Risky Facilities: Crime Concentration in Homogeneous Sets of Establishments and Facilities

by

John E. Eck
University of Cincinnati

Ronald V. Clarke
Rutgers University

and

Rob T. Guerette
Florida International University

Abstract: *The concentration of much crime in a few members of any group of homogeneous facilities is quite common and follows a well-known pattern found throughout the physical, biological and social sciences. Like repeat victimization (a closely related phenomenon), risky facilities provide opportunities for prevention. We explore a variety of explanations for risky facilities; examine measurement problems associated with studying them; list policy options; and conclude by exploring the hypothesis that crime concentration among groups of homogeneous facilities may be the outgrowth of complex dynamic interactions among individuals – offenders, targets, and place managers.*

Crime Prevention Studies, volume 21 (2007), pp. 225–264.

INTRODUCTION

The fact that crime is heavily concentrated on particular people, places and things has important implications for prevention. It suggests that focusing resources where crime is concentrated will yield the greatest preventive benefits. Researchers have therefore begun to develop concepts intended to guide prevention that capture different aspects of this concentration. These include "repeat offenders" – who commit a disproportionate amount of total recorded crime (Spelman, 1994); "hot spots" – places with high rates of crime (Sherman et al., 1989; Weisburd et al., 1992); "crime generators" – places that are high in crime because they are exceptionally busy (Brantingham and Brantingham, 1995); crime attractors" – places that contain many suitable crime targets without adequate protection (Brantingham and Brantingham, 1995); "repeat victims" – who suffer a series of crimes in a relatively short period of time (Farrell and Pease, 1993); and "hot products" – which are stolen at much higher rates than other products (Clarke, 1999).

In this paper, we add another related form of crime concentration: *for any group of similar facilities (for example, taverns, parking lots, or bus shelters), a small proportion of the group accounts for the majority of crime experienced by the entire group.* As we will demonstrate, this is a highly general phenomenon that deserves more attention from researchers than it has so far received. Naming a phenomenon helps to attract attention and we suggest it should be called "risky facilities."

Risky facilities might show up as hot spots in a city's crime map. Indeed, hospitals, schools and train stations are well known examples. But treating these facilities simply as hot spots (or even as crime attractors or crime generators) is to miss an important opportunity for analysis: a comparison of the risky facilities with the other members of their set could reveal many important differences between them, which account for the differences in risk and which might provide important pointers to preventive action.

Risky facilities can be treated as an extension of the concept of repeat victimization. This extension differentiates between the people being victimized and the location at which this occurs (Eck, 2001). Thus, a tavern that repeatedly calls for police assistance to deal with fights among its patrons is not itself repeatedly victimized (unless it routinely suffers damage in the course of these fights or the staff are regularly assaulted). Even those directly involved in the fights might not be "repeat" victims, as different patrons might be involved each time. Indeed, no one need be

victimized at all, as would be the case if the calls were about drug transactions, prostitution solicitations, or the sales of stolen property. Calling attention to the tavern directs attention to the role of management in facilitating the behaviors leading to illicit acts. Thus, when a tavern with many fights is compared with others nearby, it might be found that its layout and management practices contribute substantially to the problem, and that if these were altered the fights might greatly decrease.

In this paper, we will review the evidence showing that the concept of risky facilities is of wide application and that many different kinds of facilities show this form of crime concentration. We then offer some explanations of why risky facilities exist and consider empirical issues that must be addressed in the study of risky facilities. Next, we turn to the preventive implications of the concept. In our conclusions we propose that distributions of facility risk may be emergent properties of complex dynamic systems.

RISKY FACILITIES IN THE LITERATURE

The term "facilities" suggests large buildings and areas of land (often closed to the public), such as docks, water treatment plants and trash burning incinerators. When modified by "public" it suggests libraries, hospitals, schools, parking lots, railway stations, shopping centers and so forth. We use the term for both these kinds of large facilities. We also intend it to cover a wide range of much smaller private and public establishments such as taverns, convenience stores, banks, betting shops, Social Security offices, etc.

Our literature search for risky facilities was not intended to be exhaustive. We were not trying to identify every kind of facility where the concept holds, but we simply wanted to show that it is of wide application. We looked for studies describing crime (including disorder and misconduct) in specific kinds of facilities, and then looked to see whether the study contained evidence that a small proportion of the facilities studied accounted for a large proportion of crime experienced by the whole group. This was rarely the focus of the original studies, but many of them contained data that allowed us to judge whether it was the case. We did not define precisely what we meant by a "small" proportion of facilities or a "large" proportion of the crime. This has not been done for the other forms of crime concentrations discussed above, though it is not unusual to see figures like "Five percent of offenders account for fifty percent of

crime" or "Four percent of victims suffer forty percent of personal crimes" – and we were looking for similar proportions in the literature we examined.

Unfortunately, data were sometimes not presented in this form, but instead the studies reported differences between facilities in crime numbers or rates – for example, "Four percent of banks had robbery rates 4 to 6 times that of other banks." While consistent with "risky facilities," these figures do not satisfy a key component of the definition of the concept – they do not demonstrate that a small number of high-risk banks account for a large part of the robbery problem. Put another way, such studies show that some facilities have more crime than other like facilities, not that most crime is located at these few extreme facilities.

The concentration of crime we are looking for can be represented as a J-curve (Allport, 1934; Clarke, 1996; Clarke and Weisburd, 1990; Hertwig et al., 1999; Simon, 1955; Walberg et al., 1984). As we will see, this curve is closely related to distributions described by power laws (Schroeder, 1991), a well-known variant of which is Zipf's Law[1] (Gell-Mann, 1994; Zipf, 1949). To reveal a J-curve, the number of crimes in a given time period at each facility needs to be known, and then the facilities ranked from those with the most crimes to those with the fewest. If a bar chart of the crime frequency is drawn, a few facilities at the left end of this distribution will have many crimes, but as one moves to the right there will be a steep drop-off in crimes that flattens out at a very few or no crimes for the majority of the facilities. The resulting graph resembles a reclining J. A number of such distributions will be shown below.

The concentration represented by the J-curve is not peculiar to crime and disorder, but is practically a universal law (Bak, 1999). A small portion of the earth's surface holds the majority of life on earth. Only a small proportion of earthquakes cause most of the earthquake damage. A small portion of the population holds most of the wealth. A small proportion of police officers produce most of the arrests resulting in prosecution (Forst et al., 1982; Forst et al., 1977). In more popular terms, this kind of distribution is commonly referred to as the 80-20 rule: 20% of some things are responsible for 80% of the outcomes (Kock, 1999). In practice, it is seldom exactly 80-20, but it is always a small percentage of something or some group involved in a large percentage of some result. As we will see in the final section of this paper, the J-curve is symptomatic of a class of processes that can help explain how crime concentrations form.

Our literature search identified 37 studies of specific kinds of facilities that included data about variations in the risks of crime, disorder or miscon-

duct (see the Appendix). The studies cover a wide range of different facilities (for example, banks, bars, schools, sports facilities and parking structures) and many different kinds of crime and deviance (for example, robbery, theft, assaults and disorder). While all studies reported considerable variations in risks, not all provided clear evidence that risks were highly skewed so that a small proportion of the facilities accounted for a large proportion of the crime disorder or misconduct. Those that do (in some cases data were recalculated to show this) are identified in the Appendix with an asterisk in order to distinguish from those that merely establish that some facilities were of higher risk than others. This does not mean that risks for the second group were not highly skewed – only that the data did not allow the distribution of risk to be examined.

From this review, it appears that crime in any population of similar facilities in a geographic area and time period will be highly concentrated in a few facilities, while most of the facilities will have relatively few or even no crimes. When crimes are infrequent and short time periods are examined, this concentration will not be readily apparent (e.g., a year's worth of data may be sufficient to detect J-curves for disorders and many types of thefts, but for homicides and stranger rapes, many years of data may be required for a J-curve to become evident).

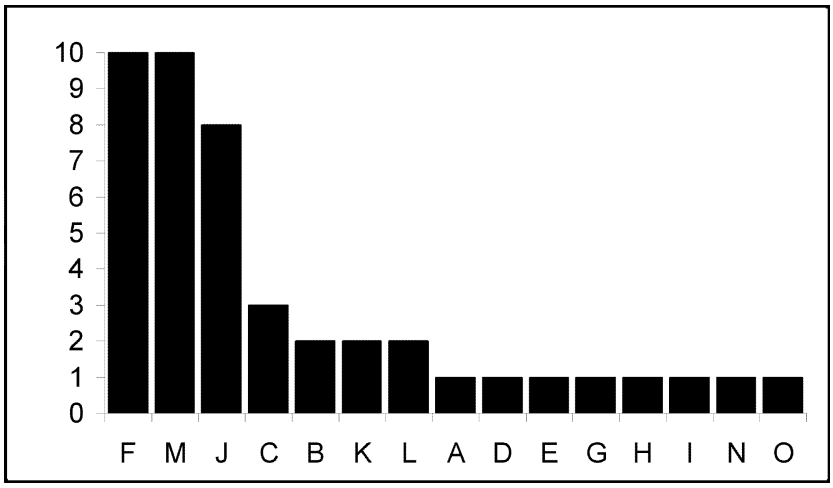
VARIETIES OF CONCENTRATION AT FACILITIES

Let us look at some examples of facility analysis drawn from data supplied by crime analysts in several cities across the United States. These examples illustrate, again, the ubiquity of the J-curve, but we must offer this caveat. This is not a test of a hypothesis because we requested these data to show how common this phenomenon is. Consequently, these examples are further demonstrations of the plausibility of a hypothesis.

Figure 1 shows the distribution of calls to the police for all 15 bars located in Shawnee, Kansas for over two years. These bars are ranked from highest to lowest. We have substituted letters for the names of each bar. Two things to note about the chart: (1) most bars have few calls, and (2) a very few have many calls. In this example, the worst three bars (F, M, and J) comprise 20% of the bars but account for 62% of reports.

The same pattern can be seen in Figure 2. This figure shows shoplifting reports made by 78 stores in Danvers, Connecticut. Seventeen out of 78 stores had three or more shoplifting incidents. In addition to these stores, there were 7 stores with 2 cases, 28 stores with 1 incident, and 26

Figure 1: Calls to Police from Bars in Shawnee, KS (July 1, 2002–Sept. 2, 2004)

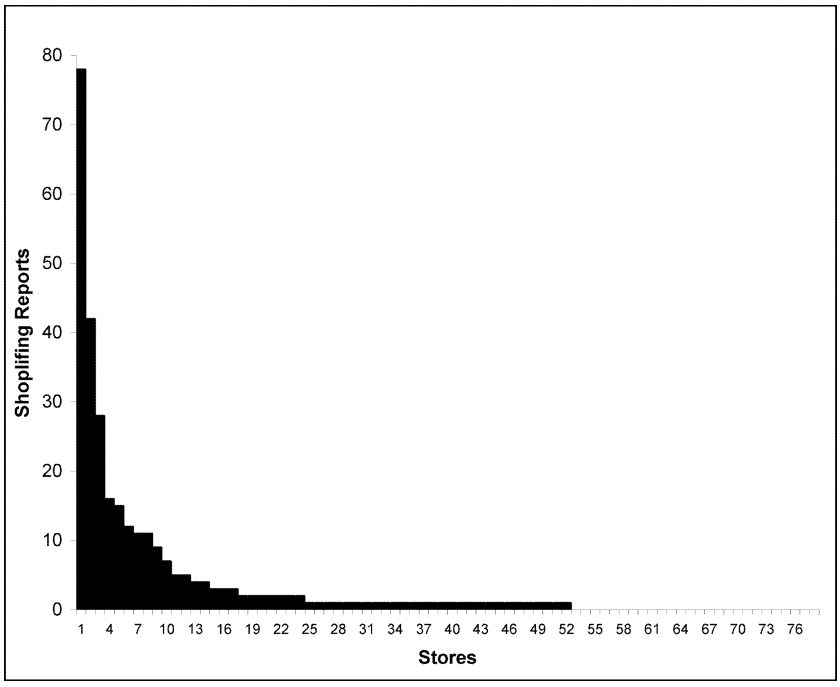


stores with no reported shoplifting. Over all, 20.3% of the stores contribute 84.9% of the shoplifting cases.

These examples have not differentiated among crime types. Yet as can be seen in Figure 3, when crimes are differentiated (in this case property and violent crimes), the J-curve persists. In this example, from Jacksonville, Florida, we are looking at 269 apartment complexes, each with over 50 units. We are examining only complexes with one or more calls, unlike the previous examples where we looked at all facilities in the jurisdiction. In each panel of Figure 3, 20% of the apartment complexes contribute about 47% of the crime (clearly, the concentration would be more extreme if apartment complexes with no calls to the police were included). Though we expect the J-curve to persist when we become more crime-specific, we do not expect that each type of crime will be equally concentrated. That is, we always expect a J-curve, but some of the curves may be more pronounced than the others.

What occurs when we become more facility-specific and subdivide the places? The Chula Vista (CA) Police Department conducted a study of motel crime. The data, graphed in Figure 4, suggests an answer. Panel

Figure 2: Shoplifting Reports from Stores in Danvers, CT (Oct. 1, 2003–Sept. 30, 2004)



A shows the J-curve for all 26 motels in the city. The top 5 (19%) of the motels contribute 51.1% of the motel calls. Some of the 26 motels are locally owned and some are parts of national chains. The two groups of motels contributed about equal numbers of calls in 2003 (1,106 from the 16 locals and 983 from the 10 national chains). When we examine both types of motels separately, we see the same shape distribution. The top 20% of the local motels contributed about 50% of the calls from these types of motels. The top 20% of the national chain motels contributed 53.6% of the calls from national chain motels.

Though there is overall similarity between the chain and non-chain distributions, an examination of the source of the concentration reveals an important difference. The concentration of the national chain motels

Figure 3: Crime Incidents from Apartment Complexes with Over 50 Units, Jacksonville, FL (Sept. 1, 2003–August 31, 2004)

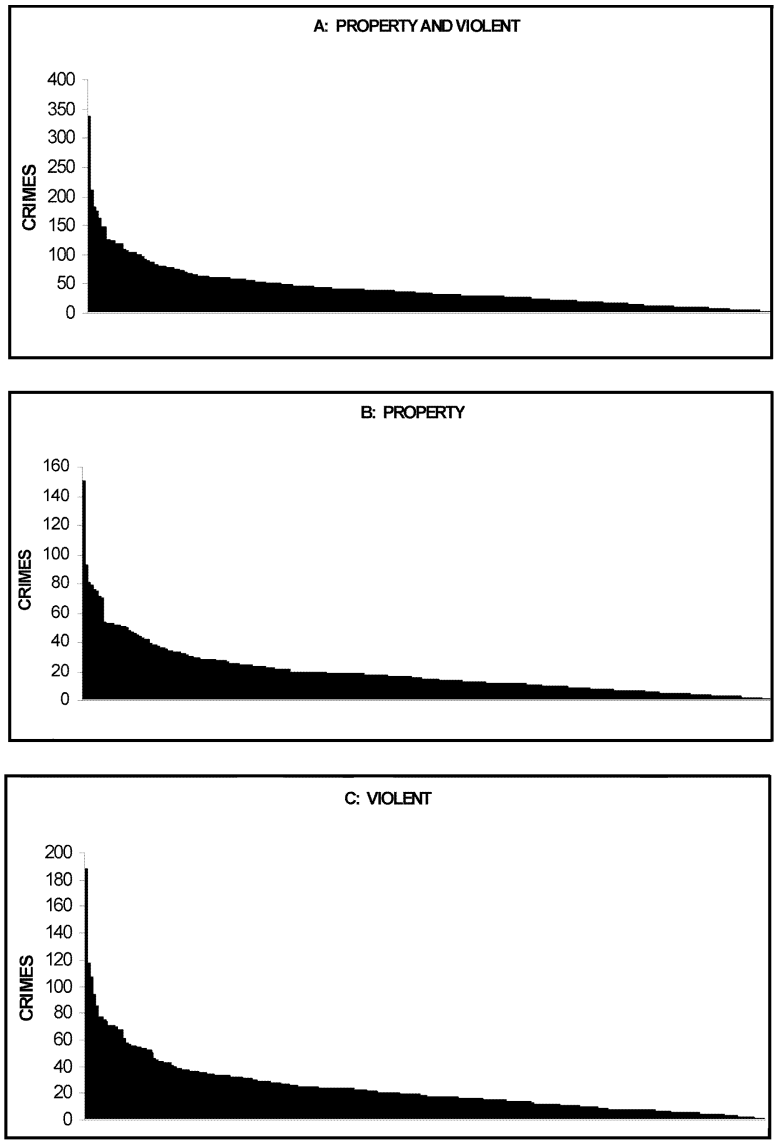
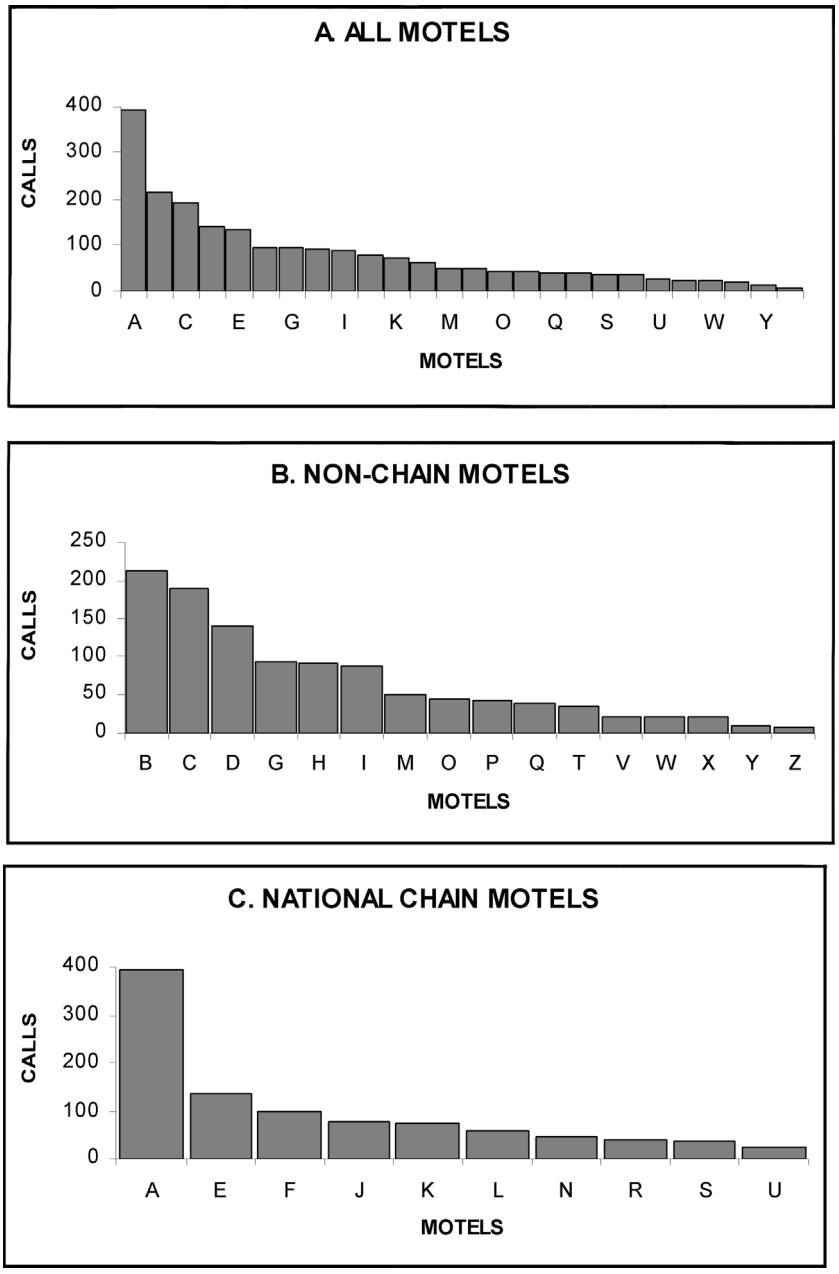


Figure 4: Calls from Motels, Chula Vista, CA – 2003



is largely due to one motel (A), whereas the concentration in the local motels is shared among several motels.

Though we will discuss the practical implications of this sort of analysis later, it is worth pointing out a specific implication. By separating the type of motel, crime prevention professionals can locate the locus of control, and this has implications for attaining improvements in facility practices. Getting a local business owner to change practices is likely to involve a different sort of persuasion than getting a national chain to change practices.

These four examples demonstrate the prevalence of the concentration of crime in facilities. We should expect to find the J-curve; the exceptions will be when it is not found. Further, we hypothesize that the J-curve will be found in every form of specificity: crime type, facility type, time period, geographic area, and other subdivisions. In most cases the J-curve will only disappear when the numbers of facilities or crimes become few in number (e.g., a street corner with three gas stations will not reveal a J-curve of gas station robberies because there will be too few robberies and gas stations, but given an area with a large number of gas stations, and sufficient time for a large number of robberies to occur, the J-curve will appear). There may be exceptions to this rule, but we believe that such exceptions will be relatively uncommon.

WHAT CAUSES RISKY FACILITIES?

Are there differences in the characteristics of the facilities at the left and right ends of these J-curves that cause the differences in crime? Answering this question should give us some insight into what can be done to reduce crime. In this section we will look at five possible answers: random variation, crime reporting, targets, offenders, and place management. We do not expect one of these answers to be true (and the others false) in all circumstances, rather we expect that in any given circumstance some of these answers will be more relevant than in other circumstances. As we will explain, it is virtually impossible to have only one answer.

Random Variation

This explanation simply claims that the distribution of crimes across facilities is a fluke: If one looked at a group of facilities at different time periods,

the facilities with the most (and least) crime would radically change. In short, there is nothing systematically different about the high crime and low crime facilities. In some circumstances this is likely to be the case. And in such circumstances the appropriate crime reduction approach is to ignore the high crime facilities: They will get better on their own and other facilities will get worse, and we will not be able to predict which will get better or worse, and how much.

The evidence from studies of geographic hot spots suggests that this explanation cannot be discounted; some hot spots improve on their own and new ones appear. But these studies also show that some crime concentrations are stable over long periods (Spelman, 1995a, 1995b; Weisburd et al., 2004).

There are two ways of testing for random instability. The first is to apply a significance test to determine if the observed distribution is sufficiently different from a randomly generated distribution; if it is not, we cannot reject the possibility that random fluctuation is the cause of the observed distribution. However, when examining very large numbers of facilities and crimes, significance tests will reject randomness as a plausible answer. So significance tests are most useful when the numbers of facilities and crimes are few and crime is only slightly concentrated.

A second approach is to examine the distribution at different time periods. If facilities do not radically change position – those on top tend to stay on top and those at the bottom tend to stay at the bottom – then we can reject the hypothesis that random instabilities are an important cause. One example is provided by Clarke and Martin (1975), who examined absconding rates in three groups of training schools for juvenile offenders in the United Kingdom: 17 "senior" schools for boys aged 15-17 on admission; 22 "intermediate" schools for boys aged 13-15; and 20 "junior" schools for boys aged up to 13 on admission. There was wide variation in the absconding rates for each group: for example, the rates of absconding in the senior schools ranged between 10% and 75% of those resident in each school during 1964. This variation was highly stable between 1964 and 1966: for senior schools it was 0.65, for intermediate schools 0.56 and for junior schools 0.43. Very few of the same boys would have been in each school during the two years compared, which suggested that regime variables, rather than random variations or "offender" variables, were the main determinants of the stability in absconding rates.

Reporting Processes

The variation in shoplifting reports from Danvers (CT) stores could be due to store policies regarding the detection of shoplifting and bringing shoplifters to police attention. It might not have much to do with the actual distribution of thefts from these stores (e.g., a store at the extreme right end of the distribution might have as many or more shoplifting incidents as one at the extreme left end, but the store fails to detect the thefts, or if they do detect them, they do not report them to the police). This is an example of the reporting process causing the distribution. Any time the managers of facilities control the reporting process, this hypothesis is a plausible contender.

Careful examination of how facility managers discover crime and the circumstances under which they report it is the best method for diagnosing this particular cause. Some reporting variation among facilities is to be expected, particularly as police presence is often perceived as having an adverse economic consequence. But the ability of facility managers to suppress crime reporting probably varies across facilities. The managers of the Chula Vista mobile home parks, for example, probably cannot control crime reports to the extent that Danvers store managers can control shoplifting reports. And managers may have more control over some crimes than others. The Danvers store managers probably can control shoplifting reports more than they can control reports of vehicle thefts from their parking lots.

Targets

The quantity and quality of targets can also be a cause of extreme variation in crime within a set of facilities. Some facilities are larger than others. Everything else being equal, we would expect big facilities to have more crime than smaller facilities, and if there are many small facilities of a given type, and few large ones, this might account for the J-curve we observe. Paul and Patricia Brantingham refer to places with high numbers of crime due to many targets as *crime generators* (Brantingham and Brantingham, 1995). It is easy to dismiss the concept of risky facilities based on target numbers, but size is often not the full explanation.

The simplest test for whether size is an important contributor is to divide the crimes by the size of each facility to get a measure of risk. If risk is constant, then size is the most important explanation. But if targets in some facilities have higher risks than in other facilities, then size is not

the entire explanation. Figure 5 shows two risk distributions, one for Chula Vista motels and one for Jacksonville apartment complexes. Both graphs show that some facilities have much higher risks than others, indicating that in these examples, the number of targets is at best an incomplete explanation.

The "quality" of targets may also make a difference. If some vehicles are particularly desirable to thieves, and these cars tend to cluster in some parking lots, then such parking facilities might have a very high level of vehicle theft, even if the overall number of vehicles in these lots is relatively small. Stores that stock "hot products" (Clarke, 1999) may have many more thefts than similar stores that do not.

Similarly, high crime facilities may differ from otherwise similar low crime facilities by having more repeat victims. The total number of possible victims may be about equal, but for some reason there are a few victims who are repeatedly attacked at the high crime facilities. And repeat victims are infrequent at the low crime facilities.

The test for the target quality explanation is to examine the distribution of crime across facilities for specific target types. One would want to examine both the number of crimes and the rate of crime, relative to the specific targets being examined. If particular targets are the cause, then facilities with such targets will have both a higher number of crimes and a higher rate of crime for these particular targets relative to other targets at the same locations.

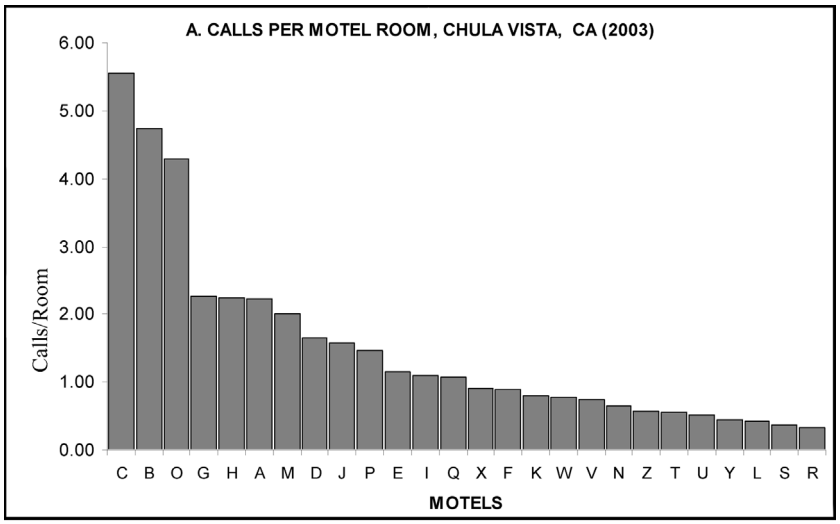
Offenders

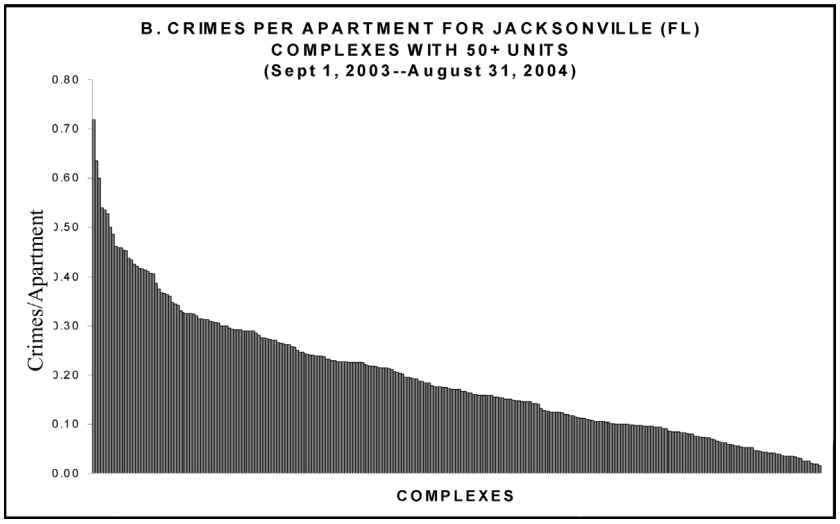
All crimes need offenders; just as they need targets. So offenders must be part of any explanation, but this will never be the complete explanation. There are two types of offender explanations. First, some facilities may attract many offenders. The Brantinghams call such places *crime attractors* (Brantingham and Brantingham, 1995). However, we do not need many offenders to produce many crimes at a facility; just a few highly active offenders will be sufficient.

As important as these explanations are, they raise more questions than they answer. In particular, why are many offenders attracted to a few facilities and not to many other similar facilities? Why are a few offenders so highly active in a few places but not in many other similar facilities? In short, what makes the few high crime facilities so attractive to offenders?

Traditionally, criminologists have answered such questions by suggesting that the few high crime places are located near areas with many

Figure 5: Two Examples of the Effect of Size on Risky Facilities





offenders, but most of the similar low crime places are located somewhere else. This explanation is probably true in some circumstances, but like each explanation we have discussed, it is unlikely to be anything close to a universal rule. When the Chula Vista Police Department looked at the locations of motels they found that all of them – high and low crime – were located in high crime areas (Chief's Community Advisory Committee, 2004).

This explanation can be tested in two ways. First, one can look at facilities in close proximity to each other. If all close-by similar facilities have similar levels of crime, but their crime levels are different from similar facilities in other neighborhoods, then proximity to offenders is a potentially useful explanation. However, if crime levels vary a great deal with the neighborhood, or crime levels are similar across neighborhoods then this is a less useful explanation.

Second, if the people caught committing crimes in the high crime facilities live near these facilities, but the people committing crimes in the low crime places traveled further, then proximity to offender populations may be part of the explanation. But if offenders travel about the same distances to both types of facilities, then proximity is an unlikely explanation.

Another offender explanation is that they are differentially attracted by facilities. That is, some facilities have features that help offenders, but most do not. One feature that might attract offenders is many targets, or particularly desirable targets. These are both target-related explanations, which we have examined earlier. Another feature that offenders might find attractive is the lack of place management: the owners and operators of the few high crime facilities are not as scrupulous about regulating conduct at their facilities compared to most similar facilities. Or the physical layout of the high crime facilities makes offending easier than is the case with the low crime facilities. These are both place explanations, which we will come to next.

Place Management

Just as targets and offenders have a role in explaining high crime facilities, so do place characteristics. Place characteristics are under the control of the people who own and manage the facility (Eck, 2003). In stores, this includes the products stocked, the way they are displayed, the opening and closing hours, and a host of other characteristics. In bars, management

controls: how drinks are dispensed; the prices charged; what entertainment is provided; how bartenders handle intoxicated patrons; the types of customers being catered to; the employment, training, and rules for bouncers, bar tenders, and other staff; and many other conditions (Homel and Clark, 1994). At motel and hotels, management controls: how reservations are taken; whether ID is examined at check-in; the establishment and enforcement of rules; hours of staffing; and many other things. In all facilities, management controls many aspects of the physical layout of the location. And management has a strong influence over the security of the site against a wide variety of crimes. So place management directly influences many things related to targets and offenders, as well as how they can interact at the location. We have termed places where management practices allow crime to occur, *crime enablers* (Clarke and Eck, 2003).

Comparing the way similar facilities with different crime levels are managed can test crime enabling. If compared to low crime facilities, the high crime locations have fewer rules, lax enforcement, easy access, poor security, and other features that help offenders detect targets, commit crimes, and get away, then place management is an important explanation. If the high crime facilities have many targets or more highly desirable targets (either hot products or repeat victims) compared to low crime facilities, but managers do little to enhance target protection, this also suggests place management is at the heart of the problem.

There is no single universal explanation for why a few facilities have far more crime than most other facilities. For any particular set of facilities the full explanation will involve a combination of the five explanations we have discussed, though the relative contribution of each explanation will vary. Crimes cannot occur without the interaction of offenders, targets and places. There will always be some level of instability. And when using official police records, the crime reporting process will have some influence. So the concentration of crime at a few facilities can seldom be dismissed as a random fluke or "just a lot of targets" or active offenders. On the other hand, the combinations of factors that contribute to such concentrations suggest multiple approaches to reducing crime at the high crime facilities.

MEASURING CONCENTRATION ACROSS FACILITIES

Throughout this discussion we have taken measurement as an assumption. Here we want to briefly describe seven issues that need to be considered

in empirical examinations of risky facilities. These issues are common to the family of crime concentration concepts.

Frequency of Events

If the events being examined are common, then it will be relatively easy to describe the distribution of crimes per facility. It will be harder to empirically describe the J-curve for rare events. We would hypothesize that stranger sexual assaults in public parks follow a J-curve. But testing this hypothesis will be difficult because sexual assaults are not common. Many years of data will be required before the curve becomes apparent (see Time Window).

Time Windows

The longer the time period over which a homogeneous set of facilities is studied the more accurate the depiction of the J-curve. This is particularly true when the events under consideration are scarce. Short period estimates with rare events are unlikely to show a crime distribution distinguishable from random variation. Over a sufficiently long time, almost all facilities will have some crime event, but even if it is difficult to distinguish between the zero-event and one-event facilities, there still will be a big difference between the left and right extremes on the J-curve. However, very long time periods can produce results confounded by changes in facilities – some may go out of business, others may come into being, and others may be altered, both physically and managerially.

Address Matching

Any study of crime concentration depends on accurate attribution of crime events to the people, places, or things of interest. This is no less true of risky facilities. Two types of errors are possible. The first is underreporting. This will result in an underestimate of crime concentration. Over reporting is also possible. Corner locations may be assigned more crimes in police reports, for example, if police find it easier to record the address to intersections. This will overestimate crime concentration (Farrell and Pease, 2003).

Frequency of Facility Types

Some facilities are more common than others in any area. If the number of facilities in an area is very small, then the J-curve may not be readily

apparent. In a moderate sized city, there will be very few hospitals, for example. Given at least two facilities, it is likely that one has more crime events (of any particular type) than the other. This may have some very practical consequences, but for examining the overall distribution the population is too small. Using a much larger region might be productive.

Zero-event Facilities

Our thesis is that given any sufficiently large population of homogeneous facilities the modal number of crime events will be zero. But zero-event facilities may be invisible if police data is the sole source of information. This is because police data only shows locations with one or more events. If a regulatory authority licenses the facilities under study (for example, locations that serve alcohol), then data from the regulatory agency can be compared to the police data to estimate the number of zero-event facilities. It may be difficult to get accurate counts of facilities that are not required to register with some authority.

Facility Size

If we are trying to estimate the risk of the average target at each facility, then we will need some indicator of how many targets are found at each facility. Target counts are usually unavailable. One reason is that the number of targets may be variable – the number of vehicles in a parking facility will vary by time of day, day of week, and season of the year, for example. One option is to hand count targets at multiple time periods. Another is to estimate average target numbers from business records (for examples, motel room occupancy rates adjusted for average number of occupants per room). A third is to use an indirect measure of targets, such as counting parking spaces in downtown parking facilities as a proxy for vehicles at risk of theft or break-in (Clarke and Goldstein, 2001).

Crime Event Data Sources

There is no single best source of crime event data for examining risky facilities. Police reports are useful because the data is readily available for a wide variety of crime events. However, reporting problems (see address matching) and lack of information about facilities without crime (see zero-event facilities) may seriously distort J-curve estimates. Business surveys

based on samples of facilities can avoid many of the reporting and zero-event problems. And surveys can be used to collect information on size and targets at risk. However, sample surveys may not have sufficient numbers of the types of facilities needed, or might not collect sufficient information to classify accurately facilities by type. And unless the sample size is very large, it is likely to exclude the rare many-event facilities. Rather than make a strong (and only weakly defensible) claim for a particular data source, we take a more pragmatic approach. Any study must be able to defend the data source relative to the particular questions being asked, the feasible alternatives available, and likely errors in estimates.

FACILITIES AND PREVENTION

The first, and most important, implication from this discussion is that it is productive to divide places by facility type and focus prevention on homogeneous sets of facilities. This is a logical extension of the first principle of Situational Crime Prevention: be crime-specific. Analysis of crime across a heterogeneous set of places is far less likely to reveal effective interventions than analysis that controls for facility type. This may seem contrary to our argument that the J-curve can be found when analyzing crime in any homogeneous set of facilities, and our argument that all five explanations we have examined contribute to producing J-curves. Indeed, there may very well be a common process that leads to J-curves, regardless of type of facility or crime. Nevertheless, details are all-important when it comes to selecting preventive measures.

The second implication is that focusing on the most troublesome facilities will have greater payoff than spreading prevention across all facilities, most of which have little or no crime. This is an extension of the principle that one should focus on the most active offenders, most victimized victims, and the hottest places.

The third implication is that any prevention measure will have to involve the people who own and run the facilities. Whether the concentration of crime is largely due to reporting, targets, offenders, or place management, the people with the obligation and authority to make changes that can prevent crime, are the people who control the space (Laycock, 2004; Scott, 2005).

The very fact that only a few facilities, in a set of similar facilities, have a great deal of crime raises several questions. What are place managers at most facilities doing that is not being done at the high crime locations?

Why aren't these things being done at the high crime facilities? And how can one get the high crime facilities to adopt necessary crime prevention? There are five general answers.

Circumstances

The high crime facilities may face different circumstances than the low crime facilities. Even though they follow the same practices, the practices are ineffective at the high crime places. Special crime prevention efforts for the few high crime facilities need to be created in these circumstances.

Ignorance

Place managers at the high crime facilities may be unaware of what they should be doing. This might occur when communications among facility managers and owners is limited. Training programs to transfer information from the knowledgeable low crime facilities to high crime facilities could help here.

Cost

The high crime facilities might face higher costs for prevention than the low crime facilities. This could occur if the high crime facilities are in older structures that are more costly to adapt to modern crime prevention standards. Old structures, for example, sometimes contain lead pipes, asbestos, and other materials that are costly to handle. Newly built structures do not contain these materials, making renovation easier and cheaper. Similarly, high crime facilities might have less revenue to spend on prevention than newer facilities. The lack of prevention may be a cost cutting method. This is most likely when the cost of crime falls more on place users than facility owners. Intimidation is the threat of a cost. Place managers might be reluctant to change if they expect to bear a high cost imposed by offenders. Lowering the costs of prevention to the facilities' owners might help in these circumstances. Examples of this include subsidized toxic waste removal to facilitate renovation, low interest loans, extra police protection, and other similar efforts.

Profit

Owners might profit from the criminal activity. At the extreme, they may be involved directly in its production. Owners might not be involved, but

their employees are. However, owners might simply feed off of deviant activity, without them or their employees having any direct involvement. For example, drug dealers and buyers might make up a disproportionate share of the customers to a convenience store and account for most of the sales. Though the store's owner might wish they were involved in a legitimate activity, he might ignore their illegal pursuits because the offenders are his best customers.

Accountability

All of the above remedies (with the partial exception of the last) assume that place managers will do the right thing if they are provided with the ability. This assumption is not always valid. It is usually cheaper to shift responsibility for a crime problem to someone else, such as the police. Consequently, it is often useful to make facility owners responsible and accountable for crime on their property. There are several methods for this, all of which increase the cost of non-compliance.

1. *Publicity.* The much greater risk of using a particular facility than of using other similar facilities, could be made known to the public. If the public acts on this information, then the facility could loose business.

2. *Sanctions.* Local governments use civil procedures to shut down facilities that are persistent trouble spots and whose owners do not attempt to address the problem. There is considerable evidence that the threat of civil sanctions can be quite effective (Eck, 2002). Sanctions can vary from fines, loss of operating licenses, to closure of the facility.

3. *Certification programs.* The police or local authority might certify premises and facilities for their security. These certification programs could be voluntary or compulsory. Police in the U.K. operate a voluntary safe car parks scheme of this kind.

4. *Voluntary codes of practice.* The managers or owners of a class of facilities in a particular region or locality might agree to follow certain practices designed to reduce crime. Examples would be the "accords" made between the managers of pubs and clubs in entertainment districts in Melbourne, Surfers Paradise (Homel et al., 1997), Geelong (Felson et al., 1997), and elsewhere in Australia to reduce drink-related violence.

5. *Performance Standards.* Recently, the Chula Vista Police Department has been experimenting with the use of performance standards (Chief's

Community Advisory Committee, 2004). Based on the analysis of crime frequency and negations, a maximum number of crimes is established for facilities of a particular type. This standard may be expressed as a rate, to account for size. Facilities that exceed the performance standards are sanctioned.[2] Along the same lines, the Oakland Police Department (2003) in California entered into an agreement with a motel chain that the chain would significantly reduce crime and disorder at one of its problem motels in the city. This agreement was guaranteed by a "performance bond," which required the chain to pay $250,000 to the city if the goal were not reached within two years. It was left to the motel chain to decide which security measures to introduce, and it decided to upgrade lighting and fencing, replace the managers and security guards, conduct pre-employment background checks on all new employees, establish strict check-in procedures with a list of banned individuals, and prohibit room rentals for more than 30 days. Crime was greatly reduced by this initiative, which earned the project the Herman Goldstein Award for Excellence in Problem-Oriented Policing for 2003.

In practice, a combination of approaches might be the best strategy. One reason for this is that facility owners can be politically powerful, and it is far easier to reduce crime if they are cooperative than if one has to engage in a political battle. So providing both carrots and sticks might be the best strategy.

TO A THEORY OF RISKY FACILITIES

In this paper we have argued that the distribution of crime across a population of similar facilities follows a J-curve: a few of the facilities account for most of the crime in these facilities. We suggest that this distribution is the norm and that regardless of how one subdivides the crime or the facilities one is interested in, the distribution will have the same basic J-shape. The implications of this are straightforward: focus on the high crime members of the facility set and, if one is successful at driving down crime at these locations, the overall crime level for all facilities in the set will decline. The flip side of this argument is just as obvious: focusing on all the facilities, and particularly the low crime facilities, will have little impact and will have greater costs per crime prevented than the recommended approach. How one addresses the high crime facilities depends on why these facilities have more crime than their cousins. We have provided five interrelated explanations – as well as diagnostic tests – for

why some facilities have far more crime than most similar facilities. We have argued that to address any of these underlying causes (with the exception of instability) will require the involvement of the owners and managers of these places. And in the previous section we have described a number of strategies for dealing with owners.

Throughout our discussion we have compared the facilities at the two ends of the distribution – what characteristics do the high crime facilities possess that are not possessed by the low crime facilities? Such characteristics suggest explanations for the crime discrepancies. These types of comparisons can be readily carried out using case-control studies. Case-control studies, unlike most other study designs, stratify and select cases based on the dependent variable. They are particularly useful when the outcome of interest is relatively rare (Loftin and McDowall, 1988). This is certainly true with risky facilities. The high crime facilities are rare relative to the norm so a probability sample will have to be large if a sufficient number of the risky facilities are to be found in the sample. In a case-control study, one selects a sample of high and of low crime facilities, thus assuring that there are sufficient cases in both categories to make useful distinctions. One then collects data on the relevant independent variables (e.g., size, management practices, physical characteristics, neighborhood, etc.). Such studies have been used to examine drug dealing locations (Eck, 1994) and convenience store robberies (Hendricks et al., 1999).

Cross-sectional studies of facility populations at one time period can tell us how high and low crime facilities differ and suggest what forms of interventions make the most sense. But such studies cannot provide a full explanation. They do not explain how the distribution of facilities came to be J-shaped. Given the prevalence of this distribution, an explanation is necessary.

We have assumed that facilities in a given population are independent of each other; for example, that the bars in Shawnee (Figure 1) can be treated as separate entities. This assumption may hide a deeper understanding. As we mentioned at the outset, concentrations like those we have been examining among facilities are common throughout nature. As noted at the beginning of this paper, the J-shaped distributions like those we have been examining often can be described by a power function. Recent theories of physics and biology suggest that power functions and their distributions are the result of the interaction of multiple agents in complex adaptive systems (Cowan et al., 1999).

Consider a crime pattern that has received extremely little attention but is familiar (in part) to every university-based academic: student party

disturbances in rental apartments. The basic components of this problem are a street network around a university; a population of apartment complexes containing variable numbers of apartments; landlords who rent these properties to students; students who rent them; students who host parties; students who attend parties; and other users of the area around the campus. Though we have no data to demonstrate this point, we predict that if one collected the relevant data, one would observe a variety of J-curves: for both apartment units and complexes; the frequency of parties; the size of parties; noise level generated by parties; calls to the police about such parties; and a host of other related phenomena.[3] These distributions would be the result of the complex interactions of the agents as: students sort themselves among rental units, parties, and other students; landlords make decisions on how they will regulate tenant behavior and where they will purchase rental housing; and other agents (e.g., non-student residents of the area, local businesses, and police) make individual decisions. The individual, and largely uncoordinated, decisions among all these agents, in the same area, will create a situation in which most rental properties have few, small, quiet parties, but a few will have many, large, noisy parties. At the far extreme will be alcohol-related student disturbances.

In short, *the J-curves of crime are an emergent macro property of the interaction of individual decisions*. Offenders, targets, and place managers make choices, which other offenders, targets and place managers respond to. The choices of owners of bars, apartment complexes, motels, gas stations, or other facilities have impacts on the choices of offenders and targets. For example, a bar owner who selects country music is not likely to attract many patrons who prefer hip-hop. If offenders congregate at a convenient storefront, scaring off other customers, then the storeowner may decide to cater to their needs. If some drivers avoid high theft parking lots, the drivers who continue to park in these lots will either have to choose to invest in better vehicle security, or become repeat victims. The security-conscious drivers who refuse to park in these lots will park in other locations, reinforcing the security choices of these lot owners.

The developing field of complexity describes the processes we have been describing: " . . . (C)omplex systems contain many relatively independent parts which are highly interconnected and interactive and that a large number of such parts are required to reproduce the functions of truly complex, self-organizing, replicating, learning, and adaptive systems" (Cowan, 1999). If we are correct, then researchers need to examine populations of facilities as parts of larger systems, and policy makers (including

crime analysts and other police officials) should similarly focus on sets of facilities rather than attempting to understand each high crime facility as a separate problem.

Address correspondence to: john.eck@uc.edu

Acknowledgments: We would like to thank Tracey Belledin, Christopher Bruce, Nanci Plouffe, Karin Schmerler, Susan Wernicke, and Matt White for their considerable assistance as well as two anonymous reviewers for their insightful comments.

NOTES

1. Power Law, Zipf's Law and Pareto's Law functions are three closely related concepts (Adamic, no date; also see, Simon, 1955). Following Adamic we will illustrate this relationship using risky facility terminology. When we want to know the number of crimes at the rth ranked facility, we need to apply Zipf's Law. This is stated as, $C \sim r^{-b}$, where C is the number of events at a facility ranked r by the number of events at that place and b is a shape parameter (the symbol ~ indicates "is proportional to"). Note that we began by ordering all facilities from biggest to smallest by the number of crimes of interest. The rank of each in this ordered list is r, so the facility with the most crimes is the first facility (with r=1). Thus, as the rank increases, the number of crimes in each subsequent facility declines non-linearly. If instead, we are interested in the number of crimes at all facilities that have more than a given number of crimes, then we need to apply Pareto's Law. This law is summarized as, $P(C>c) \sim c^{-k}$, where P(C>c) is the number of crimes, C, at all facilities with more than c crimes. Finally, if we want to know the exact number of crimes at facilities with C crimes, we use a power function, $P(C=c) \sim c^{-a}$, where P(C=c) is the number of crimes at all facilities that have exactly c crimes and a = k+1. The Pareto Law function is a cumulative probability function of a power law and the power function, a probability distribution function. The Zipf Law function is an inverted Pareto Law function – the c and r simply switch axes (Adamic, no date).

2. A variation on this is to adopt a recent innovation in pollution control; creating a market for pollution permits (Stavins, 2002; Tietenberg, 1980). Facilities could be issued permits for a prescribed crime level that they can sell to other facilities. This gives an incentive to reduce crime to below the permit level. Facilities that cannot do so, buy the permits of low crime facilities. If the number of permits is adequately set, then crime would be driven down, low crime facilities would be rewarded, and high crime facilities would pay a penalty (through the market price) for continuing to enable crime.
3. Though far beyond the scope of this enquiry, following recent studies in economics (Axtell, 2001; Luttmer, 2004) we would also predict that the distribution of landlords would by J-shaped: a few landlords owning a large percentage of the student rental properties (whether measured by numbers of buildings, apartments, or square footage), and many landlords owning a few rental properties each.

REFERENCES

Adamic, L. A. (no date). *Zipf, power-laws, and Pareto: A ranking tutorial*. Retrieved March 31, 2005 from: www.hpl.hp.com/research/idl/papers/ranking/ranking.html

Allport, F. H. (1934). The J-curve hypothesis of conforming behavior. *Journal of Social Psychology, 5*, 141-183.

Austin, C. (1988). *The prevention of robbery at building society branches* (vol. 14). London: Home Office.

Axtell, R. L. (2001). Zipf distribution of U.S. firm sizes. *Science, 293*, 1818-1820.

Bak, P. (1999). Self-organized criticality: A holistic view of nature. In G. Cowan, D. Pines and D. Meltzer (Eds.), *Complexity: Metaphors, models, and reality*. Cambridge, MA: Perseus Books.

Bowers, K., Hirschfield, A., & Johnson, S. (1998). Victimization revisited: A case study of non-residential repeat burglary in Merseyside. *British Journal of Criminology, 38*, 429-452.

Brantingham, P. L., & Brantingham, P. J. (1995). Criminality of place: Crime generators and crime attractors. *European Journal on Criminal Policy and Research, 3*, 1-26.

Burquest, R., Farrell, G., & Pease, K. (1992). Lessons From schools. *Policing, 8*, 148-155.

Burrows, J., Anderson, S., Bamfield, J., Hopkins, M., & Ingram, D. (1999). *Counting the cost: Crime against business in Scotland*. Edinburgh, SCOT: Scottish Executive Justice Department.

Chakraborti, N., Gill, M., Willis, A., Hart, J., & Smith, P. (2002). The victimisation of petrol service stations: Crime patterns and implications. *Crime Prevention and Community Safety: An International Journal, 4*, 37-48.

Chief's Community Advisory Committee (2004). *The Chula Vista Motel Project*. Chula Vista, CA: Chula Vista Police Department.

Clarke, R. V. (1996). The distribution of deviance and exceeding the speed limit. *The British Journal of Criminology, 36*, 169-181.

Clarke, R. V. (1999). *Hot products: Understanding, anticipating and reducing demand for stolen goods*. London: Home Office, Research Development and Statistics Directorate.

Clarke, R. V., & Bichler-Robertson, G. (1998). Place managers, slumlords and crime in low rent apartment buildings. *Security Journal, 11*, 11-19.

Clarke, R. V., & Eck, J. E. (2003). *Become a problem-solving crime analyst: In 55 small steps*. London: Jill Dando Institute of Crime Science.

Clarke, R. V., & Goldstein, H. (2001). Thefts from cars in center-city parking facilities: A case study in implementing problem-oriented policing. In J. Knutsson (Ed.), *Problem-oriented policing: From innovation to mainstream*. Crime Prevention Studies, vol. 15. Monsey, NY: Criminal Justice Press. (Accessible online at: www.cops.usdoj.gov.)

Clarke, R. V., & Goldstein, H. (2002). Reducing theft at construction sites: Lessons from a problem-oriented project. In N. Tilley (Ed.), *Analysis for crime prevention*. Crime Prevention Studies, vol. 13 (pp. 89-130). Monsey, NY: Criminal Justice Press.

Clarke, R. V., & Martin, D. N. (1975). A study of absconding and its implications for the residential treatment of delinquents. In J. Tizard, I. Sinclair & R. V. Clarke (Eds.), *Varieties of residential experience*. London: Routledge and Kegan Paul.

Clarke, R. V., & Weisburd, D. (1990). On the distribution of deviance. In D. M. Gottfredson & R. V. Clarke (Eds.), *Policy and theory in criminal justice* (pp. 10-27). Hants, England: Aldershot.

Cowan, G. (1999). Conference opening remarks. In G. Cowan, D. Pines and D. Meltzer (Eds.), *Complexity: Metaphors, models, and reality* (pp. 1-4). Cambridge, MA: Perseus Books.

Cowan, G., Pines, D., & Meltzer, D. (Eds.), (1999). *Complexity: Metaphors, models, and reality*. Cambridge, MA: Perseus Books.

Eck, J. E. (1994). *Drug markets and drug places: A case-control study of the spatial structure of illicit drug dealing*. Unpublished doctoral dissertation, University of Maryland, College Park, MD.

Eck, J. E. (2001). Policing and crime event concentration. In R. Meier, L. Kennedy and V. Sacco (Eds.), *The process and structure of crime: Criminal events and crime analysis* (pp. 249-276). New Brunswick, NJ: Transactions.

Eck, J. E. (2002). Preventing crime at places. In L. W. Sherman, D. Farrington, B. Welsh & D. L. MacKenzie (Eds.), *Evidence-based crime prevention* (pp. 241-294). New York: Routledge.

Eck, J. E. (2003). Police problems: The complexity of problem theory, research and evaluation. In J. Knutsson (Ed.), *Problem-oriented policing: From innovation to mainstream*. Crime Prevention Studies, vol. 15 (pp. 67-102). Monsey, NY: Criminal Justice Press.

Farrell, G., & Pease, K. (1993). *Once bitten, twice bitten: Repeat victimization and its implications for crime prevention*. London: Home Office.

Farrell, G., & Pease, K. (2003). Measuring and interpreting repeat victimization using police data: An analysis of burglary data and policy for Charlotte, North Carolina. In M. J. Smith and D. B. Cornish (Eds.), *Theory for practice in situational crime prevention*. Crime Prevention Studies, vol. 16 (pp. 265-289). Monsey, NY: Criminal Justice Press.

Felson, M., Berends, R., Richardson, B., & Veno, A. (1997). Reducing pub hopping and related crime. In R. Homel (Ed.), *Policing for prevention: Reducing crime, public intoxication and injury*. Crime Prevention Studies, vol. 7 (pp. 115-132). Monsey, NY: Criminal Justice Press.

Fisher, B., & Looye, J. (2000). Crime and small businesses in the Midwest: An examination of overlooked issues in the United States. *Security Journal*, *13*, 45-72.

Forst, B., Leahy, F., Shirhall, J., Tyson, H., Wish, E., & Bartolomeo, J. (1982). *Arrest convictability as a measure of police performance*. Washington, DC: U.S. Department of Justice.

Forst, B., Lucianovic, J., & Cox, S. (1977). *What happens after arrest?* Washington, DC: Institute for Law and Social Research.

Gell-Mann, M. (1994). *The Quark and the Jaguar: Adventures in the simple and the complex*. New York: W. H. Freeman.

Gill, M. (1998). The victimisation of business: Indicators of risk and the direction of future research. *International Review of Victimology*, *6*, 17-28.

Hendricks, S. A., Landsittel, D. P., Amandus, H. E., Malcan, J., & Bell, J. (1999). A matched case-control study of convenience store robbery risk factors. *Journal of Occupational and Environmental Medicine*, *41*, 995-1104.

Hertwig, R., Hoffrage, U., & Martignon, L. (1999). Quick estimation: Letting the environment do some of the work. In G. Girgerenzer, P. M. Todd & A. B. C. R. Group (Eds.), *Simple heuristics that make us smart* (pp. 209-234). New York: Oxford University Press.

Hirschfield, A., & Bowers, K. (1998). Monitoring, measuring and mapping community safety. In A. Marlow & J. Pitts (Eds.), *Planning safer communities* (pp. 189-212). Lyme Regis, UK: Russell House Publishing.

Homel, R., & Clark, J. (1994). The prediction and prevention of violence in pubs and clubs. In R. V. Clarke (Ed.), *Crime prevention studies*. Crime Prevention Studies, vol. 3 (pp. 1-46). Monsey, NY: Criminal Justice Press.

Homel, R., Hauritz, M., McIlwain, G., Wortley, R., & Carvolth, R. (1997). Preventing drunkenness and violence around nightclubs in a tourist resort. In R. V. Clarke (Ed.), *Situational crime prevention: Successful case studies* (2nd ed., pp. 263-282). Monsey, NY: Criminal Justice Press.

Hope, T. (1982). *Burglary in schools: The prospects for prevention*. London: Home Office.

Hopkins, M., & Ingram, D. (2001). Crimes against business: The first Scottish business crime survey. *Security Journal*, *14*, 43-59.

Johnston, V., Leitner, M., Shapland, J., & Wiles, P. (1994). *Crime prevention on industrial estates*. London: Home Office.

Kock, R. (1999). *80-20 principle: The secret to success by achieving more with less*. New York: Doubleday.

La Vigne, N. G. (1994). Gasoline drive-offs: Designing a less convenient environment (pp. 91-114). In R. V. Clarke (Ed.), *Crime Prevention Studies*, vol. 2. Monsey, NY: Criminal Justice Press.

Laycock, G. (1977). *Absconding from borstals*. London: Home Office.

Laycock, G. (2004, October 30). *Clarifying responsibility for crime and safety problems: Who is responsible for what?* Paper presented at the 15th Annual Problem-Oriented Policing Conference, Charlotte, NC.

Laycock, G., & Austin, C. (1992). Crime prevention in parking facilities. *Security Journal*, *3*, 154-160.

Lindstrom, P. (1997). Patterns of school crime: A replication and empirical extension. *British Journal of Criminology*, *37*, 121-130.

Loftin, C., & McDowall, D. (1988). The analysis of case-control studies in criminology. *Journal of Quantitative Criminology*, *4*, 85-98.

Luttmer, E. G. J. (2004). *The size distribution of firms in an economy with fixed and entry costs* (Working Paper 633). Minneapolis, MN: Federal Reserve Bank of Minneapolis, Research Department.

Matthews, R., Pease, C., & Pease, K. (2001). Repeat bank robbery: Theme and variations. In G. Farrell & K. Pease (Eds.), *Repeat victimization*. Crime Prevention Studies, vol. 12 (pp. 153-164). Monsey, NY: Criminal Justice Press.

Mirrlees-Black, C., & Ross, A. (1995). *Crime against retail and manufacturing premises: Findings from the 1994 Commercial Victimisation Survey*. London: Home Office.

National Association of Convenience Stores. (1991). *Convenience store security report and recommendations*. Alexandria, VA: National Association of Convenience Stores.

Newton, A. (2004). *Crime and disorder on busses: Toward an evidence base for effective crime prevention*. Unpublished doctoral dissertation, University of Liverpool, Liverpool.

Oakland Police Department (2003). *Oakland Police Department Beat Health Unit*. Oakland, CA: Author.

Perrone, S. (2000). *Crimes against small business in Australia: A preliminary analysis*. Canberra: Australian Institute for Criminology.

Ramsey, M. (1986). Preventing disorder. In K. Heal & G. Laycock (Eds.), *Situational crime prevention: From theory into practice* (pp. 81-89). London: Her Majesty's Stationery Office.

Schroeder, M. (1991). *Fractals, chaos, power laws: Minutes from an infinite universe*. New York: W. H. Freeman.

Scott, M. S. (2005). Policing for prevention: Shifting and sharing the responsibility to address public safety problems. In N. Tilley (Ed.), *Crime prevention handbook*. Cullompton, Devon, UK: Willan.

Sherman, L. S., Gartin, P. R., & Buerger, M. E. (1989). Hot spots of predatory crime: Routine activities and the criminology of place. *Criminology*, *27*, 27-55.

Sherman, L. S., Schmidt, J. D., & Velke, R. J. (1992). *High crime taverns: A RECAP Project in Problem-Oriented Policing*. Washington, DC: Crime Control Institute.

Simon, H. A. (1955). On a class of skew distribution functions. *Biometrika*, *42*, 425-440.

Smith, D. J., Gregson, M., & Morgan, J. (2003). *Between the lines: An evaluation of the Secured Park Award Scheme*. London: Home Office Research, Development and Statistics Directorate.

Snyder, H., & Sickmund, M. (1999). *Juvenile offenders and victims: 1999 national report*. Washington, DC: U.S. Office of Juvenile Justice and Delinquency Prevention.

Spelman, W. (1994). *Criminal incapacitation*. New York: Plenum.

Spelman, W. (1995a). Criminal careers of public places. In J. E. Eck & D. Weisburd (Eds.), *Crime and place*. Crime Prevention Studies, vol. 4 (pp. 115-144). Monsey, NY: Criminal Justice Press.

Spelman, W. (1995b). Once bitten, then what? Cross-sectional and time-course explanations of repeat victimization. *British Journal of Criminology*, *35*, 366-383.

Stavins, R. N. (2002). Lessons from the American experiment with market-based environmental policies. In J. D. Donahue & J. S. N. Jr. (Eds.), *Market-based governance: Supply side, demand side, upside, and downside* (pp. 173-201). Washington, DC: Brookings Institution Press.

Taylor, N. (2002). *Robbery against service stations and pharmacies: Recent trends*. Canberra: Australian Institute for Criminology.

Taylor, N., & Mayhew, P. (2002). *Patterns of victimisation among small retail businesses* (Vol. 221). Canberra: Australian Institute for Criminology.

Tietenberg, T. H. (1980). Transferable discharge permits and the control of stationary source air pollution: A survey and synthesis. *Land Economics*, *56*, 391-416.

Townsley, M., Homel, R., & Chaseling, J. (2000). Repeat burglary victimisation: Spatial and temporal patterns. *Australian and New Zealand Journal of Criminology*, *33*, 37-63.

Walberg, H. J., Strykowski, B. F., Rovai, E., & Hung, S. S. (1984). Exceptional performance. *Review of Educational Research*, *54*, 87-112.

Walker, J. (1996). Crime prevention by businesses in Australia. *International Journal of Risk, Security and Crime Prevention*, *1*, 279-291.

Webb, B., Brown, B., & Bennett, K. (1992). *Preventing car crime in car parks*. London: Home Office.

Weisburd, D., Bushway, S., Lum, C., & Yang, S.-M. (2004). Trajectories of crime at places: A longitudinal study of street segments in the city of Seattle. *Criminology*, *42*, 283-322.

Weisburd, D., Maher, L., Sherman, L., Buerger, M., Cohn, E., & Petrosino, A. (1992). Contrasting crime general and crime specific theory: The case of hot spots of crime (pp. 45-70). In *Advances in Criminological Theory*. vol. 4. New Brunswick, NJ: Transaction.

Zipf, G. K. (1949). *Human behavior and the principle of least effort: An introduction to human ecology*. Cambridge, MA: Addison-Wesley Press.

Appendix – Research Identifying Crime Concentrations Within Facilities by Type
(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
Apartment complexes				
Clarke & Bichler-Robertson, 1998	Police calls for service at selected properties, 1989-1995.	Santa Barbara, CA, US	All crimes/calls for police service	2 apartment properties owned by one landlord had yearly average calls for service that were 2 to 3 times that of the other apartment properties owned by that landlord.†
Banks				
*Austin, 1988	Bank association records comprising 76% of total UK branches (N = 5,236).	UK	Burglaries and robberies	All successful and attempted burglaries and robberies occurred in 5% of building society branches.
Matthews et al., 2001	Police records of attempted and completed robberies from 1992-94.	UK	Robbery	21 (4%) of branches had rates of robbery 4 to 6 times that of other bank branches.†

(continued)

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
Bars, pubs, and clubs				
*Homel & Clark, 1994	Purposive observations at 45 sites within 36 facilities conducted in winter 1991. N = 102 incidents of aggression.	Sydney, AUS	Aggressive behavior, violence	11 or 30.5% of the establishments accounted for 83% of physical incidents of aggression.
*Ramsey, 1986	Police records recording crime in public places in 1980, N = 557 incidents.	Central Southampton, UK	All crimes	15% of pubs and clubs accounted for 42% of incidents.
*Sherman et al., 1992	Homicide data, 1980 to 1989; city violation reports, 1960 to 1989; offense reports, 1986 to 1990; police dispatch records, July 1990 to January 1991.	Milwaukee, WI, US	Violent crime	15% of taverns produced over 50% of all tavern crime. 13% of taverns produced 55% of all violent tavern crime. 13% of taverns produced 52% of police dispatch calls.
Bus stop shelters				
*Newton, 2004	Recorded incidents of vandalism (N=15,628) to bus stop shelters (N=3,072) in Liverpool during 2000 to 2002.	Liverpool, UK	Vandalism	25% of bus shelters accounted for 70% of the vandalism.

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
Businesses (various)				
*Burrows et al., 1999	Survey of 2,500 business premises within Scotland.	Scotland	Violent and property crimes	10% of premises experienced 66% of all crimes. 5% of premises experienced 54% of all crimes.
*Fisher & Looye, 2000	Randomly selected survey of small businesses in six states, N=400. Conducted April of 1996.	US	All crimes	12.5% of the businesses experienced all crime incidents.
*Gill, 1998	Survey of 2,618 businesses (sample). Also reports on Small Business and Crime Initiative (SBCI) survey and Commercial Victimisation Survey (CVS).	UK	All crimes	2% of retailers suffered 25% of burglaries and 58% of thefts from vehicles (CVS). 17% of businesses suffered 83% of frauds (SBCI). 3% of businesses suffered 81% of violent attacks (SBCI). 12% of businesses accounted for 76% of burglaries and 92% of the thefts (sample). 5% of businesses experienced 68% of vehicle theft (sample).

(continued)

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
*Hopkins & Ingram, 2001	Scottish Business Crime (SBC) survey of 2,500 premises throughout Scotland regarding crime occurring in 1998.	Scotland	All crimes	10% of businesses accounted for 40% of break ins. 10% accounted for 53% incidents of vandalism. 10% accounted for 73% of thefts by non-employees.
Johnston et al., 1994	Survey of 585 tenants on 41 industrial estates performed between April and July of 1990.	UK	Violent and property crimes	A small proportion of industrial estates experienced an annual crime per unit rate reaching 4.9 – the mean crime rate was 0.8.
*Mirrlees-Black & Ross, 1995	National victimization survey of 3,000 commercial premises.	UK	Violent and property crimes	3% of retailers experienced 59% of all retail crime. 2% of manufacturers experienced 25% of all burglaries. 8% of manufacturers experienced almost 75% of all crimes.
*Perrone, 2000	Small Business Crime Survey (SBCS): National survey of small businesses for 1998-99 crimes, N= 4,315.	AUS	All crimes	1% of businesses accounted for 66% of all crime incidents.

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
*Taylor & Mayhew, 2002	Small Business Crime Survey (SBCS): National survey of small businesses for crimes occurring during the 1998-99 financial year. N= 4,000 businesses.	AUS	All crimes	1.7% of businesses accounted for 24% of burglaries. 1.6% of businesses accounted for 70% of all shoplifting incidents. 6.7% of businesses accounted for 70% of all vandalism.
*Townsley et al., 2000	Police records of 1,750 incidents over 18 months from June 1995 to November 1996.	AUS	Burglary	3% of businesses recorded 20% of burglaries.
*Walker, 1996	National survey of businesses, N=966.	AUS	All crimes	25% of businesses experienced all burglaries.
Construction sites				
*Clarke & Goldstein, 2002	Police records of reported thefts occurring in 1998 in one police district, N = 104. County records of building permits, N = 3,130.	US	Theft	3.3% of houses under construction experienced all of the reported thefts.

(continued)

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
Convenience stores				
*National Association of Convenience Stores, 1991	National survey of convenience stores.	US	Violent crime	6.5% of stores experienced 65% of the robberies.
Fast-food facilities				
*Spelman, 1995b	Police records of calls for service for 34 facilities. between 1990 and 1992. N = 1,801 calls.	San Antonio, TX, US	All crimes	10% of fast food facilities accounted for 32.7% of all crime incidents.
Gas stations				
*Chakraborti et al., 2002	Incident reports of crimes experienced by 4,360 stations. N = 91,969 incidents.	UK	All crimes	28.5% of the *companies* reporting experienced 57% of the incidents.†
*La Vigne, 1994	Police records of calls for service from 1988-90.	Austin, TX, US	All crimes	10% of gas stations experienced over 50% of calls for drive offs and drug crimes. 10% accounted for 26% of property crime calls. 10% of stations accounted for 36% of robberies.

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
*Taylor, 2002	National survey of small businesses (SBCS) for 1998-99 crimes; National Crime Statistics; and Recorded Crime Australia.	AUS	Robbery	5% of all gas stations and pharmacies experienced 72% of all reported robberies.
Healthcare facilities				
Bowers et al., 1998	Police records of reported crimes occurring between July 1994 and June 1995. Purposive sample drawn of those experiencing repeat victimizations, N=2,560.	Merseyside, UK	Burglary	17.4% of healthcare facilities experienced revictimization rates that were twice that of 69.6% of all healthcare properties that experienced revictimization.
Hotels				
Oakland Police Department, 2003	Police incident reports and calls for service for 6 area hotels, 1998-2000.	Oakland, CA, US	All crimes/calls for service	1 hotel had incident and arrest rates that were 9 times that of other area hotels.

(continued)

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
Parking lots				
*Laycock & Austin, 1992	Police records of car crimes in 1983, N = 1427 offences.	Basingstoke, UK	Theft from, of, and damage	5 parking lots accounted for 50% of the crime. Of the 5 parking lots, three accounted for 80% of that 50%.
*Smith et al., 2003	Police records of reported car crimes in 2001 for Nottingham city centre, N=415.	UK	Theft from, of, and damage	21% of parking lots accounted for 44% of crime. 10% of parking lots accounted for 35% of crime.
Webb et al., 1992	Police records of car crimes for three parking lots in three areas of London.	London, UK	Theft from, of, and damage	A few parking lots maintained crime rates that were up to 2.5 times greater than the average rate experienced across parking lots studied.†
Schools				
Bowers et al., 1998	Police records of reported crimes occurring from July 1994 to June 1995. Purposive sample drawn of those experiencing repeat victimizations, N=2,560.	Merseyside, UK	Burglary	15.6% of schools experienced revictimization rates that were 3 to 4 times that of over half of all educational properties that experienced revictimization.

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
*Burquest et al., 1992	Police records of 33 schools for 1990	Merseyside, UK	Burglary and criminal damage	18% of the schools (6) reported almost 50% of the crimes.†
*Hope, 1982	Official records of incidents. Random sample of 59 comprehensive schools.	London, UK	Burglary	Roughly 33% of the schools experienced 75% of the burglaries.
*Lindstrom, 1997	Police records of 62 randomly drawn and 43 total secondary schools (total N=96) for 1993/94 school year. 1,630 crimes reported.	Stockholm, Sweden	All crimes	10% of schools accounted for 37% of all property crimes. 17% of schools experienced 50% of all school crimes. 8% of schools suffered 50% of violent school crimes.
*Snyder & Sickmund, 1999	National survey of public elementary, middle and high school administrators.	US	Violent crimes	Only 13% of high schools and 12% of middle schools reported incidents of attacks or aggravated assaults. 8% and 5%, respectively, reported robbery and rape or sexual battery. Over all, 21% of high schools and 19% of middle schools reported an incident of serious violent crime to police.

(continued)

Appendix *(continued)*

(*Denotes studies that document a specific level of crime concentration – see text)

AUTHOR/YEAR	SAMPLE	LOCATION	CRIME TYPE	KEY FINDINGS
Sports facilities				
Bowers et al., 1998	Police records of reported crime occurring between July 1994 and June 1995. Purposive sample drawn of those experiencing repeat victimizations, N=2,560.	Merseyside, UK	Burglary	24.6% of sporting facilities experienced rates of revictimization that were 2 or more times that of 47% of all sporting facilities.
Telephone booths (kiosks)				
*Hirschfield & Bowers, 1998	Telephone calls made to police from 1992 to July 1997.	Merseyside, UK	Hoax calls	20% of the hoax calls came from 3% of the phone booths. 51% of the hoax calls came from 14% of the phone booths.
Young offender institutions				
Clarke & Martin, 1975	59 junior, intermediate, and senior training schools	UK	Absconding	A few training schools maintained absconding rates that were 5 to 6 times that of the other schools.
Laycock, 1977	Records from 22 Borstals from 1969 and 1974	UK	Absconding	Some borstals experienced 2 to 4 times the average absconding rate found across all borstals.

† Calculated by present authors.