk of 24.7%.

6.3.2.3 Area Level Characteristics

In comparison to those living in an urban location, living in a rural area was estimated to reduce risk of being worried about household crime, from the baseline risk of 25.9% to 23.5%, rural living was not found to affect risk of household victimisation. In comparison to all other regions, households located in the North West are estimated to have a reduced victimisation risk of 2.0%, victimisation risk is not estimated to differ from the baseline risk between other regions. Those living in the East Midlands, West Midlands, East of England and London are at increased risk of being worried about household crime compared to those in other regions, with risk increased to 29.7%, 29.3%, 29.4%, and 35.0% respectively. The estimated increased risk estimated for those in London had increased following the inclusion of this variable within an interaction term with not having access to a car, this suggests the effect of living in London is somewhat dependent on car ownership.

Socioeconomic disadvantage was found to increase risk of both victimisation and worry about household crime. Households in areas with the lowest level of socioeconomic disadvantage have an estimated victimisation risk of 2%, whilst those in areas with the highest levels have an estimated risk of 5.7%. With regard to worry about household crime, those in areas with the lowest levels have an estimated risk of worry of 23.1%, and those in areas with the highest levels have a risk of 35.4%. The estimated increase in risk for those in areas of higher socioeconomic disadvantage increased in model 5 when this variable was included in an interaction term with being male, suggesting a dependence of the effect

of socioeconomic disadvantage on gender. Higher presence of professional living in a neighbourhood decreased risk of both victimisation and worry. Those living in neighbourhoods where professional living was at its lowest level had a victimisation risk of 3.4%, compared to 0.1% for those in neighbourhoods with the highest levels. Risk of being worried was estimated at 29.7% in those neighbourhoods where professional living was at its lowest, and 13.8% when at its highest. There was some evidence of higher levels of settled living increasing the risk of both victimisation and worry about crime, however in the final model the standard deviation of the posterior distribution is substantial in relation to the mean, therefore no accurate conclusion of the true effect size in the population can be made.

There was some limited evidence of a potential positive effect of migration into the neighbourhood on victimisation risk, however the standard deviation of the posterior distribution is substantial in relation to the mean, and no true population effect size could be concluded. Inward migration was found to have more of an effect on worry about household crime, with risk estimated at 24.9% in areas with the lowest levels of migration, and 1.0% in areas with the highest migration. Individuals living in areas with the lowest levels of migration out of the neighbourhood have an estimated victimisation risk of 3.1%, and those in areas with the highest levels of out migration have an estimated risk of 14.9%. There was no significant evidence of an effect of outward migration on worry about crime. Ethnic heterogeneity was estimated to be a strong predictor of worry about household crime, with a higher risk of worry found for individuals within areas of high heterogeneity. The risk of being worried increased from an estimated 26.1% for those in areas with the lowest levels of ethnic heterogeneity, to 40.6% for those in areas with the highest levels, however this characteristic did not appear to influence victimisation risk.

The percentage of properties left vacant in an area was not concluded to affect risk of victimisation, however it was found to reduce the risk of being worried. Individuals

living in areas with the lowest proportion of properties left vacant have a predicted risk of

25.7%, compared to 5.7% for those in areas with the highest levels.

6.3.2.4 Incivilities

Higher levels of independently assessed incivilities in an area were found to

increase risk of victimisation, but not risk of being worried about household crime. Those

living in areas with the lowest levels of incivilities are estimated to have a risk of

victimisation of 3.0%, compared to 4.6% for those living in areas with the highest level of

incivilities. When introduced in model 4, independently rated incivilities had a slightly

stronger estimated effect on worry than in model 5, where it was included in two

interaction terms with the variables to denote whether a household was in worse condition

on average for the local area, and whether the individual had an illness or disability which

affected daily life a lot. This suggests the effect of incivilities on worry is somewhat

dependent upon house condition and disability status.

6.3.2.5 Interaction Terms

Victimisation

Independently Rated Incivilities and Disability

For the majority of individuals, living in an area with higher incivilities was associated with increased risk of victimisation, and having an illness or disability which doesn't affect daily life was not concluded to have a standalone effect on household crime victimisation risk. A negative interaction term estimated between them meant the effects of having a disability differed for individuals in areas with different levels of incivilities. In all cases, individuals with a long-standing illness or disability are estimated to be at higher risk of victimisation than those without. This was most pronounced for those living in areas with high incivilities, whose victimisation risk is estimated at 11.4%, compared to: 4.3% for those with a disability living in an area with the lowest level of incivilities; and 4.6% for those without a disability living in an area with the highest level of incivilities.

Living in London and Car Ownership

For most individuals, living in London is not estimated to affect victimisation risk, whilst lack of access to a car was estimated to increase victimisation risk. A negative interaction term meant that the effect of owning a car differed for those within, and outside of London. Those with access to a car who lived within London have a lower victimisation risk (2.1%) than those who do not own a car (2.6%), whereas those with access to a car who live outside of London are at higher risk of victimisation (3.1%) than those without a car (2.8%).

Worry

Ethnicity of HRP and Ethnic Heterogeneity

For most individuals, living in an area of high ethnic heterogeneity, or within a household with a Black HRP were at substantially increased risk of being worried about household crime, however a negative interaction term between these two variables negated

the protective effects of living in an area with low levels of ethnic heterogeneity for those

in household with a Black HRP. For individuals in households with a non-Black HRP the

estimated risk of worry ranged from 26.1% to 40.6%, between the lowest and highest

levels of area ethnic heterogeneity, respectively, and between 37.0% and 40.0% for those

with a Black HRP.

Living in the South West and HRP Socioeconomic Classification

For most individuals, living in the South West did not affect the risk of being

worried about household crime in relation to the base category, and those with a HRP in

either manual or routine employment were estimated to be at higher risk of being worried,

than all other socioeconomic classifications. The interaction term means that the effect of

having a HRP in either routine or manual employment was stronger in the South West,

compared to elsewhere, with risk of being worried increasing from 25.1% to 31.9% for

those within the South West., compared to increasing from 26.0% to 29.0% for those in

other regions.

Living in London and Car Ownership

Those without regular access to a car are estimated to be at increased risk of being

worried about household victimisation, compared to owners of either 1 or 2 cars. The

increased risk of worry associated with having no regular access to a car was opposite for

those living in London, compared to those living elsewhere. For those not in London, the

risk was expected to increase from 26.0% for those with a vehicle to 28.6% for those

without access to a vehicle, and for those in London, to reduce from 35% for those with

access to a car, to 9.7% for those without access to a car.

Independently rated Incivilities and Relative House Condition

Living in a house in worse condition relative to others in the area was found to

increase the effects of incivilities on worry about crime. For those living in a house of

average, or better than average, condition relative to the local area, the risk of being

worried remained almost static at between 25.6% and 25.8% between areas of the lowest, and highest levels of incivilities. For those living in a house that is in worse condition than average for the local area, this ranged from 22.9% for those in areas with the lowest levels of incivilities, up to 34.8% for those in areas with the highest levels of incivilities.

Independently Rated Incivilities and Illness or Disability

Having a longstanding illness or disability which has a large impact on daily life was found to increase the effects of incivilities on worry about household crime. For those without a disability which has a large impact on daily life the effect of incivilities was minimal on risk of being worried, however for those with a disability, risk increased from 31.6% in the areas with the lowest levels of incivilities to 43.9% in areas with the highest levels of incivilities.

Lone parenthood and HRP Socioeconomic Classification

Both being a lone parent and living in a household with a HRP who works in a routine or manual position were estimated to increase risk of being worried about household crime. A negative interaction term between these means that lone parents of routine or manual socioeconomic classification are at reduced risk of being worried compared to non-lone parents in a household with a routine or manual classified HRP. For lone parents, those who are not in manual or routine employment have a higher worry risk (30.4%), than those in routine or manual employment (27.8%); and for non-lone parents, those who are not in routine or manual employment have a lower estimated worry risk (25.9%), than those in routine or manual employment (29.0%).

Lone parenthood and Household Income

The possible protective effect of living in a household which earns more than £50,000 was minimal for individuals who are not lone parents. However, for lone parents the effect of living in a household which earns more than £50,000 is much larger, with

worry about household crime increasing from 30.4% for lone parents earning less than

£50,000 per year, to 43.9% for lone parents earning £50,000 or more per year.

Neighbourhood Socioeconomic Disadvantage and Gender

The effect of the level of socioeconomic disadvantage in area on worry about

household crime was substantially lower for individuals living in a household with a male

HRP, compared to those living in a household with a female HRP. For individuals living in

a household with a female HRP, those in areas with the lowest levels of socioeconomic

disadvantage have an estimated risk of 23.1%, rising to 35.4% in areas with the highest

levels of disadvantage; in contrast individuals in households with a male HRP had an

estimated risk of 22.5% in areas with the lowest amount of disadvantage, and 24.9% in

areas with the highest.

6.3.3 Household BVML Model Results-Random Part

Table 35 Random Part Results Household BVML Model

	1	2	3	4	5
Individual Level					
Covariance/ correlation	0.238(0.016)	0.233(0.016)	0.232(0.016)	0.227(0.016)	0.233(0.016)
Neighbourhood Level					
Victim variance	0.045(0.015)	0.040(0.015)	0.029(0.015)	0.025(0.014)	0.027(0.015)
Worry variance	0.056(0.008)	0.037(0.007)	0.019(0.007)	0.014(0.006)	0.018(0.006)
Victim/worry covariance	0.025(0.008)	0.019(0.008)	0.008(0.007)	0.012(0.008)	0.006(0.007)
Victim/worry correlation	0.493	0.488	0.360	0.614	0.265
Deviance (MCMC)	178967.345	179126.975	179176.272	179256.286	179172.845
Sample size (n)=31859					

Table 35 above, shows the random part of the model, allowing for assessment of

the effect of covariates on neighbourhood level variance in household victimisation and

worry about household crime, as well as the covariance between these at both the

individual and neighbourhood level. As shown in the table above, the correlation between

household victimisation and worry about household crime at the individual level was

consistently low throughout all models, this estimate remained near constant from the

estimate of 0.237 in the null model presented previously in section 5.3.1. The introduction

of year of survey did not reduce the individual level covariance from the null model, and

further variables had only very slight, if any, impact on this estimate. This suggests that the

individual and neighbourhood characteristics included in these models are not able to

explain the co-occurrence of victimisation and worry within an individual as estimated by

the model. This could be attributed to the low frequency of these two phenomena co-

occurring within the data.

Covariates did more to explain variance and covariance at the neighbourhood level,

as more insight about household victimisation and worry can be deduced from the model at

the neighbourhood level. From the null model presented in the previous chapter to model 1

presented here, minimal change was estimated in all neighbourhood level random part

estimates. Year of survey covariates had explanatory power on the worry side of the model,

however this did not offer any additional explanation of variance in worry about household

crime present between neighbourhoods. The inclusion of these variables did result in slight

improvements in model fit, shown by a reduction of 4.7 in the deviance (MCMC) statistic.

The introduction of individual and household characteristics into the model reduced

unexplained variance at the neighborhood level for both outcomes and their covariance.

Unexplained neighbourhood level variance in victimisation was reduced by 11% from

0.045 to 0.040. Variables considered likely to have contributed to this include: age;

disability; tenure type; housing type; car ownership; and tenure length, all of which are

likely to have some correlation at the neighbourhood level. Although having good

explanatory power, variables such as gender are considered unlikely to explain variation at

the neighbourhood level as this is unlikely to be correlated at the neighbourhood level.

Unexplained variance in worry between neighbourhoods was reduced by 34% from 0.056

to 0.037. Variables which may have explained some of this variance are: age; ethnicity;

HRP socioeconomic status; disability; education; house type; car ownership; income; and

length of tenure. The unexplained covariance between worry and victimisation was reduced by almost 24% following the addition of individual and household characteristics from 0.025 to 0.019. Variables which may have contributed to explaining this covariance include: age; disability; and car ownership, all of which were concluded to affect victimisation and worry similarly, i.e. they were risk factors on both sides of the model, or protective factors on both sides of the model. Despite having added substantial explanatory power to the model, and having explained previously unexplained variance at the neighbourhood level, the MCMC deviance statistic increased by 159.63 with the addition of individual and household variables.

The addition of area level variables had further effect on the neighbourhood level variance estimates, reducing the unexplained variation in victimisation by a further 28%, from 0.040 to 0.029. Variables which were concluded to affect victimisation risk included: some regions of England and Wales; the level of socioeconomic disadvantage; professional living; and outward migration, these variables are attributed with explaining the additional reduction in variance. The addition of neighbourhood variables reduced the unexplained variation in worry by a further 49%, from 0.037 to 0.019. Variables attributed with explaining this additional variation are: some regions of England and Wales; the level of socioeconomic disadvantage; professional living; the proportion of properties vacant; and ethnic heterogeneity. Estimated covariance was also reduced by 58%, from 0.019 to 0.008. Two variables which had similar effects on worry and victimisation are: socioeconomic disadvantage; and professional living and are attributed with explaining this additional covariance. There was again an increase in the deviance statistic of approximately 49.297.

The addition of independently reviewed incivilities had a smaller impact on the remaining unexplained variance. An additional 14% of neighbourhood variance in victimisation was explained with the addition of this variable, reducing the estimate from 0.029 to 0.025. The unexplained neighbourhood level variance was reduced by 26% from

0.019 to 0.014, however this variable did not have a strong coefficient in the model. The

covariance estimate increased by approximately 50%, however the credible interval

surrounding this estimate for model 4 and model 5 was large in comparison to the posterior

mean, therefore these estimates do not lead to the conclusion that independently rated

incivilities accounted for 50% of the remaining unexplained covariance, instead this is

attributed to error. The model fit statistic increased by 80.014 with the addition of this

variable.

Interaction terms offered minimal additional explanation for neighbourhood level

variance and covariance of outcomes. Between neighbourhood variance in victimisation

was estimated to increase by 8% from 0.025 to 0.027, however there is no good

explanation for a change in explained variance between these models, this change is

therefore concluded to be no real effect, instead attributed to variation of the estimate

between models well within the credible intervals. There was also an increase in

unexplained variance in worry between neighbourhoods of 29%, from 0.014 to 0.018, this

estimate is closer to that in model 3, which contained individual and household, and

neighbourhood characteristics. Given the introduction of multiple interaction terms in

model 5 which had explanatory power, as well as other variables within the model

estimating stronger coefficients it is unclear why this has risen, however the rise remains

well within the credible intervals for this coefficient in models 3,4 and 5, and therefore

may be random error. The covariance estimate decreased in this model by 50% from 0.012

to 0.006, a proportion of this may be explained by the additional explanatory power on

both sides of the model, however as concluded with the victimisation and worry covariates,

a good proportion of this change may be due to error as the credible intervals are wide

around the posterior means.

6.3.4 Summary of Risk and Protective Factors

Table 36 Summary of Risk and Protective Factors of Household Victimisation and Worry about Household Crime

	Worry	Victim
Risk	• Being Asian, Black, Chinese or other • Being married, or cohabiting • Working in an intermediate position • Having a disability which does not affect daily life, or a disability which affects daily life a little • Having below a degree as highest qualification, or other qualifications • Lone parenthood • Not owning a car, or owning more than 3 cars • Having a household income between £10,000 and £19,999 • Living in a house of better condition than average • Living in the East Midlands, West Midlands, East of England, or London • Higher socioeconomic disadvantage • Higher ethnic heterogeneity	• Being divorced or separated • Having an illness or disability which either affects life a little, or a lot • Living in social rented accommodation • Having 3 or more adult residents in a household • Lone parenthood • Either not owning a car, or owning 2 or 3 cars • Having a household income of £50,000 or above • Living in a house in either better, or worse condition than average for the area • Having a tenure length of 12 months or less • Higher levels of socioeconomic disadvantage • Higher levels of independently rated incivilities
Protective	• Older age • Being male • Being long-term unemployed • Private renting • Living in semi-detached, terraced, flat or other house type • Living in a house of worse condition than average • Having a tenure length below 5 years • Leaving the house unoccupied for less than 1 hour per day • Higher professional living • Higher inward migration	• Older age • Being male • Being Asian or Black • Having no qualifications, or other qualifications • Living in a flat, or other type of accommodation • Living in the North West • Higher levels of professional living

Worry	Victim
• Higher proportion of vacant properties	

Table 36 above shows the risk and protective factors of household victimisation and worry about household crime.

6.4 Vehicle Crime

This section first discusses how well model coefficients met acceptable MCMC diagnostics, and assumptions of the model. The reference person is then defined, to whom all risk and protective f actors are compared. Risk and protective factors are discussed in stages, followed by an assessment of the random part of the model.

6.4.1 MCMC Diagnostics, Assumptions & Residuals

6.4.1.1 MCMC Diagnostics

Analysis of the trajectories of both fixed and random coefficients for the vehicle model resulted in similar considerations to the household model presented in section 6.3.2. Again, for those coefficients where the posterior mean was substantial in relation to the standard error, and not close to 0, trajectories were all acceptable, this was the case for all coefficients concluded to have an effect on the dependent variable. When examining the random part of the model, the Brooks-Draper diagnostics were not satisfied when estimating neighbourhood level variance in victimisation, worry about crime, or the covariance between them. Only the upper quartile of the neighbourhood level covariance estimate and both upper and lower quartiles of the worry about vehicle crime variance estimate sufficiently met the Raftery-Lewis diagnostics. The kernel density plot also showed a negative skew for both neighbourhood variation in victimisation and worry. There was also significant evidence of autocorrelation and partial autocorrelation for all neighbourhood level random variables. Similarly to the household model, the individual level victimisation and worry about vehicle crime covariance estimate better met all diagnostics, with a normally distributed kernel density plot, sufficient iterations to meet

Raftery-Lewis and Brooks-Draper diagnostics. ACF and PACF measures also showed low

autocorrelation and partial autocorrelation within the Markov chain.

6.4.1.2 Checking Assumptions

Assumption 3-Normally Distributed Residuals

As shown in the graphs below, the assumption of normality of neighbourhood level

residuals has been met on both the victimisation and worry sides of the model.
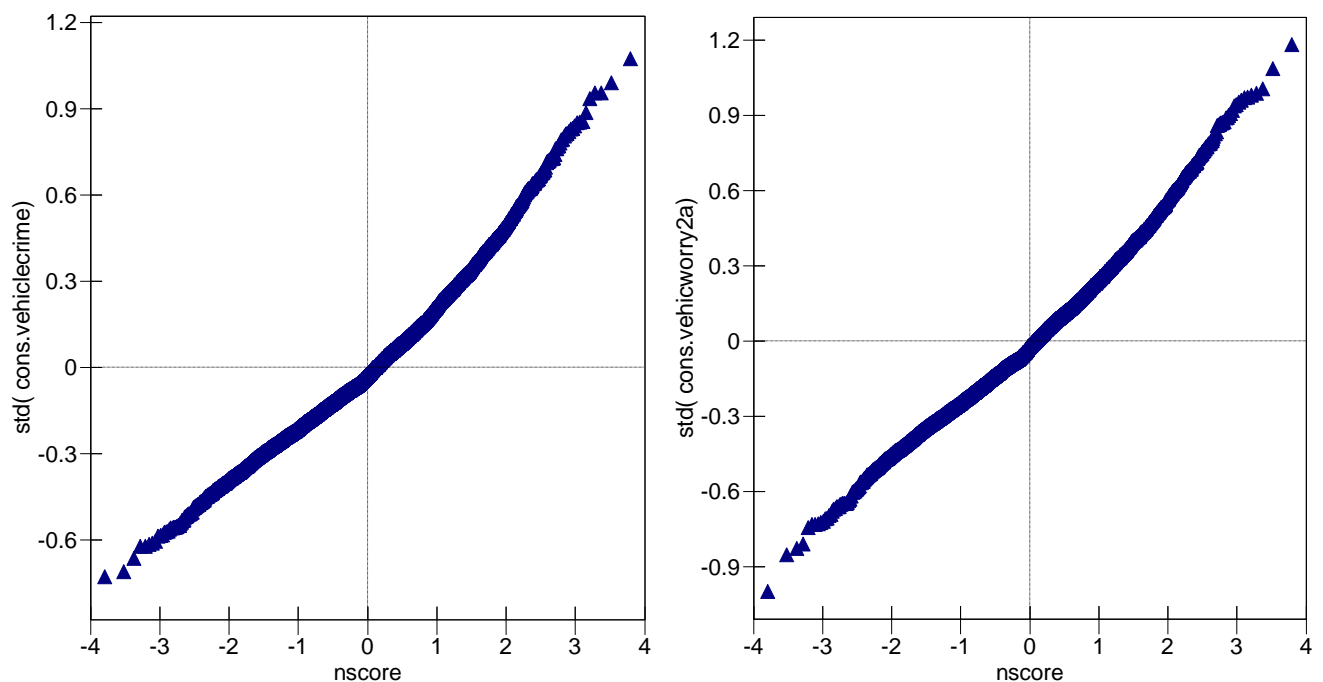
Figure 5 Plot of Standardised Residuals against Normal Scores

Assumption 4- Homoskedasticity

Graphs shown in the appendix again show heteroskedasticity is present in the

model, however the estimation methods used are considered robust enough for this

violation to not affect model accuracy.

6.4.2 Vehicle BVML Model Results-Fixed Part

6.4.2.1 Reference Individual

The reference person to which all estimated percentage risks are compared to in

determining risk and protective factors is: a 52 year old female interviewed in 2016, who is

white, single, of professional socioeconomic classification, with no longstanding illness or

disability; and has a degree level qualification; they are an owner occupier of a detached

house, with one car; they have an annual household income of £30,000-£49,999; and they

live within an urban location within the South East. The base neighbourhood has average

levels of socioeconomic disadvantage, professional living and settled living, minimum

levels of inward and outward migration, ethnic heterogeneity, and incivilities.

The baseline risk of vehicle victimisation for the reference household/person is

estimated at 1.8%, and the baseline risk of worry about vehicle crime is estimated at

19.6%.

Model results tables are presented overleaf.

Table 37 Fixed Part Results Vehicle BVML Model

	1		2		3		4		5	
	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry
Cons	-1.507 (0.025)	-0.563 (0.017)	-1.887(0.060)	-0.768 (0.040)	-1.984 (0.089)	-0.858 (0.064)	-2.106 (0.095)	-0.861 (0.068)	-2.103 (0.095)	-0.855 (0.069)
Year (16)										
14	0.072 (0.036)	0.023 (0.026)	0.079 (0.036)	0.019 (0.026)	0.092 (0.040)	0.036 (0.027)	0.094 (0.040)	0.036 (0.027)	0.093 (0.040)	0.036 (0.027)
15	0.027 (0.034)	-0.020 (0.024)	0.033 90.035)	-0.022 (0.024)	0.040 (0.035)	-0.018 (0.024)	0.043 (0.035)	-0.018 (0.024)	0.043 (0.035)	-0.017 (0.024)
17	0.018 (0.034)	0.025 (0.024)	0.019 (0.034)	0.021 (0.024)	0.017 (0.035)	0.021 (0.024)	0.015 (0.035)	0.021 (0.024)	0.015 (0.034)	0.021 (0.024)
18	0.043 (0.056)	0.127 (0.039)	0.037 (0.057)	0.125 (0.039)	0.030 (0.057)	0.122 (0.039)	0.027 (0.057)	0.122 (0.039)	0.026 (0.057)	0.123 (0.039)
LA Victim	-	0.451 (0.063)	-	0.384 (0.061)	-	0.376 (0.062)	-	0.376 (0.061)		0.376 (0.061)
Age (GM centred)			-0.010 (0.001)	-0.001 (0.001)	-0.010 (0.001)	0.000 (0.001)	-0.010 (0.001)	0.000 (0.001)	-0.010 (0.001)	0.000 (0.001)
Gender (Female)										
Male			0.022 (0.025)	-0.066 (0.017)	0.021 (0.025)	-0.072 (0.017)	0.020 (0.025)	-0.072 (0.017)	0.021 (0.025)	-0.072 (0.017)
Ethnicity (White)										
Mixed race			0.268 (0.111)	0.248 (0.091)	0.193 (0.111)	0.192 (0.091)	0.197 (0.111)	0.192 (0.092)	0.194 (0.112)	0.195 (0.092)
Asian			0.183 (0.051)	0.562 (0.039)	0.050 (0.055)	0.426 (0.041)	0.044 (0.055)	0.426 (0.041)	0.044 (0.056)	0.428 (0.041)
Black			0.045 (0.085)	0.398 (0.062)	-0.135 (0.087)	0.253 (0.064)	-0.139 (0.088)	0.252 (0.064)	-0.139 (0.088)	0.253 (0.064)
Chinese/other			0.173 (0.145)	0.446 (0.109)	0.047 (0.146)	0.362 (0.108)	0.049 (0.147)	0.361 (0.109)	0.048 (0.147)	0.365 (0.109)
Marital Status (Single)										
Married			0.007 (0.039)	0.095 (0.028)	0.018 (0.039)	0.095 (0.028)	0.018 (0.039)	0.095 (0.028)	0.018 (0.039)	0.096 (0.028)
Cohabiting			0.077 (0.045)	0.099 (0.034)	0.083 (0.045)	0.093 (0.034)	0.081 (0.046)	0.093 (0.034)	0.081 (0.046)	0.094 (0.034)
Widowed			-0.048 (0.073)	-0.076 (0.044)	-0.019 (0.073)	-0.074 (0.045)	-0.016 (0.074)	-0.073 (0.044)	-0.018 (0.074)	0.073 (0.045)
Divorced/separated			0.115 (0.049)	0.015 (0.035)	0.146 (0.049)	0.024 (0.035)	0.147 (0.049)	0.024 (0.035)	0.147 (0.049)	0.025 (0.035)
SES (Professional)										
Intermediate			0.019 (0.033)	0.082 (0.023)	0.017 (0.033)	0.079 (0.023)	0.016 (0.033)	0.079 (0.023)	0.015 (0.033)	0.080 (0.023)
Routine & Manual			0.011 (0.034)	0.122 90.024)	0.011 (0.034)	0.112 (0.024)	0.008 (0.034)	0.112 (0.024)	0.007 (0.034)	0.092 (0.025)
Long-term unemployed			0.058 (0.089)	0.106 (0.063)	0.026 (0.089)	0.088 (0.063)	0.022 (0.089)	0.088 (0.063)	0.021 (0.089)	0.085 (0.063)
Disability (None)										
Does not affect daily life			0.054 (0.044)	0.063 (0.029)	0.062 (0.044)	0.064 (0.029)	0.063 (0.043)	0.064 (0.029)	0.065 (0.044)	0.065 (0.029)
Affects daily life a little			0.110 (0.043)	0.162 (0.029)	0.116 (0.043)	0.159 (0.029)	0.118 (0.043)	0.159 (0.029)	0.118 (0.043)	0.160 (0.029)
Affects daily life a lot			0.263 (0.050)	0.209 (0.035)	0.262 (0.050)	0.201 (0.029)	0.258 (0.050)	0.201 (0.035)	0.261 (0.050)	0.202 (0.035)
Education (Degree)										
A Levels			-0.048 (0.035)	0.076 (0.025)	-0.038 (0.035)	0.072 (0.025)	-0.039 (0.044)	0.071 (0.025)	-0.039 (0.035)	0.071 (0.025)
GCSE			-0.085 (0.037)	0.061 (0.026)	-0.075 (0.037)	0.054 (0.026)	-0.076 (0.037)	0.054 (0.026)	-0.076 (0.037)	0.054 (0.026)
No qualifications			-0.055 (0.044)	0.135 (0.029)	-0.063 (0.044)	0.117 (0.029)	-0.069 (0.044)	0.117 (0.030)	-0.068 (0.045)	0.117 (0.029)
Other			-0.078 (0.073)	0.086 (0.048)	-0.084 (0.073)	0.070 (0.048)	-0.089 (0.073)	0.070 (0.048)	-0.090 (0.073)	0.071 (0.025)
Tenure (Owner Occupier)										
Private renter			0.005 (0.036)	-0.007 (0.027)	0.006 (0.036)	-0.002 (0.027)	0.002 (0.036)	-0.002 (0.027)	0.002 (0.037)	-0.002 (0.027)
Social renter			0.168 (0.042)	0.032 (0.031)	0.154 (0.042)	0.023 (0.031)	0.142 (0.043)	0.023 (0.031)	0.143 (0.043)	0.022 (0.031)
House type (Detached)										
Semi-detached			0.196 (0.034)	0.049 (0.022)	0.144 90.034)	0.016 (0.023)	0.134 (0.035)	0.016 (0.023)	0.133 (0.035)	0.016 (0.023)
Terraced			0.350 (0.036)	0.098 (0.025)	0.240 (0.038)	0.049 (0.026)	0.218 (0.038)	0.048 (0.026)	0.217 (0.038)	0.049 (0.026)
Flat, maisonette or other			0.268 (0.051)	0.108 (0.036)	0.103 (0.055)	0.070 (0.038)	0.088 (0.055)	0.069 (0.038)	0.084 (0.055)	0.071 (0.038)
No. of cars (1)										
0			-0.122 (0.164)	0.289 (0.103)	-0.140 (0.166)	0.273 (0.103)	-0.136 (0.165)	0.274 (0.103)	-0.140 (0.166)	0.276 (0.103)
2			0.139 (0.030)	0.055 (0.021)	0.175 (0.030)	0.070 (0.021)	0.177 (0.030)	0.070 (0.021)	0.177 (0.030)	0.070 (0.021)
3+			0.369 (0.042)	0.143 (0.031)	0.413 (0.042)	0.160 (0.031)	0.415 (0.042)	0.161 (0.031)	0.415 (0.042)	0.162 (0.031)
Income (£30,000-£49,999)										

	1	2	3	4	5
No information/refused		-0.061 (0.047) -0.031 (0.031)	-0.078 (0.047) -0.034 (0.031)	-0.080 (0.047) -0.034 (0.032)	-0.081 (0.047) -0.034 (0.031)
Less than £10,000		-0.023 (0.057) 0.046 (0.039)	-0.032 (0.057) 0.038 (0.039)	-0.035 (0.057) 0.037 (0.039)	-0.033 (0.057) 0.038 (0.039)
£10,000-£19,999		0.005 (0.041) -0.008 (0.028)	0.008 (0.042) -0.015 (0.029)	0.008 (0.041) -0.015 (0.028)	0.007 (0.042) -0.014 (0.029)
£20,000-£29,999		-0.024 (0.040) -0.047 (0.027)	-0.026 (0.040) -0.052 (0.027)	-0.027 (0.040) -0.052 (0.028)	-0.028 (0.040) -0.052 (0.027)
£50,000+		0.028 (0.036) -0.133 (0.026)	0.015 (0.036) -0.120 (0.026)	0.020 (0.036) -0.121 (0.026)	0.019 (0.036) -0.120 (0.026)
Time in area (10+ years)					
Less than 12 months		-0.086 (0.058) -0.110 (0.043)	-0.006 (0.058) -0.087 (0.043)	-0.003 (0.058) -0.086 (0.043)	-0.004 (0.058) -0.087 (0.043)
12 months – 2 years		-0.086 (0.058) -0.225 (0.043)	-0.064 (0.059) -0.203 (0.043)	-0.059 (0.059) -0.203 (0.043)	-0.059 (0.059) -0.203 (0.043)
2-5 years		-0.002 (0.039) -0.052 (0.028)	0.016 (0.039) -0.038 (0.028)	0.018 (0.039) -0.038 (0.028)	0.018 (0.039) -0.038 (0.028)
5-10 years		0.055 (0.036) -0.032 (0.027)	0.065 (0.037) -0.021 (0.027)	0.066 (0.037) -0.021 (0.027)	0.066 (0.037) -0.021 (0.027)
Time out of the house (3+ hours)					
Less than 1 hour		0.032 (0.058) -0.245 (0.040)	0.036 (0.058) -0.237 (0.040)	0.040 (0.058) -0.237 (0.040)	0.040 (0.058) -0.239 (0.041)
1-3 hours		-0.098 (0.036) -0.117 (0.023)	-0.090 (0.036) -0.111 (0.023)	-0.090 (0.036) -0.111 (0.023)	-0.091 (0.036) -0.111 (0.023)
Area Type (Urban)					
Rural			-0.015 (0.030) -0.036 (0.020)	-0.015 (0.030) -0.036 (0.020)	-0.035 (0.020) -0.014 (0.030)
Region (South East)					
North East			-0.188 (0.069) -0.028 (0.047)	-0.179 (0.069) -0.027 (0.047)	-0.174 (0.069) -0.026 (0.047)
North West			-0.031 (0.050) 0.042 (0.036)	-0.024 (0.050) 0.042 (0.036)	-0.021 (0.050) 0.043 (0.036)
Yorkshire & Humber			-0.160 (0.055) 0.046 (0.038)	-0.156 (0.056) 0.047 (0.039)	-0.152 (0.056) 0.048 (0.039)
East Midlands			-0.013 (0.052) 0.085 (0.037)	-0.009 (0.052) 0.085 (0.037)	-0.007 (0.052) 0.087 (0.037)
West Midlands			-0.054 (0.053) 0.138 (0.037)	-0.050 (0.052) 0.138 (0.037)	-0.049 (0.053) 0.140 (0.037)
East of England			-0.006 (0.048) 0.014 (0.034)	-0.004 (0.047) 0.014 (0.034)	-0.002 (0.048) -0.035 (0.038)
London			0.000 (0.062) -0.062 (0.047)	0.007 (0.062) -0.061 (0.047)	0.011 (0.062) -0.063 (0.047)
South West			-0.201 (0.053) -0.004 (0.036)	-0.189 (0.053) -0.004 (0.036)	-0.171 (0.054) -0.002 (0.036)
Wales			-0.030 (0.058) -0.026 (0.041)	-0.028 (0.058) -0.026 (0.041)	-0.026 (0.058) -0.024 (0.041)
Socioeconomic disadvantage			0.110 (0.015) 0.030 (0.011)	0.101 (0.015) 0.030 (0.011)	0.093 (0.016) 0.030 (0.012)
Professional living			-0.019 (0.019) -0.048 (0.014)	-0.013 (0.019) -0.048 (0.014)	-0.012 (0.019) -0.048 (0.014)
Settled living			-0.028 (0.023) -0.010 (0.017)	-0.023 (0.023) -0.009 (0.018)	-0.028 (0.024) -0.011 (0.018)
In migration (rate per 1000)			-0.003 (0.001) -0.002 (0.001)	-0.003 (0.001) -0.002 (0.001)	-0.003 (0.001) -0.002 (0.001)
Out migration (rate per 1000)			0.006 (0.001) 0.003 (0.001)	0.006 (0.001) 0.003 (0.001)	0.006 (0.001) 0.003 (0.001)
Ethnic heterogeneity			0.205 (0.118) 0.556 (0.088)	0.189 (0.117) 0.555 (0.088)	0.185 (0.119) 0.554 (0.088)
Incivilities				0.031 (0.008) 0.001 (0.006)	0.032 (0.008) 0.001 (0.006)
South West x socioeconomic disadvantage					0.111 (0.050) -
Eastern x routine/manual SES					- 0.160 (0.055)
Sample size (n)=25851					

Table 38 Final Model of Vehicle Crime Victimisation and Worry Credible Intervals and Percentage Predictions

	Victimisation				Worry about Crime			
	Coefficient	95% credible interval	90% credible interval	Coef. % prediction	Coefficient	95% credible interval	90% credible interval	Coef. % prediction
Cons	-2.103 (0.095)	(-2.290,-1.918)	(-2.259,1.947)	1.8%	-0.855 (0.069)	(-0.990,-0.721)	(-0.968,-0.742)	19.6%
Year (16)								
14	0.093 (0.040)	(0.015,0.171)	(0.027,0.159)	2.2%	0.036 (0.027)	(-0.017,0.089)	(-0.09,0.081)	21.6%
15	0.043 (0.035)	(-0.025,0.112)	(-0.014,0.101)	2.0%	-0.017 (0.024)	(-0.064,0.030)	(-0.057,0.023)	19.2%
17	0.015 (0.034)	(-0.053,0.082)	(-0.042,0.071)	1.8%	0.021 (0.024)	(-0.026,0.067)	(-0.018,0.060)	20.2%
18	0.026 (0.057)	(-0.086,0.139)	(-0.068,0.120)	1.9%	0.123 (0.039)	(0.046,0.200)	(0.058,0.188)	23.2%
LA Victim	-	-	-	-	0.376 (0.061)	(0.257,0.495)	(0.275,0.476)	31.6%
Age (GM centred)	-0.010 (0.001)	(-0.012,-0.008)	(-0.012,-0.008)	1.8% (4.2|0.1)	0.000 (0.001)	(-0.001,0.002)	(-0.001,0.001)	19.6% (19.5|19.8)
Gender (Female)								
Male	0.021 (0.025)	(-0.028,0.070)	(-0.020,0.062)	1.9%	-0.072 (0.017)	(-0.106,-0.038)	(-0.100,-0.043)	17.7%
Ethnicity (White)								
Mixed race	0.194 (0.112)	(-0.030,0.409)	(0.008,0.375)	2.8%	0.195 (0.092)	(0.014,0.375)	(0.043,0.345)	25.5%
Asian	0.044 (0.056)	(-0.065,0.153)	(-0.048,0.135)	2.0%	0.428 (0.041)	(0.347,0.509)	(0.360,0.496)	33.5%
Black	-0.139 (0.088)	(-0.312,0.031)	(-0.284,0.003)	1.2%	0.253 (0.064)	(0.127,0.378)	(0.148,0.359)	27.4%
Chinese/other	0.048 (0.147)	(-0.247,0.331)	(-0.197,0.286)	2.0%	0.365 (0.109)	(0.150,0.578)	(0.185,0.544)	31.2%
Marital Status (Single)								
Married	0.018 (0.039)	(-0.058,0.094)	(-0.046,0.082)	1.9%	0.096 (0.028)	(0.040,0.151)	(0.050,0.142)	22.4%
Cohabiting	0.081 (0.046)	(-0.009,0.170)	(0.006,0.156)	2.2%	0.094 (0.034)	(0.027,0.162)	(0.038,0.151)	22.3%
Widowed	-0.018 (0.074)	(-0.164,0.127)	(-0.140,0.104)	1.7%	0.073 (0.045)	(-0.160,0.015)	(-0.147,0.001)	21.7%
Divorced/separated	0.147 (0.049)	(0.051,0.244)	(0.066,0.228)	2.5%	0.025 (0.035)	(-0.044,0.094)	(-0.033,0.083)	20.3%
SES (Professional)								
Intermediate	0.015 (0.033)	(-0.051,0.080)	(-0.040,0.069)	1.8%	0.080 (0.023)	(0.035,0.124)	(0.042,0.117)	21.9%
Routine & Manual	0.007 (0.034)	(-0.059,0.074)	(-0.048,0.063)	1.8%	0.092 (0.025)	(0.043,0.140)	(0.051,0.132)	22.3%
Long-term unemployed	0.021 (0.089)	(-0.156,0.194)	(-0.128,0.166)	1.9%	0.085 (0.063)	(-0.039,0.208)	(-0.019,0.188)	22.1%
Disability (None)								
Does not affect daily life	0.065 (0.044)	(-0.022,0.149)	(-0.008,0.136)	2.1%	0.065 (0.029)	(0.007,0.122)	(0.017,0.113)	21.5%
Affects daily life a little	0.118 (0.043)	(0.033,0.201)	(0.046,0.188)	2.4%	0.160 (0.029)	(0.103,0.217)	(0.112,0.208)	24.4%
Affects daily life a lot	0.261 (0.050)	(0.163,0.359)	(0.178,0.343)	3.3%	0.202 (0.035)	(0.133,0.271)	(0.144,0.260)	25.7%
Education (Degree)								
A Levels	-0.039 (0.035)	(-0.109,0.030)	(-0.098,0.019)	1.6%	0.071 (0.025)	(0.022,0.119)	(0.029,0.111)	21.7%
GCSE	-0.076 (0.037)	(-0.148,-0.004)	(-0.136,-0.016)	1.5%	0.054 (0.026)	(0.003,0.104)	(0.012,0.096)	21.1%
No qualifications	-0.068 (0.045)	(-0.155,0.019)	(-0.142,0.005)	1.5%	0.117 (0.029)	(0.059,0.174)	(0.068,0.165)	23.0%
Other	-0.090 (0.073)	(-0.236,0.051)	(-0.212,0.029)	1.4%	0.071 (0.025)	(-0.025,0.165)	(-0.009,0.150)	21.7%
Tenure (Owner Occupier)								
Private renter	0.002 (0.037)	(-0.070,0.074)	(-0.059,0.062)	1.8%	-0.002 (0.027)	(-0.055,0.050)	(-0.046,0.042)	19.6%
Social renter	0.143 (0.043)	(0.059,0.227)	(0.073,0.213)	2.5%	0.022 (0.031)	(-0.039,0.084)	(-0.030,0.074)	20.2%
House type (Detached)								
Semi-detached	0.133 (0.035)	(0.064,0.201)	(0.075,0.190)	2.4%	0.016 (0.023)	(-0.028,0.061)	(-0.021,0.054)	20.1%
Terraced	0.217 (0.038)	(0.143,0.291)	(0.154,0.280)	3.0%	0.049 (0.026)	(-0.002,0.100)	(0.006,0.092)	21.0%
Flat, maisonette or other	0.084 (0.055)	(-0.024,0.191)	(-0.007,0.174)	2.2%	0.071 (0.038)	(-0.004,0.145)	(0.008,0.133)	21.7%
No. of cars (1)								

	Victimisation				Worry about Crime			
0	-0.140 (0.166)	(-0.474,0.174)	(-0.418,0.126)	1.2%	0.276 (0.103)	(0.075,0.476)	(0.108,0.445)	28.1%
2	0.177 (0.030)	(0.117,0.236)	(0.127,0.227)	2.7%	0.070 (0.021)	(0.029,0.112)	(0.036,0.105)	21.6%
3+	0.415 (0.042)	(0.333,0.498)	(0.346,0.485)	4.6%	0.162 (0.031)	(0.101,0.223)	(0.110,0.213)	24.4%
Income (£30,000-£49,999)								
No information/refused	-0.081 (0.047)	(-0.174,0.012)	(-0.159,-0.003)	1.4%	-0.034 (0.031)	(-0.096,0.027)	(-0.086,0.017)	18.7%
Less than £10,000	-0.033 (0.057)	(-0.146,0.078)	(-0.127,0.061)	1.6%	0.038 (0.039)	(-0.038,0.113)	(-0.026,0.102)	20.7%
£10,000-£19,999	0.007 (0.042)	(-0.074,0.089)	(-0.061,0.076)	1.8%	-0.014 (0.029)	(-0.070,0.042)	(-0.061,0.033)	19.2%
£20,000-£29,999	-0.028 (0.040)	(-0.106,0.050)	(-0.094,0.037)	1.7%	-0.052 (0.027)	(-0.106,0.001)	(-0.097,-0.007)	18.2%
£50,000+	0.019 (0.036)	(-0.052,0.090)	(-0.040,0.079)	1.8%	-0.120 (0.026)	(-0.172,-0.069)	(-0.163,-0.077)	16.5%
Time in area (10+ years)								
Less than 12 months	-0.004 (0.058)	(-0.118,0.109)	(-0.100,0.091)	1.8%	-0.087 (0.043)	(-0.171,-0.004)	(-0.157,-0.017)	17.3%
12 months – 2 years	-0.059 (0.059)	(-0.174,0.055)	(-0.156,0.037)	1.5%	-0.203 (0.043)	(-0.288,-0.119)	(-0.274,-0.132)	14.5%
2-5 years	0.018 (0.039)	(-0.059,0.094)	(-0.047,0.082)	1.9%	-0.038 (0.028)	(-0.093,0.017)	(-0.084,0.008)	18.6%
5-10 years	0.066 (0.037)	(-0.006,0.138)	(0.006,0.127)	2.1%	-0.021 (0.027)	(-0.074,0.031)	(-0.065,0.023)	19.1%
Time out of the house (3+ hours)								
Less than 1 hour								
1-3 hours	0.040 (0.058)	(-0.074,0.153)	(-0.056,0.135)	2.0%	-0.239 (0.041)	(-0.318,-0.160)	(-0.306,-0.173)	13.7%
	-0.091 (0.036)	(-0.162,-0.021)	(-0.150,-0.032)	1.4%	-0.111 (0.023)	(-0.156,-0.066)	(-0.149,-0.073)	16.7%
Area Type (Urban)								
Rural	-0.014 (0.030)	(-0.073,0.045)	(-0.064,0.036)	1.6%	-0.035 (0.020)	(-0.074,0.004)	(-0.068,-0.002)	19.2%
Region (South East)								
North East	-0.174 (0.069)	(-0.309,-0.038)	(-0.287,-0.061)	1.1%	-0.026 (0.047)	(-0.119,0.067)	(-0.104,0.052)	18.9%
North West	-0.021 (0.050)	(-0.119,0.078)	(-0.104,0.062)	1.7%	0.043 (0.036)	(-0.028,0.115)	(-0.016,0.103)	21.8%
Yorkshire & Humber	-0.152 (0.056)	(-0.261,-0.043)	(-0.243,-0.060)	1.2%	0.048 (0.039)	(-0.028,0.124)	(-0.016,0.111)	21.0%
East Midlands	-0.007 (0.052)	(-0.109,0.095)	(-0.093,0.079)	1.7%	0.087 (0.037)	(0.013,0.160)	(0.025,0.149)	22.1%
West Midlands	-0.049 (0.053)	(-0.152,0.053)	(-0.136,0.037)	1.6%	0.140 (0.037)	(0.066,0.212)	(0.079,0.201)	23.7%
East of England	-0.002 (0.048)	(-0.096,0.091)	(-0.081,0.076)	1.8%	-0.035 (0.038)	(-0.110,0.040)	(-0.098,-0.028)	16.7%
London	0.011 (0.062)	(-0.111,0.132)	(-0.091,0.113)	1.8%	-0.063 (0.047)	(-0.155,0.029)	(-0.140,0.014)	17.9%
South West	-0.171 (0.054)	(-0.277,-0.065)	(-0.260,-0.082)	1.1%	-0.002 (0.036)	(-0.073,0.068)	(-0.062,0.057)	19.6%
Wales	-0.026 (0.058)	(-0.141,0.087)	(-0.122,0.069)	1.7%	-0.024 (0.041)	(-0.105,0.056)	(0.092,0.044)	19.0%
Socioeconomic disadvantage	0.093 (0.016)	(0.062,0.124)	(0.067,0.119)	1.7% (1.2|5.5)	0.030 (0.012)	(0.008,0.053)	(0.011,0.049)	19.6% (18.2|24.4)
Professional living	-0.012 (0.019)	(-0.049,0.025)	(-0.043,0.019)	1.8% (1.9|1.5)	-0.048 (0.014)	(-0.076,-0.020)	(-0.071,-0.025)	19.6% (22.1|12.8)
Settled living	-0.028 (0.024)	(-0.074,0.019)	(-0.067,0.011)	1.7% (1.9|1.3)	-0.011 (0.018)	(-0.045,0.024)	(-0.040,0.018)	19.6% (19.8|18.4)
In migration (rate per 1000)	-0.003 (0.001)	(-0.005,-0.002)	(-0.004,-0.002)	0.1% (1.4|0.0)	-0.002 (0.001)	(-0.004,-0.001)	(-0.003,-0.001)	15.0% (17.9|1.6)
Out migration (rate per 1000)	0.006 (0.001)	(0.003,0.008)	(0.004,0.007)	5.5% (2.9|7.2)	0.003 (0.001)	(0.001,0.005)	(0.002,0.004)	27.3% (22.7|68.9)
Ethnic heterogeneity	0.185 (0.119)	(-0.047,0.417)	(-0.011,0.380)	1.9% (1.8|2.5)	0.554 (0.088)	(0.381,0.726)	(0.410,0.699)	22.2% (19.8|33.2)
Incivilities	0.032 (0.008)	(0.015,0.048)	(0.018,0.045)	2.5% (2.2|4.3)	0.001 (0.006)	(-0.011,0.012)	(-0.009,0.011)	19.7% (19.7|20.0)
South West x socioeconomic disadvantage	0.111 (0.050)	(0.013,0.209)	(0.029,0.193)	-	-	-	-	-

	Victimisation				Worry about Crime			
Eastern x routine/manual SES	-	-	-	-	0.160 (0.055)	(0.053,0.267)	(0.071,0.250)	-
Sample size (n)=25851								

6.4.2.2 Individual and Household Characteristics

Individual Respondent Characteristics

Older individuals are estimated to be at lower risk of experiencing vehicle crime, with the youngest individuals predicted to have a 4.2% risk of becoming a victim of vehicle crime, and the oldest individuals having an estimated risk of 0.1%. There was no evidence of age affecting the risk of being worried about vehicle crime. Males were estimated to have lower risk of being worried about vehicle crime than females, reducing risk to 17.7%, compared to the baseline level of 19.6%. No effect of gender was found on the risk of being a victim of vehicle crime.

There was limited effect of ethnicity on risk of vehicle crime victimisation, there is some evidence that Mixed race individuals are more at risk than White individuals, and that black individuals are less at risk than white individuals, although the standard deviation of the posterior distribution is too large in relation to the mean to conclude effect size. The effect of ethnicity appears stronger on worry about vehicle crime, all ethnicities show higher risk of being worried than white individuals. Mixed race individuals had an increased risk of 25.5%, Black individuals of 27.4%, Chinese or other individuals of 31.2%, and Asian individuals are at the highest risk, with a risk of 33.5%. Initially, in model 2, estimates of the effect of each ethnicity were substantially higher for both worry and victimisation than in model 3. The effect of ethnicity reduces as a more detailed profile of the individual and neighbourhood is developed in the model, therefore not account for neighbourhood characteristics in similar studies may inflate the true effect of ethnicity on worry about vehicle crime.

There is some evidence of marital status affecting risk of both victimisation and worry about vehicle crime. Divorced or separated individuals are estimated to be most at risk of vehicle crime, with a risk of 2.5%, compared to the baseline risk of 1.8%. There is also some evidence to suggest cohabiting individuals were at increased risk of victimisation, however the standard deviation of the posterior distribution is too large in

relation to the mean to conclude effect size. Married and widowed individuals were not

estimated to have differing risk of vehicle victimisation to single individuals. Married and

cohabiting individuals had increased risk of being worried about vehicle crime of just over

22%, there was also some evidence of increased risk for widowed individuals, although the

standard deviation of the posterior distribution is too large in relation to the mean to

conclude effect size.

Socioeconomic classification was not found to affect risk of being a victim of

vehicle crime, however, both those working in intermediate, or routine or manual roles

were at increased risk of being worried about vehicle crime, with the risk increased to

approximately 22% for both of these groups. Individuals who were long-term unemployed

were not at increased risk of being worried about vehicle crime.

Disability affected the risk of both victimisation and worry, having a long-standing

illness or disability which affected daily life a little increased the risk to 2.4%, and having

an illness or disability which affects life a lot increased risk to 3.3%. Having an illness or

disability which did not affect daily life increased the risk of being worried about vehicle

victimisation to 21.5%, illnesses or disabilities which affected life a little increased the risk

to 24.4%, and those which affected daily life a lot to 25.7%.

The highest educational qualification an individual had achieved appears to have

some effect on the risk of experiencing vehicle crime, in all cases the standard deviation of

the posterior distribution was too large in relation to the mean to conclude effect size,

however there consistent negative coefficients were estimated for all qualification levels

below degree level. There was more significant evidence of an effect of the highest

qualification achieved on risk of being worried about vehicle crime, those with no

qualifications were most likely to be worried about vehicle crime, with an estimated risk of

23.0%, the risk was slightly lower for those with A levels, GCSEs or other qualifications,

at between 21% and 22%.

Household Characteristics

Social renters are estimated to have increased risk of becoming a victim of vehicle crime of 2.5%, compared to the baseline risk of 1.8%, private renters were not found to have differing risk to homeowners. No effect of tenure type was found on risk of being worried about vehicle crime. Those living in semi-detached or terraced housing were at higher risk of experiencing vehicle crime, with the risk increase to 2.4% and 3.0% respectively, there was also some evidence of those living in flats or other accommodation having a higher risk of victimisation, however the standard deviation of the posterior distribution is too large in relation to the mean to conclude effect size. There was also evidence of a small increase in risk of being worried about vehicle crime for those living in terraced housing, or flats or other accommodation types, however, again there was not enough evidence to conclude effect size. In model 2 estimated effects of house type on both vehicle victimisation and worry about vehicle crime were somewhat higher, however reduced following the inclusion of area level variables in the model. This suggests that some of the variance in both victimisation and worry previously explained by household type, was better explained by neighbourhood characteristics.

Individuals with more than one car were at increased risk of victimisation with the risk increasing from 1.8% to 2.7% for those with two cars, and to 4.6% for those with three or more cars. Those who did not have access to a car for most of the year prior to interview were most likely to be worried about vehicle crime, with a risk of 28.1%, those with two or three or more cars were also at increased risk compared to those with one car, at 21.6% and 24.4% respectively. There was limited evidence of income having an effect on risk of vehicle ownership, however the evidence suggests that those who did not provide information of their income had a lower risk of experiencing a vehicle victimisation than those with an income of £30,000 to £49,999, although the standard deviation of the posterior distribution is too large in relation to the mean to conclude effect size in the

population. Income had a more substantial effect on worry about vehicle crime, with those earning £50,000 or more at higher risk of being worried, at 16.5%, and those earning between £20,000 and £29,999 are estimated to have slightly lower risk, at 18.2%.

The length of time that an individual had lived within the same area affected both risk of victimisation and worry about vehicle crime. Those living in an area for between 5 and 10 years, compared to more than 10 years were at slightly higher risk, although the standard deviation of the posterior distribution is too large in relation to the mean to conclude effect size in the population. On the worry side of the model, those who lived in the same area for either less than 12 months, or between 12 months and 2 years were at decreased risk of worry compared to the reference person, with risk reduced to 17.3% and 14.5% respectively. Individuals who were out of the house for between one and three hours on an average weekday were less at risk of vehicle victimisation than those out for more than three hours, with risk reduced to 1.4%, there was no evidence of differing risk between being out of the house for less than one hour, and more than three hours. Those out of the house for more than 3 hours were at most risk of being worried about vehicle crime, with the risk reduced to 16.7% for those out of the house for between 1 and 3 hours, and to 13.7% for those out of the house for less than one hour.

6.4.2.3 Area Level Characteristics

There was some evidence that living in a rural area reduced the risk of being worried about vehicle crime, reducing to 19.2% from the baseline, there was no evidence of living in a rural area affecting risk of being worried about vehicle crime, compared to living in an urban area. Those living in the East Midlands, and West midlands were more at risk of being worried about vehicle crime, with risk increased to 22.1% and 23.7% respectively. Those living in the North East, Yorkshire & the Humber, and the South West are estimated to have reduced risk of victimisation, compared to all other regions, with risk reduced to 1.2%, 1.2%, and 1.1% respectively,

Socioeconomic disadvantage was found to increase risk of both victimisation and worry about vehicle crime, with those in areas with the lowest level of socioeconomic disadvantage having a risk of victimisation of 1.2%, and those in areas with the highest level having a risk of 5.5%, and those in areas with the lowest levels having a risk of worry of 18.2%, and those in areas with the highest level having a risk of 24.4%. Those living in neighbourhoods with a higher presence of professional living are estimated to be less likely to be worried about vehicle crime, those living in areas with the lowest levels of professional living have an estimated risk of 22.1%, compared to 12.8% for those in areas with the highest levels. There was no sufficient evidence of an effect of professional living on the risk of vehicle victimisation. There was some evidence of higher levels of settled living reducing the risk of both victimisation and worry about crime, however in the final model the standard deviation of the posterior distribution is too large in relation to the mean to conclude an effect size in the population.

Inward migration was found to reduce risk of vehicle victimisation, and risk of worry about vehicle crime. Those living in areas with the lowest inward migration levels have an estimated risk of victimisation of 1.4%, and 0.0% in the areas with the highest inward migration, and an estimated risk of worry of 19.8% in the areas with the lowest inward migration, and 1.6% in the areas with the highest inward migration. Outward migration was associated with increased risk of both risk of victimisation and worry about vehicle crime, with the risk of victimisation estimated at 2.9% for individuals in areas with the lowest levels of outward migration, and 7.2% for individuals in areas with the highest levels of outward migration. The risk of worry was estimated at 22.7% for those in areas with the lowest levels of outward migration, and 68.9% for those in areas with the highest levels.

Living in an area with higher levels of ethnic heterogeneity was associated with increased risk of victimisation and worry about vehicle crime, those living in areas with the

lowest levels of ethnic heterogeneity have an estimated risk of victimisation 1.8%,

compared to 2.5% in areas with the highest levels, with the risk of being worried about

vehicle crime estimated at 19.8% in areas with the lowest levels, and 33.2% in areas with

the highest levels.

6.4.2.4 Incivilities

Independently assessed incivilities in an individual's local area were found to affect

their risk of victimisation, but there was not sufficient evidence of an effect on risk of

worry. Those living in areas with the lowest levels of incivilities are estimated to have a

victimisation risk of 2.2%, compared to 4.3% for those living in areas with the highest

level of incivilities.

6.4.2.5 Interaction Terms

Vehicle Crime Victimisation

Living in the South West and Neighbourhood Socioeconomic Disadvantage

The effect of the level of socioeconomic disadvantage in an area ia stronger in the

South West, compared to other areas, with the estimated risk of victimisation for those in

the South West, to be 0.4% for those in areas with the lowest levels of disadvantage, and

12.1% for those in areas with the highest levels. This is contrasted by those outside of the

South West having an estimated risk of 1.2% in the areas of lowest socioeconomic

disadvantage, and 5.5% in the highest.

Worry about Vehicle Crime

Living in the East of England and Socioeconomic Classification

The effect of working in a routine or manual occupation was stronger for those

living in the East of England, compared to those residing elsewhere. Those within the East

of England working in a routine or manual occupation had an estimated risk of being

worried about vehicle crime of 26.2%, compared to 18.7% for those in other locations,

those working in a routine or manual occupation had an estimated risk of being worried

about vehicle crime of 19.7%, compared to 22.3% for those in other occupation types.

6.4.3 Vehicle BVML Model Results-Random Part

Table 39 Random Part Results Vehicle BVML Model

	1	2	3	4	5
Individual Level					
Covariance/ correlation	0.111(0.028)	0.144(0.028)	0.144(0.028)	0.142(0.027)	0.143(0.027)
Neighbourhood Level					
Victim variance	0.053(0.012)	0.032(0.014)	0.014(0.008)	0.015(0.006)	0.018(0.008)
Worry variance	0.052(0.009)	0.039(0.009)	0.026(0.008)	0.026(0.007)	0.027(0.007)
Victim/worry covariance	0.050(0.008)	0.026(0.008)	0.016(0.006)	0.018(0.006)	0.017(0.007)
Victim/worry correlation	0.948	0.739	0.837	0.931	0.792
Deviance (MCMC)	146397.387	146252.367	146282.910	146301.750	146297.319
Sample size (n)=25851					

Table 39 above, shows the random part of the model, allowing for assessment of

the effect of covariates on neighbourhood level variance in vehicle victimisation and worry

about household crime, as well as the covariance between these at both the individual and

neighbourhood level. As can be seen in the table above, the correlation between vehicle

victimisation and worry about vehicle crime at the individual level was consistently very

low, and largely constant throughout all models, this was reduced from an estimate of

0.282 in the null model presented previously in section 5.3.2. The introduction of year of

survey reduced the individual level covariance initially by approximately one third, to

0.111, however in later models this was estimated to be slightly higher at between 0.142

and 0.144. With the introduction of year of survey variables, the between neighbourhood

victimisation variance and the covariance estimated did not change substantially, with any

change potentially due to error within the credible interval. There was a more notable

reduction in the estimate of between neighbourhood variance in worry about vehicle crime,

reducing by 15% from 0.061 to 0.052. This reduction is attributed to the good explanatory

power of year of survey variables and whether individuals had been a victim in their local

authority.

The introduction of individual and household characteristics into the model

reducing the unexplained neighbourhood level variance in victimisation by 40%, from

0.053 to 0.032. Variables which are expected to have contributed to this additional

explanation of variance are: age; ethnicity; disability status; social renting; housing type;

and car ownership. The previously unexplained variance in worry about vehicle crime

between neighbourhoods also reduced by 25%, from 0.052 to 0.039. Variables which are

expected to have contributed to this reduction in unexplained variance are: ethnicity;

socioeconomic classification; disability status; education; housing type; car ownership; and

length of residence in area. The unexplained covariance between worry and victimisation

was reduced by almost 50% following the addition of individual and household

characteristics, from 0.050 to 0.026. Variables which are expected to be responsible for this

additional explanation are: ethnicity; disability status; housing type; car ownership; and

length of residence in area.

The addition of area level variables had further effect on the neighbourhood level

estimates, reducing the unexplained variation in victimisation by a further 56%, from 0.032

to 0.014. This additional explanatory power is attributed to: some regions within England

and Wales; socioeconomic disadvantage; professional living; inwards and outwards

migration; and ethnic heterogeneity. The unexplained variation in worry between

neighbourhoods decreased by a further 33%, from 0.039 to 0.026. Variables which are

expected to have contributed to this are: living in a rural location; some regions of England

and Wales, socioeconomic disadvantage; professional living; inward and outward

migration; and ethnic heterogeneity. The estimated covariance also reduced by 38%, from

0.026 to 0.016. Variables which are expected to have increased explanatory power are:

socioeconomic disadvantage; professional living; inward and outward migration; and ethnic heterogeneity.

No evidence of independently rated incivilities explaining remaining between neighbourhood variation in vehicle victimisation, worry about vehicle crime, or the covariance between them was found. All changes were so minor these are attributed to error of the posterior mean estimate within the credible intervals.

The introduction of interaction terms also offered minimal additional explanation for neighbourhood level variation, with no real change seen in the estimated variance between neighbourhoods in worry about vehicle crime, and the covariance between victimisation and worry. There was an increase of 20% in the between neighbourhood variance in victimisation estimate, a real increase was not expected due to the additional explanatory power of the additional covariate, and a lack of change in other coefficients within the model, this may therefore be a product of error within the credible interval for this coefficient.

6.4.4 Summary of Risk and Protective Factors

Table 40 Summary of Risk and Protective Factors of Vehicle Victimisation and Worry about Vehicle Crime

	Worry	Victim
Risk	- Being Mixed race, Asian, Black, Chinese or other ethnicity - Being married or cohabiting - Working in an intermediate, or routine/manual role - Having an illness or disability which does not affect daily life, or affects it a little, or a lot - Having A-levels, GCSEs, no qualifications or other qualification as the highest educational attainment - Living in terraced housing, or a flat or other house type - Either not owning a car, or owning 2, or 3 more	- Being divorced or separated - Having an illness or disability which affects daily life either a little, or a lot - Living in social rented housing - Living in semi-detached or terraced housing - Owning one or two cars - Higher socioeconomic disadvantage - Higher levels of outward migration - Higher levels of independently rated incivilities

	Worry	Victim
	• Living in the East Midlands or the West Midlands • Living in areas of higher socioeconomic disadvantage • Higher levels of outward migration • Higher levels of ethnic heterogeneity	
Protective	• Being male • Having a household income of £50,000 or more • Having a tenure length of 2 years or less • Being out of the house for 3 hours or less on an average weekday • Higher levels of professional living • Higher levels of inward migration	• Older age • Having GCSEs as highest educational qualification • Being out of the house for between 1 and 3 hours • Living in the North East, Yorkshire & Humberside, or the South West • Higher levels of inward migration

Table 40 above shows the risk and protective factors of vehicle victimisation and worry about vehicle crime.

6.5 Personal Crime

This section first discusses how well model coefficients met acceptable MCMC diagnostics, and assumptions of the model. The reference person is then defined, to whom all risk and protective factors are compared. Risk and protective factors are discussed in stages, followed by an assessment of the random part of the model.

6.5.1 MCMC Diagnostics, Assumptions & Residuals

6.5.1.1 MCMC Diagnostics

Analysis of the trajectories of both fixed and random coefficients for the personal crime model again produced similar considerations as the previous models. For those coefficients where the posterior mean was substantial in relation to the standard error, trajectories were all acceptable. When examining the random part of the model, the Brooks-Draper diagnostics were not satisfied when estimating neighbourhood level variance in victimisation, worry about crime, or the covariance between them; only the

upper quartile of the neighbourhood level variance estimate of worry about vehicle crime

sufficiently met the Raftery-Lewis diagnostics. The kernel density plot also showed a

negative skew for neighbourhood level variation in victimisation, worry, and their

covariance. There was also significant evidence of autocorrelation and partial

autocorrelation for all neighbourhood level random variables. Similarly to the household

model, the individual level estimate of covariance of victimisation and worry about vehicle

crime better met all diagnostics, with a normally distributed kernel density plot, sufficient

iterations to meet Raftery-Lewis and Brooks-Draper diagnostics. ACF and PACF measures

also showed low autocorrelation and partial autocorrelation within the Markov chain.

6.5.1.2 Assumption Checking

Assumption 3- Normally Distributed Residuals

As shown in the graphs below, the assumption of normality of neighbourhood level

residuals has been met on both the victimisation and worry sides of the model.
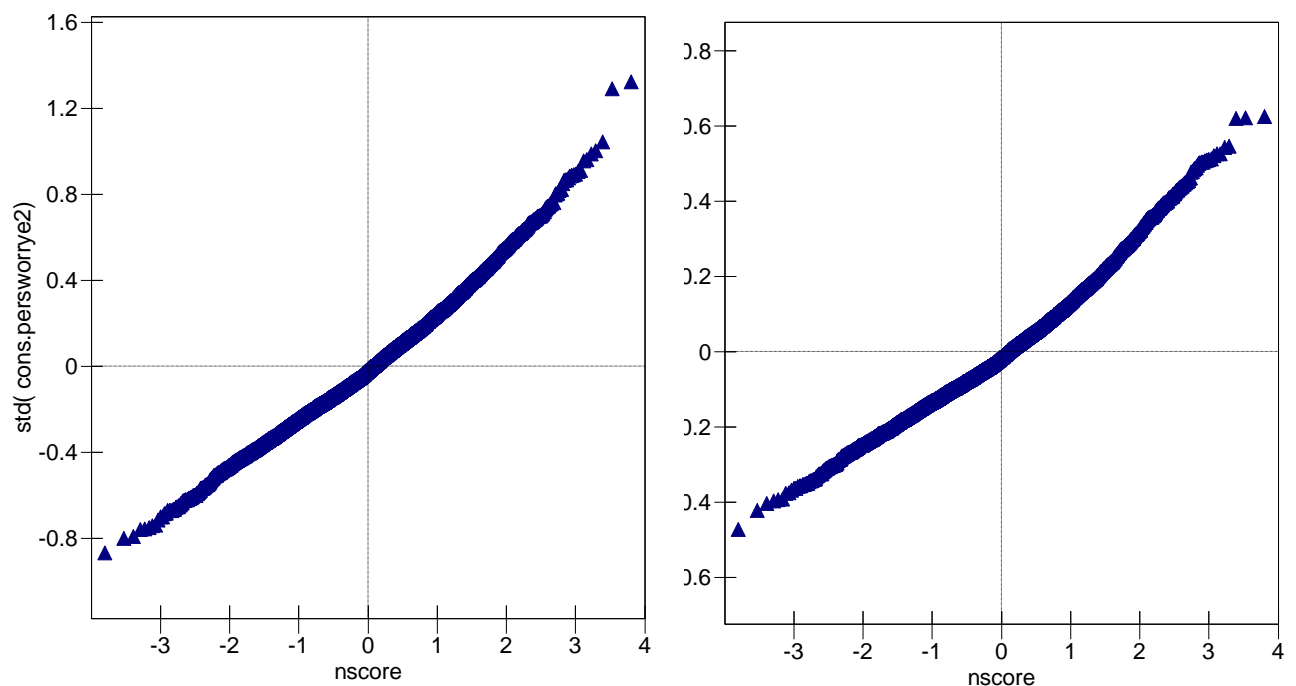
Figure 6 Plot of Standardised Residuals against Normal Scores

Assumption 4- Homoskedasticity

Graphs shown in the appendix again show heteroskedasticity is present in the

model, however the model is considered robust to this violation.

6.5.2 Personal BVML Model Results-Fixed Part

6.5.2.1 Reference Individual

The reference person to which all estimated percentage risks are compared to in determining risk and protective factors was: interviewed in 2016; a 53 year old female, who is white, single, of professional socioeconomic classification, with no longstanding illness or disability, with a degree level qualification; they are an owner occupier of a detached house, and own one car; they have an annual household income of £30,000-£49,999; they live in an urban location within the South East. The base neighbourhood has average levels of socioeconomic disadvantage, professional living and settled living, minimum levels of vacant properties, and ethnic heterogeneity.

The baseline risk of personal victimisation for the reference household/person is estimated at 2.1%, and the baseline risk of worry about personal crime is estimated at 23.6%.

Model results tables are presented overleaf.

Table 41 Fixed Part Results Personal Victimisation and Worry about Personal Crime BVML Model

	1		2		3		4		5	
	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry	Victimisation	Worry
Cons	-1.811 (0.028)	-0.516 (0.016)	-2.053 (0.071)	-0.866 (0.038)	-2.055 (0.074)	-0.854 (0.040)	-2.060 (0.090)	-0.725 (0.049)	-2.033 (0.091)	-0.720 (0.049)
Year (16)										
14	-0.022 (0.040)	0.060 (0.023)	-0.037 (0.042)	0.043 (0.023)	-0.044 (0.042)	0.041 (0.023	-0.082 (0.046)	0.090 (0.025)	-0.084 (0.046)	0.089 (0.025)
15	-0.068 (0.039)	0.035 (0.022)	-0.063 (0.040)	0.028 (0.022)	-0.064 (0.040)	0.030 (0.022)	-0.073 (0.040)	0.043 (0.022)	-0.075 (0.040)	0.043 (0.022)
17	-0.017 (0.038)	0.063 (0.022)	-0.023 (0.040)	0.062 (0.022)	-0.024 (0.039)	0.061 (0.022)	-0.024 (0.039)	0.058 (0.022)	-0.025 (0.039)	0.058 (0.022)
18	-0.054 (0.066)	0.015 (0.037)	-0.041 (0.068)	0.026 (0.037)	-0.034 (0.069)	0.023 (0.037)	-0.028 (0.067)	0.018 (0.036)	-0.029 (0.068)	0.017 (0.037)
LA Victim		0.268 (0.081)	-	0.165 (0.082)	-	0.167 (0.082)	-	0.160 (0.082)	-	0.156 (0.082)
Age (GM centred)			-0.016 (0.001)	0.000 (0.001)	-0.014 (0.001)	0.001 (0.001)	-0.014 (0.001)	0.002 (0.001)	-0.011 (0.002)	0.002 (0.001)
Gender (Female)										
Male			0.108 (0.029)	-0.388 (0.016)	0.079 (0.030)	-0.388 (0.016)	0.077 (0.030)	-0.398 (0.016)	0.037 (0.032)	-0.399 (0.016)
Ethnicity (White)										
Mixed race			0.201 (0.112)	0.170 (0.077)	0.212 (0.133)	0.168 (0.077)	0.209 (0.113)	0.089 (0.078)	0.216 (0.113)	0.086 (0.077)
Asian			-0.091 (0.067)	0.642 (0.035)	-0.035 (0.067)	0.638 (0.036)	-0.023 (0.071)	0.501 (0.037)	-0.022 (0.071)	0.496 (0.037)
Black			0.000 (0.085)	0.349 (0.049)	0.037 (0.085)	0.339 (0.049)	0.051 (0.089)	0.157 (0.050)	0.054 (0.088)	0.394 (0.116)
Chinese/other			-0.043 (0.165)	0.339 (0.090)	0.020 (0.163)	0.330 (0.090)	0.039 (0.166)	0.224 (0.091)	0.045 (0.164)	0.215 (0.091)
Marital Status (Single)										
Married/Cohabiting			-0.102 (0.052)	0.048 (0.031)	-0.051 (0.053)	0.041 (0.031)	-0.055 (0.053)	0.047 (0.031)	-0.044 (0.053)	0.048 (0.031)
Widowed			0.130 (0.071)	-0.110 (0.035)	0.160 (0.073)	-0.104 (0.035)	0.158 (0.072)	-0.098 (0.035)	0.120 (0.073)	-0.097 (0.035)
Divorced/separated			0.165 (0.050)	0.006 (0.029)	0.169 (0.053)	-0.002 (0.029)	0.166 (0.050)	-0.001 (0.029)	0.162 (0.050)	-0.001 (0.029)
SES (Professional)										
Intermediate			0.029 (0.040)	0.075 (0.022)	0.034 (0.041)	0.076 (0.022)	0.034 (0.040)	0.077 (0.022)	0.031 (0.040)	0.074 (0.022)
Routine & Manual			0.035 (0.040)	0.176 (0.022)	0.047 (0.040)	0.176 (0.022)	0.046 (0.041)	0.171 (0.022)	0.045 (0.040)	0.151 (0.023)
Long-term unemployed			-0.021 (0.080)	0.047 (0.044)	0.047 (0.081)	0.072 (0.045)	0.041 (0.082)	0.070 (0.045)	0.041 (0.081)	0.065 (0.044)
Disability (None)										
Does not affect daily life			0.232 (0.050)	0.017 (0.028)	0.234 (0.051)	0.015(0.028)	0.227 (0.051)	0.020 (0.028)	0.227 (0.051)	0.021 (0.028)
Affects daily life a little			0.318 (0.045)	0.136 (0.025)	0.338 (0.045)	0.144 (0.025)	0.337 (0.045)	0.146 (0.025)	0.343 (0.044)	0.146 (0.025)
Affects daily life a lot			0.381 (0.049)	0.320 (0.027)	0.460 (0.051)	0.362 (0.028)	0.459 (0.051)	0.361 (0.028)	0.459 (0.051)	0.362 (0.028)
Education (Degree)										
A Levels			-0.033 (0.041)	0.143 (0.024)	-0.036 (0.041)	0.145 (0.024)	-0.034 (0.042)	0.136 (0.024)	-0.033 (0.042)	0.137 (0.024)
GCSE			-0.091 (0.043)	0.181 (0.024)	-0.083 (0.043)	0.181 (0.024)	-0.088 (0.043)	0.170 (0.024)	-0.092 (0.043)	0.171 (0.024)
No qualifications			-0.174 (0.050)	0.225 (0.026)	-0.154 (0.051)	0.234 (0.026)	-0.152 (0.051)	0.205 (0.026)	-0.161 (0.050)	0.206 (0.026)
Other			-0.312 (0.092)	0.135 (0.041)	-0.308 (0.092)	0.136 (0.041)	-0.305 (0.092)	0.111 (0.041)	-0.308 (0.093)	0.114 (0.041)
Tenure (Owner Occupier)										
Private renter			0.080 (0.041)	-0.007 (0.024)	0.085 (0.041)	-0.005 (0.025)	0.078 (0.041)	0.008 (0.025)	0.081 (0.041)	0.008 (0.025)
Social renter			0.081 (0.046)	0.060 (0.025)	0.103 (0.046)	0.057 (0.025)	0.090 (0.047)	0.049 (0.025)	0.097 (0.047)	0.050 (0.025)
House type (Detached)										
Semi-detached			0.013 (0.043)	0.148 (0.022)	0.009 (0.043)	0.145 (0.022)	0.024 (0.043)	0.086 (0.022)	0.023 (0.043)	0.085 (0.022)
Terraced			0.066 (0.044)	0.149 (0.024)	0.058 (0.045)	0.146 (0.024)	0.069 (0.046)	0.068 (0.024)	0.068 (0.046)	0.056 (0.025)
Flat, maisonette or other			0.100 (0.054)	0.205 (0.030)	0.076 (0.055)	0.201 (0.030)	0.089 (0.058)	0.108 (0.032)	0.087 (0.058)	0.115 (0.033)
No. Of adults (1 adult)										
2 adults			-0.032 (0.053)	0.071 (0.031)	-0.033 (0.053)	0.081 (0.031)	-0.027 (0.053)	0.064 (0.031)	-0.040 (0.054)	0.064 (0.031)
3+ adults			-0.020 (0.057)	0.155 (0.034)	-0.026 (0.058)	0.165 (0.034)	-0.023 (0.059)	0.122 (0.034)	-0.037 (0.059)	0.122 (0.034)
No, of cars (1 car)										
0 cars			0.080 (0.040)	0.082 (0.022)	0.092 (0.041)	0.096 (0.023)	0.098 (0.042)	0.056 (0.023)	0.092 (0.042)	0.056 (0.023)
2+ cars			-0.007 (0.039)	-0.074 (0.021)	-0.022 (0.038)	-0.077 (0.021)	-0.029 (0.039)	-0.048 (0.021)	-0.026 (0.039)	-0.047 (0.021)

	1	2		3		4		5	
Income (£30,000-£39,999)									
No information/refused		-0.053 (0.058)	0.076 (0.029)	-0.029 (0.058)	0.085 (0.029)	-0.027 (0.059)	0.083 (0.029)	-0.027 (0.058)	0.082 (0.029)
Less than £10,000		-0.031 (0.059)	0.126 (0.032)	0.016 (0.059)	0.130 (0.032)	0.013 (0.059)	0.132 (0.032)	0.016 (0.060)	0.132 (0.032)
£10,000-£19,999		-0.042 (0.049)	0.090 (0.026)	-0.016 (0.049)	0.092 (0.026)	-0.015 (0.050)	0.087 (0.026)	-0.010 (0.050)	0.087 (0.026)
£20,000-£29,999		0.007 (0.048)	0.067 (0.026)	0.022 (0.048)	0.066 (0.026)	0.018 (0.048)	0.061 (0.026)	0.021 (0.049)	0.061 (0.026)
£50,000+		0.113 (0.045)	-0.060 (0.026)	0.101 (0.046)	-0.059 (0.027)	0.104 (0.046)	-0.060 (0.027)	0.102 (0.046)	-0.064 (0.027)
Relative house condition (av.)									
Better		0.087 (0.057)	0.087 (0.031)	0.087 (0.057)	0.090 (0.031)	0.076 (0.057)	0.067 (0.031)	0.076 (0.057)	0.068 (0.031)
Worse		0.058 (0.061)	-0.104 (0.036)	0.071 (0.061)	-0.100 (0.037)	0.064 (0.061)	-0.096 (0.037)	0.067 (0.061)	-0.097 (0.037)
Time living in area (5+ years)									
Less than 12 months			-0.047 (0.035)	0.037 (0.056)	-0.043 (0.035)	0.027 (0.056)	-0.028 (0.035)	0.025 (0.056)	-0.029 (0.035)
12 months – 2 years			-0.114 (0.037)	-0.008 (0.060)	-0.113 (0.037)	-0.014 (0.061)	-0.105 (0.037)	-0.016 (0.060)	-0.108 (0.037)
2-5 years			-0.052 (0.025)	0.001 (0.042)	-0.050 (0.025)	-0.004 (0.042)	-0.043 (0.025)	-0.003 (0.042)	-0.044 (0.025)
Time away from home (3+ hours)									
Less than 1 hour				-0.223 (0.068)	-0.222 (0.032)	-0.229 (0.070)	-0.210 (0.032)	-0.231 (0.069)	-0.211 (0.032)
1-3 hours				-0.155 (0.042)	-0.031 (0.020)	0.157 (0.043)	-0.024 (0.020)	-0.152 (0.042)	-0.024 (0.020)
Pub Visits (1-3 times per month)									
Never				-0.073 (0.035)	0.012 (0.019)	-0.074 (0.035)	-0.002 (0.019)	-0.077 (0.036)	-0.003 (0.019)
4-8 times				0.113 (0.042)	-0.017 (0.026)	0.120 (0.042)	-0.016 (0.025)	0.120 (0.042)	-0.016 (0.026)
9+ times				0.176 (0.065)	-0.018 (0.043)	0.184 (0.065)	-0.016 (0.042)	0.187 (0.065)	-0.016 (0.043)
Clubbing (Does not visit clubs)									
Clubber				0.117 (0.052)	-0.048 (0.036)	0.119 (0.051)	-0.058 (0.036)	0.113 (0.052)	-0.056 (0.036)
Area Type (Urban)									
Rural						0.076 (0.036)	-0.092 (0.019)	0.076 (0.035)	-0.090 (0.019)
Region (South East)									
North East						-0.038 (0.077)	-0.108 (0.042)	-0.042 (0.077)	-0.104 (0.042)
North West						-0.156 (0.064)	-0.039 (0.033)	-0.152 (0.064)	-0.036 (0.033)
Yorkshire & Humber						0.015 (0.063)	-0.035 (0.035)	0.014 (0.064)	-0.033 (0.035)
East Midlands						0.080 (0.061)	0.038 (0.035)	0.079 (0.062)	0.040 (0.035)
West Midlands						-0.034 (0.063)	0.035 (0.034)	-0.033 (0.064)	0.036 (0.034)
East of England						0.116 (0.056)	0.010 (0.032)	0.116 (0.057)	0.010 (0.032)
London						-0.101 (0.073)	0.008 (0.040)	-0.094 (0.073)	-0.025 (0.044)
South West						0.024 (0.060)	-0.045 (0.034)	0.024 (0.060)	-0.114 (0.039)
Wales						0.112 (0.066)	-0.154 (0.039)	0.113 (0.067)	-0.151 (0.039)
Socioeconomic disadvantage						0.010 (0.017)	0.055 (0.010)	0.010 (0.017)	0.057 (0.010)
Professional living						0.002 (0.018)	-0.068 (0.010)	0.000 (0.018)	-0.068 (0.010)
Settled living						-0.034 (0.022)	0.001 (0.012)	-0.033 (0.022)	0.000 (0.012)
% vacant properties						-0.003 (0.005)	-0.017 (0.003)	-0.003 (0.005)	-0.017 (0.003)
Ethnic heterogeneity						0.017 (0.134)	0.490 (0.075)	0.017 (0.135)	0.507 (0.075)
Age x male								-0.006 (0.002)	
Blau x Black									-0.516 (0.230)
South West x Routine/manual									0.191 (0.052)
London x terrace									0.106 (0.054)

	1		2		3		4		5
Sample size (n)=31719									

Table 42 Final Personal Victimisation and Worry about Personal Crime Model Credible Intervals and Percentage Predictions

	Victimisation				Worry about Crime			
	Coefficient	95% credible interval	90% credible interval	Coef. % prediction	Coefficient	95% credible interval	90% credible interval	Coef. % prediction
Cons	-2.033 (0.091)	(-2.214,-1.855)	(-2.185,-1.884)	2.1%	-0.720 (0.049)	(-0.816,-0.623)	(-0.801,-0.639)	23.6%
Year (16)								
14	-0.084 (0.046)	(-0.176,0.006)	(-0.161,-0.008)	1.7%	0.089 (0.025)	(0.040,0.139)	(0.048,0.131)	26.4%
15	-0.075 (0.040)	(-0.153,0.005)	(-0.141,-0.008)	1.8%	0.043 (0.022)	(-0.000,0.086)	(0.007,0.079)	24.9%
17	-0.025 (0.039)	(-0.102,0.052)	(-0.089,0.039)	2.0%	0.058 (0.022)	(0.015,0.100)	(0.022,0.093)	25.4%
18	-0.029 (0.068)	(-0.164,0.102)	(-0.142,0.081)	2.0%	0.017 (0.037)	(-0.055,0.088)	(-0.043,0.077)	24.1%
LA Victim	-			-	0.156 (0.082)	(-0.005,0.317)	(0.022,0.317)	28.6%
Age (GM centred)	-0.011 (0.002)	(-0.014,-0.008)	(-0.013,-0.008)	2.1% (5.2|0.1)	0.002 (0.001)	(0.000,0.003)	(0.000,0.003)	23.6% (21.4|26.6)
Gender (Female)								
Male	0.037 (0.032)	(-0.026,0.100)	(-0.016,0.090)	2.3%	-0.399 (0.016)	(-0.431,-0.367)	(-0.426,-0.372)	13.2%
Ethnicity (White)								
Mixed race	0.216 (0.113)	(-0.011,0.433)	(0.027,0.399)	3.5%	0.086 (0.077)	(-0.065,0.236)	(-0.041,0.213)	26.3%
Asian	-0.022 (0.071)	(-0.162,0.116)	(-0.139,0.095)	2.0%	0.496 (0.037)	(0.422,0.570)	(0.435,0.558)	41.1%
Black	0.054 (0.088)	(-0.122,0.224)	(-0.093,0.197)	2.4%	0.394 (0.116)	(0.166,0.621)	(0.203,0.585)	37.2%
Chinese/other	0.045 (0.164)	(-0.286,0.355)	(-0.232,0.308)	2.3%	0.215 (0.091)	(0.037,0.393)	(0.065,0.365)	30.7%
Marital Status (Single)								
Married/Cohabiting	-0.044 (0.053)	(-0.147,0.062)	(-0.131,0.044)	1.9%	0.048 (0.031)	(-0.013,0.109)	(-0.003,0.099)	25.1%
Widowed	0.120 (0.073)	(-0.023,0.264)	(-0.000,0.241)	2.8%	-0.097 (0.035)	(-0.166,-0.029)	(-0.155,-0.040)	20.7%
Divorced/separated	0.162 (0.050)	(0.065,0.260)	(0.080,0.244)	3.1%	-0.001 (0.029)	(-0.059,0.056)	(-0.050,0.047)	23.5%
SES (Professional)								
Intermediate	0.031 (0.040)	(-0.047,0.111)	(-0.035,0.098)	2.3%	0.074 (0.022)	(0.031,0.116)	(0.038,0.109)	25.9%
Routine & Manual	0.045 (0.040)	(-0.034,0.124)	(-0.022,0.111)	2.3%	0.151 (0.023)	(0.107,0.195)	(0.114,0.188)	28.5%
Long-term unemployed	0.041 (0.081)	(-0.120,0.199)	(-0.094,0.174)	2.3%	0.065 (0.044)	(-0.023,0.152)	(-0.008,0.138)	25.6%
Disability (None)								
Does not affect daily life	0.227 (0.051)	(0.127,0.326)	(0.143,0.310)	3.5%	0.021 (0.028)	(-0.034,0.076)	(-0.025,0.067)	24.2%
Affects daily life a little	0.343 (0.044)	(0.255,0.430)	(0.269,0.416)	4.6%	0.146 (0.025)	(0.097,0.195)	(0.105,0.187)	28.3%
Affects daily life a lot	0.459 (0.051)	(0.358,0.560)	(0.374,0.544)	5.8%	0.362 (0.028)	(0.308,0.417)	(0.316,0.408)	36.0%
Education (Degree)								
A Levels	-0.033 (0.042)	(-0.114,0.048)	(-0.101,0.035)	1.9%	0.137 (0.024)	(0.091,0.184)	(0.098,0.177)	28.0%
GCSE	-0.092 (0.043)	(-0.175,0.007)	(-0.162,-0.021)	1.7%	0.171 (0.024)	(0.125,0.218)	(0.133,0.210)	29.2%
No qualifications	-0.161 (0.050)	(-0.260,-0.064)	(-0.244,-0.080)	1.4%	0.206 (0.026)	(0.156,0.257)	(0.164,0.249)	30.4%
Other	-0.308 (0.093)	(-0.493,-0.130)	(-0.462,-0.157)	1.0%	0.114 (0.041)	(0.034,0.193)	(0.047,0.181)	27.2%

	Victimisation				Worry about Crime			
Tenure (Owner Occupier)								
Private renter	0.081 (0.041)	(-0.001,0.162)	(0.013,0.162)	2.5%	0.008 (0.025)	(-0.041,0.056)	(-0.033,0.048)	23.8%
Social renter	0.097 (0.047)	(0.006,0.189)	(0.021,0.174)	2.6%	0.050 (0.025)	(0.000,0.099)	(0.008,0.091)	25.1%
House type (Detached)								
Semi-detached	0.023 (0.043)	(-0.062,0.108)	(-0.048,0.094)	2.2%	0.085 (0.022)	(0.042,0.129)	(0.048,0.122)	26.3%
Terraced	0.068 (0.046)	(-0.021,0.158)	(-0.007,0.144)	2.5%	0.056 (0.025)	(0.007,0.104)	(0.015,0.097)	25.3%
Flat, maisonette or other	0.087 (0.058)	(-0.026,0.200)	(-0.008,0.182)	2.6%	0.115 (0.033)	(0.051,0.179)	(0.062,0.169)	27.3%
No. Of adults (1 adult)								
2 adults	-0.040 (0.054)	(-0.146,0.065)	(-0.129,0.049)	1.9%	0.064 (0.031)	(0.003,0.125)	(0.013,0.116)	25.6%
3+ adults	-0.037 (0.059)	(-0.152,0.078)	(-0.134,0.059)	1.9%	0.122 (0.034)	(0.054,0.189)	(0.065,0.178)	27.5%
No, of cars (1 car)								
0 cars	0.092 (0.042)	(0.010,0.174)	(0.023,0.161)	2.6%	0.056 (0.023)	(0.012,0.101)	(0.019,0.094)	25.3%
2+ cars	-0.026 (0.039)	(-0.103,0.050)	(-0.091,0.038)	2.0%	-0.047 (0.021)	(-0.088,-0.006)	(-0.081,-0.013)	22.2%
Income (£30,000-£49,999)								
No information/refused	-0.027 (0.058)	(-0.142,0.087)	(-0.124,0.069)	2.0%	0.082 (0.029)	(0.025,0.139)	(0.034,0.130)	26.2%
Less than £10,000	0.016 (0.060)	(-0.102,0.132)	(-0.083,0.114)	2.2%	0.132 (0.032)	(0.070,0.194)	(0.080,0.184)	27.8%
£10,000-£19,999	-0.010 (0.050)	(-0.108,0.088)	(-0.092,0.071)	2.1%	0.087 (0.026)	(0.036,0.139)	(0.044,0.130)	26.3%
£20,000-£29,999	0.021 (0.049)	(-0.075,0.115)	(-0.059,0.100)	2.2%	0.061 (0.026)	(0.009,0.112)	(0.018.0.104)	25.5%
£50,000+	0.102 (0.046)	(0.012,0.192)	(0.026,0.178)	2.7%	-0.064 (0.027)	(-0.113,-0.009)	(-0.105,-0.017)	21.7%
Relative house condition (av.)								
Better	0.076 (0.057)	(-0.037,0.187)	(-0.019,0.169)	2.5%	0.068 (0.031)	(0.007,0.128)	(0.017,0.119)	25.7%
Worse	0.067 (0.061)	(-0.054,0.184)	(-0.034,0.166)	2.5%	-0.097 (0.037)	(-0.169,-0.025)	(-0.157,-0.037)	20.7%
Time living in area (5+ years)								
Less than 12 months	0.025 (0.056)	(-0.087,0.133)	(-0.069,0.117)	2.2%	-0.029 (0.035)	(-0.098,0.041)	(-0.087,0.030)	22.7%
12 months – 2 years	-0.016 (0.060)	(-0.135,0.100)	(-0.116,0.082)	2.0%	-0.108 (0.037)	(-0.180,-0.035)	(-0.169,-0.047)	20.4%
2-5 years	-0.003 (0.042)	(-0.086,0.080)	(-0.073,0.067)	2.1%	-0.044 (0.025)	(-0.093,0.005)	(-0.085,-0.003)	22.2%
Time away from home (3+ hours)								
Less than 1 hour	-0.231 (0.069)	(-0.368,-0.096)	(-0.346,-0.118)	1.2%	-0.211 (0.032)	(-0.275,-0.148)	(-0.264,-0.158)	17.6%
1-3 hours	-0.152 (0.042)	(-0.235,-0.070)	(-0.222,-0.083)	1.4%	-0.024 (0.020)	(-0.063,0.016)	(-0.057,0.009)	22.8%
Pub Visits (1-3 times per month)								
Never	-0.077 (0.036)	(-0.147,-0.007)	(-0.136,-0.018)	1.7%	-0.003 (0.019)	(-0.040,0.035)	(-0.034,0.029)	23.5%
4-8 times	0.120 (0.042)	(0.037,0.204)	(0.051,0.190)	2.8%	-0.016 (0.026)	(-0.066,0.034)	(-0.058,0.026)	23.1%
9+ times	0.187 (0.065)	(0.058,0.313)	(0.078,0.294)	3.2%	-0.016 (0.043)	(-0.100,0.067)	(-0.086,0.054)	23.1%
Clubbing (Does not visit clubs)								
Clubber	0.113 (0.052)	(0.010,0.214)	(0.027,0.198)	2.7%	-0.056 (0.036)	(-0.127,0.014)	(-0.115,0.003)	21.9%

	Victimisation				Worry about Crime			
Area Type (Urban)								
Rural	0.076 (0.035)	(0.007,0.145)	(0.018,0.134)	2.5%	-0.090 (0.019)	(-0.128,-0.053)	(-0.122,-0.059)	20.9%
Region (South East)								
North East	-0.042 (0.077)	(-0.195,0.108)	(-0.170,0.084)	1.9%	-0.104 (0.042)	(-0.186,-0.023)	(-0.173,-0.036)	20.5%
North West	-0.152 (0.064)	(-0.276,-0.026)	(-0.257,-0.047)	1.4%	-0.036 (0.033)	(-0.101,0.029)	(-0.091,0.018)	22.5%
Yorkshire & Humber	0.014 (0.064)	(-0.113,0.140)	(-0.092,0.120)	2.2%	-0.033 (0.035)	(-0.102,0.037)	(-0.091,0.026)	22.6%
East Midlands	0.079 (0.062)	(-0.042,0.200)	(-0.023,0.181)	2.5%	0.040 (0.035)	(-0.028,0.107)	(-0.017,0.097)	24.8%
West Midlands	-0.033 (0.064)	(-0.158,0.093)	(-0.138,0.073)	1.9%	0.036 (0.034)	(-0.031,0.103)	(-0.020,0.092)	24.7%
East of England	0.116 (0.057)	(0.005,0.227)	(0.023,0.209)	2.8%	0.010 (0.032)	(-0.053,0.073)	(-0.043,0.063)	23.9%
London	-0.094 (0.073)	(-0.237,0.049)	(-0.214,0.026)	1.7%	-0.025 (0.044)	(-0.111,0.061)	(-0.098,0.047)	22.8%
South West	0.024 (0.060)	(-0.093,0.141)	(-0.074,0.123)	2.2%	-0.114 (0.039)	(-0.191,-0.038)	(-0.178,-0.050)	20.2%
Wales	0.113 (0.067)	(-0.019,0.245)	(0.003,0.224)	2.7%	-0.151 (0.039)	(-0.226,-0.075)	(-0.214,-0.088)	19.2%
Socioeconomic disadvantage	0.010 (0.017)	(-0.024,0.043)	(-0.018,0.038)	2.1% (2.0|2.4)	0.057 (0.010)	(0.038,0.075)	(0.041,0.072)	23.7% (20.5|34.0)
Professional living	0.000 (0.018)	(-0.035,0.035)	(-0.029,0.029)	2.1% (2.1|2.1)	-0.068 (0.010)	(-0.088,-0.048)	(-0.085,-0.051)	23.5% (27.4|11.5)
Settled living	-0.033 (0.022)	(-0.077, 0.010)	(-0.070,0.003)	2.1% (2.8|1.5)	0.000 (0.012)	(-0.024,0.024)	(-0.020,0.021)	23.6% (23.6|23.6)
% vacant properties	-0.003 (0.005)	(-0.013,0.007)	(-0.011,0.005)	2.0% (2.1|1.5)	-0.017 (0.003)	(-0.023,-0.011)	(-0.022,-0.012)	21.4% (23.4|6.5)
Ethnic heterogeneity	0.017 (0.135)	(-0.247,0.281)	(-0.205,0.239)	2.1% (2.1|2.2)	0.507 (0.075)	(0.359,0.654)	(0.382,0.630)	26.2% (23.7|36.9)
Age x male	-0.006 (0.002)	(-0.009,-0.002)	(-0.009,-0.003)		-	-	-	-
Blau x Black	-	-	-	-	-0.516 (0.230)	(-0.968,-0.066)	(-0.896,-0.139)	
South West x Routine/manual	-	-	-	-	0.191 (0.052)	(0.089,0.293)	(0.105,0.277)	
London x terrace	-	-	-	-	0.106 (0.054)	(0.001,0.211)	(0.018,0.194)	
Sample size (n)=31719								

6.5.2.2 Individual and Household Characteristics

Individual Characteristics

Age was estimated to influence both risk of personal victimisation and worry about personal crime, the youngest individuals were estimated to be at the highest risk of victimisation, with a predicted risk of 5.2% from the base of 2.1%, and the oldest individuals having an estimated risk of 0.1%. The effect of age on victimisation was initially estimated to be stronger, reducing by approximately one third throughout the model building process. The largest change was between model 4 and 5 where this variable was included in an interaction term with gender, this suggests the effect of age is somewhat dependent on gender. In contrast, age was estimated to increase risk of being worried about personal crime, with the youngest individuals having an estimated risk of 21.4% from the base of 23.6%, and the oldest have a predicted risk of 26.6%.

There was a limited effect of gender found on risk of personal victimisation, although a small increase in risk was suggested, the standard deviation of the posterior distribution is substantial in relation to the mean and does not allow for conclusion of effect size. The initial effect of being male estimated in model 2 was substantially higher, however reduced following the inclusion of routine activity variables, suggesting these variables better explain some of the variation in personal victimisation between the genders. Effect size again reduced when included in an interaction term with age in model 5, suggesting the effect of gender is somewhat dependent upon age. Males were estimated to have a reduced risk of being worried about personal crime compared to females, with risk estimated to almost half to 13.2%.

Ethnicity did not appear to have much effect on personal victimisation, with only Mixed-race individuals having a different risk to all other ethnicities, with those individuals having an increased risk of 3.5%. On the worry side of the model, in contrast, Mixed race individuals did not have differing risk compared to white individuals, however all other

ethnicities showed increased risk, to 41.1%, 37.2%, and 30.7% for those of Asian, Black,

Chinese or "other" ethnicities, respectively. The effect of ethnicity was estimated as stronger

in model 3 than model 4, suggesting the addition of area level variables accounted for some of

the variation in worry for individuals of different ethnicities. In model 5, the effect of being

Black substantially increased following this variable's inclusion in an interaction term with

ethnic heterogeneity, suggesting the effect of being black on worry about personal crime is

dependent on the level of ethnic heterogeneity in the area.

Whilst married individuals were not estimated to have different risk of victimisation

compared to single individuals, those widowed, and divorced or separated were found to be at

increased risk, with risk increased to 2.8%, and 3.1% respectively. In model 2, those either

married or cohabiting were estimated to have reduced risk of victimisation compared to those

who were single, however the effect size reduced to inconclusive levels following the

introduction of routine activity variables in model 3, suggesting a large portion of the variance

in victimisation risk between single individuals, and those married or cohabiting is better

explained by their routine activities. Widowed individuals were found to have different risk of

worry about crime than those of all other marital status, with risk reduced to 20.7%.

Socioeconomic status was not found to affect victimisation risk, however on the worry

side of the model, those working in intermediate, and routine or manual employments had

increased risk of being worried, with risk increased to 25.9%, and 28.5% respectively. Those

in long-term unemployment were not estimated to have different risk of being worried than

those in professional employment.

Those with disabilities were at increased risk of victimisation, with disabilities which

have the most significant impact on daily life, increasing risk the most. Risk was increased

from the baselines of 2.1% to 3.5% for those whose disability does not impact daily life, to

4.6% for those whose disability affects their daily life a little, and to 5.8% for those whose life

was affected a lot. Those with a disability which affects daily life were at increased risk of being worried about personal crime, with risk increased to 28.3% for those whose disability impacts daily life a little, and 36.0% for those whose disability impacts daily life a lot. Individuals with a disability which did not have an impact on daily life were not more likely to be worried about personal crime, than those without a disability.

The highest educational qualification an individual has achieved altered their risk of being a victim of personal crime, those achieving A levels were not estimated to have different victimisation risk to those with a degree, however those with GCSEs as their highest qualification had a reduced risk of 1.7%, this reduced further to 1.4% for those who had no formal qualifications. Individuals with other qualifications were at the lowest risk of victimisation, with risk reduced to 1.0%. All individuals with their highest level of qualification below degree level were estimated to be at increased risk of being worried about personal crime, with risk increasing as the individual's highest qualification level decreases, with risk increased to 28.0% for those whose highest qualification is A-levels, 29.2% for those with GCSEs, and 30.4% for those with no formal qualifications, those with "other" qualifications had an estimated risk of 27.2%.

Household Characteristics

Both private and social renters were estimated to be at increased risk of victimisation in comparison to owner occupiers, with risk increased from the baseline of 2.1%, to 2.5% and 2.6% respectively. With regard to worry, private renters were not at different risk to owner occupiers, however social renters were at increased risk at 25.1% compared to the baseline risk of 23.6%. There is some evidence of those living in housing types other than detached housing having higher risk of personal victimisation than those in detached houses, although standard errors were commonly large in comparison to the mean of posterior distributions so no effect size is concluded upon. With regard to worry, all individuals not in detached housing

are estimated to be at increased risk, with estimated risk increased to 26.3%, 25.3%, and

27.3% for those in semi-detached, terraced, and flats, maisonettes or other accommodation

types, respectively. Initially the estimated effect of an individual living in these housing types

on worry was higher, however reduced following the addition of area level variables in model

4, suggesting neighbourhood characteristics better account for some of the variation in worry

found between different house types.

The number of adults residing in a household was not found to affect an individual's

risk of personal victimisation, however individuals residing in a household with 2 adults were

at increased risk of worry, compared to those in single adult households, with risk increasing

to 25.6%, and increasing further to 27.5% for those in households with three or more adult

residents. Vehicle ownership was estimated to reduce risk of being victimised, whilst having

more cars accessible to the household did not reduce an individual's risk any more than having

access to just one car, individuals living in a household which did not have regular access to a

vehicle had an increased estimated risk of 2.6%. Individuals residing in a household with

regular access to two or more vehicles were at reduced risk of being worried about personal

crime, with risk reduced from 23.6% to 22.2%; and those living in a household without

vehicle access were estimated to be at increased risk of 25.3%. Initially the effects of car

ownership were estimated to be stronger, however reduced following the inclusion of

neighbourhood characteristics in model 4. This suggests that neighbourhood characteristics

better explain some of the variance in worry about personal crime between those of differing

levels of car ownership, than car ownership itself.

Either not declaring, or living in a household with an income lower than the reference

person income of £30,000 to £49,999 was not found to affect risk of personal victimisation,

however those earning over £50,000 were found to be at increased risk of 2.7%. Stronger

effects of income were found on risk of worry about personal crime, with those individuals not

declaring their household income, and those earning less than the reference income, estimated

to have a higher risk of being worried than those with the reference household income. Those

who did not provide information on their household income were estimated to have a risk of

26.2%, those residing in a household with an income below £10,000 were most at risk of

worry, at 27.8%, this reduced to 26.3% for those with an income of between £10,000 and

£19,999, and to 25.5% for those with an income between £20,000 and £29,999. Those living

in a household with an income above £50,000 were at the lowest risk of being worried, with

risk reduced to 21.7% compared to the baseline risk. House condition was not found to affect

risk of victimisation, however those living in houses in better condition compared to others in

the neighbourhood were more likely to be worried than those living in a house of average

condition, with a risk of 25.7%. Those living in houses in worse condition compared to other

in the neighbourhood were less likely to be worried, with an estimated risk of 20.7%.

The length of time an individual has resided in an area was not found to be associated

with personal victimisation risk, however was associated with risk of being worried about

personal crime with those living in an area for between 12 months and 2 years having the

lowest risk of reporting worry, at 20.4%, compared to the baseline risk of 23.6%. Those living

in an area for either less than 12 months, or between 2 and 5 years were not found to have

consistently different risk of being worried than the baseline person of 5 years.

6.5.2.3 Routine Activities

Those spending less time out of the house on an average weekday were less likely to

be a victim of personal victimisation, with risk reduced to 1.2% for those who are out of the

house for less than one hour on an average weekday, and to 1.4% for those out between one

and three hours. Those out of the house for three hours or less per day were estimated to be at

lower risk of worry than those out for more than three hours, risk is estimated to be reduced to

17.6% for those out of the house less than one hour per day, and to 22.8% for those out

between one and three hours per day. The frequency at which an individual visits pubs

influenced only personal victimisation risk, and did not appear to affect worry, with

individuals who do not visit pubs having the lowest risk of victimisation, estimated at 1.7%.

The risk is estimated to escalate with increasing frequency of visits, with those visiting

between 4 and 8 times a month increasing risk to 2.8%, from the baseline risk of 2.1% of the

reference person who visits the pub 1 to 3 times per month, and to 3.2% for those visiting the

pub more than 9 times per month. There was no substantial evidence of pub visits affecting

risk of being worried about fear of crime. Those who visit clubs were also more likely to be a

victim of personal crime than non-clubbers, with their risk estimated to be 2.7%, there is some

evidence of those visiting clubs being at lower risk of being worried than those who do not

visit clubs, however the standard deviation of the posterior distribution of this coefficient

estimate is too large in relation to the mean to conclude effect size in the population.

6.5.2.4 Area Level Characteristics

Those living in rural areas were estimated to have higher risk, compared to those in

urban areas, with risk estimated to be 2.5%. In contrast, those in rural areas were less likely to

be worried about personal crime, with an estimated risk of 20.9%. Individuals living in the

North West were estimated to be at lower risk of personal victimisation compared to those in

the South East, with risk estimated to be 1.4%. Individuals living in the North East, the South

West, and Wales were at decreased risk of being worried than those in the South East, with

risk estimated at 20.5%, 20.2%, and 19.2% respectively. Although no standalone effect of

living in London was estimated, following its inclusion in an interaction term with terraced

housing, the estimated effect size doubled. The effect of living in the South West more than

doubled following its inclusion in an interaction term with being in routine or manual

employment, suggesting the effect of living in the South West was somewhat dependent on

socioeconomic classification by employment type.

Socioeconomic disadvantage was not found to affect risk of victimisation, however living in an area with higher levels of socioeconomic disadvantage were associated with increased risk of being worried about personal crime, with risk estimated at 20.5% for individuals in areas with the lowest levels of socioeconomic disadvantage, and 34.0% for individuals in areas with the highest levels. Again, the level of professional living within the area an individual lives was not found to affect risk of victimisation, however did affect risk of being worried. Higher levels of professional living were associated with lower risk of being worried, with those living in an area with the lowest levels of professional living having an estimated risk of 27.4%, and those in areas with the highest levels to have an estimated risk of 11.5%. Settled living did not appear to substantially affect either risk of victimisation, or being worried about personal crime, however there was some evidence of a negative effect of settled living on the risk of personal victimisation, although the standard deviation of the posterior distribution was relatively large in relation to the mean.

Living in an area with a higher percentage of vacant properties was found to reduce risk of being worried about personal crime, with those living in areas with the lowest levels of vacant properties having an estimated risk of 23.4%, and in those areas with the highest levels having an estimated risk of 6.5%. There was limited evidence of an effect of ethnic heterogeneity on risk of personal victimisation, with a very high standard deviation of the posterior distribution compared to the mean. Those living in areas with the lowest levels of ethnic heterogeneity have an estimated risk of worry of 23.7%, compared to 36.9% in areas with the highest levels.

6.5.2.5 Interaction Terms

Personal Victimisation

Age and Gender

The effect of age differed for males and females, with age affecting males more strongly than females. The youngest females are estimated to have a victimisation risk of 5.2%, and the oldest having a risk of 0.5%; whereas the youngest males have an estimated risk of 8.5%, and the oldest, 0.3%.

Worry about Personal Crime

Ethnicity and Ethnic Heterogeneity

The effect of ethnic heterogeneity differed for Black individuals and individuals of other ethnic backgrounds, with the effect of ethnic heterogeneity almost muted for black individuals. Non-Black individuals in a neighbourhood with low ethnic heterogeneity had an estimated worry risk of 23.7%, rising to 36.9% in a high ethnic heterogeneity neighbourhood, whereas Black individuals in both a low and high ethnic heterogeneity neighbourhood had an estimated risk of being worried of 37.2%.

Living in the South West and Socioeconomic Classification

The effect of working in a routine or manual job differed in the South West compared to other locations. Individuals residing with the South West who work in a routine or manual job had an estimated risk of being worried about personal crime of 28.5%, and those in other employment types had an estimated risk of 23.6%; the difference was more substantial for those living in the South West, with those in routine or manual employment having a worry risk of 29.9%, reducing to 19.2% for those not in routine or manual employment.

Living in London and Housing Type

The increased risk of worry associated with living in a terraced house was stronger for individuals located within London compared to those living elsewhere. Individuals external to

London, not living in terraced housing are estimated to have a risk of 23.6%, and 25.3% for

those in terraced housing. For those within London, those not in terraced housing had an

estimated risk of 22.8%, and those in terraced housing had an estimated risk of 28.0%.

6.5.3 Personal BVML Model Results-Random Part

Table 43 Random Part Results Personal Model

	1	2	3	4	5
Individual Level					
Covariance/ correlation	0.127(0.022)	0.154(0.022)	0.155(0.023)	0.155(0.023)	0.155(0.022)
Neighbourhood Level					
Victim variance	0.020(0.012)	0.021(0.014)	0.018(0.013)	0.009(0.006)	0.009(0.007)
Worry variance	0.081(0.009)	0.043(0.008)	0.044(0.008)	0.025(0.008)	0.027(0.008)
Victim/worry covariance	0.007(0.009)	0.004(0.008)	0.004(0.008)	0.006(0.006)	0.007(0.005)
Victim/worry correlation	0.180	0.134	0.153	0.419	0.495
Deviance (MCMC)	179508.409	179337.933	179345.424	179372.593	179375.073
Sample size (n)=31719					

Table 43 above, shows the random part of the model, allowing for assessment of the

effect of covariates on neighbourhood level variance in personal victimisation and worry about

personal crime, as well as the covariance between these at both the individual and

neighbourhood level. As seen in the table above, the correlation between personal

victimisation and worry about personal crime at the individual level was consistently low

throughout all models, this was reduced from an estimate of 0.166 in the null model presented

previously in section 5.3.3, although from model 2 onwards this estimate increased to near

null model levels. The introduction of year of survey reduced the individual level variance

from the null model, and this estimate remained constant throughout increasing model

complexity. At the neighbourhood level, estimates of between neighbourhood variance in

worry, and the covariance of victimisation and worry did not change between the null model

and model 1 presented here. A 20% reduction in between neighbourhood variance in personal

victimisation was estimated between the null model, and model 1, this may be attributed to

error of the estimate within the credible interval, as the standard error of the posterior

distributions of these estimates are relatively high.

The addition of individual and household characteristics had limited effects on

estimated between neighbourhood variance in victimisation and covariance between

victimisation and worry, and the small changes estimated can be attributed to error within the

credible intervals. There was substantial evidence of individual and household characteristics

explaining the between neighbourhood variance in worry, with a near 50% decrease in the

estimate between model 1 and model 2, from 0.081 to 0.043. A number of strong predictors of

worry about personal crime may have attributed to this, including: ethnicity; socioeconomic

classification; disability status; education; housing type; car ownership; and household

income.

A small reduction of 14% in variation in victimisation between neighbourhoods from

0.021 to 0.018 was estimated following the introduction of routine activity variables. Whilst

these variables offered explanatory power to the model, the change in the variance estimate

here may be due to error within the credible interval, and represent no real change. There was

also very little, or no change in variance in worry about personal crime between

neighbourhoods, and the covariance of victimisation and worry, suggesting an individual's

routine activities do not contribute to the explanation of this at the neighbourhood level.

The addition of neighbourhood characteristics in the model reduced the estimated

between neighbourhood variation in victimisation to reduce by half, from 0.018 to 0.009.

Variables which may be responsible for this reduction are: living in a rural area; some regions

of England and Wales; and the proportion of vacant properties in a neighbourhood. Estimated

between neighbourhood variance in worry also reduced by 43%, from 0.044 to 0.025.

Variables which are expected to have contributed to additional explanation are: living in a

rural area; some regions of England and Wales; socioeconomic disadvantage; professional

living; the proportion of vacant properties; and ethnic heterogeneity. No real change was

estimated in the neighbourhood level covariance of victimisation and worry, and changes are

expected to be due to error within the credible intervals.

The introduction of interaction terms also offered minimal additional explanation for

neighbourhood level variation, with no real change seen in the estimated variance between

neighbourhoods in personal victimisation, worry about personal crime, and the covariance

between victimisation and worry.

6.5.4 Summary of Risk and Protective Factors

Table 44 Summary of Risk and Protective Factors of Personal Victimisation and Worry about Personal Crime

	Worry	Victim
Risk	- Being Asian, Black, Chinese or other ethnicity - Working in an intermediate, or routine/manual role - Having an illness or disability which affects daily life a little, or a lot - Having A-levels or GCSEs as the highest qualification, or no, or other, qualifications - Living in social rented housing - Living in semi-detached or terraced housing, or flats or other housing type - Living in a household with 2 or 3 or more adult residents - Not owning a car - Providing no information about household income - Having a household income below £20,000 - Living in a house in better condition than average for the local area - Higher levels of socioeconomic disadvantage	- Being Mixed race - Being divorced or separated - Having an illness or disability which either doesn't affect daily life, or affects it a little or a lot - Living in private or social rented housing - Not owning a car - Having a household income of £50,000 or more - Visiting the pub four or more times per month - Going to clubs - Living in a rural location - Living in the East of England

	Worry	Victim
	• Having higher levels of ethnic heterogeneity	
Protective	• Being male • Being widowed • Owning 2 or more cars • Having a household income of £50,000 or more • Living in a house in worse condition than average for the local area • Living in the same area for between 12 months and 2 years • Being out of the house for less than one hour per day • Living in a rural area • Living in the North East, South West, or Wales • Higher levels of professional living • Higher proportion of vacant property	• Older age • Having GCSEs as the highest educational qualifications, or having no qualifications • Being out of the house for 3 hours or less per day • Never visiting the pub • Living in the North West

Table 44 above, shows the risk and protective factors of personal victimisation and worry about personal victimisation.

6.6 Summary and Conclusion

To make an overall conclusion of the effects of the covariates included in each model the below table shows a summary of which variables were included as covariates in each model, and whether a risk or protective effect was found, or whether no conclusive results of this variable on the crime type were found. Only a table to summarise findings regarding the effect of individual, household, and neighbourhood characteristics here, as these findings are summarised discussed in more detail in the following discussion chapter. Following the table of results, a summary of the effects of covariates on the individual and neighbourhood level relationship between victimisation and worry is provided.

6.6.1 Fixed Part

Table 46 below synthesises effects of all individual, household, and neighbourhood characteristics on both victimisation and worry about crime. There is not commentary supporting this table to avoid duplication of information, however in section 7.2 of the discussion all of the below findings are discussed in the below synthesised structure in relation to findings in the existing literature and with reference to opportunity theories of crime and theories of fear of crime.

Table 45 Key to Show Symbols in Synthesis Table

Symbol Key	
↑	Risk factor
↓	Protective factor
nc	No conclusive result
-	Not included in the model

Table 46 Synthesis of effects of all Covariates on Victimisation risk, and Worry about Crime Risk on Household, Vehicle, and Personal Crime

Variable	Household		Vehicle		Personal	
	Victim	Worry	Victim	Worry	Victim	Worry
Age	-	-	↓	nc	↓	↑
Gender (*female*)						
Male	-	-	nc	↓	nc	↓
Ethnicity *(White)*						
Mixed race	-	-	nc	↑	↑	nc
Asian	-	-	nc	↑	nc	↑
Black	-	-	nc	↑	nc	↑
Chinese/other	-	-	nc	↑	nc	↑
Marital Status *(Single)*						
Married	-	-	nc[18]	↑	nc	nc
Cohabiting	-	-	nc	↑	nc	nc
Widowed	-	-	nc	nc	nc	↓
Divorced/separated	-	-	nc	nc	↑	nc
SES *(Professional)*						
Intermediate	-	-	nc	↑	nc	↑
Routine & Manual	-	-	nc	↑	nc	↑
Long-term unemployed	-	-	nc	nc	nc	nc
HRP Age	↓	↓	-	-	-	-
HRP Gender *(Female)*						
Male	↓	↓	-	-	-	-
HRP Marital Status *(Single)*						
Married	nc	↑	-	-	-	-
Cohabiting	nc	↑	-	-	-	-
Widowed	nc	nc	-	-	-	-
Divorced/separated	↑	nc	-	-	-	-
HRP Ethnicity *(White)*						
Mixed race	↓	nc	-	-	-	-
Asian	↓	↑	-	-	-	-
Black	↓	↑	-	-	-	-
Chinese/other	nc	↑	-	-	-	-
HRP SES *(Professional)*						
Intermediate	nc	↑	-	-	-	-
Routine & Manual	nc	↑	-	-	-	-
	nc	↓	-	-	-	-

[18] Married and cohabiting combined in vehicle and personal crime models.

Variable	Household		Vehicle		Personal	
Long-term unemployed						
Disability *(None)*						
Does not affect daily life	nc	↑	nc	↑	↑	↑
Affects daily life a little	↑	↑	nc	↑	↑	↑
Affects daily life a lot	↑	nc	↑	↑	↑	↑
Education *(Degree)*						
A Levels	nc	↓	nc	↑	nc	↑
GCSE	nc	↓	↓	↑	↓	↑
No qualifications	↓	↓	nc	↑	↓	↑
Other	↓	↓	nc	↑	↓	↑
Tenure *(Owner)*						
Private renter	nc	↓	nc	nc	↑	nc
Social renter	↑	nc	↑	nc	↑	↑
House type *(Detached)*						
Semi-detached	nc	↓	↑	nc	nc	↑
Terraced	nc	↓	↑	↑	nc	↑
Flat, maisonette or other	↓	↓	nc	↑	nc	↑
No. of adults *(1 adult)*						
2 adults	nc	nc	-	-	nc	↑
3+ adults	nc	nc	-	-	nc	↑
Lone parenthood *(Not lone parents)*						
Lone parents	↑	↑	-	-	-	-
No. of cars *(1)*						
0	↑	↑	nc	↑	↑	↑
2	↑	nc	↑	↑	nc	↓
3+	↑	↑	↑	↑	-[19]	-
Income *(£30,000-£49,999)*						
No information/refused	nc	nc	nc	nc	nc	↑
Less than £10,000	nc	nc	nc	nc	nc	↑
£10,000-£19,999	nc	↑	nc	nc	nc	↑
£20,000-£29,999	-[20]	-	nc	↓	nc	↑
£50,000+	↑	nc	nc	↓	↑	↓
Relative house condition *(Average)*						

[19] 2+ cars is the maximum category in the personal crime model
[20] £20,000-£29,999 collapsed into reference category for this model

Variable	Household		Vehicle		Personal	
Better	↑	↑	-	-	nc	↑
Worse	↑	↓	-	-	nc	↓
Time in area *(10 years+)*						
Less than 12 months	-	-	nc	↓	nc	nc
12 months – 2 years	-	-	nc	↓	nc	↑
2-5 years	-	-	nc	nc	nc	nc
5-10 years	-	-	nc	nc	-[21]	-
Time at address *(5+ years)*						
Less than 12 months	↑	↓	-	-	-	-
12 months – 2 years	nc	↓	-	-	-	-
2-5 years	nc	↓	-	-	-	-
Time household unoccupied *(3+ hours)*						
Less than 1 hour	nc	↓	-	-	-	-
1-3 hours	nc	nc	-	-	-	-
Time away from home *(3+ hours)*						
Less than 1 hour	-	-	nc	nc	↓	↓
1-3 hours	-	-	↓	nc	↓	nc
Pub Visits *(1-3 times)*						
Never	-	-	-	-	↓	nc
4-8 times	-	-	-	-	↑	nc
9+ times	-	-	-	-	↑	nc
Clubbing *(Does not visit clubs)*						
Clubber	-	-	-	-	↑	nc
Region *(South East)*						
North East	nc	nc	↓	nc	nc	↓
North West	↓	nc	nc	nc	↓	nc
Yorkshire & Humber	nc	nc	↓	nc	nc	nc
East Midlands	nc	↑	nc	↑	nc	nc
West Midlands	nc	↑	nc	↑	nc	nc
East of England	nc	↑	nc	nc	↑	nc
London	nc	↑	nc	nc	nc	nc
South West	nc	nc	↓	nc	nc	↓
Wales	nc	nc	nc	nc	nc	↓
Area Type (Urban)						
Rural	nc	↑	nc	nc	↑	↓
Inner City	-[22]	-	-	-	-	-

[21] Reference category 5+ years for personal crime model
[22] Inner city category not used in household and vehicle crime models

Variable	Household		Vehicle		Personal	
Socioeconomic disadvantage	↑	↑	↑	↑	nc	↑
Professional living	↓	↓	nc	↓	nc	↓
Settled living	nc	nc	nc	nc	nc	nc
In migration (rate per 1000)	nc	↓	↓	↓	-	-
Out migration (rate per 1000)	nc	nc	↑	↑	-	-
vacant property %	nc	↓	-	-	nc	↓
Ethnic heterogeneity	nc	↑	nc	↑	nc	↑
Incivilities	↑	nc	↑	nc	-	-

6.6.2 Random Part

Table 47 Synthesis of Random Part of Models of Household, Vehicle, and Personal Crime

Random Coefficient		Null→M1	M1→M2	M2→M3	M3→M4	M4-M5
		%+/-	%+/-	%+/-	%+/-	%+/-
Individual Level						
Victim/worry covariance/ correlation	Hhold	+0.4%	-2%	+0.4%	-2%	+3%
	Vehic	-61%	+30%	0%	1.4%	+1%
	Pers	-23%	+21%	+1%	+0%	+0%
Neighbourhood Level						
Victim variance	Hhold	+3%	-11%	-28%	-14%	+8%
	Vehic	-7%	-40%	-56%	-7%	+20%
	Pers	-20%	+5%	-14%	-50%	0%
Worry variance	Hhold	0%	-34%	-49%	-26%	+29%
	Vehic	-15%	-25%	-33%	0%	+4%
	Pers	-1%	-46%	+2%	-43%	+8%
Victim/worry covariance	Hhold	-4%	-24%	-58%	+50%	-50%
	Vehic	+4%	-48%	-38%	+13%	-6%
	Pers	-13%	-43%	+50%	+50%	+17%
Victim/worry correlation	Hhold	-4%	-1%	-26%	+70%	-57%
	Vehic	+17%	-22%	+13%	+11%+	-15%
	Pers	+7%	-26%	+14%	175%	+18%

Across all models, there was good evidence of low correlation between victimisation

and worry about crime for all crime types examined, which remained low throughout all levels

of model complexity. Additional explanatory variables did very little to account for the

covariance found between victimisation and worry. The largest reduction in unexplained

variance occurred in vehicle and personal crime models following the introduction of year of

survey, and whether an individual has been a victim of crime within their local authority, however following the addition of individual and household variables in model 2 the covariance estimates increased to near null model estimates.

Overall, the addition of individual and household variables accounted for a good amount of between neighbourhood variance in both victimisation and worry about crime, with between neighbourhood variance in victimisation reducing by between 11% and 40%, variance in worry reducing by 25% to 46%, and covariance reducing by 24% to 48%. The exception to this was neighbourhood level variance of personal crime, where there was an increase in estimated between neighbourhood variance, with this estimate returning to its null model size. This estimate had a relatively high standard error, and the variation in this estimate between the null model and model 2 may be due to error.

The addition of neighbourhood level variables, as expected, accounted for a good proportion of previously unexplained variance between models 2 and 3 for household and vehicle crime, and between models 3 and 4. Area level covariates accounted for between 28% and 56% of the between neighbourhood variation in victimisation, between 33% and 49% of the between neighbourhood variation in worry, and between 38% and 58% of their covariance. Excluded from the final figure is the covariance estimate of the personal model, which showed an increase of 50%, however this estimate was very small, with a large standard error, and the change in value here was not attributed to real change, but error in the estimate.

Results of the effects of the addition of incivilities in household and vehicle crime were less congruent between models, all neighbourhood level variance estimates had reduced in effect size, given the explanatory power of variables entered into the models, and their standard errors had become much larger in respect to the posterior means, therefore little can be concluded about the effects of these variables on between neighbourhood variance in victimisation, worry, and their covariance.

7.0 Discussion

This chapter interprets the results presented in the previous two chapters which reported findings on the relationship between victimisation and worry about crime, and the effect of individual, household, and neighbourhood characteristics on victimisation risk, the risk of having dispositional worry about crime, and on the relationship between them. Findings relating to the relationship between victimisation and worry about crime are discussed with relation to the victimisation of fear of crime, whilst effects of individual, household and neighbourhood characteristics on victimisation risk are explored under the opportunity structure of crime, and their effects on worry about crime are discussed in relation to vulnerability theory of fear of crime and ideas of social and physical incivilities.

7.1 Examining the Baseline Relationship Between Victimisation and Worry About Crime at the Individual and Neighbourhood Level

The following section discusses the results of analyses which identified whether a significant relationship between victimisation and worry about crime within the crime type categories of household, vehicle and personal crime. Focus then moves on to the interpretation of correlations between victimisation and dispositional worry about crime, at both the individual and neighbourhood level, assessing their support for the victimisation theory of fear of crime.

7.1.1 Assessing Whether a Significant Relationship Exists between Victimisation and Worry about Crime at the Individual Level

Initial analyses studied the *baseline* relationship between victimisation and fear of crime, meaning at this stage no consideration was made for characteristics likely to account for any amount of the existing relationship. A significant relationship between victimisation and worry about crime across all crime types was confirmed, with victimisation experiences

increasing the odds of being worried at least twofold. Previous literature has not focused on this baseline relationship without accounting for effects of other contributary factors, however, to fully understand the relationship and factors accounting for it, it was considered pertinent to primarily assess the strength of the relationship prior to potentially explanatory factors being introduced into the model, as this offers a baseline to compare later findings to, allowing for quantification of the impact of potentially explanatory characteristics.

The increased odds of being worried about crime associated with a victimisation experience was highest for victims of vehicle crime, whose odds of being worried about vehicle crime were almost three times higher, followed by victims of household crime whose odds of being worried about household crime were two and a half times higher, and then by victims of personal crime whose odds of being worried about personal crime were approximately twice as high. At this stage of the analysis some conflicts are seen with previous literature, for example, compared to experiencing a household victimisation, having experienced a personal crime victimisation was associated with double the increase in odds of being worried about non-crime-specific fear (Brunton-Smith & Sturgis, 2011), whereas in this study, the weakest relationship was found between personal victimisation and worry.

Results here more closely mirrored literature employing crime type specific measures of fear, with victims of any crime type found to have increased fear of household crimes, whilst the victimisation had no effect on fear of personal crimes (Hale, Pack & Salked, 1994; Weitzer & Kubrin, 2004), furthermore victims have even been found to have lower fear of personal crime than non-victims (Weitzer & Kubrin, 2004). Within the above examples, which are mixed in their support of the findings in this study, only either the victimisation measure or worry measure was crime type specific, with the other being a general crime measure, this comparison of results confirms that to use crime type specific worry and victimisation pairings offers additional knowledge to this area.

Victimisation theory of fear of crime posits that those who have a victimisation experience are at increased risk of being fearful of crime, this baseline analysis supports this theory with victims significantly more likely to be worried about crime than non-victims across crime types, however, does not offer further insights into this until the more developed models are discussed later in the chapter.

Consideration must be made of the stability of these estimates throughout the model building process, which may be due to the structure of the model which utilises probit transformations of the dichotomous dependent variables. In a multilevel model structure which uses continuous level one variables, the variance estimate is random with level two variance accounting for the difference between level 1 units within a level 2 unit, known as random slopes modelling (Rabash et al., 2009). When dichotomous variables are put into the multilevel structure, the correlation estimate is the same as the correlation between the two binary dependent variables, thus the unexplained variance which changed during the model building process is not accounted for in this statistic in the models analysed here, it is instead dependent on the value of the constant of each dependent variable in the model. As this statistic did not change much during the model building process, this may explain why the individual level covariance/correlation estimates remain constant.

7.1.2 The Strength of the Relationship between Victimisation and Worry at the Individual and Neighbourhood Level

At the individual level, strong evidence of a low to moderate correlation between worry and victimisation was found across crime types, estimated at 0.166 for personal crime, 0.237 for household crime, and 0.282 for vehicle crime. In alignment with existing knowledge and theory, a positive correlation between victimisation and worry about crime was found, indicating that worry is more common among those with victimisation experiences. Very high correlations were not expected, as across the crime types, prevalence of worry about crime

was between 5 and 10 times the prevalence of victimisation. The findings here also reflect the

odds ratios discussed in the previous section in terms of the relative strength of association

between crime types, and therefore the comparisons made to existing literature apply to these

results.

The strongest evidence of correlations existing between victimisation and worry about

crime at the neighbourhood level was found in vehicle crime, with an estimated correlation of

0.807, which diagnostics suggest is close to the true population value. Good, although weaker,

evidence of a moderate correlation between household victimisation and worry about

household crime was found, estimated at 0.513, however there is more variability around this

estimate for where the true population value lies. No good evidence of correlation was found

between personal crime victimisation and worry at the neighbourhood level. Findings at the

neighbourhood level again mirror previously discussed results with regard to relative strength

of relationship between the three crime types, as such, results from studies employing crime

type specific worry measures would generally support these figures.

Across the crime types discussed here there are differing implications for the

victimisation theory of fear of crime. Both vehicle crime and household crime offer support to

the theory in that neighbourhoods where either vehicle or household victimisations are more

prevalent, worry about that crime type is also higher. These findings are also suggestive of the

mechanism of indirect victimisation occurring within neighbourhoods, whereby news of

victimisations occurring within the neighbourhood travels, resulting in more widespread worry

where there are victimisations. Evidence of indirect victimisation is not found when

examining personal crime due to their being no evidence of a relationship between

victimisation and worry at the neighbourhood level. Examining individual and neighbourhood

level correlations between personal crime victimisation and worry disagree with the

suggestion that neutralisation techniques reduce worry *only* for victimised individuals, whilst

not being applicable to non-victims living in the local area, as there was much stronger

evidence of a positive correlation at the individual level of the model than at the

neighbourhood model. Instead, this finding may provide more support for the idea of the

"muting effect" whereby individuals living in areas of high social or physical disorder, here

represented by higher levels of crime, are less affected by the disorder due to repeated

exposure.

A possible statistical explanation for the lack of evidence of a correlation between

personal victimisation and worry about personal crime, and there being less strong evidence

for this relationship with household crime is that victims of vehicle crime were more prevalent

(6.3% of the sample), than victims of household crime (5.3% of the sample) and vastly more

prevalent than victims of personal crime (3.6% of the sample). Therefore, with substantially

fewer personal crime victims per neighbourhood, and many neighbourhoods having zero

victimised individuals sampled for the survey, there is less data upon which the model can

create a precise estimate in comparison to the higher prevalence crime types.

7.2 The Effects of Individual, Household and Neighbourhood Characteristics on Risk of Victimisation and Worry About Crime

This section analyses the results of the impact of individual, household and

neighbourhood characteristics on an individual's risk of victimisation and worry about crime,

interpreting their effects of victimisation through the opportunity lens, and their effects on

worry about crime through vulnerability theory and theories of social and physical incivilities.

7.2.1 How do Individual Characteristics Affect Risk of Victimisation and Worry about Crime?

Showing strong agreement between models, older HRP age was associate with reduced

risk of household victimisation, and older respondent age was associated with reduced

risk of both vehicle, and personal victimisation. Older HRP age was also associated with

reduced risk of worry about household crime, in contrast, older age was found to increase risk

of worry about personal crime, whilst having no conclusive effect on worry about vehicle

crime. Finding older adults to be at reduced risk of all victimisation types is largely supported

by the existing literature, where older age was commonly found to be a protective factor of

household (Park & Fisher, 2017; Wilsem et al., 2006), vehicle (Wilsem et al., 2006), and

personal victimisation (Brennan et al., 2006; 2010; Wilsem et al., 2006; Tseloni & Pease,

2003; 2004; Kuo et al., 2012). Mixed findings regarding worry about crime are supported by

mixed results in the literature review (Kanan & Pruitt, 2002; LaGrange et al., 1992; Eschholz

et al., 2003; Brunton-Smith & Sturgis, 2011), and present findings are consistent with negative

associations found between older age and fear of household crime (Reid & Konrad, 2004;

Rountree & Land, 1996), and positive associations found between older age and personal

victimisation (Reid & Konrad, 2004; Hale et al., 1994).

Lower victimisation risk among older individuals may be attributable to the reduced

amount, and types, of social interactions older individuals routinely engage in (King et al.,

2017), for example in the personal crime model the activities captured by the routine activities

are limited to drinking establishment visits, and may not accurately account for the differing

activities of older adults, whilst even fewer measures are included in the vehicle and

household crime models. Lifestyle/exposure theory agrees with lower victimisations in the

elderly due to their limited exposure to risky facilities and individuals. Further considerations

under the opportunity framework which may reduce the suitability of older adults as targets,

particularly with regard to personal and vehicle acquisitive crimes, is that older adults are less

likely to have CRAVED "hot products", thus this may reduce their desirability as a target for

acquisitive offenders. Equally, for violent or expressive crime, there is less "kudos" to be

gained, and likely less desire for redemption in victimising such an age group.

Consistent with vulnerability theory, older individuals were more likely to be worried about personal victimisations, despite their lower victimisation risk as is premised in the theory, this finding suggests older individuals may be more sensitive to the perceived threat of a personal victimisation. An inconclusive effect of age on vehicle victimisation may also support vulnerability theory, with vehicle crimes asked about in the worry measure not having any direct threat of physical harm to the victim. Additionally, households with older reference persons were found to be less likely to be worried about household crime. Possible explanations for this reduced vulnerability in the elderly may be increased guardianship not measured in this study, for example living in sheltered apartments, or elderly communities which may reduce the feelings of vulnerability. Such communities may also provide the necessary cohesion for individuals to feel they could cope with a crime event should it occur, additionally, their life experience may have resulted in a "muted" effect of worry caused by hearing of any local household crime occurrences. The differences between the results across crime types the heightened sensitivity to personal victimisations, compared to vehicle and household victimisations, which provides good empirical support for the vulnerability theory of fear of crime.

Households with Male HRPs were estimated to have a lower risk of household victimisation, however no conclusive effect of gender on risk of vehicle victimisation was found, and the effect of gender on personal victimisation was more complex, whereby males were found to be at higher risk of personal victimisation when younger, however this gender difference reduces to near zero as age increases. There was greater consistency on the worry side of the model, whereby being male, or living in a household with a male HRP, was associated with a reduced risk of being worried about all crime types. In contrast to the findings here, previous literature finds males to be at increased risk of household victimisation (Wilsem et al., 2006), and more likely to be a victim of multiple crime types (Outlaw et al.,

2002). In keeping with the findings here, previous literature also finds younger individuals to

be at increased risk of personal victimisation (Brennan et al., 2006; 2010; Kuo et al., 2012;

Tseloni & Pease, 2003; 2004; Outlaw et al., 2002), whilst finding no effect of gender on

vehicle victimisation risk. Findings regarding worry about crime were also largely in

agreement with the literature, with females found to have higher risk of being dispositionally

worried about crime in general than males (Kanan & Pruitt, 2002), have higher levels of worry

(LaGrange et al., 1992; Eschholz et al., 2003), and experience feelings of worry more

frequently (Dowler, 2003, Krulichova, 2019). When crime specific worry measures were

considered, females were also found to be at increased risk of being worried about burglary

(Reid & Konrad, 2004), personal crime including mugging (Reid & Konrad, 2004), assault

(Hale et al., 2004), and sexual assault (Reid & Konrad, 2004).

    In agreement with vulnerability theory of fear of crime females are expected to be

more worried about being a victim of crime due to their perception that a victimisation

experience would be particularly harmful to them due to their vulnerability, as was evident

across all crime types explored here. The more complex relationship found between age and

gender and personal crime is supported by the lifestyle/exposure element of opportunity

theories of crime. As young males are the most common offenders of personal crime, young

males are much more likely to associate with such individuals, as well as engage in a variety

of other risky routine activities including the use of alcohol and drugs (Bottoms & Shapland,

2011), which increase their exposure to potential crime events.

    Households with a Mixed race, Asian or Black HRP were found to be at reduced risk

of household victimisation, compared to those with a White, Chinese, or "other" HRP.

Whilst limited effects of ethnicity were found on vehicle and personal victimisation, except for

Mixed-race individuals being at increased risk of personal victimisation, there was good

consistency in the effects of ethnicity on worry about crime between models, with almost all

non-White ethnicities at higher risk of being worried about each crime type than White

individuals. Exceptions to this were those in Mixed race led households not having different

risk of being worried about household and personal crime than those in White led households.

Ethnicity has been associated with household victimisation in the literature, supporting

findings here that ethnicity appears to be more strongly associated with household

victimisation risk than vehicle and personal crime (Trickett et al., 1995; Outlaw et al., 2002;

Park & Fisher, 2017; Wilsem et al., 2006). In the literature, non-white individuals were also

mostly associated with reduced risk of property crime (Trickett et al., 1995; Outlaw et al.,

2002), with the exceptions of Indian individuals being at increased risk of burglary and

household criminal damage (Trickett et al., 1995) and Park & Fisher's (2017) zero-inflated

model finding being non-white a risk factor of household victimisation. Despite no effect

being found in this study, non-white individuals have been found to be at increased risk of car

vandalism (Wilsem et al., 2006), and Asians and Pacific Islanders at increased risk of personal

victimisation (Tseloni & Pease, 2003; 2004). Findings on the relationship between worry

about ethnicity and worry largely agreed with previous literature, where non-White individuals

have been found to have higher general dispositional worry than White individuals (Brunton-

Smith & Sturgis, 2011), and increased worry about burglary, assault and mugging (Hale et al.,

1994), although less likely to worry about burglary once a month (Rountree & Land, 1996).

One possible reason for ethnic minorities being more likely to have dispositional worry

about crime which is not accounted for within the model is social integration, and it is possible

that those of ethnic minority backgrounds are less socially integrated than other individuals

(Vervoort, 2012), reducing their ability to cope with victimisation experiences. Another

possible explanation is the lower socioeconomic resource of many ethnic minority people (Li

& Heath, 2020) to choose to live in an area with lower physical or social incivilities which are

theorised to increase fear of crime. Although socioeconomic resource is represented for by

some measures in the analysis, structural barriers faced by ethnic minorities are not fully

operationalised.

Households with either a separated, or divorced, HRP were at higher risk of household

victimisation and separated or divorced individuals were at increased risk of personal

victimisation, however marital status was not found to affect vehicle

victimisation risk. Greater consistency was shown between models on the worry side, with

those in households with a married or cohabiting HRP, and those married or cohabiting at

increased risk of being worried about household and vehicle crime compared to single and

widowed individuals, widowed individuals were also estimated to be at reduced risk of worry

about personal crime. Findings regarding marital status were not wholly congruent with

existing findings, with no evidence of marital status affecting household victimisation risk in

the literature, however single individuals were found to be at increased risk of vehicle

victimisation (Wilsem et al., 2006). Evidence relating marital status and personal victimisation

was much stronger in the previous literature than in this study, but in agreement with the

present findings, risk of personal victimisation, violence, and assault has previously been

found to be lower for married individuals (Tseloni & Pease, 2003; Brennan et al., 2006; 2010;

Kuo et al., 2012), whilst separated or divorced individuals have increased risk of violence

(Brennan et al., 2006). Findings on the fear side of the model also agree with existing

knowledge, with married individuals found to have the highest levels of dispositional fear

compared to individuals of all other marital statuses (Brunton-Smith & Sturgis, 2011; Oh &

Kim, 2009).

Higher risk of both household and personal victimisation of divorced or separated

individuals compared to other marital statuses may be attributed to reduced guardianship over

themselves and over their household compared to married or cohabiting individuals,

independently of whether they reside with other adults outside of a partnership. However,

single individuals are not also concluded to experience this increased risk, therefore it may be

that a change in ownership, or level, of responsibility for personal or household guardianship

has occurred because of a separation or divorce, and as such the guardianship exerted is less

capable. Another possible cause is a shift in behaviours (Bourassa et al.,2019), not captured

within the model, when transitioning from married to separated life which expose the

individual and their household to increased opportunities for crime.

It is unexpected that those married, and cohabiting were more likely to be worried than

other marital statuses, as the family unit is expected to form a support network, suggestive of a

greater ability to cope with a victimisation, should it occur. It is possible such individuals are

more invested in the safety of their home if they are bringing up a family in it, or are planning

to, therefore the effects of the victimisation may be particularly damaging to them, drawing

more support from vulnerability theory. It is also counter intuitive that widowed individuals

are less likely to be worried than other marital statuses, vulnerability theory would suggest

such individual's to be more likely to be worried, because you may expect a victimisation

experience to be more harmful once widowed than when married or civil partnered. One

consideration is the idea of a "muting effect", which suggests that previous exposure to crime

reduces an individual's sensitivity to a trigger, it may be that going through a life event such as

being widowed leaves the individual feeling less sensitive, and more able to cope to with

negative occurrences such as a personal victimisation.

There was good congruence in results between models of the effects of socioeconomic

classification, with socioeconomic classification not concluded to affect risk of victimisation

of any crime type. Despite the lack of effect on victimisation risk, those with, or in a

household led by someone with, an intermediate, or routine or manual classification, were at

increased risk of being worried about all crime types than those classified as professional, or

long-term unemployed. Additionally, those with a long-term unemployed HRP were found to

have the lowest risk of being worried about household crime. Previous work has found socioeconomic status to affect victimisation risk, particularly household victimisation risk, with those in professional occupations to have increased risk of property crimes (Wilsem et al., 2006), whilst those in households with manual and non-classified household reference persons have been found to be at reduced risk of household crimes (Tseloni, 2006). Whilst no direct effect of socioeconomic classification on vehicle crime was found in this study. those in employment have previously been found to have higher risk of vehicle crime than those unemployed (Wilsem et al., 2006). Socioeconomic status was not found to affect risk of personal victimisation in this study, however working part-time has previously been found to increase risk (Tseloni & Pease, 2003; 2004). Showing some agreement with those in routine or manual and intermediate professions being at increased risk of all types of worry, those in lower skilled occupations were found to have higher worry than those in higher skilled occupations (Brunton-Smith & Sturgis, 2011).

It was expected that socioeconomic classification would have been found to have more conclusive effects on victimisation risk. Previous literature and theoretical reasons suggest that individuals in professional socioeconomic classifications would be at increased risk, with regard to acquisitive crime it would be expected that such individuals would be more likely to possess CRAVED items which would make themselves, their vehicle or household a more desirable target, however it may be that this has been captured by other variables in the model, such as income and other socioeconomic indicators, as well as routine activity, and guardianship measures.

Individuals who were long term unemployed were found to be at least risk of worry about household crime, vulnerability theory would suggest such individuals have limited resources to recover from such an event and would therefore be more likely to be worried. The increased risk of worry among those of professional socioeconomic classification, and lower

risk of those long-term unemployed may be explained by professionals having lower exposure

to social and physical incivilities in their routine activities, thus may require fewer triggers to

establish a level of worry about crime, in contrast those in long-term unemployment may be

more familiar with social and physical disorder and therefore desensitised to such triggers,

resulting in desensitisation, rather than a baseline level of fear.

Having a long-standing illness or disability consistently, and strongly increased risk of

victimisation and worry across all crime types, especially when this affected daily life. The

exceptions to this were: disabilities which do not affect daily life not affecting risk

of both household and vehicle victimisation; disabilities affecting daily life a little not

affecting vehicle victimisation; and disabilities which affect daily life a lot not having a

standalone effect on worry about household crime following its inclusion in an interaction

term with incivilities. From the literature review carried out for this research the effect of long-

term illness and disability it was concluded that this is an understudied characteristic in studies

using quantitative methods, despite being found to be a highly consistent risk factor for both

victimisation and worry about crime across crime types. There is more existing evidence of the

effect of illness and disability on general fear of crime, with such individuals found to have

higher levels of general fear of crime, especially when their illness or disability affects their

daily life (Bruton-Smith & Sturgis, 2011), and to be more likely to be dysfunctionally worried

(Gray et al., 2010), meaning they are less able to employ effective coping strategies to reduce

their worries than those without long-term illnesses or disabilities. It does appear the effect of

illness can be somewhat mediated by a number of neighbourhood social cohesion measures

and disorder measures (Gray et al., 2010), which provides additional support for the

interaction term found between disability and incivilities in examining worry about household

crime.

Regarding personal victimisation, it is possible that those with limiting illness or disabilities are less physically able to defend themselves or their possessions, thus less able to exhibit guardianship over themselves, and relying on others to exhibit guardianship over them provides a good explanation for their increased victimisation risk. For household crime, individuals with life limiting illnesses or disabilities may have physical symbols of vulnerability on their household, e.g. ramps or handles at the door, which may highlight a household as a suitable target, and the occupier may be less able to exhibit capable guardianship over the house, for example, relying on others to lock the door, having to leave keys, having people in and out etc. Disability had a weaker effect on vehicle victimisation, which may be attributed to the vehicle being less closely connected to the individual than their person or their household.

Vulnerability theory well explains why those with disabilities and illnesses are more likely to be worried than those without, as those with a disability or illness are likely to feel less able to physically defend themselves, their household, or their vehicle. They may also correctly perceive themselves to be at higher risk than non-disabled individuals, therefore resulting in a higher baseline level of fear. With regard to worry about vehicle crime, a disabled person may require their vehicle for mobility to a greater extent than a non-disabled person, therefore they may fear vehicle victimisation more due to the greater consequences associated with losing a vehicle.

Having attained higher level qualifications was associated with increased victimisation risk. Compared to those with a degree level qualification, individuals who had either no, or "other", qualifications were at reduced risk of both household and personal victimisation, and those with GCSEs as their highest qualification were also at reduced risk of personal and vehicle victimisation. In the household crime model, all those whose highest educational qualification is below degree level were at reduced risk of being worried about household

crime, and in contrast, those individuals were at increased risk of being worried about

vehicle and personal crime.

In contrast with the findings regarding household crime, other studies have also found

having higher education, particularly above degree level to be at increased risk of household,

vehicle, and personal victimisations (Tseloni et al., 2004; Wilsem et al., 2006; Kuo et al.,

2012). Although results here regarding worry varied between the household model, and the

vehicle and personal models, mixed results in the literature when examining worry about

crime using a non-crime specific measure support the mixed results here (Brunton-Smith &

Sturgis, 2011; Kanan & Pruitt, 2002; Krulichova, 2019). Also, in opposition to the findings in

the household model, risk of worry about burglary has been found to be higher for those with

lower qualifications (Reid & Konrad, 2004). Although sexual offences were not included in

either victimisation or worry measures, risk of worry about sexual assault has been found to be

higher in those with lower educational qualifications (Reid & Konrad, 2004).

Given the additional characteristics accounted for here including socioeconomic status

and household income, opportunity theory does little to further explain why those with higher

educational qualifications would be at increased risk of victimisation without further research

into understanding potentially different behaviours of those with higher education compared to

lower levels. A potential explanation is the differing media consumed by those of differing

education level (Geers, 2020), different focuses and information obtained by alternate news

sources for those of lower educational levels could inform individuals of crime risks and

prevention strategies.

7.2.2 How do Household Characteristics Affect Risk of Victimisation and Worry about

Crime?

Compared to owner occupiers, social renters were consistently found to be at increased

risk across all crime types, with private renters also at increased risk of personal crime. There

was less consistency in the effects of tenure on risk of worry, with private renters at decreased

risk of worry about household crime, and social renters at increased risk of worry

about personal crime, whilst no effect was found on worry about vehicle crime. In agreement

with these findings, social renters have previously been found to be at increased risk of

burglary and household theft (Tseloni, 2006), private renters were not found to be at different

risk of household crime compared to owner occupiers, despite having been found to be at

increased risk in previous work (Tseloni, 2006). Much of the prior research did not distinguish

between private and social renters, however overall renters were consistently found to be at

increased risk of property and household crimes (Trickett et al., 1995; Park & Fisher, 2017;

Tseloni, 2006; Wilsem et al., 2006). Renters have also been found to be at increased risk of

both vehicle crime and violence in previous research (Wilsem et al., 2006). Variables relating

to household tenure, and their effect on worry about crime was not included in any of the

studies reviewed in this thesis, at the time of the literature search, no research including such

measures was found.

Those in social or private rented housing may be at increased risk of household

victimisation due to being less control over security upgrades compared to homeowners

(Hulse & Haffner, 2014) leaving their homes more vulnerable to household crimes, a further

consideration is that those in social housing may have less autonomy in choosing where to live

(Malpass & Victory, 2010) due to having to accept social housing offers when they arise, they

therefore may live in higher crime neighbourhoods than other tenure holders, without the

ability to move to a more desirable location. Similarly with the increased risk of vehicle

victimisation, it may be that those in social housing are unable to secure housing with secure

parking, therefore the car would have less capable guardianship exerted upon it. Also, if there

are multiple households in this situation, this may become a target area for vehicle crime.

Possible explanations of those renting, either socially or privately, being at increased risk of

personal crime are harder to determine due to the individual being more detached from the

house itself, possible explanations may be features of the area particular to rented

accommodations not captured in the area level covariates included, or possibly in the routine

activities of those in rented accommodations which differ from homeowners.

Only private renters were found to be less worried about household crime than both

owners and social renters, this may be due to privately rented accommodation being

considered only for a life stage for the majority of tenants (Ball, 2010), thus they may be less

concerned about such a crime where they feel limited connection to the household, this may

work akin to neutralisation techniques. The increased risk of worry about personal crime

associated with social renting may be due to a perceived increase in the risk of victimisation,

which is demonstrated in this study, this may also be due to elements of social and physical

disorder present in the social housing neighbourhood not captured in the model here.

The effects of accommodation type showed some agreement between crime types

across victimisation and worry models. Those living in flats were at the lowest risk

of household victimisation, and those in flats or detached housing were at the lowest risk of

vehicle victimisation, however accommodation type did not affect personal victimisation

risk. Whilst all those in non-detached housing types were at decreased risk of worry about

household crime compared to their detached counterparts, they were at increased risk of worry

about vehicle or personal crime. The exception to this is no conclusive effect of living in a

semi-detached house on worry about vehicle crime. With regard to household victimisation

risk, mixed findings were present within the existing literature. In agreement with the findings

here, those living in detached or semi-detached housing have been found to be at increased

risk of household victimisation compared to those living in flats (Wilsem et al., 2006; Trickett

et al., 1995), with detached housing found to have a protective effect in other studies (Tseloni,

2006). Supporting findings here regarding vehicle victimisation risk, detached housing has

also previously been associated with reduced risk of vehicle related theft and car vandalism

(Wilsem et al., 2006). In alignment with findings here, no evidence of housing type affecting

risk of worry about crime was found in studies reviewed in this thesis.

Theoretically, for household victimisation flats may be at lower risk of victimisation

due to the often-increased security, with blocks of flats often having at least one locked door

prior to the entrance to an individual housing unit, thus the flat has more capable guardianship

in the form of increased security. Additionally, due to those residing in the blocks of flats

likely being aware of who is usually in the building, informal surveillance may also act as

capable guardianship. Vehicle crime risk may increase in terraced or semi-detached

accommodations because vehicles are more likely to be parked on the roadside, where they are

at highly increased risk of becoming a target of crime (Town et al.,2003), compared to

detached houses which are more likely to have a garage, or on property driveway, allowing the

vehicle owner, or the location of the vehicle to exercise capable guardianship. Equally, with

regard to flats, parking availability in flats is commonly in underground car parks, with

additional security measures, thus equating to capable guardianship. Increased risk of worry

about household crime among those in detached households. Findings regarding the

relationship between housing type and worry are not seemingly well accounted for by the

discussed theories of fear of crime within this thesis, it is difficult to attribute matters of

housing characteristics to increased vulnerability, or of neighbourhood social and physical

disorder, particularly as measures of this are included within the analyses here.

The number of adults residents in a household was not found to affect risk of any

victimisation type, however households of 2 or more adults were at increased risk of being

worried about personal crime, whilst not affecting worry about other crime types. Lone

parenthood was only found to affect risk of household victimisation, and worry

about household crime, increasing the risk of both phenomenon. Previous literature found

households with three or more adults to be at increased risk of household crime, burglary, and

household theft (Tseloni, 2006), however no such effect was found in this study, this may be

due to the more detailed profile of characteristics offering explanatory power towards

victimisation risk than in the cited literature. No effect of the number of adults living in a

household was found on vehicle or personal victimisation in the literature, or on worry about

any crime type. This study found individuals living in households with more than two

residents to be at increased risk of worry about personal victimisations, this appears to

contradict ideas of vulnerability theory, as it would be assumed individuals in a household

with others would have support systems to cope with any potential victimisations. A counter

consideration is that those living alone likely often carry out routine activities alone

successfully, which may produce a desensitisation effect resulting in the individual feeling

capable to either deter or cope with a victimisation well. As found in this study, previous

literature has found lone parents to be at increased risk of household crimes (Tseloni et al.,

2004; Tseloni, 2006), and although not found in this study, possibly due to the inclusion of

other variable pertaining to household structure, and the inclusion of routine activity variables,

lone parents have previously been found to be at reduced risk of personal victimisation

(Tseloni & Pease, 2003; 2004).

Vehicle ownership affected risk of victimisation and worry for all crime types,

with some agreement in effects across crime types. Compared to households with one car,

those without a car were at increased risk of both household and personal crime, and those

with 2 or more cars at increased risk of both household and vehicle crime. Not owning a car

increased the risk of worry about all crime types. Owning 3 or more cars increased the risk of

worry about vehicle and household crime, whilst owning more than one car did not reduce risk

of worry about personal crime.

In agreement with the findings here, owning 3 or more cars has previously been found to increase risk of household victimisation (Tseloni, 2006), and risk of vehicle related theft and vandalism has been found to increase with each additional car owned (Wilsem et al., 2006), those owning more than four cars have previously been found to be at increased risk of personal crime compared to those with 3 or fewer (Tseloni & Pease, 2033; 2004). Where car ownership has been studied as a potential risk factor for victimisation the operationalisation of the variable has not allowed to an assessment of the effects of not owning a car, this suggests the relationship between victimisation and car ownership is not linear when examining car ownership from zero upwards. No prior work estimating the effects of car ownership of worry about crime was found in the literature review for this thesis.

Households with more cars may indicate the presence of more desirable goods within the household compared to those with fewer cars thus increasing their desirability as a target for household crime. Additional households with 0 cars may have their increased risk explained by lower perceived guardianship of the household for the offender, as no cars may suggest the house is unoccupied. With vehicle crime, the increased risk associated with owning more cars may be explained by the increased opportunities for vehicle victimisation simply as owning more vehicle increases the risk opportunities for victimisation, equally it may be harder to maintain guardianship over multiple cars if suitable secure parking is unavailable, resulting in increased opportunity for crime. Individuals without a car were also found to be increased risk of vehicle victimisation, this is an interesting result, as all those included in the vehicle model has stated they had use of a car in the year prior to them being surveyed, however the number of cars they have was measured by the number of cars they *regularly use*, this suggests individuals who previously had access to a car, but no longer have regular use of it are at increased risk of being worry, this may be due to a loss of a vehicle, or to having infrequent use of a vehicle. Those without cars were found to be at increased risk of

personal victimisation, a vehicle may physically act as capable guardianship for an individual

whilst going about their routine activities, resulting in lower opportunities to become a victim

of personal crime.

Individuals with no car have the lowest risk of worry about personal victimisation, this

is unexpected, especially given their increased risk, however this may be evidence of a muting

effect experienced by individuals who commonly use public transport methods or walk alone

after many successful journeys. In contrast, those with two or more cars were also at increased

risk of worry about personal crime, this may be due to them regularly travelling in a car, thus

leaving them feeling more vulnerable to personal crime when not in a vehicle without the

possible neutralisation techniques developed by someone who takes such actions more

regularly. Increased worry about household and vehicle victimisation for those owning either

no, or three or more cars is not well explained by the victimisation theories of crime explored

in this thesis. Matters of increased vulnerability and ideas of social and physical incivility offer

limited explanation as to how car ownership may affect worry. A possible suggestion is that

those without cars may lack the financial means to recover from a victimisation experience,

however this is likely to have been accounted for by other sociodemographic variables

included in the analysis, equally owning more cars may suggest greater wealth, thereby the

individual has a greater amount to lose should they be victimised.

Household income had limited effect on risk of victimisation across all household

types, with only those in a household with an income of £50,000 or more found to be at

increased risk of both household and personal victimisation. Those earning just below the

median income level were most at risk of being worried about household and vehicle

crime, conversely, reduced risk of being worried about vehicle crime was found among those

earning £50,000 or more. All those from households with an income below the reference

amount were at increased risk of being worried about personal crime, with those earning

£50,000 or more less likely to be worried than those in households with the median income.

In agreement with the findings of this study, higher incomes have been found to be

protective against household victimisation risk (Park & Fisher, 2017; Tseloni, 2006). Also, in

support of these findings, those with very low income, and those not managing well on their

income have been found to be at increased risk of burglary and household theft (Tseloni,

2006). No previous evidence of the effect of household income on personal or vehicle crime

has been found. Showing good agreement with the results of this study, higher income has

previously been found to be protective against experiencing general fear of crime (Dowler,

2003; Eschholz et al., 2003; Kanan & Pruitt, 2002; Krulichova, 2019), also in agreement with

this study, higher income has been associated with increased risk of worry about robbery (Reid

& Konrad, 2004).

The increased risk of victimisation among those with higher incomes may be attributed

to individuals with more disposable income being more likely to have CRAVED goods which

may make the individuals a more suitable target, particularly in the case of acquisitive crimes.

Higher risk of worry about crime among those with below median income levels may be

explained by vulnerability theory, whereby those with lower income are less able to financially

recover from a household victimisation thus they are particularly vulnerable to such a

victimisation.

Increased risk of household victimisation was found for those residing in households in

either better, or worse condition than average for the area. There was good agreement between

household and personal crime models with regard to worry, whereby households in better

condition than average for the area were at higher risk of being worried about both

crime types, and those in households in worse condition, at lower risk of being worried about

both crime types. This has not previously been studied in the literature, thus there is not

previous literature with which to compare the results.

Theoretically an increased risk of household victimisation for those with a household

in either better or worse condition, compared to average, is expected, with those in better

condition possibly signifying to a potential offender that the house contains CRAVED items or

desirable goods, and those in worse condition possibly having less "DAPPER" security

(Farrell et al., 2015), meaning the capable guardianship of the house is reduced. Whilst

housing condition was not found to have an effect on personal victimisation risk, it did affect

worry about personal crime, although the individual is somewhat removed from their house,

the condition of their house may be indicative an individual's self-presentation, this could

explain why those with a house in better condition than average are more afraid, as they may

perceive themselves to be a more desirable target, particularly of personal acquisitive crime,

equally, if the same is true of those living in households of worse condition, they may feel a

less desirable target.

The length of time a house is left unoccupied on a regular weekday was only included

in the household crime model, where it was found that leaving a house unoccupied for less

than three hours per day had no conclusive effect on household victimisation risk compared to

leaving it unoccupied for 3+ hours, however those leaving the house unoccupied for less than

one hour a day was found to be at lower risk of worry about household crime. Previously

leaving the house unoccupied has not been found to be a risk factor of household crimes

(Tseloni, 2006), where it is hypothesised that the apparent physical guardianship of being in

the home more may be less effective guardianship than the social guardianship which is

accounted for by other household and neighbourhood characteristics in the model. The

reduced worry about household crime among those whose home is occupied for either all, or

almost all, of the day may consider their property to be at less risk of victimisation should they perceive the person at home to be exercising capable guardianship over the home.

The effects of the length of time an individual lived at an address were investigated on household crime. Compared to residing at an address for five or more years, it was found that having lived at the same address for fewer than 12 months increased risk of household victimisation, whilst those with a tenure time of one to five years did not have different risk to those with a tenure time of over five years. Those with a tenure time of between one and five years were at a reduced risk of worry compared to those with a tenure time of five or more years. In agreement with the findings here, longer tenure time has previously been found to be protective of household victimisation risk, with those living at an address for less than a year, and between two and five years at particularly increased risk of a number of household crime types (Tseloni et al., 2004; Trickett et al., 1995). Length of tenure was not found to have been studied in the fear of crime literature. Theoretically it would be assumed that those who have resided at the same address for more than one year would have become acquainted with others in the neighbourhood, which is expected to result in social guardianship over the home reducing the victimisation risk as seen here. Equally for worry about household victimisation, the development of social networks, which is expected to occur after more time living within the same household, would be expected to reduce the risk of worry due to social integration. Thus, the increased risk of worry among shorter term residents is unexpected, this may de due to length of time at the address being a poor proxy for social integration as although more time allows more opportunity for social integration, this measure does not directly assess an individual's ties to the local community.

A similar variable, which measured the length of time an individual has lived within the same area, was included in vehicle crime and personal crime models. Whilst the length of time a person has lived within the same area was not found to affect risk of vehicle or personal

victimisation, those living in an area for less than 2 years were at reduced risk of being

worried about vehicle crime, and those living in an area for between 12 months and 2 years at

increased risk of being worried about personal crime. Although no effect of length of living in

an area was found on personal victimisation risk, previous literature has found those living in a

house for less than 2 years to be at increased risk of personal crime (Tseloni & Pease, 2003;

2004). There was no evidence of an effect of length of time in an area on vehicle victimisation

risk in the literature, nor was there any evidence of an effect of length of tenure within a

neighbourhood on risk of worry about crime.

Results here somewhat support the social integration model of fear of crime, with those

who lived in an area for 2 years or less at reduced risk of worry about vehicle crime, however

risk was then higher for those living in the area for five years of more which contrasts this

theory, considerations of how well length of residence proxies social integration remain.

Results are more supportive in the personal crime model, with longer tenure time associated

with increased risk of worry, however residents living in an area for less than twelve months

did not follow this pattern, showing equal risk of worry with those who lived in an area for

five years or more.

7.2.3 How do Routine Activities Affect Risk of Personal Victimisation and Worry About

Crime?

Being out of the house for less than three hours per day reduced the risk of personal

victimisation, and individuals who were out of the house between 1 and 3 hours were at the

lowest risk of vehicle victimisation, whilst no effect of being out the house for less than one

hour was found on vehicle victimisation risk. Reduced risk of worry about both personal and

vehicle crime was found among those who are away from their house for less than one hour

per day, risk of worry about personal crime was also lower for those out of the house between

one and three hours. In agreement with the findings in this study, staying away from the home

has been associated with increased risk of a number of personal, household and vehicle

victimisation types (Outlaw et al., 2002; Wilsem et al., 2006). There was no precedent in the

literature for the effects of such routine activities on worry about crime.

Routine activities theory offers good support for these findings particularly with regard

to personal victimisation risk, because spending more time out of the house increases the

individual's exposure to opportunities for victimisation, as whilst they are out of the house

they are outside the guardianship that the house offers, and in spaces where they are

interacting with potentially motivated offenders in spaces which may be crime generators

(Brantingham & Brantingham, 2008). Equally for vehicle crime, those out of the house more

often will either be leaving their vehicle unattended at home or have taken the vehicle away

from the guardianship of the home, thus increasing the risk of the vehicle coming into contact

with potentially motivated offenders whilst lacking capable guardianship.

Pub and club visiting habits were only included in the personal crime model, where it

was found that more frequent pub visits, and visiting clubs were associated with higher risk of

personal victimisation, however neither variable influenced risk of worry about personal

crime. Regular visitation of establishments selling alcohol has commonly been found to be a

risk factor for various types of personal crime victimisation (Brennan, Moore & Shepherd,

2006; 2010; Kuo et al. 2012), as have other evening activities (Kuo et al., 2012; Tseloni &

Pease, 2003), including involuntary routine activities such as going to work or education (Kuo

et al., 2012). The theoretical literature also agrees with these findings, as establishments such

as pubs and clubs offer an environment where individuals can consume alcohol, which for the

victim can reduce their ability to maintain capable guardianship of themselves, as well as

offenders having lowered inhibitions and potentially increased frustrations, this results in a

situation of high availability of vulnerable targets, with a stock of motivated offenders

(Fileborn, 2016), thus increasing risk for personal victimisation.

No previous precedent was found in the literature for the effects of how much an individual is out of the house, and how frequently an individual visits pubs or clubs, theoretically an individual who is at home most of the time may have lower risk of worry about personal victimisation because they feel less exposed to victimisation, reducing their feelings of vulnerability. An increased risk of worry may be expected for those engaging in the night-time economy due to their increased risk of victimisation, however the lack of effect of frequency of visiting pubs or clubs found on risk of being worried about personal victimisation may be attributed to conflicting feelings from different individuals. Whilst some individuals may have increased worry due to the increased risk they encounter when engaging with the night-time economy, in contrast those who attend such venues and report being not worried may showing a behavioural response to lack of fear (Buil-Gil et al., 2019; Gabriel & Greve, 2003).

7.2.4 How do Neighbourhood Characteristics Affect Risk of Victimisation and Worry About Personal Crime

All regions of England and Wales were included as covariates in all models. In relation to the South East, those in the North West were at reduced risk of household victimisation, those in the North East, and Yorkshire and the Humber were at decreased risk of vehicle victimisation, and those in the South West were at decreased risk of vehicle victimisation. Similarly to results in the household crime model, those in the North West were at decreased risk of personal victimisation, and those in the East of England were at reduced risk of personal victimisation. With regard to worry, despite no victimisation risk increases in these locations, those in the East Midlands, West Midlands, East of England, and London were at increased risk of worry about household crime, those in the East and West Midlands were also at increased risk of worry about vehicle crime, and those in the South West were at reduced risk of worry about personal crime. Previous literature has found risk of

victimisation and worry to vary across the regions of England and Wales (Trickett et al., 1995;

Tseloni et al., 2004; Kershaw & Tseloni, 2005). Whilst it is difficult to compare findings

between studies where different reference categories have been used, the consistency in

finding some regions to be at increased risk of victimisation or worry than others suggests that

characteristics of those regions which are not captured in this model are responsible for their

increased victimisation or worry risk. This may be due to certain areas having an increased

density of neighbourhood characteristics known to increase risk of victimisation or worry. A

potential explanation for the risk of worry being higher in locations where there was no

increased risk of victimisation could potentially be attributed to factors such as crime

prevention awareness campaigns which help residents improve their own security, thus

reducing their victimisation risk, whilst serving as a reminder of crimes occurring in the area,

thus increasing their risk of worry.

Living in a rural location was associated with increased risk of personal victimisation,

yet was associated with reduced risk of being worried about personal crime, whilst living in a

rural area was associated with increased risk of worry about household crime. The lack of

effects of living in a rural versus urban area across crime types here was unexpected, as the

existing literature previously consistently shown those in urban areas to be at increased risk of

victimisation across personal and property victimisation (Brennan, Moore & Shepherd, 2006;

2010; Park & Fisher, 2007; Tseloni, 2006; Tseloni & Pease, 2003). With regard to opportunity

theories of crime, higher risk of victimisation would be expected in urban areas as the

population is higher and more dense, creating more opportunities for crime, this would be

applicable across all crime types, however for personal crime particularly, urban areas with

locations such as shopping centres and night-time economy venues which are crime generators

(Brantingham & Brantingham, 2008), offer a high density of people creating ample

opportunity for both personal acquisitive, and violent crime.

Living in an area with higher socioeconomic deprivation increased risk of victimisation for all crime types, except for personal victimisation which had a nonconclusive result, and increased risk of being worried about all crime types. Living in an area with higher levels of professional living reduced risk of household victimisation, however had no conclusive effect on vehicle and personal victimisation risk, and reduced risk of being worried about all crime types. Measures of deprivation and vulnerability in the literature have been found to be associated with an increased risk, particularly of property and household crime (Trickett et al., 1995; Tseloni, 2006; Kershaw & Tseloni, 2005). Within the opportunity structure of crime, those with lower socioeconomic resources are considered more likely to engage in crime, due to their economic requirements and lack of legitimate routes to achieve them, alongside the knowledge that crimes are usually committed close to an individual's home (Andresen et al., 2014) well explains the increased risk of victimisation across all crime types for those in areas of higher socioeconomic deprivation. Worry is found to be higher in neighbourhoods of higher socioeconomic disadvantage, poverty is highlighted as one of the common social vulnerabilities within vulnerability theory (Pantazis, 2000), whereby for individuals of lower socioeconomic resource, a victimisation experience is very damaging, it is also considered that those of lower socioeconomic resource are found to have increased anxieties about other social matters, and that generally increased worry is expected in such individuals (Pantazis, 2000).

Migration had the strongest effect on vehicle crime, with inward migration reducing the risk of both victimisation and worry, and outward migration increasing the risk of both victimisation and worry. Inward migration was also found to reduce the risk of worry about household crime. Residential mobility has been found as a consistent risk factor of victimisation across crime types (Wilsem et al., 2006), whilst mixed findings have been found

on the effect of residential mobility on fear of crime (Brunton-Smith & Sturgis, 2011; Hale et al., 1994).

Higher levels of inward migration into a neighbourhood may be indicative of the desirability of the neighbourhood, with more people moving into the more desirable neighbourhoods where there is perceived low crime rates, thus the apparent protective effect of living in a neighbourhood with higher inward migration on both victimisation and crime may be attributed to the desirability of the neighbourhood, rather than the migration itself. Similarly, the opposite of this may be true with neighbourhoods of higher outward migrations. Higher migration out of the neighbourhood is also indicative of less well-formed social networks as it demonstrates occupants do not feel a strong enough sense of attachment with the neighbourhood to remain living there, which may explain to some extent the higher risk of worry found among those in neighbourhoods of higher outward migration. Including inward and outward migration as two separate measures, compared to a derived measure of residential mobility, reveals that inward and outward migration affect victimisation and worry oppositionally, which is not demonstrated in a derived variable and allows for a deeper understanding of the underlying processes.

Living in an area with higher ethnic heterogeneity also did not increase risk of victimisation for any crime type, however increased the risk of worry about all crime types. Ethnic heterogeneity has previously been found to be a risk factor for a general measure of fear of crime (Brunton-Smith & Sturgis, 2011), whilst no specific measure of ethnic heterogeneity was found to affect risk of victimisation in the victimisation literature, there have been mixed findings regarding the effect of the proportion of certain ethnic minorities on victimisation risk (Kershaw & Tseloni, 2005; Trickett et al., 1995; Tseloni, 2006; Wilsem et al., 2006). Ethnicity is considered within the vulnerability theory of crime literature, with those of non-white background considered to have higher social vulnerabilities (Singh et al.,

2014). Additionally, as discussed earlier in relation to individual or HRP race, higher

concentrations of ethnic minorities within a neighbourhood are associated with reduced social

networks, which are theorised to be protective against fear of crime (Vervoort, 2012).

Living in an area with higher levels of vacant properties had no effect on victimisation

risk throughout all models, however was associated with a reduction in worry about household

and personal crime. Independently rated incivilities increased risk of household and vehicle

victimisation, but no conclusive effect on worry about any crime type was found. This variable

was not included in the personal crime model. Incivilities have previously been found to be a

risk factor for both personal and property victimisation (Kuo et al., 2012; Outlaw et al., 2002),

and a consistent risk factor for general fear of crime, as well as fear of burglary (Hale, Pack &

Salked, 2004; Rountree & Land, 1996) and mugging (Hale, Pack & Salked, 2004).

Opportunity theories of crime do not offer a specific explanation as to why a higher level of

perceived incivilities may result in increased victimisation risk, however an area with a higher

presence of incivilities may trigger a potentially motivated individual to perceive more

opportunities for crime in the area, for example incivilities may highlight to the potential

offender areas lacking capable guardianship. Theories of fear of crime specify that both

physical and social incivilities in an area result in fear of crime due to the perception of risk

that they introduce to individuals within the area, however no such evidence was found to

support this in this study. The reduced impact of incivilities found in this study compared to

the literature may be due to a number of neighbourhood level covariates, such as disadvantage

and migration measures, already being included in the model, which have "proxied" the

effects of neighbourhood incivilities. A further reason is that incivilities are measured by the

interviewer rather than the respondent themselves to create a more objective measure of

disorder, thus it appears that the objective level of incivilities in an area has less effect on

worry about crime, than an individual's perception of them, and this may provide evidence to support the muting effect (Riger et al., 1981).

7.3 How Individual, Household and Neighbourhood Characteristics Have Explained the Relationship Between Victimisation and Worry about Crime

7.3.1 The Relationship between Victimisation and Worry at the Individual Level

Across all models, there was good evidence of low correlation between victimisation and worry about crime at the individual level for all crime types examined, which remained largely constant as model complexity increased. This suggests that individual and household characteristics, as well as neighbourhood characteristics, are not accounting for the relationship found between victimisation and worry at the individual level as hypothesised. However, as suggested by the review of literature and confirmed in the findings of this study, some individual and household characteristics affect victimisation and fear of crime similarly, whilst others affect each concept differently.

The following characteristics were found to affect victimisation and worry similarly:

- HRP age and gender, education, housing type, lone parenthood, car ownership and professional living in relation to household crime

- car ownership and inward and outward migration in relation to vehicle crime

- time spent away from the home in relation to personal crime,

- disability and socioeconomic disadvantage across all crime types

Some characteristics were found to affect risk of victimisation and risk appositionally, including:

- age, education, car ownership, income and rural/urban location in relation to personal crime

- HRP ethnicity, relative house condition and time at address in relation to household crime

- accommodation type in relation to vehicle crime

- residing in different regions of England and Wales across crime types.

Many other variables across crime types affecting either worry or victimisation whilst having no effect on the other. Despite numerous characteristics affecting risk of victimisation and worry similarly, especially for household crime, this resulted in no substantive change to the estimated correlation between victimisation and worry at the individual level. Due to this it is concluded that the effects of characteristics which affected worry and victimisation similarly did not have sufficient explanatory power to reduce the estimated correlation between them, thus not accounting for the relationship between victimisation and worry at the individual level.

Results of this part of the study offer support for the victimisation theory of fear of crime across crime types, as individual, household and neighbourhood characteristics were unable to account for the relationship found to exist between them, from this analysis it appears that the victimisation experience is in part independently and positively associated with worry about crime. However, it must be restated that the correlations were low, therefore given the hugely higher prevalence of worry in the community compared to victimisation experiences, there are many other contributary factors which establish worry in an individual alongside a victimisation experience, a conclusion supported by the many characteristics found to affect risk of worry across crime types within this study.

7.3.2 The Relationship between Victimisation and Worry at the Neighbourhood Level

Overall, the addition of individual and household variables accounted for a good amount of between neighbourhood variation in worry and victimisation and explained a good

proportion of the estimated relationship between victimisation and worry about crime at the

neighbourhood level across all crime types. Individuals and household characteristics

accounted for between 11% and 40% of the between neighbourhood variation in victimisation

(all figures exclude personal victimisation as no conclusion of effect size could be made) and

between 25% and 46% of the between neighbourhood variation in worry. They also explained

between 24% and 48% of the relationship between worry and victimisation, meaning that

between one quarter and one half of the baseline relationship found between victimisation and

worry at the neighbourhood level is explained by their individual and household

characteristics, thus these characteristics are much more capable at explaining variation at the

neighbourhood level than the individual level. This analysis confirms that characteristics of

individuals and households within a neighbourhood are able to in part explain the between

neighbourhood variation of both victimisation and worry, and to explain the relationship

between them.

The inclusion of neighbourhood context in the analysis accounted for a good additional

proportion of previously unexplained variance in worry and victimisation of household

and vehicle crime as expected. Neighbourhood context accounted for between 28% and 56%

of the remaining between neighbourhood variation in victimisation, between 33% and 49% of

the between neighbourhood variation in worry, and between 38% and 58% of their covariance.

Excluded from the final figure is the covariance estimate of the personal model, which showed

an increase of 50%, however this estimate was very small, with a large standard error, and the

change in value here was not attributed to real change, but error in the estimate. In the

household model, the inclusion of neighbourhood level contextual variables almost entirely

accounted for the relationship between victimisation and worry at the neighbourhood level,

this was not the case in the vehicle model where good evidence of a positive correlation

between victimisation and worry remained. Given the relationship between household

victimisation and worry about household crime at the neighbourhood has been accounted for by individual and neighbourhood characteristics, the apparent support for the indirect victimisation theory of fear of crime is somewhat diminished.

Accounting for independently assessed incivilities in an area appeared to explain additional between neighbourhood variation in household victimisation, however whether there was a true effect is size is undetermined due to the large uncertainty around the variance and covariance estimates. Incivilities did not account for any more of the neighbourhood level relationship between victimisation and worry for either household or vehicle crime. On the household model, this may be due to the fact that following the inclusion of individual, household and neighbourhood characteristics, the relationship between victimisation and worry had been explained substantially, such that there was no good evidence of an independent relationship persisting. In the vehicle model, a relationship between victimisation and worry about crime persists after all explanatory variables, therefore support remains for the indirect victimisation model, however it must be considered that there are potentially factors not included in the model which may account for the remaining covariance.

7.4 Limitations of the Study

Although the data used in this study offers many benefits and reassurances with regard to data quality (as discussed in section 4.1.2) with a key benefit being the inclusion of almost all neighbourhoods across England and Wales, a limitation was the low number of individuals sampled within each neighbourhood. The CSEW uses a multistage stratified random sampling strategy which ensures coverage of the whole of England and Wales, however, to gain coverage of the whole of England and Wales in a sample size of 35,000, few respondents are surveyed within each MSOA with the average number of individuals sampled being approximately 4 across all three models. This means the estimates of between neighbourhood

variation in victimisation and worry, and the covariance between them are based upon limited

data and therefore the reliability and accuracy of the estimates is lower than they would be

with large samples. Appropriate steps were taken to alleviate this issue as far as possible,

including the merging of multiple years to boost the sample size, and the use of MCMC

estimation, whilst the large total sample size also offers some reassurance. To gain more

accurate and reliable estimates a different sampling strategy would be required where more

individuals are interviewed within each neighbourhood, with fewer neighbourhoods

represented in the sample.

A further issue is the apparent inaccuracy of neighbourhood level correlation estimates

between victimisation and worry about crime. Trends in the change in the neighbourhood

covariance estimates are not entirely comparable with the correlation estimate, with each

estimate not fluctuating at the same rate between models. This means hesitancy is required in

discussing the correlation estimates, which are more easily interpreted and understood, over

the covariance estimates. This may be attributed to the relatively large standard error of the

neighbourhood level covariance estimates as the size of the estimate reduces due to the

inclusion of more contextual variables. A further potential measure to validate the correlation

estimates made in this study by MLWiN would be to replicate the models on an alternative

software package such as R. Due to these concerns, when reporting changes in the relationship

between victimisation and worry at the neighbourhood level, covariance estimates were

referred to rather than correlation estimates.

A further limitation of the study is the binary operationalisation of both victimisation

and worry about crime, as well as the broad categorisations of personal, vehicle and household

crime. In preliminary stages of this research, it was considered that more insight could be

gained from operationalising both victimisation and worry about crime as ordinal variables,

with measures of repeat victimisation and higher level or worry forming the higher categories

of the ordinal variables. At the exploratory modelling stage ordinal variables of three

categories for both worry (0-not worried, 1-not very worried, 2-fairly or very worried) and

victimisation (0-non-victim, 1-single victim, 2-repeat victim) were analysed in

crosstabulations and significant associations were found between victimisation and worry

across crime types, however there were low numbers of individuals within the top categories,

particularly repeat victims, and to model this would likely exacerbate the limitations discussed

above.

      As is shown in the above paragraphs, the use of secondary data in this thesis has some

limitations, the above refer to matters of sample size and to processing issues which are

attributable to making best use of available data. Additionally, when using secondary data

there is no control over the variables included in the survey, and to whom each question is

asked. Whilst the CSEW is very comprehensive in its coverage, some important characteristics

and activities highlighted in the literature review could not be included in the model.

8.0 Conclusion

This chapter summarises and synthesises the information provided within this thesis, to address the research aims and questions posed in sections 1.3 and 4.1.1. Initially conclusions regarding the baseline relationship between victimisation and worry are made, followed by conclusions of the effects of individual, household, and neighbourhood characteristics on victimisation and worry of each crime type, including how much of the between neighbourhood variance was explained by the addition of contextual variables, and outlining the risk and protective profiles. The effects of such characteristics on the relationship between victimisation and worry are then summarised. Theoretical implications of the findings are then outlined, initially this focuses on the results support for victimisation theory of fear of crime, and indirect victimisation, and then summarise where opportunity theory, and theories of fear of crime offer support for findings, and where they do not. Finally, recommendations for future work are made, to address further gaps in the knowledge exposed in this research, and to address the acknowledged limitations, as well as recommendations to increase the utility of the knowledge developed here for policy.

8.1 Summary of Key Findings

The following section highlights the key findings discussed in this thesis to summarise and highlight original contributions to knowledge made in this thesis. The summary follows the structure of the research questions.

8.1.1 The Baseline Relationship between Victimisation and Worry about Crime

This section summarises results from the crosstabulations analysis as well as the null model BVML analysis presented in Chapter 5, and the discussion of these results in Section 7.1 of the discussion chapter. This analysis established evidence of the baseline relationship between victimisation and worry about crime across crime types.

8.1.1.1 A significant relationship was confirmed between victimisation and worry about crime for household, vehicle, and personal crime.

The odds of being worried about crime were at least twice as high for victims compared to non-victims across crime types. The effect of a victimisation experience on worry about crime was strongest for vehicle crime, with odds of being worried almost three times higher for victims, two and a half times higher for household crime victims, and approximately twice as high for personal crime victims.

Existing literature both conflicts and supports these results. Previously household victimisation has been a stronger predictor of worry about crime than personal victimisation (Brunton-Smith & Sturgis, 2011), however this used a general fear of crime measure, whilst studies using crime specific fear of crime operationalisations agreed more closely with the findings here (Hale et al., 1994; Weitzer & Kubrin, 2004).

8.1.1.2 At the individual level there was strong evidence of low to moderate positive correlations between victimisation and worry about crime for household, vehicle, and personal crime.

Low correlations were found between victimisation and worry about crime at the individual level, mirroring the relationship found in crosstabulation analysis. The strongest relationship between victimisation and worry about crime was again found for vehicle crime with an estimated correlation of almost 0.28, followed by household crime with an estimated correlation of 0.24, and a correlation of 0.17 for personal crime. Low standard errors around these estimations confirm true population figures are highly likely to be close to the estimated correlations.

8.1.1.3 At the neighbourhood level there was mixed evidence of correlation between victimisation and worry between crime types.

There was good evidence of a strong positive correlation between victimisation and worry in the vehicle crime analysis and moderate evidence in the household crime analysis. Limited evidence of a positive correlation was found in the personal crime analysis. Results varied across crime types in line with the previous stages of analysis. The correlation estimate for vehicle crime was very high at 0.807, with very high probability the true value is close to this in the population, the correlation estimated for household crime was also high at 0.513, however the true population value may differ from this somewhat due to variation surrounding the estimate. A low correlation coefficient was estimated for personal crime, with high levels of variability surrounding the estimate, therefore no correlation between personal victimisation and worry about personal crime is concluded to exist at the neighbourhood level.

The relative prevalence of victimisation and worry about crime within the crime type categories may explain some of the differences in estimated correlations and reliability of estimated correlations between crime types. Vehicle and household victimisation are vastly more prevalent in the population than personal victimisations, whilst prevalence of worry about crime is more consistent across crime types. Therefore statistically, vehicle crime is more likely to co-occur in a neighbourhood with worry about vehicle crime than personal victimisations co-occurring with worry about personal crime which contributes to a higher correlation estimate.

8.1.2 The Effect of Individual, Household, and Neighbourhood Characteristics on Victimisation and Worry about Crime

8.1.2.1 Individual and Household Characteristics explained variance in between neighbourhood variation in victimisation and worry across crime types.

Individual & Household Characteristics, explained 11% of the between neighbourhood variation in household victimisation and 34% of the between neighbourhood variation in worry about household crime, 40% of the between neighbourhood variation in vehicle victimisation and 25% of the between neighbourhood variation in worry about vehicle crime, 10% of the between neighbourhood variation in personal victimisation and 45% of the between neighbourhood variation in worry about personal crime.[23] The following risk profiles outline the individual and household characteristics which influence risk of worry or victimisation of household, vehicle, and personal crime. The neighbourhood level risk profile is presented in the following section, 8.1.2.2.

Household Victimisation Risk Profile:

Individuals in a household with a HRP who is either divorced or separated; those with an illness or disability which affects life a little, or a lot; those living in a house which is socially rented, has either a lone parent occupier, or 3 or more adult residents; has either zero cars, or 2 or more car; with a household income of £50,000 or more; reside in a house which is in either better or worse condition than average for the area; and those who have lived in the area for 12 months or less are at increased risk of household victimisation

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[23] Individual and household characteristics including routine activities. Between neighbourhood variance in victimisation estimate increased by 5% following inclusion of individual and household characteristics, then reduced by 14% following the inclusion of routine activity variables. The estimate of between neighbourhood variation in worry reduced by 46% following the inclusion of individual and neighbourhood characteristics, and increased by 2% following the inclusion of routine activity variables.

Individuals residing in a household with an older; male; Asian or Black HRP; those with either no, or other qualifications, and those in a flat, or "other" type of accommodation are at reduced risk of household victimisation

Worry about Household Crime Risk profile:

Individuals who reside in a household with a HRP who is either Asian Black, Chinese or an "other" ethnicity; those either married or cohabiting; those working in an intermediate position; individuals with a disability which does not affect daily life, or which affects daily life a little; Have below degree level, or an "other" qualification as their highest qualification; occupy their household as a lone parent; either own zero, or three or more cars; have a household income between £10,000 and £19,999; and have a house which is in better condition than average for the neighbourhood are at increased risk of being worried about household crime.

Individuals residing in households with a HRP who is older than average; male; long-term unemployed; which are privately rented; and either semi-detached, terraced, a flat or an "other" accommodation type; which is in worse condition than average for the neighbourhood; have lived in the same house for 5 years or less; and those regularly leaving the house unoccupied for less than 1 hour per day are at reduced risk of being worried about household crime.

Vehicle Victimisation Risk Profile:

Individuals who are divorced or separated; those with an illness or disability which affects daily life either a little, or a lot; those living in a house which is socially rented; and either semi-detached or terraced ; and who own either one or two cars are at increased risk of vehicle victimisation.

Individuals who are older than average; have GCSEs as their highest educational qualification; are regularly out of the house for between 1 and 3 hours on a usual weekday are at reduced risk of vehicle victimisation

Worry about Vehicle Crime Risk Profile:

Individuals who are mixed race, Asian, black, Chinese or an "other" ethnicity; those who are either married or cohabiting; and working in an intermediate or routine/manual employment role; those with a life limiting illness or disability, which does or does not affect their daily life; having below degree level qualifications as their highest qualification; living in terraced housing, or a flat or "other" accommodation type; either do not own a car, or own two or more cars are at increased risk of worry about vehicle victimisation

Individuals who are male, have a household income of £50,000 or more; have lived in the same household for 2 years or fewer; and those who are out of the house for 3 hours of less on an average weekday are at reduced risk of worry about vehicle victimisation

Personal Victimisation Risk Profile:

Individuals who are mixed race, either separated or divorced, those who have an illness which either doesn't affect daily life, affects daily life a little, or a lot; live in privately or social rented housing; those who do not own a car; have a household income of £50,000 or more; visit the pub four or more times per month, and those who visit clubs at least once per month are at increased risk of personal victimisation.

Individuals who are older than average; have either GCSEs as their highest qualification, or no qualifications; those who are out of the house for 3 hours or less on an average weekday; and those who never visit pubs and clubs are at reduced risk of personal victimisation.

Worry about Personal Crime Risk Profile:

Individuals who are Asian, Black, Chinese or another ethnicity; work in an intermediate or routine, or manual role; have an illness or disability which affect daily life either a little, or a lot; have either A-Levels or GCSEs as their highest qualification, or no or "other" qualifications; live in social rented housing; which is semi-detached, terraced, or a flat or "other" housing type; live in a household with 2 or more adult residents; do not own a car; either did not state their household income, or have an income of below £20,000; and those who live in a house which is in better condition than average for the local area are at increased risk of being worried about personal crime.

Individuals who are male; widowed; own 2 or more cars, have a household income of £50,000 or more; those whose house is in worse condition than average for the local area; those who have lived within the same area for between 12 months and 2 years; and those who are out of the house for less than 1 hour per average weekday are at reduced risk of worry about personal victimisation.

8.1.2.2 Neighbourhood Characteristics explained additional variance in between neighbourhood variation in victimisation and worry across crime types.

Neighbourhood characteristics explained an additional 28% of the between neighbourhood variation in household victimisation, and 49% of the variation in worry about household crime, 56% of between neighbourhood variation in vehicle victimisation and 33% of the variation in worry about vehicle crime, and 50% of the between neighbourhood variation in personal victimisation and 43% of the variation in worry about crime.

Household Victimisation Risk Neighbourhood Characteristics Risk Profile:

Individuals in areas with higher levels of socioeconomic disadvantage, and higher levels of independently rated incivilities are at increased risk of being a victim of household crime, whilst those in the North West and in areas with higher levels of professional living are at reduced risk of household victimisation compared to the reference person.

Worry about Household Victimisation Neighbourhood Characteristics Risk profile:

Individuals in the East Midlands, West Midlands, East of England and London, and those in areas of higher socioeconomic disadvantage and higher ethnic heterogeneity are at increased risk of being worried about household victimisation than the reference person, whilst those in areas with higher levels of professional living, higher levels of inward migration and a higher proportion of vacant properties are at reduced risk of being worried about household crime compared to the reference individual.

Vehicle Victimisation Risk Neighbourhood Characteristics Risk Profile:

Individuals living in the East or West Midlands, and those living in areas of higher socioeconomic disadvantage, higher levels of outward migration, and higher levels of ethnic heterogeneity are at increased risk of worry about vehicle crime than the reference person, whilst those living in area with higher levels of professional living, and higher levels of inward migration are at reduced risk of worry about vehicle crime compared to the reference person.

Worry about Household Victimisation Neighbourhood Characteristics Risk profile:

Individuals living in areas with higher socioeconomic disadvantage, higher levels of outward migration, and independently rated incivilities are at increased risk of vehicle victimisation than the reference person. Individuals living in the North East, Yorkshire and Humberside or the South West, and in areas with higher levels of inward migration are at reduced risk of vehicle victimisation compared to the reference person.

Worry about Personal Victimisation Neighbourhood Characteristics Risk profile:

Individuals living in areas with higher levels of sociodemographic disadvantage ethnic heterogeneity are at increased risk of being worried about personal crime than the reference individual. Those living in a rural area, in the North East, South West, or Wales, and in are

with higher levels of professional living, and vacant properties are at reduced risk of being worried about personal crime.

Personal Victimisation Risk Neighbourhood Characteristics Risk Profile:

Those living in rural locations and in the East on England are at increased risk of being a victim of personal crime than the reference person, whilst those living in the North West are at reduced risk of personal crime victimisation than the reference person.

8.1.3 The Effect of Individual, Household and Neighbourhood Characteristics on the Relationship between Victimisation and Worry about Crime at the Individual and Neighbourhood Level

8.1.3.1 Individual and household characteristics had mixed effects on the relationship between victimisation and worry at the individual and neighbourhood level, and across crime types.

Individual and household characteristics accounted for 2% of the individual level, and 24% of the neighbourhood level covariance between household victimisation and worry about household crime. The individual level covariance estimate between vehicle victimisation and worry about vehicle crime increased by 30%, whilst the neighbourhood level covariance estimate decreased by 48% following the inclusion of individual and household characteristics. The individual level covariance estimate between personal victimisation and worry about personal crime increased by 21%, whilst the neighbourhood level covariance estimate decreased by 43%.

Individual and household characteristics accounted for very little of the covariance found between victimisation and worry at the individual level. Across all crime types, and all levels of model complexities, there was good evidence of low correlation between victimisation and worry about crime at the individual level. The largest reduction in unexplained variance occurred in vehicle and personal crime models following the

introduction of the control variables year of survey, and whether an individual has been a

victim of crime within their local authority, where estimated correlation increased, this

increased to the level estimated prior to the inclusion of the control variables.

Overall, the addition of individual and household variables accounted for a good

amount of between neighbourhood variance in both victimisation and worry about

crime, with between neighbourhood variance in victimisation reducing by between 11% and

40%, variance in worry reducing by 25% to 46%, and covariance reducing by 24% to 48%.

The exception to this was neighbourhood level variance of personal crime, where there was an

increase in estimated between neighbourhood variance, with this estimate returning to its null

model size. This estimate had a relatively high standard error, and the variation in this estimate

between the null model and model 2 may be due to error.

Appositional and noncongruent effects of individual and household characteristics on

victimisation and worry about crime are hypothesised to be responsible in part for the low

explanation of the covariance between victimisation and worry at the neighbourhood level.

8.1.3.2 Neighbourhood characteristics accounted for an additional 58% of the

neighbourhood level covariance between household victimisation and worry about

household crime, an additional 38% of the neighbourhood level covariance between

vehicle victimisation and worry about vehicle crime, and an additional 50% of the

neighbourhood level covariance between personal victimisation and worry about

personal crime, whilst not accounting for any of the covariance at the individual level.

The addition of neighbourhood level variables, as expected, accounted for a good

proportion of previously unexplained variance. Area level covariates accounted for between

28% and 56% of the between neighbourhood variation in victimisation, between 33% and

49% of the between neighbourhood variation in worry, and between 38% and 58% of

their covariance. Excluded from the final figure is the covariance estimate of the personal

model, which showed an increase of 50%, however this estimate was very small, with a large standard error, and the change in value here was not attributed to real change, but error in the estimate.

Results of the effects of the addition of incivilities in household and vehicle crime were less congruent between models, all neighbourhood level variance estimates had reduced in effect size due to the explanatory power of variables entered into the models, with their standard errors much larger in respect to the posterior means, therefore little is concluded about whether independently rated incivilities can explain between neighbourhood variance in victimisation, or the covariance between victimisation and worry. Where between neighbourhood variation in worry remained unexplained in household and vehicle models, no additional variation was accounted for by independently rated incivilities. This suggests independently rated incivilities are less important to risk of worry about crime than a resident's perception of incivilities.

8.1.3.3 An Independent Relationship Between Victimisation and Worry about Crime at the Neighbourhood Level Only Remained for Vehicle Crime Following the Inclusion of all Explanatory Variables

At the neighbourhood level no good evidence of a relationship between personal crime victimisation and worry about personal crime was found. In examining the relationship on household crime, initially good evidence of a moderate correlation was found at the neighbourhood level, however this was almost entirely accounted for by the characteristics in the model.

8.2 Theoretical Implications

8.2.1 The Relationship Between Victimisation and Worry about Crime

Initial assessments of the baseline relationship between victimisation and worry about crime show good support for the victimisation theory of fear of crime, with a positive

relationship found between victimisation and worry, at the individual level across all crime

types, and across methods. Multiple personal, household, and neighbourhood characteristics

were unable to account for the individual level relationship between victimisation and worry

about crime, further supporting the case that at the individual level that the victimisation

experience itself is at least partly responsible for an individual's worry about crime. Although

characteristics explored in this study were unable to explain the individual level relationship

between victimisation and worry, correlations between victimisation and worry are low across

crime types, and worry about all crime types is much more prevalent than victimisation

experiences, therefore the majority of worry about crime an individual experiences is

attributed to both characteristics examined in this study as well as other external factors, as

opposed to victimisation experiences.

A more complex theoretical picture is found when examining neighbourhood level

relationships, with less consistency shown across crime types. For both household and vehicle

crime, initial findings demonstrate support for the indirect victimisation model of fear due to

positive relationships being confirmed between victimisation and worry at the neighbourhood

level. Only vehicle crime analyses remain supportive of this model because the positive

relationship persists after accounting for potentially explanatory characteristics, whereas in

household crime analyses such characteristics successfully accounted for the relationship

between victimisation and worry. This suggests individual and neighbourhood characteristics

were largely responsible for the covariance of household victimisation and worry within

neighbourhoods, rather than victimisations occurring to neighbourhood residents. No such

support for the indirect victimisation model was found when analysing personal crime as no

evidence of a relationship between victimisation and worry was found at the neighbourhood

level. The positive relationship found at the individual level, but not at the neighbourhood

level, lacks support for the idea of neutralisation techniques only applying to direct victims,

whereby victims are able to provide reassurance to themselves due to processing the lived experience of victimisation, yet supports the idea that a "muting" effect may be happening in a neighbourhood where higher levels of personal victimisation occur.

8.2.2 Explaining Victimisation Risk

Characteristics of individuals, households, and neighbourhoods which were identified to affect victimisation risk were analysed within the opportunity theories of crime framework, with elements of rational choice theory, routine activities theory, and lifestyle/exposure theory largely able to support and explain the risk and protective factors found in the studies.

Characteristics related to target suitability, including age, gender and socioeconomic status well explained victimisation risk across crime types. Lifestyle/exposure theory accounts for the differing personal victimisation risk of older and younger males, and of young males and females, due to the routine activities of such individuals and their associates, whilst target suitability of older individuals is reduced due to a lack of tangible and intangible rewards available from either acquisitive or expressive crime. Increased risk of personal victimisation found for individuals more commonly engaging with the night-time economy, and those out of the house for more time was anticipated as such activities increase the exposure of individuals to potentially motivated offenders. Additionally, NTE venue attendance may coincide with alcohol and drug consumption, thus reducing an individual's guardianship over themselves, increasing their suitability of them as a target.

Whilst higher socioeconomic classification was expected to increase risk due to the expectation of such individuals owning more CRAVED goods, or "hot products" no evidence was found for this, however the lack of effect may be attributed to other socioeconomic indicators being included in the analysis. Both high income households and houses in better condition than average for the area are at increased risk of household victimisation, which is attributed to the expectation that households of such characteristics either contain, or appear to

contain more CRAVED goods. Similarly, owning a high number of vehicles is associated with greater risk of both vehicle and household crime, whilst owning more vehicles in itself increases the opportunities for victimisation, owning a greater number of cars is theorised to be a signifier to a potential offender of increased wealth, therefore increasing the likelihood of either the vehicle, or household containing CRAVED goods.

Increased victimisation risk across crime types was associated with neighbourhoods of greater socioeconomic disadvantage, this is expected within the opportunity framework, as areas of socioeconomic deprivation will have a higher proportion of individuals within them who feel the need to resort to illegitimate means to meet their requirements and desires, as theorised in the initial involvement model proposed by Clarke & Cornish, 1985), the exposure model suggests those who are exposed to more potentially motivated offenders are more likely to be victimised.

Changed responsibility for guardianship and having limited capability to exercise guardianship well explain increased vulnerability among those at increased risk of victimisations. The *change* in responsibility for guardianship of the self and the home associated with becoming separated or divorced is expected to reduce the capability of the guardianship exerted, compared to that exerted by single and married individuals. Shifts in routine activities throughout this life change (Bourassa et al., 2019) are also considered to contribute to their increased risk. Equally, the increased risk of household victimisation found among lone parents may be attributed to less capable guardianship being exerted over the household. The ability to exert capable guardianship over oneself and one's property is surmised to be lower among those with illnesses or disabilities, due to either lower physical strength, mobility, or reduced mental capacity, whilst also relying on others to act as their guardian, particularly for those who have carers coming into the home, such factors may explain their increased risk, particularly of personal and household victimisation.

Factors which pertain to the physical guardianship exercised over property well explain differing victimisation risk, particularly for household and vehicle crimes. Reduced autonomy over security and choice in where to live among renters, is proposed to reduce one's ability to exercise capable guardianship over their home and vehicles, whilst also resulting in social renters in particular living in less desirable neighbourhoods which may contain a greater stock of potentially motivated offenders. The increased physical security associated with living in a flat, including having a communal door before the household door, and secure parking compounds, accounts for the reduced victimisation risk of both household and vehicle crime. In contrast, increased risk of vehicle crime among those in semi-detached and terraced housing is attributed to vehicles being parked in locations with less physical guardianship. The increased household victimisation risk associated with houses in worse condition compared to others within the neighbourhood is attributed to the condition of the house likely being indicative of less "DAPPER" security.

Houses which are unoccupied for more hours of the day were not found to be at increased risk of household victimisation despite the lack of guardianship, however, previously "social guardianship" has been found to be more effective than physical guardianship on the home (Tseloni, 2006), and this finding offers further support for that. This idea is further supported by individuals living in an area for less than 12 months having a higher victimisation risk, as they are not likely to have developed the necessary social guardianship in this time.

8.2.3 Explaining Worry about Crime Risk

Theories of fear of crime, including vulnerability theory, and ideas of social and physical incivilities were found to mostly support and explain the risk and protective factors identified across crime types in this study.

Effects of individual characteristics, and of some household characteristics were largely well explained by vulnerability theory, as a number of characteristics found to affect risk of being worried about crime were related to their actual of perceived physical or social vulnerabilities. Increased risk of worry about personal crime among older individuals and females was an expected finding, due to the theoretical literature well documenting their increased perception of being physically vulnerability to victimisation. Similarly, increased worry about crime among certain ethnic minorities was expected due to the social vulnerabilities associated with being an individual from an ethnic minority (Singh et al., 2014), additionally, evidence suggests that ethnic minority individuals are less likely to socially integrate (Vervoort, 2012), and therefore do not have as strong social networks to protect them from feeling worried. Although less well studied in the fear of crime literature, the highly increased risk of worry found among those with long term illness or disability is very well explained by vulnerability theory, particularly as those whose disability impacts their daily life more are at even further increased risk of worry, it is suggested that such individuals are likely to be both physically and socially particularly vulnerable to ill-effects of a crime event. Increased worry about household and vehicle crime among those with lower incomes is expected due to the reduced financial resource available to handle the effects of a crime event, however increased risk of personal crime was higher among those with the highest income, whilst the most able to financially recover from a crime event they may also have items of higher monetary value which makes them feel particularly vulnerable to personal acquisitive crimes.

Where effects of social vulnerabilities were unexpected, it is suggested a possible desensitisation or muting effect is responsible for reduced risk of worry among those considered more vulnerable. The social networks and reduced social vulnerabilities associated with having a partner should theoretically result in reduced risk of worry, however the reduced

risk of worry among separated, divorced and widowed individuals may be explained by a

possible desensitisation effect of having previously faced emotional hardship, whereby the

successful management of this increases the individuals perceived ability to cope with a crime

event. Equally, the effects of socioeconomic status were not as expected with regards to

vulnerability theory, however, this was also considered to be attributable to desensitisation to

stressful life events occurring for those of lower socioeconomic classification, whereas those

of higher socioeconomic classification are more considered vulnerable to the fear-inducing

effects of negative events. Effects of desensitisation were also considered to explain lower risk

of worry about personal crime among those without a car, where it is suggested that a those

who regularly, and successfully, use other methods of transport feel less vulnerable through a

desensitisation mechanism.

Vulnerability theory was less suited to explaining the varying risk of being worried

about crime associated with household characteristics. As noted throughout the literature

review, research on the effects of household characteristics on fear of crime was far less

prevalent than research examining victimisation risk. As much of the theory of crime literature

is developed from empirical studies, it is assumed that the limited relevant theory is

attributable to limited evidence present with the existing literature from which to develop

theory.

Effects of neighbourhood characteristics including socioeconomic deprivation and

professional living were also well supported by vulnerability theory, whereby those most

economically vulnerable are at increased worry. The increased risk of worry among those in

neighbourhoods with higher outward migration is attributed to the reduced presence of social

networks and emotional ties to the area. Measures of vacant properties and incivilities in the

neighbourhood would be expected to increase risk of worry according to idea that physical

vulnerabilities induce crime, however no such effect was found with higher levels of vacant

properties associated with reduced risk of worry about household and personal crime, whilst

no effect of independently rated incivilities was found. A desensitisation effect is hypothesised

to be responsible for both the increased risk and lack of effects found. This finding regarding

incivilities offers further support for ideas suggested in the literature which propose it is the

perception of vulnerabilities which increase fear. Contrasts between findings associated with

perceived incivilities in other studies compared to the independently rated measure studied

here suggest the same to also be true for physical disorder.

8.4 Original Contributions to knowledge

Section 1.2 of the introduction chapter of this thesis presented four original

contributions to knowledge which this thesis intended to make; the following section clarifies

the contributions made.

1. Increased knowledge of the personal and neighbourhood characteristics which

   contribute to a person's risk of victimisation and fear of crime, which is

   sensitive to differing operationalisations of fear of crime, through examining

   the existing literature.

Existing literature was examined to provide an overview of the current state of

knowledge of all contributary factors found in regression-based studies which estimated either

victimisation or fear of crime. In this review crime types were examined separately to

highlight differences in effects of certain characteristics between crime types, and different

operationalisations of fear of crime were discussed specifically to understand differing effects

of characteristics where different operationalisations were used. In addition to satisfying this

contribution to knowledge, this chapter informed the crime specific operationalisations of both

fear and victimisation and provided a "masterlist" of characteristics to include in analyses.

2. An assessment of the baseline (i.e. not accounting for contributary factors)

   relationship between dispositional worry about crime and victimisation at both

the individual and neighbourhood level, for crime specific fear and

victimisation measures.

Analyses confirmed a significant relationship existed between crime type specific

victimisation and crime type specific worry about crime for household, vehicle, and personal

crime, which had not previously been examined. Findings were largely in agreement with

related literature.

3. An assessment of the effects of a number of individual and neighbourhood

   characteristics on victimisation and dispositional worry about crime, for crime

   specific fear and victimisation measures.

Across the crime type specific models of worry and victimisation largely the same

characteristics were included as potentially explanatory characteristics. This allowed for

development of risk and protective profiles of worry about crime and victimisation for all

three crime types which drew upon a large range of variables, whilst also allowing for a

comparison of effects of characteristics on victimisation and worry, and across crime types.

4. An assessment of the effects of those characteristics on the relationship

   between crime specific, dispositional worry about crime and victimisation, to

   confirm whether any apparent relationship can be accounted for by

   characteristics known to affect each concept.

Assessments were made at both the individual and neighbourhood level to examine the

effects of covariates on the relationship between victimisation and worry about crime.

Individual and neighbourhood characteristics were unable to account for the relationship

found at the individual level across crime types, therefore offering support for the

victimisation theory of fear of crime. Mixed findings across crime types at the neighbourhood

level showed varied support for existing theory, with personal crime analyses not identifying a

relationship at the neighbourhood level, findings best align with the victimisation theory of

crime, supporting ideas of a muting effect of disorder in neighbourhoods of higher crime,

whilst contrasting ideas of neutralisation techniques. Vehicle crime findings support the

indirect victimisation model due to persistent higher worry about crime among higher crime

neighbourhoods, despite accounting for individual and neighbourhood characteristics, whilst

the relationship found between household victimisation and worry about crime was almost

wholly explained by individual and neighbourhood characteristics, thus not attributing higher

levels of worry in a neighbourhood to the victimisations occurring there.

8.4 Recommendations & Future Work

This research has identified that individuals who have had a victimisation experience

are at increased risk of being worried about crime, and that, at least in part, the victimisation

experience appears responsible for that increased risk of worry. Support services are available

to those who have been victims of crime, including Victim Support (Victim Support, undated),

Victim and Witness information, and the Victim Contact Scheme (Gov.uk, undated). With the

knowledge of the risk profile of individuals more likely to be worried about crime, such

services may be identified by information given when filing a crime report, and more strongly

encouraged to engage with available aftercare services. Victim Support has been found to be

beneficial to the individual who has experienced a victimisation in recovering from that crime

(Simmonds, 2013), but also in improving trust in the wider Criminal Justice System (Bradford,

2011), thus targeting those most likely to be worried could have more widespread effects than

solely assisting in their recovery of a specific victimisation experience.

Victim Support also assists in getting practical support following a victimisation,

including security refitting of window and door locks which greatly reduce household

victimisation risk (Farrell et al., 2010), which, with the reduction in victimisation risk and

knowledge of increased security should reduce feelings of vulnerability resulting in a lower

chance of feeling worried about crime.

Higher levels of worry about vehicle crime are present in neighbourhoods of higher vehicle crime, which is not accounted for by neighbourhood characteristics, worry about vehicle crime was also the most prevalent of all crime types. Vehicle crime may be a more obvious crime occurring within a neighborhood as, unless within a garage, cars are visible to neighbours and passersby who may see evidence of a crime occurrence such as broken windows or other physical damage to cars, crimes also frequently occur within public carparks (Piza et al., 2019), this gives more opportunity for the effects of indirect victimisation to occur. Therefore, in neighbourhoods with an increased risk profile for vehicle crime, removing evidence of vehicle victimisations is expected to lead to a reduction in levels of worry. Educational campaigns for how to reduce your victimisation risk targeted to areas of higher vehicle crime may also reduce risk of worry as they may result in positive effects similar to those of the neutralisation techniques discussed in relation to victimisation theory of crime.

Vehicle crime, particularly with regard to worry, is a relatively understudied crime type when compared to personal and household victimisations, however given the relatively high prevalence of worry about vehicle crime compared to worry about household and personal crime, it should gain more academic focus. Given individual and structural determinants of vehicle victimisation and worry about vehicle crime have now been analysed, work to understand why higher risk of worry is found in areas of such profiles would strongly complement this work and assist in developing strategies to reduce prevalence of worry about vehicle crime.

Further processing of the findings which identify regions and neighbourhoods of higher risk could be applied to mapping software to visually identify areas with increased prevalence of victimisation and worry of each crime type, as exemplified in Hunter et al.,'s work on residential burglary (2021). In this study interactive maps were produced and made accessible to police forces to allow them to focus their burglary policing efforts into areas

where it is expected to be most beneficial, in an era of police force's acknowledgement of an inability to meet demand (Walley & Adams, 2019), knowledge of where is most valuable to deploy resources is invaluable. Comparison with police recorded crime statistics also offered further benefits in identifying neighbourhoods with lower-than-expected burglary rates, which, if replicated with this data, could offer further insights into crime and worry reduction.

One source of limitations of this study was the use of secondary data, particularly the low number of residents sampled within each neighbourhood. Replication of this analysis on a sample drawn with more individuals in each neighbourhood, at the detriment of a smaller overall coverage than the CSEW, could shed further light on the strength of relationship between victimisation and fear of crime. However, such a data source which is up to date is not readily available and would be highly demanding on resources to produce.

Disability was consistently found to be a strong predictor of victimisation and worry about crime across crime types. This concerning consistency demonstrates the increased vulnerability of disabled individuals, particularly those whose disability affects their daily life, to victimisations of all types of crime and to worry about all types of crime, independent of their sociodemographic background and neighbourhood context. This study highlights this group as being in particular need of increased guardianship against becoming a victim and increased reassurance.

8.5 Final Summary

This thesis analysed CSEW data with the primary aim to better understand the relationship between victimisation and worry about crime. Positive associations were found between victimisation and worry about crime across all crime types, supporting victimisation theories of fear of crime. Mixed results were found regarding the relationship between victimisation and worry about crime at the neighbourhood level. No relationship was evident between personal victimisation and worry about personal crime, initially a relationship was evident between household victimisation and worry about household crime, however this was accounted for by individual and neighbourhood characteristics, whilst a positive relationship between vehicle victimisation and worry about vehicle crime persisted independently of the characteristics accounted for in this study. Findings demonstrated the necessity to study victimisation and fear of crime using crime type specific measures, as findings between measures, particularly at the neighbourhood level, offered different findings with differing implications for theory.

Factors found to influence victimisation were well explained by opportunity theories of crime, and further inquiry into the results using methods suggested above should allow for targeted crime prevention initiatives to be developed using principles of situational crime prevention. Characteristics influencing worry about crime are also well supported by vulnerability theory and ideas of social and physical incivilities. This study has provided an evidence base for the identification of neighbourhoods, and individuals within them, at increased risk of both victimisation and worry about crime and offers an empirical and theoretical base for developing initiatives to reduce both victimisation and fear of crime.

Afterword

      The process of undertaking this research was affected by the COVID pandemic and associated lockdowns & restrictions. Due to the use of secure access data in this research, only accessible via a specific computer inside the university, in March 2020, I was unable to access my data or results for the purposes of writing up, delaying the finalisation of this thesis significantly. This delay meant a large proportion of the thesis was written up after my funding had expired, and during full-time work, which made for quite a challenging experience to get this thesis submitted by the final deadline. The restrictions also limited further development of the models contained in the thesis, which would have been interesting to explore further.

Bibliography

Agnew, R. S. (1985). Neutralizing the impact of crime. *Criminal Justice and Behavior*, *12*(2), 221-239.

Andresen, M. A., Frank, R., & Felson, M. (2014). Age and the distance to crime. *Criminology & Criminal Justice*, *14*(3), 314-333.

Angrist, J D., and Pischke J S, (2009). *Mostly Harmless Econometrics: An Empiricist's Companion.* Princeton, NJ: Princeton University Press.

Argyrous, G. (1997). *Statistics for social research*. Macmillan International Higher Education. Basingstoke: Macmillan Press Ltd.

Arnold, H. (1991). Fear of crime and its relationship to directly and indirectly experienced victimisation: A binational comparison of models. In *Developments in crime and crime control research* (pp. 87-125). Springer, New York, NY.

Athens, L. (2005). Violent encounters: Violent engagements, skirmishes, and tiffs. *Journal of Contemporary Ethnography*, *34*(6), 631-678.

Ball, M. (2010). *The UK private rented sector as a source of affordable accommodation*. York: Joseph Rowntree Foundation.

Beccaria, C. (1764). *On crimes and punishments* (Paolucci, H. , 1963, Trans.). NY: Pearson Education Limited.

Becker, P. (2018). Researching crime and criminals in the 19th century. *The Handbook of the History and Philosophy of Criminology* (pp 32-47). Oxford: Wiley Blackwell.

Beirne, P. (1987). Adolphe Quetelet and the origins of positivist criminology. *American Journal of Sociology*, *92*(5), 1140-1169.

Bennett, T. (1990). *Tackling Fear of Crime*. Home Office Research Bulletin.

Bennett, T., Wright, R., & Wright, R. (1984). *Burglars on burglary: Prevention and the offender*. Aldershot: Gower.

Biemann, T., & Kearney, E. (2010). Size does matter: How varying group sizes in a sample affect the most common measures of group diversity. *Organizational research methods*, *13*(3), 582-599.

Blau, P. M. (1977). *Inequality and heterogeneity: A primitive theory of social structure* (Vol. 7). New York: Free Press.

Block, R., Galary, A., & Brice, D. (2007). The journey to crime: Victims and offenders converge in violent index offences in Chicago. *Security Journal*, *20*(2), 123-137.

Bottoms, A., & Shapland, J. (2011). Steps towards desistance among male young adult recidivists. *Escape routes: Contemporary perspectives on life after punishment* (pp 43-80). Abingdon: Routledge.

Bourassa, K. J., Ruiz, J. M., & Sbarra, D. A. (2019). Smoking and physical activity explain the increased mortality risk following marital separation and divorce: evidence from the English Longitudinal Study of Ageing. *Annals of Behavioral Medicine*, *53*(3), 255-266.

Bradford, B. (2011). Voice, neutrality and respect: Use of Victim Support services, procedural fairness and confidence in the criminal justice system. *Criminology & Criminal Justice*, *11*(4), 345-366.

Brantingham, P. L., & Brantingham, P. J. (1984). *Patterns in crime*. New York: Macmillan Publishing.

Brantingham, P. L., & Brantingham, P. J. (1993). Environment, routine and situation: Toward a pattern theory of crime. *Advances in criminological theory*, *5*(2), 259-294.

Brennan, I. R., Moore, S. C., & Shepherd, J. P. (2006). Non-firearm weapon use and injury severity: priorities for prevention. *Injury Prevention*, *12*(6), 395-399.

Brennan, I. R., Moore, S. C., & Shepherd, J. P. (2010). Risk factors for violent victimisation and injury from six years of the British Crime Survey. *International Review of Victimology*, *17*(2), 209-229.

Brown, S.E., Esbensen, F. and Geis, G., (2019*). Criminology: Explaining Crime and its Context*, (10th Ed.). New Jersey: Routledge

Browne, W. J. (2019). MCMC estimation in MLwiN: Version 3.03. Retrieved from Centre for Multilevel Modelling: http://www.bristol.ac.uk/cmm/media/software/mlwin/downloads/manuals/3-03/mcmc-web.pdf [Last accessed 26/09/2021]

Browning, C. R. (2002). The span of collective efficacy: Extending social disorganization theory to partner violence. *Journal of Marriage and Family*, *64*(4), 833-850.

Browning, C. R., Dietz, R. D., & Feinberg, S. L. (2004). The paradox of social organization: Networks, collective efficacy, and violent crime in urban neighborhoods. *Social Forces*, *83*(2), 503-534.

Bruinsma, G. J., Pauwels, L. J., Weerman, F. M., & Bernasco, W. (2013). Social disorganization, social capital, collective efficacy and the spatial distribution of crime and offenders: An empirical test of six neighbourhood models for a Dutch city. *British Journal of Criminology*, *53*(5), 942-963.

Brunton-Smith, I., & Sturgis, P. (2011). Do neighborhoods generate fear of crime? An empirical test using the British Crime Survey. *Criminology*, *49*(2), 331-369.

Buil-Gil, D., Moretti, A., Shlomo, N., & Medina, J. (2019). Worry about crime in Europe: A model-based small area estimation from the European Social Survey. *European Journal of Criminology*, *18*(2), 274-298.

Burke, R. H. (2005). *An introduction to criminological theory* (2nd ed.). Devon: Willan Publishing.

Burke, R. H. (2014). *An introduction to criminological theory* (4th ed.). Abingdon: Routledge.

Cartwright, D. (2002). *Psychoanalysis, violence, and rage-type murder: Murdering minds*. Psychology Press.

Cattell, R. B., & Scheier, I. H. (1961). *The meaning and measurement of neuroticism and anxiety.* New York: Ronald Press.

Chamberlain, J. M. (2012). *Understanding criminological research: A guide to data analysis*. London: Sage Publications.

Clarke, R. V. (1983). Situational crime prevention: Its theoretical basis and practical scope. In Michael Tonry and Norval Moms (eds.), *Crime and Justice: An Annual Review of Research* (pp. 225-256)*.* Chicago: University of Chicago Press.

Clarke, R. V. (1995). Situational crime prevention. *Crime and justice*, *19*, 91-150.

Clarke, R. V. (2004). Technology, criminology and crime science. *European Journal on Criminal Policy and Research*, *10*(1), 55-63.

Clarke, R. V. (2009). Situational crime prevention: Theoretical background and current practice. In Krohn, M D., Lizotte, A J., Hall, G P. (eds.) *Handbook on crime and deviance* (pp. 259-276). New York: Springer.

Clarke, R. V. G. (1992). *Situational crime prevention: Successful case studie*s. Albany, New York.: Harrow & Heston.

Clarke, R. V. G., & Webb, B. (1999). *Hot products: Understanding, anticipating and reducing demand for stolen goods* (Vol. 112). London: Home Office, Policing and Reducing Crime Unit, Research, Development and Statistics Directorate.

Clarke, R V. (2013). Seven misconceptions of situational crime prevention. In Tilley, N (ed.) *Handbook of Crime Prevention and Community Safety* (pp. 65-96). Devon, UK: Willan Press

Clarke, R. V., & Cornish, D. B. (1985). Modeling offenders' decisions: A framework for research and policy. *Crime and justice*, *6*, 147-185.

Clarke, R.V. and Cornish, D. (2017). The Rational choice perspective In Wortley, R and Townsley, M. (eds.) *Environmental Criminology and Crime Analysis* (pp. 29-61) (2nd Edition). Abington, UK: Routledge.

Clarke, R.V., and Martin, D.N. (1975) 'A study of absconding and its implications for the residential treatment of delinquents', in J. Tizard, I.A, Sinclair & R.V. Clarke (eds.) *Varieties of Residential Experience* (pp.249-274). London: Routledge.

Cohen, L. E., & Felson, M. (1979). Social change and crime rate trends: A routine activity approach. *American sociological review*, *44*(4) 588-608.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cornish, D. B., & Clarke, R. V. (2003). Opportunities, precipitators and criminal decisions: A reply to Wortley's critique of situational crime prevention. *Crime prevention studies*, *16*, 41-96.

Cornish, D. B., & Clarke, R. V. G. (1975). *Residential treatment and its effects on delinquency* (No. 32). HM Stationery Office.

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research, and evaluation*, *10*(7), 1-9.

Covington, J., & Taylor, R. B. (1991). Fear of crime in urban residential neighborhoods: Implications of between-and within-neighborhood sources for current models. *The Sociological Quarterly*, *32*(2), 231-249.

Davcik, N. S. (2014). The use and misuse of structural equation modeling in management research: A review and critique. *Journal of Advances in Management Research, 11*(1), 47-81.

De Viggiani, N. (2007). Unhealthy prisons: exploring structural determinants of prison health. *Sociology of health & illness*, *29*(1), 115-135.

Dowler, K. (2003). Justice: The relationship between fear of crime, punitive. *Journal of Criminal Justice and Popular Cult*ure, *10*(2), 109-126.

Draper, A. J. (2000). Cesare Beccaria's influence on English discussions of punishment, 1764–1789. *History of European Ideas*, *26*(3-4), 177-199.

Duffy, B., Wake, R., Burrows, T., & Bremner, P. (2008). Closing the gaps–crime and public perceptions. *International Review of Law, Computers & Technology*, *22*(1-2), 17-44.

Eck, J. E., Clarke, R. V., & Guerette, R. T. (2007). Risky facilities: Crime concentration in homogeneous sets of establishments and facilities. *Crime prevention studies*, *21*, 225-264.

Engström, A. (2021). Conceptualizing lifestyle and routine activities in the early 21st century: A systematic review of self-report measures in studies on direct-contact offenses in young populations. *Crime & Delinquency*, 67(5), 737-782.

Eschholz, S., Chiricos, T., & Gertz, M. (2003). Television and fear of crime: Program types, audience traits, and the mediating effect of perceived neighborhood racial composition. *Social problems*, *50*(3), 395-415.

Farrall, S., Gray, E., & Jackson, J. (2007). Theorising the fear of crime: The cultural and social significance of insecurities about crime. *Experience & expression in the fear of crime working paper*, (5).

Farrell, G. (2010). Situational Crime Prevention and Its Discontents: Rational Choice and Harm Reduction versus Cultural Criminology. *Social Policy and Administration*, *44(*1), 40-66.

Farrell, G., & Tilley, N. (2020). Elegant security: Concept, evidence and implications. *European Journal of Criminology*, *00*(0), 1-22.

Farrell, G., Tseloni, A., & Tilley, N. (2011). The effectiveness of vehicle security devices and their role in the crime drop. *Criminology & Criminal Justice*, *11*(1), 21-35.

Fattah, E. A., & Sacco, V. F. (1989). Offences the elderly commit and their explanations. In *Crime and Victimisation of the Elderly* (pp. 34-68). Springer, New York, NY.

Felson , M . (1986) Linking criminal choices, routine activities, informal control, and criminal outcomes . In: D.B. Cornish and R.V. Clarke (eds.) *The Reasoning Criminal: Rational Choice Perspectives on Offending* (pp. 119-128). New York: Springer-Verlag.

Felson , M . (1995) Those who discourage crime. In: J.E. Eck and D. Weisburd (eds.) *Crime and Place* (pp.53-66). Monsey, NY: Criminal Justice Press.

Felson, M. (2002). *Crime and Everyday Life*. (3rd edition). Thousand Oaks CA: Pine Forge Press

Ferraro, K. F. (1995). *Fear of crime: Interpreting victimisation risk*. New York: State University of New York.

Fileborn, B. (2016). *Reclaiming the night-time economy: Unwanted sexual attention in pubs and clubs*. London: Springer.

Flatley, J. (2014). British crime survey. In Bruinsma, D. G. & Weisburd, D. (eds.) *Encyclopedia of criminology and criminal justice (ECCJ)* (pp.194-203). New York: Springer.

Franklin, T. W., Franklin, C. A., & Fearn, N. E. (2008). A multilevel analysis of the vulnerability, disorder, and social integration models of fear of crime. *Social Justice Research*, *21*(2), 204-227.

Friendly, M. (2007). A.-M. Guerry's" Moral Statistics of France": Challenges for Multivariable Spatial Analysis. *Statistical Science*, *22*(3), 368-399.

Gabriel, U., & Greve, W. (2003). The psychology of fear of crime. Conceptual and methodological perspectives. *British Journal of Criminology*, *43*(3), 600-614.

Geers, S. (2020). News consumption across media platforms and content: A typology of young news users. *Public Opinion Quarterly*, *84*(1), 332-354.

Gelman, A. (2003). A Bayesian formulation of exploratory data analysis and goodness-of-fit testing. *International Statistical Review*, *71*(2), 369-382.

Gelman, A. (2007). Comment: Bayesian checking of the second levels of hierarchical models,". *Statistical Science*, *22*(3), 349-352.

Gelman, A., Carlin, J. B., Stern, H. S., & Rubin, D. B. (1995). *Bayesian data analysis*. London: Chapman and Hall.

Glaser, D. (1971). *Social Deviance*. Chicago: Markham.

Goldstein H. 2005. Heteroscedasticity and Complex Variation. In Everrit, B. & Howell, D. (eds) *Encyclopedia of Statistics in Behavioral Science* (pp. 790-795). New Jersey: John Wiley & Sons, Ltd

Goldstein, H. (2011). *Multilevel statistical models*. New Jersey: John Wiley & Sons.

Gomila, R. (2021). Logistic or linear? Estimating causal effects of experimental treatments on binary outcomes using regression analysis. *Journal of Experimental Psychology: General, 150*(4), 700–709

Gov.uk. (undated). Get support as a victim of crime. Retrieved from gov.uk: https://www.gov.uk/get-support-as-a-victim-of-crime [Last Accessed 25/09/2021]

Gray, E., Jackson, J., & Farrall, S. (2011). Feelings and functions in the fear of crime: Applying a new approach to victimisation insecurity. *The British journal of criminology*, *51*(1), 75-94.

Grotenhuis, M., & Visscher, C. (2014). *How to use SPSS syntax: An overview of common commands.* California: Sage Publications, Inc.

Guerette, R. T., & Bowers, K. J. (2009). Assessing the extent of crime displacement and diffusion of benefits: A review of situational crime prevention evaluations. *Criminology*, *47*(4), 1331-1368.

Guerry, A. M. (2002). *A Translation of Andre-Michel Guerry's Essay on the Moral Statistics of France (1883): a sociological report to the French Academy of Science* (Vol. 26). Edwin Mellen Press.

Guerry, A.-M. (1833). Essai sur la statistique morale de la France. Paris: Crochard.

Hahn, E. D., & Soyer, R. (2005). Probit and logit models: Differences in the multivariate realm. *The Journal of the Royal Statistical Society, Series B*, 1-12.

Hale, C. (1996). Fear of crime: A review of the literature. *International review of Victimology*, *4*(2), 79-150.

Hale, C., Pack, P., & Salked, J. (1994). The structural determinants of fear of crime: An analysis using census and crime survey data from England and Wales. *International Review of Victimology*, *3*(3), 211-233.

Hayduk, L., Cummings, G., Boadu, K., Pazderka-Robinson, H., & Boulianne, S. (2007). Testing! testing! one, two, three–Testing the theory in structural equation models!. *Personality and Individual Differences*, *42*(5), 841-850.

Hayward, K. (2007). Situational Crime Prevention and its Discontents: Rational Choice Theory versus the 'Culture of Now'. *Social Policy & Administration, 41*(3), 232-250.

Hindelang, M. J., Gottfredson, M. R., & Garofalo, J. (1978). *Victims of personal crime: An empirical foundation for a theory of personal victimisation*. Cambridge, MA: Ballinger.

Hirschi, T. (1993). A control theory of delinquency. In Williams, F. P., & McShane, M. D. (eds.) *Criminology theory: Selected classic readings* (pp.245-261). Cincinnati: Anderson.

Hirschi, T. (1986). On the compatibility of rational choice and social control theories of crime. *The reasoning criminal: Rational choice perspectives on offending*, 105-118.

Hollis-Peel, M. E., Reynald, D. M., Van Bavel, M., Elffers, H., & Welsh, B. C. (2011). Guardianship for crime prevention: A critical review of the literature. *Crime, law and social change*, *56*(1), 53-70.

Hough, J. M., Mayhew, P., & Grande-Bretagne. Home office. (1985). *Taking account of crime: Key findings from the second British Crime Survey* (Vol. 85). HM Stationery Office.

Hoyle, R. H. (1995a). *Structural equation modeling: Concepts, issues, and applications*. California: Sage Publications, Inc.

Hoyle, R. H. (1995b). The structural equation modeling approach: Basic concepts and fundamental issues. In R. H. Hoyle (ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 1–15). California: Sage Publications, Inc.

Hunter, J., & Tseloni, A. (2016). Equity, justice and the crime drop: The case of burglary in England and Wales. *Crime Science*, *5*(1), 1-13.

Ignatans, D., & Pease, K. (2016). On whom does the burden of crime fall now? Changes over time in counts and concentration. *International review of victimology*, *22*(1), 55-63.

Jackman, S. (2009). *Bayesian analysis for the social sciences*. Sussex: John Wiley & Sons.

Jackman, S. (2012). *Bayesian analysis of choice data.* Stanford University

Kanan, J. W., & Pruitt, M. V. (2002). Modeling fear of crime and perceived victimisation risk: The (in) significance of neighborhood integration. *Sociological inquiry*, *72*(4), 527-548.

Kantar. (2015). *Confidentiality and Data Security.* Retrieved from Crime Survey: www.crimesurvey.co.uk/en/ConfidentialityDataSecurity.html#:~:text=UK%20legislation%20allows%20us%20to,statistics%20for%20the%20public%20good.&text=It%20will%20only%20be%20held,or%20anyone%20in%20your%20household. [Last Accessed 14/09/2021]

Hulse, K. & Haffner, M. (2014) Security and Rental Housing: New Perspectives, *Housing Studies*, 29(5), 573-578.

Kershaw, C., & Tseloni, A. (2005). Predicting crime rates, fear and disorder based on area information: Evidence from the 2000 British Crime Survey. *International Review of Victimology*, *12*(3), 293-311.

Killias, M. (1990). Vulnerability: Towards a better understanding of a key variable in the genesis of fear of crime. *Violence and victims*, *5*(2), 97-108.

Killias, M., & Clerici, C. (2000). Different measures of vulnerability in their relation to different dimensions of fear of crime. *British journal of criminology*, *40*(3), 437-450.

Kindynis, T. (2014). Ripping up the map: Criminology and cartography reconsidered. *British Journal of Criminology*, *54*(2), 222-243.

King, A. C., Salvo, D., Banda, J. A., Ahn, D. K., Chapman, J. E., Gill, T. M., ... & Frank, L. D. (2017). Preserving older adults' routine outdoor activities in contrasting neighborhood environments through a physical activity intervention. *Preventive medicine*, *96*, 87-93.

Kinney, J. B., Brantingham, P. L., Wuschke, K., Kirk, M. G., & Brantingham, P. J. (2008). Crime attractors, generators and detractors: Land use and urban crime opportunities. *Built environment*, *34*(1), 62-74.

Krulichová, E. (2019). The relationship between fear of crime and risk perception across Europe. *Criminology & Criminal Justice*, *19*(2), 197-214.

Kuo, S. Y., Cuvelier, S. J., Sheu, C. J., & Zhao, J. (2012). The concentration of criminal victimisation and patterns of routine activities. *International journal of offender therapy and comparative criminology*, *56*(4), 573-598.

LaGrange, R. L., & Ferraro, K. F. (1987). The elderly's fear of crime: A critical examination of the research. *Research on aging*, *9*(3), 372-391.

LaGrange, R. L., Ferraro, K. F., & Supancic, M. (1992). Perceived risk and fear of crime: Role of social and physical incivilities. *Journal of research in crime and delinquency*, *29*(3), 311-334.

Lee, M. (2011). *Investing Fear of Crime: Criminology and the politics of anxiety.* New York: Routledge.

Lee, M. (2013). *Inventing fear of crime*. Abingdon: Routledge.

Lewis, D. A., & Salem, G. (1981). Community crime prevention: An analysis of a developing strategy. *Crime & Delinquency*, *27*(3), 405-421

Li, Y., & Heath, A. (2020). Persisting disadvantages: a study of labour market dynamics of ethnic unemployment and earnings in the UK (2009–2015). *Journal of Ethnic and Migration Studies*, *46*(5), 857-878.

Maimon, D., & Browning, C. R. (2010). Unstructured socializing, collective efficacy, and violent behavior among urban youth. *Criminology*, *48*(2), 443-474.

Malpass, P., & Victory, C. (2010). The modernisation of social housing in England. *International Journal of Housing Policy*, *10*(1), 3-18.

Maxfield, M. G. (1987). *Explaining fear of crime: Evidence from the 1984 British Crime Survey*. London: Home Office.

May, D. C., Rader, N. E., & Goodrum, S. (2010). A gendered assessment of the ''threat of victimisation'': Examining gender differences in fear of crime, perceived risk, avoidance, and defensive behaviors. *Criminal justice review*, *35*(2), 159-182.

Mayhew, P., Clarke, R. V. G., Sturman, A. And Hough, J. M. (1976). *Crime as Opportunity*. Home Office Research Study No. 34. London: HMSO.

Mesch, G. S. (2000). Perceptions of risk, lifestyle activities, and fear of crime. *Deviant Behavior*, *21*(1), 47-62.

Millard, B., & Flatley, J. (2010). *Experimental statistics on victimisation of children aged 10 to 15: Findings from the British Crime Survey for the year ending December 2009: England and Wales.* Home Office Statistical Bulletin. London: Home Office.

Miró, F. (2014). Routine activity theory. *The encyclopedia of theoretical criminology* (pp. 1–7). London, England: Wiley & Sons, Inc.

Moore, S. C., & Foreman-Peck, J. (2009). Alcohol consumption predicts violent victimisation, impulsive decision making predicts violence. *The Open Behavioral Science Journal*, *3*, 28-33.

Morenoff, J. D., Sampson, R. J., & Raudenbush, S. W. (2001). Neighborhood inequality, collective efficacy, and the spatial dynamics of urban violence. *Criminology*, *39*(3), 517-558.

Morleo, M., Harkins, C., Lushey, C., & Hughes, K. (2007). Investigating drinking behaviours and alcohol knowledge amongst young people resident in the Linacre and Derby wards of Sefton: interim report. *Centre for Public Health, Liverpool John Moores University*.

Nee, C., & Meenaghan, A. (2006). Expert decision making in burglars. *British Journal of Criminology*, *46*(5), 935-949.

Nee, C., & Taylor, M. (2000). Examining burglars' target selection: Interview, experiment or ethnomethodology?. *Psychology, Crime & Law*, *6*(1), 45-59.

Newsom. (2021). Link function and the generalized linear model. *Multiple Regression and Multivariate Quantitative Methods*. Link Functions and Probit Analysis (pdx.edu) [Last accessed 08/09/2022]

NTU BLSS CREC. (2019). BLSS REC Application form. Retrieved from NTU NOW: https://now.ntu.ac.uk/d2l/le/content/322688/viewContent/3426000/View [Last Accessed 25/01/2018]

Nye, R. A. (1976). Heredity or milieu: The foundations of modern European criminological theory. *Isis*, *67*(3), 335-355.

Office for National Statistics. (2016a, January 18). What is a census? Retrieved from Office for National Statistics: https://www.ons.gov.uk/census/2011census/howourcensusworks/aboutcensuses/whatis acensus [Last Accessed 25/09/2021]

Office for National Statistics. (2016b, January 18). Compiling the address register. Retrieved from Office for National Statistics: https://www.ons.gov.uk/census/2011census/howourcensusworks/designforthe2011cens us/compilingtheaddressregister [Last Accessed 25/09/2021]

Office for National Statistics. (2017, September 7). Public perceptions of crime in England and Wales: year ending March 2016. Retrieved from Office for National Statistics: https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/articles/publi cperceptionsofcrimeinenglandandwales/yearendingmarch2016 [Last Accessed 25/09/2021]

Office for National Statistics. (2020, July 17). Crime in England and Wales: year ending March 2020. Retrieved from Office for National Statistics: https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/bulletins/cri meinenglandandwales/yearendingmarch2020 [Last Accessed 25/09/2021]

Office for National Statistics. (2021, May 13). Crime in England and Wales: year ending December 2020. Retrieved from Office for National Statistics: https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/bulletins/cri meinenglandandwales/yearendingdecember2020#trends-in-police-recorded-crime [Last Accessed 25/09/2021

Office for National Statistics. (undateda). Census Geography. Retrieved from Office for National Statistics: https://www.ons.gov.uk/methodology/geography/ukgeographies/censusgeography [Last Accessed 25/09/2021]

Office for National Statistics, (undatedb). Crime survey for england and wales (CSEW) dataset user guide: adults aged 16 and over. Retrieved from UK Data Service: http://doc.ukdataservice.ac.uk/doc/8464/mrdoc/pdf/8464_2017- 18_csew_adults_dataset_user_guide.pdf [Last Accessed 25/09/2021]

Oh, J. H., & Kim, S. (2009). Aging, neighborhood attachment, and fear of crime: Testing reciprocal effects. *Journal of Community Psychology*, *37*(1), 21-40.

Osborn, D. R., Trickett, A., & Elder, R. (1992). Area characteristics and regional variates as determinants of area property crime levels. *Journal of quantitative criminology*, *8*(3), 265-285.

Outlaw, M., Ruback, B., & Britt, C. (2002). Repeat and multiple victimisations: The role of individual and contextual factors. *Violence and Victims*, *17*(2), 187-204.

Palmer, E. J., Holmes, A., & Hollin, C. R. (2002). Investigating burglars' decisions: factors influencing target choice, method of entry, reasons for offending, repeat victimisation of a property and victim awareness. *Security Journal*, *15*(1), 7-18.

Park, S. M., & Fisher, B. S. (2017). Understanding the effect of immunity on over-dispersed criminal victimisations: Zero-inflated analysis of household victimisations in the NCVS. *Crime & Delinquency*, *63*(9), 1116-1145.

Paternoster, R., & Fisher, D. (2018). The foundation and re-emergence of classical thought in criminological theory: A brief philosophical history. In R. Triplett (Ed.), *Wiley Handbook of the History and Philosophy of Criminology* (1st ed.). New York: Wiley.

Pease, K. (1998). *Repeat victimisation: Taking stock* (Vol. 90). London: Home Office Police Research Group.

Pease, K., & Tseloni, A. (2014). *Using modeling to predict and prevent victimisation*. London: Springer.

Pillinger, R. (2011, September 8). Weights in MLwiN. Retrieved from Center for Multilevel Modelling: http://www.bristol.ac.uk/cmm/software/support/support-faqs/weights.html

Piza, E. L., Welsh, B. C., Farrington, D. P., & Thomas, A. L. (2019). CCTV surveillance for crime prevention: A 40-year systematic review with meta-analysis. *Criminology & Public Policy*, *18*(1), 135-159.

Quetelet, A. (1835). *Facts, Laws and Phenomena of Natural Philosophy, Or, Summary of a Course of General Physics*. P. Sinclair.

Quetelet, Adolphe. [1831] 1984. Research on the Propensity for Crime at Different Ages. Translated by Sawyer F. Sylvester. Cincinnati, Ohio: Anderson.

R. Sheldon (Ed.),*Controlling the dangerous classes: A critical introduction to the history of criminal justice* (pp. ix-x). Boston: Allyn & Bacon

Rader, N. E. (2004). The threat of victimisation: A theoretical reconceptualization of fear of crime. *Sociological Spectrum*, *24*(6), 689-704.

Rasbach, J., Steele, F., Browne, W. J., & Goldstein, H. (2020). A User's Guide to MLwiN. Retrieved from Centre for Multilevel Modelling:

http://www.bristol.ac.uk/cmm/media/software/mlwin/downloads/manuals/3-05/manual-web.pdf [Last Accessed 25/09/2021]

Reid, L. W., & Konrad, M. (2004). The gender gap in fear: Assessing the interactive effects of gender and perceived risk on fear of crime. *Sociological Spectrum*, *24*(4), 399-425.

Rountree, P. W., & Land, K. C. (1996). Perceived risk versus fear of crime: Empirical evidence of conceptually distinct reactions in survey data. *Social forces*, *74*(4), 1353-1376.

Russo, S., & Roccato, M. (2010). How long does victimisation foster fear of crime? A longitudinal study. *Journal of Community Psychology*, *38*(8), 960-974.

Sampson, R. J., & Groves, W. B. (1989). Community structure and crime: Testing social-disorganization theory. *American journal of sociology*, *94*(4), 774-802.

Sampson, R. J., & Raudenbush, S. W. (1999). Systematic social observation of public spaces: A new look at disorder in urban neighborhoods. *American journal of sociology*, *105*(3), 603-651.

Sampson, R. J., & Wooldredge, J. D. (1987). Linking the micro-and macro-level dimensions of lifestyle-routine activity and opportunity models of predatory victimisation. *Journal of quantitative criminology*, *3*(4), 371-393.

Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. S*cience*, *277*(5328), 918-924.

Sampson, R., Eck, J. E., & Dunham, J. (2010). Super controllers and crime prevention: A routine activity explanation of crime prevention success and failure. *Security Journal*, *23*(1), 37-51.

Scarborough, B. K., Like-Haislip, T. Z., Novak, K. J., Lucas, W. L., & Alarid, L. F. (2010). Assessing the relationship between individual characteristics, neighborhood context, and fear of crime. *Journal of criminal justice*, *38*(4), 819-826.

Schumacher, R. E. & Lomax, R. G. (2016). *A Beginners Guide to Structural Equation Modeling* (4th ed). New York: Routledge

Scurfield, J., Rees, P., & Norman, P. (2009). Criminal victimisation of the homeless: an investigation of Big Issue vendors in Leeds. *Radical Statistics*, *99,* 3-11.

Simmonds, L. (2013). Lost in transition? The changing face of Victim Support. *International Review of Victimology*, *19*(2), 201-217.

Simon, H. (1955). A behavioral model of rational choice. *The Quarterly Journal of Economics, 69*(1), 99-118)..

Singh, S. R., Eghdami, M. R., & Singh, S. (2014). The concept of social vulnerability: A review from disasters perspectives. *International Journal of Interdisciplinary and Multidisciplinary Studies, 1*(6), 71-82.

Smith, S.J. (1986). *Crime, Space and Society*. Cambridge University Press; Cambridge.

Spielberger, C. D. (1966). Theory and research in anxiety. In C. D. Speilberger (Ed.), *Anxiety and behavior* (pp. 361-398). New York: Academic Press.

Stokes, P., (2016). ONS Special Licence Review. Crime Users Conference 9th December 2016.   Royal Statistical Society, London. Retrieved from: https://www.ukdataservice.ac.uk/media/604662/stokes.pdf. [Accessed 4 July 2017]

Taub, R. P., Taylor, D. G., & Dunham, J. D. (1984). *Paths of neighborhood change: Race and crime in urban America*. Chicago: University of Chicago Press.

Taylor, M. & Nee, C. (1988), The Role of Cues in Simulated Residential Burglary. *British Journal of Criminology, 28*, 105–16.

Taylor, M. F. (2012). Addicted to the risk, recognition and respect that the graffiti lifestyle provides: Towards an understanding of the reasons for graffiti engagement. *International Journal of Mental Health and Addiction*, *10*(1), 54-68.

Taylor, R. B., & Hale, M. (1986). Testing alternative models of fear of crime. *Journal of Criminal Law and Criminology, 77*(1), 151-189.

Taylor, W. B. (1981). Foundations of Modern Penal Practice-A Symposium. *New England Journal on Prison Law*, *7*(1), 1-115.

Tedeschi, J. T., & Felson, R. B. (1994). *Violence, aggression, and coercive actions*. American Psychological Association.

Tierney, J., (2013). *Criminology: Theory and context* (3rd ed.). Abingdon & New York: Routledge.

Tilley, N., & Tseloni, A. (2016). Choosing and using statistical sources in criminology: What can the crime survey for England and Wales tell us? *Legal Information Management*, *16*(2), 78-90.

Tilley, N., Farrell, G., & Clarke, R., (2015). Target Suitability and the Crime Drop. In Andresen, A, M. & Farrell, G. (eds) *The Criminal Act: The Role and Influence of Routine Activity Theory* (pp. 59-76). Basingstoke: Palgrave Macmillan.

Tillyer, M. S., & Eck, J. E. (2011). Getting a handle on crime: A further extension of routine activities theory. *Security Journal*, *24*(2), 179-193.

TNS UK. (2017). 2017-18 Crime Survey for England and Wales Questionnaire (from April 2017). Retrieved from UK Data Service: http://doc.ukdataservice.ac.uk/doc/8464/mrdoc/pdf/8464_csew_questionnaire_adult_2 017-18.pdf

Torok, M., Darke, S., Kaye, S., & Ross, J. (2011). Conduct disorder as a risk factor for violent victimisation and offending among regular illicit drug users. *Journal of Drug Issues*, *41*(1), 25-43.

Town, S., Davey, C. & Wooton, A. (2003) *Design Against Crime: Secure Urban Environments by Design.* Salford: The University of Salford.

Townsley, M., & Sidebottom, A. (2010). All offenders are equal, but some are more equal than others: Variation in journeys to crime between offenders. *Criminology*, *48*(3), 897-917.

Trickett, A., Osborn, D. R., & Ellingworth, D. (1995). Property crime victimisation: the roles of individual and area influences. *International review of victimology*, *3*(4), 273-295.

Tseloni, A. (2000). Personal criminal victimisation in the United States: Fixed and random effects of individual and household characteristics. *Journal of Quantitative Criminology*, *16*(4), 415-442.

Tseloni, A. (2006). Multilevel modelling of the number of property crimes: Household and area effects. *Journal of the Royal Statistical Society: Series A (Statistics in Society)*, *169*(2), 205-233.

Tseloni, A., & Pease, K. (2003). Repeat personal victimisation.'Boosts' or 'Flags'?. *British Journal of Criminology*, *43*(1), 196-212.

Tseloni, A., & Pease, K. (2004). Repeat personal victimisation: Random effects, event dependence and unexplained heterogeneity. *British Journal of Criminology*, *44*(6), 931-945.

Tseloni, A., & Zarafonitou, C. (2008). Fear of crime and victimisation: A multivariate multilevel analysis of competing measurements. *European Journal of Criminology*, *5*(4), 387-409.

Tseloni, A., Mailley, J., Farrell, G., & Tilley, N. (2010). Exploring the international decline in crime rates. *European Journal of Criminology*, *7*(5), 375-394.

Tseloni, A., Wittebrood, K., Farrell, G., & Pease, K. (2004). Burglary victimisation in England and Wales, the United States and the Netherlands: A cross-national comparative test of routine activities and lifestyle theories. *British Journal of Criminology*, *44*(1), 66-91.

Tseloni, A., Wittebrood, K., Farrell, G., & Pease, K. (2004). Burglary victimisation in England and Wales, the United States and the Netherlands: A cross-national comparative test of routine activities and lifestyle theories. *British Journal of Criminology*, *44*(1), 66-91.

UK Data Service. (2019). Crime Survey for England and Wales 2017-2018. Retrieved from UK Data Service: https://beta.ukdataservice.ac.uk/datacatalogue/studies/study?id=8464#!/details

UK Data Service. (2021). General SecureLab FAQs. Retrieved from: UK Data Service: https://www.ukdataservice.ac.uk/help/faq/securelab.aspx

UK Statistics Authority. (2014, January). Assessment of compliance with the Code of Practice for Official Statistics:Statistics on Crime in England and Wales. Retrieved from UK Statistics Authority: https://osr.statisticsauthority.gov.uk/wp-content/uploads/2015/12/images-assessmentreport268statisticsoncrimeinenglandandwale_tcm97-43508-1.pdf

Unger, M. P., Crete, J. P., & Pavlich, G. (2018). Criminal Entryways in the Writing of Cesare Beccaria. *The Handbook of the History and Philosophy of Criminology*, 17.

Van Wilsem, J., Wittebrood, K., & De Graaf, N. D. (2006). Socioeconomic dynamics of neighborhoods and the risk of crime victimisation: A multilevel study of improving, declining, and stable areas in the Netherlands. *Social Problems*, *53*(2), 226-247.

Vervoort, M. (2012). Ethnic concentration in the neighbourhood and ethnic minorities' social integration: Weak and strong social ties examined. *Urban Studies*, *49*(4), 897-915.

Victim Support. (undated). Help and support: How can we help? Retrieved from Victim Support: https://www.victimsupport.org.uk/help-and-support/how-we-can-help/

Visser, M., Scholte, M., & Scheepers, P. (2013). Fear of crime and feelings of unsafety in European countries: Macro and micro explanations in cross-national perspective. *The Sociological Quarterly*, *54*(2), 278-301.

Walley, P., & Adams, M. M. (2019). An evaluation of demand management practices in UK police forces. Milton Keynes: Centre for Policing Research and Learning.

Warr, M. (1982). The accuracy of public beliefs about crime: further evidence. *Criminology*, *20*(2), 185-204.

Warr, M. (1984). Fear of victimisation: Why are women and the elderly more afraid?. *Social science quarterly*, *65*(3), 681.

Wilcox, P., Land, K.C., & Hunt, S.A. (2002). *Criminal Circumstance: A Dynamic Multicontextual Criminal Opportunity Theory* (1st ed.). New York: Routledge.

Data Sources:

Office for National Statistics, 2016, *Crime Survey for England and Wales, 2014-2015,* [data collection], UK Data Service, Accessed 20th February 2019. SN: 7889

Office for National Statistics, 2017, *Crime Survey for England and Wales, 2015-2016,* [data collection], UK Data Service, Accessed 20th February 2019. SN: 8140

Office for National Statistics, 2018, *Crime Survey for England and Wales, 2011-2017: Secure Access, Low-Level Geographic Data*, [data collection], UK Data Service, 5th Edition, Accessed 20th February 2019. SN: 7311, http://doi10.5255/UKDA-SN_7311-5

Office for National Statistics, 2018, *Crime Survey for England and Wales, 2016-2017,* [data collection], UK Data Service, Accessed 20th February 2019. SN: 8321

Office for National Statistics, 2019, *Crime Survey for England and Wales, 2017-2018,* [data collection], UK Data Service, Accessed 20th February 2019. SN: 8464

UK Data Service

ONS Research Project Application

Public

November 2017
Version: 02.00

T +44 (0)1206 872143
E help@ukdataservice.ac.uk

If the project is to be undertaken under the Approved Researcher Scheme, then relevant information in the fields marked * will be published on the ONS website as a public record of all Accredited Researchers and their research projects.

Application type

☒   Full project application   ☐   Exploratory analysis

Lead researcher

Personal details and contact information of lead researcher

Surname*	Ward
First names*	Bethany Jane
Do you have an Accredited Researcher number?	Yes ☒	No ☐	AR number ▉▉▉▉▉
Site and address of where the data will be accessed	Department of Sociology, Chaucer Building, Nottingham Trent University, 50 Shakespeare Street, Nottingham, NG1 4FQ
Describe where the data will be accessed from, e.g. open plan office, secure locked room	Secure locked room containing 2 networked PCs- Quantitative and Spatial Criminology research groups secure data lab
IP address **(Only required for access via the Secure Lab)**	▉▉▉▉▉▉ research group share these two PCs

If you do not have an Accredited Researcher number, please complete the following section:

Institution or organisation	N/A
Full address	
Telephone number	
Email	
Date of birth	
Nationality	

Research team

If you are leading a research team, please provide the names and details of all members of the team. **Please add more tables if required**.

Surname*	Tseloni
First names*	Andromachi
Do you have an Accredited Researcher number?	Yes ⊠ No ☐ AR number ███████
Site and address of where the data will be accessed	Department of Sociology, Chaucer Building, Nottingham Trent University, 50 Shakespeare Street, Nottingham, NG1 4FQ
Where the data will be accessed from, e.g. open plan office, secure locked room	Secure locked room- Quantitative and Spatial Criminology research groups secure data lab
IP address **(Only required for access via the Secure Lab)**	██████████

If the researcher does not have an Accredited Researcher number, please complete the following section.

n/a

Research sponsor

Are you carrying out this project on behalf of a third party organisation?

Yes ☐   No ⊠

If you are working on behalf of a third party organisation, please provide the details of this organisation below:

Sponsor	
Institution or Organisation*	
Address	
Telephone number	
Email	

Title of the research proposal*

Crime Reduction and Public Reassurance in a Diverse Society

Estimated duration of full research project

Start Date: 01/10/2017	**Publish Date: 30/09/2021**

Research theme

Please select the theme below which best suits your research project

Births and Mortality

Business Change, e.g. growth

Crime and Justice

Economic Output and Productivity

Education and Skills

Employment

Health, Social Care and Wellbeing

Labour Market

Migration

Personal and Household Finances

Population

Sector Specific (please specify):

UK Economy

Other (*please specify*):

Abstract of the research proposal*

Please include a short description of the project and its benefits in no more than 100 words

The project aims to further knowledge and understanding of the multi-faceted relationship between crime victimisation, fear of crime, contextual and sociodemographic factors, and social disorganisation related concepts all together. The knowledge gained from this project will inform the process of where to target either crime reduction or public reassurance activities in order for these to have as much success as possible. It will also allow for development of a neighbourhood/individual "risk profile" and a "protective profile", such that the specific factors which need to be improved can be identified to ensure both effective crime reduction and public reassurance.

Purpose of research proposal

Please provide a detailed description of the purpose for which the data are requested, describing the aims of the study/research, in no more than 500 words. Where research is part of a larger programme, please include details below.

The project aims to address identified gaps in the knowledge in the relationship between crime victimisation (risk) and fear of crime, social capital and related concepts. The aim of this research is to further the knowledge and understanding of the full relationship between crime, fear of crime, contextual and compositional factors, and social disorganisation related concepts altogether. This contribution to knowledge will allow for an informed policy response based on an understanding of a combination of factors known to influence crime victimisation risk and fear of crime. The knowledge gained will allow for policy recommendations to be made to tackle both crime victimisation, and fear of crime targeted to specific neighbourhood or individual profiles. This should increase the effectiveness of policy changes, whilst focusing the allocation of resources where it is most

necessary, something necessary to consider given current austerity measures for public services. These outcomes can be delivered through the answering of the following three specific research questions:

1. Are experiences of crime victimisation against individuals and households, and fear of crime related between individuals and communities?
2. How do concepts such as social capital and community cohesion condition the relationship between fear of crime and crime victimisation?
3. What factors relating to social capital and community cohesion are indicative of lower crime rates, and higher public reassurance or vice versa?

Research methodology

Please provide details of the research protocol or methodology (e.g. data linkage or matching, web scraping etc. and) and how you intend to use the data, in no more than 500 words.

The primary dataset on which analysis will be undertaken is the Crime Survey for England and Wales (CSEW). Secure access protected data will be required to analyse the relationship between crime victimisation and fear of crime using contextual factors at the LSOA level. It is proposed that the CSEW is merged with the 2011 census to represent contextual neighbourhood level factors, such as the percentage of households which have moved in the previous 12 months, and the percentage of non-British born head of households. Low level geographical data access for the CSEW is also required for this merging process.

Multivariate multilevel modelling (Goldstein, 2011) will be used to address research question 1, this involves specifying a multi-level regression model with two dependent variables; crime (repeat) victimisation, and fear of crime. This allows factors including individual and neighbourhood level sociodemographic variables to predict crime victimisation and fear of crime as joint outcome variables. This method will account for the association between crime victimisation and fear of crime, estimating the proportion of their relationship explained by individual and community sociodemographic and contextual explanatory variables (see Tseloni & Zarafonitou, 2008 for an example of this method in application).

Following completion of the MVML modelling, regression models to be run on the CSEW, combined with Census data, to predict both victimisation and fear of crime separately, using individual and neighbourhood level contextual and compositional factors. The equations from the best models produced will be transferred to the Community Life Survey to allow for predicted victimisation and fear of crime levels to be calculated within the CLS.

Predicted levels of victimisation and fear of crime will then be used in structural equation modelling to assess the effects of social disorganisation related concepts on the relationship between crime victimisation and fear of crime. To maintain the

community/neighbourhood focus of the research, analysis on the community life survey will require low level geographical information. It is proposed that a number of community life survey sweeps will be merged together to increase the sample size as this is significantly smaller than the CSEW sample, and a large sample is required for complex SEM modelling.

Due to the use of predictions, no merging of the CLS and CSEW is necessary. Special licence CLS datasets will be accessed separately at a later stage in the research.

Data required

Title(s) and study number(s) of datasets and the releases required

SN 7311 Crime Survey for England and Wales, 2011-2016: Secure Access, Low-Level Geographic Data

Please explain why access to legally protected data is needed? Please state what other data sources have been considered, and why they are not sufficient for your purposes.

The focus of this research on communities requires the CSEW secure access data to be able to include low level geographical areas as a level within multilevel modelling. This is also required to merge the data with the Census, such that area level variables can also be included in the analysis, providing a richer understanding of the neighbourhood and individual context.

Other data sources considered were the non-secure versions of these datasets, as well as the census, however due to the community/neighbourhood focus of this research the low-level geographical data is essential, the census is expected to add to the explanatory power of the models in the analysis, however it certainly does not contain sufficient information alone to undertake this analysis.

Does your project proposal include any matching of data sources?[24]

Yes ☒ No ☐

If yes, please provide the following details below:

- A description of the data source(s) to be matched to the ONS data;

- A summary of the key variables;

- A summary of the matching methodology.

In the initital stage of research the Census and the CSEW will be matched on LSOA identifier, The key variables from the CSEW are fear of crime and crime victimisation, as well as sociodemographics, and area level contextual indicators are of interest from the Census.

SN 7427 Census: Aggregate Data

Does your project proposal include any linking of data sources?[25]

Yes ☐ No ☒

If yes, please provide the following details below:
- a description of the data sources(s) to be matched to the ONS data;
- a summary of the key variables;
- a summary of the matching methodology; and
- the justification for the linking

---

[24] *Data matching is defined as summarising two or more data sets by a common variable (e.g. region or local authority area) to*

combine and compare summary results.

[25] *Data linkage is defined as two or more separate data sets, linked at individual record level data via a common identifiable field.*

Does your project require the use of any other external data to be imported into your Secure Lab account? (i.e. data not described in the UK Data Service Catalogue) that you would like to import into your UK Data Service Secure Lab account. Please include the following information:

- A short description of each external dataset that you will use with ONS data including whether they are publicly available or whether the permission of the data owner is required

- A link to where the data are available from

- A summary of the key variables that you'll use from each external dataset

- Why you need to use external data

None

Ethics

Does your project require ethics approval from your organisation, institution or sponsor?

Yes ☒ No ☒

If yes, please give details of the applications, attaching any relevant documentation.

If no, your project may be considered by the ONS ethics committee prior to approval.

Public good

Please describe how your project meets the required benefit to public good, as outlined in section 3 of the Approved Researcher Scheme

Public Benefit	**How project will achieve public benefit**
Provide an evidence base for public policy decision-making	**Results of analysis should identify context of neighbourhoods where policy should be targeted to gain the greatest benefit.**
Provide an evidence base for public service delivery	**See above**
Provide an evidence base for decisions which are likely to significantly benefit the UK economy, society or quality of life of people in the UK	**See above, also analysis will identify community factors which affect victimisation and fear of crime, thus if these are targetted by policy makers, there should be a reduction in crime and in fear of crime.**

To replicate, validate or challenge Official Statistics	
To replicate, validate or challenge existing research	**See below**
To significantly extend understanding of social or economic trends or events by improving knowledge or challenging widely accepted analyses	**Social capital/social disorganisation research as proposed has not been undertaken on such a wealth of information, whilst it has been undertaken on only the BCS (see Sampson and Groves 1989, and many "replications" since), without including the wealth of community cohesion type factors contained in the community life survey. Therefore it should significantly extend the understanding of how community life affects wellbeing in terms of crime victimisation and fear of crime**
To improve the quality, coverage or presentation of existing statistical information	

Required data format

☐   STATA

☒   SPSS

☐   TAB-DELIMITED

Duration of access

Please indicate how long access to data is likely to be required

Note: if applying for exploratory analysis, your access will be granted for a maximum of 12 months only

> This data is required for a PhD project ending end of September 2021, so data would be required until this date.

Publications

ONS expects that research undertaken through the Approved Researcher Scheme will be published, other than in exceptional circumstances.[26]

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[26] ONS may grant exemptions to these criteria in exceptional circumstances (e.g. where there are security concerns around naming individuals, or there is a need for confidentiality in the consideration of sensitive policy development within Government)

Note: If applying for exploratory analysis, no publications are permitted.

Do you intend to publish the results of your project once research is completed?

Yes ☒ No ☐ If no, please skip to question 15.6

How will you make the results of your research available?

Reports will be provided to institutional partners at the local level through drawing upon the re-existing connections held by the Quantitative and Spatial Criminology (QSC) research group at Nottingham Trent University, including the Nottingham Crime and Drugs partnership, and local police forces. It is also possible that results could be disseminated on a national scale, owing to the national level of this research.

It is also expected that I will attend research conferences to present the results of this, at which both academics and policy makers are expected to attend.

Two peer-reviewed journal articles are proposed from this project, one addressing the relationship between crime victimisation and fear of crime, and one addressing the influence of social capital on this relationship. These will be open access.

Additionally, it is expected that the thesis will also be published and made available through the NTU institutional repository, an open access database.

Where do you plan to publish your analysis/results?

Journals targeted will be the British Journal of Criminology, and the Journal of Quantitative Criminology

Please provide an estimated timescale for publication

Both peer reviewed journals will be submitted prior to the PhD completion date of end of September 2021.

Please outline any intended future use for products (such as linked or matched data sets or tools) produced as a result of the research, and how they will be accessed.

No products are to be created

Please explain the exceptional circumstances for not publishing your results once the project is complete. Please note that refusing to publish your research outputs may result in a rejection of your project application.

If the project is to be undertaken under the Approved Researcher scheme, then relevant information in the fields marked * will be published on the ONS website as a public record of all Accredited Researchers and their research projects.

Appendix B- Diagnostic Information to Inform Number of Iteration and Gibbs Sampling

B-Table 1 Diagnostics of Models Run at 5000 Iterations with Metropolis Hastings Sampling

	Household	Vehicle	Personal
Victim cons	-1.626 (0.013)	-1.480 (0.013)	-1.843 (0.021)
Worry cons	-0.388 (0.008)	-0.520 (0.009)	0.477 (0.008)
Neighbourhood level			
Victim variance	0.021 (0.007)	0.054 (0.008)	0.025 (0.019)
Worry variance	0.056 (0.007)	0.056 (0.008)	0.082 (0.009)
V/W covariance	0.025 (0.005)	0.053 (0.007)	0.010 (0.008)
V/W correlation	0.749	0.964	0.211
Individual Level			
V/W Covariance	0.232 (0.017)	0.275 (0.016)	0.163 (0.019)
V/W correlation	0.232	0.275	0.163
Deviance	179040.765	144690.784	179166.549
Estimation	MCMC 5000 Uni MH	MCMC 5000 Uni MH	MCMC 5000 Uni MH
Raftery Lewis			
B2	8728, 5391	5673, 5483	6185, 5673
B3	40630, 12894	14994, 14032	24,000, 12,285
σ^2_{v2}	99714, 41058	99744, 76616	72,104, 57,004
σ^2_{v3}	61490, 515,468	71708, 48189	105,052, 241,368
σ^2_{v32}	61534, 103446	50,013, 50589	151884, 79420
σ^2_{u10}	301920, 282814	44354, 32271	37795, 37179
Brooks Draper			
B2	124	118	134
B3	9	6	20
σ^2_{v2}	168980	872029	70203
σ^2_{v3}	1028859	806152	1784899
σ^2_{v32}	286615	523656	636883959
σ^2_{u10}	2514	1333	2903
Kernel density			
B2	Approx normal	Approx normal	Approx normal
B3	Approx normal	Approx normal	Approx normal
σ^2_{v2}	Negative skew	Strong positive skew	Approx normal
σ^2_{v3}	V strong positive	Strong positive skew	V strong positive skew
σ^2_{v32}	Wide normal	Strong positive skew	V strong positive skew
σ^2_{u10}	Approx normal	Approx normal	Approx normal
ACF/PACF			
B2	ACF 1 to 0 by lag 25, PACF 0.8@1	ACF 1 to 0.1 by lag 40, PACF 0.8@1	ACF from 1 to 0 by lag 20, PACF 0.8 at 1
B3			

		Household	Vehicle	Personal
	σ^2_{v2}	ACF 1 to 0.3 by lag 30, PACF 1@1	ACF 1 to 0.2 by lag 50, PACF 0.9@1	ACF from 1 to 0.2 by lag 50, PACF 1 at 1
σ^2_{v3}		ACF from 1 to 0.7 by lag 100. PACF 1@1, 0.3@2, 0.2@3, 0.1@4	ACF 1 to 0.9 by lag 100, PACF 1@1, 0.2@2, 0.1@3	Decline from 1 to 0.4 by lag 100
σ^2_{v32}		ACF1 to 0.9 by lag 100, PACF 1@1, 0.4@2, 0.3@3, 0.2@4	ACF 1 to 0.9 by lag 100, PACF 1@1, 0.3@2, 0.2@3	ACF down to 0.9 by lag 100, PACF 1@1, 0.2@2
	σ^2_{u10}	ACF1 to 0.9 by lag 100, PACF 1@1, 0.4@2, 0.3@3, 0.2@4	ACF 1 to 0.9 by lag 100, PACF 1@1, 0.2@2, 0.1@3	ACF down to 0.6 by lag 100, PACF 1@1, 0.3@2, 0.1@3
		ACF to 0.3 by lag 60, PACF 1@1	ACF 1 to 0.2 by lag 50 0 by lag 80, PACF 0.9@1	ACF from 1 to 0.2 by lag 60, PACF 1@1
MCSE				
B2		Breaks approx 9k	Breaks approx 8k	Breaks approx 8k
B3		Approx 8k	Breaks approx 8k	8k
	σ^2_{v2}	Approx 8k	Breaks approx 8k	8k
σ^2_{v3}		Approx 8k	Breaks approx 8k	8k
σ^2_{v32}		Approx 8	Breaks approx 8k	8k
	σ^2_{u10}	Approx 8	Breaks approx 8k	8k
Brooks Draper				
B2				
B3				
	σ^2_{v2}			
σ^2_{v3}				
σ^2_{v32}				
	σ^2_{u10}			
ESS				
B2		428	534	472
B3		30	69	23
	σ^2_{v2}	12	4	26
σ^2_{v3}		4	4	3
σ^2_{v32}		4	4	19
	σ^2_{u10}	16	125	94

B-Table 2 Diagnostics of Models Run at 5000 Iterations with Gibbs Sampling

	Household	Vehicle	Personal
Victim cons	-1.626 (0.013)	-1.480 (0.013)	-1.843 (0.021)
Worry cons	-0.388 (0.008)	-0.520 (0.009)	0.477 (0.008)
Neighbourhood level			
Victim variance	0.021 (0.007)	0.054 (0.008)	0.025 (0.019)
Worry variance	0.056 (0.007)	0.056 (0.008)	0.082 (0.009)
V/W covariance	0.025 (0.005)	0.053 (0.007)	0.010 (0.008)
V/W correlation	0.749	0.964	0.211
Individual Level			
V/W Covariance	0.232 (0.017)	0.275 (0.016)	0.163 (0.019)
V/W correlation	0.232	0.275	0.163
Deviance	179040.765	144690.784	179166.549
Estimation	MCMC 5000 Gibbs	MCMC 5000 Gibbs	MCMC 5000 Gibbs
Raftery Lewis			
B2	8728, 5391	5673, 5483	6185, 5673
B3	40630, 12894	14994, 14032	24,000, 12,285
σ^2_{v2}	99714, 41058	99744, 76616	72,104, 57,004
σ^2_{v3}	61490, 515,468	71708, 48189	105,052, 241,368
σ^2_{v32}	61534, 103446	50,013, 50589	151884, 79420
σ^2_{u10}	46541, 30562	44354, 32271	37795, 37179
Brooks Draper			
B2	32 (k=2, 0.05)	39 (k=2, 0.05)	42
B3	3 (k=2, 0.05)	2 (k=2, 0.05)	18
σ^2_{v2}	86923 (K=2, 0.05)	127011(k=2, 0.05)	85910
σ^2_{v3}	324215 (k=2, 0.05)	113852(k=2, 0.05)	7789070
σ^2_{v32}	55762 (k=2, 0.05)	89147 (k=2, 0.05)	39925253
σ^2_{u10}	2393 (k=2, 0.05)	1752 (k=2, 0.05)	4292
Kernel density			
B2	Normally distributed	Approx normal	Approx normal
B3	Slight neg. Skew	Approx normal	Slight negative skew
σ^2_{v2}	Approx normal	Slight positive skew	Slight negative skew
σ^2_{v3}	Strong positive skew	Slight positive skew	Strong positive skew
σ^2_{v32}	Approx normal	Slight negative skew	Strong negative skew
σ^2_{u10}	Approx normal	Approx normal	Slight negative skew
ACF/PACF			
B2	ACF at 1 initially, drop to 0 by lag 8. PACF 0.5 at 1	ACF initially 1, below 0.1 by lag 5. PACF 0.5 at 1	ACF initially 1, below 0.1 by lag 5. PACF 0.6 at 1
B3	ACF at 1 initially, remains 0.2 between	ACF initially at 1, below 0.2 by lag 10. PACF 0.2 at 1	ACF initially at 1, reduces and remains at 0.8 from lag 10

	Household	Vehicle	Personal
σ^2_{v2}	10 and 100. PACF 0.8 at 1	ACF at 1 slow decline to 0.3 PACF 1 at 1	ACF at 1 slow decline to 0.1 PACF 1 at 1
σ^2_{v3}	ACF at 1 slow decline to 0.2 PACF 1 at 1	ACF at 1 slow decline to 0.3 PACF 1 at 1	ACF at 1 declines to 0.9, PACF 1 at 1
σ^2_{v32}	ACF 1t 1, slow decline to 0.6, PACF 1 at 1	ACF at 1 slow decline to 0.2 PACF 1 at 1	ACF at 1 slow decline to 0.7 PACF 1 at 1
σ^2_{u10}	ACF at 1, gentle decline to 0.4, PACF at 1		
	ACF at 1, decline to lt 0.1 by lag 50, PACF 1 at 1	ACF at 1, decline to lt 0.1 by lag 50, PACF 1 at 1	ACF at 1, decline to lt 0.1 by lag 60, PACF 1 at 1
MCSE	Point of curve break		
B2	10-20k updates	8-15k updates	Around 10k
B3	10-30k updates	8-15k updates	8-15k
σ^2_{v2}	8-15k updates	5-20k updates	5-15k
σ^2_{v3}	5-15k updates	8-15k updates	5-15k
σ^2_{v32}	8k-20k updates	8-15k updates	5-12k
σ^2_{u10}	8k-20k updates	8-15k updates	5-12k
Brooks Draper			
B2			
B3			
σ^2_{v2}			
σ^2_{v3}			
σ^2_{v32}			
σ^2_{u10}			
ESS			
B2	1685	1609	1550
B3	125	588	6
σ^2_{v2}	52	39	72
σ^2_{v3}	15	40	3
σ^2_{v32}	33	48	11
σ^2_{u10}	125	114	92

B-Table 3 Diagnostics of Models Run at 100,000 Iterations with Gibbs Sampling

	Household	Vehicle	Personal
Victim cons	-1.637 (0.017)	-1.478 (0.015)	-1.843
Worry cons	-0.388 (0.008)	-0.521 (0.009)	-0.476
Neighbourhood level			
Victim variance	0.035 (0.016)	0.049 (0.013)	0.025 (0.019)
Worry variance	0.056 (0.008)	0.060 (0.009)	0.082 (0.009)
V/W covariance	0.027 (0.008)	0.050 (0.008)	0.008 (0.009)
V/W correlation			
Individual Level			
V/W Covariance	0.235 (0.016)	0.278 (0.015)	0.166 (0.019)
V/W correlation			
Deviance	179005.762	144636.998	179134.745
Estimation	MCMC 100000	MCMC 100000	MCMC 100000
	Gibbs	Gibbs	Gibbs
Raftery Lewis			
B2	8314, 8100	8484, 8480	9124, 9010
B3	26308, 14378	15548,12634	29,646, 16,058
σ_{v2}^2	68,856, 51,794	94448, 54490	51082, 39936
σ_{v3}^2	247,900, 156,430	109,980, 126,480	266542, 283210
σ_{v32}^2	118,166, 75,622	74978, 54886	104,784, 121,404
σ_{u10}^2	43332, 44656	37060, 37420	45,324, 50,226
Brooks Draper			
B2	31	40	38
B3	9	4	10
σ_{v2}^2	116104	224969	94277
σ_{v3}^2	4491453	991755	3831758
σ_{v32}^2	336424	155033	64263278
σ_{u10}^2	2069	1336	3614
Kernel density			
B2	Approx normal	Approx normal	Approx normal
B3	Approx normal	Approx normal	Slight negative skew
σ_{v2}^2	Approx normal	Approx normal	Normally distributed
σ_{v3}^2	Strong positive skew	Strong positive skew	Strong positive skew

	Household	Vehicle	Personal
σ^2_{v32}	Approx normal	Approx normal	Approx normal
σ^2_{u10}	Approx normal	Approx normal	Approx normal
ACF/PACF			
B2	ACF 1 to 0.1 by lag 5, PACF 0.5@1	ACF 1 to 0.1 by lag 5, PACF 0.5@1	ACF 1 to 0.1 by lag 5, PACF 0.5@1
B3	ACF 1 to 0.5 by lag 10, PACF 0.9@1, approx 0.1@2-10	ACF 1 to 0.5 by lag 10, PACF 0.9@1, approx 0.05@2-10	ACF 1 to 0.5 by lag 10, PACF 0.9@1, approx 0.05@2-10
σ^2_{v2}	ACF 1 to 0.3 by lag 100, PACF 1@1	ACF down to 0.4 by lag 100. PACF 1@1	ACF down to 0.1 by lag 100. PACF 1@1
σ^2_{v3}	ACF 1 to 0.9 by lag 100, PACF 1@1	ACF 1 to 0.9 by lag 100, PACF 1@1	ACF 1 to 0.9 by lag 100, PACF 1@1
σ^2_{v32}	ACF 1 to 0.9 at lag 100, PACF 1@1	ACF down to 0.4 by lag 100, PACF 1@1	ACF down to 0.7 by lag 100, PACF 1@1
σ^2_{u10}	ACF 1 to 0.2 by lag 60, PACF 1@1	ACF 1 to 0.1 by lag 100, PACF 1@1	ACF 1 to 0.2 by lag 100, PACF 1@1
MCSE			
B2	Breaks at 8K	Breaks at 8K	Breaks at 8K
B3	Breaks at 8K	Breaks at 8K	Breaks at 8K
σ^2_{v2}	Breaks at 8K	Breaks at 8K	Breaks at 8K
σ^2_{v3}	Breaks at 8K	Breaks at 8K	Breaks at 8K
σ^2_{v32}	Breaks at 8K	Breaks at 8K	Breaks at 8K
σ^2_{u10}	Breaks at 8K	Breaks at 8K	Breaks at 8K
ESS			
B2	34113	32291	31211
B3	146	299	201
σ^2_{v2}	771	279	1213
σ^2_{v3}	76	94	89
σ^2_{v32}	162	345	161
σ^2_{u10}	900	2428	1077

B-Table 4 Diagnostics of Models Run at Highest Number of Iterations with Gibbs Sampling

	Household	Vehicle	Personal
Victim constant	-1.642 (0.017)	-1.483 (0.015)	-1.841 (0.017
Worry constant	-0.388 (0.008)	-0.521 (0.009)	-0.476 (0.008)
Neighbourhood level			
Victim variance	0.041 (0.015)	0.057 (0.015)	0.022 (0.012)
Worry variance	0.056 (0.008)	0.061 (0.010)	0.081 (0.009)
V/W covariance	0.026 (0.008)	0.048 (0.009)	0.007 (0.009)
V/W correlation			
Individual Level			
V/W Covariance	0.237 (0.016)	0.282 (0.016)	0.166 (0.019)
V/W correlation			
Deviance	178972.534	144578.963	179134.110
Estimation	MCMC 247900	MCMC 126480	MCMC 283210
	Gibbs	Gibbs	Gibbs
Raftery Lewis			
B2	15,356, 15372	8672, 8246	11946, 11835
B3	33880, 22704	17124, 13168	29730, 19359
σ_{v2}^2	55329, 68348	81865, 37529	38686,27269
σ_{v3}^2	184272, 79242	92565, 71088	185883,117777
σ_{v32}^2	91849, 52055	64238, 38203	87879, 73290
σ_{u10}^2	53636, 52020	35947, 39784	45324, 50226
Brooks Draper			
B2	31	41	39
B3	8	5	9
σ_{v2}^2	128939	225883	101273
σ_{v3}^2	2932789	1473967	3550177
σ_{v32}^2	322530	189877	70070272
σ_{u10}^2	2430	1621	3614
Kernel density			
B2	Approx normal	Approx normal	Approx normal
B3	Approx normal	Approx normal	negative skew
σ_{v2}^2	Approx normal	Approx normal	Normally distributed
σ_{v3}^2	Strong positive skew	Positive skew	Strong positive skew

		Household	Vehicle	Personal
σ^2_{v32}		Approx normal	Approx normal	Approx normal
	σ^2_{u10}	Approx normal	Approx normal	Approx normal
ACF/PACF				
B2		ACF 1 to 0.1 by lag 5, PACF 0.5@1	ACF 1 to 0.05 by lag 5, PACF 0.5@1	ACF 1 to 0.1 by lag 5, PACF 0.55@1
B3		ACF 1 to 0.6 by lag 10, PACF 0.9@1, approx 0.1@2-10	ACF 1 to 0.4 by lag 10, PACF 0.8@1, approx 0.05@2-10	ACF 1 to 0.5 by lag 10, PACF 0.9@1, approx 0.05@2-10
	σ^2_{v2}	ACF 1 to 0.3 by lag 100, PACF 1@1	ACF down to 0.4 by lag 100. PACF 1@1	ACF down to 0.1 by lag 100. PACF 1@1
σ^2_{v3}		ACF 1 to 0.9 by lag 100, PACF 1@1	ACF 1 to 0.7 by lag 100, PACF 1@1	ACF 1 to 0.9 by lag 100, PACF 1@1
σ^2_{v32}		ACF 1 to 0.9 at lag 100, PACF 1@1	ACF down to 0.5 by lag 100, PACF 1@1	ACF down to 0.7 by lag 100, PACF 1@1
	σ^2_{u10}	ACF 1 to 0.3 by lag 60, PACF 1@1	ACF 1 to 0.1 by lag 70, PACF 1@1	ACF 1 to 0.2 by lag 100, PACF 1@1
MCSE				
B2		Breaks at 8K	Breaks at 8K	Breaks at 8K
B3		Breaks at 8K	Breaks at 8K	Breaks at 8K
	σ^2_{v2}	Breaks at 8K	Breaks at 8K	Breaks at 8K
σ^2_{v3}		Breaks at 8K	Breaks at 8K	Breaks at 8K
σ^2_{v32}		Breaks at 8K	Breaks at 8K	Breaks at 8K
	σ^2_{u10}	Breaks at 8K	Breaks at 8K	Breaks at 8K
ESS				
B2		84683	39992	86580
B3		479	459	621
	σ^2_{v2}	1683	313	3401
σ^2_{v3}		244	168	239
σ^2_{v32}		401	476	377
	σ^2_{u10}	2196	2163	1077

NOTTINGHAM TRENT UNIVERSITY
COLLEGE OF BUSINESS, LAW AND SOCIAL SCIENCES

BLSS/College REC Form

APPLICATION FORM FOR ETHICAL APPROVAL OF A RESEARCH PROJECT

For use by members of academic staff and postgraduate research students

PLEASE NOTE THAT IT NORMALLY TAKES BETWEEN 3-6 WEEKS TO PROCESS APPLICATIONS, DEPENDING ON WHETHER THE APPLICATION NEEDS TO GO TO A FULL MEETING OF CREC (PLEASE SEE GUIDANCE NOTE: BLSS/Ethics 01 – PAGE 6). IF YOU ARE ASKED TO REVISE YOUR APPLICATION, IT MAY TAKE LONGER.

Who should use this form?

You should use this form if you are a member of academic staff or a research degree student (including the D Psych but not students on other professional doctorates, taught postgraduate or undergraduate courses). If you are a student on a professional doctorate other than the D Psych, you should follow the procedure laid down by PDREC. If you are a student on a taught masters or undergraduate programme, you should follow the procedure laid down by your School REC.

If you are a PhD student you should normally have received Project Approval before you apply for ethical approval. If there is a problem with this seek advice from your PhD supervisor. Please note, that if following your application for project approval you find that you need to revise your research plans such that this ethics application no longer covers all aspects of your intended project, you will need to submit a revised application for ethical approval.

Can I begin work before the project is ethically approved?

If your project requires ethical approval (see overleaf and Section 1) you <u>must not</u> undertake primary data collection until a favourable ethical opinion is received from the College Research Ethics Committee or from an external REC. Collecting primary data in the absence of ethical approval, or in the face of an adverse ethical opinion, may constitute a disciplinary offence.

If, after receiving ethical approval, factors beyond your control change your project such that the information provided in this form no longer holds, the approval will automatically become void, and you should re-apply for ethical approval.

Is there any help available to complete this form?

Yes. Guidance on filling in this form can be found in Guidance Note BLSS/Ethics 01. If you are a member of staff you can find the guidance document on the research SharePoint site here. If you are a PhD student please click this link which will take you to NOW, and then follow this pathway to access the form: NOW Homepage > Student Communities > NTU Graduate School > Content > Ethics Guidance.

In this site, you will also find documents dealing with specific issues in research ethics, and also some examples of participant information sheets and consent forms.

Further advice is available through the College Research Support Office. Please email anton.muszanskyj@ntu.ac.uk

Please note that any subsequent amendments to approved projects need to be re-submitted to CREC for further consideration.

Please make sure that you complete the Declaration at the end of the form. Postgraduate research students must ask their Director of Studies to countersign the form before it is submitted.

Completing the Form

Which sections should I complete?
Different sections of this form should be completed for different kinds of projects:

If your project involves:	
Desk-research only, using only secondary or published sources	See Section 1
An application to an external research ethics committee (for example, those relating to research in the NHS)	Complete Sections 1-4
Collection and/or analysis of primary, unpublished data from, or about, identifiable, living human beings (either in laboratory or in non-laboratory settings)	Complete Sections 1-7 Please also complete the checklists in Sections 8–14 and provide information, as requested, if any of the checks is positive
Collection and/or analysis of data about the behaviour of human beings, in situations where they might reasonably expect their behaviour not to be observed or recorded	
Collection and/or analysis of primary, unpublished data from, or about people who have recently died	
Collection and/or analysis of primary, unpublished data from, or about, existing agencies or organisations	
Investigation of wildlife in its natural habitat	Complete Sections 1-5. and 15
Research with human tissues or body fluids	Do not complete this form. Please contact the College Research Office for advice
Research with animals, other than in their natural settings.	Do not complete this form. Please contact the College Research Office for advice

Please type or write legibly in dark ink. You are asked to keep your answers as brief as possible but you should provide sufficient detail for members of the Research Ethics Committee to form a view on the ethics of your proposed research. Where it is really necessary, you may use up to one continuation sheet for each Section of the form

Submitting the form

The form should be submitted by email, to:

The Research Office of the College of Business, Law and Social Sciences,
Room 4703 Chaucer
Email: anton.muszanskyj@ntu.ac.uk
Phone: 0115 848 8117

1   Does this project need ethical approval?

	Yes	No
Does the project involve collecting and/or analysing primary or unpublished data from, or about, living human beings?		✓
Does it involve collecting and/or analysing primary or unpublished data about people who have recently died, other than data that are already in the public domain?		✓
Does it involve collecting and/or analysing primary or unpublished data about or from organisations or agencies of any kind, other than data that are already in the public domain?		✓
Does it involve research with non-human vertebrates in their natural settings or behavioural work involving invertebrate species not covered by the Animals (Scientific Procedures) Act 1986*? *The Animals (Scientific Procedures) Act 1986 was amended in 1993. As a result the common octopus (Octopus vulgaris), as an invertebrate species, is now covered by the act.		✓
Does the project involve any of the following activities: 1) Access to websites normally prohibited on university servers, for example pornography or sites of organisations proscribed by the UK Government. 2) Investigation into extremism or radicalisation. 3) Accessing and using data of a potentially damaging nature which has been obtained from a source which may not have the requisite authority to provide it. Here, potentially damaging can mean anything from information on cases of domestic abuse to data on international spy networks. In case of uncertainty please consult the Research Support Office or your School Associate Dean for Research. 4) The acquisition of security clearances, including the Official Secrets Act. Hereinafter referred to as '**Special Risk Research**'		✓

FOR STAFF ONLY: If you have answered NO to <u>all</u> the questions above, you do not need to submit your project for ethical approval.

FOR PhD/D PSYCH STUDENTS ONLY: If you have answered NO to <u>all</u> the questions above, please complete the section below.

Name Bethany Ward
School School of Social Sciences
Name of Director of Studies Andromachi Tseloni

Signed___ (Student) Date_09/03/2018

I have read this form, and confirm that, due to the nature of the research, this project does not require the approval of a research ethics committee.

Countersigned _A. Tseloni__ (Director of Studies/Lead supervisor) Date 9 March 2018

If you have answered YES to <u>any</u> of the questions above, please proceed to Section 2 below.