WHAT WORKS: CRIME REDUCTION SYSTEMATIC REVIEW SERIES

No 1. GATING ALLEYS TO REDUCE CRIME: A META-ANALYSIS AND REALIST SYNTHESIS

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CONTENTS

BACKGROUND ........................................................................................................................................... 6
DESCRIPTION OF ALLEY GATING .............................................................................................................. 7
OBJECTIVES OF THIS REVIEW .................................................................................................................. 9
THEORETICAL RATIONALE FOR ALLEY GATING .................................................................................. 9
ON THE LOGIC, PROCESS AND ANTICIPATED OUTCOMES OF COMBINING
META-ANALYSIS WITH REALIST SYNTHESIS ...................................................................................... 11
DRAWING ON EMMIE AS PART OF A SYSTEMATIC REVIEW ................................................................. 14
METHODS .................................................................................................................................................. 14
  Criteria for considering studies for this review ..................................................................................... 14
  Search strategy for identifying studies and methodological approaches .............................................. 15
RESULTS ...................................................................................................................................................... 19
  Search results and screening .................................................................................................................. 19
  EFFECT: Meta-analysis of the impact of alley gating on burglary ....................................................... 21
MECHANISMS ........................................................................................................................................... 30
MODERATORS .......................................................................................................................................... 34
IMPLEMENTATION .................................................................................................................................... 37
  ECONOMICS: On the monetary costs and benefits of alley gating ...................................................... 39
DISCUSSION ............................................................................................................................................... 41
ACKNOWLEDGEMENTS ............................................................................................................................ 46
REFERENCES .............................................................................................................................................. 46
APPENDICES .............................................................................................................................................. 55
  Appendix 1. Search terms for electronic databases .............................................................................. 55
  Appendix 2: Search terms for other sources .......................................................................................... 56
  Appendix 3: Experts consulted as part of this review .......................................................................... 56
  Appendix 4: Narrative review of studies eligible for meta-analysis .................................................... 56
  Appendix 5: Meta-analytic formulae ..................................................................................................... 59
  Appendix 6: List of alley gating-related studies identified through our systematic searches (n = 43) .................................................. 60
LIST OF TABLES

Table 1: Contextual conditions favourable and unfavourable to alley gating producing reductions in crime
Table 2: Estimated cost of alley gates across six British studies
Table 3: Cost-benefit ratios of amount spent on alley gating and the associated costs of burglary reductions and/or increases
Table 4: Hypothesized context-mechanism-outcome configurations for alley gates
LIST OF FIGURES

**Figure 1:** Examples of alley gates implemented in the UK

**Figure 2:** Flowchart of the process to be followed in our systematic review of alley gating

**Figure 3:** Flowchart of study selection

**Figure 4:** Number of studies on alley gating by year of publication (n = 43)

**Figure 5:** Proportional reduction in burglary for studies with data pre- and post-intervention

**Figure 6:** Odds ratios for the 108 alley gated blocks evaluated in Bowers *et al.* (2004)

**Figure 7:** EMMIE plot of the findings for the six locations where alley gates were installed and where data were available

**Figure 8:** Funnel plot of standard error against log odds ratio for six studies used in meta-analysis

**Figure 9:** Funnel plot with two further imputed studies (white dots)
GATING ALLEYS TO REDUCE CRIME: A META-ANALYSIS AND REALIST SYNTHESIS

BACKGROUND

Alleys are a common feature of urban environments. The American cities of Chicago and Los Angeles contain extensive networks of alleyways spanning several thousand miles (Chicago Department of Transportation, 2007; Cassidy, Newell and Wolch, 2008). Many British towns and cities are similarly rich in alleys (Armitage and Smithson, 2007). Alleys serve various functions: as a means through which individuals and businesses can enter and exit homes; a route by which individuals can navigate the urban environment; a space through which vehicles can pass and where they can sometimes be parked; and a place to store refuse prior to its collection by relevant agencies. The common theme linking these different functions is that alleys form a means of access (Hage, 2008).

Despite their ubiquity, the history of alleys as a feature of urban design is one of division and disagreement (see Barnett-Woods, 2013). Ford (2001) writes that alleys were infrequent in the 18th century since most city streets were narrow. Growth of the use of public transport prompted a widening of many streets and an associated increase in the prevalence of alleys as a useful corridor to store refuse and connect properties to utility networks (such as gas and water). This continued through the industrialization of the early 20th century during which time alleys were co-opted by many businesses as a place to conveniently store, package and replenish stock, out of sight of prospective customers. Yet out of sight meant out of mind, or as Ford (2001, p. 275) reports: “Gradually, streets were polarized into a front-and-back dichotomy, with most of the attention focused on the front”. The condition of many alleys deteriorated, with notable commentators such as architect Frank Lloyd Wright declaring alleys to be “wasteful, unsightly anachronisms” (Martin, 2001, p. 76).

By the 1950s and 60s, urban designers were increasingly interested in the development of suburbs, a trend influenced in part by greater car ownership. Cul-de-sacs gained popularity and the prevalence of alleyways in new developments dwindled. The New Urbanism movement of the 1980s called for a reappraisal of the out-of-favour alley. New urbanists advocated a shift towards permeable urban environments characterized by high levels of public access and neighbourhoods comprising diverse populations and housing. Alleys were identified as possible facilitators of convivial urban environments where neighbours might gather and children play. This social function of urban alleys can also be seen in their most recent function, namely as people-friendly channels to locate various urban activities such as market stalls and food vendors (Barnett-Woods, 2013).

A longstanding criticism of urban alleyways is their association with crime, incivilities and undesirable behaviours, from drug dealing and prostitution to dog fouling and littering. This has given rise to various not-so-coveted labels such as “rat runs”, “corridors of crime” or as Hinshaw (2010) writes, “havens of antisocial and criminal behavior”. Seymour et al. (2010, p. 380) put alleys in the same category as “freeway shoulders, train yards, abandoned waterfronts, and parking lots” which tend to be “underutilized, underdeveloped, and often deteriorating spaces”. The negative perceptions associated with alleyways even extend to property prices. Guttery (2002)
shows that properties in Dallas (USA) that are otherwise identical save for being located on alleyways sell for approximately 5% less, which he attributes, in part, to greater levels of crime and disorder associated with the alleys.

Alleys can influence crime in several ways. They can be the places where crime occurs, boosted by a general lack of guardianship. This can occur through several mechanisms. They can function to attract offenders because of the perceived high likelihood of available crime opportunities (such as drug markets and prostitutes). They can act to generate crimes such as robbery and assaults by providing a convergence setting for motivated offenders and potential targets in the absence of capable guardians (Cohen and Felson, 1979). Alleys can also facilitate crime through providing inconspicuous access to alley-adjacent properties and a means by which to escape and evade detection. Finally, where uncertainty exists over the management and ownership of alleys, they can provide tempting and convenient sites to illegally discard waste, conduct arson or paint graffiti.

There have been diverse attempts to reduce the undesirable behaviours associated with urban alleys. Drawing on evidence from seven US cities, Newell and colleagues (2013) review several ‘alley greening’ schemes whereby unkempt and rarely used alleyways have been redesigned in an effort to, amongst other things, promote physical activity and provide a welcoming environment to facilitate neighbourly interactions. Focusing specifically on crime prevention, Kaplan, Palkovitz and Pesce (1978) describe dedicated police patrols of problem alleyways. Similarly Clarke (2004) discusses examples of high crime streets and alleys being temporarily or permanently closed.

**DESCRIPTION OF ALLEY GATING**

The focus of this review is on a situational crime prevention (SCP) technique known as “alley gating”. This refers to the use of lockable gates, usually made of steel or iron, which are designed to restrict entry to an alley or network of alleys thereby controlling access to potential crime targets. There is much diversity in the design of alley gates, reflecting the different uses and users of urban alleyways. Alley gates can be largely opaque or transparent, self-closing or manually-operated, single-leaf or double-leaf, plain or ornate and so on. Figure 1 shows examples of alley gates implemented in the UK. Residents whose properties abut the gated alley typically receive a key or passcode to operate the gates. The intention is to restrict alley access only to those legitimate users in possession of a key or passcode.

Alley gates are generally conceived as burglary reduction measures: restricting access to alleys restricts access to the backs of alley-adjacent properties. However, the acquisitive crime opportunities offered by access to the rear of properties include not only burglary but also theft of plants and tools from gardens. In limiting access to poorly surveilled areas, alley gates could also be assumed to reduce opportunities for other crime-related activities such as flytipping, prostitution, dog fouling and drug dealing. Additional objectives include a reduction in feelings of insecurity and improvements in community cohesion. As Rogers (2013, p. 106) writes, “Alley-gates have been packaged as a panacea for the evils of domestic as well as non-domestic burglaries, a raft of anti-social behavioural issues and an important device in regaining control of rarely used spaces along with the regeneration of urban communities”.
It is important to note at the outset of this review that alley gates are related to, but distinct from, ‘gated communities’. The latter generally refer to residential enclaves with restricted public access. Landman (2003) identifies two types of gated communities. The first are neighbourhoods that were once freely accessible to the
public but which have subsequently been closed off through the use of gates or fences. The second are residential developments that were purposely designed to limit public access. There is an extensive literature on gated communities (see Addington and Rennison, 2013; Atkinson and Blandy, 2013), some of which is also relevant to alley gates and will be discussed later (for a comparison of gated alleys and gated communities see Landman, 2003). Briefly, advocates of gated communities view them as promoting safe and secure private spaces. This view is supported by data from the US which indicate that households located in gated areas experience lower rates of burglary than comparable households in non-gated communities (Addington and Rennison, 2013). Critics, however, consider gated communities to be highly exclusionary with the potential to dilute community diversity and prompt an unhealthy withdrawal from community participation (Addington and Rennison, 2013). In South Africa, where the debate on gated communities is particularly emotive, they are accused of running counter to efforts to promote integration and dangerously reminiscent of the unsavoury historical practices of forced segregation (Kruger and Landman, 2008). Goodyear (2013) goes further by suggesting that in certain circumstances gated communities might reduce public safety by generating an atmosphere of suspicion toward ‘outsiders’.

OBJECTIVES OF THIS REVIEW

Alley gates are a widespread burglary reduction measure in the UK, having received support from government funding, changes in legislation facilitating agreement to their installation and guidance from the Association of Chief Police Officers (ACPO). Various articles are available on the challenges associated with implementing alley gates (Armitage, 2006; Beckford and Cogan, 2000; Johnson and Loxley, 2001) as well as their impact on crime (for e.g. see Adamson, 2005; Armitage, 2006; Bowers, Johnson and Hirschfield, 2004; Hayward, Kautt and Whitaker, 2009) and on community perceptions (Rogers, 2013; Staunton, 2006; Armitage and Smithson, 2007). Presently, however, there has been no attempt to systematically review the evidence on whether alley gates are an effective crime reduction method1. This is the first objective of this review. Our second objective, inspired by EMMIE (Johnson, Tilley and Bowers, 2015) and realist synthesis (Pawson, 2006), is to identify the causal mechanisms through which alley gates are expected to reduce crime and the conditions under which alley gates have been found to be effective, ineffective and/or to produce unintended negative effects. Systematic reviews that combine realism with traditional meta-analytical methods are rare in criminology and so it is our hope that the approach described here might usefully contribute to the systematic review literature. Our third objective is to review information on the costs and implementation of alley gates.

THEORETICAL RATIONALE FOR ALLEY GATING

Alley gates are generally considered a form of access control. Access control is a common form of crime prevention because access to vulnerable targets (broadly defined) is a causal factor in crime. Although this statement appears somewhat trite, the relationship between access and crime can be considered at different levels of

1 Armitage (2006) provides a comprehensive review of the alley gating literature but makes no claims to be systematic in her search strategy nor does she quantitatively summarise the available evidence to produce a mean effect size.
abstraction, each pertaining to a different (albeit related) theoretical perspective. Two levels are relevant here. The first concerns crime at the area level and how variations in neighbourhood accessibility (sometimes referred to as permeability) are associated with differences in crime risk. The second level is concerned with specific targets at risk of crime, and whether variations in target accessibility are associated with differences in crimes involving them. Below we discuss each in turn.

Some of the earliest discussions on area-level accessibility in the context of crime can be found in the writings of Jane Jacobs, C. Ray Jeffrey and Oscar Newman. In her seminal publication, *The Death and Life of the Great American Cities* (1962), Jacobs, an urban planner, called for the design of more permeable urban environments to better facilitate public access and opportunities for surveillance. This was grounded in the assumption that increasing the concentration of people passing through urban environments – so-called “eyes on the street” – can act as a mechanism to reduce crime by increasing the (perceived) risk of being detected thereby deterring prospective offenders through what Jacobs calls “natural policing”. For Jacobs, increasing public access improves the control of those who might otherwise commit crime.

A decade later, Newman (1972) considered how different building designs and their configuration can reduce ambiguity as to who should be found at particular places, and who should be responsible for them. Unlike Jacobs, Newman saw strangers as a source of danger not security. He advocated limiting access to places to residents (or other capable guardians) who should take ownership of them. He argued that urban design that encourages a sense of ownership (or ‘territoriality’) creates ‘defensible spaces’, whereby heightened vigilance and responsibility on the part of residents, real or perceived, can thwart prospective offenders.

Although Jacobs and Newman hold divergent views on how urban environments affect crime, both share the notion that access is causally related to crime. This can also be seen in the enduring debate on the relationship between crime and the permeability of street networks. Several studies using space syntax – an urban modelling approach used to assess pedestrian movement – suggest that burglary tends to concentrate on street segments that are less accessible, most notably cul-de-sacs (Hillier, 2004; Hillier and Shu, 2000). Consistent with Jacobs, this is attributed to a lack of ‘natural policing’ as a consequence of design-induced poor sightlines and limited pedestrian through-put. This runs counter to the findings of other studies (e.g. Beavon, Brantingham and Brantingham, 1994; Johnson and Bowers, 2010; Davies and Johnson, 2014) who, using a range of methodologies, conclude that the permeability of the street network increases burglary risk, thus suggesting that cul-de-sacs exhibit lower risks of burglary. Several access-related causal mechanisms might account for this finding. First, greater permeability affords easier access and escape routes for prospective offenders. Second, increased footfall on a given street as a function of greater permeability means that it becomes part of the ‘awareness space’ of more people, some of whom are liable to offend as they come to appreciate available crime opportunities (Brantingham and

2 Other theoretical approaches take a different view: ‘broken windows’ (Wilson and Kelling, 1982), for example, has it that failure to control antisocial behavior leads to signs of incivility that in turn create the impression that further criminal behavior is normal and permissible; and social disorganisation theory (Sampson, Raudenbush and Earls, 1997) has it that areas with low levels of social cohesion, social capital or collective efficacy are liable to lack formal and informal social control which gives rise to high levels of crime and disorder.
Brantingham, 2008). It follows that increasing the supply of people passing through an area may increase the likelihood that motivated offenders will encounter suitable targets in the absence of capable guardians, as outlined in the routine activity approach (Cohen and Felson, 1979). Third, and consistent with the logic of Newman, increased through-movement may be associated with increased anonymity which effectively cloaks crime and reduces surveillance opportunities (Poyner and Webb, 1991).

Neighbourhoods thus differ in the degree of accessibility that they afford. Likewise within a given area there is likely to be variation in the accessibility of potential crime targets. Restricting access to crime targets is widely recognized as a possible means of reducing crime through situational intervention. Indeed access control comprises one of five ways of increasing the effort required to commit crime (Cornish and Clarke, 2003). In his review of 206 published evaluations of SCP measures between 1970 and 2007, Guerette (2009) defined 18% of evaluated interventions designed to increase offender effort as ‘controlling access’, second only to ‘target hardening’ (24%). This is not to say that increasing the perceived or actual effort of prospective offenders is the only mechanism through which controlling access might reduce crime. As mentioned earlier, access control can afford greater opportunities for surveillance thereby increasing the probability that an offender is identified (à la Jane Jacobs). It can reduce provocations by separating groups of individuals liable to clash if in close proximity to one another (think of opposing football fans or patrons in a busy bar). Access controls can also conceivably remove excuses for entering private spaces through signs indicating who is and is not eligible to enter.

Nor is access control limited to crime preventers. The same principles underpinning access control as a method of crime reduction can likewise be exploited by offenders in the service of crime commission. Eck (1994) describes how drug dealers often prefer apartment buildings whose design and configuration afford greater access control. Atlas (1990) uses the term offensible space to describe criminals’ artful use of deadbolts, peepholes, security bars, spotters, lookouts and booby-traps to avoid a) predation by fellow offenders, b) contact with those who might inform on them or c) easy police access.

ON THE LOGIC, PROCESS AND ANTICIPATED OUTCOMES OF COMBINING META-ANALYSIS WITH REALIST SYNTHESIS

This review was conducted in support of the What Works Centre for Crime Reduction, hosted by the UK College of Policing. One aim of the UK College of Policing is to promote and facilitate evidence-based policing, defined as “a method of making decisions about “what works” in policing: which practices and strategies accomplish police missions most cost-effectively” (Sherman, 2013, p.377). Systematic reviews of the research literature lie at the heart of the “what works” movement. They are generally considered to be one of the more trustworthy sources of evidence and occupy the top position of many ‘hierarchies of evidence’ (see Elamin and Montori, 2012). This is usually in the form of meta-analyses whereby evidence from eligible studies is synthesized to compute an overall effect size and determine whether the “what” was reliably found to “work”.

Increased emphasis over the past decade on the importance of rooting police decisions in robust research evidence has duly prompted an encouraging increase in the number
of police-relevant systematic reviews (see Bowers, Tompson and Johnson, 2014; Telep and Weisburd, 2014), most notably through the Campbell Collaboration. Yet making good on the promise of evidence-based policing requires more than the production of research evidence; it also requires, amongst other things, an appetite among decision-makers to apply research evidence and efforts on the part of researchers to ensure that synthesized evidence is accessible and practically meaningful (a process sometimes referred to as ‘knowledge translation’). This is a complex and challenging task, not least because crime and methods to reduce it are known to be highly context sensitive: what worked in one context may be ineffective elsewhere (Tilley, 2006).

Knowledge of “what works” (or has been found to work) is likely to be insufficient to achieve the sort of evidence-informed decision-making envisaged by proponents of evidence-based policing. It is our contention that there is much to be gained by combining, where possible, reliable evidence on the statistical association between intervention and outcome – the principal outcome of a meta-analysis – with (tested) working theories on the causal processes presumed to link intervention to outcome. For this we turn to realist synthesis (Pawson, 2006), an alternative type of systematic review derived from the principles and methods of realist evaluation (Pawson and Tilley, 1997). This approach places greater emphasis on the causal mechanisms responsible for outcome patterns and the contextual conditions under which those mechanisms operate (or do not do so). The primary objective of a realist synthesis is to ask what the available evidence can tell us about how, in what form(s), for what crime types and under what conditions the intervention of interest (here alley gating) has been found to be effective, ineffective and to produce unintended negative effects.

Realist methods are increasingly advocated and used in improving health-related evaluation and reviews and we are taking our lead from developments there (see, for example, Berwick 2008; Davidoff 2009; Wong et al. 2011; Best et al. 2012; Kastner et al. 2015). In criminology, however, this is relatively new territory, with few examples of systematic reviews that combine meta-analysis and realist synthesis (an exception is van der Knaap, Leeuw, Bogaerts and Nijssen, 2008). To be clear, this is not to say that meta-analyses in criminology are dismissive of the sorts of questions that characterise realist evaluation (what works for whom, how, and in what circumstances?). In many cases there is insufficient data available in primary studies to examine these questions empirically. A novel feature of this review is our proposed method for integrating meta-analysis and realist synthesis (Figure 2), trailed in the context of appraising the evidence on the effectiveness of alley gating as a crime reduction measure.

Figure 2 shows how we combined these two approaches in the course of this review, which we will elaborate on in the sections that follow. Briefly, relevant electronic databases were searched using pre-determined search terms. Identified studies were then screened through reading the title and abstract to remove those that were unsuitable based on our inclusion criteria. Crucially, as we explain below, the inclusion criteria for realist synthesis differ from those of meta-analysis. Those studies that met the respective inclusion criteria were then coded and relevant information extracted and synthesized. In the meta-analytical branch of a review, this information was used to determine the overall effect size of the retained studies (as well as related outcome measures such as displacement). For the realist branch of the review, the same studies (plus additional ones) were analysed to elicit working theories as to how alley gates
might reduce crime in the different contexts in which they have been applied, and to provide pertinent information about how to facilitate implementation.

**Figure 2:** Flowchart of the process to be followed in our systematic review of alley gating

These dual – meta-analytic and realist – processes were intended to be symbiotic. Where included studies had sufficient data, emerging findings from one branch of evidence synthesis could inform and be informed by those from the other. As indicated in Figure 2, we anticipated this cross-over might be particularly fruitful for testing explanations for observed heterogeneity in effect sizes across studies (i.e. moderator analysis).

In sum, Figure 2 sets out our proposed method for combining two approaches to evidence synthesis that have rarely been combined in criminology, but which we argue might generate different, but complementary, outcomes of relevance to researchers, practitioners and policymakers. While it is presented here in the context of a review on alley gating, we hope that the process might be applied more generally in reviews of other crime reduction measures. In practice, as will become clear below, although the realist branch identified several potential sources of variation in expected outcome pattern by sub-group, the data for the meta-analysis did not permit moderator analysis to test those hypotheses. To do so would require future evaluations of alley gating to collect supplementary data – a point we return to in the Discussion.
DRAWING ON EMMIE AS PART OF A SYSTEMATIC REVIEW

We have previously argued that evidence-based policing requires more than the production of reliable research evidence. Equally important is devising ways through which policy-makers and practitioners can access, interpret and apply such evidence. Several initiatives and organisations have been established in the US to assist in this process of evidence translation, such as the Institute of Public Policy in Washington State and Crimesolutions.org (in association with the National Institute of Justice). In a similar vein, EMMIE (Johnson, Tilley and Bowers, 2015) has been devised as an acronym to encapsulate the types of evidence studies might provide which could inform improved decision-making. The initial E of EMMIE refers to the size of the ‘effect’ of a given policy, programme, practice or intervention. The initial M refers to ‘mechanism’ – what it is about a policy, programme, practice or intervention that brings about its effect. This is important in determining whether what has been done needs to happen if a given outcome is to be reproduced (or avoided). The second M refers to ‘moderator’ (or what realists refer to as ‘context’). This describes the conditions that need to be in place if the policy, programme, practice or intervention is to activate the mechanisms necessary to produce given effects. This is clearly crucial if improved decisions are to be made about what to put in place in the particular circumstances facing a policy-maker or practitioner. The I refers to ‘implementation’. Programmes, policies, practices and interventions often face substantial implementation problems and can flounder from implementation failures (Laycock and Tilley, 1995). Decision-makers need to know whether and how a policy, practice, programme or intervention can be put in place. Finally, the second E refers to ‘Economics’ – what the intervention will cost in relation to outputs, outcomes or benefits. There are always limited resources that can be put to alternative uses and decision makers need to determine how best to disburse those available to them.

EMMIE was initially proposed as a rating scale to assess the quality of evidence generated by systematic reviews. In this respect, it is conceptually similar to several other tools originating in the health sciences which are intended to help assess and grade the methodological quality of systematic reviews, such as AMSTAR (Shea et al. 2007), GRADE (Guyatt et al. 2008) and PRISMA (Moher et al. 2009). The key distinction between EMMIE and existing scales is that the latter primarily focus on internal validity as it relates to intervention effects. EMMIE, by contrast, gives consideration to a broader range of issues which previous research in criminology suggests are most salient to crime prevention practitioners and policymakers, in addition to intervention effectiveness (Johnson, Tilley and Bowers, 2015). Yet EMMIE was also developed to inform the conduct of new reviews, and here we use it prospectively to signpost the sorts of information we might usefully collect and as a framework for organising our findings. To our knowledge this is the first systematic review to apply EMMIE in this way.

METHODS

Criteria for considering studies for this review

We used the following criteria in selecting studies for this review:
a) **The study must have reported an explicit goal of reducing crime through the use of 'alley gates'.** We included studies on alley gates implemented by any stakeholder: law enforcement, government agencies, private entities, citizens, etc. We also included studies that reported on the effects of alley gates implemented in isolation or as part of a wider package of crime reduction interventions.

To be included in our meta-analysis, a study had to satisfy point a) above and:

b) **to report at least one quantitative crime outcome measure.** Outcome data could comprise official measures (police recorded crime data, calls for service) or unofficial measures (self-reported levels of offending and/or victimization). Studies that only reported non-crime-related outcome measures (such as changes in pedestrian and/or traffic flow) were not included.

c) **to report original research findings.** Systematic reviews were not included. The quantitative findings for any single study were incorporated only once, even if reported in multiple publications. Where this was the case, the study reporting the most detailed information was included or, where necessary, any dependency in the data was dealt with appropriately.

d) **to employ a research design that allowed for the computation of a reliable effect size (i.e. an experimental or quasi-experimental evaluation design with control group or a suitable single study interrupted time series design).**

The shortage of experimental and quasi-experimental studies in criminology is well recognised, particularly for evaluations of place-based situational interventions (Eck, 2006; Guerette, 2009). This can result in only a small number of studies being eligible for meta-analysis. Because of this, while following the above criteria we also considered studies that measured the impact of alley gating using simple before and after designs and no control area. Where such studies are used in the quantitative analysis that follows, this is clearly indicated, as are the familiar concerns regarding the internal validity of before and after study designs.

Items b, c and d did not form part of the inclusion criteria for the realist synthesis. To be included in our realist synthesis of alley gating, studies had to satisfy point a) above - report an explicit goal of reducing crime through the use of alley gates - and at least one of the items below:

e) Report substantive information relating to crime-related causal mechanisms activated by alley gates

f) Report substantive information relating to the conditions needed for alley gates to activate crime-related causal mechanisms

g) Report substantive theoretical content concerning alley gates and crime-related outcomes

h) Report substantive information about the implementation of alley gates.

**Search strategy for identifying studies and methodological approaches**
We used four search tactics to identify relevant studies: 1) A keyword search (see Appendix 1 and 2) of relevant electronic databases including grey literature and dissertation databases (see ‘electronic databases’ below); 2) A hand search of relevant journals; 3) A keyword search of publications by relevant government, research and professional agencies (see ‘other sources’ below); and 4) forward and backward citation searches of all studies that met our meta-analysis inclusion criteria. No date restrictions were applied. Studies did, however, have to be available in the English language. Available resources limited our ability to search and translate non-English studies. Our list of studies was then checked by recognised experts on alley gating (see Appendix 3).

It is important to state that this review was conducted as part of a wider exercise to review the evidence on the effectiveness of access control as a method of reducing crime in the physical environment. The keywords used when initially searching the electronic databases were therefore broader than (although included references to) alley gating (see Appendix 1). Records from each database search for access control were then uploaded into EPPI Reviewer 4 software (a programme commonly used to store and analyse systematic review information) and, after removing duplicates, the search term “alley*gat*” was used to return records within the EPPI database that related specifically to alley gating. Our searches of ‘other sources’ used search terms relating specifically to alley gating (see Appendix 2).

Electronic databases

We searched the following electronic databases:

1) ASSIA (Applied Social Sciences Index and Abstracts)  
2) Criminal Justice Abstracts  
3) Criminal Justice Periodicals  
4) ERIC (Education Resources Information Center)  
5) IBSS (International Bibliography of Social Sciences)  
6) NCJRS (National Criminal Justice Reference Service)  
7) Proquest theses and dissertations  
8) PsycINFO  
9) PsycEXTRA  
10) SCOPUS  
11) Social Policy and Practice  
12) Sociological Abstracts  
13) Web of Science  
14) CINCH (Australian Criminology Database)

Other sources

In collaboration with Phyllis Schultze, an information specialist and librarian at Rutgers University (US), we searched the publications of the following government, research and professional agencies:

3 These were Police Practice and Research: An International Journal and Policing: a Journal of Policy and Practice which, unlike most criminology journals, do not routinely feature in electronic databases and were therefore searched manually.
1) Center for Problem-Oriented Policing (Tilley Award and Goldstein Award entries)
2) Institute for Law and Justice
3) Vera Institute for Justice (policing publications)
4) Rand Corporation (public safety publications)
5) Police Foundation
6) Police Executive Research Forum
7) The Campbell Collaboration reviews and protocols
8) Urban Institute
9) European Crime Prevention Network
10) Swedish National Council for Crime Prevention
11) UK Home Office
12) UK College of Policing (Polka)
13) Australian Institute of Criminology
14) Swedish Police Service
15) Norwegian Ministry of Justice
16) Canadian Police College
17) Finnish Police (Polsi)
18) Danish National Police (Politi)
19) The Netherlands Police (Politie)
20) New Zealand Police
21) US National Institute of Justice

We also searched:

1) Google
2) Google Scholar
3) Academic Search Premier (EBSC)
4) ProQuest Sociology
5) Rutgers Criminal Justice Gray Literature Database
6) OSCE Polis Digital Library

Data extraction

For those studies eligible for meta-analysis, two study authors independently extracted the following information where possible:

1) Study identifiers (title, author(s), year, publication status)
2) Location (Country, Region, State, City)
3) Context in which alley gates were implemented (such as high crime/low crime)
4) Whether alley gates were implemented in isolation or as a package of crime reduction measures
5) Number of alley gates installed
6) Unit of analysis
7) Research design (randomized experiment, quasi-experiment, etc.)
8) Pre and post outcome measure statistics (treatment and control sites)
9) Statistical test(s) employed
10) Effect size
11) Information on forms of displacement and/or diffusion of crime control effects following alley gating
12) Information on implementing alley gates
13) Information on the costs associated with alley gating

**Quantitative data analysis**

For the quantitative analysis in this review, standard approaches were used to assess change in crime outcomes across the studies that met our inclusion criteria. These included calculation of proportional change (for studies using a before and after design) and meta-analysis to produce a weighted mean effect size from individual effect sizes expressed as odds ratios (see Lipsey and Wilson, 2001). Use of odds ratios and relative risk ratios are common in systematic reviews of place-based crime prevention interventions (e.g. Welsh and Farrington, 2008). There is, however, some controversy surrounding some aspects of this method, such as whether the computed statistic is in fact a risk ratio rather than an odds ratio, and whether it sufficiently deals with over-dispersion in the data (see Marchant, 2004; 2005). We describe these methods and our solutions to such issues in more detail below. In brief, we discuss the expression of treatment and control data in a common form across studies, the calculation of individual effect sizes, the random effect models we use for meta-analysis, how we dealt with dependency in the data and how we dealt with possible bias in study selection.

Another common form of analysis related to the outcomes of SCP concerns any spatial displacement of criminal activity to areas not receiving intervention or a diffusion of treatment effects beyond the areas where interventions were put in place (see Hesseling, 1994; Clarke and Weisburd, 1994). Displacement or diffusions of crime control benefits are increasingly measured at the primary evaluation level and recently have been addressed via systematic reviews (see Bowers et al 2011; Telep et al. 2014; Braga et al. 2012; Johnson et al., 2012). In this review we examine the possibility of spatial displacement and diffusion of benefits systematically for the alley gating interventions where data are available for a potential displacement zone.

**Realist synthesis**

As alluded to previously, the main objective of a realist synthesis is less the unbiased estimation of net effect sizes, but rather an understanding of the conditions in which different outcome patterns are expected. To this aim, proponents of realist synthesis (see Pawson 2006) argue that a wide range of evidence types can legitimately be drawn on: the issue is that of eliciting and refining working theories and assembling the strongest available evidence to test them.

The above four search tactics produced our initial population of studies. To reiterate, the realist element of our review was not confined to papers that met the methodological criteria used in the meta-analysis, although it obviously included them. Realist synthesis involved three members of the research team reading, rereading and regularly discussing the full text of all identified research articles deemed relevant to alley gating. For each article, the research team discussed whether information was reported on the installation, use and effects of alley gating. This information was then used to help develop and refine working theories for alley gating as a crime reduction method. From this, ad hoc iterative searches were also made for evidence that would add to the material that had been assembled through the systematic search processes.
RESULTS

This section reports the results of our systematic review. It begins by describing the number of studies identified by our search strategy and how many were considered eligible for meta-analysis and realist synthesis. What follows is then organised around the EMMIE framework. First, we present the findings of a meta-analysis on the effectiveness of alley gating as a crime reduction method. This includes an analysis of all pre-post data, data from quasi-experimental studies and possible displacement effects. Second, and drawing on our realist review, we discuss the mechanisms through which alley gates are expected to work and their associated outcome patterns. This is followed by a section on the moderating factors that might influence the activation of said mechanisms. Fourth is a review of what the literature says about the implementation and maintenance of alley gates. The final component of our results section is an economic evaluation of alley gates drawing on those studies eligible for meta-analysis.

Search results and screening

Our various search tactics identified over 10,000 potentially eligible records (once duplicates were removed). Following the additional searches relating specifically to alley gating, the title and abstract of identified studies were screened independently by two review authors to determine eligibility. Our approach at this stage erred on the side of inclusivity with studies being retained if the title and abstract made any reference to alley gating. The full text of eighty nine potentially eligible studies were then sought and examined independently by the same two review authors using the inclusion criteria described previously. Disagreements were resolved by discussion and, where necessary, through the involvement of a third review author. The number of reports excluded at each stage and the reasons why is shown in Figure 3. In sum, forty three studies were judged relevant to alley gating, all of which were analysed as part of our realist synthesis (Appendix 6). Of these 43 articles, six were deemed eligible for meta-analysis based on the aforementioned inclusion criteria. As displayed in Figure 3, the primary reason for this attrition was inadequate research designs with which to compute an effect size.
A narrative review of the six studies eligible for meta-analysis is provided in Appendix 4. It is located there, as opposed to the main text of this review, because many of the descriptive and contextual factors typically identified as part of a narrative review are
discussed in the course of our realist synthesis. Including our narrative here as a prelude to the meta-analysis would lead to some unnecessary duplication.

Before presenting the results of our review, structured around EMMIE, it is worth mentioning that the time period during which the 43 records on alley gating were published is rather narrow, as is demonstrated by Figure 4. It shows that the majority of studies were published in the early 2000s. As will become clear, this likely reflects the considerable government investment in Britain during this period in burglary reduction.

![Figure 4 Number of studies on alley gating by year of publication (n = 43)](image)

**EFFECT: Meta-analysis of the impact of alley gating on burglary**

**Pre-Post Studies (proportional change)**

Evaluation designs that include data for a control area (or areas) are preferred to those that do not, since the changes in the control area can be used to estimate the expected changes in the treatment area in the absence of intervention – which reduces threats to internal validity. However, because few studies identified through our searches reported data for control areas (n = 6), as with cognate systematic reviews (e.g. Weisburd et al. 2008) we analysed the more complete pre-post data before focusing solely on the data from quasi-experimental studies.

Data were available for simple counts of burglary for comparable periods of time before and after intervention for 10 geographic locations, reported across 9 studies (Green, 2005) reports data for two different towns and, given the physical separation of these places, we treat these as independent observations). In the case of one study – Bowers et al. (2004) – before and after data were available, but not for comparable intervals of time – the periods before and after intervention varied. However, because the length of
these periods was recorded, rather than exclude the data reported in this study from the analysis that follows, we computed a standardized estimate of the counts before and after intervention and analysed these data by scaling them to a common time period (1 year before and 1 year after intervention).

To look at changes in crime levels across the 10 locations, we computed proportional change scores for each location for which data were available. These values, shown in Figure 5, range from zero (no change) to 1 (100% reduction). In addition, we computed confidence intervals for each estimate, and an overall measure of effect size (also shown in Figure 5). Confidence intervals were computed using the method described in Lipsey and Wilson (2001), which is summarized in Appendix 5, as is the formula used to compute the overall weighted measure of effect.

Consistent with the hypothesis that alley gating is associated with reductions in burglary, relative to the period before intervention, the count of burglary was lower in all treatment areas post-intervention. The overall weighted mean effect size suggests that this reduction was typically about 43% (fewer burglaries), while the 95% confidence intervals suggest that the effect was reliable and that the true effect ranged between 39-48%.

**Figure 5** Proportional change in burglary following the installation of alley gates for nine studies (ten locations) with data pre- and post-intervention
Quasi-experimental studies

Six studies reported data for the count of burglary pre- and post-intervention in both treatment and control areas, thereby permitting a more reliable meta-analysis for this sub-group of studies. Before summarising across these six studies, however, we first present analyses of data collected for the Bowers et al. (2004) study in which the data structure was more complicated, but which enabled an estimation of the effect of alley gating for a smaller unit of analysis than was possible with the other studies, namely a gated street block rather than an entire area.

*Bowers et al (2004)*

Bowers et al. (2004) report changes in burglary levels observed in the gated blocks of housing compared with those in the wider police force area, minus the treatment areas and a surrounding buffer zone into which crime might have been displaced or crime control benefits diffused. Each block contained approximately 362 residential properties although this varied considerably between blocks (range = 6 – 3,190 properties). In the Bowers et al. (2004) study, implementation took place over a period of three years and so there was no simple before and after period. For this reason, here we examined the changes observed in each of the 108 housing blocks for the relevant pre- and post-intervention periods and compared these to the changes in the control area for the same intervals of time.

To do this, we computed odds ratios for each of the 108 housing blocks for which data were available. The odds ratio is a point estimate of effect size and is subject to (amongst other things) sampling error. Consequently, confidence intervals are also calculated to provide an indication of the error associated with the estimator, and the range of values within which the actual value (if it were possible to observe this) is likely to be found. The approach adopted to estimate the odds ratio and their associated confidence intervals is the same as that adopted in previous meta-analyses of place-based crime prevention interventions (e.g. Welsh and Farrington, 2008; Johnson et al., 2012). The formulae are shown in Appendix 5.

It is important to note that debate exists as to the accuracy of this statistical method (see Marchant, 2004, 2005). One concern is the extent to which the parametric assumptions on which the approach is based are reasonable (see Farrington et al., 2007). For instance, one assumption is that the data generating process is a Poisson process. This may be a reasonable assumption for studies where the unit of analysis is a person, but is probably unreasonable for studies in which the unit of analysis is a place (Marchant, 2005; Farrington et al., 2007; Johnson, 2009). The consequence of this is that the standard error derived using the standard equation is likely to underestimate the actual variance, meaning that the estimated confidence intervals will be too small. For this reason, we adopted the approach used elsewhere (Farrington et al., 2007; Weisburd et al., 2008) of multiplying the standard error by an inflation factor (IF, in this case two) when calculating confidence intervals. Doing so leads to larger confidence intervals and a more conservative test. However, it is still possible that the true effect size will not be captured by the intervals derived. In the absence of a better method, we used this approach but urge the reader to see the statistics for what they are – estimates – and to focus more on the general trends observed, their magnitude, and the overall
conclusions that these might sensibly lead to rather than fixating on the more absolute issue of statistical significance.

It is also worth noting that the measure of effect size used here is not an odds-ratio in the traditional sense. To elaborate, in a study for which the unit of analysis is people, the odds ratio represents the difference in the odds that those treated will experience a given outcome, relative to the odds for those assigned to a control condition. The analogy here would be that given that we know that $N$ crimes occurred in a treatment area in the evaluation periods pre- and post-intervention (and $M$ crimes in a control area), what are the odds that any of the $N$ crimes occurred before intervention in the treatment area(s) relative to the odds that any of the $M$ crimes occurred in the control area(s) prior to intervention? Thus, in the current case, the units of analysis are crimes not people. Given this departure from the traditional definition and approach, Farrington et al. (2007) have recently referred to the test statistic as a measure of relative effect size when evaluating place-based interventions rather than an odds ratio. As the distinction may be seen as largely semantic, we use the term odds ratio here but acknowledge the issue. Moreover, whilst acknowledging the limitations of this approach we adopt it here as it was the most logical way of consistently summarizing the available data.

The structure of the data used in Bowers et al. (2004) enabled pre- and post-implementation counts for the control area (the remainder of the police force area minus the gated areas and a surrounding buffer zone) to be determined separately for each of the 108 gated blocks. Figure 6 shows odds ratios (ORs) and confidence intervals for these 108 gated blocks. The black dots represent the point estimates, whilst the horizontal lines show the 95% confidence intervals within which the actual value of the OR is most likely to fall. Where a confidence interval intersects the vertical reference line of 1, the estimate is not statistically significant. Where estimates are non-significant this may be because there is no effect or because the counts of crime are so low that the test lacks statistical power. It is apparent that the ORs are overwhelmingly positive (82 of 108 estimates were above one; 24 were statistically significant), suggesting that, relative to the wider police force area, the rate of burglary (per unit time) typically declined faster in the gated areas.

To summarise the overall pattern observed, we computed a weighted mean effect size (see the black triangle in Figure 6 and refer to Appendix 5 for formula). The weighted mean effect size suggests that relative to the comparison area, burglary reduced across the areas in which alley gating was implemented. One issue with this estimate is that the observations from which it is calculated are not independent as the comparison area in all cases is the wider police force area within which the intervention was implemented. As such, the assumption of independence associated with this test is violated. Thus, the reader should not take too much notice of the weighted mean effect size. It is presented because it achieves what many readers will attempt to do by eye – estimate the overall trend in the data (after accounting for the reliability of each estimate).
The above analysis allowed us to estimate how consistent the effects of alley gates were across many housing blocks in one area of Britain. This is instructive as no other studies have evaluated the impact of alley gating on such a large scale. In what follows, we examine the trends observed across the six studies for which data were available for both treatment and control areas before and after alley gates were installed. Given that the patterns observed in the Bowers et al. (2004) study were relatively consistent across gated blocks of housing, we compute a single effect size for this study by aggregating the data across gated locations in the ensuing analysis.

In most of the studies eligible for meta analysis, there was a simple before and after period. However, as noted above, in the case of the Bowers et al. (2004) study, implementation was reported to be more gradual. For example, during the first year of implementation only 5% of the total number of gates that were eventually installed had been fitted. Thus, while the “before” period can be defined as the interval of time prior to the installation of any gates, the “after” period could be defined either as the period that immediately followed, or some later period after which a reasonable number of gates had been fitted (e.g. the last year, or the last two years of implementation). Analyses indicated that the later the period considered (when more gates had been installed), the larger the estimated effect of the gates, which is consistent with the idea

Figure 6 Odds ratios for the 108 alley-gated blocks evaluated in Bowers et al. (2004)
that the change observed was attributable to the gates themselves (rather than some unobserved influence). In what follows, for this study, we consider the data for the final year of implementation, but note that the overall results are not affected by the use of other “after” periods.

For each study, we estimate the effect of intervention by computing an odds ratio and a confidence interval in the way described above. These are shown (in black) in Figure 7. We also computed an overall weighted mean effect size using a random effects model. The results suggest that, relative to the changes observed in the control areas, burglary reduced at a faster rate in the areas in which alley gates were installed. For four of the locations, this effect was statistically significant. The overall weighted mean effect size of 1.73 (confidence intervals: 1.21-2.48) was also statistically significant and suggests that, relative to the control areas, burglary declined substantially in the areas where gating was implemented.

![Forest plot of the findings for the six locations where alley gates were installed and where data were available](image)

**Figure 7** Forest plot of the findings for the six locations where alley gates were installed and where data were available

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4 An estimate of the heterogeneity observed across studies (Q=13.18, df=5, p<0.05) indicated that the use of a random effects model was warranted.
All of the studies included in this analysis were quasi-experiments, and as there were no examples of RCTs, it was not possible to compare the findings for studies with different research designs to see if those that ruled out other threats to internal validity (such as allocation bias) showed different outcomes. All but one of the studies (Bowers et al. 2004) appeared in grey (i.e. non-academic) literature and thus the findings cannot logically be attributable to publication bias, in the narrowest sense.

However, as so few studies were available for analysis it is possible that the results so far presented do not capture the variation that would be observed in a larger population of studies (if it existed). Methods for estimating the absence of studies in a meta-analysis have been developed to examine the extent to which publication bias might exist. These approaches can be used to estimate the likely number of studies that are missing, and the effect sizes that would be observed should those studies be located. This allows the recomputation of estimates of the overall effect size of an intervention with the estimated effect sizes if such studies were to be included. While such approaches are typically used to estimate the effects of publication bias, they can also be used to estimate the effects of missing studies more generally.

A variety of procedures are available to examine the possible effects of missing studies and here we use the trim and fill algorithm proposed by Duval and Tweedie (2000). This approach assumes that in the event that all studies are included in a meta-analysis, the effect sizes should be distributed symmetrically around the mean effect. Moreover, if the effect sizes are plotted graphically as a function of the standard error of the estimates, a “funnel” shape should emerge, with the estimates for studies with the largest standard errors being located furthest from the mean effect (see Figure 8). Where an asymmetry is observed in the plot, it is assumed that some studies are missing.

Figure 8 shows the results of this analysis. The key principle for analysis of this sort is that in the absence of bias, the funnel plots displayed, which in this case show the effect size (log odds ratio) on the x-axis against the standard error on the y-axis, should be symmetric around the mean effect size. If there are more studies on one side of the plot, the concern is that there are missing studies.

The trim and fill method imputes the ‘missing’ points on the funnel plot using an iterative procedure which continues until the funnel plot is symmetric. This yields an adjusted estimate of effect size. Figure 9 shows the trim and fill results, suggesting that 2 studies are missing in this case (these are the two additional points, illustrated here as white dots). The original point estimate in log units was 0.717, confidence intervals 0.171-1.264. The adjusted point estimate is 0.283, with confidence intervals of 0.231-0.335. These results demonstrate that accounting for possible missing studies, whilst resulting in a slightly more modest effect size does not seem to affect the initial conclusions of the meta-analysis; the adjusted effect size continues to demonstrate a significant positive effect of treatment (reductions in burglary following the installation of alley gates). It appears therefore, that publication bias – or potentially omitted studies with smaller effects – are not a major concern for this analysis. This is confirmed by a regression test for funnel plot asymmetry undertaken on the six data points shown in

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5 The narrowest sense in that a publication bias can arose not from ignoring the grey literature, but also because of selective reporting on the part of authors or the preferential publication of positive results by scientific journals.

6 Note that these estimates do not compensate for over-dispersion.
Figure 9. This tests the hypothesis that observed outcomes are related to the standard error of the sample if there is a publication bias. If there is a relationship the plot will manifest asymmetrically. This test demonstrates no significant differences between Figure 9 and a symmetric plot (t = 1.3895, df = 4, p = 0.2370).

**Figure 8:** Funnel plot of standard error against log odds ratio for six studies used in meta-analysis

**Figure 9:** Funnel plot with two further imputed studies (white dots)

An issue with this approach, however, is that it is based on the assumption that there is one overall mean effect size, around which the estimates derived from individual studies should be distributed (symmetrically). This assumes that there is a relatively homogeneous effect of intervention and that the variation across studies is largely due to sampling error. If the overall rationale underpinning this review (and EMMIE) is valid, and context matters, then this assumption may not be so reasonable. Ideally, we
would conduct a moderator analysis to see if the effect of alley gates varies systematically with particular study characteristics (e.g. in different contexts), and adjust for this in the funnel plot. However, with so few studies available for analysis this was not possible. We thus present the above analysis for completeness but invite the reader to consider carefully what it might mean. One interpretation is that it represents an estimated worst-case scenario. One in which context does not matter and that there are studies missing from the analysis for which the estimated effect of intervention is systematically different from those for which data were available. Even for this scenario, the effect of intervention is still estimated to be positive with an estimated mean effect of 1.33 (p<0.001).

Spatial Displacement

In addition to examining outcomes in the areas in which gating was implemented, where possible we also examined those in the immediately surrounding areas (or buffer zones). The reason for this is to see if alley gates may have displaced crime geographically, or if any benefits might have been diffused spatially (e.g. Bowers et al., 2011). Data were available for changes observed in the surrounding areas of potential displacement (hereafter, ‘catchment’) areas for five of the six studies (not Agar et al. 2011). In four of these studies, changes were examined in one catchment area and for one period of time post-intervention. In the case of the Bowers et al. (2004) study, data were available for catchment areas that surrounded the treatment area that were 200m or 1km wide. In what follows, we analyse the data for the former (200m) and define the post-intervention period as the final year of implementation (see above).

For each catchment area we computed an odds ratio in the way described above. This procedure – computing a separate effect for the catchment area – was recently used in a published systematic review of spatial displacement (Bowers et al. 2011). The results of these analyses are shown in grey in Figure 7. In each case, burglary declined in the catchment areas at a rate that exceeded observed changes in the control areas. This suggests that rather than displacing crime, alley gating appeared to be associated with a diffusion of crime control benefits. That is, the positive effect of the intervention was enjoyed in an area wider than the treatment boundary. The weighted mean effect size (computed using a random effects model) of 1.62, also shown in Figure 7, suggests that overall this diffusion effect was statistically significant. An analysis (not shown) conducted using the 1km catchment area (and the final year of intervention) for the Bowers et al. (2004) study, suggested that the changes observed in the catchment area were commensurate with those observed in the control area. In this case, the weighted mean effect size of 1.23 (CI: 0.99-1.53) was in the same direction as before but was marginally non-significant.

Tactical displacement

Alley gates are often installed in a bid to reduce rear-entry burglary. If displacement is inevitable, then blocking opportunities to enter the property from the rear (via the alley) would cause a commensurate increase in the number of burgled properties entered via the front, otherwise known as tactical displacement. Although not included in a meta-analysis, it is worthwhile mentioning that several studies sought to assess signs for tactical displacement following the gating of alleys (Agar, 2011; Green, 2005; Bowers et al. 2004; Haywood et al. 2009; Sturgeon-Adams, Adamson and Davidson, 2005).
sum, although in certain cases there was some evidence of a switch of modus operandi to entry and exit via the front of properties to commit residential burglaries (i.e. Bowers et al. 2004), these increases did not threaten to negate the positive reductions in burglary levels associated with the installation of alley gates.

**Other Outcomes**

We turn now to non-crime prevention outcomes associated with alley gating. Note that these have not been measured quantitatively as the data were not available. A number of studies indicated the potential of alley gates to reduce fear of crime (Rogers, 2006; 2013). For example, Armitage and Smithson’s (2007) analysis of survey data from residents affected by alley gates over a four year period indicated a general improvement in feelings of safety. For Rogers (2006), this follows when residents are enabled to regain public space (i.e. gated alleys) and increase surveillance of it (which is in turn linked to the assumed preventive mechanism of increasing risk to prospective offenders). However, alley gates may also generate fear. Within the literature there are suggestions that a downside of strong, functional alley gates is the sense of inhospitable fortress-like neighbourhoods, suggesting that they are unsafe (Barker, 2014). Barker (2014) found that residents felt that alley gates were ‘prison like’ and made the streets seem dangerous and intimidating. By contrast, surveys conducted in Liverpool (UK) found just two percent of 188 respondents in gated areas showed concerns about feeling ‘imprisoned’ by the alley gates (Armitage and Smithson, 2007).

A related issue concerns crime reporting. Wilkie (2008) describes a case study in Blackpool, England, where residents living in areas where alley gates were being considered were sent a letter informing them of the possibility of this intervention being implemented. Residents were told that the final decision would be based on perceived demand, influenced by crime statistics and feedback from affected residents. Wilkie (2008) argues that this may lead to an artificial peak in crime reporting by residents in a bid to ensure alley gates are installed in their street.

Gating may generate fear of crime in more specific ways. It is inevitable that gating alleys functions to alter residents’ use of public space and this may create new problems. Rogers (2006) described how the introduction of the alley gates prevented young people from congregating discreetly in the darkness of the alleys where they were invisible to residents. Instead, they congregated in the streets where they were visible to residents, which made residents fearful.

**MECHANISMS**

Where possible this review sought to collect evidence that spoke to all components of EMMIE. To this aim, next we report efforts to supplement the results of our meta-analysis by considering those other elements that we suggest might better enable evidence-informed practice decisions, beginning with mechanisms.

To reiterate, mechanisms refer to the theories thought to underpin an intervention. In the context of this review, they describe ‘how’ and ‘why’ alley gates might contribute to achieving the intended outcome(s) of crime reduction. The range of mechanisms through which alley gates were deemed to have worked (or not) is potentially vast. Consequently, rather than enumerate all the possible ways through which alley gates
might plausibly contribute to reductions in crime, our aim here was to identify the dominant mechanisms that emerged from reading the relevant literature. It should be noted that oftentimes study authors did not describe alley gating using realist terms such as ‘mechanisms’. This is perhaps unsurprising: articulating ‘how’ an intervention produces the observed outcomes is not routine practice in criminology (Sidebottom and Tilley, 2012; van der Knaap et al. 2008). Moreover, as noted by Kastner et al. (2015), the working theories generated by realist reviews are often constructed by piecing together ‘bits’ of information present in numerous studies. For this reason, it is often unrealistic to attribute suggested mechanisms to particular studies. In the context of this review, however, where studies did explicitly refer to the causal mechanisms presumed to be responsible for the observed outcomes, this is acknowledged.

In total, on reading those studies judged relevant to alley gating (appendix 6, n = 43) we identified six mechanisms through which alley gates could conceivably be expected to generate positive crime prevention outcomes, though in many scenarios these causal mechanisms might be expected to operate in concert. We also discuss a seventh potential mechanism through which alley gates might contribute to increases in crime. Discussing each in turn:

Increasing the effort

By far the most commonly assumed mechanism by which alley gates might prevent burglary concerns increases in effort (for e.g. see Armitage, 2006; Agar, 2011; Green, 2005; Kay et al. 2002). This suggests that alley gating puts physical barriers in the way of would-be offenders and, quite literally, makes it physically harder to commit crime. Prospective offenders are unable to access targets (such as properties to burglarize) or use the now-gated alley as a way to escape the scene of crime and evade police capture. Even if a property has been entered for a burglary from the front, a closed back alley may produce a preventive effect in blocking off prospective escape routes. The gates also restrict access to the alley which previously provided an unsupervised location to commit crime (such as drug dealing). Crucially, an increase-effort mechanism places relatively little emphasis on the actions of residents for its excitation. Effectiveness is not contingent on residents forging closer links with one another or displaying overt cues that they care for (and are willing to intervene in) their designated space, unlike other mechanisms which are discussed below. The only requirement this mechanism makes of residents is the diligent closure of the gates.

Guardianship and surveillance

Alley gates might prevent crime by increasing the (perceived) risk of committing an offence by extending guardianship and assisting natural surveillance. Here gating draws on the principle of ‘defensible space’. Following Newman (1972), residents may feel little control or responsibility for an area which is occupied by numerous residents who are relatively anonymous. The physical redesign of an alley following gating – especially if coupled with signs of ownership – might function to generate a sense of security. In this vein it is held that the creation of community sentiments around well-defined shared space behind gates, leads to increased collective efficacy (Sampson, Raudenbush and Earls, 1997). By converting once public space into private space, residents could be motivated to take greater pride and care for the alley (through, say, installing plants and trellis and maintaining a clean environment) and feel more
empowered to act as capable guardians. Indeed, many alley gating initiatives in Britain were funded by monies designed to encourage community regeneration and cohesiveness, which speaks to this mechanism (Rogers, 2013).

Changes in potential indicators of guardianship and surveillance before and after the installation of alley gates were not systematically tested in the literature reviewed (we suggest data that might feasibly be collected to do so in future studies in the Discussion). However, it is noteworthy that Johnson and Loxley (2001) report anecdotal evidence of residents in Manchester installing plants and shrubbery to reclaimed (gated) alleys, interpreted as signs of affected residents taking greater pride in their area. Moreover in Liverpool, Johnson and Loxley (2001) report anecdotal evidence of residents being reportedly more comfortable using alleyways once they are gated. In Wales, however, Rogers’ (2013) analysis of interview data collected from a sample of affected residents over a six year period found that alley usage fluctuated over time and in the case of night time usage, was generally low (between 9-24% reported using the alley at night time).

Unlike the increase-effort mechanism discussed above, to operate effectively this mechanism asks a great deal of affected residents. It assumes that changes to the physical environment (gating) will initiate a change in the behaviour of residents, in particular a willingness to display greater ‘togetherness’ in ways that resonate with and ultimately deter prospective offenders.

**Territoriality and Removing Excuses**

Kaplan, Palkovitz and Pesce (1978, p.36) write that “alleyways offer little indication of where public property ends and private property begins. This lack of space definition adds to an impression of poor control of alleyways”. Gating alleys may function to increase real or perceived proprietary or territorial interest on the part of those residents who retained access to it (Armitage, 2006). In this scenario, residents should feel happier to question the activities of ‘strangers’ within the alley. In turn, any would-be intruder should fear watchful residents and refrain from offending. This mechanism assumes that freely accessible alleys provide a legitimate excuse for potential offenders to survey properties and/or lie in wait for potential crime targets: closing alleys removes these excuses. Through blocking off space, alley gates might thereby create ‘symbolic indicators’ of private space which would mean that anyone crossing the newly created threshold would either feel they might, or would indeed be challenged by affected residents. If this mechanism were activated, an expected outcome would be improved control over the behaviour of those backing onto the alleys, which would in turn would mean reduced antisocial behaviour. If this mechanism were activated, it would not matter if alley gates failed to comprise a physical barrier that made entry more difficult or if the gates were not always locked; gates could simply act as persuasive indicator of a boundary between public and private space, within which resident intervention is more likely.

This mechanism is in some ways related to the increasing guardianship and surveillance mechanism stated above. However, the distinction is that territoriality assists with the identification of strangers, whilst increasing guardianship encourages resident use, management and ownership. Consequently, while data on resident use of gated alleys and signs of improving the gated area speaks to guardianship and surveillance, information on the number of unfamiliar people reportedly spotted in the alley or the
number of occasions when strangers have been questioned as to the reason for being in alleys relates more specifically to territoriality.

**Broken windows**

A fourth mechanism operates via the principles of ‘broken windows’ (Wilson and Kelling, 1982), which suggests that failure to control antisocial behaviour leads to signs of incivility that in turn creates the impression that further criminal behaviour is normal and permissible (for an empirical demonstration of Broken Windows see Keizer, Lindenber and Steg, 2008). In the context of alley gates, open access alleys comprise unregulated spaces where signs of disorder are produced, creating a permissive environment for crime. Closing them creates orderly space providing cues to suggest that this is not a suitable place to offend because the risk is high. Operated effectively, the gate leads to the maintenance of an ordered environment that is cared for and over which residents have ownership.

The activation of this mechanism is dependent on the behaviour of both residents and various local authorities (i.e. bin men, street cleaners) in keeping the space within gated areas tidy, and potentially the police to remove graffiti and vandalism. Information from residents collected several years after the installation of alley gates suggests that such ordered environments are indeed commonplace. For example, comparing survey respondents in gated and non-gated areas four years after gates were put in place, Armitage and Smithson (2007) found residents in gated areas reported encountering considerably fewer cases of littering, dog fouling and public urination.

**Deflection**

Areas known to have many alleys may attract offenders because of the tempting crime targets judged to be found there. Alley-rich areas therefore feature in the ‘awareness spaces’ of more individuals, some of whom will act upon available crime opportunities. Gating some alleys could reduce the attractiveness of the area more generally and remove it from the awareness space of criminally inclined individuals (Armitage, 2006). If activated, this mechanism might plausibly generate crime falls in local streets without alley gates as well as those with them, as a diffusion of benefits.

**Reducing Rewards**

Restricting access to alleyways could conceivably reduce the rewards of committing burglary (Armitage, 2006). Alleyways introduce concealed pathways to the back of alley-adjacent terraced properties. This could mean that there is a reduced need for the goods chosen as part of a burglary to be easily concealable and removable (two of the elements of highly stolen goods, see Clarke, 1999) so as to reduce the risk of detection. This suggests that larger higher-value items might be easier to steal and less conspicuous when exiting via the back of a property than via the front. A change in the nature of goods stolen in response to the installation of alley gates might be a form of benign displacement (Barr and Pease, 1990), where offences may continue following intervention but the financial loss caused by those offences is lessened because of their change in nature, leading to a positive reduction in harm overall. This mechanism could be investigated by comparing what was stolen (and estimated total losses) in burglaries
before and after the implementation of alley gates. Regrettably such information was not collected in the primary studies reviewed here.

*Increases in offending through reductions in guardianship*

Through extending guardianship and improving natural surveillance, alley gating is presumed to generate positive crime prevention outcomes. However, the same mechanism could also potentially increase offending. If alleys were previously well-used by residents in their day-to-day routines, gating them might conversely function to reduce their usage and so increase would-be offenders’ perceptions of anonymity. Haywood et al. (2009) described how gating led to a reduction in footfall in an alley which had previously conveniently linked a park and food store. This was thought to be associated with an increase in burglaries because would-be offenders felt that they were less likely to be observed than had previously been the case. Closed alleys might remove routine surveillance from passers-by who would otherwise act as capable guardians. As mentioned previously, Rogers (2013) found that residents in gated areas in Wales seldom used alleys following the installation of gates, particular after dark. Residents attributed their infrequent use of alleys to the fact that their function as convenient short cuts had been removed, and because some no longer had direct access to the alleys through their properties, which had been removed by the gates. Unfortunately data were not available in the Rogers (2013) study to assess if infrequent usage of alleys was associated with increases in crime.

**MODERATORS**

The previous section described the mechanisms gleaned from the reviewed literature on alley gates. Yet the mechanisms underpinning crime reduction measures are rarely, if ever, activated unconditionally. The same alley gating literature was therefore examined to identify contextual factors (or moderators) that might facilitate or undermine the activation of putative mechanisms. Note that generally moderators refer to distinct contexts (such as different physical locations) or to the *pre-existing* conditions of a place (for example, the historical nature of a particular neighbourhood) that might affect the performance of interventions. These conditions might either facilitate or undermine the success of particular mechanisms in achieving the desired outcome. This is distinct from how the intervention happens *in practice* and the influences of this on mechanism activation (or not) and associated outcome patterns, which are categorised here as ‘implementation’ factors, and are discussed in the next section.

**Crime Context**

The first moderating factor concerns the characteristics of the problem alley that gates are intended to effect. Alley gates are not a suitable response to all crime problems, for example they are unlikely to be effective in reducing burglary if the modus operandi (MO) of burglars is front access, or where would-be offenders live within the confines of the gated alleys. Some studies noted the importance of understanding the crime context before gates are implemented (e.g. Bowers et al 2004) and a number of studies noted the difficulties of generating detailed information on the manifestation of local burglary problems, such as the proportion of rear-access burglaries (Bowers et al, 2004; Haywood et al, 2009; Sturgeon-Adams et al, 2005; Rogers, 2013).
Neighbourhood Context

Alley gating will be limited in effectiveness if access to keys is not well-regulated or if the number combination of gate key-pads (where used) becomes widely known. The profile of the residents affected by alley gates might well be important here. Where neighbourhoods have a high turnover of residents the number of residents with access to keys and passcodes may increase. Millie and Hough (2004) describe a burglary reduction project where alley gates were installed in an area characterized by a large student population. Whilst the gates installed were self-closing and self-locking and sufficient keys were provided it proved difficult to keep track of the number of keys and whether these had been lost. They went on to note that residents often propped the alley gates open. They conclude that although ‘this intervention had a plausible impact during the life of the evaluation, these issues could have hindered longer-term success’, and that whilst the crime prevention theory was sound it was perhaps targeted at the wrong area (Millie and Hough, 2004). Other studies find more positive outcomes, however. For example, Armitage and Smithson’s (2007) assessment of alley gating four years post installation in Liverpool showed that the vast majority of gates were closed and locked appropriately.

Resident and community investment in alley gating

For mechanisms whose activation is dependent on changes in the behaviour of residents, time is likely required for residents to learn new routines and incorporate the gates into them. These changes may then transform and mediate their impact. Haywood et al. (2009) found that committed individuals took personal responsibility for informally regulating the gates without which effectiveness would have been reduced. The existence of these residents might not be essential but their presence will likely increase the probability of activating the aforementioned crime reduction mechanisms. In this regard, Haywood et al. (2009) note that gates are not simply physical interventions but ‘living’ ones relying on ongoing buy-in and commitment from residents to make them work.

Whilst it is hoped that implementing alley gating programmes might function to generate community cohesion which in turn might lead residents to work together cooperatively to prevent crime, this should not be assumed. Firstly, it may be that the successful installation and operation of alley gate schemes is dependent on the existence of an already cohesive community. Thus community cohesion may be a precursor to, rather than an outcome of, successful alley gating programmes. High crime rate neighbourhoods are often associated with low social cohesion (e.g. Sampson et al. 2002; Hirschfield and Bowers 1997). Alley gating programmes are generally – though not always – proposed as a solution in high crime areas and this may render them difficult to deliver. However, it should be kept in mind that the results of our meta-analyses – which included studies where gates were fitted in high burglary areas – show that when implemented well, alley gates have on average been found to be effective.

The absence of community cohesiveness can make it difficult to persuade residents to work together to follow the processes judged to be required to effectively deliver alley gating programmes. A related problem is that residents in high crime areas may be wary of working with the police. Areas characterised by high numbers of renters or a high
turnover of residents might be especially problematic as they may lack the interest in working together to introduce safety measures in a locale where they have little long-term investment. Indeed, home ownership is so important that it may inoculate against the problems of implementing alley gating in high crime rate locations (Rogers, 2013). Consulting the local community to gauge their feelings towards alley gating and their neighbourhood more generally is thus an important part of the alley gating process (Armitage and Smithson, 2007).

In some sets of circumstances bringing residents together has undermined the generation of community cohesiveness. Mutual hostility between advocates and opponents of schemes may generate a fractured community. Haywood et al. (2009) reported the deleterious effect that one awkward resident can have on scheme effectiveness and community cohesion. Specifically, one aggressive tenant would not close the gates and made threats when approached by residents to do so. Concerted efforts to resolve the situation made little difference to the behaviour of this aggressive individual. The sense of fear amongst residents participating in Haywood et al.’s (2009, p. 376) research “demonstrates the dependency of the implementation and operation of gating on the cooperation of all scheme residents and the fragile nature of community cohesion”. Indeed, in the most extreme cases alley gates, although mooted to promote cohesiveness, may function to generate a more exclusive and divided society, in ways similar to those found for gated communities more generally (see Addington and Rennison, 2013). As Rogers (2013, p. 123) warns, ‘One inevitable risk is that the success of alley-gating schemes may in fact contribute to a more exclusive and divided society’. They could become, it is argued, islands of tranquillity in an urban sea of those unfortunate enough to live outside such protected and regulated environments. Although little evidence is available to test this conjecture, it should be noted that none of the 188 residents surveyed by Armitage and Smithson (2007) reported feeling ‘blocked/locked in’ by the installation of alley gates.

Physical Environment

The ‘broken windows’ mechanism described previously assumes that alley gates help contribute to an orderly and cared for environment, which might function to discourage offenders. However, evidence suggests that this can be undermined in a number of ways. Cases in which rubbish builds up behind gates appear frequently in the literature and could be interpreted as indicating an uncared for area (Rogers, 2006). This may reflect an inability of residents to access the alleys. For example, Rogers (2006) describes cases whereby residents, following antisocial and criminal behaviour in the alleys adjoining their properties, had acted to seal rear access routes to improve security. Accumulated rubbish might be compounded in situations where refuse collectors refuse to enter the gated alleyways or do not have access to them to do so. This can be linked to the design and installation of the gates themselves. Some gates have proved unfit for purpose. Thompson et al. (2002, p. 14) observe that “following the first three installations, it became clear the gates were inappropriate. They quickly became rusty and unsightly, could be ‘kicked in’ relatively easily and residents found them very noisy. A revision of the gate specifications took place, which led to delays and an increase in the unit cost”.

Context-mechanism interactions
It is important to consider the interaction between contexts and mechanisms. In this section we have seen that alley gating may function as intended in some contexts, but in others might inadvertently activate mechanisms that foster crime and antisocial behaviour. This is illustrated in Table 1, which summarises various ways in which contextual factors discussed here may be important in shaping crime-related outcomes of alley gating.

Table 1: Contextual conditions favourable and unfavourable to alley gating producing reductions in crime

<table>
<thead>
<tr>
<th>Aspect of context</th>
<th>Features conducive to crime prevention with alley gates</th>
<th>Features unconducive to crime prevention with alley gates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criminality attributes</td>
<td>External to gated streets</td>
<td>Crime and antisocial behaviour committed by those living within gated alleys</td>
</tr>
<tr>
<td>Crime attributes</td>
<td>Rear-focused and alley-related crime and antisocial behaviour</td>
<td>Crime and disorder concentrates at the front of properties unrelated to rear alleyways</td>
</tr>
<tr>
<td>Resident and housing attributes</td>
<td>Low turnover, high consensus, high collective efficacy</td>
<td>Transient population, residents amongst whom there is hostility or mutual mistrust, where there is a lack of consensus, where informal rules regarding the use of alley gates are not agreed</td>
</tr>
<tr>
<td>Alley attributes</td>
<td>Infrequently used for non-resident pedestrian travel or infrequently needed for resident access, open to surveillance by residents, ownership of the alley is clear and the alley is not a public right of way</td>
<td>Alleys never used as through-routes by outsiders or alleys routinely used by outsiders, not visible to local residents, ownership of the alley is unclear and/or is a public right of way</td>
</tr>
<tr>
<td>Local service provider attributes</td>
<td>Rubbish-collection, clearance, clean-up and key (code) allocation/replacement needs are all in place. Agreement with emergency services achieved</td>
<td>Local authorities unwilling or unable to service alleys and manage key allocation and maintenance. No agreement with emergency services</td>
</tr>
<tr>
<td>Gate attributes</td>
<td>Sufficiently tall, self-locking and robust</td>
<td>Flimsy, scalable gates that are easily opened or left open</td>
</tr>
</tbody>
</table>

IMPLEMENTATION

The context into which alley gates are implemented, their planning and the ways that they are used are all important in understanding the outcomes achieved. There are a number of helpful guides for those considering installing alley gates (see Beckford and
Cogan, 2000; Johnson and Loxley, 2001; Armitage, 2006). The following is not intended as an exhaustive guide but rather a summary of the implementation conditions within which alley gating is most likely to be effective, based on the reviewed literature.

1. Consultation with and consent of residents: A primary precursor to successful alley gating is gaining the consent of residents. Many studies discuss this matter, underscoring its importance (Armitage and Smithson, 2007; Johnson and Loxley, 2001; Bowers et al 2004; Haywood et al, 2009; Sturgeon-Adams et al, 2005; Adamson, 2005; Rogers, 2006, 2007, 2013). In Britain, legally there needs to be agreement with local residents before alleys can be gated. If the alley is privately owned all affected residents must agree to the installation of gates. If the alley is publically owned there is variation. Some authorities work on the ‘greater than 51%’ rule whilst others insist on 100% agreement. Residents need to have information about the gates and be given the opportunity to discuss any concerns that they might have.

2. Resident commitment to and use of gates: Gaining the consent of affected residents is but one aspect of community engagement when it comes to alley gating. Residents need to agree rules about how they will use the gates and be committed to following those rules if alley gates are to function effectively. Studies have revealed that where residents do not consent they will not use them properly leaving them insecure, or they may pass the keys on to others (Haywood et al, 2009; Rogers, 2013). It can be difficult to generate agreement amongst residents about whether gating is necessary and subsequently to develop rules, routines and norms about how the gates and alleys should be used. Residents may be wary of alley gating for numerous reasons. Millie and Hough (2004) observed that three alleys remained ungated in one project owing to resident concerns. Concerns included wheelchair access needed by one resident and concern from another who had previously been attacked in an alley. Likewise residents commonly express concerns about the arrangements for the maintenance of gates, the impact on services and utilities such as rubbish collection, noise, access to keys and a stigmatizing impact on a neighbourhood (Sturgeon-Adams et al, 2005; Johnson and Loxley, 2001; Adamson, 2005). Moreover, community buy-in and engagement needs to be ongoing since the population will invariably change over time, the nature of problems in an area may evolve and residents might otherwise ‘forget’ what the gates were originally intended to achieve and why (Rogers, 2007; 2013).

3. Informal regulation of the gates: Informal regulation of the gates is important. Alley gates alter the way that residents use public space. Residents must agree to informally regulate the alleys and this agreement may need reinforcement and reinvigoration over time. As Millie and Hough (2004) found, gates will fail to deflect access to crime targets if they are not properly used by residents. Indeed, the literature is replete with examples of residents failing to lock or close the gates and in so doing undermining potential crime prevention mechanisms (although this is not always the case, see Armitage and Smithson, 2007). This can happen for a number of reasons. Otherwise supportive residents may become frustrated where the gates are inconvenient and leave them open. It follows that resident misuse of the gates might be compounded where unsuitable gates and lock procedures have been implemented. Some gates are
not easy to lock. Others are not self-closing. Unsupportive residents may purposefully undermine the initiative.

4. **Consultation with local authorities:** Early consultation with local service providers potentially affected by the gating of alleys is important. This is to ensure that local services (from emergency services to the regular collection of rubbish) are not compromised and relevant personnel can access the alleys. There may also be matters to do with cables, wires, pipes and sewers under the ground that need to be considered.

5. **The ‘status’ of the alley:** Implementation of alley gates rests on identifying ownership of the alleys. In the UK alleys are sometimes public rights of way owned by local authorities. In these circumstances establishing alley gates can be complex and time consuming. The local authority may be required to transfer ownership of the land to local residents who in turn would be responsible for maintaining it. This process can be costly and requires negotiations with the local authority. In other circumstances alleys are owned privately by one or more residents. If so, they can be closed with permission of all home owners. Whilst the process of gating is less complex than when alleys are public rights of way, there can also be problems with privately owned alleys as ownership is not always clear, responses from owners might not be swift and advice from solicitors is generally required.

6. **Features of the gates:** Successful operation of alley gating will depend on whether a suitable gate/lock combination has been selected. Where the gates are operated with locks and keys, decisions need to be made about who distributes the keys (for example the police or a residents’ group), how to handle keys/key codes in areas where turnover of residents is high and when to change key pad codes (which are likely to become widely known in the long run). The gate needs to be appropriate for the site (potentially to facilitate access to vehicles and people). It needs to be strong (but not so solid that it inhibits natural surveillance) and large enough to prevent people jumping over it. The gate might need lighting at night time. There needs to be consideration of aesthetics as well as security. The design will depend on the physical dimensions of the alley, the amount of money available to pay for it and what local residents want. It is advisable to check whether gates need planning permission. Reaching agreement for who is responsible for maintaining the gate over time is important.

**ECONOMICS: On the monetary costs and benefits of alley gating**

Monetary cost is a key consideration when deciding how to respond to crime. For alley gating, financial costs include installing, insuring and maintaining the alley gates as well as consulting the community and in particular those residents whose property is likely to be most affected. These costs will also vary according to the number of affected residents, the number of gates installed, the type of alley gate, the materials with which the gates are constructed and so on. The six studies included in our meta-analysis all examined the costs of alley gating (Table 2). In four studies the estimated cost per gate was reported and in the remaining two studies (marked by an asterix) we were able to compute costs by dividing the reported total expenditure on alley gating by the number
of gates installed. Across the six studies the median cost per alley gate was £726. The lowest reported cost per gate was £158 and the highest was £1,453. The abovementioned factors may explain this variation.

**Table 2** Estimated cost of alley gates across six British studies

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Date</th>
<th>Setting</th>
<th>Number of alley gates installed</th>
<th>Cost per gate (in £)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agar</td>
<td>2011</td>
<td>Enfield, UK</td>
<td>88</td>
<td>1090.91*</td>
</tr>
<tr>
<td>Bowers et al.</td>
<td>2004</td>
<td>Merseyside, UK</td>
<td>3178</td>
<td>659.00</td>
</tr>
<tr>
<td>Kay et al.</td>
<td>2002</td>
<td>Selly Oak, UK</td>
<td>103</td>
<td>158.00</td>
</tr>
<tr>
<td>Sturgeon-Adams et al.</td>
<td>2005</td>
<td>Hartlepool, UK</td>
<td>14</td>
<td>1453.21*</td>
</tr>
<tr>
<td>Thompson et al.</td>
<td>2002</td>
<td>Stirchley, UK</td>
<td>62</td>
<td>212.00</td>
</tr>
<tr>
<td>Thompson et al.</td>
<td>2002</td>
<td>Fordbridge, UK</td>
<td>44</td>
<td>792.73</td>
</tr>
</tbody>
</table>

*Note that the costs relate to the time the study took place. Inflation and other financial changes over time might therefore mean that these price estimates might not be directly comparable between studies.*

Cost is relative: the significance of any financial outlay can only be judged in the light of the expected returns on investment. For crime prevention, returns ordinarily refer to the financial gains associated with crimes averted following intervention. This can be calculated using published estimates on the average cost of various crime types (see Dubourg and Hamed, 2005). Five of the six studies included in our meta-analysis generated cost-benefit ratios to assess the total amount spent on burglary reduction against the estimated savings (or losses) associated with burglary reductions (or increases). These are displayed in Table 3 and denote the financial loss or savings for every one pound spent.

Four of the five studies reported cost beneficial results. Several points should be kept in mind, however, when interpreting the findings in Table 3. Firstly, cost benefit analysis was performed using the total amount spent on all burglary reduction measures and not specific interventions (such as alley gates). As alluded to previously, in all but one study (the exception is Bowers et al. 2004) alley gates were evaluated as part of a suite of measures designed to reduce burglary. Second, Kay et al. (2002) and Thompson et al. (2002a; 2002b) report several cost benefit ratios which vary according to whether displacement/diffusion of crime control benefits is included or not. In some cases the difference is considerable. In Fordbridge, for example, Thompson and colleagues report cost benefit ratios of £1.24 to £9.32 for every £1 spent, the former incorporating changes in burglary in the surrounding buffer area and the latter focusing on burglary.
as a proportion of all acquisitive crime in the target area. Here, we report only the most conservative, lower estimates.

**Table 3** Cost-benefit ratios of amount spent on alley gating and the associated costs of burglary reductions and/or increases

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Date</th>
<th>Setting</th>
<th>Cost benefit ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowers et al.</td>
<td>2004</td>
<td>Merseyside, UK</td>
<td>£1: £1.86</td>
</tr>
<tr>
<td>Kay et al.</td>
<td>2002</td>
<td>Selly Oak, UK</td>
<td>£1: - £2.79</td>
</tr>
<tr>
<td>Sturgeon-Adams et al.</td>
<td>2005</td>
<td>Hartlepool, UK</td>
<td>£1: £2.19</td>
</tr>
<tr>
<td>Thompson et al.</td>
<td>2002</td>
<td>Stirchley, UK</td>
<td>£1: £1.87</td>
</tr>
<tr>
<td>Thompson et al.</td>
<td>2002</td>
<td>Fordbridge, UK</td>
<td>£1: £1.24</td>
</tr>
</tbody>
</table>

Several studies described ways of potentially reducing the costs of an alley gating programme. One approach was to invite local residents to help build and install the alley gates. The rationale was that “rather than just give a gate to the local community, actually show them what goes into making it, teach them the skills…mix together crime reduction, community spirit, training and employment opportunities’ (CDF, 2013, p.4). A second approach was used in an alley gating project in London whereby offenders on community service orders were required to participate in the (supervised) installation of alley gates (Reed and Nutley, 1998). In addition to savings on costs, it was argued that involving former offenders formed a useful part of their rehabilitation process by teaching them vocational skills, although this was not formally assessed.

**DISCUSSION**

This review of alley gating, the first to be undertaken, has attempted to be innovative in combining two approaches to evidence synthesis that hitherto are rarely integrated in criminological systematic reviews, namely meta-analysis and realist synthesis. Drawing on EMMIE (Johnson, Tilley and Bowers, 2015), it has also collated

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7 These denote modelled costs which “convert costs to a common price base (GDP deflated) and point in time (discounted). The modelled costs for Stirchley SDP use net present values at April 1999 prices, and the cost of capital items (equipment) as an amortised value, based on the expected life of the assets and the time they were used in the intervention. This assumes that the assets continue to be available beyond the end of the project” (Thompson et al. 2002, p. 25).
information relevant to the implementation of alley gates and the economic costs and benefits of doing so.

Alley gating has been particularly popular in Britain as a form of situational crime prevention, yet only a small number of studies have attempted systematically to measure its effects. Reflecting the main rationale for installing gates, the main effects focused on have related to domestic burglary. Experimental studies to date have found gating to have been successful as a burglary reduction technique in the areas where it has been implemented.

Drawing on a wider range of studies that were identified through the literature search, this review has also attempted to identify causal mechanisms through which alley gating can reduce crime and through which it may also unintentionally produce other positive and negative outcomes. Building on this, we scrutinised the literature for evidence of variations in conditions under which alley gating does or does not activate causal mechanisms to produce particular patterns of positive and negative effects. However, the evidence that has been collected so far is, for the most part, only suggestive of how alley gating may produce effects and the conditions that are relevant to variations in outcome patterns. It had been hoped that the data collected in the course of the experimental studies would be sufficient for reanalysis to test conjectures about mechanisms and the conditions for their activation. Unfortunately, the available data were not sufficient for this. This is a great pity given that decision-makers need to be able to distinguish more from less suitable candidate places for alley gates to produce net overall benefits.

In addition, the review drew on studies that included evidence on the implementation of alley gating. Here, descriptive studies as well as evaluations proved useful in highlighting the complex processes involved in forging agreements to install gates, obtaining funding for them, the maintenance of gates and their locks, the design of gates, and the administration of gating schemes. It is hoped that this material, which is often paid limited attention in systematic reviews, will be valuable to policymakers and practitioners considering future gating schemes.

Finally, this review has drawn together evidence of the economic costs and benefits from gating schemes that have been operated and evaluated to date. This indicates that that have been cost effective.

Summary of the main results

Six studies were eligible for meta-analysis. All six studies took place in Britain, used police recorded burglary data as the outcome measure and employed a quasi-experimental research design. Our search strategy identified no eligible randomised controlled trials. Four of the six studies reported statistically significant reductions in domestic burglary associated with the installation of alley gates, relative to the control areas. Overall this produced a weighted mean effect size of 1.73. No studies reported a statistically significant increase in crime following the installation of alley gates.

In the course of undertaking this review, we were also able to obtain additional information from the largest evaluation of alley gates to date (Bowers et al. 2004), to explore the extent and direction of any burglary reduction effect in 108 separate treatment areas. Consistent with the results of the meta-analysis, we found that the majority of treatment sites reported reductions in burglary compared to the control area. Across the six studies there was little evidence of any spatial displacement, as has been
shown for other types of SCP (see Guerette and Bowers, 2009). On the contrary, the evidence suggests a diffusion of crime control benefits, here burglary, to nearby areas where alleys were not gated. Moreover, the available evidence suggests that in monetary terms, the reductions in burglary attributed to alley gates generally exceeded the investment required to install and maintain them.

Taken together, our results suggest that alley gating has been an effective and cost-beneficial burglary reduction measure. There are, however, several factors that limit the generalisability of our findings. First, all of the studies included in our meta-analysis took place in Britain. It is unclear whether the generally positive results obtained from these studies can be generalised to other settings with different street layouts and housing characteristics. Second, in five of the six studies (the exception is Agar et al. 2011) the alley gates being evaluated were purchased using funds provided by the same government scheme (the Reducing Burglary Initiative). In some cases the injection of money was considerable. This is noteworthy since efforts to replicate well-resourced demonstration projects at a reduced cost often fail to produce the same positive outcomes (see Tilley, 1993). Third, we found that alley gates tended to be implemented as part of a package of crime prevention measures. Although this is true of many crime prevention schemes and is a familiar limitation when synthesising such studies (for e.g. see Bennett, Farrington and Holloway’s (2008) review of neighbourhood watch), we must reiterate the consequent inability to reliably determine the comparative effectiveness of individual interventions. In the context of this review, we were unable to isolate the effect of alley gates absent associated crime prevention measures. Fourth, our meta-analysis draws only on quasi-experimental studies. This warrants mention given that previous research has suggested that non-randomised study designs are more likely to produce positive results than when randomisation is used (see Weisburd, Lum, and Petrosino, 2001). However, comparing the proportional change scores for the six studies eligible for the meta-analysis with those studies that did not use comparison areas (Figure 5) does not suggest that heterogeneity in effect size can be attributed to study design. This is consistent with Guerette (2009) whose review of SCP evaluations found that the conclusions generated by randomized controlled trails did not vary considerably from those derived from other research designs.

Questions concerning the generalisability of our meta-analysis findings speak also to our realist review, and in particular our attempt to identify how alley gates are expected to reduce crime and the conditions in which the sought-after outcomes are more likely to be observed (or not). These are summarised in Table 4 (below) which outlines the outcomes that are expected to follow from the activation of particular mechanisms in given contexts. By far the most commonly assumed mechanism was that alley gates produce a crime reduction effect by increasing the effort of prospective offenders committing burglary. A virtue of this mechanism is that it requires little change or input from affected residents – its only requirement is that the gates are regularly closed – it is therefore comparatively context-insensitive. The same cannot be said for some of the other mechanisms through which alley gates might conceivably reduce crime – such as removing excuses for loitering, creating orderly spaces and so on – all of which have higher thresholds of activation and variously require input from affected parties (such as residents, municipal agencies, police). It is our contention that knowing how alley gating might engender crime prevention outcomes (in addition to evidence suggesting it is effective) can better equip policy makers and practitioners to make informed decisions as to whether alley gating is suitable for their particular problem context.
Table 4: Hypothesized context-mechanism-outcome configurations for alley gates

<table>
<thead>
<tr>
<th>Context</th>
<th>Mechanism</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offenders select targets with which they are familiar</td>
<td>Closing alleys removes vulnerable properties from likely offenders’ awareness spaces</td>
<td>Reduction of domestic burglary, non-domestic burglary and theft from the garden and yards accessible from the alley</td>
</tr>
<tr>
<td>Alleys provide easy access to targets or a means of escape for offenders</td>
<td>Closing alleys increases the effort and risk of offending</td>
<td></td>
</tr>
<tr>
<td>Public alleys provide a legitimate excuse for would-be offenders to survey properties</td>
<td>Closing alleys removes excuses for loitering</td>
<td></td>
</tr>
<tr>
<td>Open access alleys generate disorder and facilitate further crime and disorder</td>
<td>Closing alleys creates orderly space, providing cues to suggest that this is not a suitable place to offend because the risk is high</td>
<td>Reduction of drug use and dealing, prostitution, arson, the accumulation of litter, robbery and anti-social behaviour</td>
</tr>
<tr>
<td>Open access alleys are unregulated, no-one takes proprietary interest and disorderly behaviour goes unchallenged</td>
<td>Alley gates create defensible space where those backing onto the enclosed alleys display territoriality over it</td>
<td></td>
</tr>
<tr>
<td>Alley gates are installed in high crime areas with little collective efficacy</td>
<td>The process of secure agreement for alley gates to be installed builds collective efficacy, enhancing mutual protection</td>
<td></td>
</tr>
<tr>
<td>Areas known to have many rear alleys attract would-be offenders</td>
<td>Alley gating reduces the attractiveness of the neighbourhood for offenders who are looking for vulnerable targets</td>
<td>A diffusion of benefits</td>
</tr>
</tbody>
</table>

A limitation of this review was our inability to test the mechanisms we identified as part of the realist synthesis. The reason for this was that most alley gating studies considered here did not report their findings in realist terms – such as ‘mechanism’ and ‘context’ – nor did they collect data that speak to the different mechanisms and associated outcome patterns shown in Table 4. Van der Knapp and colleagues (2008) arrived at a similar conclusion when attempting to combine meta-analysis with realist synthesis. We suspect this pattern also partly explains why there are so few examples of systematic reviews in criminology that combine meta-analysis with realist synthesis.

Future evaluation studies are necessary to systematically collect data to better determine which putative mechanism might be responsible for any outcome patterns associated with the installation of alley gates. We argue that the findings of our realist synthesis can usefully inform that endeavour. Take the broken windows mechanism described previously. If this mechanism were activated following the implementation of alley gates...
gates then we would expect to see reductions in the sort of visual cues believed to generate crime and disorder by indicating to prospective offenders a lack of community investment and an attendant low probability of resident intervention. These cues include littering, vandalism, graffiti and signs of public urination (see Keizer et al. 1998) which could conceivably be measured through, say, systematic observations as part of an alley gating evaluation. Likewise the probability of resident intervention for strangers found in gated alleys could be estimated through community surveys or artfully designed systematic observations (for example see Reynald, 2009). These are examples of intermediate outcomes that allow for a much sharper evaluation of alley gates. Moreover, as indicated in Table 4, the activation of particular mechanisms would likely generate several ultimate outcomes beyond merely changes in burglary, which again could be captured as part of an impact evaluation.

Different mechanisms are expected to produce different outcome signatures (Johnson, Birks, McLaughlin, Bowers and Pease, 2007; Eck and Madensen 2009; Pawson and Tilley 1997). Consequently, if crime falls following the implementation of alley gates but we see little change in the presence of the abovementioned visual cues (or an increase) or indicators of guardianship, then we can be more confident that some other mechanism is responsible for the patterns observed. In the course of this review it became clear that such analyses could not be performed retrospectively. Clearly crime prevention evaluation is often a costly and time consuming task. However, we believe that data of the kind indicated above could be collected with relative ease as part of an evaluation that focused on conjectures concerning the possible causal pathways and the conditions for their passage.

**Reflections on EMMIE and combining meta-analysis with realist synthesis**

In this final section we shift our focus away from alley gating and reflect on the approach we have taken in carrying out this review, in particular using EMMIE as a framework to organise our results and our attempt to combine meta-analysis and realist synthesis. With respect to the application of EMMIE, the main challenge we encountered was the distinction between moderators and implementation. Unlike the three other elements of EMMIE, on occasion there was disagreement as to whether information available in the primary studies related to moderators or implementation. This is perhaps unsurprising given the two concepts are intimately related: failure to successfully implement a crime prevention measure (including alley gates) is likely to be a leading cause of ineffectiveness, in part because poor implementation might not be germane to the sorts of conditions necessary to activate the causal mechanism(s) responsible for positive outcome patterns. However, to the extent that this review was intended to advance our knowledge on alley gating as a method to reduce crime, the implications of any potential misplacement – i.e. describing information on implementation as a moderating factor – are rather trivial, of greater concern is that consumers of evidence are made aware of the key considerations of choosing alley gates as a means to reduce crime. Nonetheless, future reviews employing EMMIE would benefit from consensually agreeing upon a definition of these two concepts from the outset. Apportioning information from primary studies on the bases of these definitions could then be tested via inter-rater reliability exercises.

We began this review by setting out our rationale for and method of combining meta-analysis and realist synthesis, as well as our intention that this approach might stimulate
further research to refine, develop and possibly simplify the method followed here. We are encouraged that similar efforts are currently underway in medicine (Kastner et al. 2015; Meads et al. 2015). As a way ahead, three lessons learnt in the process of this review might inform any future endeavours. The first is an acknowledgement that extending our search strategy to include evidence collected from a wider range of studies (as is commonplace in realist syntheses) was very resource-intensive. Moreover, it introduced greater uncertainty as to what studies were suitable for inclusion in a way that is less apparent when studies can be excluded from review on the basis of, say, research design. Second, our hope of producing a fully integrated systematic review in which theoretically-warranted moderators derived from our realist review were used to investigate effect size heterogeneity proved unrealistic. It was unrealistic because information presented in the primary studies reviewed here were insufficient to enable this sort of analysis. Consequently, the function of the realist synthesis in the context of this review was largely limited to trying to make sense of the results of the meta-analysis. Further research is needed to determine if this is representative of the crime prevention literature more generally. Finally, to streamline the realist branch of the review process, we speculate whether it might be helpful to apply some sort of generic framework to help organise the information of interest. For example, one possibility is to record whether each source reports information that alludes to contexts, mechanisms or outcome configurations. We are not suggesting that such a tool be applied slavishly and information falling outside of these concepts be jettisoned, but instead it would assist in assessing the comparability of the realist reviewers and, where appropriate, attributing extracted information to particular sources.

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REFERENCES

References marked with an asterix (*) indicate studies used in our meta-analysis.


APPENDICES

Appendix 1. Search terms for electronic databases

The following terms were used when searching the electronic databases. Where necessary, search terms were adapted to fit particular databases:

1. su.Exact("access control")
2. TLAB,IF("access control" OR (access NEAR/10 restrict*) OR (gated PRE/2 communit*) OR (alley PRE/2 gate*) OR lockout* OR smartcard* OR (smart PRE/1 card) OR password* OR passcode OR (card NEAR/2 read*) OR authenticicat* OR authenticicat* OR (access PRE/0 code*) OR sentries OR key*pad OR "tamper proof"* OR (auth* NEAR/5 access) OR (security PRE/1 bars) OR (electronic* NEAR/4 secur*) OR "Secured by Design" OR "Crime Prevention Through Environmental Design" OR "situational crime prevention" OR "defensible space")
3. #1 OR #2
4. ((SU.EXACT.EXPLODE("Crime") OR SU.EXACT.EXPLODE("Crime Prevention")))
5. TLAB,IF(arrest* OR arson* OR assault* OR batter* OR "bodily harm" OR burglar* OR "call* for service" OR (criminal NEAR/3 damage) OR convict* OR crim* OR delinquen* OR (dr*nk NEAR/5 driv*) OR (dangerous NEAR/5 driv*) OR (impair* NEAR/5 driv*) OR (influence NEAR/5 driv*) OR (intoxicat* NEAR/5 driv*) OR felon* OR fire*arm OR grafitti OR *gun OR gun* OR homicid* OR incarc* OR imprison* OR jail* OR (knife NEAR/2 crim*) OR (law NEAR/2 breaking) OR loot* OR murder* OR offen* OR pistol OR (public PRE/0 disorder) OR rape OR rapist OR raping OR revolor OR riot* OR shoplift* OR steal OR stolen OR theft* OR thieve* OR unlawful* OR vandal* OR violen* OR weapon))
6. #4 OR #5
7. #3 AND #6
8. TLAB,IF((barrier OR territoriality OR entrance* OR lock* OR *lock OR alarm* OR grilles OR surveillance OR guardian*) NEAR/5 (arrest* OR arson* OR assault* OR batter* OR "bodily harm" OR burglar* OR "call* for service" OR (criminal NEAR/3 damage) OR convict* OR crim* OR delinquen* OR (dr*nk NEAR/5 driv*) OR (dangerous NEAR/5 driv*) OR (impair* NEAR/5 driv*) OR (influence NEAR/5 driv*) OR (intoxicat* NEAR/5 driv*) OR felon* OR fire*arm OR grafitti OR *gun OR gun* OR homicid* OR incarc* OR imprison* OR jail* OR (knife NEAR/2 crim*) OR (law NEAR/2 breaking) OR loot* OR murder* OR offen* OR pistol OR (public PRE/0 disorder) OR rape OR rapist OR raping OR revolor OR riot* OR shoplift* OR steal OR stolen OR theft* OR thieve* OR unlawful* OR vandal* OR violen* OR weapon))
9. #7 OR #8

The sequence of searching the databases was thus:

1. Controlled vocabulary for access control term
2. Natural language for access control terms (title, abstract, keywords)
3. #1 OR #2
4. Controlled vocabulary for crime terms
5. Natural language for crime terms (title, abstract, keywords)
6. #4 OR #5
7. #3 AND #6
8. Natural language for general access control terms related to crime terms (title, abstract, keywords)
9. #7 OR #8

Appendix 2: Search terms for other sources

The following terms were used when searching other sources.

1. alley-gat*  
2. alleygat*  
3. back yards and crime  
4. backyard* and crime  
5. backyard* and burglar*  
6. alleys and crime  
7. alleys and burglar*  
8. burglary and reduc* and gates  
9. target hardening and burglary and gates  
10. crime prevention and gates

Appendix 3: Experts consulted as part of this review

Professor Rachel Armitage, University of Huddersfield.  
Professor Colin Rogers, University of South Wales.

Appendix 4: Narrative review of studies eligible for meta-analysis

Adamson (2005) and Sturgeon-Adams, Adamson and Davidson (2005)

Adamson and colleagues describe the Hartlepool Strategic Development Project (SDP), part of the Home Office Reducing Burglary Initiative (see Hamilton-Smith, 2004). This initiative funded crime prevention activities in areas which had at least twice the national average number of recorded burglaries. This was a multi-agency project involving the police, local authority and other relevant agencies and groups (such as Residents Associations). Following analysis and consultation a set of factors were identified as contributing to the burglary problem. These included a significant number of offences being committed through the rear entrance of properties which were accessed through alleyways. The alleys also gave cover to, and exit routes for, offenders. A range of burglary reduction initiatives, including diversionary schemes for young people, alley-gates, target-hardening, property-marking and community development, were introduced into the SDP area. As part of the initiative a total of 14 gates were installed, aiming to protect 185 properties. A further 10 gates were installed in the next year as part of another funding package. The effectiveness of the programme was assessed by using burglary counts from 2 years prior to implementation in comparison with 1-2 and 3-4 years after installation. Changes in burglary associated
with the SDP were compared to burglary in a buffer zone of up to 600m and a control area similar in socio-economic characteristics.

Agar (2011)

Agar, writing on behalf of the Enfield Strategic Partnership, describes the ‘Safe As Houses’ domestic burglary reduction project in the London Borough of Enfield. This is an example of problem-oriented policing following the SARA method. Project partners include the Local Government, London Fire Brigade, Metropolitan Police and Local Community Safety Partnership. Analysis discovered that there were temporal and spatial burglary hotspots. A number of alleyway networks led to persistent chronic hotspots, and while repeat victimisation was low (10%), there was a very high incidence of near repeat burglaries (Bowers and Johnson, 2004). In addition, there were very low detection rates of offenders, and the arrest of notable offenders had no impact on overall burglary rates. A range of crime prevention interventions, including physical measures to harden properties such as locks on windows and doors, were implemented as part of the project. Alley-gating was implemented by the local council in selected areas where rear entry burglaries were found to concentrate, with 88 gates in total. To assess the impact of alley gating, the number of burglaries in the streets with alley-gates was compared with those streets in the borough without the initiative, as well as with the number of offences in the previous year.


Bowers and colleagues analysed the effect of alley gates in the city of Liverpool. Implementation of the alley gates was gradual, with a total of 3,178 gates installed over a period of three-years (1st January 2000 - 31st June 2003). On completion, 108 housing blocks were protected by alley gating, with each block typically containing 362 properties. In order to analyse the effect of the alley-gates, police recorded burglary data were collected from 1st January 1998 – 31st December 1999 to provide a historical comparison. The comparison area was the wider police force area in which the scheme was located, minus 200m buffer zones. The limited amount of time after the installation of some gates meant that those which had been installed earlier were used to allow 6 month and 12 month comparisons to be conducted. The authors also analysed the intensity of alley-gate implementation upon burglary reduction. Finally, they sought to identify evidence of any spatial displacement or diffusion of benefits by assessing the number of burglaries in the buffer zones, as well as any tactical displacement by offenders by comparing the modus operandi employed.

Kay et al - Selly Oak Strategic Development Project (2002)

The Selly Oak SDP, located south-west of Birmingham city centre, had a burglary rate of almost six times the national average. The area was characterized by large numbers of students living in private rented accommodation. High turnover of residents and the hours of occupation kept by the students meant that strangers could pass-by unnoticed and natural surveillance was low. The alleyways were often used for access due to the conversion of front rooms of Victorian houses into extra bedrooms for students. The alleyways themselves were often unkempt and contained overgrown foliage giving burglars further protection from surveillance and omitting a sense of lack of ownership. A suite of interventions was put in place to tackle the problem, including property
marking, a street watch scheme, the provision of incentives for landlords to better maintain their properties, and alley-gating to prevent access for offenders. A total of 103 alleyways were fitted with self-closing and self-locking gates between January 2000 and June 2000. The impact of the package of interventions was evaluated by assessing the number of burglaries in the target area compared to buffer zones and a reference area, chosen to match the target area in socio-demographic characteristics. An economic analysis was also conducted to assess whether the interventions were cost effective.

**Thompson et al. - Fordbridge Strategic Development Project (2002)**

The Fordbridge SDP in Solihull, West Midlands, was implemented after the burglary rate in this area was found to be over three times the national average. The project involved multiple agencies including the police, environmental services, housing authority and community safety partnerships. Analysis showed that Fordbridge had a particular problem with drug-addicted youths committing a large number of offences, and that poorly-protected homes and alleyways allowed easy access for offenders. A package of interventions, including target hardening for individual houses, improved street lighting, youth diversion projects, and alley-gating, was put in place to tackle the burglary problem. Forty-four alley-gates were installed in 19 residential locations which were identified as being particularly problematic after consultation with police and local residents. The alley-gates were installed in two separate periods, with the first package of three gates installed in autumn 1999 and the second raft of 41 gates installed in spring 2000. The impact of the package of interventions was evaluated by assessing the number of burglaries in the target area compared to buffer zones and a reference area, chosen to match the target area in socio-demographic characteristics. An economic analysis was also conducted to assess whether the interventions had been cost effective.

**Thompson et al - Stirchley Strategic Development Project (2002)**

The Stirchley SDP, located in Selly Oak ward of Birmingham, 5 kilometers south-west of the city centre, was initiated after the area had over twice the national average number of burglaries. An initial analysis showed that the two areas targeted by the SDP accounted for 26% of all burglaries in the police beat area. In the SDP, 80% of burglaries were committed by offenders who had accessed the property from the rear, often through a series of inter-connecting alleyways. Some alley-gates already existed but were of poor quality and were easily bypassed through climbing under or over, or opening with a kick. Other fences erected at the rear of properties by residents were unable to provide sufficient security against offenders. This project was mainly led by the police and city council, with the latter taking main responsibility for the installation of alley gates. A package of interventions was chosen to reflect the needs of the area, including more fencing, property marking, and the fitting of alley-gates. In total 63 gates and 43 gate headers were installed between July 2000 and December 2000, protecting 583 properties. Delays were experienced in the installation of several alley gates due to failure to secure agreement from affected residents. Public meetings between the police, council and residents and close working with local Neighbourhood Watch coordinators was identified as facilitating alley gate installation. The impact of the package of interventions was evaluated by assessing the number of burglaries in the target area compared to buffer zones and a reference area, chosen to match the target area.
area in socio-demographic characteristics. An economic analysis was also conducted to assess whether the suite of interventions was cost effective.

Appendix 5: Meta-analytic formulae

Proportional change analysis

To compute confidence intervals:

\[ ES_i = \frac{p}{k} \]  

(1)

\[ SE_i = \sqrt{\frac{p(1-p)}{n}} \]  

(2)

\[ \omega_i = \frac{1}{SE_i^2} \]  

(3)

Where,  

- \( ES_i \) is the measure of effect size for study location i
- \( SE_i \) is the standard error of the estimate
- \( \omega_i \) is the inverse variance weight
- \( n \) is the count of crime pre-intervention
- \( p \) is the proportional change

To compute an overall weighted measure of effect size we use the equation:

\[ \bar{ES} = \frac{\sum_{i=1}^{n} \omega_i \cdot ES_i}{\sum \omega_i} \]  

(4)

Odds ratios

The odds ratio is computed as follows:

\[ OR = \frac{Trt_{before} \times Ctrl_{after}}{Trt_{after} \times Ctrl_{before}} \]  

(5)

For computational reasons, the standard error (SE) is calculated for the natural logarithm of the OR (\( LOR = \log_e(OR) \)) rather than the raw OR. The formula for computing the SE for \( LOR \) is as follows (IF is an inflation factor, see below):

\[ SE_{LOR} = \sqrt{\frac{1}{Trt_{before}} + \frac{1}{Trt_{after}} + \frac{1}{Ctrl_{before}} + \frac{1}{Ctrl_{after}}} \times 2 \]  

(6)

Confidence intervals are then computed in the usual way (by multiplying the SE by 1.96 and adding and subtracting this value from the LOR to get the upper and lower estimates of the interval) and the estimates are then exponentiated as logged values can be difficult to understand.
**Estimating mean effect sizes**

To do this, we first computed the inverse variance weights for each OR using the formula shown in (3). The weighted mean effect size is then simply:

\[
\overline{OR} = \frac{\sum (\omega_i \times \text{LOR}_i)}{\sum \omega_i}
\]  

(7)

The above (fixed effects) formula assumes that any variation in effect sizes observed across locations (or studies) is due to sampling error alone. However, it is also possible that there is real variation across studies (e.g. due to contextual differences). To account for this, we use a random effects model to compute the weighted mean effect size (see, Lipsey & Wilson, 2001), this essentially serves to increase the estimated standard error of the estimates.

**Appendix 6: List of alley gating-related studies identified through our systematic searches (n = 43)**


