



Home Office

An analysis of indicators of serious violence

Findings from the Millennium Cohort Study and the Environmental Risk (E-Risk) Longitudinal Twin Study

Research Report 110

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The views expressed in this report are those of the authors, not necessarily those of the Home Office (nor do they represent Government policy).

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A summary for policy and practitioners

What is this report?

- **It examines factors linked to serious violence:** There is much previous research on risk factors for crime. A limited number of UK-based studies examine factors linked to more serious types of violence like weapons carrying or use and gang conflict (labelled in this paper as serious violence linked behaviours: SVLBs). This research aims to fill that gap.
- **It uses two UK-based surveys:** The surveys are longitudinal, meaning that they follow young people over a number of years. A small proportion (under 10%) report committing SVLBs. Analysis is used to see which risk factors are more strongly associated with these behaviours. Further analysis shows the difference that using risk factors can make to identifying individuals for intervention.

What do the results show?

- **Factors most strongly associated with SVLBs in this study are:** gender, the number of siblings in the household, having experienced child maltreatment, lack of self-control, early puberty, experience of victimisation, frequency of truanting, bullying, self-harm, risk taking/gambling, feeling isolated, and having previously committed minor violence, theft, public disorder and/or cybercrime. However, these factors may not necessarily be causal so while they can be used to identify groups for intervention, addressing these factors (e.g. victimisation) will not necessarily lead to reductions in serious violence.
- **Using risk factors markedly changes the proportion of 'at risk' individuals reached by an intervention.** For example, the results suggest that not using risk factors and simply giving an intervention to all 14-year-olds would result in just 3.5% of intervention spend going to those genuinely 'at risk'. Using gender and one risk factor (e.g. an intervention to all 14-year-old males previously victimised) improves the percentage, but only marginally (to 8% in this case). Using multiple risk factors can put this measure of intervention 'reach' above 50%.

What conclusions should we draw?

- **Analysis of risk factors can make a very large difference to identifying individuals for interventions.** Many current violence prevention programmes use one or two criteria for selecting participants in intervention. This report shows that using combinations of risk factors (criteria) and using those with stronger associations can markedly increase the ability of interventions to reach those who are at most risk. We recommend the use of local research and data where possible to maximise the efficiency of identifying individuals for intervention.

- **Using risk factors, while beneficial, does have an important trade-off – not all at risk individuals will be reached.** This means that using risk factors is sensible for intensive interventions where only a small number of individuals can be reached due to cost restraints. For cases where the cost of providing to an additional individual is much lower, for example media campaigns, extensive use of risk factors is less appropriate.

Executive summary

The Serious Violence Strategy (Home Office, 2018) highlighted recent increases in homicides, gun crime and knife crime. These offences account for around 1% of all recorded crime, but their impact on society is significant. The Costs of Crime report estimates the total economic and social costs (2015/16 prices) of homicide and violence with injury at £1.8 billion and £15.5 billion respectively (Heeks *et al.*, 2018). One of the recommendations in the strategy was to pursue early intervention, given the strong evidence that it can prevent violent behaviour (Home Office, 2018, ch.2). The aim of this report is to support the roll-out of early intervention by:

- investigating, using risk factor analysis, the extent to which resources can be allocated to high-risk groups to maximise effectiveness and value for money, and the trade-offs involved;
- using logistic regression analysis with a rich set of control variables to determine which factors are associated with serious violence-linked behaviours (SVLBs), and hence adding to the evidence base on how to identify individuals for early intervention.

Data for this report comes from two surveys: the Millennium Cohort Study (MCS) and the Environmental Risk (E-Risk) Longitudinal Study. The MCS is a nationally representative study of people born in the UK in 2000 and 2001. The E-Risk study involves same-sex twins born in 1994 and 1995 in England and Wales. The advantage of using these surveys is that they are broadly representative of today's UK youth cohort (age 17 to 24).

The MCS section of the report analyses factors associated with weapon carrying/use (self-reported at age 13 to 15).¹ In our MCS sample, 317 of the 11,024 individuals (2.88%) report these behaviours. The E-Risk section looks at gang fighting and robbery in addition to weapon carrying/use (all self-reported at age 18). Descriptive statistics show that 185 of the 2,046 individuals in our E-Risk sample (9.04%) self-reported at least one of these SVLBs.

For both surveys, we investigate the relationship between the SVLBs and a rich set of other variables, including individual/family/community/educational and behavioural factors, using descriptive statistics and two methods of logistic regression (enter method and stepwise). For each survey we use three different models, which are an attempt to tailor the analysis to the practicalities of policy activity. Model 1 contains no educational or behavioural factors – it mostly contains individual and parental variables. It therefore attempts to assess the variables that would likely be available to early intervention projects without significant additional data collection and regardless of the age of the identified group. Model 2 adds (in addition to the variables included in Model 1) variables relating to school and certain types of social behaviour that might become available to projects when the child has reached school age. Model 3 adds variables that relate to anti-social behaviour (ASB), substance use and criminal activity. By

¹ Although ages 13 to 15 are referred to here, 75% of the sample were aged 14, 23% aged 13 and 2% aged 15. For this reason, the MCS sample will be referred to as age 14 in the rest of the report.

observing how the significance of indicators changes as additional characteristics are included, potential inferences may be drawn.

Key points/findings

Table 1: Indicators found to be significantly associated with weapon carrying/use self-reported at age 14 (MCS)

	Model 1	Model 2	Model 3
Gender	✓	✓	✓
Ethnicity	✗	✗	✗
Age	✗	✗	✗
Country	✗	✗	✗
Parental occupation	✗	✗	✗
Parental education	✗	✗	✗
Parental drug use	✓	✗	✗
Parental mental illness	✗	✗	✗
Frequency of arguing with mother	✓	✗	✗
Frequency of arguing with father	✓	✗	✗
Number of siblings in the household	✓	✓	✓
Parents child lives with	✗	✗	✗
Income quintiles ²	✗	✗	✗
Pubertal indicator	✓	✓	✓
Perceived area safety	✓	✗	✓
Peer behaviour	-	✗	✗
Experience of victimisation	-	✓	✓
School suspension or exclusion	-	✓	✗
Frequency of truanting	-	✓	✓
Ever hurts or picks on other children (either in person or online)	-	✓	✓
Victim of bullying	-	✗	✗
Academic self-concept	-	✗	✗
Self-harm	-	✓	✓

² A quintile is a type of quantile, which is defined as equal-sized segments (fifths) of a range.

	Model 1	Model 2	Model 3
Independence	-	✓	✗
Risk-taking	-	✓	✓
Perceived life quality	-	✗	✗
Feelings of isolation	-	✓	✓
Ever tried drugs	-	-	✗
Ever cautioned or arrested	-	-	✗
Ever stopped and questioned by the police	-	-	✗
Ever smoked	-	-	✗
Ever gambled	-	-	✓
Alcohol consumption	-	-	✗
Pushed/shoved or hit someone	-	-	✓
Committed public disorder	-	-	✓
Ever stolen	-	-	✗
Committed cybercrime	-	-	✓

Notes:

- Results presented are from the enter method – results vary slightly compared to the stepwise method. See Section 2 for the stepwise models and all indicators controlled for.
- ✓ indicates significance at 5% level.
- ✗ indicates non-significant at the 5% level.
- Variable descriptions available in Appendix A.

Table 2: Indicators found to be significantly associated with SVLB self-reported at age 18 (E-Risk)

	Model 1	Model 2	Model 3
Gender	✓	✓	✓
Mother's age at first birth	✗	✗	✗
Parental monitoring	✓	✗	✗
Father anti-social behaviour	✗	✗	✗
IQ score	✗	✗	✗
Social class	✗	✓	✓
Child experienced maltreatment	✓	✓	✓

	Model 1	Model 2	Model 3
Domestic violence in household	✗	✗	✗
Mother's anti-social personality symptoms	✗	✗	✗
Perinatal disease	✗	✗	✗
Number of children mother gave birth to	✗	✗	✗
Parental substance abuse	✗	✗	✗
Low maternal warmth	✗	✗	✗
Father marital status	✓	✓	✗
Health professional diagnosed learning/behaviour/development/mental health problem – age 10	✗	✓	✓
Ever in foster care	✗	✗	✗
Often skips school – age 12	-	✓	✗
School performance	-	✗	✗
Self-control	-	✓	✓
Bullying	-	✗	✗
Independence	-	✓	✗
Stealing	-	-	✓
Hits parent	-	-	✗
Violence	-	-	✓
Hurts people	-	-	✗
Starts fights	-	-	✗
Public disorder	-	-	✗

Notes:

- Results presented are from the enter method – results vary slightly compared to the stepwise method. See Section 3 for the stepwise models and all indicators controlled for.
- ✓ indicates significance at 5% level.
- ✗ indicates non-significant at the 5% level.
- Variable descriptions available in Appendix B.

Gender

In line with other research, results from this report suggest that being male is associated with serious violence. Headline results for the MCS analysis showed males were more likely to report SVLBs and this was also the case in the E-Risk analysis.

Age (including biological development)

This report provided only a very limited test of the association between age and SVLBs. In the MCS there was some age variation in participants, between 13 and 15, but this was generally not significantly associated with weapon carrying/use. Interestingly though, biological development (measured by body hair growth) was significantly associated with weapon carrying/use in all models tested. Age was not tested in the E-Risk study as the SVLBs were only reported by 18-year olds.

Ethnicity

This was tested using self-reported data from the MCS only and two grouped categories were examined: White and Non-white. There was no significant relationship between ethnicity and weapon carrying/use, which is in line with other UK-based research. It is not clear whether this finding extends to other types of serious violence. In this study, there was no relationship even at the bivariate level (the relationship between weapon carrying/use and ethnicity without controlling for other factors). But the Serious Violence Strategy showed a strong bivariate relationship between ethnicity and homicide victimisation/perpetration. It is unclear whether that relationship would remain significant with a full set of control variables.

Income/social class

Findings were mixed. Measures of socio-economic status (income, parental education and parental occupation) were not significant indicators of weapon carrying/use in the MCS when controlling for all other variables. However, social class was a significant indicator of SVLBs in most instances of the E-Risk analysis; individuals belonging to a lower social class were significantly more likely to engage in SVLBs than those belonging to a higher social class. This is similar to other research which found that socio-economic status is a significant indicator for gang membership, as investigated in the E-Risk analysis, but not for knife carrying.

Parental/family factors

These were tested in both surveys but the measures differed. Generally, a selection of parental/family variables were significant in Model 1 but became insignificant in Models 2 and/or 3. This was the case for parental drug use and arguing with parents in the MCS analysis, and with parental monitoring and father's marital status in the E-Risk analysis. This is consistent with (but does not prove) a narrative in which parental factors partly lead on to interim behaviours like truancy and ASB which in turn lead on to SVLBs. One exception was the number of siblings in the household, which was significant in all three models of the MCS analysis. Those with no siblings and those with four or more siblings were generally more likely to report weapon carrying/use than those with one sibling. However, a similar measure in the E-Risk analysis – total number of children born to the participant's mother – was not significant.

Neighbourhood factors

Few neighbourhood variables were tested, but the young person's perceived safety of the local area was a significant indicator of weapon carrying/use in most of the MCS analyses.

Educational factors

Truancy was tested in both surveys and generally showed a strong association with SVLBs. For example, in the MCS analysis those who truant once a week were more likely to

carry/use a weapon than those who never truanted, even when controlling for all other variables. Being excluded from school was only tested in the MCS analysis and results were slightly more mixed, although those who had been excluded were significantly more likely to carry/use a weapon than those who had not. Measures of self-reported academic/educational performance were generally not significant.

Victimisation and vulnerability

Various vulnerabilities were significantly associated with SVLBs in the MCS and E-Risk studies, both alone and when other factors were controlled for. These include victimisation, feelings of isolation, self-harm and experiences of maltreatment. For example, the MCS analysis showed that 81% of weapon carriers/users reported experiencing victimisation. This is consistent with evidence of a considerable overlap between victims and offenders of serious violence as highlighted in the Serious Violence Strategy.

Other types of risky/anti-social or criminal behaviours

Both the MCS and E-Risk analyses showed strong associations between other types of risky/anti-social/criminal behaviour and SVLBs. Those who reported impulsivity, gambling or having a high appetite for risk, along with those who self-reported minor theft and/or violence, were consistently more likely to also report SVLBs. Interestingly, those who reported cybercrimes (hacking or sending viruses) were also more likely to also report SVLBs. However, smoking, drinking and any illegal drug use (including by peers) were generally not significantly related to SVLBs once other variables were controlled for.

Policy implications

Implications for directing resources at high-risk groups

The research in this report can be used to indicate which factors to use when selecting individuals for different interventions. The factors with significant relationships (see Tables 1 and 2) and those with higher odds ratios (Tables 9, 10, 15 and 16) give an indication of how strongly each factor is associated with serious violence-linked behaviours (SVLBs).

Using the more strongly associated factors should help reach the individuals most in need of intense support. The results of the MCS analysis suggest that supplying an intervention to all of today's 14-year-olds would require treatment of around 700,000 individuals, only 3.5% (around 25,000 individuals) of whom would have carried/used a weapon (see Table 3). Risk factors (regardless of whether they actually cause SVLBs) can be used to increase the percentage of weapon carriers/users identified. For example, 63.5% of individuals with five of the structural risk factors used in Model 1 reported weapon carrying/use compared with the general population rate of 3.5%.

Generally, the results show that it is possible to identify individuals for intervention using early years factors, but identification becomes more accurate as individuals get older and more can be learned about their behaviour. Individuals with five of the non-behavioural, social or school factors had approximately 95% chance of reporting weapon carrying/use, which is 27 times higher than the general population risk. However, the findings of this report also show that there is a trade-off. The more risk factors are used to identify the most at-risk individuals, the smaller the percentage of *total* carriers/users likely to be affected by intervention (see Table 3).

Table 3: Descriptive statistics for a selection of high-risk sub-groups relative to the general population

Population	Proportion of group carrying/using a weapon (%)	National population size (age 14)*	Total weapon carriers/users captured (%)
All	3.50%	707,970	100.00%
	(3.2%,3.7%)		
Males	4.80%	365,383	71.30%
	(4%,5.6%)	(334,870 – 395,968)	(70.2%,72.2%)
Males who have started or finished growing body hair	5.40%	284,179	61.90%
	(4.4%,6.3%)	(259,259 – 309,100)	(59.5%,63.8%)
Males in bottom two income quintile	5.70%	212,816	49.20%
	(4.5%,6.9%)	(191,931 – 233,701)	(45.7%,51.7%)
Males who have ever been victimised	7.70%	182,656	57.10%
	(6.3%,9.1%)	(165,665 – 199,718)	(54.8%,58.9%)
Males whose parents at least occasionally take drugs	9.10%	24,283	9.00%
	(6.1%,11.1%)	(20,177 -28,460)	(5.3%,12.9%)
Males who have ever pushed/shoved/hit someone	9.90%	182,656	61.10%
	(8.1%,11.7%)	(136,497 – 167,152)	(58.9%,62.8%)
Males who don't live in a safe area	9.90%	26,336	10.60%
	(6.3%,13.5%)	(22,159 – 30,514)	(8% -12.6%)
Males who argue with their father at least once a week	11.30%	45,098	20.80%
	(7.6%,15.1%)	(39,151 – 51,115)	(16.3%,24.1%)
Males who have ever committed a public disorder offence	17.40%	63,930	45.40%
	(13.8%,21.1%)	(56,206 – 71,706)	(42%,47.9%)
Males who truant more than once	27.10%	17,912	19.70%
	(18.7%,35.5%)	(14,230 – 21,522)	(16%,22.5%)
Males who have been excluded	42.40%	3,327	5.70%
Model 1 selected factors	63.50%	566	1.40%
Model 3 selected factors	76.30%	2,478	7.80%
Model 2 selected factors	95%	708	2.60%

Notes:

- Model 1 includes: males who have started or finished growing body hair, argue with their father at least once a week, don't perceive that their area is safe and their parents at least occasionally take drugs.
- Model 2 includes: males who have been excluded from school, truanted more than once, have ever been victimised and have self-harmed.
- Model 3 includes: males who have truanted more than once, have self-harmed, have ever pushed/shoved or hit someone, and committed public disorder.
- 95% confidence intervals are displayed in brackets but could not be calculated for males who have been excluded and the populations with selected factors from Models 1 to 3 as the sample size was too small.

*Based on scaling up from the MCS, which is a nationally representative survey, using age 14 mid-year population estimates 2017 for the United Kingdom (Office for National Statistics, 2018a).

Policy implications for intervention activity

Parental interventions

The fact that some parental factors were significant on their own but not as other factors were added may indicate early parenting intervention will prove effective to avoid the development of later social/school or ASB/substance use/criminal behaviour. But this needs to be tested using robust evaluation. To help with that, this study has shown several interim behaviours that are significantly linked to SVLBs. This means evaluation of early years intervention does not necessarily need to take 15 to 20 years to show results. If robust reductions in interim behaviours can be demonstrated, we can probably infer an effect on SVLBs.

Educational interventions

The strong association between educational factors (truancy and exclusion) and SVLBs suggest that schools need to be an intervention target. While previous Ministry of Justice (MoJ) analysis had shown that many of those cautioned/convicted for serious violence offences have also been persistently absent or excluded, that study did not control for other factors (Ministry of Justice, 2018).³ By adding controls, this study has shown that the association is not an artefact of – for example – low income levels driving both exclusion and SVLBs. However, the findings do not allow us to determine the direction of causality. It may be that the truancy/exclusion led to SVLBs or that the SVLBs led to exclusion/truancy. Further analysis using longitudinal data from the MCS age 14 and age 17 sweeps would be able to explore causality (the age 17 data is expected to be available in early 2020).

Gang/knife carrying interventions

Our results suggest that interventions aimed at reducing gang membership may be best focused on specific geographical locations associated with social disadvantage; however, this approach may not be as beneficial for reducing weapon carrying/use, which seems to be more distributed across social groups.

Vulnerability

Many indicators of vulnerability increased the likelihood of SVLBs, so it is vital for vulnerable children to be identified early and for appropriate interventions to be in place to support these individuals. Our results also suggest that interventions that can be shown to improve self-control or reduce an appetite for risk may be effective.

Drinking/smoking and illegal drug use

Our analysis did not offer much support for the notion that interventions aimed at reducing these behaviours would also reduce SVLBs. But this was only tested at age 13 to 15. It would be interesting to see if this result holds at a later age and for other types of crime.

Limitations of this analysis

- For much of the analysis in this paper, the SVLBs and the risk factors were measured at the same age. This limits inference relating to causality. Ideally, risk factors would be

³ It is important to note that the variable definitions used in this report for 'truancy' and 'exclusion' vary slightly from the definitions used by the Department of Education for exclusion and persistent absence. See Appendices A & B for variable definitions.

measured at an earlier age. This is an important avenue for further research when findings for the same individuals at older ages become available.

- There are many different indicators of SVLBs and there are likely to be many different avenues into engaging in them. It is possible that there are other indicators which have an impact but are not captured in these analyses.
- The difference in findings between the analyses may be explained by:
 - the additional behaviours accounted for in the E-Risk analysis (gang fighting and robbery);
 - the E-Risk sample being only twins; and
 - the MCS surveying 13- to 15-year olds, whereas SVLBs in the E-Risk analysis were self-reported at age 18.
- Attrition occurred in both studies. Individuals with more chaotic lifestyles may be more likely to engage in serious violence as well as drop out of longitudinal studies. This may lead to underestimation of individuals most likely to engage in serious violence.

1 Introduction

1.1 Background: serious violence and linked behaviours

The evidence shows that after declining for around a decade, homicide, knife crime and gun crime started rising again in 2014 across most police force areas in England and Wales. Some of this increase can be attributed to improved police recording of crime but some of the increases are thought to be genuine, including a rise in offences involving knives and firearms. These increases have been accompanied by a slight shift towards younger victims and perpetrators, which highlights the importance of understanding potential indicators of SVLBs, especially at younger ages (Office for National Statistics, 2018b). There is a huge cost to victims of crime and society in general through loss of life, and the trauma caused by the physical and psychological injuries suffered. Early and effective intervention to prevent offending can help reduce the costs to victims and society from serious violent crime but requires an awareness of the risk factors so that interventions can be aimed at those most likely to go on to offend.

Focusing specifically on knife crime, national statistics demonstrate that there has been a continued rise in offences involving a knife or sharp instrument with recorded offences involving these increasing by 8% to 43,516 in the year to 31 March 2019 compared to the previous year (Office for National Statistics, 2019a). This is the highest number since the year ending 31 March 2011 (the earliest point for which comparable data are available). As the Serious Violence Strategy (Home Office, 2018) published in April 2018 highlighted, studies show that those who commit robbery and use weapons before they reach the age of 18 are much more likely to have long criminal careers than young people who commit less serious crimes. It also examined 14 systematic reviews that looked at interventions aimed at reducing aggressive behaviour in individuals aged under 21. Of the 14 reviews, 11 found that early interventions were effective in reducing violent behaviour. The most recent review by Cambridge University showed an average reduction in aggression of about 25% (Farrington *et al.*, 2017). It is therefore important to identify potential indicators linked to serious violence-related behaviours, such as weapon carrying/use, so that interventions can be designed effectively and supplied at an early stage.

1.2 Aims and structure

The aims of this paper are as follows:

- To use survey data relating to current UK youth cohorts to establish potential indicators of serious violence-linked behaviours (SVLBs); a range of individual, familial, socio-economic, school-related and behavioural indicators are tested.
- To explain the results in such a way that they can help to direct early intervention aimed at preventing serious violence.

The structure of the report is as follows. This introductory section (Section 1) concludes with a brief review of the literature on risk factors for serious violent offending and outlines how this report aims to add to the evidence base. After that, we split the methodology and results into two: one for each of our data sources. Section 2 looks at the Millennium Cohort Study (MCS), which begins with a description of the data source and the variables used in the analysis, before moving on to descriptive statistics and full regression results. It also contains some indicative statistics showing how factors can be combined to improve the efficiency of interventions. Section 3 repeats this process for the E-Risk data source, followed by Sections 4 and 5 which contain a discussion of the findings, their relevance for policy activity and a conclusion. Finally, a list of caveats and limitations of the analysis are outlined in Section 6.

The regression analyses in Sections 2 and 3 are each split into three different models. The logic for this is based on the practicalities of using these results for policy activity. The availability of information on risk factors is likely to vary by the age of the individual and the amount of data that an intervention project has available. For example, one of the factors examined in this report is persistent truancy; information might well be available to a project aimed at 10- to 14-year-olds, but not one aimed at 3- to 5-year-olds. Similarly, it might be that projects have access to educational data but not criminal justice system data or have access to neither. For these reasons, we test three models. The first one does not contain any educational or behavioural factors; it mostly contains individual and parental variables. It is our best attempt to assess the variables that would likely be available to all interventions without significant additional data collection or link-up, and regardless of the age of the identified group. In Model 2 we add in certain variables relating to school and social behaviour, for example truancy, bullying and self-reported willingness to take risks. In Model 3, we add variables that relate to anti-social behaviour (ASB), substance use and criminal activity. These include theft and violent behaviour. This structure is hopefully useful for the reality of supplying interventions to different age groups and with different data availability. But there is potentially an additional benefit. By seeing which individual and parental variables remain significant through the three models and which are mediated by behavioural factors, we hope to shed light on the relationship between these risk factors. This is explored further in the Discussion section (Section 4).

1.3 Risk factors for serious violence: brief literature review

As the Serious Violence Strategy identifies, there is a large body of research on factors that predict violence and, although the evidence base has limitations, there are some clear conclusions. These are summarised below.

Studies are consistent in finding that males commit the majority of serious violence and research has also shown that males are more likely to carry a weapon (Office for National Statistics, 2018c and McVie, 2010). Evidence from surveys also highlights that self-reported violence and weapons carrying peaks around the age of 15, but that a minority of chronic offenders continue offending beyond this age and that this group commit a large proportion of overall serious violence (Moffitt, 1993). Criminal justice system statistics show a later peak. In the latest Ministry of Justice statistics on knife and offensive weapon offences, 80% of cautions and convictions were for individuals aged 18 and over (Ministry of Justice, 2019). Evidence on

links between serious violence and ethnicity is more limited and, once other factors are controlled for, it is unclear whether ethnicity is a predictor of offending or victimisation.⁴

Aside from demographic factors, there are a range of other factors linked to perpetration and victimisation of crime and violent behaviour. Figure 1 highlights a subset of these identified as predictors of at least one form of serious violence (homicide, knife crime, gang membership) in systematic reviews, and/or longitudinal studies, or in relevant UK studies.⁵

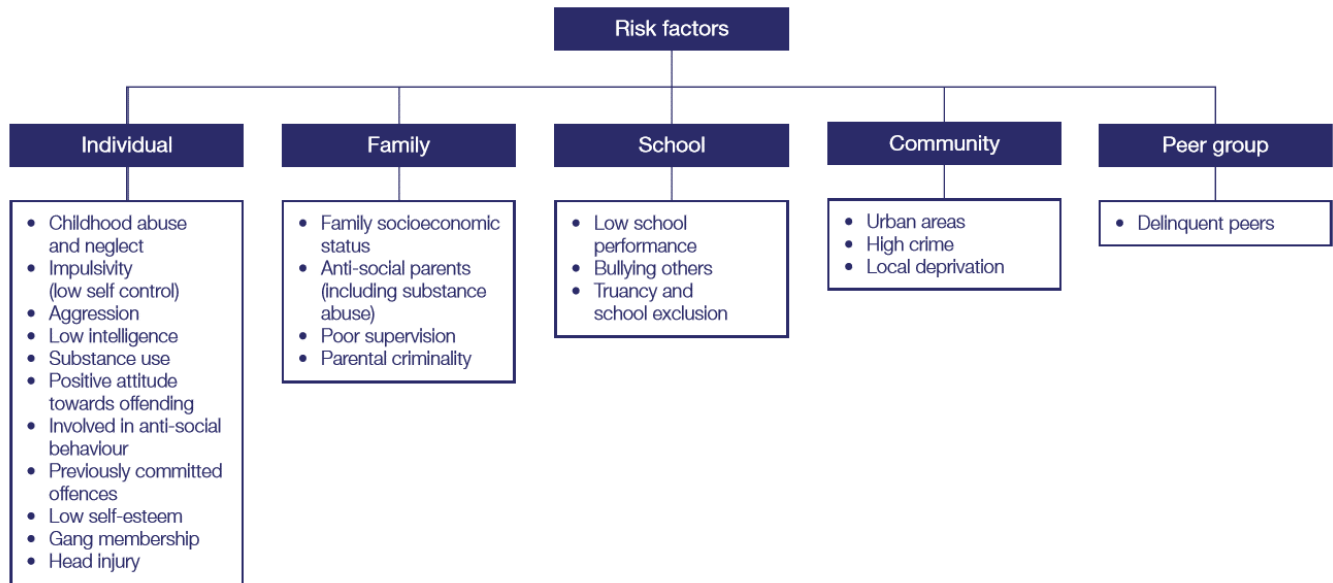


Figure 1: Identified risk factors for serious violence

Most of the research on risk factors for serious violence originates from the US, although there have been some UK-based studies. As an example, The Murder in Britain study (Dobash *et al.*, 2007) showed that out of 786 men convicted of homicide, 73% were persistent offenders before committing homicide and many had a cluster of risk factors such as those in Figure 1. A fifth began offending before the age of 13, and this group had the most chaotic backgrounds – 30% had been physically abused, 17% sexually abused and 45% had been taken into care before the age of 16. A study looking at 80 firearms offenders convicted in England and Wales, half of whom had also committed robbery, reached similar conclusions (Hales *et al.*, 2006). Most came from disrupted family environments and over half reported being excluded from school. The study also noted that gang membership and involvement in drug markets were important. Separate statistics support this conclusion – 89% of the robberies committed by a sample of arrestees were committed by current or former gang members, and gang members were also much more likely than non-gang members to be involved in drug supply offences (Bennet & Holloway, 2005).

⁴ The evidence on the links between serious violence and ethnicity is limited. One UK-based study (Brennan, 2018) suggests ethnicity was not predictive of illegal weapon carrying among 10- to 25-year-olds in England and Wales. However, a meta-analysis of mainly US-based studies (Piquero *et al.*, 2015) looking at age, sex, ethnicity and race as predictors of violent recidivism found that white ethnic groups were less likely to be involved in violent crimes after release compared to non-white ethnic groups.

⁵ See Raby & Jones (2016), O'Brien *et al.* (2013), Brennan & Moore (2009), Gerard *et al.* (2014), Farrington *et al.* (2012) and McVie (2010). See also Early Intervention Foundation & Cordis Bright Consulting (2015); the approach taken for this review differs from the EIF review in that it focused on recent systematic reviews, meta-analysis and longitudinal studies, and where possible with a focus on the UK. The main outcomes differed in that they also looked at specific violent offences such as homicide and knife crime, while the EIF report focused on youth violence and gang membership only.

Estimates from the Crime Survey for England and Wales show that in the years ending 31 March 2016 to 2018, around 28,000 children aged 10-15 self-identified as being a member of a street gang (Office for National Statistics, 2019b). An even larger number of children, estimated at just under 280,000, reported that they knew a member of a street gang over the same period. Further analysis of the Crime Survey data by the Children's Commissioner (Children's Commissioner, 2019) estimated that just over 310,000 children aged 10-17 knew someone they defined as a street gang member in the year ending 31 March 2017. Within this group they identified that 33,000 children are siblings of gang members and 34,000 children have been the victims of a violent crime in the past 12 months, and either are a gang member or know a gang member.⁶ These groups are noted as particularly vulnerable. They also combined data from youth offending teams and children's services to identify that a low proportion of children who are involved in gangs are known to the authorities (6,560 children).

They found that of the children in gangs who are assessed by children's services compared to other children referred to children's services, those in gangs were more likely to have social, emotional and mental health issues, be self-harming, have a parent or carer misusing substances, and more likely to be misusing substances themselves. Additionally, comparing children in gangs within the criminal justice system to other young offenders reveals that children in gangs are more likely not to be having their basic care needs met at home, to have witnessed domestic violence and to be missing/absent from school. Domestic violence within the household and parental substance misuse are two of the 'toxic trio' of factors which can also have negative consequences for the wellbeing and outcomes of children and are cited as being key to understanding levels of vulnerability (Brandon *et al.*, 2013; Children's Commissioner, 2017 and Children's Commissioner, 2018).

The current study will aim to add to this evidence base by further examining links between factors like school exclusion, childhood maltreatment etc. and SVLBs including weapon carrying/use, robbery and gang-related activity. Importantly, the current study will also be able to determine whether these factors remain significantly associated with SVLBs even when factors like household income are controlled for. There is some evidence that risk factors for knife carrying are slightly different to gang-related crime. A longitudinal study carried out in Edinburgh examined both gang membership and knife carrying and found some key differences (McVie, 2010). Young people who became involved in gangs were characterised by childhood disadvantage including family poverty and living in high-crime neighbourhoods. Young people who carried knives, on the other hand, had less history of disadvantage but did show other signs of vulnerability such as lack of support from parents, social isolation and tendencies towards low self-esteem and self-harm.

This may be because knife carrying is particularly susceptible to peer influence, with studies distinguishing between those who use weapons for instrumental reasons (for example to bully other young people or defend drug profits) and those who carry knives out of fear of the first group or in order to fit in with them (Dijkstra *et al.*, 2010). Research shows that fear is a predictor of knife carrying, but generally only in those who already have previous tendencies towards aggression and who feel victimised (Dijkstra *et al.*, 2012).

Studies also show that serious violent crime shares similar risk factors with other types of crime, sexual and domestic abuse, and other poor life outcomes such as low educational

⁶ See Children's Commissioner (2019) report for details of methodology.

attainment, poor health and unemployment.⁷ For example, analysis of longitudinal data from London showed that predictors of domestic violence and street violence were similar and that individuals who committed both types had the most risk factors overall (Piquero *et al.*, 2014 and Whitaker *et al.*, 2008).⁸ This means effective preventative interventions should have benefits across crime types. There is also a complex relationship between substance abuse and serious violence. The two behaviours have many of the same risk factors (Hawkins *et al.*, 1992), and substance abuse may also be a risk factor for involvement in violence, either through exposure to drug market violence or through the psychoactive effects of drugs. A recent UK-based study, involving foster youths who had exited care, looked at risk and protective factors for illicit drug use (Barn & Tan, 2015). It found that experience of homelessness and school exclusion were strong influences that predict high levels of drug use among these youths. The qualitative element to this study also highlighted that crime, drugs, exploitation and violence were problems that respondents faced.

The Ministry of Justice (MoJ) have researched the educational background of young offenders and produced research specifically focused on young knife possession offenders. They found that the knife possession offenders group (1,800 individuals who had turned 16 in the year ending 31 March 2013 and had been cautioned or convicted of a knife possession offence at some point between age 10 and 18) had lower educational attainment and were also more likely to have been persistently absent and/or excluded from school than three comparison groups. The comparison groups were: the overall population of school pupils; an 'all offenders cohort' cautioned/convicted of any offence (rather than just knife possession); and a cohort who had only committed theft offences. They were also more likely to have special educational needs (SENs) and be eligible for free school meals (Ministry of Justice, 2018). Care should be taken when interpreting these results because the associations do not imply causality and this analysis does not control for other factors, meaning that factors related to the individual's prior upbringing may be responsible for both the educational issues (poor attainment, school exclusion etc.) and the knife possession criminality. This report will add to the MoJ analysis by controlling for a variety of indicators. However, there are still limitations on what can be said regarding causality, which are outlined in the Discussion section (Section 4). In a separate paper, MoJ found similar results for offending more widely; individuals with poorer educational outcomes, or who had been excluded, or received free school meals were more associated with criminality generally than the overall population (Ministry of Justice, 2016).⁹

⁷ See Ministry of Justice & Department for Education (2016), Loeber & Farrington (2000), Seto & Lalumiere (2010) and Whitaker *et al.* (2008). However, it is important to note that there may also be distinct risk factors for certain crimes. For example, one study showed that adolescent sex offenders are five times more likely to have a history of being abused than adolescent non-sexual offenders (Seto & Lalumiere, 2010). A meta-analysis reported that compared to non-sexual offenders, child abuse offenders had more family risk factors, greater social deficits and less tendency to violence (Whitaker *et al.*, 2008).

⁸ Piquero *et al.* (2014) used longitudinal data to compare men in London who are violent within and outside the home. They found that these two groups are distinguished mostly by differences in degree than in kind, to the extent that the authors recommend that similar interventions be offered to both groups. Similarly, a meta-analysis reports that compared to non-sexual offenders, child abuse offenders had more family risk factors, greater social deficits and less tendency to violence (Whitaker, *et al.*, 2008)

⁹ This MoJ research looking at offending more widely also found that young offenders sentenced to custody had lower attainment at Key Stage (KS) 2 than those given Youth Rehabilitation Orders and Referral Orders or cautions. Young offenders given custodial sentences also had lower attainment at KS4 than those given community sentences or caution. Forty-four per cent of those given custodial sentences were known to be eligible for free school meals, and 45% of those sentenced to less than 12 months in custody were recorded as having SENs without a statement and 28% with a statement. Thirty-one per cent of those sentenced to custody for 12 months or longer were looked after and the equivalent figure for custody sentences less than 12 months was 27%. Finally, over 90% of those sentenced to custody had a previous record of being persistently absent from school, and 23% of those sentenced to less than 12 months in custody had been permanently excluded from school prior to their sentence date. For those sentenced to 12 months or longer in

Other individual characteristics have also been shown to increase the likelihood of engaging in violent crime. A US study investigated the risk for violent and nonviolent crime by investigating longitudinal associations between child and adolescent risk factors (Kalvin & Bierman, 2017). It found that the severity of child dysfunction in late childhood including aggression, emotion dysregulation and social isolation was a powerful and direct predictor of violent crime. The Edinburgh study previously mentioned also showed that individuals most engaged in bullying as perpetrators between ages of 13 and 16 years were significantly more likely to report being violent at age 17 (McVie, 2014). Bullying at age 14 has been found to predict violent convictions between ages 15 and 20, self-reported violence at ages 15 to 18, and drug use at ages 27 to 32 among other life outcomes. These results held after controlling for various risk factors such as IQ, disrupted family and low income at ages 8 to 10 (Farrington & Ttofi, 2011).

All of this research does have limitations. Factors may vary across time and place. Predictors of serious violence in the US may differ from those in the UK. Also, it is very important to stress that most people with a risk factor will not go on to commit serious violence. Figure 2 presents an example from a study in Peterborough (Wikstrom & Treiber, 2016).¹⁰ Of the 27 prolific offenders identified, 19 (70%) were from disadvantaged families, suggesting that disadvantage is a risk factor. But the vast majority of young people from disadvantaged families (255 out of 274; 93%) did not become persistent offenders.

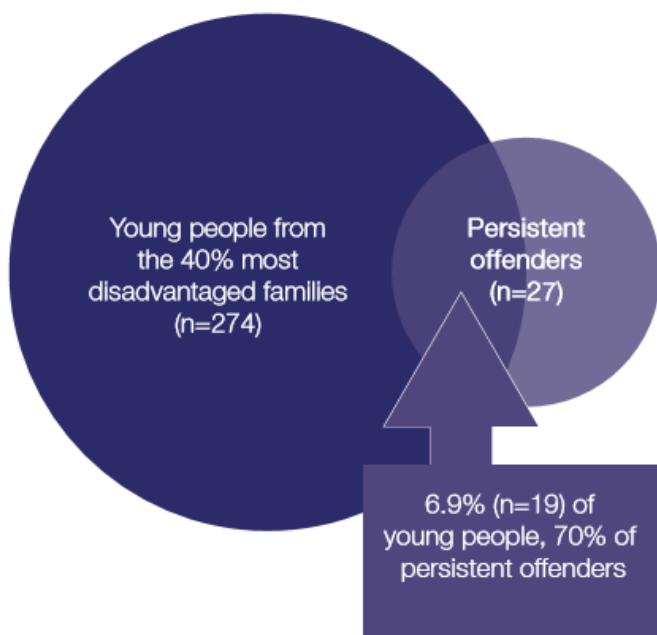


Figure 2: Venn diagram showing the overlap between disadvantage and persistent offenders

Finally, the sheer number of different risk factors and the complex relationships that exist between them means it is difficult to know exactly which factors may be causal and which are simply indicators. This makes it difficult to decide which factors to target and at which ages.

custody, 16% had a previous record of being excluded from school prior to sentencing. Again, this analysis does not imply causality. It also only presents results for a single academic year of pupils and only focuses on those sentenced in 2014.

¹⁰ Note: Certain numbers are special calculations from the Peterborough Adolescent and Young Adulthood Development Study (PADS+).

This research aims to add to the evidence base and to provide some guidance for UK policy-makers looking to reverse the current trends in serious violence. In this regard, the current study has three main advantages:

- It provides findings relating to today's cohort of young people; the MCS is a nationally representative cohort who are around 17 to 18 years old at the time of writing, while the E-Risk cohort are around 23 to 24 years old.
- Much of the previous literature in this area is US-based; the current study uses two UK-based cohorts.
- Unlike other recent UK evidence, the analysis in this study controls for a rich set of other indicators.

2 The Millennium Cohort Study

The MCS is a highly multi-disciplinary longitudinal study following a nationally representative cohort of around 19,000 children born in the UK in 2000 and 2001. This analysis is based on the 2015 wave of data collection which took place when the young people were aged around 14. In this wave, interviews were conducted with 11,884 individuals from 11,726 families. This is only 60.9% of the original sample due to attrition. All questions were answered by young people as part of an electronic questionnaire self-completed in private in their homes. Age 14 is a significant age for various reasons; mainly being a period when children are in between childhood and adulthood. During this period, many trajectories are still possible, but many are also influenced by the child's choices and behaviours at this age (Centre for Longitudinal Studies, 2018). In particular for this study, the research outlined above reveals that 14 is a crucial age for serious violence. It is close to the peak age (age 15) of self-reported weapon carrying, and seems to mark the point at which weapons carriers are separated into a minority who will go on to more serious offending, and the majority who reduce these behaviours from that point on (Moffitt, 1993).

In this report, we will examine the prevalence of weapon carrying/use in this cohort of 14-year olds and establish which indicators relate to the likelihood of carrying/using a weapon. The analysis focuses on three types of indicators: non-behavioural factors; social and school factors; and factors linked to ASB, substance use and criminal activity. The non-behavioural indicators include demographics such as gender, age and ethnicity and parent-related variables such as their education, occupation and drug use. The social and school indicators used include victimisation (verbal, physical or weapons, stealing and sexual), bullying, school exclusion and truanting. Finally, some of the ASB, substance use and criminal activity indicators used are smoking, gambling, committing cybercrime, and pushing, shoving or hitting someone.

The decision on which indicators to include was based on identifying the variables recorded in the MCS that were associated with known indicators of offending found in existing research. After all possible variables were identified, variables which were determined to align closely theoretically were grouped. A representative variable was selected from these groupings based on the correlation with the dependent variable as well as consideration for variations and variable quality. The variables were then selected into their corresponding indicators. Further details on the inclusion and exclusion of variables are provided in Appendix C. The indicators selected are a variety of types. Some, like gender, are dichotomous i.e. they are coded 1 or 0. Some, like the Father marital status (Not present, Married to maternal mother etc.) are categorical, i.e. they can be one of many categories and one variable (risk-taking) is continuous. Details of these manipulations are provided in Appendix A.

The age 17 survey is currently being carried out and data will be available in early 2020. Further analysis using data from the MCS age 14 and age 17 sweeps would allow for identification of the behaviours at age 14 that significantly predict self-reported SVLBs at age 17. It would

subsequently be possible to track the individuals in this sample to explore any progression in their SVLBs.

Respondents were asked two questions relating to weapons:

- “Have you ever carried a knife or other weapon for your own protection because someone else asked you to or in case you get into a fight?”
- “In the last 12 months have you used or hit someone with a weapon?”

These variables were combined due to the low counts of individuals reporting these behaviours. Three per cent of respondents reported ever carrying a knife or weapon and 1% reported weapon use in the previous 12 months. This analysis therefore concentrates on those who have ever carried and/or used a weapon in the previous 12 months (3% of the sample). If the respondent answered “No” to one of the questions but did not answer the other, then they were coded as ‘Missing’ to avoid making assumptions.

At the age 14 sweep, the MCS cohort contains 11,884 respondents of which 308 are twins and triplets. This analysis focuses on individuals with no siblings in the same cohort as their inclusion complicates the data manipulation for analysis. 491 cases were also classed as not applicable. The non-applicable cases are those where the parent(s) took part in the survey but the young person did not. Forty-one cases were also missing data on the dependent variable (weapon carrying/use) and a further 20 cases were excluded during model estimation. These further exclusions consisted of Missing categories where no individuals reported weapon carrying/use. In total, 860 cases were removed resulting in a dataset with 11,024 cases available for analysis. All analysis was completed using weighting and took the complex sample of the MCS into account (see Appendix C for details).

The next section displays prevalence of the chosen indicators by those who have engaged in the SVLBs and those who have not.

2.1 Self-reported weapon carrying/use at age 14 – descriptive statistics

The aim of this section is to provide some basic statistics displaying and describing the various indicators available from the MCS dataset in relation to weapon carrying/use. This will form a basis for the more complex analysis in Section 2.2. The below findings do not imply causality and do not control for other factors. See Appendix A for a full description of the indicators.

2.1.1 Non-behavioural indicators – individual-related

Table 4: Weapon carrying/use by individual-related non-behavioural indicators

Variables	Non-weapon carriers/users % (unweighted base N=10,707)	Weapon carriers/users % (unweighted base N=317)	% of group carrying/using a weapon	Unweighted base N
Gender*				
Male	50.9%	71.3%	2.5%	5,463
Female	49.1%	28.7%	1.0%	5,561
Ethnicity				
White	80.6%	83.5%	2.9%	8,778

Variables	Non-weapon carriers/users % (unweighted base N=10,707)	Weapon carriers/users % (unweighted base N=317)	% of group carrying/using a weapon	Unweighted base N
Non-white	19.4%	16.5%	0.6%	2,246
Age*				
13	23.5%	19.8%	0.7%	2,676
14	75.0%	76.1%	2.6%	8,205
15	1.4%	4.1%	0.1%	143
Country				
England	82.6%	83.1%	2.9%	7,212
Wales	5.0%	4.8%	0.2%	1,573
Scotland	8.3%	9.0%	0.3%	1,188
Northern Ireland	4.1%	3.1%	0.1%	1,051
Pubertal indicator*				
My body hair has not yet begun to grow or has barely started to grow	15.9%	9.1%	2.0%	1,671
My body hair has definitely started to grow	62.3%	65.9%	3.7%	6,756
My body hair growth seems completed	21.8%	25.0%	4.0%	2,394
Perceived area safety*				
Not safe at all or not very safe	7.2%	16.7%	7.7%	811
Very safe or safe	92.8%	83.3%	3.1%	10,221
Notes:				
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • All descriptives are weighted. 				

All of these individual-related non-behavioural indicators – except for ethnicity and country – were found to be significantly associated with weapon carrying/use. Consistent with existing research, these descriptive statistics show that there is a higher percentage of male weapon carriers/users and it appears that those carrying/using weapons are more developed in terms of puberty than non-carriers/users. Care must be taken when interpreting the age results given that this wave only focuses on those aged around 14 years old (75% of respondents), and the number of respondents aged 13 years old (23% of respondents) or 15 years old are considerably lower, especially age 15 (2% of respondents).

They also show that a higher percentage of those feeling not safe at all or not very safe around the area that they live reported weapon carrying/use whereas those who did not report weapon carrying/use were more likely to perceive their area as very safe or safe. Table 4 also shows the percentages of people within a given group who carry/use a weapon. For example, of the respondents living in an area that they perceive as not safe at all or not very safe, 7.7% of them carry/use a weapon. Ethnicity was not significantly associated with weapon carrying/use

and the descriptive statistics show that Whites were over-represented in the weapon carrying/use group relative to the overall sample.

2.1.2 Non-behavioural indicators – family-related

Table 5: Weapon carrying/use by family-related non-behavioural indicators

Variables	Non-weapon carriers/users % (Unweighted base N=10,707)	Weapon carriers/users % (Unweighted base N=317)	% of group carrying/using a weapon	Unweighted base N
Parental occupation*				
Not in work	15.1%	29.0%	6.5%	1,317
Routine and manual occupations	22.4%	18.1%	2.8%	2,063
Intermediate occupations	22.9%	21.5%	3.3%	2,430
Managerial and professional occupations	39.7%	31.4%	2.8%	4,835
Parental education*				
No qualifications	9.3%	17.2%	6.2%	766
Low grade GCSE	6.1%	8.0%	4.5%	510
GCSE A* to C	23.8%	27.4%	4.0%	2,151
A levels	13.4%	10.6%	2.8%	1,451
Degree	33.3%	28.3%	3.0%	4,043
Postgraduate	14.1%	8.6%	2.2%	1,916
Parental drug use*				
Never	93.6%	87.8%	3.3%	9,894
Occasionally or regularly	6.4%	12.2%	6.6%	579
Parental mental illness				
No	90.2%	86.2%	3.3%	10,004
Yes	9.8%	13.8%	4.8%	942
Frequency of arguing with mother*				
Never or hardly ever	44.2%	30.3%	2.4%	4,811
Less than once a week	29.4%	29.3%	3.4%	3,334
More than once a week	17.4%	19.7%	3.9%	1,916
Most days	7.5%	18.7%	8.2%	817
No mother/contact	1.5%	2.1%	4.8%	117
Frequency of arguing with father*				
Never or hardly ever	55.1%	36.3%	2.3%	6,042
Less than once a week	22.7%	19.6%	3.0%	2,611
More than once a week	9.4%	15.2%	5.5%	1,090
Most days	4.1%	12.2%	9.6%	462
No father/contact	8.7%	16.7%	6.4%	774

Variables	Non-weapon carriers/users % (Unweighted base N=10,707)	Weapon carriers/users % (Unweighted base N=317)	% of group carrying/using a weapon	Unweighted base N
Number of siblings in the household*				
0	13.9%	21.3%	5.2%	1,470
1	42.8%	35.1%	2.9%	4,855
2	25.4%	17.7%	2.5%	2,807
3	12.0%	14.8%	4.2%	1,248
4+	6.0%	11.1%	6.2%	644
Parents child lives with*				
Both natural parents	56.4%	41.2%	2.6%	7,100
Natural mother and step-parent or other parent/carer/adoptive parent	12.8%	14.0%	3.8%	1,131
Natural mother only	25.8%	38.5%	5.1%	2,405
Other	5.0%	6.2%	4.3%	388
Income quintiles*				
Lower quintile	18.5%	29.0%	5.3%	1,811
Second quintile	19.6%	22.0%	3.9%	1,841
Third quintile	20.3%	22.3%	3.8%	2,257
Fourth quintile	20.6%	15.3%	2.6%	2,567
Highest quintile	21.0%	11.4%	1.9%	2,548
Notes:				
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • All descriptives are weighted. 				

Every family-related indicator was significantly associated with weapon carrying/use except for parental mental illness. A higher percentage of weapon carriers/users had parents who were not in work and parents who generally had lower levels of education. A higher proportion of weapon carriers/users also reported having no father or no father contact and arguing with their father more compared with non-weapon carriers. For example, 8.7% of non-weapon carriers/users said that they had no father or no father contact, whereas 16.7% of weapon carriers/users reported having no father or no father contact. A higher percentage of carriers/users compared with non-carriers/users live with only their natural mother (25.8% of non-carriers/users, 38.5% of carriers/users) and a higher percentage have no siblings in the household. Finally, there appears to be a gradient in terms of income quintiles with more carriers/users in the lower quintile.

2.1.3 Social/school indicators

Table 6: Weapon carrying/use by social/school indicators

Variables	Non-weapon carriers/users % (Unweighted base N=10,707)	Weapon carriers/users % (Unweighted base N=317)	% of group carrying/using a weapon	Unweighted base N
Peer behaviour*				
No risky behaviours	45.1%	10.8%	0.8%	3,567
Some risky behaviours	49.0%	59.9%	4.0%	3,413
Many risky behaviours	6.0%	29.3%	14.5%	392
Experience of victimisation*				
No	51.2%	18.7%	1.3%	5,631
Yes	48.8%	81.3%	5.6%	5,376
School suspension or exclusion*				
Never suspended or excluded	93.3%	74.3%	2.8%	10,330
Excluded (with suspension or not)	0.4%	6.0%	32.5%	49
Suspended (not excluded)	6.2%	19.7%	10.3%	527
Frequency of truanting*				
Never	90.5%	59.5%	2.3%	10,008
Once	5.0%	10.5%	6.9%	482
Less often than once a month	2.0%	7.9%	12.5%	243
Once a month	0.9%	6.3%	19.9%	87
Once a week	0.4%	8.6%	42.4%	68
2 to 3 times a week or most days	1.1%	7.1%	18.3%	120
Ever hurts or picks on other children (either in person or online)*				
No	66.5%	31.1%	1.7%	7,333
Yes	33.5%	68.9%	6.9%	3,689
Victim of bullying*				
No	44.3%	28.8%	2.3%	4,837
Yes	55.7%	71.2%	4.4%	6,187
Academic self-concept*				
Poorer view of academic capability	15.5%	24.4%	5.3%	1,669
Better view of academic capability	84.5%	75.6%	3.1%	9,355
Self-harm*				
No	85.4%	58.6%	2.4%	9,367
Yes	14.6%	41.4%	9.3%	1,610
Independence*				
No	74.3%	38.1%	1.8%	8,175

Variables	Non-weapon carriers/users % (Unweighted base N=10,707)	Weapon carriers/users % (Unweighted base N=317)	% of group carrying/using a weapon	Unweighted base N
Yes	25.7%	61.9%	8.0%	2,833
Perceived life quality*				
Good	16.7%	8.1%	1.7%	1,851
Average	79.1%	79.9%	3.5%	8,650
Poor	4.2%	12.0%	9.3%	433
Feelings of isolation*				
No	86.4%	66.1%	2.6%	9,503
Yes	13.6%	33.9%	8.1%	1,461
Notes:				
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • Parental mental illness was borderline not significant (0.053). • All descriptives are weighted. 				

All the behavioural indicators in Table 6 were significantly associated with weapon carrying/use. Vulnerabilities such as being a victim of bullying, victimisation, self-harm and feeling isolated were more prevalent among weapon carriers/users. Strikingly, 81.3% of weapon carriers/users reported being victimised, compared with 48.8% of non-carriers/users. Additionally, 41.4% of weapon carriers/users reported self-harming, whereas only 14.6% of non-carriers/users reported self-harming. The variables related to education show that carriers/users reported being excluded or suspended more than non-carriers/users and they also reported greater truanting. In terms of academic self-concept, more carriers/users reported a poorer view of their own academic capability than non-carriers/users.

Table 7: Weapon carrying/use by experiences of victimisation

	Non-weapon carriers/users % (Unweighted base N=10,707)	Weapon carriers/users % (Unweighted base N=317)
Insulted, called names, threatened or shouted at*	42.6%	72.5%
Experienced physical violence (pushed, shoved, hit, slapped, punched)*	21.8%	62.1%
Hit with or had a weapon used against them*	2.5%	30.9%
Had something stolen*	7.1%	26.4%
Had an unwelcome sexual approach or been sexually assaulted*	2.5%	11.9%
Notes:		
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • See Appendix E for % of group carrying/using a weapon and unweighted bases. 		

Table 7 examines the components of the victimisation indicator more closely and highlights the overlap between weapon carrying/use and experiencing victimisation. Despite differences in

severity across these types of victimisation, prevalence was consistently higher for weapon carriers/users than non-weapon carriers/users. Around a third of respondents who have been hit with or had a weapon used against them also self-reported weapon carrying/use. However, from this we cannot say for certain whether the victimisation caused the individual to carry/use a weapon or vice versa.

Table 8: Means for risk-taking

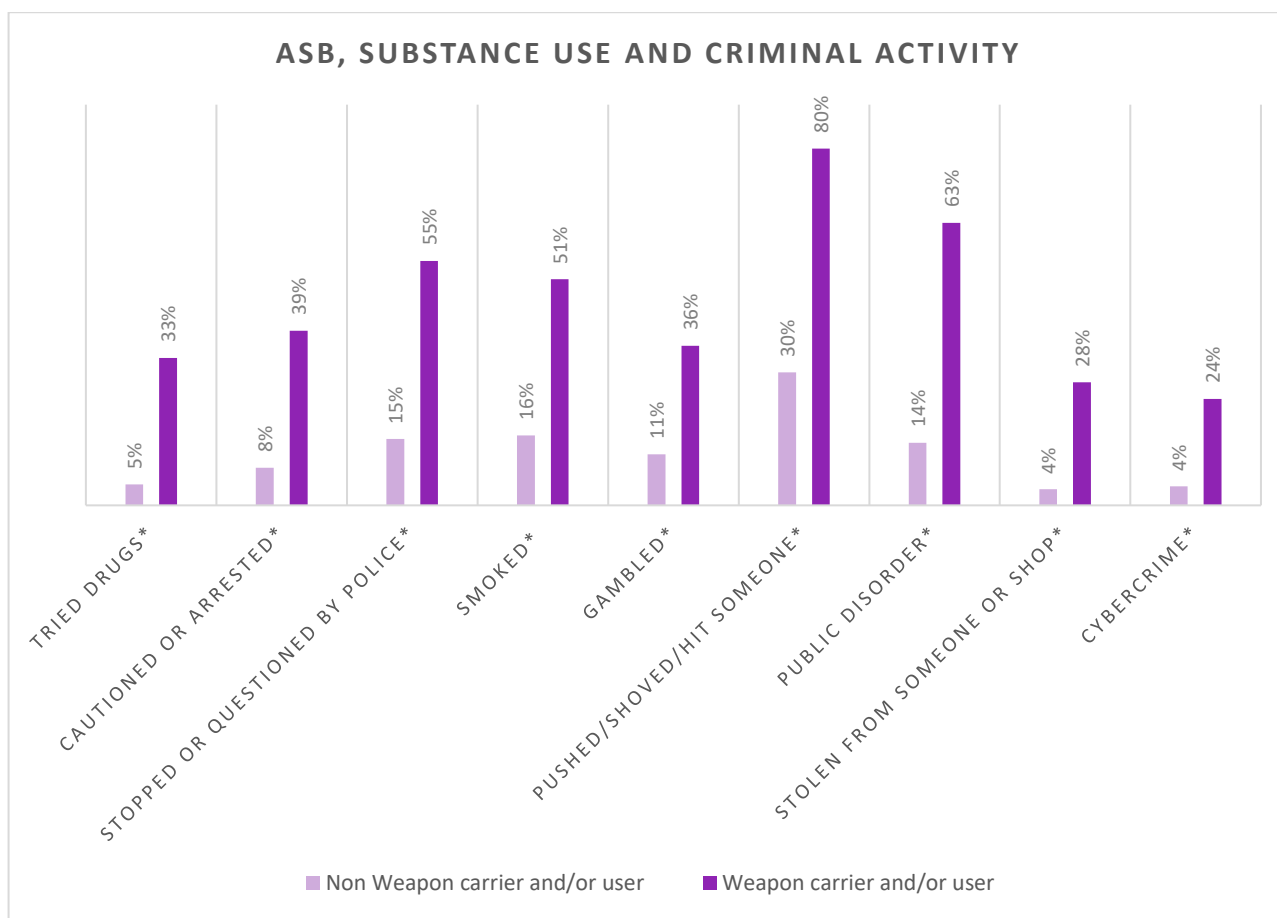
	Non-weapon carriers/users (Unweighted base N=10,707)	Weapon carriers/users (Unweighted base N=317)
Risk-taking*	6.08 (0.03)	7.39 (0.14)

Notes:

- Figures represent means and (standard errors).
- Missing cases were imputed.
- * indicates significance at 5% level.
- All descriptives are weighted.

The means displayed in Table 8 demonstrate that weapon carriers/users reported being more willing to take risks than non-carriers/users and this variable was significantly associated with weapon carrying/use.

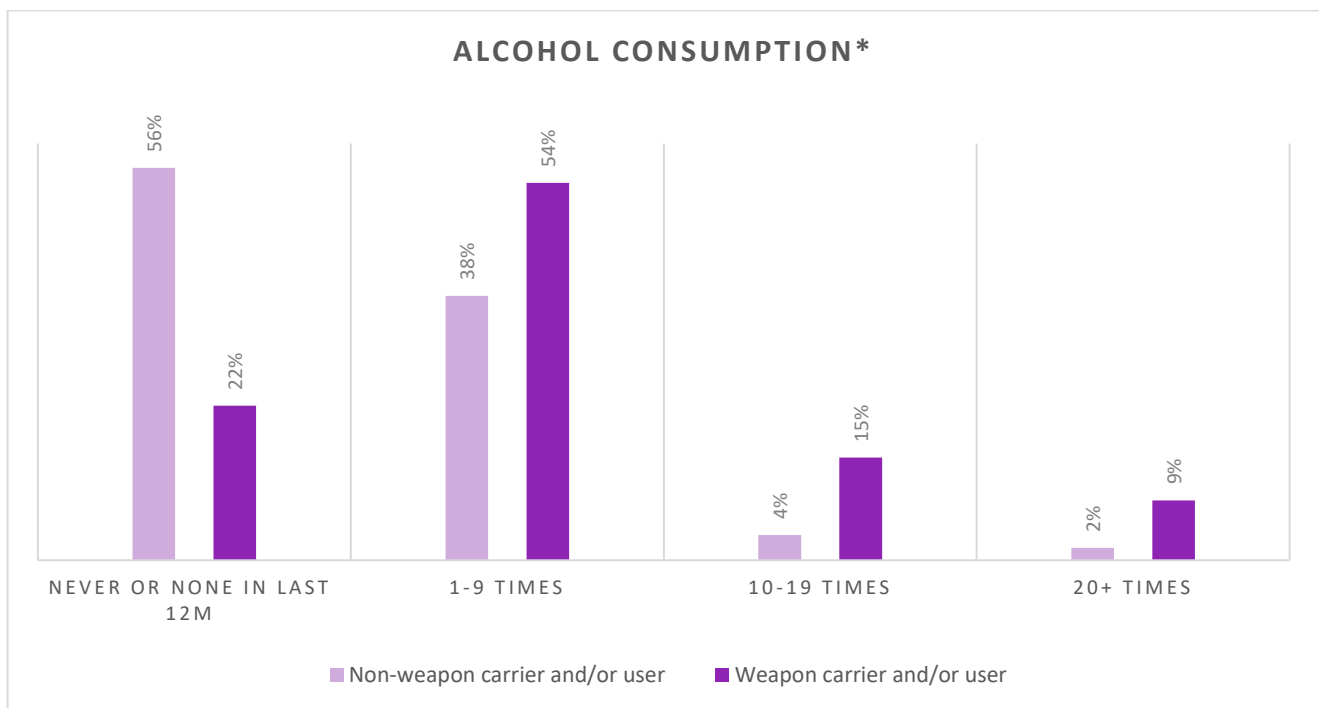
2.1.4 ASB, substance use and criminal activity indicators



Notes:

- Missing cases were excluded when calculating the percentages and significance tests.
- * indicates significance at 5% level.
- All descriptives are weighted.
- See Appendix E for % of group carrying/using a weapon and unweighted bases.

Figure 3: Weapon carrying/use by ASB, substance use and criminal activity



Notes:

- Missing cases were excluded when calculating the percentages and significance tests.
- * indicates significance at 5% level.
- All descriptives are weighted.
- See Appendix E for % of group carrying/using a weapon and unweighted bases.

Figure 4: Weapon carrying/use by alcohol consumption

The descriptive statistics visualised in Figure 3 and Figure 4 show that engaging in ASB, substance use or criminal activity are consistently more prevalent among those involved with weapons than those who are not involved. As an example, 80% of those who have carried/used a weapon reported pushing, shoving or hitting someone, whereas 30% of those who have not carried/used a weapon reported this behaviour. Additionally, those involved with weapons also reported higher alcohol consumption. All indicators were significantly associated with carrying/using a weapon.

2.2 Self-reported weapon carrying/use at age 14 – logistic regression models

Logistic regression models were used to identify the indicators significantly associated with weapon carrying/use while controlling for other indicators. The analysis looks at three models. The first model regresses weapon carrying/use on the non-behavioural indicators such as demographics and parent-related indicators as control variables. In the second model, social and school characteristics such as school exclusion and bullying were added. After controlling for these indicators, the final model adds a range of ASB, substance use and criminal activity indicators for example, drinking alcohol, hitting, pushing or shoving someone and committing cybercrime. The indicators were grouped into these three different categories and the models were estimated hierarchically to analyse the effect of the indicators after controlling for other indicators. This allowed us to see whether non-behavioural indicators such as the number of siblings in the respondent’s household remained significantly associated with weapon carrying/use once behavioural indicators such as truanting and risk indicators such as alcohol

consumption were controlled for. See Section 1.2 for more details on why we adopted the three-model structure.

The logistic regression models were estimated using two different variable selection methods – the enter method and the stepwise selection method (see Appendix C for details of these methodologies). The enter method was estimated with a maximum number of cases (N=11,024), retaining a maximum number of missing cases (which were treated as a separate category in the models). The stepwise method was estimated using a smaller number of cases (N=10,689) whereby missing cases were only included as a separate category if there were at least 30. The models were estimated using weights and took the complex sample design into account.

Odds ratios (OR) are reported for the models and * is used to indicate significance at the 5% level (see Appendix D for full models). Ninety-five per cent confidence intervals for the estimates are also provided. An odds ratio greater than one indicates higher odds of weapon carrying/use relative to the reference category, whereas an odds ratio less than one indicates lower odds of weapon carrying/use relative to the reference category. Therefore, larger ORs indicate more powerful indicators than ORs closer to one. For example, Table 9 shows that across the three models, males consistently have over twice the odds of carrying/using a weapon compared to females.

While a wide range of indicators are controlled for, care must be taken when interpreting the findings as the associations shown cannot be interpreted as causal because, even though we have included a very rich set of control variables, it is still possible that there may be other unobserved factors affecting the outcome (weapon carrying/use) and the regressors (indicators). Additionally, the outcome and regressors are both reported at age 14 so it is not possible to say, for example, that smoking is a predictor of later weapon carrying/use. Only 3% of respondents reported weapon carrying/use which must also be considered when interpreting the results.

Table 9: Logistic regression of reported weapon carrying/use (enter method)

	Model 1		Model 2		Model 3	
Independent variable	OR	95% CI ¹¹	OR	95% CI	OR	95% CI
Male	3.35*	(2.28,4.92)	4.10*	(2.65,6.34)	2.74*	(1.69,4.44)
Ethnicity (reference category: White)						
Non-white	0.75	(0.50,1.12)	0.86	(0.56,1.32)	0.83	(0.51,1.35)
Age (reference category: 13)						
14	1.13	(0.80,1.58)	1.03	(0.69,1.55)	0.92	(0.59,1.42)
15	2.90*	(1.21,6.98)	2.86*	(1.16,7.03)	2.72*	(1.09,6.77)
Country (reference category: England)						
Wales	0.89	(0.64,1.25)	0.9	(0.62,1.31)	0.98	(0.67,1.44)
Scotland	1.04	(0.66,1.63)	0.86	(0.54,1.37)	0.78	(0.47,1.28)

¹¹ Confidence intervals

	Model 1		Model 2		Model 3	
Northern Ireland	0.7	(0.44,1.10)	0.71	(0.45,1.13)	0.66	(0.42,1.06)
Parental occupation (reference category: Managerial and professional occupations)						
Intermediate occupations	0.96	(0.64,1.45)	0.99	(0.63,1.56)	1.04	(0.65,1.66)
Routine and manual occupations	0.7	(0.42,1.16)	0.78	(0.44,1.38)	0.98	(0.54,1.76)
Not in work	1.18	(0.64,2.18)	1.67	(0.87,3.21)	1.79	(0.92,3.47)
Parental education (reference category: Postgraduate)						
Degree	1.16	(0.73,1.85)	1.11	(0.65,1.91)	1.19	(0.71,2.01)
A levels	0.93	(0.49,1.77)	0.94	(0.47,1.89)	0.86	(0.43,1.71)
GCSE A* to C	1.21	(0.68,2.17)	1.19	(0.62,2.28)	1.13	(0.57,2.25)
Low grade GCSE	1.32	(0.60,2.91)	1.49	(0.66,3.38)	1.43	(0.60,3.41)
No qualifications	1.96	(1.00,3.83)	2.36*	(1.13,4.94)	2.54*	(1.18,5.46)
Parental drug use (reference category: Never)						
Occasionally or regularly	1.81*	(1.00,3.27)	1.39	(0.80,2.44)	1.4	(0.74,2.63)
Parental mental illness	0.98	(0.61,1.58)	0.85	(0.49,1.47)	0.86	(0.48,1.56)
Frequency of arguing with mother (reference category: Never or hardly ever)						
	*					
Less than once a week	1.38	(0.88,2.17)	0.98	(0.63,1.54)	0.85	(0.54,1.33)
More than once a week	1.31	(0.79,2.17)	0.59*	(0.35,0.98)	0.49*	(0.27,0.87)
Most days	2.39*	(1.42,4.05)	0.78	(0.44,1.38)	0.6	(0.32,1.10)
No mother/contact	1.61	(0.39,6.57)	1.2	(0.33,4.41)	1.06	(0.30,3.71)
Frequency of arguing with father (reference category: Never or hardly ever)						
	*					
Less than once a week	1.28	(0.86,1.92)	1.13	(0.74,1.73)	1.11	(0.71,1.72)
More than once a week	2.37*	(1.30,4.33)	1.49	(0.83,2.68)	1.54	(0.82,2.90)
Most days	2.54*	(1.48,4.36)	1.33	(0.76,2.30)	1.29	(0.74,2.27)
No father/contact	1.85*	(1.14,2.99)	1.26	(0.73,2.15)	1.2	(0.68,2.13)
Number of siblings in the household (reference category: One)						
	*		*		*	
None	1.70*	(1.05,2.77)	2.01*	(1.18,3.41)	1.68	(0.94,3.03)
Two	0.82	(0.55,1.22)	0.86	(0.56,1.31)	0.86	(0.56,1.32)
Three	1.24	(0.78,1.99)	1.36	(0.83,2.23)	1.32	(0.78,2.25)
Four or more	1.99*	(1.13,3.49)	2.24*	(1.21,4.13)	2.26*	(1.16,4.40)
Parents child lives with (reference category: both natural parents)						

	Model 1		Model 2		Model 3	
Natural mother and step-parent or other parent/carer/adoptive parent	1.06	(0.65,1.72)	0.9	(0.52,1.55)	0.81	(0.47,1.39)
Natural mother only	1.32	(0.82,2.11)	1.04	(0.63,1.74)	0.99	(0.58,1.69)
Other	0.98	(0.36,2.63)	0.68	(0.28,1.70)	0.79	(0.33,1.92)
Income quintiles (reference category: Lower quintile)						
Second quintile	0.89	(0.55,1.45)	0.88	(0.53,1.46)	0.85	(0.48,1.50)
Third quintile	1.03	(0.55,1.93)	1.34	(0.68,2.67)	1.37	(0.67,2.82)
Fourth quintile	0.76	(0.38,1.49)	1.23	(0.62,2.42)	1.19	(0.60,2.36)
Highest quintile	0.57	(0.26,1.25)	1.04	(0.46,2.34)	1.15	(0.48,2.71)
Pubertal indicator (reference category: Body hair not begun to grow or barely started)	*		*		*	
My body hair has definitely started to grow	2.04*	(1.33,3.12)	1.91*	(1.20,3.03)	1.77*	(1.10,2.86)
My body hair growth seems completed	3.41*	(2.05,5.68)	2.56*	(1.46,4.49)	2.17*	(1.22,3.86)
Perceived area safety (reference category: Very safe or safe)						
Not safe at all or not very safe	2.06*	(1.34,3.17)	1.47	(0.94,2.29)	1.59*	(1.04,2.43)
Peer behaviour (reference category: No risky behaviours)						
Some risky behaviours	-		2.11*	(1.10,4.05)	1.34	(0.66,2.75)
Many risky behaviours	-		2.53*	(1.15,5.60)	1.1	(0.49,2.46)
Experience of victimisation	-		2.74*	(1.84,4.09)	1.87*	(1.24,2.82)
School suspension or exclusion (reference category: Never suspended or excluded)			*			
Excluded (with suspension or not)	-		5.95*	(1.99,17.74)	3.40*	(1.27,9.12)
Suspended (not excluded)	-		1.48	(0.83,2.62)	1.2	(0.63,2.30)
Frequency of truanting (reference category: Never)			*		*	
Once	-		1.1	(0.59,2.05)	0.98	(0.53,1.80)
Less often than once an month	-		2.17*	(1.22,3.87)	1.43	(0.81,2.52)
Once a month	-		3.92*	(1.46,10.54)	2.08	(0.73,5.96)
Once a week	-		8.43*	(3.74,19.03)	6.05*	(2.80,13.10)
2 to 3 times a week or most days	-		1.87	(0.84,4.17)	1	(0.44,2.30)
Ever hurts or picks on other children (either in person or online)	-		2.34*	(1.56,3.51)	1.64*	(1.03,2.59)
Victim of bullying (reference category: Yes)	-		1.42	(0.90,2.22)	1.31	(0.84,2.05)

	Model 1		Model 2		Model 3	
Academic self-concept (reference category: Better view of academic capability)	-		1.21	(0.84,1.73)	1.06	(0.72,1.56)
Self-harm	-		2.70*	(1.81,4.03)	2.39*	(1.55,3.69)
Independence	-		1.88*	(1.37,2.59)	1.16	(0.80,1.67)
Takes risk			1.25*	(1.15,1.35)	1.13*	(1.04,1.23)
Perceived life quality (reference category: Good)						
Average	-		1.39	(0.85,2.28)	1.46	(0.86,2.48)
Poor	-		1.59	(0.75,3.37)	1.78	(0.83,3.79)
Feelings of isolation	-		1.73*	(1.19,2.53)	1.85*	(1.27,2.69)
Ever tried drugs	-		-		1.54	(0.97,2.46)
Ever cautioned or arrested	-		-		1.25	(0.75,2.10)
Ever stopped and questioned by the police	-		-		1.39	(0.89,2.17)
Ever smoked	-		-		1.02	(0.66,1.60)
Ever gambled	-		-		1.74*	(1.24,2.44)
How many times have you drunk in the last 12 months (reference category: Never or none in last 12 months)						
1 to 9 times	-		-		1.46	(0.86,2.47)
10 to 19 times	-		-		1.95*	(1.05,3.61)
20 or more times	-		-		1.4	(0.63,3.10)
Ever pushed/shoved or hit someone	-		-		2.38*	(1.47,3.86)
Ever committed public disorder	-		-		2.26*	(1.53,3.32)
Ever stolen from someone or a shop	-		-		1.49	(0.98,2.28)
Ever committed cybercrime	-		-		1.99*	(1.37,2.88)

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- * indicates significance at 5% level.
- - indicates variable not in model.
- Where not stated, reference category is 'No'.
- Risk-taking is a continuous variable.
- Age was borderline not significant in all three models 0.059, 0.057, and 0.050. School suspension or exclusion in Model 3 was also borderline not significant 0.051. Peer behaviour in Model 2 was also borderline not significant 0.052.
- All analyses are weighted.

Table 9 presents the results for the regression models examining the associations of a range of indicators with self-reported weapon carrying/use. These models estimate the various effects of the chosen indicators on the probability that a person will carry/use a weapon.

Model 1

As expected, Model 1 shows that males had over three times the odds of carrying/using a weapon than females and this gender difference was consistent across the three models and one of the strongest effects. In every model, ethnicity continued not to be significantly associated with weapon carrying/use which is similar to other research suggesting that once other factors are controlled, ethnicity does not have a significant relationship with weapon carrying/use (Brennan, 2018). Respondents whose parent(s) have used recreational drugs in the past year had nearly twice the odds of carrying/using a weapon than those whose parents had not. Also, indicators for parental relationship were significantly associated with weapon carrying/use (arguing with mother and arguing with father). Respondents arguing most days with their mother or father had over twice the odds of carrying/using a weapon than those who never or hardly ever argue with them. Interestingly, there is a significant difference between those who have their father present and never or hardly ever argue with them and those who have no father present or no contact with them. Those with no father present or no contact with them had nearly twice the odds of carrying/using a weapon. This same association does not hold for mothers, but this may be due to a lower count of individuals with no mother present or no mother contact. The number of siblings in the household was also a significant indicator. Specifically, those with no siblings compared to one sibling had nearly twice the odds as did those who had four or more siblings compared to only one. This finding relating to four or more siblings held across the three models.

The variable indicative of puberty (amount of body hair) showed that those who reported that their body hair growth seems completed had over three times the odds of carrying/using than those whose body hair had not begun to grow or barely started. This difference was significant across the three models and another strong effect. Finally, area safety was also a significant indicator and respondents who perceived their area as not safe at all or not very safe were more likely to carry/use a weapon than those who perceived it as very safe or safe.

Model 2

Model 2 showed gender, the number of siblings in the household and pubertal status to be significant indicators, which is consistent with Model 1. This demonstrates that some biological factors are important regardless of behaviour. However, the addition of social and school indicators changed the association of parent drug use, arguing with parents and perceived area safety. One possible explanation for the changing significance of parental indicators is that some of the indicators featuring in Model 2 such as self-harm and independence may have resulted from this initial parent relationship. In other words, there may be a causal chain relationship in which parental factors lead to these interim behavioural factors which in turn lead on to weapon carrying/use. Consistent with the Edinburgh study findings (McVie, 2014), Model 2 found that young people who carried/used weapons (including knives) showed signs of vulnerability, such as social isolation and self-harm. Carriers/users were also more likely to have been victimised and bullied someone (in person or online).

However, two of the strongest effects in this model came from educational indicators. Individuals who had been excluded from school had nearly six times the odds of carrying/using a weapon than those who had not been suspended or excluded. Additionally, truancy was found to be a significant indicator with individuals who truant once a week having over eight times the odds of carrying/using than those who have not truant in the last year. This indicator generally follows a gradient whereby increased truancy increases the odds of

carrying/using; however, the final category “2 to 3 times a week or most days” stands out as not following this gradient, which may be because of a lack of variation in this category. It is important to note that there is no significant difference between this group and the group who have not truanted. In this model, the category indicative of individuals whose parents have no qualifications becomes significant and demonstrates that these individuals have over twice the odds of carrying/using a weapon than individuals who have a parent or parents with a postgraduate qualification. This significant difference also holds when ASB, substance use and criminal activity indicators are added to the model. Independence and risk-taking were also significant indicators.

Model 3

In line with the previous two models, gender, the number of siblings in the household and pubertal status remained significant even when accounting for risky behaviours. Additionally, victimisation, truanting, being a bully, self-harm, risk-taking and isolation remained significant in this model as they were in Model 2.

Focusing on the behaviours that were added in this final model: gambling, pushing, shoving or hitting someone, public disorder and committing cybercrime were found to be significantly associated with weapon carrying/use. Those who have been involved with these types of minor violence (pushing, shoving or hitting) had over twice the odds of carrying/using a weapon than those who have not been involved. Individuals who have committed cybercrime (including hacking and sending viruses) had nearly twice greater odds of carrying/using a weapon than those who have not committed cybercrime.

The significant difference between those who have been excluded and those who have not been suspended or excluded remains (though the odds are lower compared to Model 2); however, this finding should be treated with caution as the overall variable is borderline not significant ($p=0.051$). It is also interesting that although perceived area safety became non-significant in Model 2, Model 3 shows this indicator to be significant (although this effect is not as strong as in the first model). Areas that are more unsafe may impact upon the behaviours that individuals living there engage in, therefore when these behaviours are controlled for, area safety is not a significant indicator. However, the ASB, substance use and criminal activity indicators introduced may be more influential within unsafe areas. Further analysis would be needed to understand this changing association. Finally, despite no general significance for alcohol consumption, there is a significant difference between those who have never consumed alcohol or have not in the past 12 months, and those who have had alcohol 10 to 19 times in the past 12 months who have nearly twice the odds of weapon carrying/use compared to the non-consumption group.

Some indicators were not significant in general across any of the models. A number of these were parent- and family-related: parent occupation, parent education, parental mental illness, income and the parents child lives with. However, some were individual-related: age, peer behaviour, victim of bullying, academic self-concept, perceived life quality, drug taking, police contact, smoking, alcohol consumption and stealing. Country was also not a significant indicator suggesting that there are no significant differences across the different countries in the United Kingdom. Income, parent education and parent occupation were not significant in any of the models, suggesting that socio-economic status is not an important indicator for weapon carrying/use once other variables are controlled for.

Table 10: Logistic regression of reported weapon carrying/use (stepwise method)

Independent variable	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Male	3.51*	(2.30,5.36)	4.08*	(2.40,6.95)	3.14*	(1.91,5.18)
Age (reference category: 13)					*	
14	1.10	(0.77,1.57)	1.03	(0.68,1.54)	0.89	(0.59,1.34)
15	3.15*	(1.24,8.03)	3.27*	(1.22,8.78)	3.03*	(1.24,7.38)
Parental education (reference category: Postgraduate)					*	
Degree					1.3	(0.79,2.14)
A levels					0.94	(0.49,1.81)
GCSE A* to C					1.24	(0.67,2.30)
Low grade GCSE					1.89	(0.86,4.14)
No qualifications					2.87*	(1.41,5.82)
Parental drug use (reference category: Never)						
Occasionally or regularly	2.01*	(1.15,3.52)				
Frequency of arguing with mother (reference category: Never or hardly ever)	*					
Less than once a week	1.33	(0.83,2.14)				
More than once a week	1.22	(0.70,2.11)				
Most days	2.38*	(1.36,4.17)				
No Mother/contact	1.64	(0.41,6.48)				
Frequency of arguing with father (reference category: Never or hardly ever)	*					
Less than once a week	1.34	(0.88,2.03)				
More than once a week	2.61*	(1.36,5.00)				
Most days	2.98*	(1.75,5.07)				
No father/contact	1.96*	(1.18,3.25)				
Number of siblings in the household (reference category: One)	*		*		*	
None	1.83*	(1.13,2.97)	2.24*	(1.34,3.75)	1.95*	(1.12,3.41)
Two	0.92	(0.62,1.37)	0.88	(0.57,1.34)	0.89	(0.59,1.34)
Three	1.49	(0.95,2.35)	1.42	(0.84,2.40)	1.29	(0.77,2.18)
Four or more	2.44*	(1.43,4.17)	2.31*	(1.30,4.12)	2.03*	(1.07,3.84)

	Model 1		Model 2		Model 3	
Parents child lives with (reference category: Both natural parents)	*					
Natural mother and step-parent or other parent/carer/adoptive parent	1.18	(0.73,1.92)				
Natural mother only	1.86*	(1.21,2.87)				
Other	1.14	(0.40,3.24)				
Pubertal indicator (reference category: Body hair not begun to grow or barely started)	*		*		*	
My body hair has definitely started to grow	2.41*	(1.56,3.71)	2.19*	(1.36,3.53)	1.93*	(1.21,3.09)
My body hair growth seems completed	4.05*	(2.35,6.97)	2.99*	(1.63,5.50)	2.56*	(1.39,4.72)
Perceived area safety (reference category: Very safe or safe)						
Not safe at all or not very safe	2.20*	(1.45,3.35)	1.67*	(1.10,2.52)	1.56*	(1.03,2.36)
Peer behaviour (reference category: No risky behaviours)						
Some risky behaviours	-		1.95*	(1.03,3.68)		
Many risky behaviours	-		2.51*	(1.14,5.51)		
Experience of victimisation	-		2.54*	(1.71,3.79)	1.96*	(1.27,3.05)
School suspension or exclusion (reference category: Never suspended or excluded)			*			
Excluded (with suspension or not)	-		6.43*	(2.22,18.67)		
Suspended (not excluded)	-		1.54	(0.84,2.83)		
Frequency of truanting (reference category: Never)			*		*	
Once	-		1.49	(0.80,2.79)	1.21	(0.64,2.30)
Less often than once a month	-		2.25*	(1.28,3.96)	1.58	(0.89,2.81)
Once a month	-		4.18*	(1.50,11.62)	2.31	(0.83,6.42)
Once a week	-		9.05*	(3.63,22.54)	5.55*	(2.13,14.45)
2 to 3 times a week or most days	-		2.11	(0.89,4.98)	1.31	(0.59,2.90)
Ever hurts or picks on other children (either in person or online)	-		2.03*	(1.33,3.10)	1.47	(0.93,2.33)
Self-harm	-		2.47*	(1.68,3.62)	2.49*	(1.66,3.71)
Independence	-		1.95*	(1.41,2.69)		
Risk-taking			1.21*	(1.11,1.32)	1.10*	(1.01,1.20)
Feelings of isolation	-		1.66*	(1.13,2.45)	1.83*	(1.26,2.66)
Ever tried drugs	-		-		1.65*	(1.06,2.56)

	Model 1		Model 2		Model 3	
Ever stopped and questioned by the police	-		-		1.66*	(1.09,2.51)
Ever gambled	-		-		1.79*	(1.25,2.56)
Ever pushed/shoved or hit someone	-		-		2.55*	(1.56,4.16)
Ever committed public disorder	-		-		2.41*	(1.62,3.61)
Ever stolen from someone or a shop	-		-		1.49	(0.97,2.29)
Ever committed cybercrime	-		-		2.09*	(1.40,3.11)

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- * indicates significance at 5% level.
- - indicates variable not in model.
- Where not stated, reference category is 'No'.
- Risk-taking is a continuous variable.
- The variables not displayed in the models are non-significant with $p > 0.10$.
- Age in Model 2 was borderline not significant 0.052.
- All analyses are weighted.

The models estimated using the stepwise method (Table 10) have broadly comparable results as the enter method so only the results that differed will be discussed. One possible explanation for the differences outlined below is that the stepwise models do not include variables that were found to be not significant. Moreover, missing cases in the stepwise models were only included if there were at least 30 resulting in a smaller base overall.

Model 1

In Model 1 estimated using stepwise, all the same indicators were significant except for the variable indicative of Parents child lives with. This variable was significant in the stepwise model and shows that respondents living with their natural mother only, had nearly twice the odds of carrying/using a weapon compared to those living with both natural parents.

Model 2

All the significant indicators for the stepwise Model 2 were significant in the enter method except for perceived area safety, which was found to be a significant indicator in this stepwise model with respondents who do not feel safe at all or not very safe compared to those feeling safe or very safe having around twice the odds of carrying/using a weapon. Perceived area safety was significant in the other two enter models so this result for the stepwise model is unsurprising.

Model 3

Four indicators were different in the stepwise Model 3 compared to the enter Model 3: age, parent education, drug taking, and being stopped and questioned by the police. Being a bully was also not significant in this model but was found to be significant in the enter Model 3. The age variable demonstrated a significant difference between those aged 13 and those aged 15, with 15-year-olds having over three times the odds of reporting carrying/using than 13-year-olds. However, care must be taken when interpreting this result as there were considerably

fewer 15-year-olds in the sample. Focusing on parent education, respondents whose parents have no qualifications were found to have nearly three times greater odds of carrying/using than parents with postgraduate level education. Although this variable appeared as significant in this stepwise model and not in the enter model, this specific finding was similarly present in two of the enter models. This model also found that those who had tried drugs or ever been stopped or questioned by the police were more likely than those who had never tried drugs or never been stopped or questioned by the police; however, these indicators have a smaller effect size than many of the other indicators in this model.

2.3 Using risk factors to identify high-risk populations

This section shows how risk factors can be used to improve the efficiency of interventions by identifying groups with a high risk of weapon carrying/use. To demonstrate this, we firstly used descriptive statistics to explore the expected proportion of weapon carriers/users that can be identified when using gender alone and gender combined with a number of the most important risk factors (Table 11). Secondly, we present an illustration of how risk factors can be combined using a selection of significant factors from each of the models (Figure 5 to Figure 7).

Two metrics are used in this analysis: the proportion of total weapon carrier/users identified; and the proportion of people identified who are weapon carrier/users.

The proportion of weapon carriers/users identified is how many weapon carriers/users exhibit a given combination of risk factors. For instance, Table 11 shows that supplying the intervention to the whole population without using risk factors will capture 100% of weapon carriers/users. Supplying the intervention to males only will capture 71.3% of weapon carriers/users in the population (28.7% of weapons carriers/users in the sample are female). The proportion of people identified who are weapon carriers/users is a measure of how many people who exhibit a given combination of risk factors are weapon carriers/users. As shown in Table 11, not using a combination of risk factors means that only 3.5% of the treated group will be a weapon carrier/user. However, supplying the intervention to males who have truanted more than once, means that 27.1% of those treated would be likely to be weapon carriers/users (in the absence of intervention). In the later examples this is scaled by the UK population of 14-year-olds to provide an indicative number of how many individuals would be treated by a given intervention approach. The examples given in Table 11 are illustrative and not exhaustive of the possible combinations of risk factors.

Table 11: Combinations of risk factors

Proportion of weapon carriers/users identified		Proportion of people identified who are weapon carriers/users	
No risk factors	100%	No risk factors	3.5%
Male by itself	71.3%	Male by itself	4.8%
	(70.2%,72.2%)		(4%,5.6%)
Male and ...		Male and ...	
Parents at least occasionally take drugs	9.0%	Parents at least occasionally take drugs	9.1%
	(6.1%,11.1%)		(5.3%,12.9%)

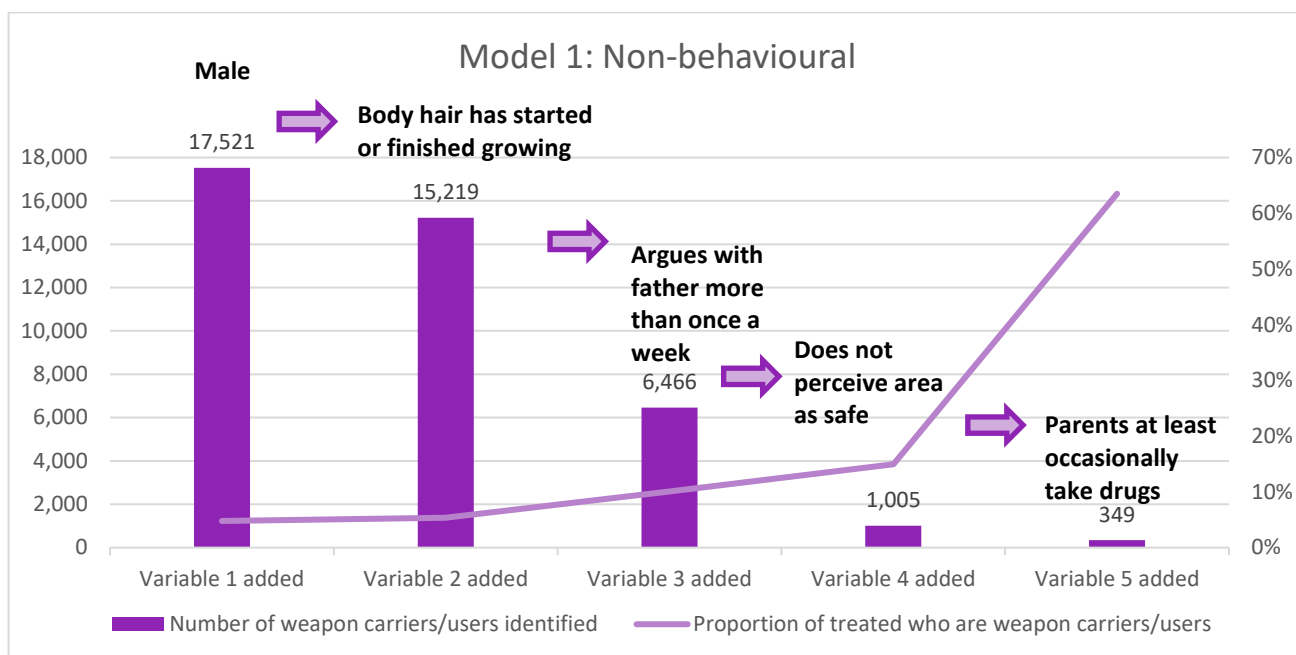
Proportion of weapon carriers/users identified		Proportion of people identified who are weapon carriers/users	
Argues with mother at least once a week	13.5%	Argues with mother at least once a week	11.1%
	(9.3%,16.7%)		(6.5%,15.8%)
Argues with father at least once a week	20.8%	Argues with father at least once a week	11.3%
	(16.3%,24.1%)		(7.6%,15.1%)
4 or more siblings	7.5%	4 or more siblings	8.8%
	(4.4%,9.7%)		(4.4%,13.1%)
Body hair has started or finished growing	61.9%	Body hair has started or finished growing	5.4%
	(59.5%,63.8%)		(4.4%,6.3%)
Does not perceive area as safe	10.6%	Does not perceive area as safe	9.9%
	(8%, 12.6%)		(6.3%,13.5%)
Has ever been excluded	5.7%	Has ever been excluded	42.4%
Has truanted more than once	19.7%	Has truanted more than once	27.1%
	(16%, 22.5%)		(18.7%,35.5%)
Has ever been victimised	57.1%	Has ever been victimised	7.7%
	(54.8%,58.9%)		(6.3%, 9.1%)
Has ever self-harmed	22.2%	Has ever self-harmed	17.5%
	(18.9%,24.7%)		(12.7%,22.3%)
Ever pushed/shoved/ or hit someone	61.1%	Ever pushed/shoved/ or hit someone	9.9%
	(58.9%,62.8%)		(8.1%,11.7%)

Notes:

- Missing cases were excluded.
- All descriptives are weighted.
- It is not possible to estimate the confidence intervals for males who have been excluded.

The first line of Table 11 shows that in a universal intervention (where participants are selected without using risk factors), only a very small proportion (3.5%) of individuals treated would be likely to report weapon carrying/use. The next line shows how adding one risk factor – being male – changes this; 71.3% of those reporting weapon carrying/use at age 14 in the MCS were male, which made it a significant indicator of risk. Our results suggest that around 4.8% of males, or around 1 in 20, report weapon carrying/use at age 14. This is an improvement on 3.5%, but still means that an intervention aimed just at males would involve a lot of resource being spent on individuals unlikely to become involved with weapon carrying/use. The rest of Table 11 shows how risk factors can be combined to increase that percentage further and therefore improve the efficiency of resource allocation. The cost, though, is a decrease in the total number of weapon carriers/users that the intervention reaches. For example, supplying the intervention to all males who do not perceive their area as safe roughly doubles the efficiency of the intervention – now 9.9% of all individuals identified are likely to report weapon carrying/use. But the left side of Table 11 shows that such an intervention would only ever reach 10.6% of all weapon carriers/users. The stronger risk factors are therefore the ones with higher percentages in both columns. For example, our results suggest that a hypothetical

intervention supplied to male truants would ‘correctly’ identify 27.1% of individuals and reach 19.7% of all those likely to carry/use weapons. Further examples, combining multiple risk factors are shown in Figure 5.



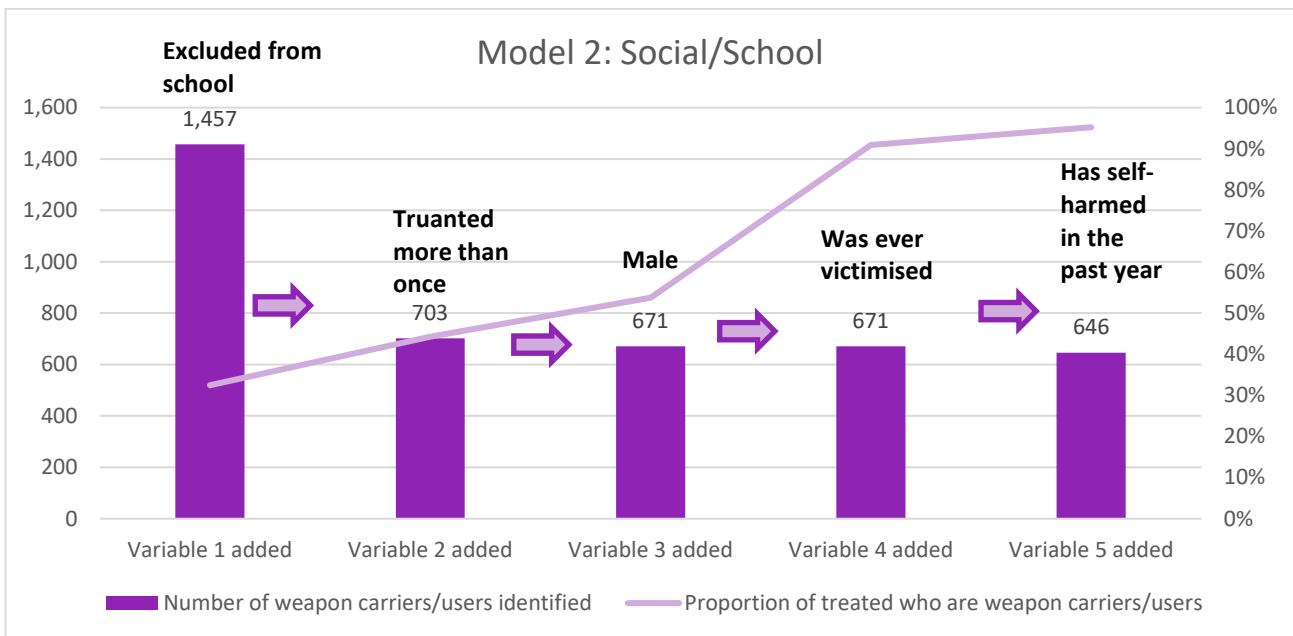
Notes:

- Missing cases were excluded.
- All descriptives are weighted.
- *Based on scaling up from the MCS, which is a nationally representative survey, using age 14 mid-year population estimates for 2017 for the United Kingdom (Office for National Statistics, 2018a).

Figure 5: Combinations of risk factors from Model 1

Reading from left to right, the first column in Figure 5 shows that 17,521 males in the population are likely to report weapon carrying/use at age 14. This is based on the MCS finding from Table 11 that 3.47% of the sample population reported weapon carrying/use and that 71.3% of these were male. As the MCS is a nationally representative survey, this can be scaled to the national population by multiplying by the number of 14-year-olds in England and Wales.

The line on the chart shows the improvement in the proportion of those treated who are likely to be weapon carriers/users as more risk factors are added (i.e. it captures the statistics on the right side of Table 11). The results show that with just two risk factors from Model 1, we capture a large majority of the weapon carriers/users in the sample. However, this approach is relatively inefficient at identifying at-risk individuals, with less than 10% of the identified sample reporting weapon carrying/use. Adding more factors increased the efficiency. For example, having five factors from Model 1 increased the efficiency to approximately 60%. Our results suggest that such an intervention would be supplied to 550 individuals nationwide and that 349 of them would report weapon/carrying use in the absence of intervention. This shows the benefit of using risk factors to identify high-risk individuals. But there is also a trade-off; our results suggest that such an intervention would only reach 1.4% of all weapon carriers/users.

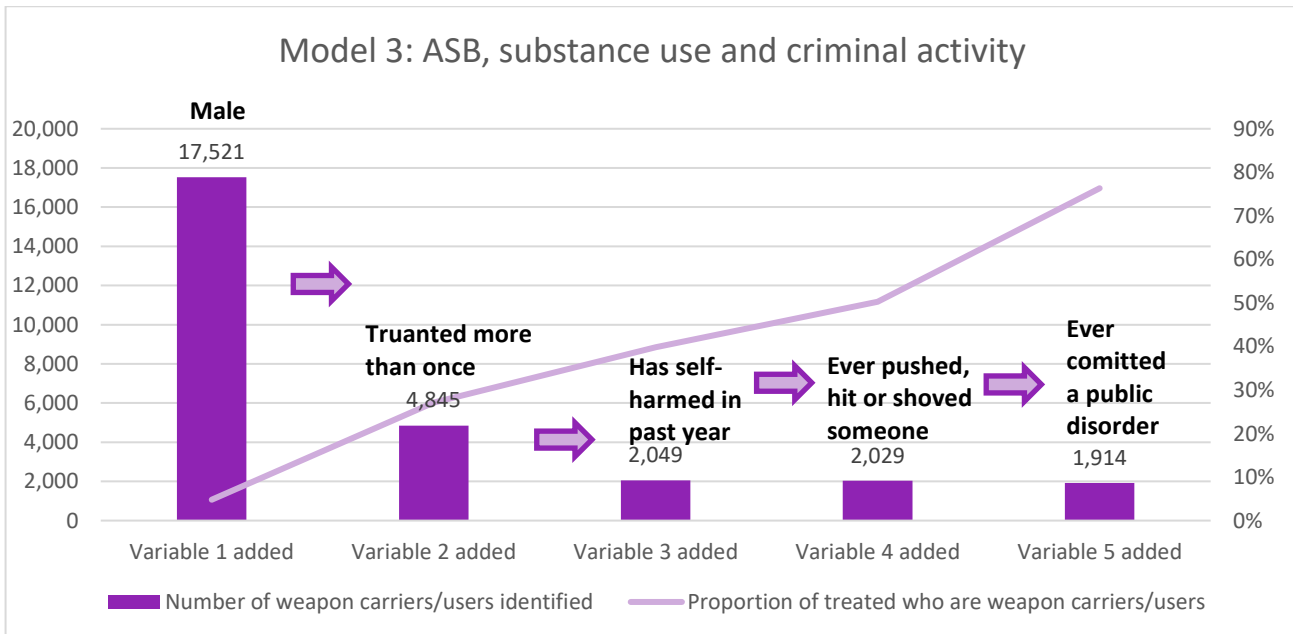


Notes:

- Missing cases were excluded.
- All descriptives are weighted.
- *Based on scaling up from the MCS, which is a nationally representative survey, using age 14 mid-year population estimates for 2017 for the United Kingdom (Office for National Statistics, 2018a).

Figure 6: Combinations of risk factors from Models 1 and 2

The inclusion of factors from Model 2 results in a significantly smaller pool of identified weapon carriers/users and more efficient identification of high-risk cases. This efficiency was further increased as factors were added with minimal loss of identified weapon carriers/users. The small sample size and low attrition when adding risk factors in this example potentially indicates that there is a specific population within the MCS that these factors are identifying. Despite this, it is apparent that social/school factors provide much stronger efficiency.



Notes:

- Missing cases were excluded.
- All descriptives are weighted.
- *Based on scaling up from the MCS, which is a nationally representative survey, using age 14 mid-year population estimates for 2017 for the United Kingdom (Office for National Statistics, 2018a).

Figure 7: Combinations of risk factors from Models 1, 2 and 3

Once additional variables from Model 3 are added we see the same change as was apparent for the Model 2 factors. Although there is a decrease in carriers/users identified, there is an increase in identification efficiency. This continues with the inclusion of additional Model 3 factors resulting in a reach of nearly 80%, which increases the efficiency 22-fold compared with not using risk factors (the proportion of those treated who would report weapon carrying/use increases from 3.5% to 76.3%).

These results are only exploratory and could be improved upon with more complex techniques. However, our indicative results suggest that if identification efficiency is the main priority, we gain little additional value from the variables in Model 3. We reach 95% efficiency in Model 2 and do not improve on that in Model 3, although we did not try every permutation.

This approach can also be used to look at resource allocation given finite resources and the costs of potential interventions. For example, using the five risk factors shown for Model 2 in Figure 6, the results imply that there would be an estimated 680 people in the population identified, of which 646 would be weapon carrier/users. Other evidence shows that one possible intervention for this group could be Multisystemic Therapy (MST) and that this costs about £2,285 per individual (Cary *et al.*, 2013). So, to give this intervention to all 680 individuals with the five risk factors above, would cost approximately £1.6m.

This indicative example shows that although there is a trade-off with using risk factors – intervention is unlikely to reach **all** individuals who will become involved with weapon carrying/use – it is also likely to be essential. Applying intensive interventions like MST to the entire population is cost prohibitive.

This illustrative analysis shows generally that combining risk factors increases the likelihood that interventions will be aimed at the right individuals. But the cost is that a smaller proportion of all at-risk individuals will be identified. One method for mitigating this may be identifying different sub-populations. As there are multiple pathways into carrying/using a weapon it should be possible to distinguish multiple non-overlapping sub-populations through different combinations of risk factors. This could reduce the impact of the trade-off mentioned above, although further analysis would be required to prove this.

This is a simple approach and provides no causal inference. It is intended to illustrate how risk factors can be used to improve identification of at-risk individuals generally, rather than suggesting that the particular risk factors used in this section are necessarily the most efficient ones to use for that purpose.

3 The Environmental Risk (E-Risk) Longitudinal Study

This report also uses data from the E-Risk Longitudinal Study. The study involves 1,116 pairs of same-sex twins born in 1994 and 1995 in England and Wales. This analysis is based on the 1999 to 2000, 2001 to 2002, 2004 to 2005, 2006 to 2007 and 2012 to 2014 waves of data collection, which took place when the twins were 5, 7, 10, 12 and 18 years of age respectively. The E-Risk sample was selected to represent the UK population of families with new-borns in the 1990s based on residential location throughout England and Wales and mother's age. Teenaged mothers with twins were over-selected to replace high-risk families who were selectively lost to the register through non-response. Older mothers having twins via assisted reproduction were under-selected to avoid an excess of well-educated older mothers. These strategies ensured that the study sample represents the full range of socio-economic conditions in Great Britain (Beckley *et al.*, 2018).

Only 7% of the original sample of 2,232 individuals were lost by age 18 due to attrition and it has been shown that there is no difference between those who did and did not take part at age 18 on key factors such as socio-economic status (Baldwin *et al.*, 2016). From the 2,232 individuals available, 180 were excluded due to missing data on the SVLBs and six were excluded during model estimation. This resulted in our sample of 2,046 individuals.

In this analysis, SVLBs self-reported at age 18 make up the dependent variable. This includes ever being in a gang fight, using a weapon such as a knife or baseball bat, carrying a hidden weapon, or 'threatening someone to get money or stuff off them (i.e. robbery). Of the sample, 185 individuals (9%) self-reported at least one of these behaviours linked to serious violence. The indicators used are from ages 5 to 12 so that they pre-date the reported involvement in SVLBs at age 18 (however, the SVLB questions asked whether an individual had **ever** been in a gang fight/carried a weapon etc., so it is still not 100% possible to determine the direction of any relationship). They were selected using the same technique as used for the MCS analysis. All analysis takes account of within family clustering, given that the sample consists of only twins.¹²

3.1 Self-reported SVLBs at age 18 – descriptive statistics

This section will provide some basic statistics displaying and describing the indicators available from the E-Risk dataset in relation to the variable indicative of SVLB. As previously mentioned, the below findings do not imply causality and do not control for other factors.

¹² Weights were not used for the E-Risk analysis as we were advised by the survey owners not to use them. Weights are no longer used in any E-Risk study publications.

3.1.1 Non-behavioural indicators

Table 12: Involvement in SVLBs by non-behavioural indicators

Variables	No SVLB % (N=1,861)	SVLB % (N=185)	% of group engaging in SVLB	Unweighted base N
Gender*				
Female	56.1%	17.3%	3.0%	1,076
Male	43.9%	82.7%	15.8%	970
Social class*				
Low	31.9%	48.1%	13.0%	683
Middle	32.7%	36.8%	10.0%	677
High	35.4%	15.1%	4.1%	686
Child experienced maltreatment*				
No maltreatment	79.9%	69.7%	8.0%	1,616
Probable	15.0%	15.7%	9.4%	308
Definite	5.1%	14.6%	22.1%	122
Domestic violence in household*				
No	58.7%	47.5%	7.4%	1,174
Yes, with no exposure	26.4%	27.9%	9.5%	539
Yes, with exposure	14.9%	24.6%	14.0%	321
Mother anti-social personality symptom count				
None	67.3%	61.7%	8.3%	1,364
One	14.3%	12.0%	7.7%	287
Two	8.7%	12.0%	12.0%	183
Three or more	9.8%	14.2%	12.5%	208
Perinatal disease				
No	83.8%	86.5%	8.9%	1,585
Yes	16.2%	13.5%	7.3%	302
Number of children				
Two	26.7%	23.8%	8.1%	540
Three	37.2%	33.5%	8.2%	755
Four	20.6%	22.7%	9.9%	425
Five	9.7%	13.5%	12.1%	206
Six or more	5.8%	6.5%	10.0%	120
Parental substance abuse*				
Low symptoms	75.3%	63.7%	7.7%	1,508

Variables	No SVLB % (N=1,861)	SVLB % (N=185)	% of group engaging in SVLB	Unweighted base N
High symptoms	24.7%	36.3%	12.6%	522
Low maternal warmth*				
No	61.5%	48.2%	7.3%	1,097
Yes	38.5%	51.8%	11.9%	722
Father marital status*				
Married to mother	67.9%	48.6%	6.6%	1,354
With new partner or married to other	26.5%	38.9%	12.7%	565
Father not present	5.6%	12.4%	18.1%	127
Health professional diagnosed learning/behaviour/development/mental health problem – age 10				
No	84.3%	80.3%	8.6%	1,671
Yes	15.7%	19.7%	11.0%	319
Ever in foster care*				
No	99.5%	97.3%	9.0%	1,987
Yes	0.5%	2.7%	33.3%	15
Notes:				
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. 				

Many of the non-behavioural indicators (displayed in Table 12) were significantly associated with the SVLBs. These linked behaviours were more prevalent among males than females and among those belonging to a lower social class compared to those belonging to a higher social class. Parent-related indicators such as parent substance abuse, low maternal warmth and father marital status were also significantly associated with the respondent's self-reported SVLB. Finally, the descriptive statistics show that 2.7% of individuals engaging in SVLBs reported experience of foster care compared to only 0.5% of individuals not engaging in SVLBs. This was a significant finding, but caution must be taken as only a small number of individuals (N=15) had experience of being in foster care and, of these, an even smaller number (N=5) had engaged in SVLB. This contrasts with more prevalent indicators such as being a bully (N=568) of which a larger number of individuals engaged in SVLB (N=82). Table 12 also shows percentages of people within a given group who carry/use a weapon; for example, around 22% of people who have experienced maltreatment reported carrying/using a weapon.

Table 13 displays the continuous non-behavioural indicators, all of which were significantly associated with the SVLBs. Individuals involved with SVLBs had mothers who were younger at their first birth, had less parental monitoring, had fathers with higher levels of ASB, and had lower IQ score.

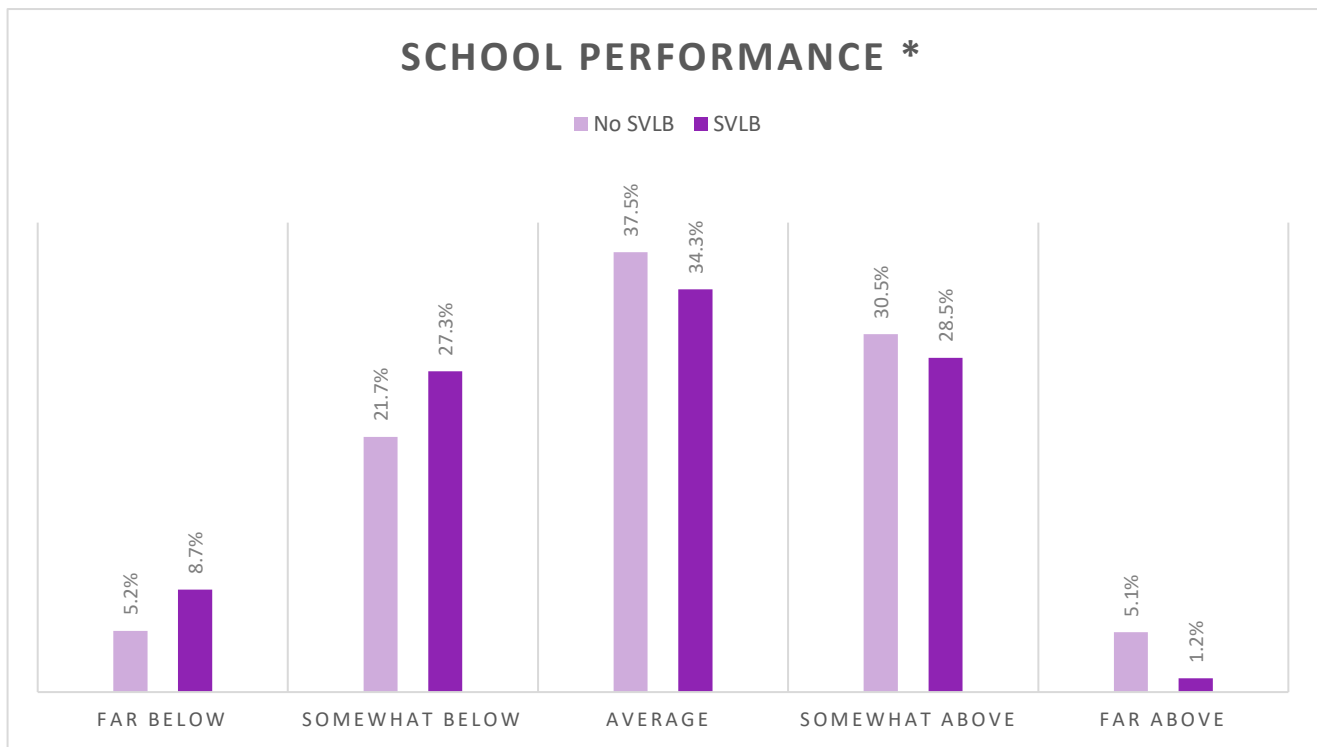
Table 13: Means for non-behavioural indicators

	No SVLB (N=1,861)	SVLB (N=185)
Mother's age at first birth*	23.73 (0.14)	21.22 (1.72)
Parental monitoring*	18.86 (0.05)	17.99 (1.33)
Father anti-social behaviour score*	16.95 (0.42)	22.14 (1.78)
IQ score*	96.36 (0.33)	91.90 (6.84)

Notes:

- Figures represent means and (standard errors).
- Missing cases were imputed.
- * indicates significance at 5% level.

3.1.2 Social/school indicators



Notes:

- Missing cases were excluded when calculating the percentages and significance tests.
- * indicates significance at 5% level.
- See Appendix E for % of group engaging in SVLB and bases.

Figure 8: SVLBs by school performance

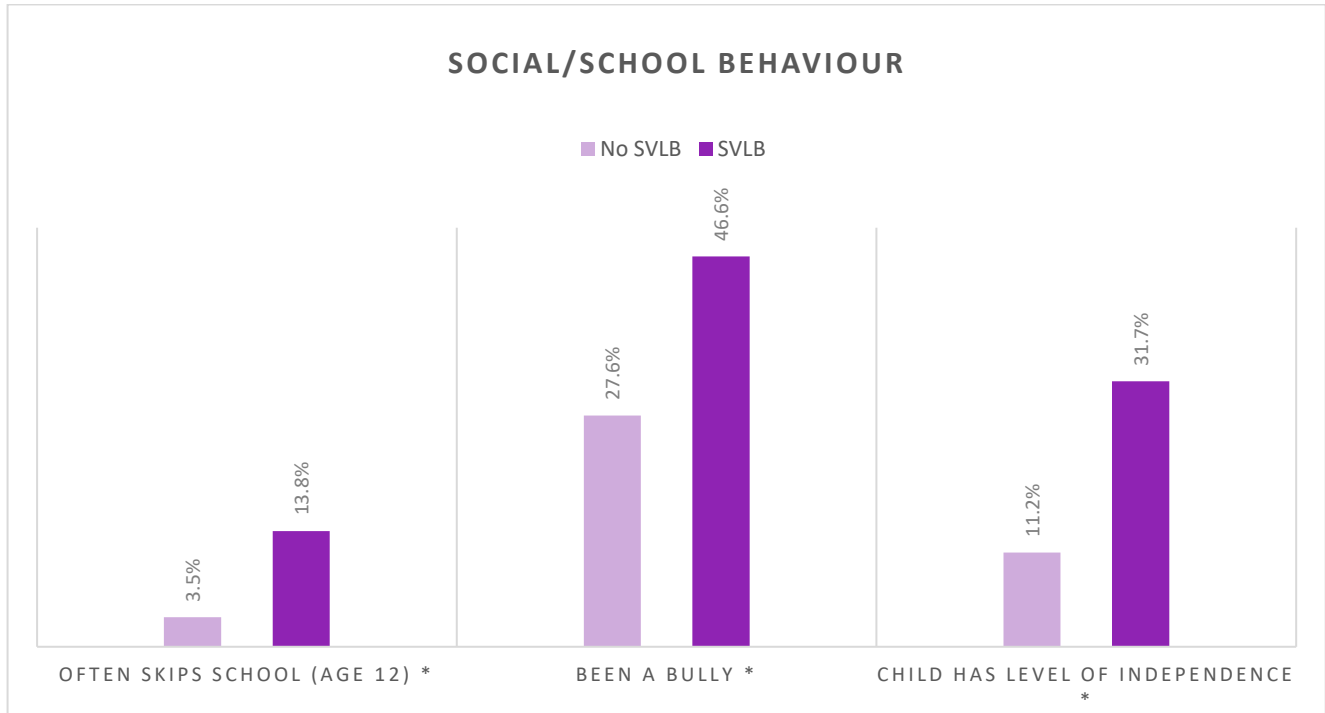
Figure 8 shows that respondents who have engaged in SVLBs have lower levels of teacher-reported school performance than those who have not, and Table 14 indicates that those who have engaged in SVLBs have lower levels of self-control than those who have not. A higher score for self-control means more problems with self-control, not better self-control.

Table 14: Means for self-control

	No SVLB (N=1,861)	SVLB (N=185)
Self-control*	-0.10 (0.02)	0.79 (0.07)

Notes:

- Figures represent means and (standard errors).
- Missing cases were imputed.
- * indicates significance at 5% level.



Notes:

- Missing cases were excluded when calculating the percentages and significance tests.
- * indicates significance at 5% level.
- See Appendix E for % of group engaging in SVLB and bases.

Figure 9: SVLBs by behavioural indicators

Skipping school, being a bully and a higher level of self-reported independence are all significantly associated with SVLBs. These risk indicators were consistently more prevalent among those who have been involved with SVLBs than those who have not.

3.1.3 ASB/crime behaviour

Figure 10 displays the higher prevalence of anti-social and criminal behaviour for those who have engaged in SVLBs in comparison to those who have not. For example, respondents who have engaged in SVLBs reported previously committing minor violence or starting fights more than respondents who did not report engaging in SVLBs (67% compared with 38%).



Notes:

- Missing cases were excluded when calculating the percentages and significance tests.
- * indicates significance at 5% level.
- ‘Sometimes hits parent’ was borderline not significant (0.053).
- See Appendix E for % of group engaging in SVLB and bases.

Figure 10: SVLBs by ASB/Crime indicators

3.2 Self-reported SVLBs at age 18 – logistic regression models

The same methods were used for the E-Risk logistic regression models as the MCS models. The models were used to identify the indicators significantly associated with SVLBs (weapon carrying/use, gang fighting and robbery) while controlling for other indicators.

The enter method was estimated with a maximum number of cases (N=2,046) and retaining a maximum number of missing cases (which were treated as a separate category in the models), whereas the stepwise method was estimated using a smaller number of cases (N=2,010) whereby missing cases were only included as a separate category if there were at least 30. Within family clustering was taken into account, given that this is a twin study.

ORs are reported for the models and * is used to indicate significance at the 5% level (see Appendix D for full models). Ninety-five per cent confidence intervals for the estimates are also provided. An odds ratio greater than one indicates higher odds of involvement with SVLBs relative to the reference category, whereas an odds ratio less than one indicates lower odds of involvement with SVLBs relative to the reference category. For example, Table 15 shows that individuals who have definitely experienced maltreatment have around twice the odds of engaging in SVLBs compared with those who have experienced no maltreatment.

As previously mentioned, the associations shown cannot be interpreted as causal, as there may be other unobserved factors affecting the outcome (SVLBs) and the regressors (indicators). Only 9% of respondents reported involvement in SVLBs, which must be considered when interpreting the results.

Table 15: Logistic regression of reported SVLBs (enter method)

Independent variable	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Male	6.79*	(4.34,10.62)	5.13*	(3.24,8.14)	4.53*	(2.81,7.30)
Mother's age at first birth	0.97	(0.92,1.01)	0.98	(0.94,1.02)	0.98	(0.93,1.02)
Parental monitoring	0.91*	(0.85,0.97)	0.94	(0.87,1.01)	0.92	(0.85,1.00)
Father anti-social behaviour score	1.00	(0.98,1.01)	0.99	(0.98,1.01)	0.99	(0.98,1.01)
IQ score	0.99	(0.98,1.01)	1.00	(0.98,1.02)	1.00	(0.99,1.02)
Social class (reference category: Low)			*		*	
Middle	1.13	(0.72,1.78)	1.18	(0.73,1.90)	1.12	(0.68,1.84)
High	0.55	(0.29,1.08)	0.50*	(0.25,0.98)	0.51	(0.26,1.01)
Child experienced maltreatment (reference category: No maltreatment)	*		*		*	
Probable	0.88	(0.54,1.42)	0.70	(0.42,1.16)	0.70	(0.42,1.18)
Definite	2.25*	(1.27,3.97)	1.89*	(1.05,3.39)	1.79	(0.96,3.33)
Domestic violence in household (reference category: No)						
Yes, with no exposure	0.92	(0.57,1.46)	0.90	(0.56,1.46)	1.05	(0.65,1.69)
Yes, with exposure	1.19	(0.71,2.01)	1.20	(0.71,2.04)	1.32	(0.78,2.24)
Mother anti-social personality symptom count (reference category: No symptoms)						
One	0.69	(0.41,1.17)	0.74	(0.43,1.29)	0.68	(0.38,1.20)
Two	1.2	(0.64,2.25)	1.23	(0.64,2.35)	1.09	(0.56,2.13)
Three or more	0.79	(0.44,1.42)	0.78	(0.42,1.44)	0.73	(0.39,1.38)
Perinatal disease	0.77	(0.45,1.32)	0.73	(0.42,1.27)	0.74	(0.42,1.31)
Number of children (reference category: Two)						
Three	1.15	(0.70,1.89)	1.13	(0.68,1.90)	0.98	(0.57,1.68)
Four	1.04	(0.59,1.84)	0.99	(0.55,1.80)	0.94	(0.52,1.70)
Five	1.24	(0.60,2.58)	1.00	(0.49,2.05)	0.88	(0.43,1.79)
Six or more	0.72	(0.36,1.47)	0.66	(0.31,1.40)	0.52	(0.25,1.08)
Parental substance abuse (reference category: Low symptoms)						
High symptoms	1.16	(0.74,1.82)	1.05	(0.64,1.71)	1.01	(0.61,1.66)
Low maternal warmth	1.17	(0.82,1.66)	0.95	(0.65,1.37)	0.97	(0.66,1.44)

	Model 1		Model 2		Model 3	
Father marital status (reference category: Married to mother)	*		*			
With new partner or married to other	1.46	(0.94,2.28)	1.55	(0.98,2.46)	1.45	(0.91,2.31)
Father not present	2.37*	(1.22,4.63)	2.17*	(1.10,4.30)	2.24*	(1.11,4.55)
Health professional diagnosed learning/behaviour/development/ mental health problem – age 10	0.65	(0.40,1.06)	0.39*	(0.22,0.72)	0.40*	(0.21,0.74)
Ever in foster care	2.88	(0.71,11.73)	2.89	(0.81, 10.32)	2.61	(0.62, 10.95)
Often skips school – age 12	-		1.92*	(1.04,3.55)	1.54	(0.80,2.97)
School performance (reference category: Far below)						
Somewhat below	-		0.92	(0.42,2.00)	0.80	(0.37,1.75)
Average	-		1.03	(0.47,2.26)	0.88	(0.40,1.95)
Somewhat above	-		1.38	(0.61,3.15)	1.16	(0.50,2.70)
Far above	-		0.51	(0.11,2.36)	0.38	(0.09,1.60)
Self-control	-		1.83*	(1.49,2.25)	1.77*	(1.43,2.21)
Been a bully	-		1.41	(0.95,2.09)	1.09	(0.70,1.67)
Independence	-		1.63*	(1.02,2.62)	1.41	(0.84,2.35)
Stealing	-		-		1.87*	(1.11,3.16)
Sometimes hits parent	-		-		0.93	(0.37,2.33)
Violence	-		-		2.07*	(1.37,3.13)
Hurts people	-		-		0.70	(0.39,1.25)
Starts fights	-		-		1.14	(0.73,1.79)
Public disorder	-		-		1.09	(0.65,1.83)

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- * indicates significance at 5% level.
- - indicates variable not in model.
- Where not stated, reference category is 'No'.
- Mother's age at first birth, Parental monitoring, Father anti-social behaviour score, IQ score and Self-control are all continuous variables.
- Father Marital Status in Model 2 as well as Model 3 was borderline significant 0.045 and borderline not significant 0.059.
- Parental monitoring in Model 3 was borderline not significant 0.054.

Table 15 displays the results for the regression models examining the associations of a range of indicators with self-reported SVLBs. These models estimate the various effects of the chosen indicators on the probability that a person will engage in the SVLBs.

Model 1

Consistent with the literature, males had nearly seven times the odds of engaging in SVLBs than females; this finding was one of the strongest effects in the model. The model also shows that children who have experienced maltreatment have just over twice the odds of being involved with SVLBs when compared with respondents who have experienced no maltreatment. These two indicators were also significant across the other two models which control for various behavioural and risk indicators, demonstrating the stability of these indicators.

Two parent-related indicators were significant in this model: parental monitoring and father marital status. Higher levels of parental monitoring decrease the likelihood of being involved in SVLBs and respondents who have no father present or whose mother is with a new partner or married to another person are more likely to engage in SVLBs.

Model 2

Gender, child experienced maltreatment and father marital status remained significant even when controlling for the behavioural indicators. However, parental monitoring became non-significant with the addition of the social and school indicators. It is possible that the lack of parental monitoring led to truanting and decreased self-control which is why the parental monitoring variable becomes insignificant. Respondents with diagnosed problems were less likely to engage in SVLBs, whereas those who reported truanting from school had nearly twice the odds of engaging in these behaviours. This model also found levels of self-control and levels of independence significant. Respondents with lower levels of self-control had nearly twice the odds of involvement in SVLBs than those with higher levels. The indicator relating to independence had a similar finding with higher levels of independence increasing the likelihood of involvement. Finally, social class was found to be significant in this model but it was not significant in the first model. This indicator shows respondents belonging to a higher social class are less likely to be involved in SVLBs than those belonging to a lower social class.

Model 3

As previously mentioned, gender and child maltreatment were significant across all three models. Consistent with the previous model, having a diagnosed learning, behavioural, development or mental health problem and self-control were also significant in this model; however, father marital status, truancy and independence became non-significant with the addition of various risky behaviours. From these behaviours only two were significantly associated with SVLBs, namely stealing and minor violence, which both increased the likelihood of involvement. Respondents who had previously been involved in minor violence (hitting someone) have over twice the odds of engaging in SVLBs than those who have not been involved in minor violence. Social class remained significant in this model following on from Model 2. Although father marital status becomes non-significant as a general indicator in this model, there was still a significant difference between those whose fathers are not present and those whose father is married to their mother. Those with no father present have nearly twice the odds of engaging in SVLBs than those whose fathers are married to their mother.

Factors relating to pregnancy including mother's age at first birth, perinatal disease, number of children mother gave birth to and low maternal warmth were not generally significant indicators in any of these models. Other parent-related variables were also non-significant: father's ASB score, domestic violence in the household, mother's ASB symptoms and parent substance abuse. IQ and school performance were not significant, indicating that there are indicators

more important than low educational attainment and intelligence. Being in foster care or being a bully were not significant indicators of SVLBs either. Finally, in terms of ASB, substance use and criminal activity behaviours, hitting parents, hurting people, starting fights and public disorder were not significant in the final model.

Table 16: Logistic regression of reported SVLBs (stepwise method)

Independent variable	Model 1		Model 2		Model 3	
	OR	95% CI	OR	95% CI	OR	95% CI
Male	6.13*	(3.98,9.44)	4.87*	(3.07,7.74)	4.20*	(2.64,6.69)
Mother's age at first birth	0.96*	(0.92,1.00)				
Parental monitoring	0.91*	(0.85,0.96)	0.93	(0.86,1.00)	0.92*	(0.85,0.99)
Social class (reference category: Low)			*		*	
Middle	1.07	(0.70,1.64)	1.17	(0.75,1.82)	1.03	(0.67,1.59)
High	0.56	(0.30,1.02)	0.52*	(0.30,0.89)	0.44*	(0.27,0.73)
Child experienced maltreatment (reference category: No maltreatment)	*		*		*	
Probable	0.78	(0.48,1.27)	0.63	(0.38,1.05)	0.63	(0.38,1.07)
Definite	2.08*	(1.21,3.56)	1.58	(0.88,2.82)	1.53	(0.84,2.77)
Father marital status (reference category: Married to mother)						
With new partner or married to other	1.42	(0.94,2.15)	1.50	(0.97,2.32)		
Father not present	1.94*	(1.06,3.53)	1.91*	(1.03,3.55)		
Health professional diagnosed learning/behaviour/ development/ mental health problem – age 10			0.40*	(0.24,0.67)	0.44*	(0.26,0.73)
Often skips school – age 12	-		1.95*	(1.03,3.69)		
Self-control	-		1.86*	(1.54,2.25)	1.81*	(1.49,2.20)
Independence	-		1.84*	(1.17,2.89)	1.60*	(1.01,2.53)
Stealing	-		-		1.88*	(1.22,2.89)
Violence	-		-		2.02*	(1.37,2.98)

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- Where not stated, reference category is 'No'.
- Mother's age at first birth, Parental monitoring, Father anti-social behaviour score, IQ score and Self-control are all continuous variables.
- The variables not displayed in the models are not significant with $p > 0.10$.
- Parental monitoring in Model 2 was borderline not significant 0.052.
- * indicates significance at 5% level.

Like the MCS analysis, the E-Risk models estimated using the stepwise method (Table 16) had broadly comparable results as the E-Risk enter method so only the different results will be

discussed. As previously mentioned, one possible explanation for the differences outlined below is that the stepwise models do not include variables that were found to be not significant. Moreover, missing cases in the stepwise models were only included if there were at least 30, resulting in a smaller base overall.

Model 1

There are two differences between this model and the same model using the enter method. Mother's age at first birth is a significant indicator in this model but was not when using the enter method. This model found that respondents whose mothers had their first birth at an older age have a decreased likelihood of engaging in SVLBs. Additionally, father marital status was significant using the enter method but did not appear as significant in this model using the stepwise method. For this model and Model 2, although father marital status features as non-significant as a general indicator, there remains to be a significant difference between those whose fathers are not present and those whose father is married to their mother. Those with no father present have nearly twice the odds of engaging in SVLBs than those whose fathers are married to their mother.

Model 2

The only difference in terms of significant indicators between this stepwise model and the Model 2 enter method is father marital status, which was significant using the enter method but does not appear as significant in this stepwise model. However, like in the previous model, there is a significant difference for the father not present category.

Model 3

This model is also very similar to the enter method Model 3 except for the indicators relating to parental monitoring and independence. Independence is significant in this stepwise model but not in the enter Model 3. As with previous findings relating to this indicator, individuals with a greater level of independence are more likely to engage in SVLBs than those with lower levels of independence. Additionally, parental monitoring is significant in this stepwise model but not in the respective enter method.

4 Discussion

Early and effective intervention to prevent offending requires an awareness of the risk factors so that interventions can be supplied to those most likely to go on to offend. The analysis of the MCS and E-Risk studies presented in this report highlights several individual, family, school and community factors as important indicators of self-reported SVLBs among young people. Some of the strongest indicators of weapon carrying/use, as found in the MCS analysis, include being male, earlier puberty, school suspension or exclusion, truanting and self-harm. For SVLBs more widely, some of the strongest indicators include being male, experience of maltreatment perpetrated by an adult (physical, sexual or emotional abuse/neglect) and self-control.

4.1 Individual

In terms of individual demographics, gender was consistently found to be a significant indicator of SVLBs across all models of the MCS and E-Risk analyses. Other research which uses the age 14 MCS wave showed that males and females fairly evenly engaged in smoking, alcohol consumption and substance use, but our results suggest that SVLBs are particularly male dominated at this age (Fitzsimons *et al.*, 2018).

Ethnicity was not significantly associated with weapon carrying/use in the MCS analysis when looking at the two factors alone or when controlling for a range of other indicators. This is in line with previous research suggesting that, once other factors are controlled for, it is unclear whether ethnicity is a predictor.¹³ However, further research is needed to determine if this finding generalises to all types of serious violence. It must be noted that there was no relationship between ethnicity and weapon carrying/use, even at the bivariate level in this study. This is different to the relationship between ethnicity and homicide victimisation and perpetration in official statistics (Home Office, 2018).

The pubertal indicator (body hair) was a consistently significant indicator across all three MCS models, with those reporting a higher level of development being more likely to carry/use a weapon than those reporting lower levels. Age was generally not significant, so taken together these results imply that biological development is potentially more important for indicating possible involvement in serious violence than just age. However, it is important to remember that the MCS analysis provided a limited test of the association between age and weapon carrying/use given that individuals were only aged 13 to 15.

The descriptive statistics demonstrated that a variety of vulnerabilities such as being a victim of bullying, victimisation, feelings of isolation and experiences of maltreatment are more prevalent among those engaging in SVLBs compared with those who do not. Many of these vulnerabilities were found to be significant indicators of engaging in SVLBs when controlling for

¹³ A UK-based study (Brennan, 2018) suggests ethnicity was not predictive of illegal weapons carrying among 10- to 25-year-olds in England and Wales.

a variety of non-behavioural, social and school, and ASB, substance use and criminal activity indicators. However, the factor indicative of victim of bullying is non-significant when the social and school, and ASB, substance use and criminal activity indicators are controlled for. This may be due to the impact that the general victimisation indicator has in the models. Experiencing victimisation (self-reported in the MCS) was a significant indicator of weapon carrying/use as well as self-harm and isolation. In this case, victimisation includes verbal, physical or weapons, stealing and sexual victimisation. Table 7 showed that around a third of weapon carriers/users had weapons used against them. Although these behaviours are significantly associated, we cannot be certain of the direction of causality as these behaviours were all reported at age 14 so we cannot really say which occurred first. That is why further research using the MCS age 17 survey will be important. These indicators relating to vulnerability were also apparent in the longitudinal study carried out in Edinburgh (McVie, 2010).

Similarly, the E-Risk analysis found that children who had experienced maltreatment were more likely to engage in SVLBs and this finding held across all three models when a variety of non-behavioural, social and school, and ASB, substance use and criminal activity were controlled for. This finding relating to child maltreatment is consistent with the Murder in Britain study (Dobash *et al.*, 2007) which found that 30% of 786 men convicted of homicide had been physically abused and 17% had been sexually abused. It is therefore important for vulnerable children to be identified and for appropriate interventions to be in place to support these individuals.

The Murder in Britain study found that, of the men convicted of homicide, 45% had been taken into care before the age of 16. However, despite a significant association between foster care and SVLBs when these two variables are looked at alone, foster care is no longer a significant indicator of SVLBs when other indicators are controlled for. It is likely that this is because there are other risk factors, specifically maltreatment, that drive both entry into care and SVLBs. However, it must be noted that only a small number of people in the E-Risk sample had experience of foster care.

Self-control and risk-taking have been previously highlighted as risk factors for serious violence (Moffitt *et al.*, 2011). The results from the E-Risk and MCS analyses support this. The E-Risk analysis found self-control as a significant indicator when controlling for a range of social and school as well as ASB and crime indicators, whereby lower levels of self-control increased the likelihood of engaging in SVLBs. Similarly, risk-taking was also found to be a significant indicator in the MCS Models 2 and 3.

The use of addictive substances was generally not an indicator of SVLBs despite higher prevalence in smoking, alcohol consumption and drug taking among weapon carriers/users compared to non-carriers/users. For example, 33% of weapon carriers/users reported trying drugs compared to 5% of non-carriers/users. Factors relating to substance use were only available from the MCS data. Use of cannabis or any other illegal drug was significant in the MCS stepwise model but not in the enter model, so we cannot say for certain that drug taking is significant. Smoking and alcohol consumption were generally not found to be significant. Nevertheless, although these indicators do not generally present associations to SVLBs, they may themselves be linked to the behavioural factors that are found to be significantly associated with SVLBs. For example, a recent UK-based study involving foster youth who had exited care found that experiences of homelessness and school exclusion were strong

influences that predict high levels of drug use among these youths (Barn & Tan, 2015). Additionally, the MCS analysis is only focused on behaviours self-reported at age 14.

SVLBs are likely linked to other risky behaviours. Both analyses found that minor violence was a significant indicator for SVLB. Involvement in gambling, public disorder and cybercrime were also all indicators of weapon carrying/use in the MCS analysis. The finding relating to cybercrime may be contrary to public perception that individuals who commit cybercrime are a separate group to those who engage in serious violence and linked behaviours, but this finding is consistent with other literature (Weulen Kranenbarg *et al.*, 2017).

Additionally, the E-Risk analysis found that minor violence and stealing reported at age 12 were indicators of SVLBs reported at age 18. This is not to say that the SVLBs were not also present at age 12, but this suggests that engaging in risky behaviours at an earlier age may influence the likelihood of engaging in more SVLBs at later ages. Stealing was not significant in the MCS analysis, which is perhaps unsurprising given that the dependent variable only includes individuals self-reporting weapon carrying/use whereas the E-Risk analysis dependent variable included an element of robbery. Generally, these results are consistent with other literature, suggesting that few offenders tend to specialise and most commit a variety of different types of crime (Piquero, 2000). This implies that interventions targeting ASB and criminality generally may also impact serious violence.

4.2 Family

Parent-related indicators were generally only significant when controlling for non-behavioural indicators. When indicators relating to the individual's community, peer group and school as well as ASB, substance use and criminal activity were added, most parental variables became insignificant. For the MCS models, these indicators were parental drug use, frequency of arguing with mother and frequency of arguing with father. The number of siblings in the household was also significant across all three MCS models. Having no siblings or four or more siblings increased the likelihood of carrying/using a weapon compared with having one sibling. In contrast, the E-Risk models did not find number of children as a significant indicator. Nevertheless, these variables are distinct in that number of children as recorded by the E-Risk study indicates the number of children the twin's mother gave birth to, whereas the MCS variable indicates the number of siblings in the household. This suggests the possibility that the effect of multiple siblings is due to how much it divides parental resources, but if the siblings are not in the household this division may not occur and affect the child as much. Additionally, given that the E-Risk study is a twin study, it is not possible to distinguish any only child effects. The finding from the MCS that having lots of children increases the likelihood of them engaging in serious violence is in line with other research (Fischer, 1984 and Farrington & Loeber, 1999), but we are not aware of any research linking only children to serious violence. We recommend that more analysis should be carried out which looks at this before drawing any strong conclusions.

Levels of independence and parental monitoring were found to be important indicators across both surveys. The MCS analysis found that individuals who stayed out late at night or away over night without their parents knowing were more likely to carry/use a weapon than those who had not. However, it is important to note that, once ASB, substance use and criminal activity behaviours were controlled for, this was no longer a significant indicator. A similar finding was apparent in the E-Risk analysis which found that individuals who sometimes stay

out late at night when their parents do not want them to are more likely to engage in SVLBs but this finding was also no longer significant when ASB and crime behaviours were introduced into the model. The E-Risk analysis additionally found that lower levels of parental monitoring increased the likelihood of SVLBs, but this became insignificant when social and school as well as ASB, substance use and criminal activity indicators were controlled for. The findings in both surveys would generally be consistent with (but do not prove) a possible narrative in which the significant parental variables lead to behaviour which in turn is linked to involvement SVLBs.

The E-Risk analysis shows that individuals in a family structure where there is no father present have higher odds of being involved in wider SVLB. This is significant even in Model 2 where other parental factors have become insignificant, indicating a broader impact from family structure. However, once ASB, substance abuse and criminal activity factors have been included, family structure becomes insignificant, indicating potential links between family structure and risky behaviours. Overall, our findings suggest that elements of both family structure and family relationships are important given the significance of arguing with parents and the parent child lives with in the MCS analysis.

High family income has previously been found to be a protective factor against offending (Farrington *et al.*, 2009) but income was not a significant indicator of weapon carrying/use in any of the MCS models. A robustness check was carried out to investigate whether there was an existing high correlation between income and perceived area safety that may bias the results given that families with higher incomes are likely to live in safer areas. However, when we removed the safe area variable from the models, income did not become significant. Parental occupation, another common indicator of socio-economic status, was also insignificant across the three MCS models. In contrast, a variable indicative of socio-economic status, social class, was significant in two of the E-Risk models (regardless of the method used). These models showed that respondents belonging to a higher social class were less likely to be involved in SVLBs than those belonging to a lower social class. It is important to remember though that the E-Risk analysis also includes gang activity and robbery.

This disparity between socio-economic status as an indicator for weapon carrying/use and gang activity has been found in a previous study. The longitudinal study carried out in Edinburgh found that knife carriers were no more likely to be entitled to free school meals because of low family income, but that gang members were more likely than non-gang members to be entitled to free school meals on the basis of low family income, and were also more likely to be living in families where the head of the household was in manual employment or unemployed (McVie, 2010). This suggests that interventions aimed at reducing gang membership may be best focused on specific geographical locations and among those more socially disadvantaged. However, this approach may not be as beneficial for reducing weapon carrying/use which seems to be more distributed across social groups.

4.3 School

Several school-related indicators were significant across the two studies. School exclusions began rising alongside serious violence in around 2014 and are still increasing. Latest figures show a 15% rise in permanent exclusions in England and Wales in the year ending 31 March 2017. These have risen by 67% since the end of March 2013 (Department for Education, 2018).

This report found that those who have been excluded from school are more likely to carry/use a weapon compared with those who have not been suspended or excluded, although it is important to note that this does not prove that school exclusion causes weapon carrying/use or that all those who have been excluded are involved with weapons. This is consistent with the MoJ research on the educational background of young knife possession offenders; however, unlike MoJ's research (Ministry of Justice, 2018), this analysis confirms that even when controlling for a variety of factors, school exclusion does increase an individual's odds of being involved with weapons. However, it is important to consider that we do not know whether they have been excluded for their weapon carrying/use or whether the lifestyle following exclusion is their reason for carrying/using. MoJ indicated an approximate 50/50 split between those whose first permanent exclusion was prior to the offence, and those who were permanently excluded at some point after the offence (*ibid*). It noted that knife possession offences rarely followed shortly after exclusions, with the majority being over 90 days after. It must also be noted that only a very small percentage of knife possession offences result in caution or conviction (*ibid*).

Truancing is another important educational indicator that was significant when controlling for several other indicators. Those who truant were more likely to carry/use a weapon. These findings suggest the need to identify early those who are truanting from school and the need to support individuals who have been suspended or excluded from school.

MoJ research highlighted that young offenders and weapon carriers had lower educational attainment than non-offenders or non-weapon carriers but this research did not control for other factors (Ministry of Justice, 2016, 2018). When controlling for a variety of other factors, the MCS and E-Risk analyses found that school performance and IQ were not significant indicators. However, it must be noted that the MCS and E-Risk analyses involves self-reported behaviour. Further research using official educational attainment data and controlling for a range of factors would be beneficial to better understand this relationship.

Bullying others was found to be a significant indicator for weapon carrying/use specifically (using MCS data) but not for SVLBs more widely (using E-Risk data). This variance in findings may be due to the different indicators used across each survey and the difference in ages measured. The significant finding for bullying is consistent with previous research which found that bullying at age 14 predicted violent convictions at ages 15 to 20, self-reported violence at ages 15 to 18 and drug use at ages 27 to 32, among other life outcomes (Farrington & Ttofi, 2001). When available, analysis of the age 17 sweep of the MCS would see if bullying at age 14 predicts self-reported SVLBs at age 17.

4.4 Community

Perceived area safety was a significant indicator in nearly every MCS model (except for the enter method Model 2). Those who felt the area around their home during the day to be not very safe or not at all safe were more likely to carry/use a weapon than those who perceived their area as very safe or safe. Knowledge of area characteristics can be helpful, but these should be combined with individual-level risk factors to identify those who need most support. In the analysis looking at the usefulness of risk factors for identifying at-risk individuals, we found that adding perceived area safety to a group of individual-level risk factors (gender, pubertal status and arguing with father) increased the effectiveness by 46.7% (from 10.1% of individuals correctly identified to 14.8%) compared with the individual-level factors alone.

4.5 Peer group

The Serious Violence Strategy highlights that knife carrying is particularly susceptible to peer influence. Peer behaviour was generally not found to be a significant indicator of weapon carrying/use in this study.¹⁴ However, our measure of peer behaviour does not measure peer weapon carrying/use, it measures whether weapons carrying/use in an individual is affected by having peers who indulge in risky behaviour (smoking, drinking, drug taking), hence our results are not necessarily out of keeping with the potential contagion effects referenced in other studies (Dijkstra *et al.*, 2012). Smoking and alcohol consumption were generally not significant at the individual level, so it seems unsurprising that they were also not significant from a peer perspective.

¹⁴ In MCS Model 2, peer behaviour was not significant generally (the coefficient was borderline non-significant: 0.052) but the sub-category of 'Peers engaging in no risky behaviours' was significantly different from the sub-categories 'Having peers who engage in some risky behaviours (smoking, alcohol consumption, drug taking or getting into trouble at school)' and 'Having peers who engage in many risky behaviours'. These significant differences did not hold when further variables like minor violence and committing public disorder were added in Model 3.

5 Conclusion

Prevention approaches are frequently classified as universal/selective/indicated. Universal programmes are those administered to everyone within a defined population regardless of risk for example, a communications campaign like #knifefree. This type of programme tends to be light-touch and can deliver a range of impacts ranging from improved attitudes and knowledge to behavioural changes. Targeted programmes are for individuals who have already committed violence (so called 'indicated' programmes) or groups who have been identified as high-risk but have not committed violence yet (selective programmes). MST is an example of the latter.

The analysis in this report implies that both universal and more targeted approaches can have benefits. Universal approaches reach a higher proportion of the total proportion of the at-risk population, whereas targeted programmes have the potential to apply more intensive, costly interventions to those most at risk. There is some evidence that targeted approaches, whether selective/indicated are more effective at reducing violence than universal programmes (Matjasko et al., 2012).¹⁵ This emphasises the importance of developing successful strategies for identifying the individuals most at risk, without stigmatising them, especially as those with the greatest number of risk factors are often the hardest to reach. Evidence suggests that for medium and low risk individuals the use of very intense programmes had no greater success than lighter touch ones (Schaeffer & Borduin, 2005).

The research in this report can be used to indicate which factors to use when selecting individuals for different interventions. Using the more strongly associated factors should help reach the individuals most in need of intense support. Importantly though, this study is only one of many that has looked at risk factors for violence. These results should therefore be used in conjunction with wider evidence.

The analysis in this report shows that combining the risk factors most associated with SVLBs increases the likelihood that interventions will be aimed at the right individuals. But the cost is that a smaller proportion of all at-risk individuals will be identified. This is a cost worth paying for intensive interventions, but less so for light-touch, low-cost interventions.

¹⁵ However, most universal interventions' participants would never go on to offend even if they did not take part in a programme, so the effectiveness is to an extent diluted by non-offenders. There is not yet enough evidence to say whether targeted programmes should be preferred to universal programmes in all instances.

6 Caveats and improvements

- Some categories were combined due to small counts which may conflate interpretation of these categories or not allow for full assessment of the variation.
- Attention should be paid to the confidence intervals (CIs) in the tables as some are wide due to the low counts within some categories.
- Numerous variables were identified which captured broadly the same point of interest. In these instances, a single representative variable was chosen based on correlation and review of data quality. Further details can be found in Appendix C.
- Although we have included a rich set of controls, there will always be some factors that are not included, and it is possible that these may drive both the SVLB or the other indicators. This is inevitable with secondary analysis.
- We have not explicitly examined the immediate motivations for carrying/using a weapon such as because of fear or provocation. These could be considered when implementing interventions.
- The MCS analysis uses indicators measured at the same age meaning that we cannot establish the direction of any relationship and care should be taken when interpreting the odds ratios. For example, we cannot say whether victimisation drives weapon carrying/use or vice versa. We can only determine if they are significantly associated. This could be addressed using the age 17 wave which will allow for a stronger causal position to be presented on drivers of SVLBs.
- We cannot say the extent to which behaviour at these ages are exploratory or established. Further studying with age 17 MCS data will allow for this.
- While the MCS data did contain twin pairs, these were not used in this analysis. As a result, there has not been any insight into these individuals. Further research could look at this smaller sample within the data to control for genetic effects.
- Given that the E-Risk sample is only comprised of twins, inferences drawn from this study may not apply to the general population. Further research could also use this sample to explore family effects.
- Many of the factors were controlled for using self-reported variables which may result in bias. This could cause under- or over-estimation of the impact of several indicators. There is also a possibility that individuals who are most at risk are those least likely to participate in surveys.
- There was attrition in both studies, more notably in the MCS. Individuals with more chaotic lifestyles may be more likely to engage in serious violence and drop out of longitudinal studies. This could lead to underestimation of individuals most likely to engage in serious violence.

Appendix A: Indicators used from the Millennium Cohort Study

A.1 Non-behavioural

Gender

Dichotomous variable indicating Female or Male.

Ethnicity

Ethnicity was grouped into White and Non-white due to small counts for some of the categories. Non-white consists of Mixed, Indian, Pakistani, Bangladeshi, Black Caribbean, Black African and Other ethnic group (including Chinese and Other).

Age

Given that the wave used in this report was at age 14, this variable only contains three categories: 13, 14 and 15. Seventy-five per cent of respondents were aged 14, 23% were aged 13 and 2% were aged 15.

Country

This is a categorical variable which includes England, Wales, Scotland and Northern Ireland. The inclusion of this variable will show whether there are any significant differences across these countries.

Parental occupation

The highest parent-reported occupation was calculated for this variable. An MCS-derived variable was used which derives the working status of the respondent along with a derived version of the National Statistics Socio-economic Classification (NS-SEC) full version of the respondent's current job (if employed at the time). The categories were collapsed based on the three-class version of the NS-SEC with a separate category to identify those not in work. The three categories were Routine and manual occupations, Intermediate occupations, and Managerial and professional occupations. The Intermediate occupations category includes small employers and own account workers, and the Routine and manual occupations category includes semi-routine and routine occupations.

Parental education

The maximum parent-reported education level was calculated for this variable using an MCS-derived variable which indicates the highest academic level across all sweeps of the survey. The categories range from NVQ Level 1 (low grade GCSE or equivalent) to NVQ Level 5 (postgraduate or equivalent). The category identifying overseas qualifications only was excluded as it would not be possible to discern the level of qualification.

Parental drug use

This variable indicates whether either parent used recreational drugs (like cannabis, cocaine or ecstasy) in the past 12 months. There are two categories: Never and Yes, where Yes includes Occasional and Regular users.

Parental mental illness

This variable indicates whether either parent has a longstanding illness affecting their mental health. Two variables were used to create this: one indicating whether the parent has any physical or mental health conditions or illnesses lasting or expected to last 12 months or more, and if any of these condition(s) or illness(es) affects their mental health.

Frequency of arguing with mother

This variable indicates the frequency of arguments and incorporates a variable concerning closeness to mother to identify whether the respondent has no mother or no contact with their mother. There are five categories: Most days, More than once a week, Less than once a week, Hardly ever or Never, and No mother/contact.

Frequency of arguing with father

This variable indicates the frequency of arguments and incorporates a variable concerning closeness to father to identify whether the respondent has no father or no contact with their father. There are five categories: Most days, More than once a week, Less than once a week, Hardly ever or Never, and No father/contact.

The number of siblings in the household

This is an MCS-derived variable and is indicative of how many siblings there are in the household. These may be natural, half, step, adopted or foster siblings of the respondent and the variable consists of five categories ranging from None to Four or more.

Parents child lives with

This is an MCS-derived variable indicating the parents and carers in the household and is created through counting the numbers of each parent type from variables in the Household Grid. Due to small counts, the variable relating to parents/carers in the household was collapsed into a smaller number of categories. It identifies Both natural parents, Natural mother and step-parent or other parent/carer/adoptive parent, Natural mother only, and Other. Other encompasses a wide range of alternatives: Natural father and step-parent, Natural father and other parent/carer, Two adoptive parents, Two foster parents, Two grandparents, Grandmother and other parent/carer, Two other parents, Natural father only, Adoptive mother only, Grandmother only, Other parent/carer only (foster/sibling/relative), Step father only, Adoptive mother and step-parent, and Two step-parents.

Income

This is an MCS-derived variable and divides the total net income by the number of household members according to their weight on the Organisation for Economic Co-operation and Development (OECD) equivalised income scale to give net disposable income. This is then collapsed into quintiles based upon UK income distribution. This variable breaks down OECD equivalised income into quintiles for the UK as a whole.

Pubertal indicator – body hair

The body hair variable was included to be indicative of puberty and respondents were asked to describe the growth of their body hair. My body hair has not yet begun to grow and My body hair has barely started to grow were combined into one category, and My body hair has definitely started to grow and My body hair growth seems completed were kept separate.

Perceived area safety

This variable was collapsed into a dichotomous variable indicating whether the respondent perceives walking, playing or hanging out in their area (within about a mile or 20-minute walk from their home) during the day as Very safe or safe to play in, or Not very safe or not at all safe.

A.2 Social/School behaviour

Peer behaviour

This variable was created to indicate peer behaviour by a summation of four variables to which respondents could answer: None of them, Some of them, Most of them, or All of them.

1. How many of your friends smoke cigarettes? Do not include electronic cigarettes (e-cigarettes).
2. How many of your friends drink alcohol?
3. Do any of your friends take cannabis (weed) or any other illegal drugs?
4. How many of your close friends get into a lot of trouble at school?

These variables were summed and the average was taken. The variable was coded No risky behaviours, Some risky behaviours, or Many risky behaviours.

Experience of victimisation

This variable shows whether the respondent has faced any victimisation in the past year. Five different types of victimisation were included:

1. Insulted you, called you names, threatened or shouted at you in a public place, at school or anywhere else?
2. Been physically violent towards you e.g. pushed, shoved, hit, slapped or punched you?
3. Hit you with or used a weapon against you?
4. Stolen something from you e.g. a mobile phone, money etc.?
5. Made an unwelcome sexual approach to you or assaulted you sexually?

If the respondent answered yes to any of these they were classed as Yes; however, if they did not answer some of them and said no to any of them they were classed as No as it is not possible to ascertain whether they have been a victim of any of these behaviours.

School suspension or exclusion

This variable was created using a variety of variables:

1. Has [^Cohort member's name] ever been temporarily suspended or temporarily excluded from school for at least one day?

2. Can I just check, is the school [^Cohort member's name] attends now the same school [^he/she] started secondary school at?
3. Why has [^Cohort member's name] changed to a different secondary school?
 - a. Reason: Excluded from previous school
4. Has [^Cohort member's name] ever been expelled or permanently excluded from school?

These were combined to indicate whether the respondent has Not been suspended or excluded, Excluded (with suspension or not), or Suspended (not excluded).

Frequency of truanting

Two variables were combined to indicate frequency of truanting. There are six categories: Never, Once, Less often than once a month, Once a month, Once a week, and 2 to 3 times a week or most days (combined into one category due to low counts).

1. In the last 12 months, have you ever missed school **without your parents' permission** even if only for half a day or a single lesson?
2. In the last 12 months, how often did you miss school **without your parents' permission** (even if only for half a day or a single lesson)?

Bullying

Two variables were combined to indicate bullying.

1. How often do you hurt or pick on other children on purpose?
2. How often have you sent unwanted or nasty emails, texts or messages, or posted something nasty about other children on a website?

Any frequency aside from Never was coded to indicate Yes (Most days, About once a week, About once a month, Every few months).

Victim of bullying

This variable was created in the same way as the Bullying variable using the following questions.

1. How often do other children hurt you or pick on you on purpose?
2. How often have other children sent you unwanted or nasty emails, texts or messages, or posted something nasty about you on a website?

Academic self-concept

The responses to the below variables were summed and an average was taken for respondents who had answered all three questions. Respondents could answer Strongly disagree, Disagree, Agree, or Strongly agree. The average was subsequently rounded and Strongly disagree and Disagree were combined to represent a poorer view of their academic capability, and Strongly agree and Agree were combined to represent a better view of their academic capability.

1. How much do you agree or disagree with each of the following statements about you?
 - a. I am good at English;

- b. I am good at Maths;
- c. I am good at Science.

Self-harm

Respondents were asked the following dichotomous variable indicating Yes or No.

1. In the past year have you hurt yourself on purpose in any way?

Independence

The variable to indicate independence comprises two variables:

1. In the past month, how many times have you stayed out after 9.00pm at night without your parents knowing where you were?

To which respondents could answer Never, 1 to 2 times, 3 to 9 times or 10 or more times.

2. In the last 12 months did you ever stay away over night without your parents knowing where you were?

To which respondents could answer No, never, Yes, once or a few times, or Yes, lots of times.

The responses were recoded as dichotomous variables to indicate Yes or No and were combined into one variable if the respondent said Yes to either.

Risk-taking

Respondents were asked:

1. On a scale of 0 to 10, where 0 is never and 10 is always, how willing to take risks would you say you are?

Their responses ranged from Never (0) to Always (10). This variable was therefore used as a continuous variable.

Perceived life quality

Respondents were asked:

1. On a scale of 1 to 7 where '1' means completely happy and '7' means not at all happy, how do you feel about the following parts of your life?

- a. Your life as a whole?

2. How much do you agree or disagree with the following statements about you?

- a. On the whole, I am satisfied with myself.

To which they could respond Strongly agree, Agree, Disagree or Strongly disagree.

These two variables were summed and an average was taken and rounded. Three categories are indicative of Good, Average and Poor perceived life quality.

Feelings of isolation

Respondents were asked to think about their current relationships with friends, family members, community members, and so on and to indicate to what extent each statement describes their current relationships with other people.

1. I have family and friends who help me feel safe, secure and happy.
2. There is someone I trust whom I would turn to for advice if I were having problems.
3. There is no one I feel close to.

Respondents could answer Very true, Partly true, or Not true at all. These variables were summed for respondents answering all three questions and the average was rounded. The variable is coded Yes or No.

A.3 ASB, substance use and criminal activity behaviour

Ever tried drugs

Respondents were asked if they had ever tried cannabis or any other illegal drug. These two variables were combined and if the response was Yes to either then they were classed as Yes, and respondents answering No to both were classed as No.

Ever cautioned or arrested

Two variables were used to create this variable:

1. Have you ever been given a formal warning or caution by a police officer?
2. Have you ever been arrested by a police officer and taken to a police station?

If the response was Yes to either question then they were classed as Yes, and respondents answering No to both were classed as No. Respondents answering No to one and not responding to the other were classed as Missing.

Ever stopped and questioned by the police

This variable was classed as Yes if they reported ever being stopped and questioned by the police or No if they had not.

Ever smoked

This variable was classed as No if the respondent had never smoked cigarettes and Yes if they have Only ever smoked cigarettes once, Used to smoke sometimes but never smoke now, Sometimes smoke but not as many as one a week, Usually smokes between one and six cigarettes a week, or Usually smokes more than six cigarettes a week.

Ever gambled

Several variables were combined to indicate if the respondent has spent any of their own money on gambling in the past month. This includes fruit machines, placing a private bet for money (e.g. with friends), placing a bet in a betting shop or any other gambling. Respondents answering Yes to either were classed as Yes, and respondents answering No to both were classed as No. Respondents answering No to one and not responding to the other were classed as Missing.

Alcohol consumption

Two variables were used to indicate whether the respondent had ever had an alcoholic drink (more than a few sips) and then how many times they have had an alcoholic drink in the last 12 months. The variable identifies 1 to 9 times, 10 to 19 times, and 20 or more times (categories were combined due to smaller counts for some of the categories).

Ever pushed/shoved or hit someone

Respondents were asked the following dichotomous variable indicating Yes or No:

1. In the last 12 months have you pushed or shoved/hit/slapped/punched someone?"

Ever committed public disorder

Three variables were used to create this variable:

1. In the last 12 months have you been noisy or rude in a public place so that people complained or got you into trouble?
2. In the last 12 months have you written things or spray painted on a building, fence or train or anywhere else where you shouldn't have?
3. In the last 12 months have you on purpose damaged anything in a public place that didn't belong to you, for example by burning, smashing or breaking things like cars, bus shelters and rubbish bins?

Respondents answering Yes to either were classed as Yes, and respondents answering No to both were classed as No. Respondents answering No to one and not responding to the other were classed as Missing.

Ever stolen from someone or a shop

Respondents were asked:

1. Have you stolen something from someone, e.g. a mobile phone, money etc., in the last 12 months?
2. Have you taken something from a shop without paying for it in the last 12 months?

Respondents answering Yes to either were classed as Yes, and respondents answering No to both were classed as No. Respondents answering No to one and not responding to the other were classed as Missing.

Ever committed cybercrime

Respondents were asked:

1. Have you accessed, or hacked into, someone else's computer, e-mail or social networking account without their permission in the last 12 months:
2. Have you used the internet to send viruses, or other harmful software to deliberately damage or infect other computers in the last 12 months?

Respondents answering Yes to either were classed as Yes, and respondents answering No to both were classed as No. Respondents answering No to one and not responding to the other were classed as Missing.

Appendix B: Indicators used from the E-Risk Longitudinal Study

B.1 Non-behavioural

Gender

This is a dichotomous variable indicating Female or Male.

Mother's age at first birth

This variable identifies the age at which the twin's mother had her first child and is used as a continuous variable.

Parental monitoring – age 10

The children's mothers were asked several questions relating to the activities of their children. The below items were summed (all coded 0 – No, never; 1 – Sometimes; 2 – Yes, always) therefore higher scores reflect greater monitoring.

1. Do you know which friends _____ hangs about with during his/her free time?
2. Do you know where _____ goes during his/her free time?
3. Do you know what _____ spends his/her money on?
4. Do you usually know what type of homework _____ has?
5. Do you usually know when _____ has tests or projects due at school?
6. Do you know how _____ does in different subjects at school?
7. Does _____ need to have your permission to leave home (or go somewhere with friends)?
8. Does _____ need to ask you before she/he can decide with his/her friends what she/he will do at the weekend?
9. Before _____ goes out with friends, do you expect him/her to tell you where she/he is going and with whom?
10. After _____ comes home, do you expect him/her to tell you what he/she did and whom he/she was with?

Father anti-social behaviour score – measured when child was age 5

This variable is based on the Young Adult Behavioural Checklist (Achenbach, 1997), modified to obtain lifetime data and supplemented with questions from the Diagnostic Interview Schedule (DIS) (Robins *et al.*, 1995: Ch.1). It is used as continuous and higher scores indicate higher levels of ASB.

IQ score – measured when child was age 5

This is based on the Wechsler Preschool and Primary Scale of Intelligence (revised 2012) (Wechsler, 1967). It is used as continuous and higher scores are indicative of higher IQ.

Social class

Social class is a standardised composite of income, education and social class and is used to measure socio-economic status at age 5 (Trzesniewski *et al.*, 2006).

Child maltreatment – between ages 5 and 12

This variable is child maltreatment including physical, sexual or emotional abuse/neglect perpetrated against the individual by an adult. There are three categories: No maltreatment, Probable maltreatment and Definite maltreatment.

Domestic violence in household – measured at age 5

Two variables were combined to create this variable to show whether there is domestic violence in the household and whether the individuals were exposed to it. There are three categories: No, Yes with no exposure, and Yes with exposure.

Mother anti-social personality symptom count – measured when child was age 5

This was created in the same way as the Father anti-social behaviour score; however, this was used as categorical with four categories: No symptoms, One symptom, Two symptoms, and Three or more symptoms.

Perinatal disease

This variable has two categories: Yes for presence and No for absence. The codes included in this variable indicating perinatal disease can be found here:

<http://www.icd10data.com/ICD10CM/Codes/O00-O9A>.

Number of children

This variable identifies the number of children the twin's mother gave birth to and ranges from 2 to 12; however, values of 6 or more were grouped together due to lower counts for these values.

Parent substance abuse – measured when child was age 5

Two variables were combined to create this variable: Mother substance problems (four or more symptoms) and Father substance problems (five or more symptoms), which are based on DAST items (Drug Abuse Screening Test). The variable identifies whether either parent was categorised as having four or more symptoms (mother) or five or more symptoms (father).

Low maternal warmth – measured when child was age 5

Low maternal warmth was measured if 50% or more comments in an Expressed Emotion interview were negative. This is a dichotomous variable of Yes or No.

Father marital status – measured when child was age 5

This variable indicates whether the individual's father is Married to mother, With new partner or married to other, or if Father not present.

Health professional diagnosed learning/behaviour/development/mental health problem – age 10

At age 10, parents were asked if they have ever been told by a health professional that the child has any behavioural problem, learning problem, developmental problem or mental health problem. This is a dichotomous variable of Yes or No.

Ever in foster care – from birth to age 7

The foster care variable identifies whether the respondent has been in foster care and/or social care at any point since birth and is coded Yes and No.

B.2 Social/School behaviour

Often skips school – age 12

Respondents were asked if they sometimes do not go to school when they should. This is a dichotomous variable of Yes or No.

School performance reported by the child's teacher – age 7

This variable was measured at age 7 and combines English and Maths school performance reported by the child's teacher. Responses are coded Far below, Somewhat below, Average, Somewhat above, and Far above. An average was taken of these two variables and the result was rounded.

Self-control – ages 5 to 10

This variable was derived by E-Risk and combines the childhood self-control variable across ages 5 to 10. For this variable a higher score reflects lower self-control.

Been a bully – age 12

Two variables were combined to create this variable and it indicates whether the respondent sometimes bullies or threatens people they do not like or bullies or threatens their twin or sibling. It is coded Yes and No.

Independence – age 12

For this variable, respondents were asked if they sometimes stay out late when their parents do not want them to. This is a dichotomous variable of Yes or No.

B.3 ASB/Crime behaviour

All of these risk indicators were measured at age 12 and are all dichotomous variables of Yes and No.

Stealing

Two variables were combined to indicate whether the respondent has stolen something while nobody was looking or taken something from a shop or stall.

Sometimes hits parent

This variable identifies whether the respondent sometimes hits one of their parents or step-parents.

Violence

For this, variable respondents were asked if they sometimes hit someone when they have an argument.

Hurts people

Two variables were combined to create this variable which indicates whether the respondent has hurt someone for the fun of it or to be nasty. The new variable was coded Yes if the respondent answered Yes to any of these variables, and No if they responded No to all of them.

Starts fights

This identifies whether the respondent sometimes starts fights with people.

Public disorder

For this variable four variables were combined:

1. Have you damaged others property like smashing bottles in the street?
2. Have you damaged or destroyed property that belongs to a school?
3. Have you painted or written graffiti on a wall in a public place?
4. Have you damaged a parked car?

The new variable was coded Yes if the respondent answered Yes to any of these variables, and No if they responded No to all of them.

Appendix C: Methodology

C.1 Technical methodology

The MCS uses a complex sampling design that needs to be taken into consideration when trying to infer findings wider than the cohort itself. The factors that were accounted for were the overall weight (which accounts for attrition and non-response), the stratification, the clustering and the finite population correction factor. Additionally, given that the E-Risk study is a twin study, within family clustering was accounted for.

For the MCS analysis, six datasets were merged using the unique ID number for each household: the longitudinal family file, cohort member self-completion, cohort member-derived variables, family-derived variables, parent interview and the parent-derived variables.

For both analyses, data was cleaned using SPSS Statistics and analysis was completed on STATA.

C.2 Excluded variables

The decision on which variables to exclude and include was made on the degree of variation with the dependent variable, correlation with the dependent variable, number of missing observations and correlation with other independent variables. Some other variables which may have been relevant were not selected due to the quality of the variable or because they covered the same factor as other variables. As an example, for the MCS analysis, a variable indicating foster care was not included because zero respondents reporting weapon carrying/use were also in or had ever been in foster care.

C.3 Dealing with missing data

C.3.1 Excluded missing cases

For the models estimated using the enter method, all missing cases were retained (except those mentioned below which were removed in the modelling process) as a separate category to ensure that they were controlled for. This was also the case for continuous variables for which the means were imputed and dummy variables indicating the missing cases were created. These were both included in the analysis with only the continuous variable being interpreted. The Missing categories for the categorical variables have not been displayed in the models. All missing cases were deleted for the dependent variable.

The stepwise method models used a smaller number of cases than the enter method, whereby Missing cases were only included as a separate category if there were at least 30. This avoided the inclusion of very small Missing categories, which can result in large ORs, so that the 'stability' of the models could be examined.

There were some categories of Missing where there was no variation to allow their inclusion (some respective Missing categories were only cases which did not report the SVLBs); these cases were therefore removed during the modelling process.

C.4 Logistic regression methodology

C.4.1 Enter method

For the enter models, all variables are entered in a single step so, for each of the three models, every indicator being controlled for was entered at the same time. The models were estimated using the weighting and the complex sample design, as previously explained, was taken into account. All categories for each variable were jointly tested excluding the Missing category to determine overall significance of the variable.

Stepwise method

For the stepwise method, the three models were first estimated using forwards stepwise and backwards stepwise accounting for only the weighting. It is not possible to estimate models using stepwise and complex samples simultaneously, therefore following these original estimation, all variables that were either in the forwards stepwise model or the backwards stepwise model were included in a model using the enter method which accounted for weighting and the complex sample design. Finally, every variable from that model was included as starting variables in a simulated (backwards) stepwise regression using the complex design and weighting. All categories for each variable were jointly tested excluding the Missing category to determine overall significance of the variable.

Appendix D: Full logistic regression models

Table 17: MCS weighted logistic regression of reported weapon carrying/use (enter method)

Independent variable	Model 1				Model 2				Model 3			
	OR	Sig.	95% CI		OR	Sig.	95% CI		OR	Sig.	95% CI	
Gender												
Female	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Male	3.35	0.00	2.28	4.92	4.10	0.00	2.65	6.34	2.74	0.00	1.69	4.44
Ethnicity												
White	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Non-white	0.75	0.15	0.50	1.12	0.86	0.50	0.56	1.32	0.83	0.46	0.51	1.35
Age		0.06				0.06				0.05		
13	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
14	1.13	0.49	0.80	1.58	1.03	0.87	0.69	1.55	0.92	0.70	0.59	1.42
15	2.90	0.02	1.21	6.98	2.86	0.02	1.16	7.03	2.72	0.03	1.09	6.77
Country		0.44				0.51				0.30		
England	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Wales	0.89	0.51	0.64	1.25	0.90	0.59	0.62	1.31	0.98	0.91	0.67	1.44
Scotland	1.04	0.88	0.66	1.63	0.86	0.52	0.54	1.37	0.78	0.32	0.47	1.28
Northern Ireland	0.70	0.12	0.44	1.10	0.71	0.15	0.45	1.13	0.66	0.08	0.42	1.06

	Model 1				Model 2				Model 3			
Parental occupation		0.34				0.10				0.27		
Managerial and professional occupations	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Intermediate occupations	0.96	0.85	0.64	1.45	0.99	0.96	0.63	1.56	1.04	0.87	0.65	1.66
Routine and manual occupations	0.70	0.16	0.42	1.16	0.78	0.39	0.44	1.38	0.98	0.94	0.54	1.76
Not in work	1.18	0.60	0.64	2.18	1.67	0.12	0.87	3.21	1.79	0.08	0.92	3.47
Parental education		0.34				0.18				0.12		
Postgraduate	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Degree	1.16	0.52	0.73	1.85	1.11	0.70	0.65	1.91	1.19	0.51	0.71	2.01
A levels	0.93	0.82	0.49	1.77	0.94	0.87	0.47	1.89	0.86	0.66	0.43	1.71
GCSE A* to C	1.21	0.52	0.68	2.17	1.19	0.60	0.62	2.28	1.13	0.72	0.57	2.25
Low grade GCSE	1.32	0.49	0.60	2.91	1.49	0.34	0.66	3.38	1.43	0.42	0.60	3.41
No qualifications	1.96	0.05	1.00	3.83	2.36	0.02	1.13	4.94	2.54	0.02	1.18	5.46
Parental drug use												
Never	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Occasionally or regularly	1.81	0.05	1.00	3.27	1.39	0.24	0.80	2.44	1.40	0.30	0.74	2.63
Parental mental illness												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	0.98	0.95	0.61	1.58	0.85	0.55	0.49	1.47	0.86	0.63	0.48	1.56
Frequency of arguing with mother		0.02				0.29				0.17		
Never or hardly ever	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Less than once a week	1.38	0.17	0.88	2.17	0.98	0.94	0.63	1.54	0.85	0.47	0.54	1.33
More than once a week	1.31	0.29	0.79	2.17	0.59	0.04	0.35	0.98	0.49	0.02	0.27	0.87
Most days	2.39	0.00	1.42	4.05	0.78	0.39	0.44	1.38	0.60	0.10	0.32	1.10

	Model 1				Model 2				Model 3			
No mother/contact	1.61	0.51	0.39	6.57	1.20	0.78	0.33	4.41	1.06	0.93	0.30	3.71
Frequency of arguing with father		0.00				0.64				0.70		
Never or hardly ever	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Less than once a week	1.28	0.23	0.86	1.92	1.13	0.58	0.74	1.73	1.11	0.65	0.71	1.72
More than once a week	2.37	0.01	1.30	4.33	1.49	0.18	0.83	2.68	1.54	0.18	0.82	2.90
Most days	2.54	0.00	1.48	4.36	1.33	0.32	0.76	2.30	1.29	0.37	0.74	2.27
No father/contact	1.85	0.01	1.14	2.99	1.26	0.41	0.73	2.15	1.20	0.53	0.68	2.13
Number of siblings in household		0.00				0.00				0.01		
One	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
None	1.70	0.03	1.05	2.77	2.01	0.01	1.18	3.41	1.68	0.08	0.94	3.03
Two	0.82	0.34	0.55	1.22	0.86	0.48	0.56	1.31	0.86	0.49	0.56	1.32
Three	1.24	0.37	0.78	1.99	1.36	0.22	0.83	2.23	1.32	0.30	0.78	2.25
Four or more	1.99	0.02	1.13	3.49	2.24	0.01	1.21	4.13	2.26	0.02	1.16	4.40
Parents child lives with		0.71				0.82				0.82		
Both natural parents	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Natural mother and step-parent or other parent/carer/adoptive parent	1.06	0.82	0.65	1.72	0.90	0.70	0.52	1.55	0.81	0.44	0.47	1.39
Natural mother only	1.32	0.25	0.82	2.11	1.04	0.87	0.63	1.74	0.99	0.98	0.58	1.69
Other	0.98	0.96	0.36	2.63	0.68	0.41	0.28	1.70	0.79	0.60	0.33	1.92
Income quintiles		0.23				0.60				0.67		
Lower quintile	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Second quintile	0.89	0.64	0.55	1.45	0.88	0.61	0.53	1.46	0.85	0.58	0.48	1.50
Third quintile	1.03	0.93	0.55	1.93	1.34	0.40	0.68	2.67	1.37	0.39	0.67	2.82
Fourth quintile	0.76	0.42	0.38	1.49	1.23	0.55	0.62	2.42	1.19	0.62	0.60	2.36

	Model 1				Model 2				Model 3			
Highest quintile	0.57	0.16	0.26	1.25	1.04	0.93	0.46	2.34	1.15	0.75	0.48	2.71
Pubertal indicator		0.00				0.00				0.02		
My body hair has not yet begun to grow or has barely started to grow	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
My body hair has definitely started to grow	2.04	0.00	1.33	3.12	1.91	0.01	1.20	3.03	1.77	0.02	1.10	2.86
My body hair growth seems completed	3.41	0.00	2.05	5.68	2.56	0.00	1.46	4.49	2.17	0.01	1.22	3.86
Perceived area safety												
Very safe or safe	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Not safe at all or not very safe	2.06	0.00	1.34	3.17	1.47	0.09	0.94	2.29	1.59	0.03	1.04	2.43
Peer behaviour						0.05				0.59		
No risky behaviours	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Some risky behaviours	-	-	-	-	2.11	0.02	1.10	4.05	1.34	0.42	0.66	2.75
Many risky behaviours	-	-	-	-	2.53	0.02	1.15	5.60	1.10	0.81	0.49	2.46
Experience of victimisation												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	2.74	0.00	1.84	4.09	1.87	0.00	1.24	2.82
School suspension or exclusion						0.00				0.05		
Not suspended or excluded	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Excluded (with suspension or not)	-	-	-	-	5.95	0.00	1.99	17.74	3.40	0.02	1.27	9.12
Suspended (not excluded)	-	-	-	-	1.48	0.18	0.83	2.62	1.20	0.58	0.63	2.30
Frequency of truanting		-				0.00				0.00		
Never	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Once	-	-	-	-	1.10	0.75	0.59	2.05	0.98	0.95	0.53	1.80

	Model 1				Model 2				Model 3			
Less often than once a month	-	-	-	-	2.17	0.01	1.22	3.87	1.43	0.22	0.81	2.52
Once a month	-	-	-	-	3.92	0.01	1.46	10.54	2.08	0.17	0.73	5.96
Once a week	-	-	-	-	8.43	0.00	3.74	19.03	6.05	0.00	2.80	13.10
2 to 3 times a week or most days	-	-	-	-	1.87	0.13	0.84	4.17	1.00	1.00	0.44	2.30
Ever hurts or picks on other children (either in person or online)												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	2.34	0.00	1.56	3.51	1.64	0.04	1.03	2.59
Victim of bullying												
Yes	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
No	-	-	-	-	1.42	0.13	0.90	2.22	1.31	0.23	0.84	2.05
Academic self-concept		-										
Better view of academic capability	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Poorer view of academic capability	-	-	-	-	1.21	0.31	0.84	1.73	1.06	0.76	0.72	1.56
Self-harm												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	2.70	0.00	1.81	4.03	2.39	0.00	1.55	3.69
Independence												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.88	0.00	1.37	2.59	1.16	0.43	0.80	1.67
Risk-taking		-			1.25	0.00	1.15	1.35	1.13	0.00	1.04	1.23
Perceived life quality		-				0.37				0.27		
Good	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Average	-	-	-	-	1.39	0.19	0.85	2.28	1.46	0.16	0.86	2.48

	Model 1				Model 2				Model 3			
Poor	-	-	-	-	1.59	0.22	0.75	3.37	1.78	0.14	0.83	3.79
Feelings of isolation												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.73	0.01	1.19	2.53	1.85	0.00	1.27	2.69
Ever tried drugs												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.54	0.07	0.97	2.46
Ever cautioned or arrested												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.25	0.39	0.75	2.10
Ever stopped and questioned by the police												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.39	0.14	0.89	2.17
Ever smoked												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.02	0.92	0.66	1.60
Ever gambled												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.74	0.00	1.24	2.44
How many times have you drunk in the last 12 months		-				-				0.20		
Never or none in the last 12 months	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
1 to 9 times	-	-	-	-	-	-	-	-	1.46	0.16	0.86	2.47
10 to 19 times	-	-	-	-	-	-	-	-	1.95	0.03	1.05	3.61

	Model 1				Model 2				Model 3			
20 or more times	-	-	-	-	-	-	-	-	1.40	0.41	0.63	3.10
Ever pushed/shoved or hit someone												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.38	0.00	1.47	3.86
Ever committed public disorder												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.26	0.00	1.53	3.32
Ever stolen from someone or a shop												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.49	0.06	0.98	2.28
Ever committed cybercrime												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.99	0.00	1.37	2.88

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- - indicates variable not in model.
- All analyses were weighted.
- Model 1 Fit Statistics: AIC = 3022.28, BIC = 3380.36, Pseudo R² = 0.12.
- Model 2 Fit Statistics: AIC = 2474.70, BIC = 3044.71, Pseudo R² = 0.30.
- Model 3 Fit Statistics: AIC = 2278.53, BIC = 3016.62, Pseudo R² = 0.37.

Table 18: MCS weighted logistic regression of reported weapon carrying/use (stepwise method)

	Model 1				Model 2				Model 3			
Independent variable	OR	Sig.	95% CI		OR	Sig.	95% CI		OR	Sig.	95% CI	
Gender												
Female	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Male	3.51	0.00	2.30	5.36	4.08	0.00	2.40	6.95	3.14	0.00	1.91	5.18
Age		0.06				0.05				0.02		
13	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
14	1.10	0.61	0.77	1.57	1.03	0.90	0.68	1.54	0.89	0.59	0.59	1.34
15	3.15	0.02	1.24	8.03	3.27	0.02	1.22	8.78	3.03	0.02	1.24	7.38
Parental education										0.04		
Postgraduate	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Degree									1.30	0.30	0.79	2.14
A levels									0.94	0.86	0.49	1.81
GCSE A* to C									1.24	0.49	0.67	2.30
Low grade GCSE									1.89	0.11	0.86	4.14
No qualifications									2.87	0.00	1.41	5.82
Parental drug use												
Never	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Occasionally or regularly	2.01	0.01	1.15	3.52								
Frequency of arguing with mother		0.02										
Never or hardly ever	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Less than once a week	1.33	0.23	0.83	2.14								
More than once a week	1.22	0.49	0.70	2.11								
Most days	2.38	0.00	1.36	4.17								
No mother/contact	1.64	0.48	0.41	6.48								

	Model 1				Model 2				Model 3			
Frequency of arguing with father		0.00										
Never or hardly ever	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Less than once a week	1.34	0.17	0.88	2.03								
More than once a week	2.61	0.00	1.36	5.00								
Most days	2.98	0.00	1.75	5.07								
No father/contact	1.96	0.01	1.18	3.25								
Number of siblings in household		0.00				0.00				0.02		
One	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
None	1.83	0.02	1.13	2.97	2.24	0.00	1.34	3.75	1.95	0.02	1.12	3.41
Two	0.92	0.68	0.62	1.37	0.88	0.54	0.57	1.34	0.89	0.57	0.59	1.34
Three	1.49	0.08	0.95	2.35	1.42	0.19	0.84	2.40	1.29	0.33	0.77	2.18
Four or more	2.44	0.00	1.43	4.17	2.31	0.01	1.30	4.12	2.03	0.03	1.07	3.84
Parents child lives with		0.04										
Both natural parents	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Natural mother and step-parent or other parent/carer/adoptive parent	1.18	0.50	0.73	1.92								
Natural mother only	1.86	0.01	1.21	2.87								
Other	1.14	0.81	0.40	3.24								
Pubertal indicator		0.00				0.00				0.01		
My body hair has not yet begun to grow or has barely started to grow	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
My body hair has definitely started to grow	2.41	0.00	1.56	3.71	2.19	0.00	1.36	3.53	1.93	0.01	1.21	3.09
My body hair growth seems completed	4.05	0.00	2.35	6.97	2.99	0.00	1.63	5.50	2.56	0.00	1.39	4.72
Perceived area safety												

	Model 1				Model 2				Model 3			
Very safe or safe	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Not safe at all or not very safe	2.20	0.00	1.45	3.35	1.67	0.02	1.10	2.52	1.56	0.04	1.03	2.36
Peer behaviour						0.06						
No risky behaviours	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Some risky behaviours	-	-	-	-	1.95	0.04	1.03	3.68				
Many risky behaviours	-	-	-	-	2.51	0.02	1.14	5.51				
Experience of victimisation												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	2.54	0.00	1.71	3.79	1.96	0.00	1.27	3.05
School suspension or exclusion						0.00						
Not suspended or excluded	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Excluded (with suspension or not)	-	-	-	-	6.43	0.00	2.22	18.67				
Suspended (not excluded)	-	-	-	-	1.54	0.16	0.84	2.83				
Frequency of truanting		-				0.00				0.01		
Never	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Once	-	-	-	-	1.49	0.21	0.80	2.79	1.21	0.55	0.64	2.30
Less often than once a month	-	-	-	-	2.25	0.01	1.28	3.96	1.58	0.12	0.89	2.81
Once a month	-	-	-	-	4.18	0.01	1.50	11.62	2.31	0.11	0.83	6.42
Once a week	-	-	-	-	9.05	0.00	3.63	22.54	5.55	0.00	2.13	14.45
2 to 3 times a week or most days	-	-	-	-	2.11	0.09	0.89	4.98	1.31	0.51	0.59	2.90
Ever hurts or picks on other children (either in person or online)												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	2.03	0.00	1.33	3.10	1.47	0.10	0.93	2.33
Self-harm												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			

	Model 1				Model 2				Model 3			
Yes	-	-	-	-	2.47	0.00	1.68	3.62	2.49	0.00	1.66	3.71
Independence												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.95	0.00	1.41	2.69				
Risk-taking		-			1.21	0.00	1.11	1.32	1.10	0.02	1.01	1.20
Feelings of isolation												
Not isolated	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Partly isolated or isolated	-	-	-	-	1.66	0.01	1.13	2.45	1.83	0.00	1.26	2.66
Ever tried drugs												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.65	0.03	1.06	2.56
Ever stopped and questioned by the police												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.66	0.02	1.09	2.51
Ever gambled												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.79	0.00	1.25	2.56
Ever pushed/shoved or hit someone												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.55	0.00	1.56	4.16
Ever committed public disorder												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.41	0.00	1.62	3.61
Ever stolen from someone or a shop												

	Model 1				Model 2				Model 3			
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.49	0.07	0.97	2.29
Ever committed cybercrime												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.09	0.00	1.40	3.11

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- - indicates variable not in model.
- All analyses were weighted.
- The variables not displayed in the models are not significant with $p > 0.10$.

Table 19: E-Risk logistic regression of reported SVLBs (enter method)

	Model 1				Model 2				Model 3			
Independent variable	OR	Sig.	95% CI		OR	Sig.	95% CI		OR	Sig.	95% CI	
Gender												
Female	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Male	6.79	0.00	4.34	10.62	5.13	0.00	3.24	8.14	4.53	0.00	2.81	7.30
Mother's age at first birth	0.97	0.12	0.92	1.01	0.98	0.35	0.94	1.02	0.98	0.26	0.93	1.02
Parental monitoring	0.91	0.00	0.85	0.97	0.94	0.10	0.87	1.01	0.92	0.05	0.85	1.00
Father anti-social behaviour score	1.00	0.53	0.98	1.01	0.99	0.36	0.98	1.01	0.99	0.25	0.98	1.01
IQ score	0.99	0.31	0.98	1.01	1.00	1.00	0.98	1.02	1.00	0.85	0.99	1.02
Social class		0.06				0.02				0.04		
Low	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Middle	1.13	0.60	0.72	1.78	1.18	0.50	0.73	1.90	1.12	0.65	0.68	1.84
High	0.55	0.08	0.29	1.08	0.50	0.04	0.25	0.98	0.51	0.05	0.26	1.01

	Model 1				Model 2				Model 3			
Child experienced maltreatment		0.01				0.02				0.04		
No maltreatment	Reference				Reference				Reference			
Probable	0.88	0.60	0.54	1.42	0.70	0.17	0.42	1.16	0.70	0.18	0.42	1.18
Definite	2.25	0.01	1.27	3.97	1.89	0.03	1.05	3.39	1.79	0.07	0.96	3.33
Domestic violence in household		0.61				0.60				0.57		
No	Reference				Reference				Reference			
Yes, with no exposure	0.92	0.71	0.57	1.46	0.90	0.68	0.56	1.46	1.05	0.85	0.65	1.69
Yes, with exposure	1.19	0.51	0.71	2.01	1.20	0.50	0.71	2.04	1.32	0.31	0.78	2.24
Mother anti-social personality symptom count		0.37				0.48				0.41		
0	Reference				Reference				Reference			
1	0.69	0.17	0.41	1.17	0.74	0.30	0.43	1.29	0.68	0.18	0.38	1.20
2	1.20	0.57	0.64	2.25	1.23	0.54	0.64	2.35	1.09	0.80	0.56	2.13
3 or more	0.79	0.44	0.44	1.42	0.78	0.42	0.42	1.44	0.73	0.33	0.39	1.38
Perinatal disease												
No	Reference				Reference				Reference			
Yes	0.77	0.34	0.45	1.32	0.73	0.26	0.42	1.27	0.74	0.30	0.42	1.31
Number of children		0.66				0.70				0.45		
2	Reference				Reference				Reference			
3	1.15	0.58	0.70	1.89	1.13	0.63	0.68	1.90	0.98	0.94	0.57	1.68
4	1.04	0.90	0.59	1.84	0.99	0.99	0.55	1.80	0.94	0.83	0.52	1.70
5	1.24	0.56	0.60	2.58	1.00	1.00	0.49	2.05	0.88	0.72	0.43	1.79
6 or more	0.72	0.37	0.36	1.47	0.66	0.28	0.31	1.40	0.52	0.08	0.25	1.08
Parental substance abuse												
Low symptoms	Reference				Reference				Reference			

	Model 1				Model 2				Model 3			
High symptoms	1.16	0.52	0.74	1.82	1.05	0.85	0.64	1.71	1.01	0.98	0.61	1.66
Low maternal warmth												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	1.17	0.38	0.82	1.66	0.95	0.77	0.65	1.37	0.97	0.88	0.66	1.44
Father marital status		0.03				0.04				0.06		
Married to mother	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
With new partner or married to other	1.46	0.09	0.94	2.28	1.55	0.06	0.98	2.46	1.45	0.12	0.91	2.31
Father not present	2.37	0.01	1.22	4.63	2.17	0.03	1.10	4.30	2.24	0.03	1.11	4.55
Health professional diagnosed learning/behaviour/development/ mental health problem – age 10												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	0.65	0.08	0.40	1.06	0.39	0.00	0.22	0.72	0.40	0.00	0.21	0.74
Ever in foster care												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	2.88	0.14	0.71	11.73	2.89	0.10	0.81	10.32	2.61	0.19	0.62	10.95
Often skips school – age 12												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.92	0.04	1.04	3.55	1.54	0.20	0.80	2.97
School performance						0.46				0.38		
Far below	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Somewhat below	-	-	-	-	0.92	0.83	0.42	2.00	0.80	0.58	0.37	1.75
Average	-	-	-	-	1.03	0.94	0.47	2.26	0.88	0.76	0.40	1.95
Somewhat above	-	-	-	-	1.38	0.44	0.61	3.15	1.16	0.73	0.50	2.70
Far above	-	-	-	-	0.51	0.39	0.11	2.36	0.38	0.19	0.09	1.60

	Model 1				Model 2				Model 3			
Self-control	-	-	-	-	1.83	0.00	1.49	2.25	1.77	0.00	1.43	2.21
Been a bully												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.41	0.09	0.95	2.09	1.09	0.71	0.70	1.67
Independence												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.63	0.04	1.02	2.62	1.41	0.19	0.84	2.35
Stealing												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.87	0.02	1.11	3.16
Sometimes hits parent												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	0.93	0.87	0.37	2.33
Violence												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.07	0.00	1.37	3.13
Hurts people												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	0.70	0.23	0.39	1.25
Starts fights												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.14	0.57	0.73	1.79
Public disorder												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.09	0.74	0.65	1.83

	Model 1	Model 2	Model 3
Notes:			
<ul style="list-style-type: none"> • The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models. • * indicates significance at 5% level. • - indicates variable not in model. • Model 1 Fit Statistics: AIC = 1099.12, BIC = 1301.57, Pseudo R² = 0.17. • Model 2 Fit Statistics: AIC = 1048.30, BIC = 1318.23, Pseudo R² = 0.23. • Model 3 Fit Statistics: AIC = 1038.94, BIC = 1376.36, Pseudo R² = 0.26. 			

Table 20: E-Risk logistic regression of reported SVLBs (stepwise method)

	Model 1				Model 2				Model 3			
Independent variable	OR	Sig.	95% CI		OR	Sig.	95% CI		OR	Sig.	95% CI	
Gender		0.00				0.00				0.00		
Female	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Male	6.13	0.00	3.98	9.44	4.87	0.00	3.07	7.74	4.20	0.00	2.64	6.69
Mother's age at first birth	0.96	0.04	0.92	1.00								
Parental monitoring	0.91	0.00	0.85	0.96	0.93	0.05	0.86	1.00	0.92	0.02	0.85	0.99
Social class		0.07				0.01				0.00		
Low	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Middle	1.07	0.75	0.70	1.64	1.17	0.48	0.75	1.82	1.03	0.89	0.67	1.59
High	0.56	0.06	0.30	1.02	0.52	0.02	0.30	0.89	0.44	0.00	0.27	0.73
Child experienced maltreatment		0.01				0.03				0.04		
No maltreatment	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Probable	0.78	0.32	0.48	1.27	0.63	0.08	0.38	1.05	0.63	0.09	0.38	1.07
Definite	2.08	0.01	1.21	3.56	1.58	0.12	0.88	2.82	1.53	0.16	0.84	2.77
Father marital status		0.07				0.06						
Married to mother	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			

	Model 1				Model 2				Model 3			
With new partner or married to other	1.42	0.10	0.94	2.15	1.50	0.07	0.97	2.32				
Father not present	1.94	0.03	1.06	3.53	1.91	0.04	1.03	3.55				
Health professional diagnosed learning/behaviour/development/mental health problem – age 10												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes					0.40	0.00	0.24	0.67	0.44	0.00	0.26	0.73
Often skips school – age 12												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.95	0.04	1.03	3.69				
Self-control	-	-	-	-	1.86	0.00	1.54	2.25	1.81	0.00	1.49	2.20
Independence												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	1.84	0.01	1.17	2.89	1.60	0.04	1.01	2.53
Stealing												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	1.88	0.00	1.22	2.89
Violence												
No	<i>Reference</i>				<i>Reference</i>				<i>Reference</i>			
Yes	-	-	-	-	-	-	-	-	2.02	0.00	1.37	2.98

Notes:

- The joint tests were calculated excluding categories representing 'Missing'. The categories representing 'Missing' are not displayed in these models.
- The variables not displayed in the models are not significant with $p > 0.10$.
- - indicates variable not in model.

Appendix E: Additional tables

Table 21: Weapon carrying/use by victimisation (MCS)

Variables	% of group carrying and/or using a weapon	Unweighted base N
Insulted, called names, threatened or shouted at*		
Non-victim	1.7%	6,272
Victim	5.8%	4,738
Experienced physical violence (pushed, shoved, hit, slapped, punched)*		
Non-victim	1.7%	8,602
Victim	9.3%	2,405
Hit with or had a weapon used against them*		
Non-victim	2.5%	10,669
Victim	30.3%	335
Had something stolen*		
Non-victim	2.8%	10,214
Victim	11.8%	791
Had an unwelcome sexual approach or been sexually assaulted*		
Non-victim	3.1%	10,695
Victim	14.6%	308
Notes:		
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • All descriptives are weighted. 		

Table 22: Weapon carrying/use by ASB, substance use and criminal activity (MCS)

Variables	% of group carrying/using a weapon	Unweighted base N
Ever tried drugs*		
No	2.4%	10,508
Yes	19.9%	500
Ever cautioned or arrested*		
No	2.3%	10,170
Yes	14.3%	836
Ever stopped and questioned by the police*		
No	1.9%	9,493

Variables	% of group carrying/using a weapon	Unweighted base N
Yes	11.7%	1,515
Ever smoked*		
No	2.0%	9,376
Yes	10.3%	1,596
Ever gambled*		
No	2.5%	9,714
Yes	10.1%	1,281
Ever pushed/shoved or hit someone*		
No	1.0%	7,670
Yes	8.7%	3,349
Ever committed public disorder*		
No	1.5%	9,377
Yes	13.9%	1,627
Ever stolen from someone or a shop*		
No	2.6%	10,582
Yes	21.6%	441
Ever committed cybercrime*		
No	2.8%	10,481
Yes	16.7%	539
How many times have you drunk in the last 12 months*		
Never or none in the last 12 months	1.4%	6,474
1-9 times	4.8%	3,907
10-19 times	12.6%	412
20 or more times	14.7%	202
Notes:		
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • All descriptives are weighted. 		

Table 23: SVLBs by social/school indicators (E-Risk)

Variables	% of group engaging in SVLB	Unweighted base N
School performance*		
Far below	14.6%	103
Somewhat below	11.4%	414
Average	8.5%	692
Somewhat above	8.7%	564
Far above	2.3%	88

Variables	% of group engaging in SVLB	Unweighted base N
Often skips school (age 12)*		
No	8.3%	1,888
Yes	28.4%	88
Been a bully*		
No	6.9%	1,370
Yes	14.4%	568
Independence*		
No	7.2%	1,719
Yes	22.0%	259
Notes:		
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. 		

Table 24: SVLBs by ASB/Crime indicators (E-Risk)

Variables	% of group engaging in SVLB	Unweighted base N
Stealing*		
No	6.8%	1,681
Yes	22.6%	270
Sometimes hits parent		
No	8.9%	1,916
Yes	16.1%	62
Violence*		
No	5.2%	1,151
Yes	15.4%	786
Hurts people*		
No	8.5%	1,779
Yes	15.0%	193
Starts fights*		
No	6.9%	1,544
Yes	17.8%	410
Public disorder*		
No	7.1%	1,688
Yes	20.8%	284
Notes:		
<ul style="list-style-type: none"> • Missing cases were excluded when calculating the percentages and significance tests. • * indicates significance at 5% level. • Sometimes hits parent was borderline not significant (0.053). 		

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