Closed-Circuit Television Surveillance and Crime Prevention

A Systematic Review

Report prepared for
The Swedish National Council for
Crime Prevention

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

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Foreword

Closed circuit television surveillance is a commonly used and equally commonly debated method for preventing crime. Technological developments have also contributed to a constant growth in the use of CCTV surveillance. First and foremost in the UK, CCTV surveillance has been used extensively in public places. In Sweden, the use of CCTV for crime prevention purposes has to date mainly been restricted to locations such as shops, parking garages and other indoor environments. Over recent years, however, the use of CCTV surveillance for the purposes of crime prevention has become increasingly common on public transport, in taxis and in schools. It has also become common to use CCTV surveillance in bank entrances and near cash point machines. There are however still very few examples of the use of CCTV for crime prevention purposes in larger public spaces where large numbers of people gather and move around such as on the street, or in parks.

The debate on the use of CCTV is mainly concerned with the balance between the potential benefits and the risk for violations of individual privacy. The financial aspects are also an issue. The Swedish National Council for Crime Prevention (Brå) has previously contributed to the knowledge base underlying these discussions by conducting evaluations of Swedish projects involving the CCTV surveillance of a city centre, a park and two parking lots (Brå Report 2003:11). These evaluations showed that effects varied, but that if CCTV was used correctly and under generally favourable conditions, crime could be prevented. Evaluating specific and concrete projects in this way provides important knowledge. But for practical and financial reasons, very few reliable scientific evaluations are performed in this area in individual countries such as Sweden. It is therefore a good thing that we can learn from the experiences of other countries.

This report presents a systematic meta-analysis of the effects of CCTV surveillance that has been conducted by two of the world's most prominent researchers in the field, Associate Professor Brandon C. Welsh of the University of Massachusetts Lowell (United States) and Professor David P. Farrington of Cambridge University (United Kingdom). Welsh and Farrington have also written the report. The study follows a rigorous method for the conduct of systematic meta-analyses. The meta-analysis combines the results from a large number of evaluations from several different countries that are considered to satisfy a number of specified empirical criteria for measuring effects as reliably as possible. One of the evaluations employed is the one conducted by Brå and mentioned above. The analysis then uses the results from these previous evaluations to calculate and produce an overview

of the effects that improved CCTV does and does not produce. The results from a large number of studies in several different countries are thus systematically evaluated to produce a more reliable picture of CCTV surveillance and the opportunities and limitations it presents for preventing crime. Studies of this kind are also useful when making combined assessments of the circumstances in which a certain measure works and is cost-effective.

Research of this kind contributes with an important knowledge base for decision-making processes. In the future, Brå aims to present more international, systematic meta-analyses of different types of crime prevention measures. But there are also good reasons for proceeding from a more national - and in our case – context-bound perspective on occasion. Not all results based on the experiences of other countries can be transferred to Swedish conditions. There are strict laws and regulations in place in Sweden concerning how CCTV surveillance can be used, which are not taken into consideration in international research reviews of this kind. There is also good reason to weigh the international results and experiences against our own history and our current situation as regards the use of CCTV, which are very different from those of countries like the United Kingdom, for example, which has long been developing large-scale CCTV surveillance as a means of combating terrorism. Having said this, I will now make way for the readers of the report to learn of – and themselves reflect upon – the results that have been produced and presented by the report's authors.

Stockholm, October 2007

Jan Andersson
Director-General

Summary

Closed-circuit television (CCTV) surveillance cameras serve many functions and are used in both public and private settings. The prevention of personal and property crime is among the primary objectives in public space. As an intervention targeted at crime, CCTV is a type of situational crime prevention (Clarke, 1995).

In recent years, there has been a marked and sustained growth in the use of CCTV surveillance cameras in public places in many Western nations. One estimate puts the total number of public CCTV cameras in the U.K. at 4.2 million, or one for every 14 citizens. It has also been estimated that the average Briton is caught on camera 300 times each day (The Associated Press, 2007).

There are no national estimates as of yet on the number of CCTV cameras in the U.S., but local accounts indicate that they are being implemented at an unprecedented rate and their popularity is not limited to large urban centers (Fountain, 2006; Nieto et al., 2002). There are also signs that other countries, most more cautiously than the U.K. and U.S., are increasingly experimenting with CCTV to prevent crime in public places.

This growth in CCTV has come with a large price tag, and there has been much debate about the effectiveness of CCTV to prevent crime and hence, on the wisdom of spending such large sums of money. A key issue is how far funding for CCTV, especially in the U.K. and U.S., has been based on high quality scientific evidence demonstrating its efficacy in preventing crime.

The mechanisms by which CCTV may prevent crime are numerous. CCTV may deter potential offenders because of their increased subjective probability of detection. Also, CCTV may increase the true probability of detection, may increase pedestrian usage of places and hence further increase the subjective probability, may encourage potential victims to take security precautions, and may direct police and security personnel to intervene to prevent crime (Armitage et al., 1999, pp. 226-227). Another possibility is that CCTV could signal improvements in the area and hence increase community pride, community cohesion, and informal social control.

Studies were included in this systematic review if CCTV was the main intervention, if there was an outcome measure of crime, if there was at least one experimental area and one comparable control area, if there were before and after measures of crime, and if the total number of crimes in each area before the intervention was at least 20. (Any study with less than 20 crimes before would have insufficient statistical power to detect changes in crime.)

Four search strategies were employed to locate studies meeting the criteria for inclusion: searches of electronic bibliographic databases, searches of literature reviews on the effectiveness of CCTV on crime, searches of bibliographies of CCTV reports, and contacts with leading researchers. Forty-four studies met the inclusion criteria.

The results suggest that CCTV caused a small (16%) but significant decrease in crime in experimental areas compared with comparable control areas. However, this overall result was largely driven by the effectiveness of CCTV schemes in car parks, which caused a 51% decrease in crime. Schemes in most other settings had small and non-significant effects on crime: a 7% decrease in city and town centers and in public housing. Public transport schemes had greater effects (a 23% decrease overall), but these were still non-significant. Schemes evaluated in the U.K. were more effective than schemes evaluated in other countries, but this effectiveness was largely driven by the studies in the car parks.

CCTV schemes in car parks could have been the most effective for a variety of reasons. First, in all the schemes CCTV was combined with other interventions such as improved lighting, fencing, and security personnel. Second, camera coverage was high, and this factor is related to effectiveness. Third, vehicle crimes were targeted, and it may be that such crimes are easier to detect than violent crimes for example.

Overall, it might be concluded that CCTV reduces crime to some degree. In light of the marginally successful results, future CCTV schemes should be carefully implemented in different settings and should employ high quality evaluation designs with long follow-up periods.

Acknowledgements

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We benefited from excellent research assistance by Katherine Harrington at the University of Massachusetts Lowell. We would also like to thank the following individuals and organizations for helpful assistance in locating and interpreting new evaluation studies for this report: Dr. Madeleine Blixt (National Council for Crime Prevention, Sweden), Dr. Martin Gill (Perpetuity Research and Consultancy International), Dr. John Hood (Glasgow Caledonian University), Professor Lorraine Mazerolle (Griffith University), Professor Jonathan Shepherd (Cardiff University), Deborah Friedman (University of Massachusetts Lowell), and Fairfield City Council (Australia).

Brandon C. Welsh
David P. Farrington

Introduction

Closed-circuit television (CCTV) surveillance cameras serve many functions and are used in both public and private settings. The prevention of personal and property crime is among the primary objectives in public space. As an intervention targeted at crime, CCTV is a type of situational crime prevention (Clarke, 1995). According to Clarke and Homel's (1997) classification of situational crime prevention, CCTV is viewed as a technique of "formal surveillance." In this regard, CCTV cameras are seen to enhance or take the place of security personnel.

It is argued that CCTV (especially if well publicized) may prevent crime because potential offenders are deterred by their increased subjective probability of detection. Also, CCTV may increase the true probability of detection, may increase pedestrian usage of places and hence further increase the subjective probability, may encourage potential victims to take security precautions, and may direct police and security personnel to intervene to prevent crime (Armitage et al., 1999, pp. 226-227). Another possibility is that CCTV could signal improvements in the area and hence increase community pride, community cohesion, and informal social control.

CCTV could also cause crime to increase. For example, it could give potential victims a false sense of security and make them more vulnerable because they relax their vigilance or stop taking precautions, such as walking in groups at night and not wearing expensive jewelry. It may encourage increased reporting of crimes to the police and increased recording of crimes by the police. CCTV may also cause crime to be displaced to other locations, times, or victims.

The main aim of this report is to present the results of an updated systematic review on the effects of CCTV surveillance on crime in public places. Six years have elapsed since we completed the first systematic review on the subject (Welsh and Farrington, 2002; see also Welsh and Farrington, 2004a, b, 2006a). This report is divided into five chapters. The second chapter provides some background on the use of CCTV to prevent crime. The third chapter, on research methods, reports on the criteria for inclusion of CCTV studies in this review and the methods used to search for new evaluation studies. The fourth chapter reports on the key features of the studies that were included and the results of a meta-analysis. The final chapter provides some concluding comments and explores implications for policy and research.

Background

In recent years, there has been a marked and sustained growth in the use of CCTV surveillance cameras in public places in many Western nations. The U.K. for one finds itself on the cusp of becoming, in the words of some, a "surveillance society" (Reuters, 2006). One estimate puts the total number of public CCTV cameras in the U.K. at 4.2 million, or one for every 14 citizens. It has also been estimated that the average Briton is caught on camera 300 times each day (The Associated Press, 2007).

There are no national estimates as of yet on the number of CCTV cameras in the U.S., but local accounts indicate that they are being implemented at an unprecedented rate and their popularity is not limited to large urban centers (Fountain, 2006; Nieto et al., 2002). While some of this increased use in the U.S. has come about in an effort to aid the police in the detection and prevention of terrorist activities, especially in New York City and other metropolises, the prevention of crime remains an important aim of these CCTV systems (Kinzer, 2004; McCarthy, 2007; The Associated Press, 2006b). Similar claims have been made in the U.K. about the purpose of public CCTV there (The Associated Press, 2007).

There are signs that other countries, most more cautiously than the U.K. and U.S., are increasingly experimenting with CCTV to prevent crime in public places. One source of this knowledge on the growth in the use of public CCTV, albeit limited but welcomed, comes in the form of evaluation research. In the course of searching for new studies for the present systematic review, we found evaluation studies of public CCTV schemes in a number of European countries, including Germany, Norway, and Sweden, as well as in Australia and Japan. Many of these countries have not previously used CCTV in public places, let alone evaluated its effects on crime.

This growth in CCTV has come with a large price tag. In the U.K. CCTV is the single most heavily funded non-criminal justice crime prevention measure. Between 1999 and 2001, the U.K. government made available £170 million (approximately US$350 million) for "CCTV schemes in town and city centres, car parks, crime hot-spots and residential areas" (Home Office Policing and Reducing Crime Unit, 2001, p. 8). Over the last decade, CCTV accounted for more than three-quarters of total spending on crime prevention by the Home Office (Koch, 1998; Reuters, 2007). In the U.S., figures range from US$25 million spent on cameras in buses and subway stations in New York City, to US$5 million spent in Chicago on a 2,000-camera system throughout the city, to more than US$10 million spent in Baltimore (McCarthy, 2007; The Associated Press, 2006a, b).

During this time there has been much debate about the effectiveness of CCTV to prevent crime and hence, on the wisdom of spending such large sums of money. A key issue is how far funding for CCTV, especially in the U.K. and U.S., has been based on high quality scientific evidence demonstrating its efficacy in preventing crime. In the U.K. there has long been concern that funding for public CCTV has been based partly on a handful of apparently successful schemes that were usually evaluated using simple one group (no control group) before-after designs, done with varying degrees of competence (Armitage et al., 1999), and done with varying degrees of professional independence from the Home Office (Ditton and Short, 1999). Recent reviews that have examined the effectiveness of CCTV in preventing crime (Eck, 2006; Wilson and Sutton, 2003) have also noted the need for higher quality, independent evaluation research.

Research methods

As noted above, this report presents a systematic review of the effects of CCTV surveillance on crime and follows closely the methodology of this review technique. Systematic reviews use rigorous methods for locating, appraising, and synthesizing evidence from prior evaluation studies, and they are reported with the same level of detail that characterizes high quality reports of original research. According to Johnson et al. (2000, p. 35), systematic reviews "essentially take an epidemiological look at the methodology and results sections of a specific population of studies to reach a research-based consensus on a given study topic." They have explicit objectives, explicit criteria for including or excluding studies, extensive searches for eligible evaluation studies from all over the world, careful extraction and coding of key features of studies, and a structured and detailed report of the methods and conclusions of the review. All of this contributes greatly to the ease of their interpretation and replication by other researchers. It is beyond the scope of this report to discuss all of the features of systematic reviews, but interested readers should consult key volumes on the topic (see Farrington and Welsh, 2001; Petticrew and Roberts, 2006; Welsh and Farrington, 2006b).

Criteria for Inclusion of Evaluation Studies

In selecting evaluations for inclusion in this review, the following criteria were used:

(a) CCTV was the focus of the intervention. For evaluations involving one or more other interventions, only those evaluations in which CCTV was the main intervention were included. The determination of what was the main intervention was based on the author identifying it as such or, if the author did not do this, the importance the report gave to CCTV relative to the other interventions.

(b) There was an outcome measure of crime. The most relevant crime outcomes were violent and property crimes.

(c) The evaluation design was of high methodological quality, with the minimum design involving before-and-after measures of crime in experimental and comparable control areas.

(d) The total number of crimes in each area before the intervention was at least 20. The main measure of effect size was based on changes in numbers of crimes between the before and after time periods. It was considered that a measure of change based on an *N* below 20 was potentially misleading. Also, any study with less than 20 crimes

before would have insufficient statistical power to detect changes in crime. The criterion of 20 is probably too low, but we were reluctant to exclude studies unless their numbers were clearly inadequate.

Search Strategies

In order to locate studies meeting the above criteria, four search strategies were employed:

(a) Searches of electronic bibliographic databases (see below).

(b) Searches of reviews of the literature on the effects of CCTV on crime. Four new reviews were identified and assessed: Gill (2003, 2006); Ratcliffe (2006); and Wilson and Sutton (2003). (Appendix 1 lists all of the literature reviews that we consulted for our first systematic review on CCTV and the present update.)

(c) Searches of bibliographies of evaluation reports of CCTV studies.

(d) Contacts with leading researchers (see Acknowledgments).

Both published and unpublished reports were considered in these searches. Furthermore, the searches were international in scope and were not limited to the English language. These searches were completed in April 2007 and reflect material published or reported over a six-year period, between January 2001 and December 2006.

The following ten electronic bibliographic databases were searched:

- Criminal Justice Abstracts
- National Criminal Justice Reference Service (NCJRS) Abstracts
- Sociological Abstracts
- Educational Resources Information Clearinghouse (ERIC)
- Government Publications Office Monthly Catalogue (GPO Monthly)
- Psychology Information (PsychInfo)
- Dissertation Abstracts
- Social, Pyschological, Educational, and Criminological Trials Register (C2-SPECTR)
- Google Scholar
- Medline

These electronic databases were selected on the basis of the most comprehensive coverage of criminological, criminal justice, and social and behavioral science literatures. They are also among the top databases recommended by the Campbell Collaboration Crime and Justice Group.

Three databases, Social Science Abstracts (SocialSciAbs), Public Affairs Information Service (PAIS) International, and the Australian Criminology Database (CINCH), which were used in the initial systematic review, were not used here because they were no longer available to the researchers. In their place, two new electronic databases were searched: Google Scholar and Medline.

The following terms were used to search the ten databases noted above: closed circuit television, CCTV, cameras, social control, surveillance, and formal surveillance. When applicable, "crime" was then added to each of these terms (e.g., CCTV and crime) to narrow the search parameters.

These search strategies resulted in the collection of 22 new evaluations of CCTV that met our inclusion criteria. Twenty-three other new CCTV evaluations were obtained and analyzed but did not meet the inclusion criteria and thus were excluded. The majority of these evaluations were excluded because they did not use a control area or they used a non-comparable control area, such as the rest of the city.

Previous search strategies (up to December 2000) produced 22 CCTV evaluations that met the inclusion criteria. The results reported here are based on these 22 plus the 22 new evaluations, for a total of 44 CCTV evaluations.

Results

To assess the effectiveness of CCTV in reducing crime, meta-analytic techniques were used. A meta-analysis is essentially a statistical summary of comparable effect sizes reported in each evaluation. In order to carry out a meta-analysis, a comparable measure of effect size and an estimate of its variance are needed in each program evaluation (Lipsey and Wilson, 2001; Wilson, 2001). In the case of CCTV evaluations, the measure of effect size had to be based on the number of crimes in the experimental and control areas before and after the intervention. This is because this was the only information that was regularly provided in these evaluations. Here, the odds ratio is used as the measure of effect size. For example, in the Doncaster city center CCTV evaluation (Skinns, 1998; see below), the odds of a crime after given a crime before in the control area were 2,002/1,780 or 1.12. The odds of a crime after given a crime before in the experimental area were 4,591/5,832 or 0.79. The odds ratio, therefore, was 1.12/0.79 or 1.42.

The odds ratio (OR) has a very simple and meaningful interpretation. It indicates the proportional change in crime in the control area compared with the experimental area. In this example, the OR of 1.42 indicates that crime increased by 42% in the control area compared with the experimental area. An OR of 1.42 could also indicate that crime decreased by 30% in the experimental area compared with the control area, since the change in the experimental area compared with the control area is the inverse of the OR, or 1/1.42 here. The OR is calculated from the following table:

	Before	**After**
Experimental	a	b
Control	c	d

Where a, b, c, d are numbers of crimes

$$OR = ad/bc$$

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

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

In order to produce a summary effect size in a meta-analysis, each effect size is weighted according to the inverse of the variance. This was another reason for choosing the OR, which has a known variance (Fleiss, 1981, pp. 61–67).

The estimate of the variance is based on the assumption that total numbers of crimes (a, b, c, d) have a Poisson distribution. Thirty years of mathematical models of criminal careers have been dominated by the assumption that crimes can be accurately modeled by a Poisson process (Piquero et al., 2003). However, the large number of changing extraneous factors that influence the number of crimes may cause overdispersion; that is, where the variance of the number of crimes VAR exceeds the number of crimes N.

$$D = VAR/N$$

specifies the overdispersion factor. Where there is overdispersion, V(LOR) should be multiplied by D. Farrington et al. (2007) estimated VAR from monthly numbers of crimes and found the following equation:

$$D = .0008 \times N + 1.2$$

D increased linearly with N and was correlated .77 with N. The mean number of crimes in an area in their CCTV studies was about 760, suggesting that the mean value of D was about 2. However, this is an overestimate because the monthly variance is inflated by seasonal variations, which do not apply to N and VAR. Nevertheless, in order to obtain a conservative estimate, V(LOR) calculated from the usual formula above was multiplied by D (estimated from the above equation) in all cases. This adjustment corrects for overdispersion within studies but not for heterogeneity between studies. (For a more detailed discussion of the variance in this case, see Farrington et al., 2007.)

Each of the included evaluations was rated on their effectiveness in reducing crime. Each evaluation was assigned to one of the following four categories: desirable effect (marked decrease in crime), undesirable effect (marked increase in crime), null effect (evidence of no effect on crime), or uncertain effect (unclear evidence of an effect on crime).

Also important to this review were the issues of displacement and diffusion of benefits. Displacement is often defined as the unintended increase in targeted crimes in other locations following from the introduction of a crime reduction scheme. (For a discussion of "benign" or desirable effects of displacement, see Barr and Pease, 1990.) Reppetto (1976) identified five different forms of displacement: temporal (change in time), tactical (change in method), target (change in victim), territorial (change in place), and functional (change in type of crime). Diffusion of benefits is defined as the unintended decrease in crimes following from a crime reduction scheme, or the "complete reverse" of displacement (Clarke and Weisburd, 1994).

In order to investigate these topics, the minimum design should involve one experimental area, one adjacent 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. Slightly less than half of the included evaluations had both adjacent and non-adjacent but comparable control areas. Others had an adjacent control area and the remainder of the city as another (non-comparable) control area.

Pooled Effects

From the 41 evaluations that could be included in the meta-analysis, it was concluded that CCTV had a significant but small desirable effect on crime, with a weighted mean odds ratio of 1.19 (95% confidence interval 1.08 – 1.32, p = .0008). This means that crimes increased by 19% after CCTV in control areas compared to experimental areas or, conversely, crimes deceased by 16% in experimental areas compared to control areas. Table 1 summarizes the results of the 41 studies. This shows the odds ratio for total crime measured in each study plus its 95% confidence interval. It can be seen that 14 studies showed a significant desirable effect of CCTV on crime, while three studies showed a significant undesirable effect, and the remaining 24 studies showed no significant effect.

Table 1. Meta-Analysis of CCTV Evaluations. Pages 19–20.

Study Location	Odds Ratio	Confidence Interval	Z	P
City/Town Center (20)				
Newcastle	0.90	0.79-1.01	-1.77	.077
Birmingham	1.91	1.24-2.96	2.91	.004
Doncaster	1.42	1.24-1.63	5.01	.0001
Burnley	1.37	1.19-1.58	4.42	.0001
Airdrie	1.79	1.56-2.05	8.26	.0001
Southwark-EC	1.05	0.89-1.25	0.61	ns
Southwark-C	1.10	0.95-1.28	1.29	ns
Southwark-E	0.95	0.81-1.10	-0.70	ns
Cincinnati-N	0.98	0.86-1.13	-0.25	ns
Cincinnati-H	0.91	0.77-1.07	-1.10	ns
Cincinnati-F	1.00	0.89-1.13	0.03	ns
Malmö	2.32	1.27-4.23	2.73	.006
Multiple Centers	0.91	0.79-1.06	-1.16	ns
Oslo	0.76	0.62-0.94	-2.59	.010
Borough Town	1.12	0.89-1.42	0.97	ns
Market Town	0.79	0.61-1.01	-1.88	.060
Shire Town	1.22	0.98-1.51	1.76	.078
South City	0.99	0.88-1.12	-0.18	ns
Cambridge	0.85	0.73-0.99	-2.07	.038
Gillingham	1.48	1.28-1.71	1.71	.087
Public Housing (8)				
New York City	0.89	0.38-2.07	-0.27	ns
Glasgow	1.43	1.19-1.72	3.85	.0001
Deploy Estate	0.85	0.70-1.04	-1.58	ns
Dual Estate	0.78	0.63-0.97	-2.27	.023
Southcap Estate	0.76	0.57-1.02	-1.83	.067
Eastcap Estate	1.03	0.75-1.42	0.19	ns
Northern Estate	1.34	0.84-2.12	1.23	ns
Westcap Estate	1.85	1.44-2.37	4.83	.0001
Public Transport (4)				
Underground-S	2.58	1.84-3.61	5.51	.0001
Underground-N	1.32	0.87-2.01	1.29	ns
Underground-C	0.89	0.74-1.07	-1.22	ns
Montreal	1.02	0.86-1.22	0.23	ns
Car Parks (6)				
Guildford	0.23	0.02-2.38	-1.23	ns
Hartlepool	1.78	1.25-2.52	3.23	.001
Bradford	2.67	1.43-4.98	3.09	.002
Coventry	1.95	1.41-2.71	4.00	.0001
Sutton	1.49	1.61-1.91	3.14	.002
Multiple Sites	3.34	2.73-4.08	11.76	.0001
Other (3)				
City Outskirts (res)	1.34	1.16-1.54	4.02	.0001
Borough (res)	0.80	0.63-1.02	-1.78	.075
City Hospital (hospital)	1.38	0.80-2.40	1.15	ns

Study Location	Odds Ratio	Confidence Interval	Z	P
Summary Results				
20 City/Town Center	1.08	0.97-1.20	1.43	ns
15 UK City/Town	1.11	0.98-1.27	1.62	ns
5 non-UK City/Town	0.97	0.83-1.13	-0.44	ns
8 Public Housing	1.07	0.83-1.39	0.54	ns
4 Public Transport	1.30	0.87-1.94	1.27	ns
6 Car Parks	2.03	1.39-2.96	3.65	.0003
34 UK	1.24	1.10-1.39	3.47	.0005
7 non-UK	0.97	0.86-1.09	-0.52	ns
All 41 Studies	1.19	1.08-1.32	3.36	.0008

Notes to Table 1 on pages 19–20.
Southwark-EC = Elephant and Castle; Southwark-C = Camberwell; Southwark-E = East Street; Cincinnati-N = Northside; Cincinnati-H = Hopkins Park; Cincinnati-F = Findlay Market; Multiple Centers = multiple city and town center study by Sivarajasingam et al. (2003); Underground-S = southern line; Underground-N = northern line; Underground-C = Oxford Circus; Multiple Sites = multiple sites study by Gill and Spriggs (2005). For analyses presented in summary results, random effects model were used in all cases.

Setting

Forty-one of the 44 CCTV evaluations were carried out in four main settings: city and town centers, public housing, public transport, and car parks. The remaining three CCTV evaluations were carried out in residential areas (n=2) and a hospital.

City and Town Centers. Twenty-two evaluations met the criteria for inclusion and were carried out in city and town centers. Seventeen of the 22 evaluations were carried out in the United Kingdom, three in the United States, one in Sweden, and one in Norway (see Table 2). Only some of the studies reported the coverage of the cameras. For example, in the Newcastle-upon-Tyne and Malmö studies, coverage of the target or experimental area was 100%. Many more reported the number of cameras used and their features (e.g., pan, tilt, zoom). Information on camera coverage is important because if a large enough section of the target area or even high crime locations in the target area are not under surveillance the impact of CCTV may be under estimated. Most of the evaluations that reported information on the monitoring of the cameras used active monitoring, meaning that an operator watched monitors linked to the cameras in real time. Passive monitoring involves watching tape recordings of camera footage at a later time. In some of the schemes active monitoring was carried out by police, but more often it was carried out by security personnel who had some form of communication link with police (e.g., one-way radio, direct line).

Table 2. CCTV Evaluations in City and Town Centers (n=22). Pages 21–30.

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 center Note: There are 2 other C, but each is less comparable to E	None Note: 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 months Note: There were 2 Es and 6 Cs used. The C used here is because the author says it was the most comparable to E Note: 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 et al. (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 months[1]	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

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
Ditton & Short (1999), Airdrie, UK	12 cameras	Active monitoring by police; 24 months	E=6 police beats, C1= rest of 6 police beats (not in camera vision), C2= rest of police subdivision, C3= rest of police division	None	Crime (total and multiple categories); police records	Before-after, experimental control Before=24 months After=24 months	E vs C1: total crimes: -43.9% (3,007 to 1,687) vs +0.2% (3,793 to 3,802); total violent crimes: -10.8% (111 to 99) vs +43.5% (131 to 188); total property crimes: -50.4% (2,732 to 1,356) vs –5.3% (3,455 to 3,273) (desirable effect) Diffusion occurred
Sarno et al. (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=shopping 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 months Note: 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
Sarno et al. (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 Camberwell C2=BZ	Notices of CCTV	Crime (total); police records	Before-after, experimental-control Before=24 months After=12 months Note: 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

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 et al. (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 months Note: 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
Mazerolle et al. (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

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Intervention	Sample Size	Other Interven-tions	Outcome Measure and Data Source	Research Design and Before–After Time Period	Results and Displacement/ Diffusion
Mazerolle et al. (2002), Cincinnati (Hopkins Park), US	n.a. (pan, tilt, zoom)	No monitoring (video foo-tage used); 3 months	E=1 site with CCTV, C=1,000 foot radius BZ	None	Calls for service (weekly average); police records	Before-after, experi-mental-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
Mazerolle et al. (2002), Cincinnati (Findlay Market), US	n.a. (pan, tilt, zoom)	No monitoring (video foo-tage used); 2 months	E=1 site with CCTV, C=1,000 foot radius BZ	None	Calls for service (weekly average); police records	Before-after, experi-mental-control Before=24.5 months After=3.5 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): +16.9% (1,005 to 1,175) vs +17.1% (111 to 130) (null effect) Some 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
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 improvement 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 et al. (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, Eastbourne, 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 matching Before=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 & Knutsson (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 & Spriggs (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 & Spriggs (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	Community 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 & Spriggs (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	Community 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 & Spriggs (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	Community 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 et al. (2007), Cambridge, UK	30 cameras	n.a.; 11 months	E=city center C= secondary center	None	Crime (total and multiple categories); police records Also 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
Griffiths (no date), 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, neighbor-hood 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

[1] 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 & Spriggs (2005) are pseudonyms.

On average, the follow-up period in the 22 evaluations was 15 months, ranging from a low of three months to a high of 60 months. Six programs included other interventions in addition to the main intervention of CCTV. Four others used notices of CCTV to inform the public that they are under surveillance, but CCTV notices do not necessarily constitute a secondary intervention. A couple of the evaluations used multiple experimental areas (e.g., police beats), meaning that the CCTV intervention was quite extensive in the city or town center. Multiple control areas (e.g., adjacent police beats, remainder of city) were used in many more of the evaluations. We only included comparable control areas in our meta-analysis. Where control and adjacent areas were used, we analyzed control areas. We excluded non-comparable area (e.g., the remainder of the city).

As shown in Table 2, the city and town center CCTV evaluations showed mixed results in their effectiveness in reducing crime. Ten of the 22 evaluations were considered to have a desirable effect on crime, five were considered to have an undesirable effect, and one, the multi-site evaluation by Sivarajasingam et al. (2003), was considered to have both (desirable effects for emergency department admissions and undesirable effects for police records). The remaining six evaluations were considered to have a null (n=5) or uncertain (n=1) effect on crime. More schemes showed evidence of no displacement occurring.

In pooling the data from the 20 studies for which effect sizes could be calculated, there was evidence that CCTV led to a small and non-significant reduction in crime in city and town centers. The weighted mean effect size was an odds ratio of 1.08 (95% confidence interval 0.97 – 1.20, n.s.), which corresponds to a 7% reduction in crimes in experimental areas compared with control areas. However, when these 20 studies were disaggregated by country, the 15 U.K. studies showed a slightly larger effect on crime (OR = 1.11, n.s.), while the five non-U.K. studies showed no effect on crime (OR = 0.97, n.s.).

Table 3. CCTV Evaluations in Public Housing (n=9). Pages 32–36.

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 et al. (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
Williamson & McLafferty (2000), Brooklyn, New York, US	105 cameras	Active monitoring by police (24 hrs/ day); 18 months	E=9 buildings (1,220 apart-ments; Albany project), C=no. of buildings n.a. (Roosevelt project)	None	Crime (total and multiple catego-ries) inside hou-sing projects and inside zones of 0.1 to 0.5 miles radii around projects; police records	Before-after, experimental-control with matching Before=18 months; After=18 months	E vs C: change in total crimes inside projects: 0.0% vs -5.3%; chan-ge in total crimes in-side 0.1 mile BZ: 0.0% vs -4.0%; change in major felonies inside projects: -22.8% vs -14.5%; change in major felonies inside 0.1 mile BZ: -6.4% vs -8.6% (data n.a.) (null effect) Displacement and dif-fusion did not occur

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
Hood (2003), Greater Easterhouse Housing Estate, Glasgow, UK	n.a.	Active monitoring by security personnel (10 am – 2 am); 12 months	E=Council Ward 5 C1=Easter-house subdivision C2=D division	None	Violent and drug crimes; police records	Before-after, experimental-control Before=12 months After=20 months Note: 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 & Spriggs (2005), Deploy Estate, UK	34%	Active monitoring (24 hrs/ day), 49-66 cameras per operator, one-way communication with police; 12 months	E=housing estate C1= non-adjacent comparable housing estate C2= 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 & Spriggs (2005), Dual Estate, UK	9%	Active monitoring, 67 cameras per operator, 2-way commun-cation with police; 12 months	E=housing estate C1= non-adjacent comparable housing estate C2= 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 & Spriggs (2005), Southcap Estate, UK	73%	Active monitoring (24 hrs/ day), 148 cameras per operator, one-way communication with police and police in room; 6 months	E=housing estate C= 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

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 & Spriggs (2005), Eastcap Estate, UK	29%	Active monitoring (24 hrs/ day), 50 cameras per operator, 2-way communication with police; 12 months	E=housing estate C1= non-adjacent comparable housing estate C2= 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
Gill & Spriggs (2005), Northern Estate, UK	87%	Active monitoring (24 hrs/ day), 25-40 cameras per operator, one-way communication with police; 12 months	E=housing estate C1= non-adjacent comparable housing estate C2= 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

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 & Spriggs (2005), Westcap Estate, UK	62%	Active monitoring (24 hrs/ day), 20-60 cameras per operator; 12 months	E=housing estate C= 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

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 & Spriggs (2005) are pseudonyms.

Public Housing. Nine evaluations met the criteria for inclusion and were carried out in public housing. Seven of the evaluations were carried out in the U.K. and two in the U.S. (see Table 3). Camera coverage ranged from a low of 9% to a high of 87% in the six evaluations that reported this information. Active monitoring was used in all of the schemes, with one of them (Williamson and McLafferty, 2000) carried out by police. In the six U.K. schemes evaluated by Gill and Spriggs (2005) security personnel who monitored the cameras had some form of communication link with police (i.e., one- or two-way radio). On average, the follow-up period in the 22 evaluations was 11 months, ranging from a low of three months to a high of 18 months. Only three schemes included other interventions in addition to the main intervention of CCTV (e.g., youth inclusion project, improved lighting).

As shown in Table 3, the public housing CCTV evaluations showed mixed results in their effectiveness in reducing crime. Three of the nine evaluations were considered to have a desirable effect on crime, two an undesirable effect, three an uncertain effect, and one a null effect. Only five schemes measured diffusion or displacement, and in each case it was reported that displacement did not occur.

In pooling the data from the eight studies for which effect sizes could be calculated, there was evidence that CCTV led to a small and non-significant reduction in crime in public housing. The weighted mean effect size was an odds ratio of 1.07 (95% confidence interval 0.83 – 1.39, n.s.), which corresponds to a 7% reduction in crimes in experimental areas compared with control areas.

Public Transport. Four evaluations met the criteria for inclusion and were carried out in public transportation systems. All of the evaluations were conducted in underground railway systems: three in the London Underground and one in the Montreal Metro (see Table 4). None of the studies reported on the percentage of the target areas covered by the cameras, but most did provide information on the number of cameras used. Each of the schemes involved active monitoring on the part of police.

With the exception of the Canadian program, all of the programs involved interventions in addition to CCTV. In the first Underground scheme, notices were posted to alert people to the presence of CCTV cameras and special police patrols were in operation prior to the installation of CCTV. (In the evaluation of this program, any effect of the police patrols was controlled by using as the before period the 12 months prior to the patrols coming into operation. The police patrols were discontinued at the time CCTV was implemented, so there was no direct influence of the patrols during the after period.) For the two other Underground schemes, some of the other interventions that

Table 4. CCTV Evaluations in Public Transport (n=4)

Author, Publication Date, and Location	Camera Coverage or Number of Cameras	Monitoring and Duration of Inter-ven-tion	Sample Size	Other Inter-ventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/ Diffusion
Burrows (1980), "Underground" sub-way, London, UK	n.a. (fixed)	Active monito-ring by BTP; 12 months	E=4 stations on southern sector, C1=15 other stations on south-ern sector, C2=228 other Under-ground stations	Notices of CCTV (also special police patrols prece-ded CCTV)	Personal theft and robbery; BTP records	Before-after, experi-mental-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 & Laycock (1992), "Underground" subway, London, UK	Expansion of cameras: 7-14 per E station (mix of fixed and pan, tilt, and zoom)	Active monito-ring 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 mo-nitor CCTV, mirrors, and improved ligh-ting	Robbery; BTP records	Before-after, experi-mental-control Before=46 months; After=26 months Note: special po-licing 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 Inter-vention	Sample Size	Other Interventions	Outcome Measure and Data Source	Research Design and Before-After Time Period	Results and Displacement/ Diffusion
Webb & Laycock (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 & Tremblay (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 analyses Before=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.

were used included: passenger alarms, kiosks to monitor CCTV, and mirrors. For each of these three Underground schemes, CCTV was, however, the main intervention. Follow-up periods ranged from a low of 12 months to a high of 32 months.

Overall, CCTV programs in public transportation systems present conflicting evidence of effectiveness: two had a desirable effect, one had no effect, and one had an undesirable effect on crime. However, for the two effective programs in the London Underground, the use of other interventions makes it difficult to say with certainty that it was CCTV that produced the observed crime reductions, although in the first of these programs CCTV was more than likely the cause. Only two of the studies measured diffusion of benefits or displacement, with one showing evidence of diffusion and the other displacement.

In pooling the data from the four studies, there was evidence that CCTV led to a sizeable but non-significant reduction in crime in public transport. The weighted mean effect size was an odds ratio of 1.30 (95% confidence interval 0.87 – 1.94, n.s.), which corresponds to a 23% reduction in crimes in experimental areas compared with control areas.

Car Parks. Six CCTV evaluations met the criteria for inclusion and were conducted in car parks. All of the programs were implemented in the U.K. between the early 1980s and early 2000s (see Table 5). Camera coverage was near 100% in the two schemes that reported on it. All of the schemes, with the exception of one that did not provide data, involved active monitoring on the part of security staff. The large-scale, multi-site scheme evaluated by Gill and Spriggs (2005) also included a radio link with the British Transport Police.

Each of the programs supplemented CCTV with other interventions, such as improved lighting, painting, fencing, payment schemes, and security personnel. In each program, however, CCTV was the main intervention. Follow-up periods ranged from a low of ten months to a high of 24 months.

As shown in Table 5, five of the programs had a desirable effect and one had an undesirable effect on crime, with vehicle crimes being the exclusive focus of five of these evaluations. Most studies did not measure either diffusion of benefits or displacement. The odds ratios showed a significant and desirable effect of CCTV for five of the schemes. In the other scheme (Guildford), the effect was undesirable, but the small number of crimes measured in the before and after periods meant that the odds ratio was not significant. When all six odds ratios were combined, the overall odds ratio was 2.03 (95% confidence interval 1.39 – 2.96, p = .0003). Thus, crime increased by 103% in control areas compared with experimental areas or, conversely, crime decreased by 51% in experimental areas compared with control areas.

Table 5. CCTV Evaluations in Car Parks (n=6). Pages 41–43.

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 parks Note: 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 hicles: -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

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), 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 painting Note: 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 months Note: 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
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

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 & Spriggs (2005), multiple sites, UK	95-100%	Active monitoring by security, link (one-way) with BTP, 123-153 cameras per operator; 12 months	E=57 train station car parks C=train station car parks in the whole country	Improved lighting, fencing, security	Total crime; police records	Before-after, experimental control Before=12 months After=12 months	E vs C: -73.0% (794 to 214) vs -10.0% (12,590 to 11,335) (desirable effect) Displacement/diffusion not measured

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

Other Settings. As noted above, three of the 44 included evaluations took place in other public settings: two in residential areas and one in a hospital. It was deemed necessary to categorize these three schemes separately from the others because of the differences in the settings in which these three schemes were implemented as well as their small numbers. Table 6 provides information on the key characteristics of these CCTV evaluations (all of which took place in the U.K.) and their effects on crime.

There were some notable differences between the two residential schemes. City Outskirts was implemented in an economically depressed area on the outskirts of a Midlands city, while Borough was implemented throughout a southern borough of mixed affluence. Camera coverage was quite good in City Outskirts (68%), but not so in Borough. Gill and Spriggs (2005) noted that this was due in large measure to the use of re-deployable cameras in Borough, while fixed cameras were used in City Outskirts. Other interventions were used in City Outskirts, but not in Borough. Evaluations of the two schemes also found contrasting effects on crime: a significant desirable effect in City Outskirts (OR=1.34, 95% confidence interval 1.16 – 1.54, p = .0001) and a nearly significant undesirable effect in Borough (OR = 0.80, 95% confidence interval 0.63 – 1.02, p = .075).

The one evaluation of CCTV implemented in a city hospital showed that it produced a desirable but non-significant effect on crime (OR = 1.38, 95% confidence interval 0.80 – 2.40). Among some of the scheme's distinguishing features, camera coverage was quite good (76%), active monitoring was used, there was a direct line between the camera operators and police, and other interventions were implemented, including improved lighting and police operations.

Country Comparison

From the 41 evaluations that could be used in the meta-analysis, the overwhelming majority were from the U.K. (n=34). Five were from North America (four from the U.S. and one from Canada) and the remaining two were from Sweden and Norway. When the pooled meta-analysis results were disaggregated by country, there was evidence that the use of CCTV to prevent crime was more effective in the U.K. than in other countries. From the U.K. studies, CCTV had a significant desirable effect on crime, with an overall 19% reduction in crime (OR = 1.24, 95% confidence interval 1.10 – 1.39, p = .0005). In the other studies, CCTV showed no desirable effect on crime (OR = 0.97, 95% confidence interval 0.86 – 1.09, n.s.). The significant results for the U.K. studies were largely driven by the effective programs in car parks.

Table 6. CCTV Evaluations in Other Settings (n=3)

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 & Spriggs (2005), City Outskirts, UK (residential area)	68%	Active monitoring (24 hrs/ day), 48 cameras/ operator, direct line to police; 12 months	E= residential area C1= adjacent residential areas C2=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 & Spriggs (2005), Borough, UK (residential area)	Low (8 re-deployable used)	n.a.; 12 months	E= residential area C1= adjacent residential areas C2=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
Gill & Spriggs (2005), City Hospital, UK (hospital)	76%	Active monitoring, direct line to police; 12 months	E=hospital C1= adjacent areas C2=rest of police division	Leaflets, posters, improved lighting, police operations	Crime (total and multiple categories); police records	Before-after, experimental-control Before = 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

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

Conclusions and Directions for Policy and Research

The studies included in this systematic review and meta-analysis showed that CCTV had a small but significant desirable effect on crime, has been most effective in reducing crime in car parks, and has been more effective in reducing crime in the U.K. than in other countries.

Exactly what the optimal circumstances are for effective use of CCTV schemes is not entirely clear at present, and this needs to be established by future evaluation research. But it is interesting to note that the success of the CCTV schemes in car parks was mostly limited to a reduction in vehicle crimes (the only crime type measured in five of the six schemes) and camera coverage was high for those evaluations that reported on it. In the national U.K. evaluation of the effectiveness of CCTV, Farrington et al. (2007) found that effectiveness was significantly correlated with the degree of coverage of the CCTV cameras, which was greatest in car parks. Furthermore, all six car park schemes included other interventions, such as improved lighting and security officers.

Conversely, the evaluations of CCTV schemes in city and town centers and public housing measured a much larger range of crime types and only a small number involved other interventions. These CCTV schemes, and those focused on public transport, had only a small effect on crime. Could it be that a package of interventions focused on a specific crime type with a high degree of camera coverage is what made the CCTV-led schemes in car parks effective?

Part of the difficulty in attempting to explain why CCTV schemes were more effective in reducing crime in car parks compared to the other settings was that important information on implementation (e.g., How many cameras were installed and where? What was their degree of coverage of the targeted area? Were the cameras monitored? If so, for how long and by whom?) was not always reported in the evaluation studies. Of course, this issue appears in evaluations of other interventions as well.

Another interesting finding to emerge from this review is that CCTV schemes in the U.K. showed a sizeable (19%) and significant desirable effect on crime, while those in other countries showed no desirable effect on crime. (Even the Brooklyn public housing scheme that could not be included in the meta-analysis showed evidence of having a null effect on crime. The Malmö, Sweden, city center scheme was the only effective one.) What might account for this? Or, more importantly, what lessons can be drawn from the U.K. studies to help improve the crime prevention effectiveness of CCTV use in

other countries? There were some differences in key characteristics between the U.K. and non-U.K. CCTV schemes, which may help to address these questions.

First, the average follow-up period of the eight non-U.K. CCTV schemes was substantially lower than for the 36 U.K. schemes: 9.6 months versus 15.9 to 16.1 months. (Four of the non-U.K. studies had the shortest follow-up periods of all 44 CCTV evaluations, ranging from a low of three months to a high of six months.) Because of the short follow-up periods in the non-U.K. studies, it is possible that the CCTV schemes were not given enough time to produce a clear effect on crime, either desirable or undesirable (six of the eight non-U.K. studies showed evidence of either a null or uncertain effect on crime). Longer follow-up periods, as in the majority of the U.K. studies, seem to be warranted for future CCTV experiments in other countries, particularly in the U.S.

Second, and perhaps most importantly, not one of the eight schemes from the other countries used other interventions alongside CCTV, while half (n=18) of the 36 U.K. schemes used one or more other types of intervention, such as improved lighting, fencing, security personnel, or youth inclusion projects. If the six car park schemes are removed, because all of them were carried out in the U.K. and involved other interventions, this leaves 12 out of 18 U.K. studies that used other interventions. It is possible that the absence of other situational or social crime prevention measures in the non-U.K. CCTV schemes may be a contributing factor to their overall poor effect in reducing crime; for example, CCTV on its own may not represent a sufficient deterrent threat to influence an offender's decision making process to commit a crime or not.

Another important issue that may be a contributing factor to the difference in effectiveness between the U.K. CCTV schemes and those in other countries is cultural context. In the U.K., there is a high level of public support for the use of CCTV cameras in public settings to prevent crime (Norris and Armstrong, 1999; Phillips, 1999). In the U.S., the public is less accepting of and more apprehensive of "Big Brother" implications arising from this surveillance technology (Murphy, 2002). In Sweden, Blixt (2003) notes that surveillance cameras are highly regulated in public places, with their use requiring in almost all instances a permit from the county administrative board. In Norway, Winge and Knutsson (2003) note that there is a high degree of political scrutiny of public CCTV schemes run by the police.

It could very well be that the overall poor showing of CCTV schemes in other countries was due in part to a lack of public or political support, which, in turn, may have resulted in cuts in program funding, the police assigning lower priority to the schemes, or attempts to discourage desirable media coverage, for example. Each of these

could potentially undermine the effectiveness of CCTV schemes. In contrast, the U.K. Home Office, who funded many of the U.K. evaluations, wanted to show that CCTV was effective.

One of the issues that this review was not able to explore was that CCTV might produce other important benefits beyond preventing crime, such as preventing fear of crime, aiding in police apprehension of suspects, police officer safety, and the prevention of terrorist activities. Also, our measure of effectiveness necessarily is based only on the number of crimes before and after the implementation of CCTV and is not based on time series data, for example. Research is needed on these fronts.

Advancing knowledge about the crime prevention benefits of CCTV programs should begin with attention to the methodological rigor of the evaluation designs. The use of a comparable control group by all of the 44 included evaluations went some way towards ruling out some of the major threats to internal validity, such as selection, maturation, history, and instrumentation (see Cook and Campbell, 1979; Shadish et al., 2002). The effect of CCTV on crime can also be investigated after controlling (e.g., in a regression equation) not only for prior crime but also for other community-level factors that influence crime, such as neighborhood poverty and poor housing. Another possible research design is to match two areas and then to choose one at random to be the experimental area. Of course, several pairs of areas would be better than only one pair.

Also important in advancing knowledge about the effectiveness of CCTV in preventing crime is attention to methodological problems or changes to programs that take place during and after implementation. Some of these implementation issues include: statistical conclusion validity (adequacy of statistical analyses), construct validity (fidelity), and statistical power (to detect change) (see Farrington and Painter, 2003). For some of the included evaluations, small numbers of crimes made it difficult to determine whether or not the program had an effect on crime. It is essential to carry out statistical power analyses before embarking on evaluation studies (Cohen, 1988). Few studies attempted to control for regression to the mean, which happens if an intervention is implemented just after an unusually high crime rate period. A long time series of observations is needed to investigate this. The contamination of control areas (i.e., by the CCTV intervention) was another, albeit less common, problem that faced the evaluations.

There is also the need for longer follow-up periods to see how far the effects persist. Of the 44 included schemes, eight were in operation for less than 12 months prior to being evaluated. This is a very short time to assess a program's impact on crime or any other outcome measure, and for these programs the question can be asked: Was the intervention in place long enough to provide an accurate esti-

mate of its observed effects on crime? Ideally, time series designs are needed with a long series of crime rates in experimental and control conditions before and after the introduction of CCTV. In the situational crime prevention literature, brief follow-up periods are the norm, but "it is now recognized that more information is needed about the longer-term effects of situational prevention" (Clarke, 2001, p. 29). Ideally, the same time periods should be used in before and after measures of crime.

Research is also needed to help identify the active ingredients of effective CCTV programs and the causal mechanisms linking CCTV to reductions in crime. Forty-three percent (19 out of 44) of the included programs involved interventions in addition to CCTV (not including notices of CCTV), and this makes it difficult to isolate the independent effects of the different components, and interactional effects of CCTV in combination with other measures. Future experiments are needed that attempt to disentangle elements of effective programs. Also, future experiments need to measure the intensity of the CCTV dose (e.g., the degree of coverage) and the dose-response relationship, and need to include alternative methods of measuring crime (surveys as well as police records).

Research is also needed on the financial costs and benefits of CCTV programs. Eight of the 44 programs conducted a cost-benefit analysis. Seven of these are reported in Gill and Spriggs (2005), but cost-benefit analyses were only carried out on those schemes where crime was reduced relative to the control area. In a cost-benefit analysis of the Doncaster scheme, Skinns (1998) found that the criminal justice costs saved from fewer prosecutions and sentences (the benefits) were greater than the costs of running the CCTV program by more than three times, for a benefit-cost ratio of 3.5 to 1. Future cost-benefit analyses of CCTV should take account of any displacement of crime or diffusion of crime prevention benefits. It is also important to measure the cost-effectiveness of CCTV in preventing crime compared with other alternatives such as improved street lighting. Although there remains a number of other issues pertaining to cost-benefit analysis of situational crime prevention in need of examination (see Roman and Farrell, 2002), our previous work (Welsh and Farrington, 1999, 2000) has shown that situational crime prevention generally is an economically efficient strategy.

Overall, it might be concluded that CCTV reduces crime to some degree. In light of the marginally successful results, future CCTV schemes should be carefully implemented in different settings and should employ high quality evaluation designs with long follow-up periods.

Appendix

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