

SYSTEMATIC REVIEW

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How concentrated is crime among victims? A systematic review from 1977 to 2014

SooHyun O¹, Natalie N. Martinez¹, YongJei Lee² and John E. Eck^{1*}

Abstract

Background: Considerable research shows that crime is concentrated among a few victims. However, no one has systematically compared these studies to determine the level of concentration and its variation across studies. To address this void in our knowledge of repeat victimization, we conducted a systematic review and meta-analysis of the evidence that crime is concentrated among victims.

Methods: We distinguished between studies of victimization prevalence, which examine both victims and non-victims, and studies of victimization frequency, which only examine subjects that were victimized once or more. We identified 20 prevalence studies and 20 frequency studies that provided quantitative information sufficient for analysis. We organized data using visual binning and fitted logarithmic curves to the median values of the bins.

Results: We found that crime is concentrated within a small proportion of the subjects in both the prevalence studies and frequency studies, but also that it is more concentrated in the former. When we compared studies of business victimization to studies of household victimization, we found that victimization is more concentrated among households than among businesses in prevalence studies, but that the reverse is true for frequency studies. A comparison between personal and property victimizations shows that the patterns of re-victimizations are similar. Crime is more concentrated in the United States compared to the United Kingdom in prevalence studies, but the opposite is true when frequency studies are examined. Finally, the concentration of victimization changes over time for both the US and the UK, but the nature of that change depends on whether one is examining prevalence or frequency studies.

Conclusions: Not surprisingly, our systemic review supports the notion that a large proportion of victimizations are of a relatively small portion of the population and of a small portion of all those victimized at least once. There is no question that crime is concentrated among a few victims. However, there is also variation in concentration that we also explored.

Keywords: Concentration of crime, Victim, Systematic review, Meta-analysis, Visual binning

The importance of repeat victimization

Crime victimization is a relatively rare event in the general population. Among those who experience it, most do so only once. For example, Tseloni et al. (2004) found that 92% of British households reported experiencing no victimizations over a 1-year period. Of those households that were victimized, about 80% experienced it only once.

Conversely, the few households that were repeatedly victimized in a year accounted for 40% of the crimes in that period (Tseloni et al. 2004).

The proportion of the population that is ever victimized and the proportion that is victimized repeatedly varies over studies. Several studies suggest that over 8% of the population experiences victimization and that more than half of all victims experienced crime more than twice (Lauritsen and Quinet 1995; Osborn et al. 1996; Sparks 1981). For example, Lauritsen and Quinet (1995) found that about half of the National Youth Survey participants

*Correspondence: john.eck@uc.edu

¹ School of Criminal Justice, University of Cincinnati, Cincinnati, OH, USA
Full list of author information is available at the end of the article

experienced at least one larceny victimization. Among these victims almost 60% experienced larceny victimization more than once. However, most repeat victimizations happen to a small fraction of those ever victimized (Ellingworth et al. 1995; Farrell 1995). Ellingworth et al. (1995) found that the 10% of people who experienced the most personal crime victimizations accounted for half of all personal crime victimizations in 1984. A study of small businesses found that 1% of businesses accounted for 45% of all robberies committed, and three percent of businesses accounted for 81% of all violent attacks committed (Wood et al. 1997). These findings imply that opportunities for crime are highly concentrated among a small proportion of the most afflicted repeat victims.

Scholars introduced the concept of “repeat victimization” in the late 1970s (Sparks et al. 1977). Hindelang et al. (1978) argued that looking at “multiple and recurrent victimization” might benefit public crime prevention policy by helping identify the causes of victimization. Over a decade later, the Kirkholt Project in Great Britain, initiated a successful crime control strategy focusing on repeat victims (Forrester et al. 1988, 1990). Later, the approach was extended to domestic violence (Lloyd et al. 1994), racial attacks (Sampson and Philips 1992, 1995), burglary (Webb 1997), and vehicle crimes (Chenery et al. 1997). These efforts also produced substantial crime reductions. For example, Pease (1998) evaluated a prevention effort targeting repeat victims in Stockport, England and found that this project reduced overall crime by reducing repeat victimization by 44%. In sum, there is substantial evidence that repeat victimization accounts for most crimes, and that preventing repeat victimization can reduce crime.

State dependence, population heterogeneity, and repeat victimization

Research suggests two general explanations for repeat victimization—*state dependence* and *population heterogeneity* (Lauritsen and Quinet 1995; Osborn and Tseloni 1998; Wittebrood and Nieuwbeerta 2000). These are distinct concepts in theory, but they can be intertwined in practice (Tseloni and Pease 2003). State dependence is the idea that prior victimization predicts future risk because it alters something about the victim. This implies that initial victimization “boosts” the probability of experiencing a subsequent victimization (Pease 1998). For example, if an initial victimization makes a person more fearful to confront offenders, this changed behavioral pattern increases that person’s vulnerability and attractiveness (Schwartz et al. 1993). However, some scholars (e.g., Nelson 1980; Sparks 1981) suggest that state dependence does not explain all repeat victimization scenarios. For example, Sparks (1981) argued that it

does not explain repeat victimization involving different crime types (e.g., experiencing a robbery, followed by a burglary, followed by a car theft).

Alternatively, it may be that prior victimization changes something about offenders, rather than victims. Strong evidence suggests that repeated crimes are disproportionately the work of prolific offenders (Ashton et al. 1998, see Martinez et al. [2017, this issue] for a review of crime concentration among offenders). For example, about half of all residential burglary offenders return to the same houses (Winkel 1991) and about half of all bank robbers strike the same banks (Gill and Matthews 1993). Offenders may also provide each other with useful information about places they have previously burgled, robbed, or otherwise victimized. Thus, repeat victimization may involve different offenders (Bennett 1995; Sparks 1981). In the case of repeat violent victimization, Felson and Clarke (1998) explain that offenders’ previous experiences may help them to identify victims who are least likely to resist. This boost account of offenders holds for across other types of crimes such as armed robberies (Gill and Pease 1998).

The other general explanation of repeat victimization is *population heterogeneity*. This explanation is also known as a “flag account” (Pease 1998) and claims that possessing certain characteristics make some people or households are more at risk for victimization. These characteristics can include biological factors (e.g., individual size or physical vulnerability), psychological propensity (e.g., submissive or aggressive personality), lifestyle (e.g., staying out late drinking), or occupation (e.g., delivering pizzas). Most people have characteristics that make them unlikely to be victimized, but some people have characteristics that make them susceptible to many victimizations. For example, Hindelang et al. (1978) explained that differences in lifestyle patterns lead a concentration of victimization among certain people and households. That is, the risk of revictimization appears to be stable for people who do not change their lifestyles in response to a previous victimization (Nelson 1980).

Two measures of victimization

Two measures of crime concentration are commonly used in the victimization literature. The first measure is “prevalence,” or the number of people with at least one victimization divided by the total number of people in a population. The second measure is “frequency,” or the total number of victimizations divided by the total number of victims (Hope 1995; Osborn and Tseloni 1998; Tseloni and Pease 2015; Trickett et al. 1992, 1995). These two measures suggest different crime prevention approaches. The higher the prevalence of victimization, the greater the proportion of the population at risk for

being victimized. If a high prevalence of victimization is driving crime rates, crime can be reduced by focusing efforts on preventing a non-victim from becoming a victim. However, if crime rates are mainly due to a high frequency of victimization, crime prevention strategies should concentrate on keeping victims from being revictimized (Hope 1995; Trickett et al. 1992, 1995).

The current study

Numerous studies have demonstrated that a large proportion of victimizations happen to a relatively small portion of the population. Furthermore, a small proportion of those affected are victimized at more than once. There seems to be no question that crime is concentrated among a few victims. However, it is important for the advancement of science that we test ideas that have gained general acceptance to make sure the community of scholars have not made a collective error. No one has systematically reviewed the repeat victimization literature and meta-analyzed the findings. Consequently, there is an a priori chance that the common understanding of repeat victimization could be wrong.

Further, looking at individual studies does not tell us how concentrated victimization is generally. Therefore, this paper synthesizes the findings from multiple studies of repeat victimization to estimate overall proportion of crime that is attributed to a few repeat victims. Equally as important is the variation in concentration within populations and among victims, which may vary among studies for several reasons. First, some studies look at the prevalence of victimization and its frequency, while others only examine frequency. As a shorthand, we refer to the first set of studies as prevalence studies and the second as frequency studies.

A second reason studies may show variation in victimization concentration has to do with the type of victim. Two broad types of victimization surveys are common in the literature: surveys of households and surveys of businesses (Weisel 2005). These two types of victimization are also related to two different types of places. Thus, variation in concentration between household and business victimization might reveal how criminal opportunities vary depending on the features of places. Other kinds of victimization this study examined are property and personal victimizations. A comparison of these two types of victimization are important because different targets of crime may have different patterns of concentration.

A third reason is that the concentration of crime may vary across countries. For instance, a cross national comparative victimization study by Tseloni et al. (2004) found that the UK has higher burglary victimization concentration than the US. The comparison was based on two different nationally representative victimization surveys:

The U.S. National Crime Victimization Survey (NCVS) and the British Crime Survey (BCS). Thus, variation in concentration may be attributable to local nature of crime (Weisel 2005) or to differences in data collection processes between different surveys (Lee 2000). In this study, each country includes various types of surveys and thus, we expect greater variation between countries.

Finally, concentration of crime may vary across decades. For example, the US experienced a sharp nationwide decline in crime during the 1990s (Farrell et al. 2014). Importantly, this decline was consistent across two different measures of crime, the FBI's Uniform Crime Reports (UCR) and the National Crime Victimization Survey (NCVS). Further, the NCVS shows an even greater reduction in crime between 1991 and 2001 than the UCR does. Possible explanations for the sharp drop in crime include the use of innovative policing strategies, an increase in the number of police, increased incarceration rates, changes in crack and other drug markets, tougher gun control laws, and a stronger economy; however, the effectiveness of each of these strategies is debatable (Farrell et al. 2014; Zimring 2006; Blumstein and Wallman 2006). Accordingly, the drop in crime may have been associated with changes in crime concentration across decades.

With many studies available, we can begin to explain the concentration of victimization phenomenon by systematically reviewing and analyzing their research findings. The next section describes the methods used, including the literature search and inclusion strategy, how data was extracted, and how concentration was measured. The third section describes the analysis of this literature and our findings. In the final section, we draw conclusions and state their implications for research and policy.

Data and methods

Criteria for inclusion and exclusion

Our goal is to determine the concentration of victimization based on previous research. We need quantitative information that can describe the distribution of crime across a sample of victims. To achieve this, we required studies to have specific information describing crime among victims, which are reflected in our three criteria for inclusion in our analysis. First, the study must be written in English. Second, the study had to include empirical data from which it drew its findings—we had to be able to retrieve relevant statistics from the text of the study, or access its original data set to calculate them. Third, the study must provide statistics on the percentage of victims (X%) in its sample and percentage of crimes (Y%) associated with those victims. We use the combinations of these X and Y percentages as ordered pairs to plot points

Table 1 Characteristics of the studies and ordered pairs identified and analyzed

Characteristics	Prevalence		Frequency	
	Number of studies	Number of coordinates	Number of studies	Number of coordinates
Type of victim				
Household	10	156	10	143
Business	3	40	4	43
Type of crime				
Property	3	71	6	116
Personal	7	109	7	93
Two nations				
US	8	188	7	144
UK	12	193	12	180
US across decades				
1970s	5	140	5	122
1990s	3	48	3	42
UK across decades				
1970s	2	27	1	24
1980s	3	48	3	35
1990s	6	55	6	64
2000s	3	55	3	51
Total				
Studies analyzed (studies identified)	20 (66)	397 (548)	20 (25)	359 (371)

on a logarithmic crime concentration curve. For example, Tseloni and her coauthors (2004) provided a cumulative distribution of 1412 burglary victimizations over 12,845 households in England and Wales from the 1994 British Crime Survey. In Table 1 of their study, each of the 11 rows in the first column provides the percentage of burglaries explained by the percentage of households, thus it is possible to retrieve and record these 11 X–Y ordered pairs into our database.

Since, for any single study, there may be an insufficient number of X–Y ordered pairs to reliably represent the distribution of crime across the victims/households—a single X–Y ordered pair does not reliably represent the victim–crime distribution of the study—we applied another criterion to filter out the studies with too few X–Y ordered pairs. Specifically, in addition to the points where the percent of victims is 100% or the percent of crimes is 100%, relevant studies must supply at least two X–Y ordered pairs to represent the victim–crime distribution of the data (for example, 15% of the respondents [X] had 45% of the victimizations [Y] and 50% of the respondents [X] had 100% of the victimizations [Y]).

Data sources and search strategy

We searched for empirical studies addressing the concentration of victimization in journal articles, academic institutions, and government reports. First, we used

keywords to conduct an electronic search for studies. To determine our keywords, we first consulted the earliest studies on victimization. We chose the baseline keywords ‘*victimization*’ from Sparks et al. (1977) and ‘*repeat victimization*’ from Hindelang et al. (1978). In our searches, we spelled “victimization” with a z, as used in North America, and with an s, as used in Great Britain. We examined the titles, abstracts, and methods sections of each article in our search results to determine if it fits our inclusion criteria. Once we found further studies using these keywords, we chose new keywords from the studies we found and then conducted another round of online searches. In summary, we used the following keywords in our searches: *victimization*, *re-victimization*, *repeated victimization*, *repeat victimization*, *concentration of victim*, *multiple victimization*, *distribution of victimization*, *heterogeneity of victimization*, *state-dependence of victimization*, and *frequency of victimization*.¹ The databases we searched were: Criminal Justice Abstracts, EBSCO, ProQuest, Google, and Google Scholar.

¹ Our study is not dependent on any particular search term, but on the set of terms used. Further, even a term that unveils a single study might be very valuable, if that single study is largely unknown, it contains findings at variance to other studies, or it suggests other search terms that lead to many other studies. In short, we treated the search terms not as independent items, but as part of a large web of terms.

Second, we manually examined bibliographies of retrieved studies for additional studies to include. If we found a relevant study from the bibliography of a retrieved study, we then looked at the bibliography of the new study and repeated the process. During this iterative approach, if we found new possible keywords, we repeated the computerized searching process again across the databases.² The bibliographies of several publications were particularly useful because they specifically focused on the phenomenon of victimization concentration (i.e., Ellingworth et al. 1995; Farrell 1995; Farrell and Pease 1993; Pease 1998; Tseloni 2000, 2006).

In addition, we presented a preliminary version of this study at the 2015 Environmental Criminology and Crime Analysis international symposium in Christchurch, New Zealand and at the 71st Annual Conference of the American Society of Criminology at Washington, DC and asked attendees if they knew any gap in our literature.

These search methods resulted in a total of 70 studies with 560 X–Y ordered pairs. However, many of these studies did not satisfy our stringent third criterion requiring at least two X–Y ordered pairs. As shown in Table 1, when including only those studies that did, we had 20 prevalence studies with 397 ordered pairs and 20 frequency studies with 359 ordered pairs. These studies and ordered pairs are the data we examine in this paper.

Coding protocol

Our comparative analysis of crime concentration among population or victims has no precedent in the literature. Conventional meta-analysis calculates a variety of statistics including t-statistics, estimated coefficient, standard errors, and confidence intervals and then weights the data points to compensate for uncertainty in the data (Higgins and Green 2011; Mulrow and Oxman 1997). However, because we used actual values of X–Y ordered pairs to estimate the general distribution of victimizations over possible victims, rather than estimated coefficients (as is standard in meta-analysis), it is unclear if weights improve the validity of our analysis. As our test of this indicated that weights were not helpful, we did not use them.³

² Because recording the number of studies from multiple databases without duplicates is cumbersome, particularly when using an iterative process, and it does not shed additional light on the validity of the findings of our study, we did not record the number of studies found per search engine or database.

³ We tested whether weighting our data would change our results. We weighted X–Y pairs of each study by the study's sample size. We used the study's sample size (w) to weight Y value of each coordinate point within each bin (i), then calculated the weighted median ($\tilde{w}y_i$) to represent the weighted central tendency of each bin. We did not find any substantive difference in the findings with weighted ordered pairs compared to the findings with un-weighted points (see Appendix 1).

For our meta-analysis, we recorded the X–Y ordered pairs for each study in two ways.⁴ To analyze the prevalence of victimization, we coded the X and Y pairs based on the number of the potential victims (e.g., people or households who could have been victimized). Twenty studies had sufficient information for this purpose, yielding 397 X–Y pairs. To analyze the frequency of victimization, we coded the values of X based on the number of victimization for those who experienced at least one crime (i.e., people or household who did not experience crime were dropped). Twenty studies provided frequency distributions with 359 X–Y ordered pairs (19 of these studies were also used to analyze victimization prevalence). We also coded the data with regards to the type of victim, type of crime, country of origin, and years of data collected for each study. Table 1 shows the characteristics of the studies reviewed in this paper.

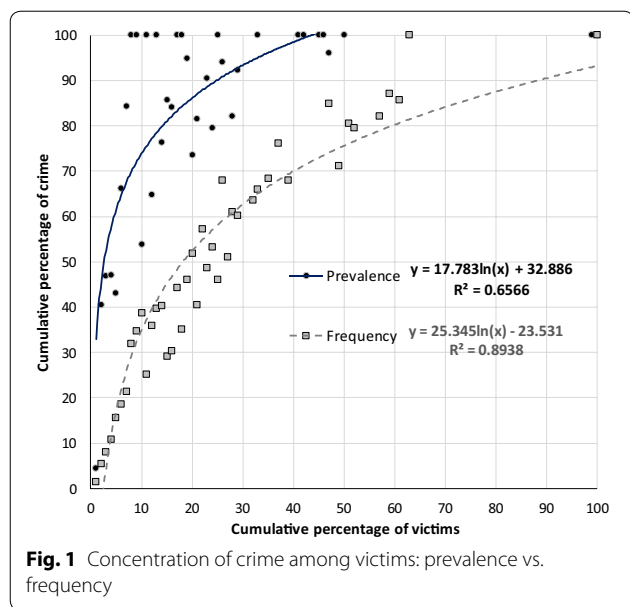
Synthesis of the evidence

To answer the question of how concentrated crime is among victims, we estimated the cumulative distribution of crime using visual binning tool in SPSS 21. Each bin on the horizontal axis represents a 1% interval over the range from 0 to 100% of the victims. These bins are arrayed from victims who experienced the most crimes to non-victims with zero crimes (i.e., the first bin contains the most crime afflicted 1% of the victims and the last bin contains 1% of the victims, all of which have no crimes). We then tabulated the median values of Y for each bin. We used this technique for two specific reasons. First, we assumed that Y values within each one-percent range bin on the horizontal (X) axis vary, so we needed a measure of the central tendency of each one percent bin. Second, we chose the median as a representative statistic for each bin to remedy possibly skewed distributions of Y values in each bin. A visual representation of the process we used can be found in Fig. 1 of Lee et al. (2017, this issue).

After calculating median values of each bin, we estimated the cumulative curve by interpolating the median values. We used the logarithmic and the power law functions as possible candidates to fit our lines. These two functions are mathematically connected: power-law behavior in either nature or social systems can be often transformed into a logarithmic scale for easier understanding on the phenomenon (Newman 2005).

To determine which function would produce a better fit, we compared their R-square statistics. Though this statistic is high for both functions, the R-square for the

⁴ The leading author retrieved and coded X–Y ordered pairs from the studies, and then the other co-authors reviewed the database, and calculated the raw distribution of X–Y ordered pairs to cumulative distribution of victimizations if needed.



logarithmic function is greater (see panel D in Fig. 1 of Lee et al. 2017, this issue). Therefore, we used it to estimate the distribution curve between the cumulative percentage of (binned) victims and crime. We selected only a single functional form to use throughout the analysis because we wanted to have a common standard metric for our comparisons that was simple to interpret. Further, as we anticipated comparing victim concentration to place and offender concentrations (see Eck et al. 2017, in this issue) we did not want to introduce variation in functional form.

Results

Using the 20 studies with 397 corresponding X–Y pairs for prevalence and the 20 studies with 359 corresponding X–Y pairs for frequency, we first provide an overall comparison of the extent of crime concentration. Then, we examine how victimization concentration varies depending on victim type, crime type, between nations, and across decades in the US and the UK.

Prevalence and frequency

Figure 1 shows the concentration curves for the overall prevalence and frequency of victimization. Visually and analytically, it is obvious that crime is more concentrated when examining the population of possible targets than when only examining targets with at least one victimization. The dots on the prevalence and frequency curves (representing the bin medians) do not overlap much, and the fitted curves are clearly distinct. Estimated coefficients also provide evidence that the prevalence and frequency curves are substantially different in

the victimization concentration. Using 5% of the targets as a benchmark, the difference is quite dramatic: the prevalence curve shows that 5% of the population experiences 61.5% of all victimization, whereas the frequency curve shows that top 5% of all victims’ experience 17.3% of the victimizations (see Appendix 2). When the prevalence curve hits 100% of victimizations, about half of the population has experienced some victimization. On the frequency curve, half of the victims has experienced only 75.6% of victimization.

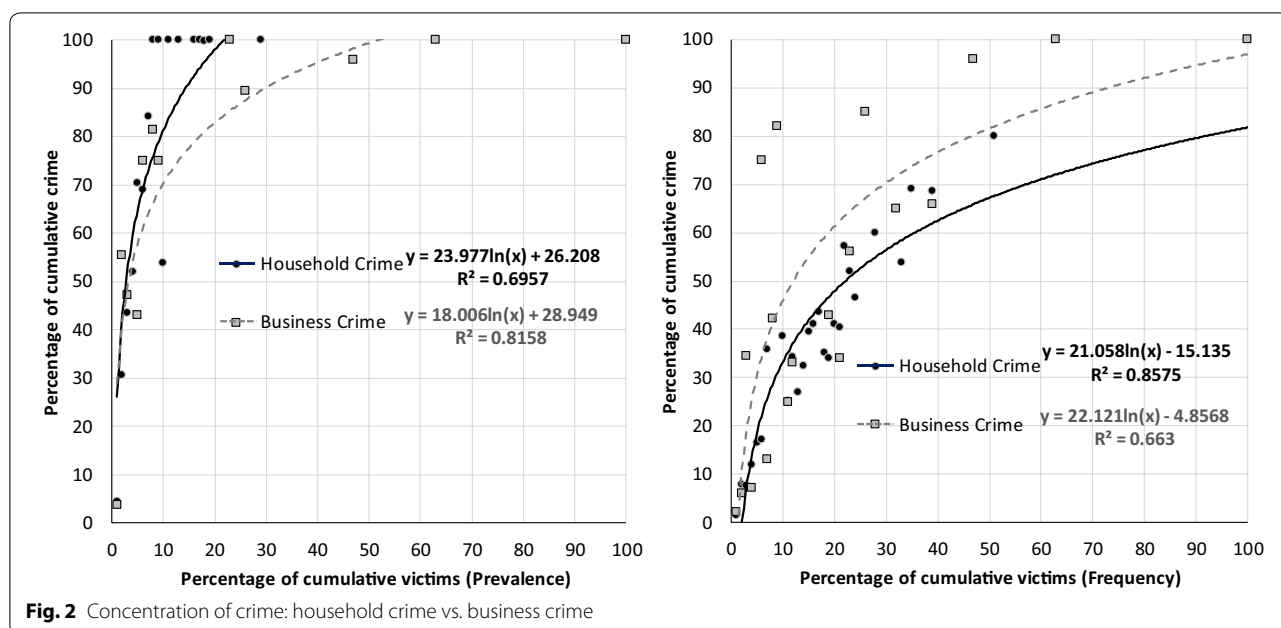
This illustrates two sources of concentration previously identified in the literature. First, there is concentration due to the fact that most possible targets are not victimized. Population heterogeneity may be the source of this. Second, even when this is accounted for in the frequency curve, we still see concentration. Some of this may be due to state dependence.

Although both curves fit the data reasonably well (using the R-square statistics), we still can see variation around the fitted curves. This implies that the amount of concentration varies across studies. Note that this variation is understated in Fig. 1 because the dots represent median values for bins and there is variation around these median values. We turn to possible explanations for this variation next.

Household victimization vs. business victimization

One source of variation is the type of victim. Two common data sources in the literature are household and business victimization surveys (Weisel 2005). As shown in Table 1, 10 studies of households provided 156 X and Y ordered pairs and three studies of businesses provided 40 X and Y pairs for the prevalence curve. For the frequency curve, the 10 studies of households provided 143 X and Y pairs and the four studies of businesses provided 43 X and Y pairs. The types of crimes included in the studies of households included domestic violence (Lloyd et al. 1994; Mayhew et al. 1993), household burglary (Johnson 2008; Mayhew et al. 1993; Nelson 1980; Sidebottom 2012; Tseloni et al. 2004; and other types of victimization occurring to households (Ellingworth et al. 1995; Hindelang et al. 1978; Percy 1980; Tseloni 2006). The studies of businesses included commercial burglary (Laycock 2001), pub violence and work-based violence (Mayhew et al. 1993), business burglary and robbery (Nelson 1980) and manufacturing commercial victimization and retail commercial victimization (Pease 1998).

Figure 2 shows the distributions for prevalence and frequency for each type of victim. In the left panel of prevalence curves, we see that the two distributions are quite similar when considering the targets most involved with crime (at 5% of the targets have about 60% of the victimizations). When we consider victims above the 10%



value on the horizontal axis, the two curves diverge substantially. Importantly, about 50% of the businesses have no crime involvement whereas about 80% of households have no crime. This finding is interesting for crime prevention: it suggests that when one selects a small fraction of the most crime involved, there is no useful distinction between households and businesses. Stated differently, addressing the most crime involved 5% of households or businesses would theoretically yield equivalent results.

The frequency curves show different results. When we only consider businesses and households with at least one victimization, business victimization is more concentrated than household victimization. The most victimized 5% of businesses accounts for about 30.7% of the business victimization, whereas the most victimized 5% of the households only account for about 18.5% of the household victimizations (see Appendix 2). This suggests that repeat victimization interventions might be more useful for businesses than households. However, there is more variation around the business victimization frequency curve than the corresponding curve for households so we have less confidence in the conclusions drawn from the business studies.

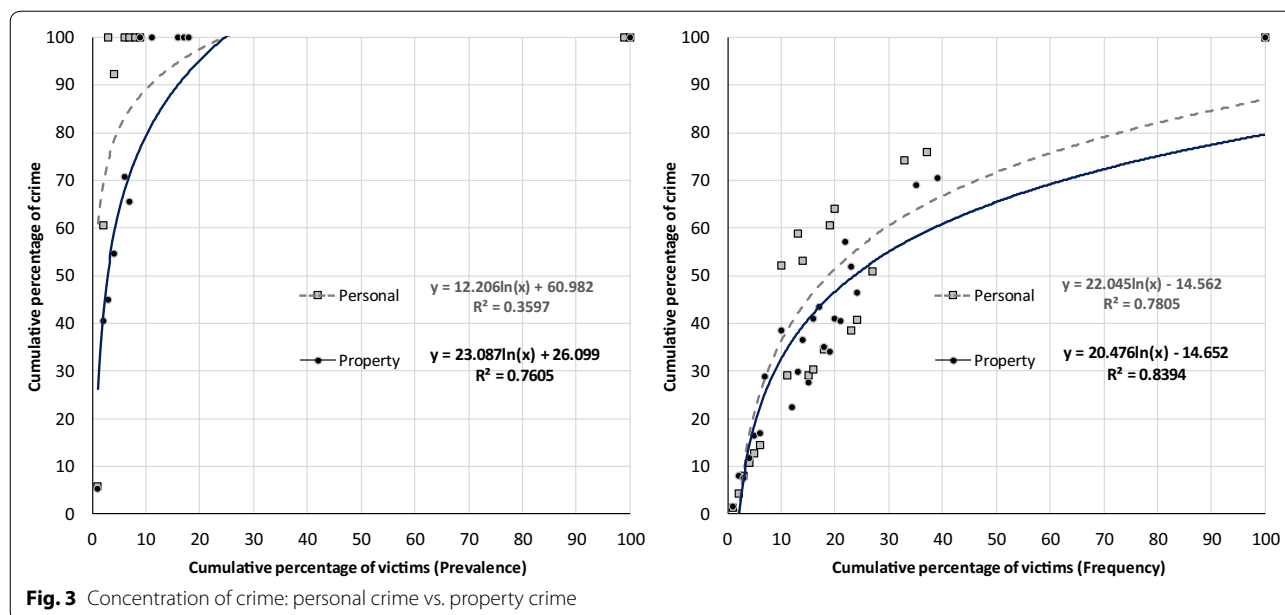
Property victimization vs. personal victimization

We also compared property victimization and personal victimization. For the prevalence curve, three studies of property victimization provided 71 X–Y ordered pairs (Tseloni et al. 2004; Tseloni 2006; Ellingworth et al. 1995) and seven studies of personal victimization provided 109 X–Y ordered pairs (Ellingworth et al. 1995; Hindelang et al. 1978; Nelson 1980, 1984; Tseloni 2000; Tseloni and

Pease 2005, 2015). For the frequency curve, six studies of property victimization provided 116 X–Y ordered pairs (Ellingworth et al. 1995; Johnson 2008; Mayhew et al. 1993; Nelson 1980; Tseloni et al. 2004; Tseloni 2006) and seven studies of personal victimization provided 93 X–Y pairs (Ellingworth et al. 1995; Nelson 1980, 1984; Tseloni 2000; Tseloni and Pease 2005; Tseloni and Pease 2015).

Figure 3 shows the prevalence and frequency distributions. In the prevalence curve panel, we see that the two distributions are quite different up to 10% of the victims (on the horizontal axis), and that personal victimizations are more concentrated than property victimizations. Because both curves hit the 100% value on the vertical axis when their horizontal values are about 25%, approximately 75% of targets for both types of victims experience no crime. This finding requires caution in its interpretation because the R square for personal victimization curve is only 0.36 and the estimated beta is not significant (beta = 12.206, t-statistic = 2.12).

The frequency curves provide a somewhat different story. When we consider up to 20% of targets in both property and personal victimization, we do not find any substantial difference in the patterns of victim concentration. The most victimized 20% of properties and persons account for 46.7 and 51.5% of victimizations, respectively. This small difference in victimization suggests that the patterns of property and personal re-victimizations are similar once a target has been victimized once. Though we see more variation around the personal victimization curve than the property victimization curve, relatively large R-squares suggest that both frequency curves fit well through the median values of each bin.



US vs. UK

Another source of variation in victimization concentration relates to the data’s country of origin. The US and the UK each have their own nationally representative victimization surveys (the National Crime Victimization Survey and the British Crime Survey, respectively). In addition to studies based on these surveys, we identified other studies using other surveys either from US or from UK and we include them in this analysis.

As shown in Table 1, the eight studies using the data from the US provided 188 X and Y ordered pairs for prevalence curve, and seven studies provided 144 X and Y ordered pairs for frequency curve. Twelve studies using the data from the UK provides 193 X and Y pairs for prevalence curve and 180 X and Y pairs for frequency curve. The eight US studies use data from the National Crime Survey (Hindelang et al. 1978; Nelson 1980; Nelson 1984), the NCVS (Tseloni 2000; Tseloni and Pease 2003; Tseloni et al. 2004), National Youth Survey (Lauritsen and Quinet 1995), the National Crime Survey of Business Victimization (Nelson 1980) and other sources, including a general citizen survey (Percy 1980) in the US. The twelve UK studies use the BCS (Ellingworth et al. 1995; Farrell 1995; Farrell and Pease 1993, Mayhew et al. 1993; Tseloni et al. 2004; Tseloni 2006; Tseloni and Pease 2015), local surveys (Farrell 1995; Sparks et al. 1977), a business crime survey (Laycock 2001), a commercial victimization survey (Pease 1998), calls to the police data (Lloyd et al. 1994) or police-recorded crime data (Johnson 2008) in the U. K.

Figure 4 shows the prevalence and frequency distributions for each country. Looking at the prevalence curves, we see that the two distributions are quite different. Victimization

seems to be more concentrated in the US than the UK. The most victimized 5% of the targets in the US account for 65.8% of all victimizations, whereas the most victimized 5% of the targets in the UK account for 55.4% of victimizations (see Appendix 2). At the other extreme, about 76% of the US respondents experience no crime whereas only half of the UK respondents experience no crime. These differences in number of non-victims account for differences in victimization concentration in these prevalence curves.

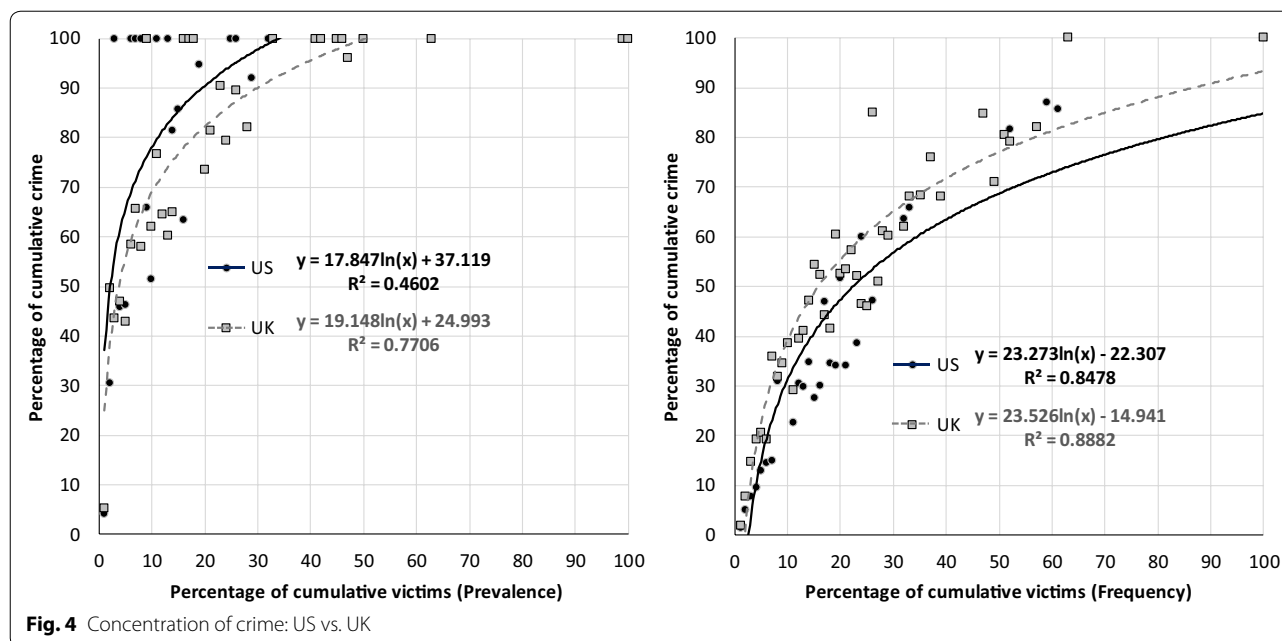
The frequency curves appear to show that victimization is more concentrated in the UK than in the US when we only consider people with at least one victimization. However, the difference is not large as in prevalence curve comparison. The most victimized 5% of victims accounts for 21.7% of the victimization in the UK, whereas the most victimized 5% of the victims accounts for 15.1% of the victimizations in the US (see Appendix 2). Overall, the comparisons in the prevalence and frequency curves show that there is variation in the concentration between the two nations. However, given the variation in the data for each country, we should be cautious about drawing a firm conclusion.

Across decades

Because previous studies contended that there is variation in victimization across decades (e.g., Blumstein and Wallman 2006; Zimring 2006), we look at the variation in concentration in the US and the UK over decades.

US across decades

First, we looked at the victimization concentration among the population of possible targets and the targets



with at least one victimization in the US. We looked at the victimization concentration for only two decades (the 1970s and 1990s) due to the lack of studies in other decades. As shown in Table 1, we found eight studies using the data from the US with 188 X–Y ordered pairs (Hindelang et al. 1978; Lauritsen and Quinet 1995; Nelson 1980, 1984; Percy 1980; Tseloni 2000; Tseloni et al. 2004; Tseloni and Pease 2003). Five studies used the data collected from 1970s (Hindelang et al. 1978; Lauritsen and Quinet 1995; Nelson 1980, 1984; Percy 1980) and three studies used data from 1990s (Tseloni 2000; Tseloni et al. 2004; Tseloni and Pease 2003).

Figure 5 shows the distributions for prevalence and frequency for each. In the prevalence curves, we see that the two distributions are quite different. In fact, the most victimized 5% of possible targets account for 60.2% of the victimizations during 1970 whereas the top 5% account for 81.7% of the victimizations in the 1990s (see Appendix 2). About 75% of the population experienced no victimization during 1990s whereas 70% of the population experienced no victimizations during 1970s. This finding is consistent with victimization trend across decades with the sharp decline in all categories of crime and all parts of the nation during 1990s (Rennison 2001).

The difference between the two curves is less when we examine frequency of victimization (right panel) than between prevalence curves (left panel). This is logical because we are only looking the subset of the population who had at least one victimization. Victimization appears slightly more concentrated in the 1970s than in the 1990s. However, the right end of these curves is less reliable and

of less consequence than the left end. When we look at the top 5% of the victims we see that these victims experienced 17% of the crime in the 1990s and 15.6% of the crime in the 1970s: not a large or meaningful difference (see Appendix 2). These two frequency curves diverge more rapidly beyond the 5% value on the horizontal. The interpretation of these frequency curves is that once victimized, the likelihood of re-victimization did not change substantially in 1990s compared to 1970s.

UK across decades

We also looked at changes in the victimization concentrations among the population of possible targets and the targets with at least one victimization in the UK. In contrast to the US studies, we were able to examine each decade from the 1970s to the 2000s. We found twelve studies for the frequency curve. Among those, Sparks et al.'s (1977) study used data from the 1973 local survey in England for all offenses and three other studies used data from the 1982, 1984 and 1988 British Crime Surveys (Ellingworth et al. 1995; Farrell 1995; Farrell and Pease 1993). Six studies used data collected from 1990s (Ellingworth et al. 1995; Laycock 2001; Lloyd et al. 1994; Mayhew et al. 1993; Pease 1998; Tseloni et al. 2004) and three studies used data collected from 2000s (Tseloni 2006; Johnson 2008; Tseloni and Pease 2015). When a study used the data collected for several years across different decades (e.g., 1999–2003), the study was assigned to the decade for median year. In addition, some include data from more than two decades (Ellingworth et al. 1995) and two nations (Tseloni et al. 2004). In these cases, we

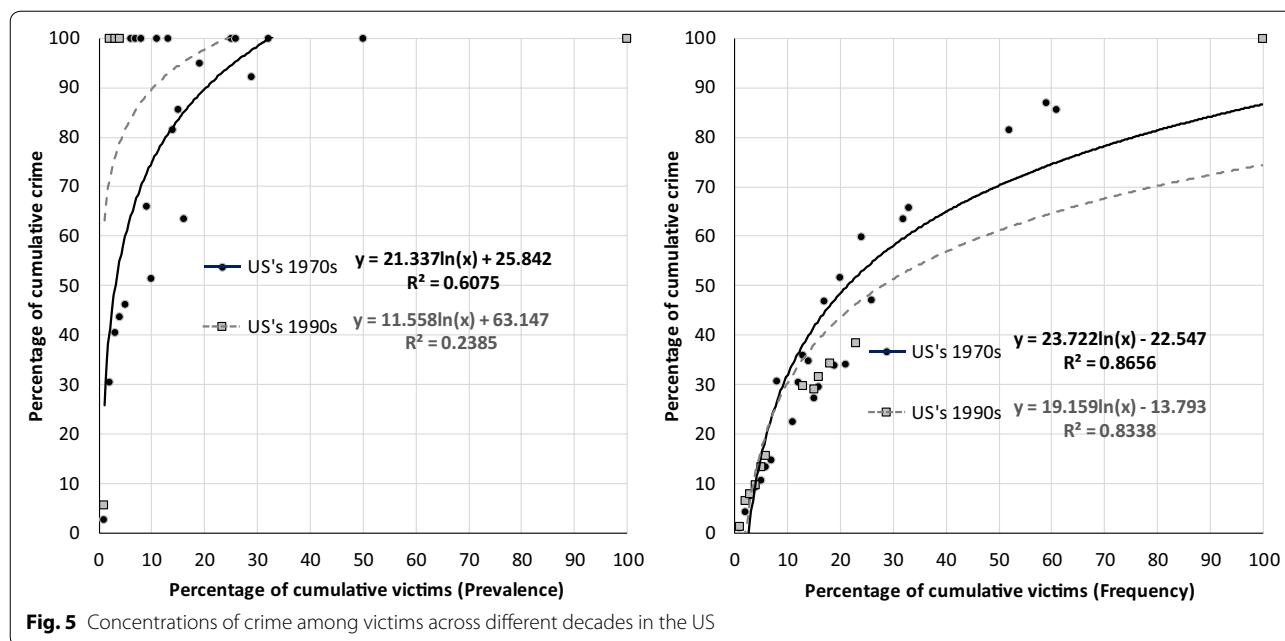


Fig. 5 Concentrations of crime among victims across different decades in the US

use the relevant data for each country or time period (e.g., if a study displayed results for both the UK and the US, the UK data was included in the UK analysis and the US data was included in the US analysis).

Figure 6 shows the distributions for prevalence and frequency for four decades. In the left panel, we see that three decades (1980s, 1990s and the 2000s) have quite similar quite similar distributions, but seem to be different than the decade of the 1970s (see Appendix 2). In fact, the most victimized 5% in the UK during the 1980s, 1990s and 2000s have approximately 59–65% of crime, whereas most victimized 5% during the 1970s have only about 38.6% of crime (see Appendix 2). About 40% of the population has zero crime during 1970s whereas 50–60% of the population has zero crime during other decades.

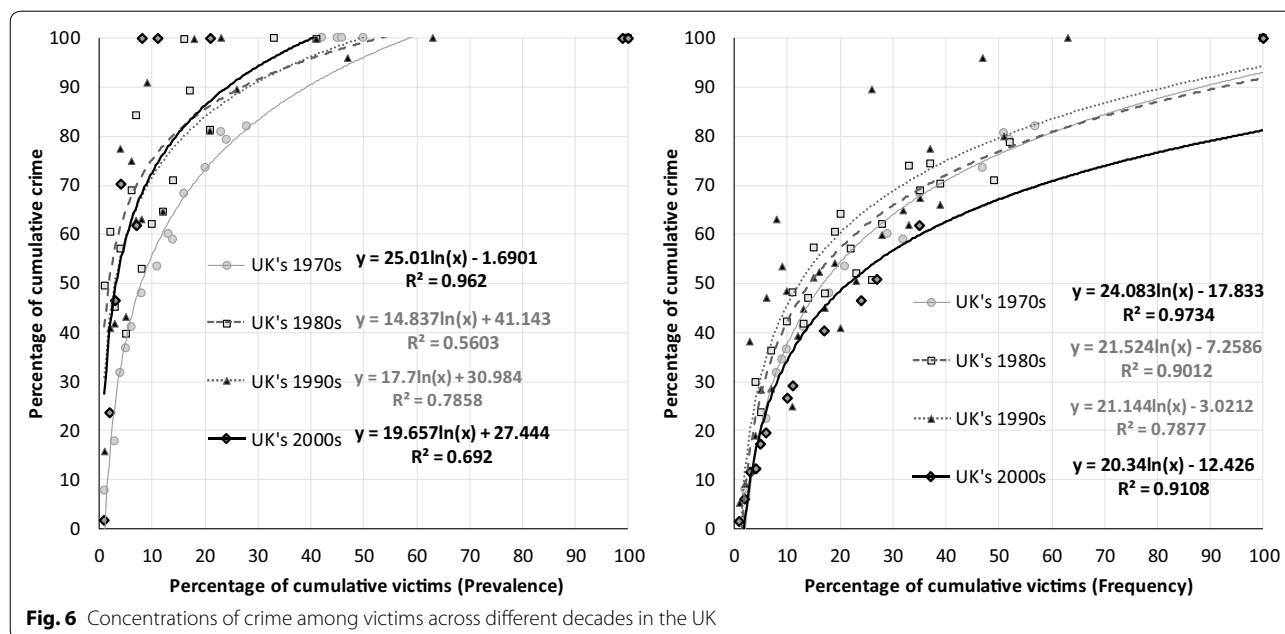
According to the frequency curves, the 2000s show the least concentration compared to the other three decades when we only consider targets with at least one victimization. In fact, the most victimized 5% of victims in the 1980s and 1990s experienced 27.4 and 31% of victimization respectively, whereas most victimized 5% of repeat victims during the 2000s experienced only about 20.3% of crime (see Appendix 2). Overall, the UK frequency curves show that victimization concentration increased gradually from 1970s to 1990s, then dropped substantially into the 2000s (see Appendix 2).

Limitations

The heterogeneity of the literature on victimization and the sheer scarcity of studies found for particular categories of victimization create limitations to our findings. We alluded to most of these limitations in the previous sections, but they warrant reiteration here.

First, the 70 studies we found included various types of victimizations, including sexual victimization (Fisher et al. 1998; Gagné et al. 2005; Gidycz et al. 1993; Tillyer et al. 2016) and peer victimization (Bond et al. 2001; Espelage et al. 2013; Fekkes et al. 2004; Fisher et al. 2015; Pabian and Vandebosch 2016; Li et al. 2003). However, many of those studies did not satisfy our third criteria requiring at least two empirical ordered pairs, and so we excluded them. Thus, we ended up with few types of victimization for our meta-analysis.

Second, visual binning can reduce the true variation in the X and Y points. Losing variations in the raw data reduces the degrees of freedom, and can lead to a less accurate estimation of the curve. For example, we found that some of the estimated betas (in Figs. 3 and 5) were not statistically significant (see italicized estimates in Appendix 2). Theoretically, this finding does not make sense because it suggests that there is no significant evidence of victim concentration. Despite this limitation, we used bin medians rather than means because there is no



other metric to represent the typicality of each bin, given the skewness of the distributions within bins.

Third, we did not weight our data nor X–Y pairs. Because data from a large sample can be more reliable and have more statistical power for a meta-analysis than data from a small sample, weighting by sample size would be reasonable. However, because we did not find any substantial difference in the findings by using the weighting method, we used the unweighted data points for meta-analysis. Based on our analysis, we believe weighting makes no difference, but there is always the possibility that we could be wrong.

Fourth, we used the logarithmic function throughout the meta-analyses. Because the logarithmic transformation is not possible for zero, all curves in the figures are marginally away from the origin either vertically or horizontally. Using functional forms tailored to suit different categories of victimization concentration may be better than a using a standard logarithmic function. The extreme upper right in our estimated curves are likely to be biased in most of the figures. The most important part of the curves is toward the lower left where the most victimized subjects appear. The logarithmic functions fit the data well here, as judged by the dispersion of cases around the fitted lines. In future research, other functional forms should be tested.

Finally, our findings are limited by the populations researchers have examined with sufficient frequency that we could make comparisons. We could only compare concentration levels of the UK to the US, for example, because sufficient number of X–Y pairs are given for reliable comparison. Other national comparisons would be interesting, but there are insufficient studies to make such comparisons.

Discussion and conclusions

This is the first study to systematically review studies on the concentration of victimization and to synthesize their findings using a form of meta-analysis. One of the reasons researchers use systematic reviews and meta-analysis is to avoid potentially biased conclusions that can arise from standard narrative reviews (Wilson 2001). Prior to conducting a meta-analysis, it is quite possible that the community of scholars examining a topic is wrong in their conclusions. Now that we have conducted a meta-analysis of repeat victimization studies, our findings suggest that the scholars who promote the importance of repeat victimization are correct. Though this may seem obvious, the obviousness of our findings is not the point: in principle, the findings could have been otherwise.

The studies collectively show that a relatively few households and businesses have a disproportionate

number of victimizations. When all possible victims are included (regardless of whether they have experienced victimization during a study's reference period), 5% of the subjects have 60% of the victimizations. When only those who have experience at least one victimization are examined, the 5% most victimized subjects have 12% of the victimizations. On average, therefore, the biggest source of victimization concentration is due to the non-involvement in crime of most subjects. It seems plausible that much of the cause of the first source of concentration is due to population heterogeneity—some people, households, or businesses are at less risk of crime than others due to some characteristics they do not share with others who are at greater risk. In fact, our findings suggest that about 50% of population of businesses and 20% of population of households have experienced victimization and this can be attributed to the difference in the features of places in terms of crime opportunities. However, additional concentration is due to repeated victimization of a minority of victims after the first victimization. And state dependence is more likely to be an explanation for repeated victimization following the first victimization.

Furthermore, we found that high involvement in crime is associated with high repetition once involved. Though this is a rough summary of our findings, it is tantalizing and deserving of further enquiry. The reasoning for this is twofold, implying (1) that involvement and repetition are not separate processes that require different explanations and (2) that mixed processes of flag and boost account (i.e., population heterogeneity and state dependence, respectively) operate at the aggregate level. Fortunately, we are not the only researchers to point out this association. Trickett et al. (1992, 1995) found that high crime rates can be attributed to both measures of victimization, high crime prevalence and high crime repetition. These findings suggest that crime prevention should focus on preventing initial victimization and on preventing subsequent (repeat) victimizations as well. Economic efficiency, however, suggests focusing more on the previously victimized, as this is a much smaller portion of the population so it is easier to concentrate prevention programs. Accordingly, having two different measures of victimization concentration is necessary. Though this conclusion reiterates what others have said about victimization, no study has systematically analyzed and confirmed this conclusion. When we began, it was possible that our review could contradict what researchers thought they would know, or it could confirm it. The

fact that in this case the community was probably right, is a useful finding. From this standpoint, reasserting the need for two different measures for victimization concentration is useful.

Based on the victimization comparisons between frequency and prevalence, households and businesses, property and personal, the UK and the USA, and across the decades (i.e. over time) in each of these countries, we conclude our paper as follows.

First, the variation between households and businesses among the targets with at least one victimization, suggests that on average, households do better at avoiding subsequent crimes than managers of businesses: a smaller proportion of households are at the upper end of repeat involvement than is the case with businesses. For businesses that experience repeat victimization, changing management practices through the adoption of more protective measures may be costly and inconvenient. Especially when they do not make much profit in more crime ridden places, they might prefer to put up with repeat victimization. In contrast, households may put forth more effort to reduce criminal opportunities because repeat victimizations are more expensive and inconvenient. This finding emphasizes the role of place management in reducing repeat victimization at places (Madanssen and Eck 2013). Thus, increasing the responsibility of place managers or owners through the application of publicity, user fees, or even civil actions might reduce a substantial amount of business victimization (Weisel 2005). However, it is still possible that the difference between households and businesses can be attributed to the different data collection process from different surveys.

Second, the comparison between personal and property victimizations suggests that the patterns of revictimization are similar once a target has been victimized. If we assume that personal crime is a crime against person and that property crime is a crime at a place, this is consistent with the findings in Eck et al. (2017, in this issue). In other words, victim concentration is not substantially different from place concentration in the frequency curves.

Third, in the variation between decades in the US, the findings suggest that during 1990s, the percentage of the population that was victimized decreased and the targets with at least one victimization generally experienced less repeat victimization. Thus, findings are consistent with victimization trend across decades with the sharp decline in all categories of crime and all parts of the nation during 1990s (Zimring 2006).

This first meta-analysis of repeat victimization raises a number of questions about the variation in crime concentration among people, households, and businesses. It does, however, show that, when data is available to draw a conclusion, concentration of crime among people, households and businesses is standard. We found no study that contradicted this finding. Nor did we find any study that suggests that the concentration is due only to prevalence (the proportion of subjects who were victimized one or more times) or only due to frequency (the repetition of victimization given an initial victimization). Though it should not need repeating, given crime policy makers proclivity to fads, we do repeat that the concentration of crime among a relatively small proportion of possible crime targets must be part of any sensible prevention policy.

Authors' contributions

This paper was conducted by a team. SO was the lead writer for this paper, contributed to the development of the methods used, and provided expertise on victims. NNM provided expertise on offenders, assisted in the development of the research methods, and provided editorial reviews. YJL was the lead analyst for the team and provided editorial assistance. JEE headed the team and provided overall guidance and editorial assistance. All authors read and approved the final manuscript.

Author details

¹ School of Criminal Justice, University of Cincinnati, Cincinnati, OH, USA.
² School of Public Affairs, University of Colorado, Colorado Springs, USA.

Competing interests

The authors declare that they have no competing interests.

Availability of data and materials

Articles used in the systematic review are noted in the references. For other information regarding data, please contact the lead author.

Ethics approval and consent to participate

Does not apply. As a review of summary data from previously conducted research, no humans (or their tissues) participated as subjects in this research.

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Appendix 1

Estimated distributions of crime at victim for prevalence and frequency schema: A comparison of fitted lines between un-weighted and weighted X–Y ordered pairs (Figs. 7, 8)

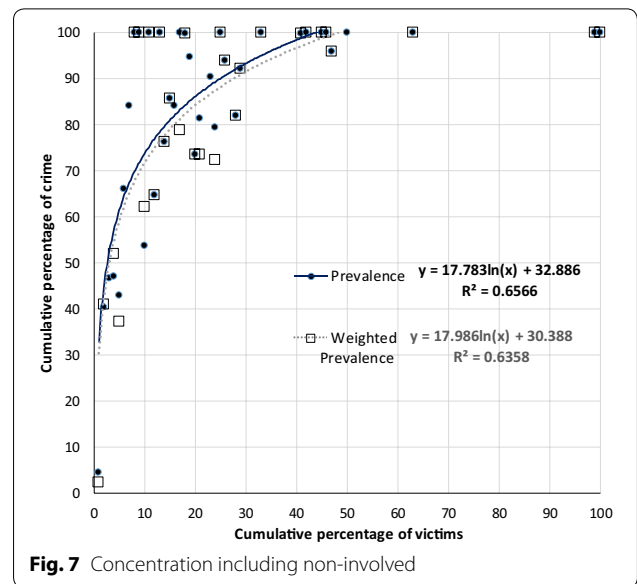


Fig. 7 Concentration including non-involved

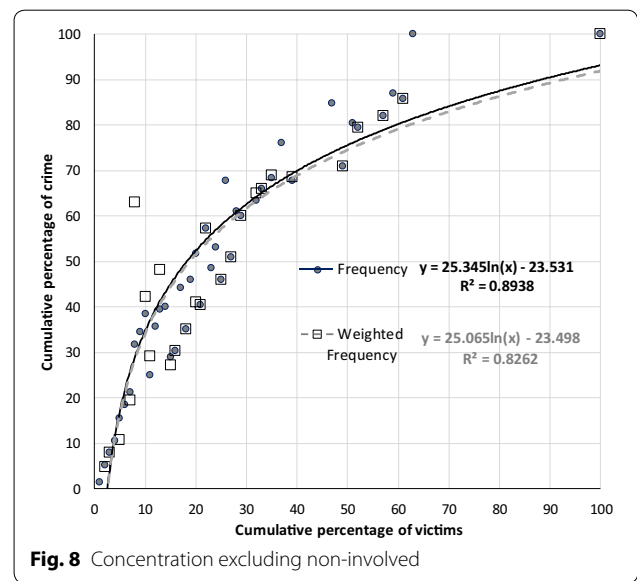


Fig. 8 Concentration excluding non-involved

Appendix 2

See Table 2

Table 2 Estimated coefficients and summary statistics of the models specifications in Figs. 1, 2, 3, 4 and 5

Figure number	Key	Constant	Beta	Std. error	Confidence interval	t-statistic	Percentage of crime explained by:				
							5%	10%	20%	50%	
Figure 1	Prevalence	32.89	17.78	2.11	13.56	22.01	8.41	61.5	73.8	86.2	100.0
	Frequency	-23.53	25.35	1.35	22.65	28.04	18.81	17.3	34.8	52.4	75.6
Figure 2	Household (P)	23.69	24.61	3.68	17.25	31.97	6.69	63.3	80.4	97.4	100.0
	Business (P)	28.95	18.01	2.58	12.85	23.16	6.98	57.9	70.4	82.9	99.4
	Household (F)	-15.28	21.017	1.66	17.70	24.33	12.68	18.5	33.1	47.7	66.9
Figure 3	Business (F)	-4.86	22.121	3.72	14.69	29.56	5.95	30.7	46.1	61.4	81.7
	Property (P)	26.10	23.087	4.10	14.89	31.28	5.64	63.3	79.3	95.3	100.0
	Personal (P)	60.98	<u>12.0206</u>	5.76	0.50	23.54	<u>2.12</u>	80.3	88.7	97.0	100.0
Figure 4	Property (F)	-14.65	20.476	1.91	16.66	24.29	10.73	18.3	32.5	46.7	65.5
	Personal (F)	-14.56	22.045	2.69	16.67	27.42	8.22	20.9	36.2	51.5	71.7
	US (P)	37.12	17.847	4.32	9.20	26.49	4.13	65.8	78.2	90.6	100.0
Figure 5	Non-US (P)	23.97	19.503	1.77	15.96	23.05	11.00	55.4	68.9	82.4	100.0
	US (F)	-22.31	23.273	1.93	19.41	27.14	12.03	15.1	31.3	47.4	68.7
	Non-US (F)	-16.82	23.962	1.34	21.29	26.64	17.92	21.7	38.4	55.0	76.9
Figure 6	US 1970' (P)	25.84	21.337	3.84	13.67	29.01	5.56	60.2	75.0	89.8	100.0
	US 1990' (P)	63.15	<u>11.558</u>	11.93	-12.29	35.41	<u>0.97</u>	81.7	89.8	97.8	100.0
	US 1970' (F)	-22.55	23.722	1.91	19.91	27.54	12.43	15.6	32.1	48.5	70.3
Figure 6	US 1990' (F)	-13.79	19.159	2.71	13.75	24.57	7.08	17.0	30.3	43.6	61.2
	UK 1970' (P)	-1.69	25.01	1.21	22.60	27.42	20.74	38.6	55.9	73.2	96.1
	UK 1980' (P)	41.14	14.837	3.19	8.46	21.21	4.65	65.0	75.3	85.6	99.2
	UK 1990' (P)	30.98	17.7	2.24	13.22	22.18	7.90	59.5	71.7	84.0	100.0
	UK 2000' (P)	27.44	19.657	4.64	10.38	28.93	4.24	59.1	72.7	86.3	100.0
	UK 1970' (F)	-17.83	24.083	1.06	21.96	26.21	22.63	20.9	37.6	54.3	76.4
	UK 1980' (F)	-7.26	21.524	1.59	18.34	24.71	13.51	27.4	42.3	57.2	76.9
Figure 6	UK 1990' (F)	-3.02	21.144	2.04	17.07	25.22	10.37	31.0	45.7	60.3	79.7
	UK 2000' (F)	-12.43	20.34	1.92	16.50	24.18	10.60	20.3	34.4	48.5	67.1

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