Report prepared for Brå by Eric L. Piza, Brandon C. Welsh, David P. Farrington and Amanda L. Thomas

CCTV and Crime Prevention

A new Systematic Review and Meta-Analysis

brå

Swedish National Council for Crime Prevention

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A New Systematic Review and Meta-Analysis

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Brå – a centre of knowledge on crime and measures to combat crime

The Swedish National Council for Crime Prevention (Brottsförebyggande rådet – Brå) works to reduce crime and improve levels of safety in society by producing data and disseminating knowledge on crime and crime prevention work and the justice system's responses to crime.

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Foreword

Closed circuit television surveillance (CCVT) is a commonly used and equally commonly debated method for preventing crime. Technological developments have contributed to a constant growth in the use of CCTV, and the body of research on the effects is also expanding. This systematic review examines the best available research up to this point to answer the question: does CCTV prevent crime?

There are never sufficient resources to conduct rigorous evaluations of all the crime prevention measures employed in an individual country such as Sweden. Nor are there resources to conduct scientific studies of all of the possible effects produced by different measures against crime and unsafety. For these reasons, the Swedish National Council for Crime Prevention (Brå) has commissioned distinguished researchers to conduct a series of international reviews of the research published in these fields.

In 2007 Brå published a systematic review on the effects of CCTV, based on 44 studies which at that time were available and efficient enough to be included. This report comprises an updated review, with now includes a total of 80 studies. In focus are the effects of CCTV on levels of crime. The work has been conducted by Professor Eric L. Piza at John Jay College of Criminal Justice, (USA), Professor Brandon C. Welsh at Northeastern University (USA), Professor David P. Farrington at the University of Cambridge (UK), and Amanda L. Thomas at John Jay College of Criminal Justice (USA).

The study follows the rigorous methodological requirements of a systematic review and statistical meta-analysis. The analysis combines the results from a substantial number of studies that are considered to satisfy a list of empirical criteria for measuring the effects as reliably as possible. Even though important questions remain unanswered, the study provides a vital and far-reaching overview to date of the preventive effects of CCTV.

Stockholm, June 2018

Erik Wennerström
Director-General

Acknowledgments

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We also thank the CCTV evaluation authors who provided data and/or clarified report findings, as well as helped us locate additional evaluation studies for this report: Anabel Cerezo, Emirham Darcan, Martin Gill, Manne Gerell, Nancy LaVigne, Hyungjin Lim, Tae-Heon Moon, Jerry Ratcliffe, and Nick Scott. We identified a number of foreign language studies in our search and are grateful to our colleagues who assisted by reviewing these studies to determine their selection eligibility and code the variables of interest: Veroni Eichelsheim, Manne Gerell, Hyungjin Lim, Martine Rondeau, and Victoria Sytsma. We also thank Phyllis Schultze of the Gottfredson Library at the Rutgers University School of Criminal for assisting us in developing our search strategies and providing full-text versions of articles we were unable to locate.

Lastly, two of us (Piza and Thomas) are new additions to the research team and we want to express our gratitude to Welsh and Farrington for giving us the opportunity to contribute to this effort. We are honored to have played a role in contributing to the evidence-base on the role of CCTV in preventing crime. We also thank Anthony Braga for making the introductions that led to this collaboration.

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Summary

This report updates the systematic reviews and meta-analyses of the crime prevention effect of closed-circuit television (CCTV) conducted by Welsh and Farrington (2002, 2007, 2009). We build upon the important insights generated by the prior reviews while posing new questions on the effect of CCTV as a crime prevention strategy. We began our study through a rigorous approach for locating, appraising, and synthesizing evidence from prior evaluation studies.

The search process resulted in the collection of 36 new evaluations of CCTV that met the inclusion criteria. In considering these new evaluations alongside those included in the last review (Welsh and Farrington, 2007, 2009), the present review includes 80 distinct evaluations of CCTV. This represents an approximately 82% increase from the 44 studies included in the last review. Of the 80 included studies, 76 provided the requisite data to be included in the meta-analysis.

Our meta-analysis generated a number of findings that both replicate and build upon those of the last review, including:

- Overall, CCTV is associated with a modest but significant decrease in crime.
- The effect of CCTV was largest and most consistently observed in car parks. However, findings suggest that more settings may be amenable to CCTV than previously thought, as crime reductions were also observed in residential areas.
- Of the six countries where CCTV was evaluated, CCTV showed the strongest evidence of effectiveness in the UK.
- Of the five primary crime types tested in the CCTV evaluations, property crime, vehicle crime, and drug crime exhibited statistically significant reductions.
- The manner by which public safety agencies use CCTV is an important consideration. Actively monitored systems and programs deploying CCTV in conjunction with multiple other interventions generated larger effect sizes than their counterparts.

The findings of this review have implications for researchers, policymakers, and practitioners. Overall, we can conclude that CCTV reduces crime to a certain degree and that these effects are most pronounced within certain environments. The research evidence also supports the notion that CCTV should be deployed not as a "stand-alone" intervention, but rather as one component of a comprehensive strategy involving multiple interventions. For the research community, we see opportunities for the further improvement of the evidence base. Researchers can increase the rigor of CCTV

evaluations by emphasizing the use of rigorous quasi-experimental evaluations and creatively generating opportunities for randomized experiments. Furthermore, researchers should move beyond the singular research question of "Does CCTV Work?" and attempt to isolate the programmatic, societal, and geographic factors associated with CCTV effect.

Introduction

Recent decades have seen the emergence of CCTV as a mainstream crime prevention tactic around the world. Whereas video surveillance systems were once limited to indoor retail environments and office buildings, public officials have invested heavily in video surveillance technology to monitor public places. The tactic's rise can be traced to Great Britain, where three-quarters of the Home Office budget was allocated to CCTV-related projects from 1996 to 1998 (Armitage, 2002). Such policy decisions increased dramatically the number of CCTV systems in Britain from approximately 100 in 1990 (Armitage, 2002) to over four million less than two decades later (Farrington et al., 2007a). Cities throughout the United States have likewise made substantial investments in CCTV. According to the most recently available estimates, 49% of local police departments in the United States report using CCTV, with usage increasing to 87% for agencies serving jurisdictions with populations of 250,000 or more (Reaves, 2015).

Public safety agencies may invest in CCTV for a number of reasons, such as to assist in the detection and retroactive investigation of crime or promote increased use of public spaces (Gill & Spriggs, 2005; Ratcliffe, 2006). However, a review of the literature suggests that the primary anticipated benefit of CCTV is the prevention of crime, as the majority of empirical evaluations test CCTV's effect by measuring crime level changes from "pre" to "post" camera installation periods. While such a research agenda seems to reflect an emphasis on deterrence effects (Piza et al., 2014a)the relationship between CCTV and deterrence has been left iPiza, E. L., Caplan, J. M., & Kennedy, L. W. (2012, CCTV can prevent crimes through other mechanisms (Welsh & Farrington, 2007). For example, Pawson and Tilley (1994) offered nine potential mechanisms by which CCTV can impact crime, while Gill and Spriggs (2005) offered a truncated list of five mechanisms. Similarities appear across these works, with increased offender apprehension, increased natural surveillance, publicity, and improved citizen awareness identified as potential causes of crime reduction by both Pawson and Tilley (1994) and Gill and Spriggs (2005). CCTV further has the potential to assist police post-crime commission, specifically by improving the response of personnel to emergencies (Ratcliffe, 2006), providing visual evidence for use in criminal investigations (Ashby, 2017), and securing early guilty pleas from offenders (Owen et al., 2006). With various preventative mechanisms and potential uses, CCTV can be considered a situational crime prevention strategy (Clarke, 1997), as the potential benefits provided by CCTV will be contingent on the

precise circumstances of the crime problem it is deployed to address. We must also acknowledge the possibility for CCTV to increase crime, as CCTV can detect crimes that would have otherwise gone unreported to police (Winge & Knutsson, 2003) or make citizens more vulnerable by providing a false sense of security, causing them to relax their vigilance or stop taking precautions in public settings (Welsh & Farrington, 2007).

Background

During the early expansion of CCTV, many scholars attributed the vast rise of the technology to political motivation and public enthusiasm. Painter and Tilley (1999) argued that CCTV's rise in Britain was due to the "surface plausibility" of the measure and the political benefits officials expected from "being seen to be doing something visible to widespread concerns over crime…" (p. 2). Pease (1999) commented on the popularity of CCTV and how small a role evaluation played in its expansion: "Crime reduction has been bedeviled by the tendency to polarize measures into those which will be helpful in all circumstances and those which will not be helpful in any, a process that the evaluative process has often mirrored and accelerated. In recent years…closed circuit television (CCTV) has sadly fallen into the first category" (p. 48). Pease further lamented that policymakers seemingly did not readily consult the scientific evidence when considering the adoption of CCTV, stating "one is tempted to ask where rigorous standards went into the headlong rush to CCTV deployment" (p. 53).

While research on CCTV was once sparse, the state of the literature can no longer be described as such. The number of CCTV evaluations has increased significantly over time. Furthermore, while public surveillance research has been previously described as methodologically weak, with over 55% of studies using less than a comparable experimental-control design (Welsh et al., 2011), rigorous designs have increasingly been incorporated in the study of CCTV. We now have several examples of researchers using randomized field trials to test the effect of interventions deploying cameras as a stand-alone crime deterrent (Hayes and Downs, 2011; La Vigne and Lowry, 2011) or as part of proactive place-based patrol strategies (Piza et al., 2015). Others have used sophisticated matching techniques in the absence of randomization to help ensure statistical equivalence between treatment and control groups (Farrington et al., 2007a; Piza, 2018a). Researchers have also taken advantage of opportunities afforded by naturally occurring social occurrences to reduce problems of endogeneity (i.e. when the allocation of surveillance cameras is correlated with unobserved factors that determine crime) when evaluating CCTV (Alexandrie, 2017). As a result, the CCTV literature has become robust, offering a great deal of insight to both the research community and practice agencies considering the adoption of video surveillance technologies.

Systematic reviews and meta-analyses conducted by Welsh and Farrington (2002, 2007, 2009) synthesize the empirical knowledge on

CCTV. The initial review (Welsh and Farrington, 2002) included 22 evaluations and found that CCTV had a small, but significant, effect on vehicle crimes and no effect on violent crimes. The most recent review (Welsh and Farrington, 2007, 2009) included 44 evaluations and examined the effect of CCTV across four main settings: city and town centers, public housing, public transport, and car parks. The pooled effects (across all studies) showed an overall 16% drop in crime. However, the crime reduction was driven by a 51% reduction in the car parks schemes, with the CCTV systems in the other settings having small and non-significant effects on crime.

Following the systematic reviews of Welsh and Farrington, Alexandrie (2017) reviewed seven randomized or natural experiments on CCTV, finding that CCTV reduced crime between 24 to 28% in public streets and urban subway stations, but had no desirable effect in parking facilities or suburban subway stations. The findings of Alexandrie (2017) diverged somewhat from those of Welsh and Farrington (2002, 2007, 2009). Alexandrie (2017) identified the smaller effect sizes associated with quasi-experiments, varying study settings (i.e., countries), and differing integration with police practices as contextual factors that could explain this divergence. However, we must also acknowledge the likely effect of the small sample size of Alexandrie (2017), with seven studies representing a small proportion of the of overall knowledge base on CCTV.

Recent developments in research on and use of CCTV point to the need for an updated review and meta-analysis, which we present in this report. Our review builds upon the insights provided by Welsh and Farrington (2002, 2007, 2009) while posing new questions on the effect of CCTV as a crime prevention strategy. Our study methodology is discussed in the next section. We conclude the report with a presentation of findings and discussion of their implications for CCTV policy and research.

Research Methods

Criteria for inclusion of evaluation studies

In following the methodology of systematic reviews (Welsh et al., 2013), we incorporated a rigorous approach for locating, appraising, and synthesizing evidence from prior evaluation studies. Studies were selected for inclusion in the review according to the following 4 criteria (Welsh and Farrington, 2002, 2007, 2009).

1) *CCTV was the main focus of the intervention*. For evaluations involving one or more other interventions, only those evaluations in which CCTV was the main intervention were included. We determined the main intervention based upon the author's identification of such. When the authors did not explicitly identify the main intervention, we based this determination on the importance the report gave to CCTV relative to the other interventions.
2) *The evaluation used an outcome measure of crime*.[1,2]
3) *The research design involved, at minimum, before-and-after measures of crime in experimental and control areas*. This is widely accepted as the minimum interpretable research design (Cook and Campbell, 1979; Farrington et al., 2002).
4) *Both the treatment and control areas experienced at least 20 crimes during the pre-intervention period*. Any study with less than 20 crimes in the pre-intervention period would lack the sufficient statistical power to detect changes in crime.

[1] We originally planned on expanding this criterion by including studies that measured citizen fear of crime as well. However, given that raw data was unavailable for a very high proportion of studies, our main focus for this review remained crime. Nonetheless, a meta-analysis of the handful of studies reporting sufficient fear data is included in sections A1 and A2 of the appendix.

[2] It should be noted that certain studies include outcome measures of criminal activity that were not derived from police records. Sivarajasingam et al. (2003) included emergency room visits as well as police records to measure incidents of assault injury. We considered both measures in our calculation of effect size. Reid and Andresen (2014) used insurance data along with police recorded data to evaluate vehicle crime in a car park system. However, the insurance data totaled less than 20 incidents during the pre-intervention period in the experimental area, so this measure was excluded from our analysis.

Search strategies

We incorporated five search strategies to locate studies for inclusion in this review.[3]

1) *Searches of electronic bibliographic databases*. In total, 11 bibliographic databases were searched using relevant key words:[4] Criminal Justice Abstracts, CrimeSolutions.gov, National Criminal Justice Reference Service (NCJRS) Abstracts, Sociological Abstracts, Educational Resources Information Clearinghouse (ERIC), Google Scholar, Government Publications Office Monthly Catalogue (GPO Monthly), Psychology Information (PsychInfo), Proquest Dissertation & Theses Global, Rutgers Gottfredson Library gray literature database, and the Campbell Collaboration virtual library (www.campbellcollaboration.org/library).

2) *Manual searches of CCTV evaluation study bibliographies*. As our search progressed, we conducted manual searches of the references section of each study identified for potential inclusion. This was done in order to identify cited research that may fit the inclusion criteria.

3) *Manual searches of other CCTV study bibliographies*. We conducted manual searches of the following theoretical articles, policy essays, qualitative studies, and literature reviews published since Welsh and Farrington (2007) that either directly or tangentially related to CCTV: Alexandrie (2017); Adams and Ferryman (2015); Augustina and Clavell (2011); Hempel and Topfer (2009); Keval and Sasse (2010); Hollis et al. (2011); Lett et al. (2012); Lorenc et al. (2013); Gannoni et al. (2017); Piza (2018b); Taylor (2010); Welsh et al. (2015); Woodhouse (2010).

4) *Forward searches of CCTV evaluations*. We used Google Scholar to conduct forward searches of all evaluation studies identified in the prior reviews (Welsh and Farrington, 2002, 2007, 2009) as well as during our updated search. Through this process, we obtained all articles that cited a study included in this updated review and manually reviewed their references section.

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[3] Phyllis Schultze of the Gottfredson Library at the Rutgers University School of Criminal Justice provided assistance to us throughout the project. At the outset, Ms. Schultze assisted us in developing our search strategies. As we conducted the search, she provided further assistance by making available full-text versions of articles we were unable to collect and contacting CCTV evaluation authors and librarians at other universities to obtain titles not housed at the Rutgers library.

[4] The following search terms were used: CCTV, Closed-Circuit Television, Video Surveillance, Public Surveillance Formal Surveillance, Video Technology, Surveillance Cameras, Camera Technology, and Social Control. Each of these terms was searched on their own and in conjunction with (i.e. "AND") the following terms: crime, public safety, evaluation.

5) *Contacts with leading researchers*. The names of the researchers we contacted can be found in the acknowledgments.

These search strategies identified 71 CCTV evaluations conducted since the publication of Welsh and Farrington (2007).[5] Thirty-two studies did not meet the inclusion criteria and were thus excluded. An additional three studies met the criteria but were excluded because they presented findings that were redundant to those presented in other research.[6] All excluded studies are denoted with x in the references section.

This process resulted in the collection of 36 new evaluations of CCTV that met the inclusion criteria.[7] In considering these new CCTV evaluations alongside those included in the last review (Welsh and Farrington, 2007, 2009), the present review includes 80 distinct evaluations of CCTV. This represent an approximately 82% increase from the 44 studies included in the last review. Of the 80 included studies, 76 provided the requisite data to be included in the meta-analysis. See A3 through A7 in the appendix for a list of all included studies. Included studies are denoted with * in the references section.

Analytical approach

We use the Odds Ratio (OR) as the measure of effect size for each study. The OR is based on the number of crimes in the experimental and control areas before and after the intervention. This makes OR the ideal effect size for CCTV reviews, as before/after crime counts are the only outcome measures regularly provided in these evaluations. The OR is calculated via the following formula:

$$OR = (a \cdot d) / (b \cdot c)$$

where a, b, c, and d each represent numbers of crimes, derived from the following table:

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[5] We were unable to obtain an evaluation of CCTV in Cairns, Australia, conducted by Pointing et al. (2010). Therefore, we were unable to determine if this study fit the criteria.

[6] Caplan et al. (2011) and Piza et al. (2014b) presented a preliminary analysis of the first wave of cameras and a micro-level analysis of individual camera sites in Newark, NJ, respectively. Given that effect of Newark's fully deployed system was evaluated by Piza (2018a), both Caplan et al. (2011) and Piza et al. (2014b) were excluded in favor of this study. Similarly, Waples et al. (2009) analyzed systems included in Gill & Sprigg's (2005) national evaluation of CCTV in the UK and was thus excluded. Lim (2015) was excluded in favor of the peer-reviewed version of this same evaluation (Lim and Wilcox, 2017).

[7] One study (Darcan, 2012) did not report the crime counts for the control areas. We contacted the author, who was unable to provide us with the necessary data to calculate program effect sizes. This study was excluded from the meta-analysis.

Area	Before	After
Experimental	a	b
Control	c	d

Interpretation of the OR is straightforward, as it indicates the proportional change in crime in the control area as compared with the experimental area. The obtained value represents the strength and direction of the program effect. An OR > 1 indicates a desirable effect on crime in the experimental area relative to the control area, while an OR < 1 indicates an undesirable effect. For example, in the Doncaster city center evaluation (Skinns, 1998) the OR was calculated from the values in the following table:

Area	Before	After
Experimental	5,832	4,591
Control	1,789	2,002

with the formula returning a value of 1.421 [(5,832 · 2,002) / (4,591 · 1,789)]. The OR of 1.421 indicates that crime increased by 42% in the control area as compared with the experimental area in Doncaster. The inverse of the OR communicates the crime difference within the experimental area. In Doncaster, the OR of 1.42 indicates that crime decreased by approximately 30% (1/1.421 = 0.703) in the experimental area as compared to the control area.

The variance of the OR is calculated from the variance of LOR (the natural logarithm of OR). The typical calculation of variance is as follows:

$$V(LOR) = 1/a + 1/b + 1/c + 1/d.$$

This estimation of variance is based on the assumption that the total numbers of crimes (a, b, c, d) follow a Poisson distribution. However, much research suggests that extraneous factors that influence crime totals may cause overdispersion. Said differently, the variance of the number of crimes (VAR) exceeds the actual number of crimes (N). Where there is overdispersion, V(LOR) should be multiplied by D. By estimating VAR from monthly crime counts, Farrington et al. (2007a) found the following equation:

$$D = 0.008 \cdot N + 1.2$$

In order to obtain a conservative estimate, V(LOR) calculated from the usual formula above was multiplied by D in all cases.

Following the calculation of these measures, we inputted the OR, LOR, and V(LOR) for each evaluation in BioStat's Comprehensive Meta-Analysis software (version 3.0) to conduct the meta-analysis of

effect sizes. We calculated the pooled effect from the overall sample of evaluations. We then conducted five subsequent meta-analyses using variables of interest as categorical moderators to compare effect sizes across sub-populations of evaluations: setting, crime type, monitoring type, the use of other interventions, and country. We conducted all analyses as random effects models under the assumption that effect sizes are heterogeneous across individual evaluations as well as sub-populations of evaluations (Lipsey and Wilson, 2001). In each case, observed Q statistics and associated p values supported this assumption, demonstrating significantly heterogeneous effect sizes across studies.

In this review, we pay particular attention to the potential influence of outcome measures on observed effect sizes. As discussed by Braga et al. (2018: p. 12), social scientists commonly do not prioritize examined outcomes, considering the lack of prioritization good practice. However, this complicates the presentation of findings as the choice of reporting one outcome over others may present misleading results (Braga et al., 2018). This is an important issue in this review, as the newly identified evaluations seem to analyze a much wider range of outcomes than earlier CCTV research. We conduct our meta-analyses via three approaches. First, all reported outcomes are summed in order to present an overall average effect size statistic. This is a conservative measure of the effect of CCTV. Second, the largest reported effect size for each study is used, which presents a "best-case" upper bound estimate of the effects of CCTV. Third, we used the smallest reported effect size for each study to provide a highly conservative measure of CCTV effect. We should note that this measure likely underestimates the effect of CCTV on crime. Nonetheless, we present it as a lower bound estimate of our findings.

Also relevant to this review are the issues of spatial displacement and diffusion of benefits. Displacement is commonly defined as the unintended increase in crime in other locations following from the introduction of a crime prevention program in a targeted location (Repetto, 1976). While the literature has identified five distinct forms of displacement (Barr and Pease, 1990) spatial displacement poses a particular threat to place-based crime prevention efforts such as CCTV (Guerette and Bowers, 2009) Diffusion of benefits has often been referred to as the "opposite" of displacement: an unintended decrease in crimes not directly targeted by the intervention (Clarke and Weisburd, 1994). In order to investigate these topics, the minimum design should involve one experimental area, one adjacent comparable control area, and one non-adjacent comparable control area. If crime decreased in the experimental area, increased in the adjacent area, and stayed constant in the control area, this might be evidence of displacement. If crime decreased in the experimental and

adjacent areas and stayed constant or increased in the control area, this might be evidence of diffusion of benefits. Fifty (65.8%) studies included in this review included the necessary designs to measure the occurrence of displacement or diffusion of benefits.[8]

[8] We should note that because displacement and diffusion of benefits are typically seen as responses to successful crime prevention efforts, it may not make sense to look for evidence of such absent a significant crime reduction (Clarke & Eck, 2005: step 51). This may explain why a higher proportion of the CCTV evaluations did not attempt to estimate displacement/diffusion effects.

Results

Pooled effects

Figure 1 displays the results of the meta-analysis of effect sizes across the 76 studies. Overall, the OR for the CCTV studies was 1.141 ($p<0.001$), which indicates a modest but significant crime prevention effect. The percentage crime change, the OR, suggests that crime decreased by approximately 13% (1/1.141 = 0.876) in CCTV areas compared to control areas. These results do not qualitatively differ from the largest and smallest effect size analyses, with statistically significant ORs of 1.205 ($p<0.001$) and 1.079 ($p = 0.026$) reported, respectively.

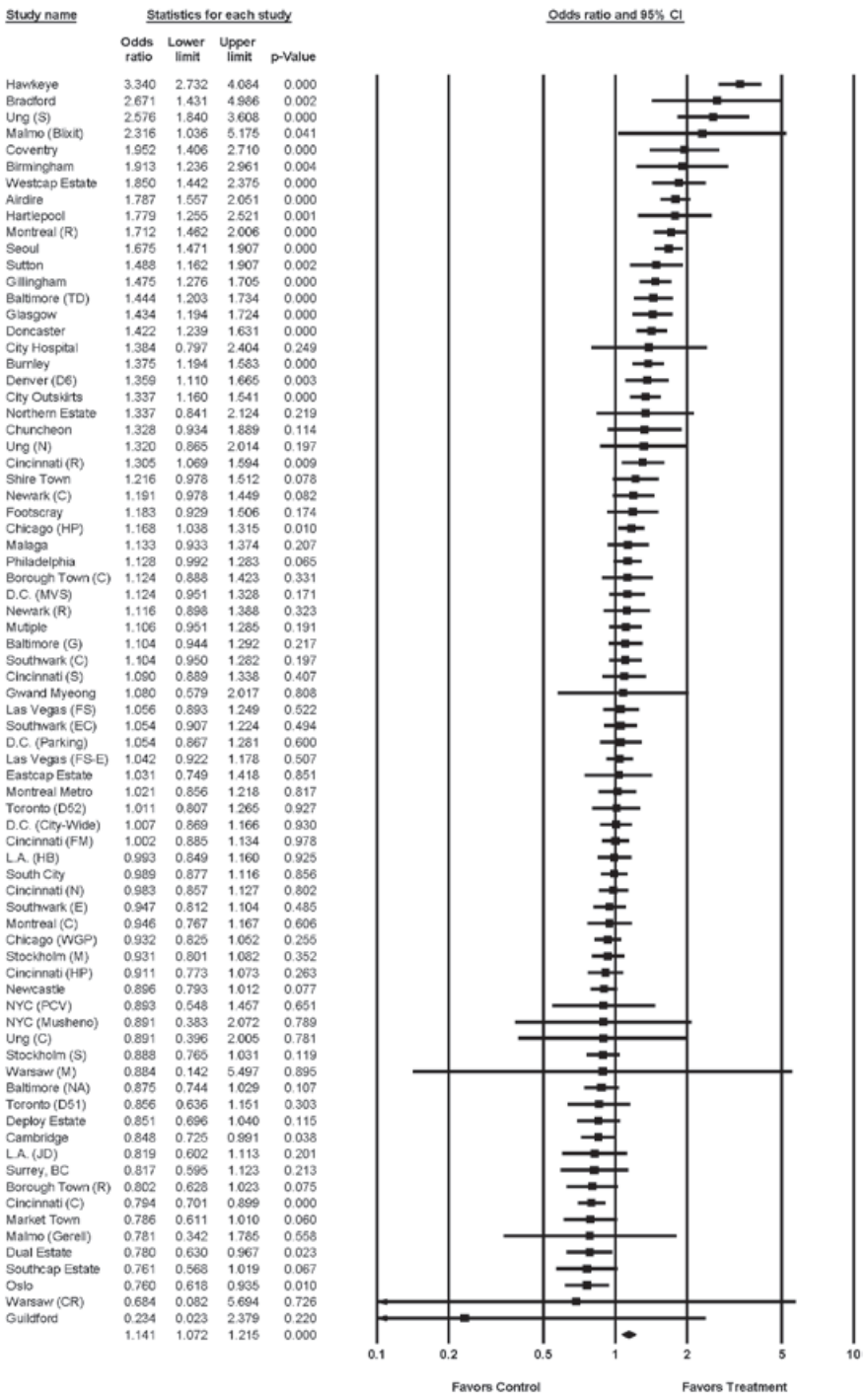
Setting

In following prior CCTV reviews, we turn our attention to the differing effect of CCTV across various geographic settings (see Table 1). Used as an effect size moderator in the meta-analysis, six categories comprised the setting variable: car park, city/town center, housing,[9] residential, public transport, and other setting. In the prior CCTV reviews, residential was included as part of the "other" category given that only two CCTV evaluations were conducted in this setting. However, our literature search identified 16 additional CCTV evaluations conducted in residential areas. Residential was the second most common study setting (n = 16) behind city/town center (n = 33). "Public transport" and "other"[10] settings were the most infrequent, with four and five evaluations, respectively. Keeping with the findings of the prior reviews, observed effects were largest in car parks. However, whereas most settings previously generated non-significant effects, significant crime reductions were generated in residential systems. Effects of CCTV were non-significant in the city/town center, housing, public transport, and "other" settings, echoing results of Welsh and Farrington (2007, 2009).

[9] Welsh and Farrington (2007, 2009) referred to the housing category as "public housing" given that all of the complexes in the identified evaluations were publicly owned. Our updated reviewed identified CCTV evaluations that were conducted in housing complexes that were privately owned and operated, rendering the "public housing" label inaccurate. Rather than treat the different types of housing complexes separately, we use the more generic label "housing" in reference to all evaluations of CCTV in housing complexes.

[10] It should be noted that two of the newly added studies (Kim, 2008; LaVigne et al., 2011[D.C.]) evaluated city-wide CCTV systems that could not be classified according to setting. These studies are included in the "other" category.

Figure 1: Forest plot of pooled effects



Note: Random effects model, Q = 553.130 , df = 75, p<0.001

Table 1: CCTV effects by setting

Category	N	Odds Ratio	Lower Limit	Upper Limit	*p*
Car park	8	1.588	1.054	2.394	0.027
City center	33	1.066	0.986	1.153	0.107
Housing	10	1.028	0.824	1.282	0.805
Residential	16	1.133	1.031	1.245	0.009
Public transport	4	1.370	0.822	2.284	0.227
Other	5	1.265	0.975	1.641	0.077

Note: Random effects model, Q=85.947, df=5, $p<0.001$

Car parks

Eight of the included evaluations were conducted in car parks (see A3 in the appendix for a full list of car park studies). All of the car park schemes deployed CCTV alongside other interventions, such as improved lighting, fencing, notices of CCTV, or security personnel. Five of the schemes reported that cameras were actively monitored by CCTV operators. Two reported passive schemes and one did not report information on the monitoring strategy. Follow-up periods in the car park projects averaged 12.75 months, with a low of 8 months and a high of 24 months.

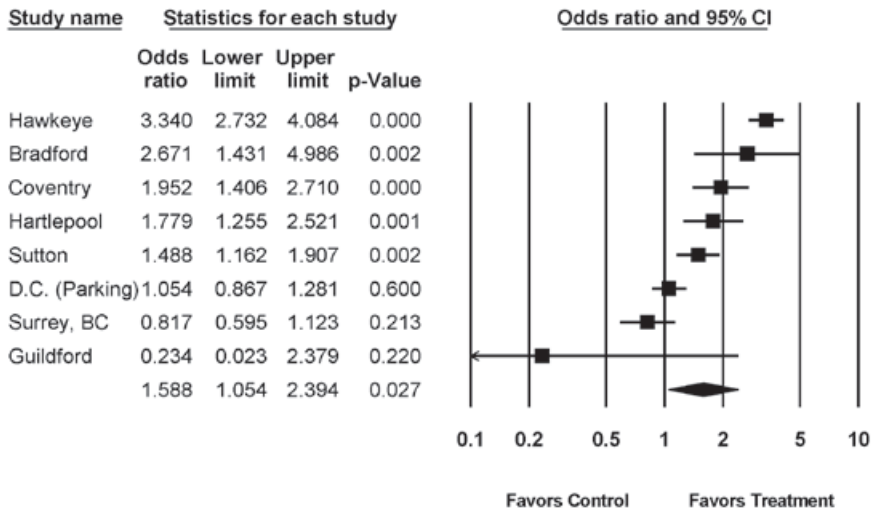
Five of the car park projects demonstrated statistically significant reductions in crime. The combined OR of the car park schemes was 1.588 ($p = 0.027$). Crime reduced by approximately 37% in experimental areas compared to control areas (see Figure 2). The upper and lower bounds suggested by the largest and smallest effect size analyses do not differ qualitatively. The smallest effect analysis found an OR of 1.620 while the largest effect analysis found an OR of 1.618.[11] ORs in both cases were statistically significant. Four of the car park evaluations tested for spatial displacement. Two found no evidence of either displacement or diffusion, one found evidence of displacement, and one found evidence of diffusion of benefits.

City and town centers

Thirty-three evaluations meeting the criteria for inclusion were conducted in city and town centers (see A4 in the appendix for a full list of city and town center studies). Since the last review, the number of

[11] La Vigne and Lowry (2011) was the only car park evaluation to report multiple outcome measures. For all other evaluations, the average, largest, and smallest effects were identical. This led to the counterintuitive finding of the smallest-effect meta-analysis having a larger OR than the largest-effect meta-analysis. This likely occurred due to the effect of the high variance on the random effects model findings in the lowest effect meta-analysis.

Figure 2: Forest plot of effect sizes in car parks

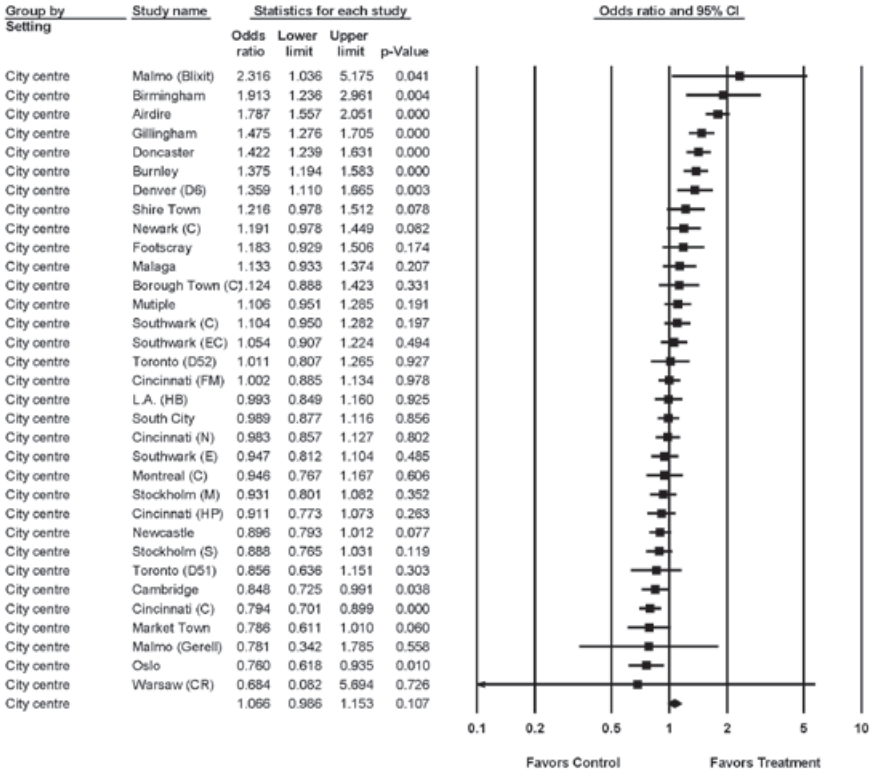


evaluations measuring the effect of CCTV in city and town centers increased by 45% since. Twelve (36.36%) of the schemes deployed CCTV alongside other interventions. A wide range of complementary interventions were reported, from improved lighting, increased police presence, community wardens, notices of CCTV, social improvement programs, and public "help points" to notify police. The vast majority (n = 24; 72.73%) of city and town center schemes reported the active monitoring of cameras. Six schemes reported passive monitoring and three studies did not report the necessary information for us to determine the monitoring type. The follow-up periods in city and town centers averaged 16.43 months with a low of two and high of 60.

Seven of the individual studies found positive effects, while three evaluations found evidence of undesirable effects (i.e. crime significantly increased in experimental areas compared to control areas). The remaining 23 evaluations generated non-significant effects. The pooled data from the city and town center evaluations indicates an OR of 1.066 (p = 0.107). While this suggests a small effect on crime, the OR did not achieve statistical significance (see Figure 3). The smallest-effect meta-analysis similarly generated non-significant findings (OR = 1.005, p = 0.896). Conversely, the largest-effect meta-analysis suggested a statistically significant crime reduction (OR = 1.21, p = 0.012). While not as robust as the observed reduction in the overall studies or within car parks, this suggests that CCTV may have positive effects in city or town centers when the upper bounds of effect are achievable. Twenty-three (71.88%) of the city and town center evaluations examined displacement or diffusion

of benefits. Of these observations, more than half (13) found no evidence of either displacement or diffusion. Six studies found evidence of diffusion of benefits, three found some evidence of displacement, and one study found evidence of both diffusion and displacement.

Figure 3: Forest plot of effects in city and town centers



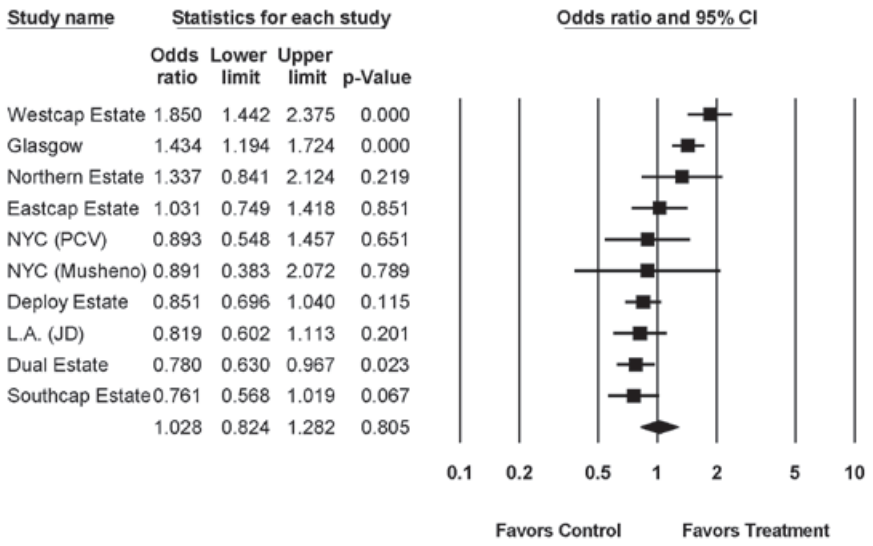
Group by Setting	Study name	Odds ratio	Lower limit	Upper limit	p-Value
City centre	Malmo (Blixit)	2.316	1.036	5.175	0.041
City centre	Birmingham	1.913	1.236	2.961	0.004
City centre	Airdire	1.787	1.557	2.051	0.000
City centre	Gillingham	1.475	1.276	1.705	0.000
City centre	Doncaster	1.422	1.239	1.631	0.000
City centre	Burnley	1.375	1.194	1.583	0.000
City centre	Denver (D6)	1.359	1.110	1.665	0.003
City centre	Shire Town	1.216	0.978	1.512	0.078
City centre	Newark (C)	1.191	0.978	1.449	0.082
City centre	Footscray	1.183	0.929	1.506	0.174
City centre	Malaga	1.133	0.933	1.374	0.207
City centre	Borough Town (C)	1.124	0.888	1.423	0.331
City centre	Mutiple	1.106	0.951	1.285	0.191
City centre	Southwark (C)	1.104	0.950	1.282	0.197
City centre	Southwark (EC)	1.054	0.907	1.224	0.494
City centre	Toronto (D52)	1.011	0.807	1.265	0.927
City centre	Cincinnati (FM)	1.002	0.885	1.134	0.978
City centre	L.A. (HB)	0.993	0.849	1.160	0.925
City centre	South City	0.989	0.877	1.116	0.856
City centre	Cincinnati (N)	0.983	0.857	1.127	0.802
City centre	Southwark (E)	0.947	0.812	1.104	0.485
City centre	Montreal (C)	0.946	0.767	1.167	0.606
City centre	Stockholm (M)	0.931	0.801	1.082	0.352
City centre	Cincinnati (HP)	0.911	0.773	1.073	0.263
City centre	Newcastle	0.896	0.793	1.012	0.077
City centre	Stockholm (S)	0.888	0.765	1.031	0.119
City centre	Toronto (D51)	0.856	0.636	1.151	0.303
City centre	Cambridge	0.848	0.725	0.991	0.038
City centre	Cincinnati (C)	0.794	0.701	0.899	0.000
City centre	Market Town	0.786	0.611	1.010	0.060
City centre	Malmo (Gerell)	0.781	0.342	1.785	0.558
City centre	Oslo	0.760	0.618	0.935	0.010
City centre	Warsaw (CR)	0.684	0.082	5.694	0.726
City centre		1.066	0.986	1.153	0.107

Housing

Ten evaluations meeting the inclusion criteria were conducted in housing complexes (see A5 in the appendix for the full list of housing studies). Five of the housing systems deployed complementary interventions along with CCTV. One housing scheme also added door alarm monitoring and electronic access into building entrances and another deployed CCTV alongside a police-led gang injunction and task force. Two housing schemes evaluated by Gill and Spriggs (2005) involved youth inclusion projects (Southcap Estate and Westcap Estate) while another (Eastcap Estate) installed improved lighting. Nine of the housing schemes reported actively monitored systems and one did not explicitly report the monitoring strategy. The follow-up periods in the housing systems averaged 10.13 months with a low of three months and high of 12 months.

Only two of the ten housing schemes reported statistically significant reductions in crime. As displayed in Figure 4, the pooled effects of the housing schemes suggest a non-significant effect, with an OR of 1.028 that failed to achieve statistical significance (p = 0.805). Both the smallest effect (OR = 0.992, p = 0.940) and largest effect (OR = 1.056, p = 0.663) meta-analyses similarly generated non-significant results. Despite the lack of widespread crime reductions, six of the ten housing evaluations did test for displacement. All six of these evaluations found no evidence of displacement or diffusion of benefits.

Figure 4: Forest plot of effects in housing



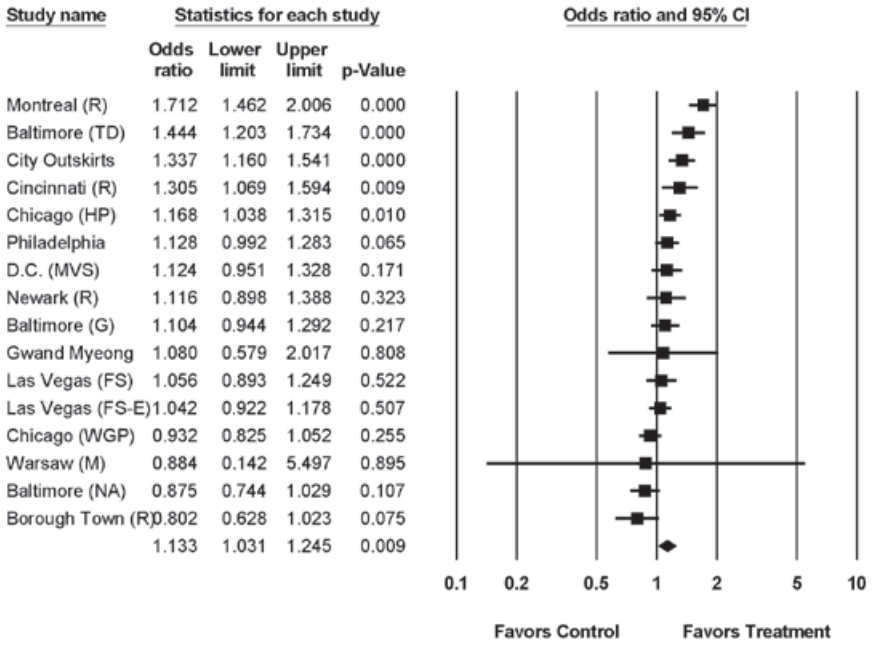
Residential areas

Sixteen studies fitting the criteria for inclusion were conducted in residential areas (see A6 in the appendix for the full list of residential studies). Ten (62.5%) of the residential evaluations included complementary interventions alongside CCTV. Similar to what we observed with city and town center projects, these complementary interventions involved a range of activities, including police patrol, improved lighting, CCTV notices, and flashing lights on top of cameras. Ten of the residential schemes reported actively monitored systems and two involved passive systems. Four studies did not provide information on the precise monitoring strategy. The follow-up periods in the residential systems averaged 19.15 months with a low of five months and high of 36 months.

Five of the residential schemes reported statistically significant crime reductions, and another scheme—in Philadelphia (Ratcliffe et al.,

2009)—fell just outside the bounds of significance (OR = 1.128, p = 0.065). All of the other residential evaluations reported non-significant effects. The meta-analysis of pooled effects found that CCTV use in residential areas exhibited a statistically significant OR of 1.133 (p = 0.009), reflecting that crime decreased about 12% in experimental areas compared to control areas. The largest effect meta-analysis further suggests a significant crime reduction (OR = 1.239, p<0.001). However, the smallest effect meta-analysis did not generate significant findings (OR = 1.055, p = 0.268). Similar to the findings of city and town center schemes, evidence of a crime reduction effect in residential areas is not as robust as the observed reduction in the overall studies or within car parks. However, the evidence of effect in residential areas is stronger than that for city and town centers, as two of the three (average- and largest-effects) meta-analyses generated findings suggestive of a crime reduction. Eleven (68.75%) residential evaluations tested for the presence of displacement or diffusion of benefits. Four evaluations found evidence of diffusion of benefits and one found evidence of displacement. Six did not find any evidence of displacement or diffusion of benefits.

Figure 5: Forest plot of effects in residential areas



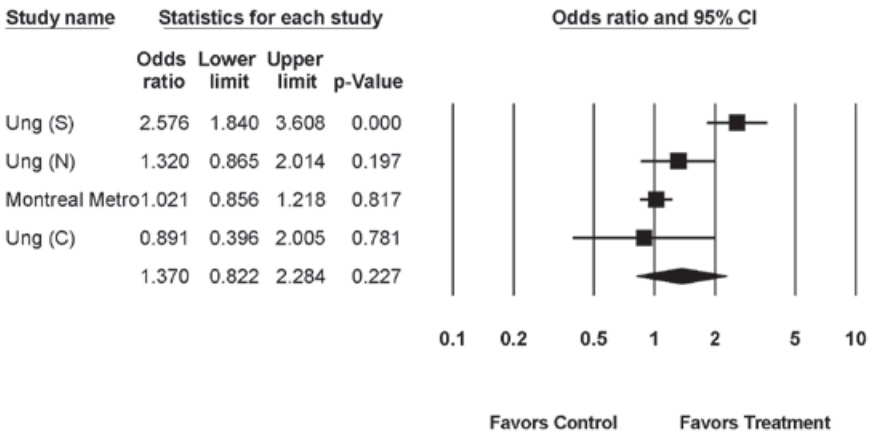
Public transport

Four evaluations meeting the inclusion criteria were conducted in public transport systems (see A7 in the appendix for the full list

of public transport studies). These are the same four evaluations included in the prior CCTV review (Welsh and Farrington, 2007, 2009); no new public transport evaluations have been reported. Three of the evaluations deployed other interventions alongside CCTV. These complementary interventions included notices of CCTV, police patrols, and passenger alarms. All four public transport schemes were actively monitored systems. The follow-up periods in the public transport systems averaged 22.00 months with a low of 12 months and high of 32 months.

Only one of these public transport systems generated a statistically significant reduction in crime with all other evaluations finding non-significant effects. The pooled effects of the public transport systems also indicated a non-significant effect, with the OR of 1.370 failing to achieve statistical significance (p = 0.227). Non-significant effects were also found by the largest effect size (OR = 1.368, p = 0.219) and smallest effect size (OR = 1.310, p = 0.368) meta-analyses. Two of the evaluations tested for potential displacement or diffusion effects, one finding evidence of diffusion of benefits and the other findings evidence that some displacement occurred.

Figure 6: Forest plot of effects in public transport



Other settings

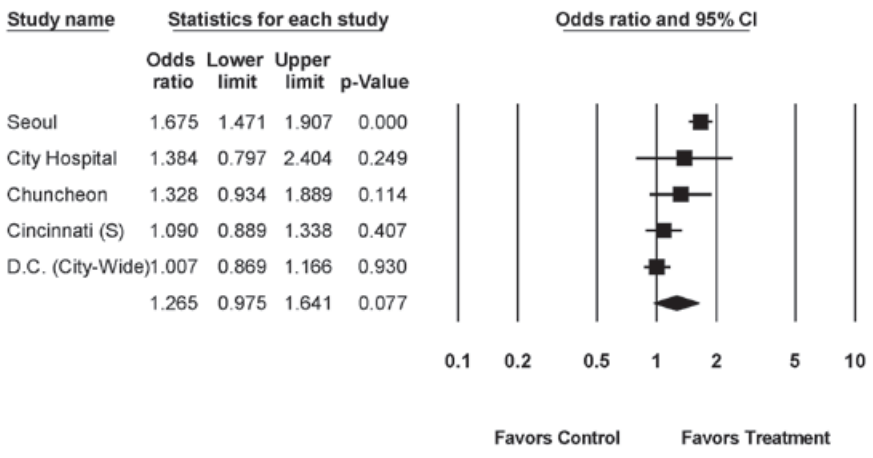
Five evaluations were conducted in settings that did not fit any of the above classifications and thus comprise the "other settings" category (see A8 in the appendix for the full list of studies in other settings).[12] Two of the schemes deployed CCTV alongside other types of inter-

[12] One evaluation was conducted at City Hospital (Gill and Spriggs, 2005), one was conducted in school/university settings (Lim et al., 2017), three were conducted across entire cities (Kim, 2008; La Vigne et al., 2011), and one reported that the target area was comprised of undisclosed mixed environments (Lim et al., 2016) which prevented us from disaggregating the cameras into setting types.

ventions. These complementary interventions included activities such as CCTV notices, improved lighting, and flashing lights on top of cameras. Two of these schemes were actively monitored and one used passive monitoring. Two studies did not report sufficient information for us to determine the monitoring strategy. The follow-up periods in other settings averaged 22.25 months with a low of 12 months and high of 36 months.

Only one "other setting" evaluation detected a significant reduction in crime (see Figure 7). The pooled effects suggested an overall non-significant effect, with the OR of 1.265 failing to achieve statistical significance (p = 0.077). However, differing findings were suggested by the largest and smallest effect size meta-analyses. The smallest effect analysis found a non-significant effect (OR = 1.151, p = 0.447), echoing the findings of the main analysis. However, similar to city and town centers, the largest effect meta-analysis suggests that CCTV generated significant reductions in the "other setting" experimental areas compared to control areas (OR = 1.351, p = 0.014). Therefore, while two of the three analyses suggest CCTV had a non-significant effect in "other settings" the largest effect analysis suggests that CCTV may produce desirable outcomes in certain contexts. Four of the evaluations measured potential displacement and diffusion effects. Three evaluations found evidence of diffusion of benefits and one found no evidence of displacement or diffusion.

Figure 7: Forest plot of effects in other settings



Crime type

In order to explore CCTV's effect on different crimes, we introduced crime type as an effect size moderator in the meta-analysis. The results of this analysis are reported in Table 2. Violent crime was the most commonly reported (n = 29), followed closely by vehicle

crime (n = 23) and property crime (n = 22). In comparison, disorder and drug crime were rarely reported, with each of these crime types included as outcomes in only six CCTV evaluations. Echoing the findings of the last CCTV review, CCTV generated statistically significant reductions in vehicle crime (OR = 1.164, p = 0.030) and property crime (OR = 1.161, p = 0.021). The ORs translate to reductions of approximately 14% for both vehicle crime and property crime. Interestingly, CCTV had the largest effect on drug crime (OR = 1.249, p = 0.044), for a reduction of approximately 20%. Despite the small number of studies that investigated effects on drug crime, this finding is interesting in light of prior research reporting that drug offenders largely do not believe that CCTV is a viable deterrent to street-level drug dealing (Gill & Loveday, 2003). No significant effects were observed for violent crime or disorder.

Table 2: CCTV effects by crime type

Category	N	Odds Ratio	Lower Limit	Upper Limit	*p*
Disorder	6	0.994	0.849	1.163	0.935
Drug crime	6	1.249	1.006	1.551	0.044
Property crime	22	1.161	1.023	1.317	0.021
Vehicle crime	23	1.164	1.015	1.335	0.030
Violent crime	29	1.050	0.954	1.155	0.320

Note: Random effects model, Q = 47.862, df = 4, p<0.001

Monitoring styles and use of other interventions

As discussed in the section on setting types, CCTV projects can differ greatly in terms of how they are used by public safety agencies. There appears to be a great deal of heterogeneity in terms of the monitoring styles, as well as in the number of complementary interventions deployed alongside CCTV.

Table 3 displays the effect of CCTV across active and passive monitoring systems. Eleven studies did not provide sufficient information for us to determine the monitoring type, and thus had to be excluded from the analysis. As shown in Table 3, CCTV schemes incorporating active monitoring generated significant crime reductions of approximately 15% (OR = 1.172, p.<0.001) in experimental areas compared to control areas. This finding was supported by the smallest-effect (OR = 1.091, p = 0.050) and largest-effect (OR = 1.241, p<0.001) meta-analyses, with both finding evidence of a crime reduction. This finding stands in sharp contrast to passively monitored systems, which showed non-significant effects across all these meta-analyses: average effects (OR = 1.015, p = 0.633), small-

est effects (OR = 0.991, p = 0.804), and largest effects (OR = 1.036, p = 0.383).

Table 3. CCTV effects by monitoring type

Category	N	Odds Ratio	Lower Limit	Upper Limit	*p*
Active	54	1.172	1.080	1.272	0.000
Passive	11	1.015	0.954	1.081	0.633

Note: Random effects model, Q = 12.623, df = 1, p<0.001

CCTV schemes can be classified into one of three categories: CCTV alone (n = 36), CCTV with one other intervention (n = 26), and CCTV with multiple interventions (n = 14) (see Table 4). Of these categories, schemes incorporating multiple complementary interventions had the largest effect size, with an OR = 1.513 suggesting an approximately 34% crime reduction in experimental areas compared to control areas. This reduction was statistically significant (p<0.001). Furthermore, the lower and upper bounds suggested by the largest-effect size (OR = 1.523, p<0.001) and smallest-effect size (OR = 1.484, p = 0.001) analyses do not differ qualitatively from the average effects. The ORs for both schemes deploying no additional interventions (OR = 1.083) and schemes deploying a single additional intervention (OR = 1.076) did not achieve statistical significance. The largest-effect size meta-analysis found that both the "none" (OR = 1.138, p = 0.007) and "single" (OR = 1.160, p = 0,001) categories exhibited significant crime reduction effects while the smallest-effect size analysis found non-significant effects for both categories ("none" OR = 1.017, p = 0.684; "single" OR = 1.004, p = 0.926). We can conclude that the effects observed for the "none" and "single" categories are not as stable as the effects observed for the "multiple" category.

Table 4. CCTV effects by use of other interventions

Category	N	Odds Ratio	Lower Limit	Upper Limit	*p*
None	36	1.083	0.998	1.176	0.057
Single	26	1.076	0.985	1.175	0.103
Multiple	14	1.513	1.220	1.877	0.000

Note: Random effects model, Q = 46.370, df = 2, p<0.001

Country comparison

The 76 evaluations included in the meta-analysis were carried out in nine different countries. Most of the studies (n = 34, 44.73%) were conducted in the UK. The US contributed 24 (31.58%) of the studies in the meta-analysis (up from 4 of 41 studies or 9.76%). In addition to the UK and US, studies were conducted in Canada (n = 6), South Korea (n = 3), Sweden (n = 4), Norway (n = 1), Spain (n = 1), Poland (n = 2), and Australia (n = 1).

To measure the extent to which CCTV effect varies across countries, we incorporated country as an effect size moderator in the meta-analysis.[13] Of the six categories, two exhibited statistically significant reductions in crime (see Table 5). In the UK, CCTV generated significant crime reductions of approximately 20% in experimental areas compared to control areas.

Studies conducted in South Korea (OR = 1.506, p<0.001) showed larger ORs than the UK studies, indicative of a crime reduction of about 33% in experimental areas compared to control areas. The small number of studies in South Korea calls for caution in interpretation of the magnitude of effects. In addition, while both the smallest- and largest-effect meta-analyses supported crime reductions in the UK, the smaller-effects analysis did not find a significant effect in South Korea (OR = 1.354, p = 0.112). No significant effects were observed for Sweden, US, or "other" countries.

Table 5: CCTV effects by country

Category	N	Odds Ratio	Lower Limit	Upper Limit	*p*
Canada	6	1.041	0.812	1.333	0.753
South Korea	3	1.506	1.212	1.871	0.000
Sweden	4	0.944	0.787	1.132	0.533
UK	34	1.259	1.122	1.414	0.000
US	24	1.050	0.990	1.113	0.104
Other	6	0.996	0.779	1.273	0.973

Note: Random effects model, Q = 89.694, df = 5, p<0.001

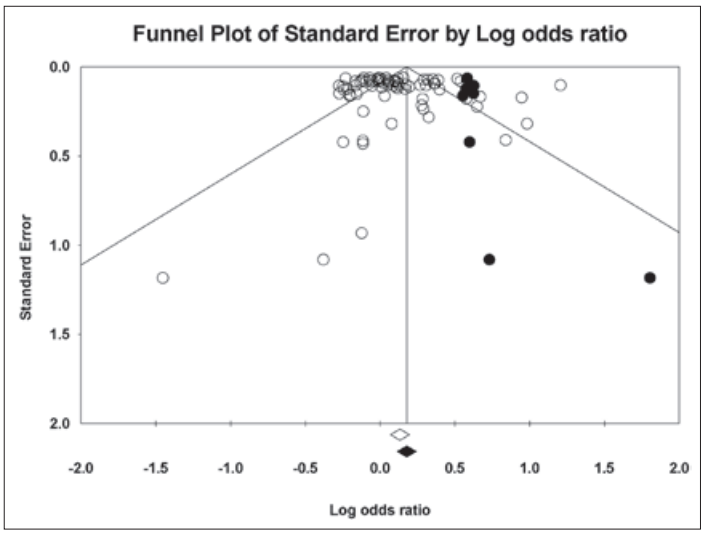
[13] Given the low number of evaluations occurring in the individual countries, Norway, Spain, Poland, and Australia were jointly considered the "other" category in the country-moderated meta-analysis.

Publication Bias

We conclude our analysis with a test of publication bias in our results. Similar to how a biased sample can generate invalid results in an individual study, a biased collection of studies can potentially lead to invalid conclusions in a systematic review (Braga et al., 2018: 32). To determine the presence of potential publication bias, we used BioStat's trim-and-fill procedure to estimate how reported effects would change if bias was discovered and addressed (Duval, 2005). The diagnostic funnel plot used to test publication bias assumes that effect sizes should be symmetric about the mean when a representative collection of studies has been obtained. When there is asymmetry, the trim-and-fill procedure inputs the hypothesized missing studies and re-computes a mean effect size.

In Figure 8, the funnel plot for the current study suggests asymmetry, with more studies to the left of the mean than to the right. BioStat's trim-and-fill procedure determined that ten studies should be added to this portion of the funnel plot to create symmetry. When the effect size is re-computed to include these additional studies, the mean effect size increased from 1.141 to 1.194 However, the 95% confidence intervals of the observed and adjusted ORs overlap, suggesting that the effect sizes are not statistically significantly different. The smallest- and largest-effect version of the trim-and-fill procedure

Figure 8: Publication bias test



Note: Empty circle indicate the original studies. Filled-in circle indicate imputed studies from the trim-and-fill analysis.
Observed values: Random effects = 1.141 (95% C.I. [1.072 – 1.215])
Adjusted values (10 studies trimmed): Random effects = 1.194 (95% C.I. [1.121 – 1.273])

similarly produced estimates with overlapping confidence intervals. In light of these findings, we conclude that publication bias did not affect our results.

Conclusions and Directions for Policy and Research

This new systematic review and meta-analysis of CCTV provides some important insights for researchers, policymakers, and practitioners. First, the amount of scientific knowledge on CCTV has steadily increased. This review identified 80 studies that met the inclusion criteria (76 provided the requisite data to be included in the meta-analysis). We think this has resulted in an improved knowledge base on CCTV effects. The amount of new research conducted on CCTV in residential areas illustrates this point. While the prior review could only include two evaluations of CCTV in residential areas, the present review identified an additional 14 studies that met the inclusions criteria. This makes residential areas the second most common setting for CCTV evaluations (n = 16), behind city and town centers (n = 33). In addition, while UK evaluations made up the majority (82.93%) of studies in the last review, UK evaluations accounted for less than half (44.74%) of the studies included in this review. The field now has much more evidence on the effect of CCTV in other countries. This is particularly the case for the US. Welsh and Farrington (2007, 2009) identified only 4 sufficiently rigorous CCTV evaluations that took place in the US, accounting for 9.76% of the studies in their meta-analysis. The paucity of rigorous CCTV evaluations in the US was not lost on the research community, with a number of US-based evaluations specifically noting the lack of relevant research evidence in the country (Caplan et al., 2011; Ratcliffe et al., 2009). Therefore, as with the setting of residential areas, the field's knowledge on the effect of CCTV in the US has expanded with this new review.

Our results both support and build upon the lessons of the last review (Welsh & Farrington, 2007, 2009). For one, the pooled effects show that CCTV is associated with a modest but statistically significant reduction in crime. The pooled OR of 1.141 translates to approximately a 13% reduction in crime, which is similar in magnitude to the 16% reduction found by Welsh and Farrington (2007, 2009). Similar to the prior review, we also found the largest and most consistent effects of CCTV within car parks. The reduction in car parks was further reflected in both the largest-effect size and smallest-effect size meta-analyses. However, whereas Welsh and Farrington (2007, 2009) found that car parks was the only setting where CCTV was associated with significant effects, our review found evidence of significant crime reductions within other settings, most notably residential areas. It should be noted that crime reduc-

tions were detected in the average-effect size and largest-effect size analyses, but not the smallest-effect size analysis. Therefore, evidence of crime reduction was not as stable in residential areas as in car parks.

In discussing the disproportionate effect of CCTV in car parks, Welsh and Farrington (2007, 2009) noted that car park schemes were more likely to deploy other interventions alongside CCTV to complement the effect of video surveillance. Through this observation, Welsh and Farrington (2007, 2009) suggested that strategic aspects of CCTV schemes may be as important as the environmental setting. The findings of the current review provide further support of this observation. In terms of complementary interventions, schemes that incorporated multiple interventions alongside CCTV generated larger effect sizes than schemes deploying single or no interventions alongside CCTV. This finding seems to support the view that the effect of CCTV can be maximized when the technology is considered as a key component of a package of interventions rather than as a stand-alone tactic against crime (LaVigne et al., 2011; Piza et al., 2015). Furthermore, actively monitored CCTV systems generated significant reductions in crime, while passive systems had no significant effect. This further argues against the use of CCTV as a stand-alone tactic; that is, conspicuous camera presence may not generate a deterrent effect absent active camera monitoring and the subsequent crime prevention responses such activity generates.

Lastly, the findings of our new review echo those of Welsh and Farrington (2007, 2009) in terms of CCTV use in the UK, with the 34 UK schemes demonstrating a statistically significant crime reduction of approximately 10% in experimental areas compared to control areas. However, the present review also found significant crime reductions in South Korea. We should note that the number of evaluations in South Korea (n = 3) represented only about 9% of the evaluations conducted in the UK. The small number of evaluations in South Korea, as well as other countries, draws attention to the need for more research outside of the UK and US to more concretely determine the precise effect of CCTV in these societies. Another interesting finding relates to the absence of a significant effect observed in the US. Welsh and Farrington (2007, 2009) also found no significant effects in the US. However, given that the present review included 20 more evaluations conducted in the US, the absence of an observed effect in the US is particularly noteworthy. In considering the weak effects of CCTV outside of the UK, Welsh and Farrington (2007, 2009) noted that schemes in the UK incorporated complimentary interventions more often than schemes in other countries. This is helpful in interpreting the findings for CCTV schemes in the US because these schemes did not include additional

interventions as often as CCTV in the UK. However, the difference is not as stark as in the prior review: UK schemes included other interventions in 64.71% of cases, while US schemes did so 57.17% of the time. Another explanatory factor may be the differing cultural contexts, as there exists a high level of support for CCTV in the UK (Norris & Armstrong, 1999; Phillips, 1999). As argued by Welsh and Farrington (2007, 2009), this may mean that the political and public support necessary to maximize CCTV effects may be absent in the US. However, we acknowledge that we are not able to directly test this possibility.

Despite the increase in evaluations of CCTV, we still see opportunities for further improvement. For one, randomized controlled trials (RCTs), widely considered the best method for ensuring causal validity, are a rarity in the study of CCTV. La Vigne and Lowry (2011), who randomized parking decks to receive cameras, and Piza et al. (2015), who randomized the allocation of a directed patrol function to existing CCTV sites, represent the only randomized experiments of CCTV in public places.[14]

Piza (2018a) noted that, because CCTV sites are permanent fixtures (hard wired to physical structures and configured to wireless communications networks), moving locations after experimentation would require additional expenditures. Therefore, practitioners understandably install cameras at locations of their choosing, giving little to no thought to the implications for research design. Other crime prevention strategies, such as hot spots policing, do not present such difficulties and, therefore, are more amenable to randomization. Nonetheless, random assignment of CCTV cameras may be possible in certain cases. As argued by Piza (2018a), agencies could hypothetically identify priority locations at the onset of a program and randomly select a subset of locations to receive cameras during the first phase of installation. Other priority sites could receive cameras in later installation phases, after completion of the randomized experiment. Under this strategy, officials could simultaneously generate the most rigorous evidence of CCTV effect while still ensuring that all priority locations received CCTV (assuming that the results of the experiment support the installation of additional cameras). In this sense, there may also be a role for redeployable CCTV cameras, with the absence of hard wired cameras meaning that experimental areas can be moved and permanently affixed elsewhere to reflect the results of the experiment. Though, we acknowledge the issues previously observed with the reliability of redeployable CCTV, such as

[14] Piza et al. (2015) was not included in this review because directed patrol, rather than CCTV, is the main intervention.

poor image quality and difficulty integrating multiple cameras into a single network (see Waples & Gill, 2006).

Future research should aim to investigate the active ingredients associated with CCTV effects (Welsh & Farrington, 2007, 2009). This is an important consideration, as knowing whether a technology "works" is not enough for decision makers; the contextual and procedural aspects necessary to maximize the effect are equally important when weighing the adoption (and associated expenditures) of a crime prevention technology (Salvemini et al., 2015). Recent research has contributed to this end by testing the role that proactive policing may play in the success of CCTV systems (La Vigne et al., 2011; Gerrell, 2016; Piza et al., 2014b, 2015). However, the interventions in this review extended beyond police activities, including a variety of situational, publicity, and community outreach tactics. While it is difficult to isolate the specific effect of various interventions deployed in tandem, researchers may be able to use statistical approaches such as mediation models (Braga and Bond, 2008) or incorporate more theoretically-informed reach designs (Eck, 2006; Sampson et al., 2013). Evaluations more often identifying causal mechanisms would enable meta-analyses to better isolate program components that are most strongly correlated with effect size (see Ttofi & Farrington, 2011 for an example). We recommend that researchers build upon the state of research presented in this review by seeking opportunities to maximize the rigor of CCTV methodology.

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Appendix

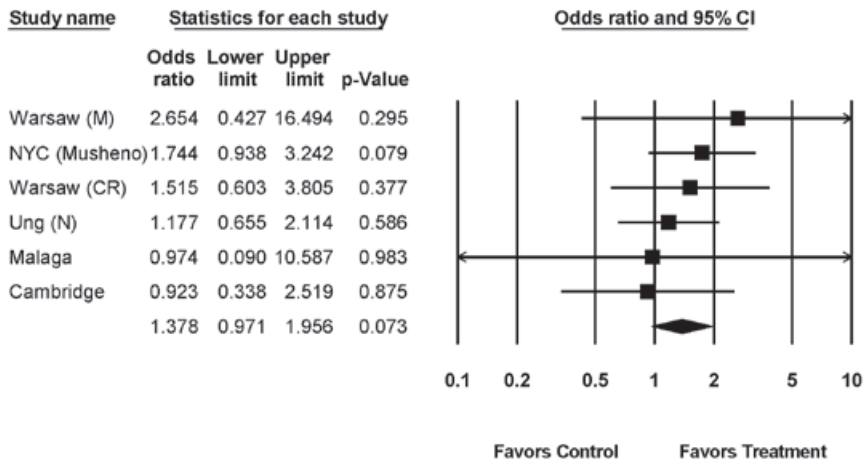
A1: Included and excluded fear of crime studies

Author, Publication Date, and Location	Included or Not Included (and Reason)	How was Fear Measured?	Questions asked?	Follow-up and Results
Musheno 1978, Bronx, NYC [Bronxdale Housing Development]	Included	Criminal victimization surveys	Fear of crime (e.g., feeling unsafe at night)	Pre- and post-survey (3 months after implementation); fear of crime did decrease after CCTV for most crime types
Webb 1992, London, UK [London Underground]	Included	Questionnaire surveys	Fear of crime	A few months between surveys; limited evidence in change in attitudes around crime
Farrington 2007, Cambridge, England [Cambridge City Center]	Included	Survey opinion questions	Worried about crime?	12 months post intervention; no statistically significant findings in the experimental and control areas
Cerezo 2013, Malaga, Andalusia, Spain	Included	Victimization survey (with citizens); reported in percent change	Fear of individual victimization?	12 months between surveys; E vs. C: 0.64 (3.13 to 3.11) vs. 3.20 (3.44 to 3.33), OR = 0.97
Waszkiewicz 2013, area that bordered the Warsaw Central Railway Station, Warsaw, Poland	Included	Victimization survey	Feeling safe in their district	12 months between surveys; E vs. C: 59.14 (30.1 to 12.3) vs. 38.11 (39.1 to 24.2), OR = 1.51
Waszkiewicz 2013, Muranow District, Warsaw, Poland	Included	Victimization survey	Feeling safe in their district	12 months between surveys; E vs. C: 65.37 (28.3 to 9.8) vs. 53.15 (22.2 to 10.4), OR = 2.65
Burrows 1979, London, UK [London Underground]	Not included; fit criteria but data unavailable	Survey	Feelings of safety in the city	12 months between survey

Author, Publication Date, and Location	Included or Not Included (and Reason)	How was Fear Measured?	Questions asked?	Follow-up and Results
Gill 2005, London, UK [Deploy Estate, Dual Estate, Southcap Estate, Eastcap Estate, Northern Estate, and Westcap Estate]	Not included; fit criteria but data unavailable	Public attitude surveys	Worried about being the victim of a crime	6 to 12 months between pre- and post-measures; only statistically significant in 3 areas
Alvarado 2009, Old Town College Park, MD	Not included; no control used	Victimization survey; residents and non-residents	Multiple questions	12 months between surveys; some statistically significant results
Washington States, Office of the City Auditor, 2009, Seattle, WA	Not included; no control used	Face-to-face surveys on perception of safety	Multiple questions	2 months (N = 103); cameras appear to have had a minimal effect on respondent's perceptions of safety
Sousa 2010, MacArthur Park in Los Angeles, CA	Not included; no control area	Interview & focus groups	Changes (if any) in terms of fear, safety, crime and disorder	n.a.; overall, notes a positive change in the park
Reid 2012, Surrey, BC	Not included; no control area	Victimization survey	Fear of crime during the pilot program	4 months prior to intervention & 1 year after intervention; respondents were generally more optimistic before the implementation of CCTV then after
Hennen 2017, Malmo, Sweden	Not included; no control area	Police surveys	Perceived a change in feeling of safety in the area	11 months between surveys; 44% reported no change & 28% felt safer

Notes: E = experimental area
C = control area
n.a. = not available
A&E = accident and emergency department.

A2: Fear of crime effects



A total of 6 studies measured fear of crime and reported the necessary data for inclusion in the meta-analysis. While 4 of the 6 studies had ORs above 1, suggestive of a positive effect, none achieved statistical significance. The pooled effects suggest a similarly non-significant effect: the OR of 1.378 did not achieve statistical significance (p. = 0.073).

However, we suggest caution in the interpretation of these results. Seven studies meeting the inclusion criteria did not report the sufficient data for us to calculate effect sizes and variances for the meta-analysis. We attempted to obtain the relevant data from study authors and were informed that they no longer had access to the data given the age of the reports. Therefore, given that more eligible studies were excluded due to lack of data than those that could be included, the results of this meta-analysis may lack validity.

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Poyner (1991), University of Surrey, Guildford, UK	100% (almost)	Active monitoring by security personnel; 10 months	E = 1 parking lot (no. 4), C = 1 parking lot (no. 1)	Improved lighting and foliage cut back (for both E and C; only E received CCTV)	Theft from vehicles; private security records	Before-after, experimental-control Before = 24 months; After = 10 months	E vs C (monthly average): theft from vehicles: -73.3% (3.0 to 0.8) vs -93.8%(1.6 to 0.1)(undesirable effect)Diffusion occurred
Tilley (1993), Hartlepool, UK	n.a. (pan, tilt, zoom, infrared (most))	Active monitoring by security personnel; 24 months	E = CCTV covered car parks, C = non-CCTV covered car parksNote: no. of E and C car parks or spaces n.a.	Security officers, notices of CCTV, and payment scheme	Theft of and from vehicles; police records	Before-after, experimental control Before = 15 months; After = 30 months	E vs C: theft of vehicles: -59.0% (21.2 to 8.7 per quarter year) vs -16.3% (16.0 to 13.4 per quarter year); theft from vehicles: -9.4% (6.4 to 5.8 per quarter year) vs +3.1% (16.0 to 16.5 per quarter year)(desirable effect)Displacement occurred
Tilley (1993), Bradford, UK	n.a.	Active monitoring by security personnel; 12 months	E = 1 car park, C1 = 2 adjacent car parks, C2 = adjacent street parking	Notices of CCTV, improved lighting, and paintingNote: C1 received some CCTV coverage for last 4 months	Theft of and from vehicles; police records	Before-after, experimental control Before = 12 months; After = 12 monthsNote: a third C is used, but is less comparable than C1 or C2	E vs C1: theft of vehicles: -43.5% (23 to 13) vs +5.9% (17 to 18); theft from vehicles: -68.8% (32 to 10) vs +4.5% (22 to 23)E vs C2: theft of vehicles: -43.5% vs +31.8% (22 to 29); theft from vehicles: -68.8% vs +6.1% (33 to 35)(desirable effect) Displacement/diffusion not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Tilley (1993), Coventry, UK	n.a.	Active monitoring by security personnel; various	E = 3 car parks, C = 2 car parks	Lighting, painting, and fencing	Theft of and from vehicles; police records	Before-after, experimental control Before and after = 8 months (E) and 16 months (C)	E vs C: theft of vehicles: -50.5% (91 to 45) vs -53.6% (56 to 26); theft from vehicles: -64.4% (276 to 101) vs -10.7% (150 to 134)(desirable effect)Displacement/diffusion not measured
Sarno (1996), London Borough of Sutton, UK	n.a.	n.a.; 12 months	E = 3 car parks in part of Sutton police sector, C1 = rest of Sutton sector,C2 = all of Borough of Sutton	Multiple (e.g., locking overnight, lighting)	Vehicle crime; police records	Before-after, experimental control Before = 12 months; After = 12 months	E vs C1: -57.3% (349 to 149) vs -36.5% (2,367 to 1,504)E vs C2: -57.3% vs -40.2% (6,346 to 3,798) (desirable effect)Displacement/diffusion not measured
Gill (2005), Hawkeye, UK	95-100%	Active monitoring by security, link (one-way) with BTP, 123-153 cameras per operator; 12 months	E = 57 train station car parksC = train station car parks in the whole country	Improved lighting, fencing, security	Total crime; police records	Before-after, experimental control Before = 12 monthsAfter = 12 months	E vs C: -73.0% (794 to 214) vs -10.0% (12,590 to 11,335)(desirable effect)Displacement/diffusion not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
La Vigne (2011), Washington, D.C., US a	75 cameras total; fixed, still photographic cameras (N = 25) and dummy cameras (N = 50), 3 at each location (1:2)	Passive monitoring not integrated with the police; 12 months	E = 1 (25 car parks)C = 1 (25 car parks)	Signage	Crime (total and multiple offenses); police records; administrative data; environment assessment	Before-after, experimental-control with matchingBefore = 12 months; After = 12 months	E vs C: total crimes: 11.43 (672.96-596.04) vs 6.67 (840-783.96), OR = 1.05No displacement or diffusion of benefits occurred
Reid (2014), Surrey, BC, CA	12 cameras total; mixed cameras (N = 11); adjustable (N = 1)	Passive monitoring by security; 12 months	E = 1 car parkC = 6; compared to the larger communities	Upgraded lighting; signage	Vehicle crime (multiple offenses); police records; insurance claims	Before-after, experimental-control Before = 29 months; After = 12 months	E vs C: vehicle crimes: -13 (100-113) vs 7.67 (4968-4587), OR = 0.82No displacement or diffusion of benefits occurred

Notes: BTP = British Transport Police
E = experimental area
C = control area
n.a. = not available.

[a] We deliberated as to whether to include La Vigne and Lowry (2011) due to the nature of the cameras in this evaluation. In particular, the parking facilities in this study installed photographic cameras rather than video cameras. In the end, we decided to include this evaluation given that the conspicuous presence of cameras seemed to rely on a similar deterrence mechanism as many traditional CCTV systems. Furthermore, potential offenders are likely not able to distinguish between photographic cameras and video cameras. Our decision to include this study also follows the approach of recent CCTV reviews (Alexandrie, 2017).

A4: CCTV evaluations in city and town centers (n = 33)

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Brown (1995), Newcastle-upon-Tyne, UK	Full coverage of most vulnerable premises on streets	Active monitoring by police; 15 months	E=4 beats of central area, C=7 remaining beats of city centerNote: There are 2 other C, but each is less comparable to E	NoneNote: 14 of 16 cameras are in E; remaining 2 are in C	Crime (multiple offenses); police records	Before-after, experimental control Before=26 months After=15 months	E vs C (monthly average): total crimes: -21.6% (343 to 269) vs -29.7% (676 to 475); burglary: -57.5% (40 to 17) vs -38.7% (75 to 46); theft of vehicles: -47.1% (17 to 9) vs -40.5% (168 to 100); theft from vehicles: -50.0% (18 to 9) vs -38.9% (106 to 65)(undesirable effect)Some displacement and diffusion occurred
Brown (1995),Birmingham, UK	14 cameras (pan, tilt, zoom)	Active monitoring by police (24 hrs/ day); 12 months	E=Area 1 (streets with good coverage), C1=Area 2 (streets with partial coverage), C2=Area 4 (other streets in Zone A of Div. F), C3= Area 5 (streets in Zones B-G of Div. F)	None	Crime (total and most serious offenses); victim survey	Before-after, experimental control Before=12 months After=12 months	E vs C1: total crimes: -4.3% (163 to 156) vs +131.6% (19 to 44)E vs C2: total crimes: -4.3% vs +130.8% (26 to 60)E vs C3: total crimes: -4.3% vs +45.5% (33 to 48)(desirable effect) Displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Sarno (1996), London Borough of Sutton, UK	11 cameras	n.a.; 12 months	E=part of Sutton city centre, C1=rest of Sutton city centre,C2=all of Borough of Sutton	None	Crime (total and selected offenses); police records	Before-after, experimental control Before=12 months After=12 months	E vs C1: total crimes (not including vehicle crime): -12.8% (1,655 to 1,443) vs -18% (data n.a.)E vs C2: total crimes: -12.8% vs -30% (data n.a.)(undesirable effect)Displacement/diffusion not measured
Skinns (1998), Doncaster, UK	63 cameras	Active monitoring by police; 12 months	E=all or parts of streets in vision of cameras in commercial area, C=commercial areas of 4 adjacent townships	47 'help points' for public to contact CCTV control rooms	Crime (total and selected offenses); police records	Before-after, experimental-control Before=24 months; After=24 monthsNote: There were 2 Es and 6 Cs used. The C used here is because the author says it was the most comparable to ENote: This E has been used because it includes the other E	E vs C: total crimes: -21.3% (5,832 to 4,591) vs +11.9% (1,789 to 2,002)(desirable effect)No displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Squires (1998), Ilford, UK	n.a.	n.a.; 7 months	E=city center, C=areas adjacent to city center	None	Crime (total, violent, and selected offenses); police records	Before-after, experimental-control Before=6 months After=7 months-Note: 2 other Cs used, but less likely to be comparable to E	E vs C: total crimes: -17% (data n.a.) vs +9% (data n.a.)(desirable effect) Displacement occurred
Armitage (1999), Burnley, UK	n.a.	n.a.; 20 months	E=police beats with CCTV, C1=beats having a common boundary with CCTV beats, C2=other beats in police division	None	Crime (total and multiple offenses); police records	Before-after, experimental-control Before=12 months After=12 monthsb	E vs C1: total crimes: -28% (1,805 to 1,300) vs -1% (6,242 to 6,180); violence: -35% (117 to 76) vs -20% (267 to 214); vehicle crimes: -48% (375 to 195) vs -8% (1,842 to 1,695); burglary: -41% (143 to 84) vs +9% (2,208 to 2,407)E vs C2: total crimes: -28% vs +9% (1,069 to 1,175); violence: -35% vs 0% (32 to 32); vehicle crimes: -48% vs -8% (309 to 285); burglary: -41% vs +34% (366 to 490)(desirable effect) Diffusion occurred
Sarno (1999), London Borough of Southwark (Elephant and Castle), UK	34 cameras outside (6 pan, tilt, zoom), 15 cameras inside (12 pan, tilt, zoom)	Active monitoring by security personnel (24 hrs/ day); 24 months	E=shopp-ing center area and subways, bus stops, streets around center, C1= Newington C2=BZ	Notices of CCTV	Crime (total); police records	Before-after, experimental-control Before=12 months After=24 monthsNote: 4 other Cs used, but less comparable to E	E vs C1 (yearly average): total crimes: -14.1% (491 to 422) vs -9.4% (4,814 to 4,360)E vs C2 (yearly average): total crimes: -14.1% vs -15.1% (2,090 to 1774)(null effect) Possible evidence of diffusion

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Sarno (1999), London Borough of Southwark (Camberwell), UK	17 cameras (pan, tilt, zoom)	Active monitoring by security personnel and sometimes police (24 hrs/ day); 12 months	E=city center C1=rest of Cam-berwell C2=BZ	Notices of CCTV	Crime (total); police records	Before-after, experimental-control Before=24 months After=12 monthsNote: 2 other Cs used, but less comparable to E	E vs C1 (yearly average): total crimes: -13.6% (913 to 789) vs -4.1% (3,915 to 3,755)E vs C2 (yearly average): total crimes: -13.6% vs -2.8% (1,245 to 1,210)(desirable effect)No displacement occurred
Sarno (1999), London Borough of Southwark (East Street), UK	12 cameras (11 pan, tilt, zoom; 1 fixed)	Active monitoring by security personnel and sometimes police (24 hrs/ day); 12 months	E=city center (street market, adjacent streets, car parks)C1= Newington C2=BZ	Notices of CCTV	Crime (total); police records	Before-after, experimental-control Before=24 months After=12 monthsNote: 2 other Cs used, but less comparable to E	E vs C1 (yearly average): total crimes: -9.4% (791 to 717) vs -14.2% (4,277 to 3,671)E vs C2 (yearly average): total crimes: -9.4% vs- 22.1% (1,066 to 830)(uncertain effect)No diffusion; possible functional displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Mazerolle (2002), Cincinnati (Northside), US	n.a. (pan, tilt, zoom)	No monitoring (video footage used); 3 months	E=1 site with CCTV, C=1,000 foot radius BZ	None	Calls for service (weekly average); police records	Before-after, experimental-control Before=23 months After=6 months-Note: 2 other Cs of 200 and 500 foot radii were used and are included in the 1,000 foot radius C	E vs C (weekly average): +1.8% (901 to 917) vs 0.0% (36 to 36) (null effect)Little or no displacement occurred
Mazerolle (2002), Cincinnati (Hopkins Park), US	n.a. (pan, tilt, zoom)	No monitoring (video footage used); 3 months	E=1 site with CCTV, C=1,000 foot radius BZ	None	Calls for service (weekly average); police records	Before-after, experimental-control Before=23 months After=4 months-Note: 2 other Cs of 200 and 500 foot radii were used and are included in the 1,000 foot radius C	E vs C (weekly average): +9.8% (1,062 to 1,166) vs 0.0% (22 to 22) (null effect)Displacement/diffusion not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Mazerolle (2002), Cincinnati (Findlay Market), US	n.a. (pan, tilt, zoom)	No monitoring (video footage used); 2 months	E=1 site with CCTV, C=1,000 foot radius BZ	None	Calls for service (weekly average); police records	Before-after, experimental-control Before=24.5 months After=3.5 monthsNote: 2 other Cs of 200 and 500 foot radii were used and are included in the 1,000 foot radius C	E vs C (weekly average): +16.9% (1,005 to 1,175) vs +17.1% (111 to 130)(null effect)Some displacement occurred
Griffiths (2003), Gillingham, UK	n.a.	Active monitoring by security personnel, operational all day; 60 months	E=city center (High Street and adjacent car parks) C=city center of Strood (borough of Rochester)	Improved lighting, neighborhood watch, “shop safe” network (radio link for shops to report crime)	Crime (total and multiple offenses); police records	Before-after, experimental-control Before=12 months After=60 months	E vs C (yearly average): total crimes: -35.6% (1,376 to 886) vs -5.0% (1,298 to 1,233); violent crimes: +47.9% (96 to 142) vs +59.5% (84 to 134); burglary: -21.7% (69 to 54) vs -33.3% (144 to 96); vehicle crimes (theft of and from): -50.0% (272 to 136) vs –17.9% (352 to 289); theft: -36.o% (239 to 153) vs +13.7% (131 to 149); criminal damage: -22.2% (180 to 140) vs +29.1% (206 to 266)(desirable effect)Displacement/diffusion not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Blixt (2003), Malmö (Möllevångstorget or Möllevång Square), Sweden	100% coverage	Passive monitoring by security personnel	E=city square C1=rest of city center C2= areas adjacent to city square	Social improve-ment programs (begun years prior)	Violent crime (assault, serious assault, robbery); police records	Before-after, experimental-control Before=36 months After=12 months	E vs C1 (yearly average): -50.0% (32 to 16) vs +15.8% (393 to 455) E vs C2 (yearly average): -50.0% vs -3.3% (91 to 88)(desirable effect)No displacement occurred
Sivarajasingam (2003), multiple city and town centers, UK	n.a.	Active monitoring by local council (with links to police) and police (in East-bourne only), operational all day; 24 months	E=5 centers (Ashford, East-bourne, Lincoln, Newport, Peterborough) C=5 centers (Derby, Huntingdon, Poole, Chelms-ford, Scar-borough)	None	Assault with injury (total); emergency department records; Violent crime (total); police records	Before-after, experimental-control with matchingBefore=24 months After=24 months	E vs C (emergency dept.):-3.3% (8,194 to 7,923) vs +11.2% (9,724 to 10,817)(desirable effect)E vs C (police): +16.1% (1,629 to 1,892) vs +6.2% (1,770 to 1,880)(undesirable effect)Displacement/diffusion not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Winge (2003), Oslo, Norway	6 cameras	Active monitoring by security personnel (with links to police), operational all day; 12 months	E=city center near central railway station C1=rest of city center C2=areas adjacent to E	Notices of CCTV	Crime (total and multiple categories); police records (incident log data)	Before-after, experimental-control Before=12 months After=12 months	E vs C1: total crimes: +35.3% (1,102 to 1,491) vs +2.8% (388 to 399); violent crime: +26.0% (204 to 257) vs +14.3% (98 to 112); public order: +10.4% (402 to 444) vs +3.4% (145 to 150); robbery/theft from person: -26.3% (133 to 98) vs -3.3% (30 to 29); narcotics: +87.0% (269 to 503) vs -2.4% (41 to 42) E vs C2: total crimes: +35.3% vs +0.7% (410 to 413); violent crime: +26.0% vs +4.4% (137 to 143); public order: +10.4% vs +1.3% (156 to 158); robbery/theft from person: -26.3% vs +35.0% (20 to 27); narcotics: +87.0% vs -50.0% (16 to 8) (undesirable effect)No displacement occurred
Gill (2005), Borough Town, UK	70%	Active monitoring, 173-520 cameras per operator, one-way communication with police; 12 months	E=town center C1=non-adjacent comparable area C2= adjacent area	None	Crime (total and multiple categories); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C1: total crimes: +0.3% (334 to 335) vs +12.8% (549 to 619)E vs C2: total crimes: +0.3% vs −5%(desirable effect)No displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Gill (2005), Market Town, UK	34%	Active monitoring, 27 cameras per operator, direct line to police; 12 months	E=town center C1=adjacent area C2=rest of police division	Comm-unity wardens, car park	Crime (total and multiple categories); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C1: total crimes: +18.4% (245 to 290) vs -7.0% (585 to 544) E vs C2: total crimes: +18.4% vs +3%(undesirable effect)No displacement occurred
Gill (2005), Shire Town, UK	76%	Active monitoring, 27 cameras per operator, retail radio; 12 months	E=town center C1= adjacent area C2=rest of police division	Comm-unity wardens	Crime (total and multiple categories); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C1: total crimes: -4.0% (352 to 338) vs +16.8% (1,018 to 1,189) E vs C2: total crimes:-4.0% vs +3%(desirable effect)No displacement occurred
Gill (2005), South City, UK	72%	Active monitoring (24 hrs/day), 65-86 cameras per operator, public house/retail radio, police in room; 12 months	E=town center C1=adjacent area C2=rest of police division	Comm-unity wardens, police operations	Crime (total and multiple categories); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C1: total crimes: -10.2% (5,106 to 4,584) vs −11.2% (27,608 to 24,511)E vs C2: total crimes:-10.2% vs −12%(null effect)No displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Farrington (2007a), Cambridge, UK	30 cameras	n.a.; 11 months	E=city centerC= secondary center	None	Crime (total and multiple categories); police recordsAlso victim survey data on crime and disorder	Before-after, experimental-control Before=11 months After=11 months	E vs C: total crimes: -13.8% (2,600 to 2,242) vs -26.9% (1,324 to 968); violent crimes: -6.0% (151 to 142) vs -33.8% (77 to 51); vehicle crimes: -53.1% (224 to 105) vs -54.0% (250 to 115); percentage victimized: +8.0% (26.4% to 28.5%) vs +19.3% (11.4% to 13.6%)(undesirable effect) Displacement/diffusion not measured
Cameron (2008), Hollywood Boulevard, Los Angeles, CA, US	5 cameras (pan, tilt, zoom)	Active, real-time monitoring (10-12 hours per day) by police; 14 months	E=Hollywood Boulevard (5 cameras) C="The Box" (5 surrounding police districts)	Signage; though not necessarily part of the intervention	Crime (total and multiple categories); police records; qualitative, semi-structured interviews	Before-after, experimental-control, comparison/matched pairBefore=25 months After=14 months	E vs C: total crimes: 10.67 (1074.64-959.98) vs. 11.34 (3432.24-3043.04), OR=0.99None of the findings reached statistical significance; despite that, displacement was suggested for battery and burglary/theft from vehicle
Verga (2008), Division 51, Toronto, ON, CA	7 cameras (pan, tilt, zoom)	Passive monitoring by police; 6 months	E=1 (target areas)C=1 (control areas)	None	Crime (total); police records	Before-after, experimental-control Before=6 months After=6 months	E vs C: total crimes: 0.84 (475-471) vs. 15.16 (178-151), OR=0.85Displacement did not occur
Verga (2008), Division 52, Toronto, ON, CA	8 cameras (pan, tilt, zoom)	Passive monitoring by police; 12 months	E=1 (target areas)C=1 (control areas)	None	Crime (total); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C: total crimes: 10.32 (853-765) vs. 9.37 (363-329), OR=1.01First 6 months, some evidence of diffusion & displacement; second 6 months, some evidence of diffusion & no evidence of displacement

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Charest (2010), Montreal, Quebec, CA	12 cameras (unknown type)	Active monitoring by designated operators; 12 months	E=1 (target areas)C=1 (control areas)	None	Crime (total, crimes against person, property crimes); police records; field observations	Before-after, experimental-control Before=42 months After=12 months	E vs C: total crimes: 21.96 (672-524.4) vs. 26.15 (679.2-501.6), OR=0.95Displacement/diffusion of benefits not measured
Papazian (2012), District #6, Denver, CO, US	44 cameras (pan, tilt, zoom)	Active, real-time monitoring by police; 24 months	E=1 (treatment areas) C=1 (control areas)	None	Crime (total and multiple categories); police records	Before-after, experimental-control with matchingBefore=24 months After=24 months	E vs C: total crimes: 0.75 (668-663) vs. -34.89 (536-723), OR=1.34Displacement/diffusion of benefits not measured
Cerezo (2013), Malaga, Andalusia, Spain	17 cameras (pan, tilt, zoom)	Active monitoring by designated operators; set in time-lapse mode but can be switched to real-time; 12 months	E=1 (treatment areas) C=1 (control areas)	None	Crime (total); police records; victimization survey w/ citizens	Before-after, experimental-control Before=12 months After=12 months	E vs C: total crimes: 1.93 (982-963) vs. -11.07 (560-622), OR=1.13Some displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Waszkiewicz (2013), area that bordered the Warsaw Central Railway Station, Warsaw, Poland	1 camera (unknown type)	Active monitoring by security, 24/7; 12 months	E=1 (treatment area) C=1 (control area)	None	Victimization surveys (experiences in past 12 months)	Before-after, experimental-control Before=12 months After=12 months	E vs C: survey: 23.08 (3.9-3) vs. 47.37 (7.6-4), OR=0.68Displacement/diffusion of benefits not measured
Slutrapport (2015), Stockholm (Medborgarplasten), Sweden	9 cameras (pan, tilt, zoom)	Active monitoring by police; during weekend-nighttime only; 2-way communication; 33 months	E=1 (treatment areas) C=1 (control areas)	None	Crime (total); police records	Before-after, experimental-control Before=33 months After=33 months	E vs C: total crime: 14.38 (1586-1358) vs. -32.57 (1523-2019), OR=1.55Displacement/diffusion of benefits not measured
Slutrapport (2015), Stockholm (Stureplan), Sweden	7 cameras (pan, tilt, zoom)	Active monitoring by police; during weekend-nighttime only; 2-way communication; 33 months	E=1 (treatment areas) C=1 (control areas)	None	Crime (total); police records	Before-after, experimental-control Before=33 months After=33 months	E vs C: total crime: 10.25 (1649-1480) vs. -32.57 (1523-2019), OR=1.45Displacement/diffusion of benefits not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Gerell (2016), Malmo, Scania, Sweden	6 cameras (unknown type)	Active monitoring by police; from 0000 hrs. to 0600 hrs. on Saturday & Sunday; 12 months	E=1 (treatment areas) C=1 (control areas)	Directed patrol	Crime (assaults during monitoring times); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C: assaults: 20.0 (35-28) vs. 37.5 (32-20), OR=0.78Displacement/diffusion of benefits not measured
Scott (2016), Footscray, Victoria, Australia	32 cameras (unknown type)	Active monitoring by police; 25 months	E=1 (treatment areas) C=1 (control areas; surrounding suburbs)	None	Drug user survey (all drug crimes, heroin street purchase, heroin street injection)	Before-after, experimental-control Before=29 months After=25 months	E vs C: all drug crimes: 62.02 (732-278) vs. 55.09 (639-287), OR=1.18Displacement did not occur
Lim (2017), Cincinnati, OH, US	Unknown number of cameras (pan, tilt, zoom)	Active monitoring by police; camera installation occurred 11/09-05/11; data starts 01/06 & ends 12/12 (84 months)	E=1 (treatment areas) C=1 (control areas)	None	Crime (total and multiple categories); police records	Before-after, experimental-controlMinimum-Before = 47 months After = 37 monthsMaximumBefore = 65 months After = 19 months	E vs C: total crime: 38.36 (7789-4801) vs. 51.07 (8353-4087), OR=0.79Diffusion of benefits occurred more than displacement did

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Piza (2018), Newark, NJ, US	69 cameras (pan, tilt, zoom)	Active monitoring by police, live, 24/7; 12 months	E=1 (treatment areas) C=1 (control areas)	None	Crime (total and multiple categories); police records	Before-after, experimental-control Before=12 months After=12 months	E vs C: total crime: 17.25 (800-662) vs. 1.47 (682-672), OR=1.19Diffusion of benefits occurred

b There was an additional eight months of follow-up, but the authors reported crime data as percentage changes relative to the 12-month before period, so it was not possible to accurately calculate the number of incidents for the additional eight months.

Notes: BZ = buffer zone (area surrounding experimental area)
E = experimental area
C = control area
n.a. = not available.
The location names for the four evaluations by Gill (2005) are pseudonyms.

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Musheno (1978), Bronxdale Houses, New York City, US	n.a.	CCTV monitoring system (cameras in lobby and elevators; monitors in apart-ments); 3 months	E = 3 buildings, C = 3 buildings Note: project had 26 high-rises; 53 apartments in each	None	Crime (multiple offenses); victim survey	Before-after, experimental-control Before = 3 months; After = 3 months	E vs C: total crimes:-9.4% (32 to 29) vs -19.2% (26 to 21)(uncertain effect)Displacement/diffusion not measured
Hood (2003), Greater Easterhouse Housing Estate, Glasgow, UK	n.a.	Active monitoring by security personnel (10 am – 2 am); 12 months	E = Council Ward 5C1 = Easter-house subdivisionC2 = D division	None	Violent and drug crimes; police records	Before-after, experimental-control Before = 12 months After = 20 monthsNote: 1 other C but, less comparable to E	E vs C1 (monthly average): total violent crimes: +30.8% (13 to 17) vs +15.4% (39 to 45); total drug crimes: -9.1% (33 to 30) vs +60.0% (92 to 147)E vs C2 (monthly average): total violent crimes: +30.8% vs +120.3% (79 to 174); total drug crimes: -9.1% vs +80.6% (186 vs 336)(desirable effect)Displacement/diffusion not measured
Gill (2005), Deploy Estate, UK	34%	Active monitoring (24 hrs/day), 49-66 cameras per operator, one-way communcation with police; 12 months	E = housing estateC1 = non-adjacent comparable housing estateC2 = adjacent area	None	Crime (total and multiple categories); police records and victim survey	Before-after, experimental-control Before = 12 months After = 12 months	E vs C1: total crimes (police records):+20.7% (760 to 917) vs +2.6% (534 to 548); total crimes (victim survey): -2.5% (864 to 842) vs -10.0% (397 to 359)E vs C2: total crimes (police records): +20.7% vs +3%(undesirable effect) No displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Gill (2005), Dual Estate, UK	9%	Active monitoring, 67 cameras per operator, 2-way communcation with police; 12 months	E = housing estateC1 = non-adjacent comparable housing estateC2 = adjacent area	None	Crime (total and multiple categories); police records and victim survey	Before-after, experimental-control Before = 12 months After = 12 months	E vs C1: total crimes (police records): +4.4% (799 to 834) vs -18.5% (464 to 378); total crimes (victim survey): -13.3% (732 to 635) vs -5.6% (414 to 391)E vs C2: total crimes (police records): +4.4% vs +11%(uncertain effect)No displacement occurred
Gill (2005), Southcap Estate, UK	73%	Active monitoring (24 hrs/ day), 148 cameras per operator, one-way communcation with police and police in room; 6 months	E = housing estateC = non-adjacent comparable housing estate	Youth inclusion project	Crime (total and multiple categories); police records and victim survey	Before-after, experimental-control Before = 6 months After = 6 months	E vs C: total crimes (police records): +13.8% (160 to 182) vs -13.4% (529 to 458); total crimes (victim survey): +20.0% (486 to 583) vs -47.1% (719 to 380)(undesirable effect)Displacement/diffusion not measured
Gill (2005), Eastcap Estate, UK	29%	Active monitoring (24 hrs/ day), 50 cameras per operator, 2-way communcation with police; 12 months	E = housing estateC1 = non-adjacent comparable housing estateC2 = adjacent area	Improved lighting	Crime (total and multiple categories); police records and victim survey	Before-after, experimental-control Before = 12 months After = 12 months	E vs C1: total crimes (police records): +2.2% (450 to 460) vs +5.4% (130 to 137); total crimes (victim survey): +2.4% (659 to 675) vs -23.4% (256 to 196)E vs C2: total crimes (police records): +2.2% vs -17%(uncertain effect)No displacement occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Gill (2005), Northern Estate, UK	87%	Active monitoring (24 hrs/day), 25-40 cameras per operator, one-way communcation with police; 12 months	E = housing estateC1 = non-adjacent comparable housing estateC2 = adjacent area	None	Crime (total and multiple categories); police records and victim survey	Before-after, experimental-control Before = 12 months After = 12 months	E vs C1: total crimes (police records): -9.8% (112 to 101) vs +20.5% (73 to 88); total crimes (victim survey): +27.8% (151 to 193) vs +32.3% (214 to 283)E vs C2: total crimes (police records): -9.8% vs +10%(desirable effect)No displacement occurred
Gill (2005), Westcap Estate, UK	62%	Active monitoring (24 hrs/day), 20-60 cameras per operator; 12 months	E = housing estateC = non-adjacent comparable housing estate	Youth inclusion project	Crime (total and multiple categories); victim survey	Before-after, experimental-control Before = 12 months After = 12 months	E vs C: total crimes (victim survey): -35.6% (649 to 418) vs +19.2% (266 to 317)(desirable effect)Displacement/diffusion not measured

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Cameron (2008), Jordan Downs Housing Project, Los Angeles, CA, US	6 cameras (pan, tilt, zoom)	Active, real-time monitoring by police (before & after school); 16 months	E = Jordan Downs housing developmentC = Nickerson Gardens housing development	Gang injunction & task force	Crime (total and multiple categories); police records; qualitative, semi-structured interviews	Before-after, experimental-control Before = 45 months; After = 16 months	E vs C: total crimes: 10.09 (11.69-10.51) vs 25.40 (22.76-16.75), OR = 0.82No displacement occurred
Greenberg (2009), Peter Cooper Village, Manhattan, NY, US	198 cameras total; CCTV cameras (9 cameras inside each of the 21 buildings) (N = 189) & cameras outside (N = 9) (pan, tilt, zoom)	Unknown; 24 months	E = Peter Cooper Village (2,483 apts)C = Stuyvsant Town (8,747 apts)	Door alarm monitoring, proximity card access, & emergency call boxes (interior & exterior)	Crime (total, vandalism, and larceny); police records; security records	Before-after, experimental-control Before = 36 months; After = 24 months	E vs C: total crimes: 11.17 (49.44-43.92) vs 20.63 (364.08-288.96), OR = 0.89No displacement or diffusion of benefits occurred

Notes: BZ = buffer zone (area surrounding experimental area)
E = experimental area
C = control area
n.a. = not available.
The location names for the six evaluations by Gill (2005) are pseudonyms.

Author, Publication Date, and Location (context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Gill (2005), City Outskirts, UK(residential area)	68%	Active monitoring (24 hrs/ day), 48 cameras/ operator, direct line to police; 12 months	E = residential areaC1 = adjacent residential areasC2 = rest of police division	Improved lighting, anti-burglary schemes	Crime (total and multiple categories); police records	Before-after, experimental-control Before = 12 months After = 12 months	E vs C1: total crimes: -28.0% (1,526 to 1,098) vs -3.4% (16,696 to 16,062)E vs C2: total crimes: -28.0% vs +4%(desirable effect)No displacement occurred
Gill (2005), Borough, UK(residential area)	Low (8 redeployable used)	n.a.;12 months	E = residential areaC1 = adjacent residential areasC2 = rest of police division	None	Crime (total and multiple categories); police records	Before-after, experimental-control Before = 12 months After = 12 months	E vs C1: total crimes: +72.8% (257 to 444) vs +38.5% (421 to 583) E vs C2: total crimes: +72.8% vs +8%(undesirable effect)No displacement occurred
Ratcliffe (2009), Philadelphia, PA, US	18 cameras total; (pan, tilt, zoom, N = 8) and (PODSS, N = 10)	Mostly passive monitoring by police, in real-time (PTZ); police can watch wirelessly from their car (PODSS); months vary by camera type & location	E = 1 (treatments areas) C = 1 (control areas)	None	Crime (total, serious crime, disorder crime); police records	Before-after, experimental-controlPTZBefore = 11-14 months After = 18-21 months PODSS-Before = 22-23 months After = 9-10 months	E vs C: total crime: 15.49 (2460-2079) vs. 4.64 (162589-155029), OR = 1.13Possible displacement (at 2 sites) and diffusion of benefits for 2 other sites

Author, Publication Date, and Location (context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Charest (2010), Montreal, Quebec, CA	6 cameras (unknown type)	Active monitoring by designated operators; 30 months	E = 1 (target areas)C = 1 (control areas)	Foot patrol	Crime (total, crimes against person, property crimes); police records; field observations	Before-after, experimental-control Before = 25 months After = 30 months	E vs C: total crimes: 36.43 (1680-1068) vs. -8.85 (1560-1698), OR = 1.71Displacement/diffusion of benefits not measured
La Vigne (2011), Greenmount Area, Baltimore, MD, US	33 cameras (pan, tilt, zoom)	Active monitoring by police, 2-way communication; 33 months	E = 1 (treatment area)C = 1 (control area)	Flashing lights & signage	Crime (all crime); police records	Before-after, experimental-control, with matchingBefore = 31 months After = 33 months	E vs C: total crime: 20.69 (2112-1675.08) vs. 12.44 (1333.86-1167.87), OR = 1.10Displacement/diffusion of benefits did not occur
La Vigne (2011), North Avenue Area, Baltimore, MD, US	35 cameras (pan, tilt, zoom)	Active monitoring by police, 2-way communication; 26 months	E = 1 (treatment area)C = 1 (control area)	Flashing lights & signage	Crime (total and multiple categories); police records	Before-after, experimental-control, with matchingBefore = 38 months After = 26 months	E vs C: total crime: -2.69 (1626.3-1669.98) vs. 10.15 (1141.92-1025.96), OR = 0.87Displacement/diffusion of benefits not measured

Author, Publication Date, and Location (context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
La Vigne (2011), Tri-District, Baltimore, MD, US	27 cameras (pan, tilt, zoom)	Active monitoring by police, 2-way communication; 26 months	E = 1 (treatment area)C = 1 (control area)	Flashing lights & signage	Crime (all crime; larceny inside; robbery); police records	Before-after, experimental-control, with matchingBefore = 38 months After = 26 months	E vs C: total crime: 22.57 (977.86-757.12) vs. -11.54 (845.78-945.88), OR = 1.44Displacement did not occur; small evidence of diffusion of benefits, but results were not statistically significant
La Vigne (2011), Humboldt Park, Chicago, IL, US	24 cameras (pan, tilt, zoom)	Active monitoring by police, 2-way communication; 36 months	E = 1 (treatment area)C = 1 (comparison area)	Signage & flashing lights	Crime (total and multiple categories); police records	Before-after, experimental-control Before = 23 months After = 36 months	E vs C: total crime: 19.19 (10850.04-8767.08) vs. 5.6 (12584.52-11880), OR = 1.17Displacement did not occur; small evidence of diffusion of benefits, but results were not statistically significant
La Vigne (2011), West Garfield Park, Chicago, IL, US	9 cameras (pan, tilt, zoom)	Active monitoring by police, 2-way communication; 36 months	E = 1 (treatment area)C = 1 (comparison area)	Signage & flashing lights	Crime (total and multiple categories); police records	Before-after, experimental-control Before = 23 months After = 36 months	E vs C: total crime: -6.65 (6503.4-6936.12) vs. 0.64 (7736.76-7687.08), OR = 0.93Displacement/diffusion of benefits not measured
La Vigne (2011), Mount Vernon Square, Washington, DC, US	13 cameras (pan, tilt, zoom)	Mostly passive monitoring by police; 29 months	E = 1 (target area, camera/cluster)C = 1Individual camera sites	Signage & flashing lights	Crime (all crime and multiple categories); police records	Before-after, experimental-control, with matchingBefore = 21 months After = 29 months	E vs C: total crime: 6.94 (1211.04-1126.94) vs. -4.55 (1179.43-1233.08), OR = 1.12Displacement/diffusion of benefits not measured

Author, Publication Date, and Location (context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Park (2012), Gwang Myeong City, Gyeonggi Province, SK	23 cameras (unknown type)	Unknown; 5 months	E = 1 (Haan Residential Zone)C = 2 (Parts of Gwang Myeong; (a) 2-3 Dongs, (b) 5-6 Dongs)	None	Crime (violent crime; robbery theft); police records	Before-after, experimental-control Before = 5 months After = 5 months	E vs C: total crime: 11.76 (34-30) vs. 4.67 (107-102), OR = 1.08No/minimal displacement of crime but there were signs of diffusion of benefits
Waszkiewicz (2013), Muranow District, Warsaw, Poland	1 camera (unknown type)	Active monitoring by security, 24/7; 12 months	E = 1 (treatment area)C = 1 (control area)	None	Victimization surveys (experience in past 12 months)	Before-after, experimental-control Before = 12 months After = 12 months	E vs C: survey: 65 (10-3.5) vs. 69.05 (12.6-3.9), OR = 0.88Displacement/diffusion of benefits not measured
Sousa (2016), (FS) Las Vegas, NV, US	Unknown number of cameras (unknown type)	Police monitored; 5 months	E = 1 (target location, 2 block radius) C = 3 (Southwest, South Central, Southwest)	Flashing lights	Police calls for service (all crime); survey data (from community)	Before-after, experimental-control, with matchingBefore = 5 months After = 5 months	E vs C: total crime: 10.63 (649-580) vs. 5.59 (11675-11022), OR = 1.06Diffusion of benefits occurred

Author, Publication Date, and Location (context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Sousa (2016), (FS-E) Las Vegas, NV, US	Unknown number of cameras (unknown type)	Police monitored; 5 months	E = 1 (target location, 2 block radius) C = 3 (Southwest, South Central, Southwest)	Directed patrols	Police calls for service (all crime); survey data (from community)	Before-after, experimental-control, with matchingBefore = 5 months After = 5 months	E vs C: total crime: 9.42 (5317-4816) vs. 5.59 (11675-11022), OR = 1.04Diffusion of benefits occurred
Lim (2017), Cincinnati, OH, US (residential)	Unknown number of cameras (pan, tilt, zoom) for this specific area; 35 total used for study	Active monitoring by police; camera installation occurred 11/09-05/11; data starts 01/06 & ends 12/12 (84 months)	E = 1 (residential)C = 1 (700-1,000 ft. from target areas)	None	Crime (total and multiple categories); police records	Before-after, experimental-controlMinimum-Before = 47 months After = 37 monthsMaximum-Before = 65 months After = 19 months	E vs C: total crime: 62.51 (1419-532) vs. 51.06 (897-439), OR = 1.30Diffusion of benefits occurred more than displacement did

Author, Publication Date, and Location (context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Piza (2018), Newark, NJ, US (residential)	48 cameras (pan, tilt, zoom)	Active monitoring by police, live, 24/7; 12 months	E = 1 (treatments areas) C = 1 (control areas)	None	Crime (total and multiple categories); police records	Before-after, experimental-control Before = 12 months After = 12 months	E vs C: total crime: 15.72 (496-418) vs. 5.94 (640-602), OR = 1.12Diffusion of benefits occurred

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E = experimental area
C = control area
n.a. = not available.
The location names are pseudonyms.

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Burrows (1979), "Underground" subway, London, UK	n.a. (fixed)	Active monitoring by BTP; 12 months	E = 4 stations on southern sector, C1 = 15 other stations on southern sector, C2 = 228 other Under-ground stations	Notices of CCTV (also special police patrols preceded CCTV)	Personal theft and robbery; BTP records	Before-after, experimental-control Before = 12 months; After = 12 months	E vs C1: robbery: -22.2% (9 to 7) vs +23.1% (13 to 16); theft: -72.8% (243 to 66) vs -26.5% (535 to 393)E vs C2: robbery: -22.2% vs +116.3% (43 to 93); theft: -72.8% vs -39.4% (4,884 to 2,962)(desirable effect) Some displacement occurred
Webb (1992), "Underground" subway, London, UK	Expansion of cameras: 7-14 per E station (mix of fixed and pan, tilt, and zoom)	Active monitoring by BTP; 26 months	E = 6 stations on south end of Northern line, C1 = 6 stations on north end of line, C2 = 236 other Under-ground stations	Passenger alarms, visible kiosk to monitor CCTV, mirrors, and improved lighting	Robbery; BTP records	Before-after, experimental-control Before = 46 months; After = 26 months-Note: special policing used in E stations during first 3 years (1985-87) of before period (i.e., first 36 of 46 months of before period); in 1988 (remaining 10 months of before period), policing activity reduced in E stations	E vs C1 (monthly average): -62.3% (5.3 to 2.0) vs -50.0% (7.8 to 3.9) E vs C2: -62.3% vs -12.2% (69.6 to 61.1)(desirable effect)Note: for C2, Guardian Angels patrols began in May 1989 (7 months into 26 months of after period)Diffusion occurred

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/Diffusion
Webb (1992), Oxford Circus station, "Underground" subway, London, UK	30 cameras	Active monitoring by BTP; 32 months	E = 1 station, C = 1 station	Passenger alarms, visible kiosk to monitor CCTV, and BTP patrols	Personal theft, robbery, and assault; BTP records	Before-after, experimental-control Before = 28 months; After = 32 months	E vs C (monthly average): robbery: +47.1% (1.7 to 2.5) vs +21.4% (1.4 to 1.7); theft: +11.0% (31.0 to 34.4) vs -1.9% (20.8 to 20.4); assault: +29.4% (1.7 to 2.2) vs +36.4% (1.1 to 1.5)(undesirable effect)Displacement/diffusion not measured
Grandmaison (1997), "Metro" subway, Montreal, Canada	130 cameras (approx. 10 per E station)	Active monitoring by police; 18 months	E = 13 stations,C = 52 stations	None	Crime (total and multiple offenses); police records	Before-after, experimental-control with statistical analysesBefore = 18 months; After = 18 months	E vs C: total crimes: -20.0% (905 to 724) vs -18.3% (1,376 to 1,124); robbery: -27.0% (141 to 103) vs -30.8% (312 to 216); assault: -27.5% (178 to 129) vs +5.6% (233 to 246); total theft and fraud: -15.5% (388 to 328) vs -16.0% (507 to 426)(null effect)Displacement/diffusion not measured

Notes: BTP = British Transport Police
E = experimental area
C = control area
n.a. = not available.

Author, Publication Date, and Location(context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/ Diffusion
Gill (2005), City Hospital, UK(hospital)	76%	Active monitoring, direct line to police;12 months	E = hospitalC1 = adjacent areasC2 = rest of police division	Leaflets, posters, improved lighting, police operations	Crime (total and multiple categories); police records	Before-after, experimental-controlBefore = 12 months After = 12 months	E vs C1: total crimes:-36.6% (41 to 26) vs -12.2% (3,218 to 2,824)E vs C2: total crimes:-36.6% vs –9%(desirable effect)No displacement occurred
Kim (2008), Gangnam-gu, Seoul, SK (City-Wide)	42 cameras (unknown type)	Unknown; 12 months	E = 1C = 2	None	Crime (theft & burglary); police records	Before-after, experimental-controlBefore = 12 months After = 12 months	E vs C: theft & burglary: 52.20 (5864-2803) vs 19.93 (4862-3893), OR = 1.68Diffusion of benefits occurred
La Vigne (2011), Washington, D.C., US (City-Wide)	73 cameras (pan, tilt, zoom)	Mostly passive monitoring by police; 29 months	E = 1 (73 individual camera sites/ treatment area)C = 1 (73 comparison area)	Signage & flashing lights	Crime (total and multiple categories); police records	Before-after, experimental-controlBefore = 21 months After = 29 months	E vs C: all crime: 0.21 (1949.96-1945.9) vs -0.46 (1967.94-1976.93), OR = 1.01Displacement/diffusion of benefits not measured

Author, Publication Date, and Location(context of intervention)	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/ Diffusion
Lim (2016), Chuncheon, Gangwon Province, SK (Mixed environments)	26 cameras total; pan, tilt, zoom (N = 22) & fixed (N = 4)	Unknown;2 phases, duration of intervention varied by site	E = 1 (26 locations; mixed; school, residential, & city center) C = 1 (26 comparison locations)	None	Crime (serious & disorder crime); police records	Before-after, experimental-controlPhase 1 (sites 7-9)Before = 12 months After = 36 monthsPhase 2 (sites 1-6)Before = 35 months After = 13 months	E vs C: all crime: 66.30 (184-62) vs 55.25 (1200-537), OR = 1.33Diffusion of benefits occurred (higher for serious crimes than disorder crimes)
Lim (2017), Cincinnati, OH, US (School/university)	Unknown number of cameras (pan, tilt, zoom) for this specific area; 35 total used for study	Active monitoring by police; camera installation occurred 11/09-05/11; data starts 01/06 & ends 12/12 (84 months)	E = 1 (schools/target area)C = 1 (700-1,000 ft. from target areas)	None	Crime (total and multiple categories); police records	Before-after, experimental-controlMinimum-Before = 47 months After = 37 monthsMaximum-Before = 65 months After = 19 months	E vs C: all crime: 42.58 (1031-592) vs 37.39 (690-432), OR = 1.09Diffusion of benefits was more apparent than crime displacement

Notes: BZ = buffer zone (area surrounding experimental area)
E = experimental area
C = control area
n.a. = not available.
The location names are pseudonyms.

Closed circuit television surveillance (CCTV) is a commonly used and equally commonly debated method for preventing crime. A previous review from Brå from 2007 showed that CCTV had the capacity to prevent crime, though significant effects on the meta-level were only present at car-parks. Technological developments have contributed to a constant growth in the use of CCTV, and the body of research on the effects is also expanding. Therefore it is timely with an updated review focusing on essential core-questions. Does CCTV effectively prevent crime? Does CCTV work better in some settings than in others? Is CCTV most effective alone, or in conjunction with other preventive measures? What does the research tell us?

Systematic reviews are one means of helping people to find their way through the massive body of research findings. Systematic reviews combine a number of studies that are considered to satisfy a list of empirical criteria for measuring effects as reliably as possible. The results of these studies are then used to calculate and produce an overall picture of the effects associated with a certain phenomenon. In this way systematic reviews produce a more reliable overview based on the best well-founded knowledge available.

The Swedish National Council for Crime Prevention (Brå) has therefore initiated the publication of a series of systematic reviews, in the context of which distinguished researchers have been commissioned to perform the studies on our behalf. In this study, the authors have carried out an updated systematic review, including meta-analysis, of 80 studies from different parts of the world that study the effects of CCTV.

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