

Weapon-carrying and the reduction of violent harm

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Introduction

Violence, weapon use and public health

Weapon use in a violent incident is strongly associated with injury severity (Zimring 1968; Brennan *et al* 2006; Cook 2018) and removing weapons from violent encounters would significantly reduce the global burden of violent harm. Recognition of the harm potential of weapons, alongside the positioning of violence as a public health issue (Dahlberg and Mercy 2009; World Health Organization 2002), has led to weapon-carrying becoming a shared priority for criminal justice and public health policy-makers and researchers (WHO 2002; Williams and Donnelly 2014).

Although not usually discussed in these terms, the prevention of weapon-carrying should be seen as a form of 'harm reduction'. Emerging from public health research in the 1980s, harm reduction is a philosophical and practical approach that prioritises reducing the harm of risky behaviours over their prevention or prohibition. With the exception of research in the areas of drugs and sex work, and despite its emphasis on crime prevention, criminology has not embraced this agenda. However, three factors suggest that criminology is ready to engage with a harm reduction approach to violence. Firstly, the development (Sherman *et al* 2016) and adoption of measures of criminal harm (Statistics Canada 2009) indicates an intellectual and practical turn towards locating crimes – particularly violence – along a spectrum of harm rather than as discrete

events. Secondly, the expansion of the ‘law enforcement and public health’ movement (van Dijk and Crofts 2016) represents a convergence of public health and criminological approaches to violence prevention. Thirdly, while violent crime is at historically low levels, the proportion of violence involving weapons has remained constant, suggesting that weapon use is a sensible next target for violence reduction activity. In an effort to build further momentum, this paper suggests that the harm reduction agenda should seek to incorporate violence prevention, specifically by removing weapons from violent encounters. It demonstrates that criminology and public health have much to offer each other in the way that they theorise about violence and apply knowledge for prevention. In demonstrating the potential links between the fields, this paper identifies risk factors for carrying a weapon by young people in England and Wales and advances theories of weapon-carrying by showing the predictive value of a social-ecological frame for modelling weapon-carrying and identifying a criminological factor in the decision to carry a weapon that has been overlooked by public health researchers – trust in the police.

Weapons and violence in England and Wales

With fewer than 10 murders per million people (Office for National Statistics 2016), England and Wales is one of the world’s safest places (United Nations Office on Drugs and Crime 2013). Illegal firearm ownership and firearm-related murder is rare and knives are the most commonly-used weapons (Office for National Statistics 2016). Despite the low rate of murder, a 22% increase in youth homicide between March 2016 and March 2017 has led to claims that

England and Wales – particularly London – is experiencing an ‘epidemic of knife crime’ (Jones 2017). This increase in fatalities has focused the attention of the media and politicians on the prevention of ‘knife crime’ and has prompted strategic responses by government (Mayor of London 2017; HM Government 2018) and police (Metropolitan Police 2018). This increased focus on ‘knife crime’ in England and Wales and, by extension, weapon-carrying, has exposed the fact that risk factors for weapon-carrying in England and Wales have not been rigorously modelled using a national sample.

The burden of violence and weapon-carrying

The use of weapons increases the burden of violence in two ways: direct harm and contagion. Firstly, violence with a weapon tends to result in more serious injury than violence without a weapon (Brennan *et al* 2006; Cook 1979). In England Wales, knives were used in only 7% of all violence in 2015/16, but 37% of murders (Office for National Statistics 2017). Secondly, at a community level, weapon lethality is proportional to demand. The introduction of a new weapon type to community violence signals an increase in the overall riskiness of the area, which increases demand for more lethal weapons among those who do not have them. This contagion phenomenon has been observed in social groups (Dijkstra *et al* 2010; Tracy, Braga, and Papachristos 2016), neighbourhoods (Wilkinson and Fagan 1996) and large cities (Blumstein and Cork 1996) and, as much as the acute effects on violent harm, demonstrates why any violence prevention or harm reduction strategy must address weapon use.

Despite the disproportionate harm that weapons can cause, explanations of weapon-carrying or weapon use have, in general, been limited to viewing it either as an extension of violence in general – thus, reducing the need for a distinct theory of weapon-carrying – or suggesting, simplistically, that it is a direct response to fear of victimisation (Button and Worthen 2017; Lemos 2004). Perhaps more promisingly, Djikstra *et al* (2010) have proposed that weapon-carrying is the result of interaction between individual trait aggression and aggressive peer influence, while Brennan (2017) has suggested that weapon-carrying is an attempt to reduce the uncertainty of violent encounters in risky environments. Bottom-up, risk factor-driven efforts to explain weapon-carrying have yielded further insight into this behaviour by identifying who carries weapons rather than focusing on why. These studies, usually undertaken by public health researchers, have been broad in scope, but narrow in how they have hypothesised mechanisms of weapon-carrying. The present study goes beyond the limitations of these studies – summarised below – by retaining their breadth of scope and introducing a criminological risk factor, trust in the police, that advances the understanding of why young people carry weapons.

Theories of weapon-carrying: A social-ecological perspective

Despite being a discipline that is, in general, theoretically rich, a limitation of criminological research is the tendency towards explaining violence through a single mechanism (Sampson and Lauritsen 1994). Biological, learning, differential association, ecological and structural theories of violence all have empirical support, but none alone provide a comprehensive explanation of violent

behaviour. While integrated criminological theories of violence have existed since the 1960s (Messner *et al*, 1989), they remain obscure when compared to the popularity of single-levelled theories – particularly when applied to affect some criminal justice outcome (McGloin and Thomas 2013). A consequence of single-levelled theories of violence is that preventive strategies that are informed by these theories will affect fewer people than a strategy that addresses violence at individual, interpersonal, community and societal levels. Although traditionally less theoretically rich than criminology, public health has yielded more success in preventing violence because it adopts a multi-levelled social-ecological framework (Bronfenbrenner 1979) that views violence as being influenced by interacting individual, interpersonal, community and societal factors and by targeting each level (Dahlberg and Mercy 2009; World Health Organization 2002). Rather than being a collection of theories seeking to explain cognate or related phenomena, the social-ecological approach is a framework for modelling behaviour. It can comprise theories from any number of disciplines – and is strengthened by this – but at its heart is the assertion that individual behaviour does not happen in a vacuum: it is shaped by individual, interpersonal, organisational and societal factors. While this approach is more complex but less refined than single-levelled theories and necessitates more expansive programmes of intervention (e.g. Scottish Violence Reduction Unit 2017), it has a greater likelihood of effecting population-level change. In recognition of the considerable evidence that violence can be affected by mechanisms at each of these levels and seeking to inform a broad violence prevention strategy, this paper adopts a social-ecological perspective to identifying risk factors for

weapon-carrying. The following overview details the existing explanations of weapon-carrying in the international literature across the levels of the social-ecological model.

Individual-level risk factors

At the centre of the social-ecological model is the individual, consisting of demographic, experiential and attitudinal risk factors.

Demographic risk factors: Males are between two (McVie 2010; Hemenway *et al* 2011) and five (Molnar *et al* 2004; Tigri *et al* 2016) times more likely to report carrying a weapon than females and weapon-carrying tends to peak in mid-adolescence (Swahn *et al* 2013; Haegerich *et al* 2014; Hemenway *et al* 2011; Ilie *et al* 2016). Studies that have directly compared ethnic groups have found that minority groups are at heightened risk of carrying a weapon compared to white respondents (Hemenway *et al* 2011; Molnar *et al* 2004; Swahn *et al* 2013). The risk associated with socioeconomic factors is unclear because household income is rarely well-captured in self-report surveys completed by young people. Bégue, Roché and Duke (2016) used living in public housing as a proxy for deprivation/affluence and found it to be a protective factor against weapon-carrying. However, Molnar *et al* (2004) found no relationship between family socioeconomic status and weapon-carrying, nor was there a relationship between weapon-carrying and school lunch eligibility (Williams *et al* 2002), suggesting that the relationship between deprivation and weapon-carrying is not strong.

Attitudes: Analysis of non-criminogenic psychological factors has found relatively little that predicts weapon-carrying. Weapon-carrying was more likely in sensation seekers (Thurnherr *et al* 2009) and McVie (2010) found that low self-esteem was weakly associated with weapon-carrying. Criminogenic attitudes have greater explanatory power: Bégue *et al* (2016) found that pro-delinquent attitudes positively predicted weapon-carrying, although, given the theoretical link, the relationship was surprisingly weak. Importantly, that study found no link between trust in authorities and weapon-carrying, which is relevant to the discussion of trust in the police below.

Victimisation and offending: The two most fundamental explanations for why someone might carry a weapon are because they expect to be either a victim or a perpetrator of violence. Both positions have received considerable empirical scrutiny. To those familiar with the extensive literature on victim-offender overlap, treating ‘victims’ and ‘offenders’ as mutually exclusive is naïve. That issue notwithstanding, efforts to reduce weapon-carrying and use would benefit from knowing the relative effects of offensive and defensive motives on this behaviour. Fortunately, several studies have compared the relative weight of victimisation and offending on the decision to carry a weapon, albeit through proxy variables rather than direct questioning about motives. Studies have tended to compare the relative effects of recent violent victimisation and recent violent offending, judging that these variables can reveal something about motives for subsequent or concurrent weapon-carrying. Analyses that have included recent experience of both victimisation and offending have consistently

shown recent offending to be a stronger predictor of weapon-carrying than victimisation (McVie 2010; Saukkonen *et al* 2016; Kodjo, Auinger and Ryan 2003; Spano, Pridemore and Bolland 2012). However, two studies are notable for their dissent. Yun and Hwang's (2011) analysis of predictors of carrying a weapon in school found that prior victimisation far outweighed violent delinquency. However, the types of victimisation that were used to generate their violent victimisation variable ("being threatened at gun or knifepoint; being shot at; being stabbed; and being jumped", p.371) are heavily weighted towards weapon violence and more extreme than those typically used in other studies (reflected in a low mean score of 0.36 on a 0–8 scale). This also resonates with the very strong relationship between weapon-carrying and being threatened or attacked with a knife reported by Webster, Gainer, and Champion (1993; odds ratio 5.74 for males) and Khubanchandani and Price (2017; odds ratio 5.14). Therefore, it is doubtful that Yun and Hwang's study can be regarded as showing that victimisation outweighs offending in the decision to carry a weapon, but is more a reflection of a linear relationship between the severity of violent victimisation and weapon-carrying. Secondly, Spano and Bolland (2013) found that controlling for baseline violent victimisation neutralised the relationship between baseline violent offending and gun-carrying at one-year follow-up. However, their later paper (Spano *et al* 2012), which accommodated victim-offender overlap, reversed the findings and gave greater weight to violent offending as an explanation of weapon-carrying.

Fear of victimisation: Beyond actual experience of victimisation, weapon-carrying may be driven by the anticipation of victimisation or by concerns about safety. Carrying a weapon is a plausible response to most conceptualisations of fear of crime (Farrall, Jackson, and Gray 2009). A weapon can give confidence to the carrier, it can be used to deter violence and, theoretically, it reduces the risk of harm to oneself if an encounter becomes violent (Brennan 2017). Therefore, an association between weapon-carrying and fear of victimisation or worry about personal safety is plausible. Despite this logical connection, the supporting evidence for a relationship between fear of crime and weapon-carrying is weak. Although Hemenway *et al* (2011) found that weapon-carrying was slightly more likely among respondents who “never or rarely felt safe” (p.1000), this relationship was not statistically significant once the model controlled for other variables. Saukkonen *et al* (2016) found that a ‘sense of security’ was only predictive of carrying a gun, but not of carrying a knife or other weapon and Spano and Bolland (2013) found that fear of crime at baseline did not predict weapon-carrying one year later.

Deviant identity: Carrying a weapon, and making this known to others may be a way of shaping one’s identity. Given the danger that many people associate with weapons, carrying one is an easy way to express deviant tendencies. Therefore, rather being driven by directly violent motives (offensive or defensive), weapon-carrying may simply reflect a general antisocial disposition or a desire to convey this. This has been examined in the literature in several ways. Researchers have directly measured antisocial attitudes or beliefs (Webster *et al* 1993; Bégue *et al*

2016; Williams *et al* 2002), school exclusion (Kodjo *et al* 2003), arrest (Williams *et al* 2002), general offending behaviour (McVie 2010; Saukkonen *et al* 2016; Thurnherr *et al* 2009; Barlas and Egan 2006) or they have employed a proxy for deviance, most commonly substance use (McVie 2010; Williams *et al* 2002; Khubanchandani and Price 2017; Ilie *et al* 2017; Buschmann *et al* 2017; Thurnherr *et al* 2009). Substance use is an imperfect proxy for deviance because behaviours associated with drug use may involve the use of a weapon, particularly if the respondent is involved in drug distribution. Nonetheless, it has value as an indicator of a more general deviance or disregard for the law. In general, these studies have identified a relationship between deviant attitudes or behaviour that is independent of violent victimisation and violent offending. While these studies have not yielded deeper insight than a statistical association between general deviance and weapon-carrying, Harcourt's (2006) analysis of interviews with convicted gun carriers suggested that weapons offer far more than a rational response to threat: they are a means through which (anti)social bonds are formed and a prop for the expression of (deviant) identity.

Interpersonal risk factors

By definition, violence is an interaction between two or more people. Therefore, interpersonal factors are likely to play an important role in weapon-carrying behaviour. In particular, peer influence, as a major source of information about threat and violence, should play a role. From a rational perspective, an individual may learn about the prevalence of weapon-carrying in their environment through exposure to peer weapon-carrying and respond accordingly.

Alternatively, taking a differential association approach, someone may carry a weapon to reflect the behaviours of a deviant peer group.

In the US literature, the influence of both of these factors have been considered. Peer deviance was constructed in a number of ways. Firstly, respondents were often asked to describe the extent to which their peers had committed crimes or to estimate the diversity of that offending. Secondly, peer delinquency was inferred if a respondent indicated that they were a member of a gang. The effect sizes for the latter (e.g. Spano and Bolland 2013 and Hemenway *et al* 2011, reported odds ratios of 4.70 or greater) were typically stronger than for the former (usually up to an odds ratio of 2: McVie 2010; Saukkonen *et al* 2016). While general peer deviance has received a lot of attention in the literature, relatively few studies have estimated the relationship between perceived peer weapon-carrying and respondent weapon-carrying. Given the contagion effects of weapon-carrying that have been demonstrated at the group- and community-levels, this is an unfortunate oversight. When this relationship has been tested, it has been shown to be a very strong predictor of weapon-carrying. Williams *et al* (2002) found that having at least two of a respondent's four best friends carrying a gun in the past year was associated with an eleven-fold increase the likelihood of ever having carried a gun.

Two important studies have uncovered more about the relationship between peer and respondent weapon-carrying than simple statistical association. Firstly, Hemenway *et al* (2011) found that young people tended to overestimate the

prevalence of weapon-carrying among their peers. Importantly, they also found that this effect is particularly pronounced among weapon-carriers. This miscalculation, which creates a positive feedback loop that reinforces weapon-carrying, could explain the observed contagion effects within communities.

Secondly, in a longitudinal, social network analysis, Dijkstra *et al* (2010) provided robust evidence that when a peer begins to carry a weapon, it has a transformative effect on the weapon-carrying behaviour of the respondent: “participants were 2.29 times more likely to make a move towards their friends’ weapon-carrying average than not to change their weapon-carrying” (p. 205).

Taken together, these two findings highlight the importance of peer behaviour on weapon-carrying and also suggest that intervening through peer influence is a potentially fruitful preventive mechanism.

Community risk factors

If weapon-carrying is driven by perceived need for self-protection, weapon-carrying should be more likely in neighbourhoods with higher rates of weapon-carrying and violence. Similarly, if weapon-carrying is driven by violent intentions, weapon-carrying would be rational in riskier areas as an intended victim has a higher likelihood of carrying a weapon. Rennison, Jacques and Berg (2011) provided indirect support for this by demonstrating that weapon use in violence was more common against neighbourhood outsiders. Presumably this reflected assailant attempts to overcome the uncertainty of a violent encounter with a stranger who might be armed.

Studies have demonstrated that weapon-carrying and the type of weapon carried are influenced by the characteristics of the weapon carrier's neighbourhood. The most commonly-tested relationship is that between neighbourhood deprivation and weapon-carrying. Baumer *et al* (2003) showed that firearms were more likely to be used in assaults in deprived neighbourhoods than in more affluent ones. In contrast, Molnar *et al* (2004) found that neighbourhood poverty did not predict the carrying of concealed firearms in Chicago and Yun and Hwang (2011) found that neighbourhood disadvantage did not predict carrying a weapon to school.

Beyond a rational response to threat or efforts to overcome uncertainty in violent situations, a neighbourhood can have a less direct influence on weapon-carrying: Exposure to violence and weapon-carrying may inoculate a person against the seriousness of violence (Mrug, Madan and Windle 2016); weak informal social control may limit the extent to which a community can inhibit violence (Haegerich *et al* 2014); and physical signs of disorder may foster injunctive norms that violence is permissible in this area (Keizer, Lindenberg and Steg 2008). The supporting evidence for these theories varies. In a survey of high school students in Boston, Hemenway *et al* (1993) found that the more victims of violence a respondent knew, the higher their likelihood of carrying a firearm, but this relationship did not predict carrying a knife and concern about neighbourhood gun violence did not predict weapon-carrying. Spano *et al* (2012) found that exposure to community violence – experienced and witnessed – predicted weapon-carrying at one-year follow-up. However, when violent

behaviour was statistically controlled, no relationship between exposure and weapon-carrying was found to exist. Both findings suggest something more complex than simple neighbourhood exposure driving weapon-carrying. More convincingly, Haegerich *et al* (2014) found a negative relationship between informal social control and weapon-carrying and Molnar *et al* (2004) found that collective efficacy – a combination of social cohesion and informal social control – was a strong protective factor against weapon-carrying. Finally, Molnar *et al* (2004) have shown that visible neighbourhood physical and social disorder are positively associated with weapon-carrying, but Haegerich *et al* (2014) found no relationship between the two.

In summary, the evidence for a link between neighbourhood and violence is moderated by the perceived level of violence rather than more tangible factors such as economic deprivation. Importantly, none of the studies that sought to test for neighbourhood effects on weapon-carrying included a robust estimate of violence or weapon use in that neighbourhood using police or health statistics. This may be a consequence of respondent-identifiable data not being available to researchers. In addition, indicators of the most useful phenomenon – prevalence of weapon-carrying – are not routinely available. This is problematic because an important confounding factor may have been overlooked in the analyses of this social-ecological level raising the risk of Type I and Type II errors. It also highlights a research and practical limitation of violence prevention, that small-area estimates of weapon-carrying are extremely rare: none exist in Europe and

even in the US, the illegal nature of much weapon-carrying necessitates the use of proxy estimates such as firearm suicides (Azrael, Cook and Miller 2004).

Societal risk factors

An analysis of societal risk factors for weapon-carrying requires a reliable metric of weapon-carrying at a population-level. As noted, a sufficiently granular metric does not exist for illegal weapon-carrying by young people in England and Wales (Tiratelli, Quinton and Bradford 2018). Proxy variables, such as murder and police-recorded violence involving a weapon exist in many countries and have been used to determine the impact of legislative changes in the availability of firearms on weapon violence (McPhedran 2016; Cook 2018), but the focus of these studies on legal weapon ownership by adults limits their value for understanding illegal weapon-carrying by young people.

Weapon-carrying and trust in the police

This section puts forward a theoretical basis for a previously untested potential driver of weapon-carrying: trust in police competence. (Jackson and Bradford 2010). Harcourt describes how the respondents in his interviews have little faith in the ability of the police or the state to protect them from violence. This belief provides a rationale for carrying a weapon. In Harcourt's interviews, many respondents were engaged in drug-dealing or gang membership – occupations that offer little routine protection from police and, when disputes arise, inhibit the use of law via police to resolve the issue. These respondents are probably not typical of weapon-carriers in England and Wales, but being engaged in criminal

activity is not a requirement for having reduced levels of trust in police competence (Bradford and Myhill 2014).

An alternative interpretation of ‘trust in the police’ is a trust in the police to execute their roles fairly (Jackson and Bradford 2010). Trust in police fairness can be based on direct or vicarious experience of police discrimination, a reflection of community norms or even societal-level distrust of the police. This type of distrust could also explain weapon-carrying, but more as being endogenous of general anti-police attitudes than having a direct causal link. It is important that Bégue *et al* (2016) found no link between weapon-carrying and distrust of authorities. However, this is the only test of this relationship in the literature and a distrust of police fairness or competence may be more specific than a general distrust of authorities. Finally, it is unclear if this is a *post hoc* technique of neutralisation (Sykes and Matza 1957) or if it reflects a reasoned decision in a violent environment: either explanation is credible. A third explanation is that a lack of trust in the police’s ability to protect them is an expression of disdain for the police as an organisation rather than a realistic evaluation of threat. Indeed, the three explanations need not be mutually exclusive and any relationship between weapon-carrying and trust in police competence would require further exposition. Given the multiple causal mechanisms through which trust in the police may affect weapon-carrying, this paper tests the relationship between this attitude and weapon-carrying.

Hypotheses

Following a summary of the risk factors for carrying a weapon by a young person identified in an international collection of studies, this paper seeks to add to the literature by identifying risk factors for weapon-carrying by young people in England and Wales. As can be seen from the literature detailed above, the list of risk factors is long and important influencers can be found at all levels of the social-ecological model. Informed by this literature and organised around the critical masses of evidence, this paper tests the contribution of five blocks of variables to the explanation of weapon-carrying: *demographic factors*, *victimisation*, *antisocial behaviours and attitudes*, *deviant peer influence* and *neighbourhood characteristics*. As the first analysis of this behaviour with a national sample in England and Wales, the study is exploratory, resulting in a large number of hypotheses being tested. Adjustments to the threshold for statistical significance to accommodate the exploratory and multi-test nature of this study are described below.

The hypotheses on which these models are based are:

Demographics

1. Weapon-carrying is more likely among males
2. The relationship between age and weapon-carrying is non-linear with a peak in the mid-teenage years
3. Weapon-carrying is more likely in ethnic minority respondents

Antisocial behaviours

4. Weapon-carrying is more likely among those with a history of violent offending
5. Weapon-carrying is more likely among those with a history of drug use
6. Weapon-carrying is negatively related to trust in the police

Victimisation

7. Weapon-carrying is more likely among those who have been threatened with violence
8. Weapon-carrying is more likely among those who have been victims of violence

Deviant peers

9. Peers offending history is associated with an increased likelihood of carrying a weapon

Neighbourhood characteristics

10. Weapon-carrying is less likely in safer neighbourhoods
11. Weapon-carrying is more likely in disordered neighbourhoods

Methods

Sample

Conducted in England and Wales, the Offending, Crime and Justice Survey (OCJS) is a survey of self-reported offending in the 12 months preceding completion of the survey. The survey began in 2003 with an initial sample of 10,079. Approximately one-third of these respondents were surveyed again each year until 2006 (inclusive). Between 2004 and 2006, the survey also added up to 2,000 new respondents. This method generated a combined panel and cross-sectional data set with a total of 25,617 completed surveys across 13,538 unique respondents. The sampling of the survey was weighted towards young people: the mean age of respondents was 23.2 years (Minimum 10 years, Maximum 66 years, Standard deviation 13.3 years) and the median age was 18 years (Interquartile range 14–25 years). The dataset for each of the four waves was downloaded from the UK Data Service archive (Home Office Research, Development and Statistics Directorate 2008a; 2008b; 2008c).

For the purposes of this study, which focused on weapon-carrying by young people, the sample was restricted to respondents aged 25 years or younger (77% of the total sample) and, because the variable, ‘trust in the police’, was only introduced in 2004, the data set was restricted to waves 2, 3 and 4 (covering 2004-2006). Only the first completed survey from each respondent was included to avoid any potential panel effects; this resulted in a final eligible sample of 6,789 respondents. The pooling of data sets is common practice in the modelling of relatively rare events (such as weapon-carrying) and the use of multiple waves

was possible due to the consistent wording of questions over waves. Wave was included as a covariate in each of the models, but was not found to be a statistically significant predictor of weapon-carrying, nor did it substantially affect the relationship between weapon-carrying and any of the other variables in the models. Consequently, it was excluded from the results presented below.

Measures

Carrying a weapon. Respondents were asked if they had carried a knife or gun with them for their own protection, for use in crimes or in case they got into a fight. This was coded as a binary indicator and served as the outcome variable.

Demographic factors

Respondent *sex* was coded as a binary variable. *Age* (at the time of completion) was defined in years as a continuous variable and was centred around the mean age. An ‘age-squared’ variable was included to facilitate testing non-linearity in the relationship between age and weapon-carrying. As the distribution of *ethnicity* was heavily weighted towards white respondents, using multiple categories of ethnicity would have yielded unstable statistical models.

Consequently, a binary indicator, with ‘white’ and ‘non-white’ categories was generated.

Attitudes and dispositional factors

Recent violent behaviour was captured by asking respondents if they had committed any violent offence in the past year. This was coded as a binary

variable. *Drug use in the past year* was also a binary variable. *Trust in local police* was measured on a four-point Likert scale. The response options were “A lot”, “A fair amount”, “Not very much” and “Not at all”.

Personal victimisation factors

Violent victimisation was coded as a binary variable in response to the question “in the last 12 months has anyone used force against you on purpose, for example, scratched, hit or kicked you, or used a weapon of any sort, or been violent to you in any way?”. *Threat victimisation* was coded as a binary variable in response to the question “in the past 12 months, has anyone threatened you in a way that actually frightened you?”.

Interpersonal factors

Criminal peers was measured as a five-point Likert scale in response to the question: “Thinking about your closest friends. About how many of them, if any, have been in trouble with the police in the last 12 months? (not including driving fines)”. Response options were: “None of them”; “A few of them”; “Quite a lot of them”; “Nearly all of them”; and “All of them”. The distribution of this variable was highly positively skewed with fewer than 0.1% of respondents indicating that all of their friends had been in trouble with the police in the past year. To achieve a reasonable balance between item validity and model integrity, the variable was reduced to a four-point variable by merging “Nearly all of them” and “All of them” into a single category (“All or nearly all of them”).

Community factors

Perceived area disorder was created by summing binary responses to the perceived presence of six disorder-related issues in their area: noisy neighbours; teenagers hanging around causing problems; people sleeping rough on the streets or in other public places; people being harassed in the street because of their skin colour; people using or selling drugs; and people being drunk or rowdy in public. Brunton-Smith (2011) has shown, using the OCJS data set, that these items combined can be regarded as a single latent factor, so the scores for these variables were summed to create a single continuous factor. *Perceived neighbourhood safety* was a four-point ordinal scale. Respondents were asked “how safe would you feel walking or playing alone in this area after dark?”. The response options were “very safe”, “fairly safe”, “fairly unsafe” or “very unsafe”.

Analytic strategy

Logistic regression was used to identify predictors of weapon-carrying. To examine the cross-validity of the results, the data were split in two with years 2004 and 2005 forming the ‘training’ (n=5,994) and 2006 forming the ‘testing’ data set (n=795). This temporally-based splitting of the data was chosen to increase confidence in the future predictive value of the models. Variables were introduced in blocks and then included in a ‘full’ model that included all variables. A final ‘best’ model was developed using the guidelines for regression model development proposed by Gelman and Hill (2007).

As the analyses were exploratory and contained a large number of variables, a high threshold for statistical significance was set to reduce the risk of Type II (false positive) errors. The alpha-level was calculated using the Bonferroni-adjustment, which is $0.05/k$, where k is the total number of variables in the model. The ability of the models developed on the ‘training’ data set to predict weapon-carrying in the ‘testing’ data set was examined and these statistics are reported in Table 2 as area under the curve (AUC) statistics. The results section also reports confusion matrix statistics for the ‘best’ model to illustrate its ability of the model to identify weapon-carriers in the test data set.

Reproducibility: All analyses were undertaken using R statistical software version 3.4.3 (R Core Team 2016) through RStudio version 1.1.423 (RStudio, Inc.). R packages, ‘pscl’ (Jackman 2017) and ‘ROCR’ (Sing *et al* 2005) were employed. The R syntax used to prepare and analyse the data are available here: <https://github.com/iainbrennan/paper-syntax/blob/master/Weapon-carrying%20and%20the%20reduction%20of%20violent%20harm.R> and the data sets used (SN5374; SN5601 and SN6000) can be accessed without charge through the UK Data Service: <http://www.ukdataservice.ac.uk>.

Results

Four per cent of the respondents reported carrying a weapon at least once in the 12 months preceding their completion of the survey. Table 1 is based on the pooled 2004, 2005 and 2006 data sets and presents descriptive statistics. Table 2 describes the logistic regression models and model fit statistics used in

predicting weapon-carrying based on the pooled 2004 and 2005 'training' data set.

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Logistic regression models

In Model 1, examining the contribution of demographic factors, males were approximately three times more likely to carry a weapon than females (H1). Age and age-squared were statistically significant predictors of weapon-carrying, which indicated that a non-linear model was a good fit for the data (H2). In this model, likelihood of weapon-carrying peaked at 17.2 years. There was no statistically significant relationship between ethnicity and weapon-carrying (H3). The model accounted for around 6% of the variance in weapon-carrying. Area under the curve (AUC) statistics indicate that ability of a model using demographics alone to accurately classify respondents was modest (AUC=0.73).

Model 2 examined the role played by antisocial attitudes and dispositional factors. Respondents who had committed a violent offence in the past year were almost four times as likely to report carrying a weapon than those who were not violent (H4). Drug use (H5) in the past year was also a strong predictor of

weapon-carrying. The relationship between weapon-carrying and distrust of the police was curvilinear (H6). Respondents who had a fair amount of trust in police in their area were no more likely to carry a weapon than those who had a lot of trust in the police. Respondents who reported having not very much trust in police in their area were two and a half times and those with not trust at all were almost five times more likely to report carrying a weapon than those who had a lot of trust in the police. The model explained a reasonable proportion of the variance in weapon-carrying – 22% – but the ability of the model to correctly classify respondents was modest (AUC=0.76).

Model 3 examined the role of victimisation in predicting weapon-carrying. Having been threatened with violence (H7) and having been a victim of violence (H8) were statistically significant predictors of weapon-carrying. However, the model had a weak predictive ability (AUC=0.68) and explained only five per cent of the variance.

Model 4 examined the role of interpersonal factors on weapon-carrying and contained a single variable – delinquent peers (H9). As the proportion of a respondent's peer had been in trouble with the police in the preceding year increased, weapon-carrying likelihood increased rapidly. Respondents who had 'a few' friends who had been in trouble with the police were almost three and a half times as likely to have carried a weapon compared to those whose friends had not been in trouble with the police. Odds ratios for those who reported that 'quite a lot' and 'all or nearly all' of their friends had been in trouble were 11 and 8.7

times more likely to have carried a weapon, respectively. The wide confidence intervals suggest that the non-linearity observed in this relationship is more likely a reflection of the skewed distribution of peer delinquency than the actual relationship between the two variables. The model explained 14% of the variance in weapon-carrying and had modest predictive ability (AUC=0.71).

Model 5 explored the contribution of neighbourhood-level factors to weapon-carrying. In this model, the perceived extent of physical and social disorder in a respondent's neighbourhood predicted weapon-carrying (H10), as did respondent fear of walking alone in that neighbourhood after dark (H11). The proportion of variance explained by the model was modest and it was a modest classifier of weapon-carrying (AUC=0.68).

Model 6 - the 'full' model - contained all 14 variables. Male gender, violence and drug use, little or no trust in the police, deviant peers and area disorder were strong predictors of weapon-carrying. The model explained 33% of the variance and was a good classifier of weapon-carrying (AUC=0.87).

Model 7 describes the 'best' model. It contains nine variables. In this model, male gender, violent offending in past year, drug use in the past year, lack of trust in the police, violent victimisation and having delinquent peers were all statistically significant predictors of weapon-carrying. The model explained 32% of the variance and was a good classifier of weapon-carrying (AUC=0.87),

identifying 56% of the weapon-carriers in the testing data set (true positive=21; true negative=719; false positive=39; false negative=16).

Discussion

In summary, the risk factors for weapon-carrying among youth people in England and Wales were largely consistent with those for weapon-carrying in the international literature. Importantly, the combined characteristics of male gender, violent behaviour, drug use, little or no trust in the police, deviant peers and neighbourhood disorder identified over half of the weapon-carriers in the test data set. Although the number of weapon-carriers was relatively small, this finding indicates considerable homogeneity among weapon-carriers and holds promise for the targeting of interventions to reduce weapon-carrying among young people. In terms of explaining why young people carry weapons, this paper has demonstrated the value of a multi-levelled, social-ecological explanation of the behaviour and has shown the contribution that criminological variables, such as trust in the police, can make to existing knowledge about the predictors of this behaviour.

Males were around two and a half times more likely to carry a weapon than females; weapon-carrying was non-linearly related to age, with a peak around 17 years – slightly later than in other studies. In the demographic-only model, the relationship between ethnicity and weapon-carrying was not statistically significant. Because the paper set a high threshold for statistical significance and the sample had a relatively low representation of respondents from an ethnic minority, it is likely that the relationship between ethnicity and weapon-carrying is moderated by a number of external factors that needs to be explored in greater detail. Experiencing threats or violent victimisation were strong

predictors of weapon-carrying. However, this model explained only a small proportion of the variance when other covariates were included in the 'full' and 'best' models, none of the victimisation variables remained statistically significant. This suggests that the statistical relationship is more indicative of a victim-offender overlap than of self-defence being a direct, standalone cause of weapon-carrying. Consistent with this assertion is the observation that weapon-carrying is more strongly associated with antisocial behaviour and anti-police attitudes: violent offending and drug use in the past year and lack of trust in the police were all strong predictors of weapon-carrying. In terms of peer influence, the proportion of friends who had been in trouble with the police was a statistically significant predictor of weapon-carrying, but the relationship was non-linear, with respondents who had 'quite a lot' having greater likelihood of carrying a weapon than those who reported that 'all or nearly all' of their friends had been in trouble with the police. As hypothesised, area characteristics influenced weapon-carrying. The extent of area social disorder and the extent to which a respondent regarded their area as unsafe were statistically significant predictors of weapon-carrying although the amount of variance explained by the 'Area' model was small. Area social disorder remained a statistically significant predictor in the 'full' and 'best' models, but perceived area safety did not. Finally, there was no relationship between the year of data collection and the likelihood of weapon-carrying. This suggests that national-level factors, such as macroeconomic or legislative change had little effect on the risk factors for weapon-carrying over this very short period.

Factors relating to personal victimisation and perceived area safety predicted weapon-carrying in the more basic models but the contribution was modest when compared to the explanatory power of the variables relating to criminogenic individual-level factors such as recent offending, drug use and trust in the police and the interpersonal factor, deviant peers. Although the pseudo R-squared statistics should not be compared directly, it is difficult to dismiss the vastly superior explanatory power of the latter variables. In terms of theories of weapon-carrying, this suggests that weapon-carrying is more a reflection of a deviant or criminal lifestyle than it is a response to threat or victimisation.

However, as noted in the introduction, victim-offender dichotomies are far too simplistic: self-protection should be an important consideration for someone who plans to do violence and, someone who fears violence is probably not immune to the desire to balance the odds of success in their own favour. One potentially fruitful way to think about weapon-carrying is as a technique for reducing the uncertainty of violent encounters (Brennan 2017). For those motivated to commit violence, weapons offer a way to overcome potential resistance, a wider pool of victims, reduced exposure to police detection and both a script (Wilkinson and Fagan 1996) and a point of focus during the 'forward panic' of violence (Collins 2009).

The analysis demonstrates that weapon-carrying behaviour cannot be explained by individual, interpersonal, community or societal factors alone. Indeed, even including variables from this broad range of factors, the 'best' model could only explain around one-quarter of the variance in individual weapon-carrying and

failed to identify almost half of the weapon-carriers in the test data set.

Nonetheless, a social-ecological approach to identifying risk factors and building predictive models offers considerable potential for understanding and responding to weapon-carrying. This has strong relevance for criminological research. As noted earlier, despite efforts to integrate theories of violence, criminology research has a tendency to be theoretically-sophisticated, but focused on a single explanatory mechanism (Sampson and Lauritsen 1994). Plainly, it goes deep but not broad. By comparison, social-ecological approaches accommodate many layers of influence, but are often crude in their measurement and simplistic in their explanation of the proposed mechanism – i.e., broad but not deep. By combining perspectives to reduce the harm of crime, criminology can bring a dimension of theoretical sophistication to harm reduction research that is currently lacking, while assuming the explanatory and preventive advantages of a multi-levelled approach: both broad and deep.

The inclusion of criminological variables – particularly, trust in the police – is a step forward in the explanation of weapon-carrying behaviour. Although public health-informed models of weapon-carrying have included questions about victimisation, offending, peer influence and area safety, none to date have included all of these variables and none have included a question about trust in the police. The role of trust in the police in weapon-carrying is a valuable finding as it reveals a new mechanism through which weapon-carrying may occur.

Although young people in high-crime neighbourhoods may be ‘over-policed’ in terms of ‘stop and search’ or the prosecution of drug-related offences, they may

be 'under-policed' in terms of the protection from harm or the deterrent effect that the police offer, leading to weapon-carrying as a form of self-protection. Unfortunately, the simple language of the questionnaire item does not allow the complex dimensions of trust in the police to be unpicked. In this case, low trust in the police could reflect a perceived inability to keep all citizens safe or it could reflect perceived bad intentions towards some citizens. Undeniably, the two types of trust are correlated (Jackson and Bradford 2010), but interventions to reduce weapon-carrying based around police effectiveness or police legitimacy would probably look very different.

The role of trust in the police in the decision to carry a weapon represents an opportunity for the typical responses of public health and criminal justice to converge. As Abt (2017) has noted, public health responses to violence tend to understate the relevance of police to directly and indirectly influence prevention. If trust in the police is a driver of weapon-carrying behaviour and violent harm, then this factor needs to be included in violence prevention strategies that originate in public health and to be embedded in interventions that span the life-course, rather than after weapon-carrying has initiated or the drivers of weapon-carrying have taken hold.

Limitations

Much has changed in the lives of young people since 2004–2006 and the risk factors for weapon-carrying may be somewhat different today. In the intervening years, social media has emerged as a major form of communication and platform

for identity construction. An insult or threat to reputation can be shared far more widely and rapidly than in the past, potentially increasing the perceived need to protect one's ego and identity in the real world (Irwin-Rogers and Pinkney 2017; Patton, Eschmann and Butler 2013). Social media's popularity-driven algorithms may distort perceptions about the threat and likelihood of serious violence through availability heuristics (Kahneman and Tversky 1973) and the effect of selective exposure to information (Wood 2017), which may affect weapon-carrying decisions.

The analysis is based on cross-sectional data. Consequently, causality and the direction of the relationship between predictors and weapon-carrying cannot be inferred. In order to first identify the variables that best identify weapon-carrying behaviour, cross-sectional analyses were required. As the OCJS contains a longitudinal subsample, in future outputs it will be possible to test the relationship between predictor variables on later weapon-carrying in order to establish a temporal direction.

Conclusion

The paper identified risk factors for carrying a weapon by young people in England and Wales. Building on the existing international literature, it has demonstrated that risk factors for weapon-carrying exist across the levels of the social-ecological model and that weapon carriers can be distinguished from other respondents using relatively few characteristics. The study has shown that victimisation and concerns about personal safety are relevant to understanding

weapon-carrying, but they are outweighed by criminogenic factors such as offending behaviour, neighbourhood disorder and lack of trust in the police. The last factor represents an important new direction for future exploration and a potential avenue for intervention to reduce the harm from violence.

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Table 1. Descriptive statistics

	n	%
Weapon-carrying		
Yes	245	4.1
No	5,749	95.9
Sex		
Male	2,983	49.8
Female	3,011	50.2
Age (years)	5,994	M=16.68, SD=4.22
Ethnicity		
White	5,412	90.3
Non-white	581	9.7
Area disorder	5,994	M=1.43,SD=1.34
Area safety		
Very safe	1,111	18.6
Fairly safe	3,067	51.3
Fairly unsafe	1,241	20.7
Very unsafe	561	0.09
Violence		
Yes	999	17.19
No	4,813	82.81
Drug use		
Yes	1,163	19.85
No	4,697	81.15
Trust in the police		
A lot	1,304	22.42
A fair amount	3,161	54.35
Not very much or not at all	1,351	23.22
Victim of violence		
Yes	1,191	19.88
No	4,799	80.12
Threatened with violence		
Yes	739	12.33
No	5,253	87.77
Proportion of friends in trouble with police		
None	4,284	76.60
A few	1,309	21.6
More than a few	100	1.79

(M=mean; SD=standard deviation)

Table two. Logistic regression models

Variable (reference category)	Demographics		Antisocial		Victimisation		Deviant peers		Neighbourhood		Full model		Best model	
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI
Sex (Female): <i>Male</i>	3.41***	2.53-4.61									2.77***	1.94-3.94	2.81***	1.99-3.95
Age	2.83***	2.03-3.94									1.41	0.96-2.08	1.42	0.97-2.09
Age squared	0.97***	0.96-0.98									0.99*	0.98-1.00	0.99*	0.98-0.99
Ethnicity (White): <i>Non-white</i>	1.43	0.97-2.11									1.54	0.96-2.46	1.54	0.97-2.46
Violence in past year (No): <i>Yes</i>			4.37***	3.28-5.83							2.79***	2.02-3.87	2.85***	2.06-3.93
Drug use in past year (No): <i>Yes</i>			2.67***	1.99-3.57							2.36***	1.67-3.32	2.41***	1.71-3.38
Trust in police (A lot): <i>A fair amount</i>			1.30	0.82-2.07							1.32	0.80-2.18	1.26	0.76-2.07
<i>Not very much or not at all</i>			2.91***	1.83-4.62							2.25**	1.35-3.78	2.27**	1.36-3.79
Victim of violence (No) <i>Yes</i>					3.22***	2.46-4.22					1.33	0.92-2.02	1.54**	1.11-2.12
Threatened with violence (No) <i>Yes</i>					1.67***	1.21-2.29					1.17	0.86-1.93		
Peers in trouble with police (None): <i>A few</i>							3.51***	2.64-4.66			1.56	1.15-2.20	1.62**	1.17-2.23
<i>More than a few</i>							8.15***	4.67-14.22			2.24	1.17-4.29	2.28*	1.20-4.35
Disorder									1.49***	1.36-1.63	1.26**	1.13-1.41	1.25***	1.12-1.39
Area safety (Very safe): <i>Fairly safe</i>									0.40***	0.30-0.55	0.62	0.43-0.90		
<i>Fairly unsafe</i>									0.33***	0.22-0.49	0.63	0.39-1.02		
<i>Very unsafe</i>									0.38***	0.24-0.62	0.91	0.49-1.66		
<i>N</i>	5,993		5,526		5,988		5,593		5,980		5,218		5,228	
McFadden's R ²	0.06		0.22		0.05		0.14		0.05		0.33		0.32	
AUC	0.73		0.80		0.66		0.71		0.68		0.88		0.87	

OR: Odds ratio; 95% CI: 95% confidence interval; AUC: Area under the curve; *p<0.05; **p<0.01; ***p<0.001 (Bonferroni-adjusted)