

Public Area CCTV and Crime Prevention: An Updated Systematic Review and Meta-Analysis

Brandon C. Welsh and David P. Farrington

In recent years, there has been a marked and sustained growth in the use of closed circuit television (CCTV) surveillance cameras to prevent crime in public places in the USA and other Western nations. Amidst this expansion and the associated public expenditure, as well as concerns about their efficacy and social costs, there is an increasing need for an evidence-based approach to inform CCTV policy and practice. This paper reports on an updated systematic review and meta-analysis of the effects of CCTV on crime in public places. Evaluations were included if CCTV was the main intervention and the design was of high methodological quality. Forty-four evaluations met the inclusion criteria. The results suggest that CCTV caused a modest (16%) but significant decrease in crime in experimental areas compared with control areas. 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 public settings had small and nonsignificant effects on crime: a 7% decrease in city and town centers and in public housing communities. Public transport schemes had greater effects (a 23% decrease overall), but these were still nonsignificant. Schemes evaluated in the UK were more effective than schemes evaluated in the USA and other countries, but this was largely driven by the studies in the car parks. Implications for policy and research are discussed.

Keywords CCTV; surveillance; crime prevention; systematic review; meta-analysis

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Closed circuit television (CCTV) surveillance cameras or video surveillance cameras (as they are also known) serve many functions and are used in both public and private settings.¹ 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. This is an approach that is focused on reducing opportunities for crime and increasing perceived risk through modification of the physical environment (Clarke, 1995). According to Cornish and Clarke's (2003) 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 true and subjective probabilities, may encourage potential victims to take security precautions, and may direct police and security personnel to intervene to prevent crime (Armitage, Smyth, & Pease, 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, which in turn might decrease crime.

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, and also raises concerns over threats to privacy and civil liberties.

In recent years, there has been a marked and sustained growth in the use of CCTV surveillance cameras to prevent crime in public places in many Western nations. The UK for one is on the cusp of becoming, in the words of some, a "surveillance society" (Goold, 2004; Norris, 2007; Norris & Armstrong, 1999). One estimate puts the total number of public CCTV cameras in the UK at 4.2 million, or one for every 14 citizens (Norris & McCahill, 2006), accounting for one-fifth of all CCTV cameras worldwide (Coleman, 2004). It has also been estimated that the average Briton is caught on camera 300 times each day (Associated Press, 2007).

There are no national estimates as yet on the number of CCTV cameras in the USA, but local accounts indicate that they are being installed at an unprecedented rate and their popularity is not limited to large urban centers (Nieto, Johnston-Dodds, & Simmons, 2002; Savage, 2007). While some of this increased use in the USA has come about in an effort to aid the police in the detection and

1. The original meaning of CCTV was a system of video cameras that were connected in a closed circuit or loop that sent images to a central television monitor or recorder. CCTV has since come to refer to "any form of monitoring system that uses video cameras as a means of surveillance" (Goold, 2004, p. 12).

prevention of terrorist activities, especially in New York City and other metropolises, the prevention of crime remains an important aim of these CCTV systems (Associated Press, 2006b; McCarthy, 2007). Similar claims have been made in the UK about the purpose of public CCTV there (Associated Press, 2007).

There are signs that other countries, most more cautiously than the UK and USA, are increasingly experimenting with CCTV to prevent crime in public places. One source of this knowledge on the growth in public area CCTV, albeit limited but welcomed, comes in the form of evaluation research. In the course of the research for this 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 huge price tag. In the UK, CCTV continues to be the single most heavily funded crime prevention measure operating outside of the criminal justice system. McCahill and Norris (2002) estimated that more than £250 million (approximately \$500 million) of public money was spent on CCTV over the 10-year period of 1992 to 2002. This figure could very well be an underestimate. For example, between 1999 and 2001 alone, the British government made available £170 million (approximately \$340 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 British Home Office (Koch, 1998; Reuters, 2007).

In the USA, figures range from \$25 million spent on cameras in buses and subway stations in New York City, to \$5 million spent in Chicago on a 2,000-camera system throughout the city center, to more than \$10 million spent in Baltimore (Associated Press, 2006a, 2006b; McCarthy, 2007). Total government expenditures are largely unknown. A recent analysis conducted by the *Boston Globe* estimated that “a large number of new surveillance systems, costing at least tens and probably hundreds of millions of dollars, are being simultaneously installed around the country as part of homeland security grants” (Savage, 2007).

During this time there has been much debate about the effectiveness of CCTV in preventing crime and hence on the wisdom of spending such large sums of money. A key issue is to what extent funding for CCTV, especially in the UK and USA, has been based on high quality scientific evidence demonstrating its efficacy in preventing crime. In the UK, 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, conducted with varying degrees of competence (Armitage et al., 1999), and with varying degrees of professional independence from the Home Office (Ditton & Short, 1999). Recent reviews that have examined the effectiveness of CCTV in preventing crime (Eck, 2006; Ratcliffe, 2006; Wilson & Sutton, 2003) have also noted the need for higher quality, independent evaluation research.

To address some of these concerns with respect to the research in the UK, the British Home Office commissioned the first systematic review of the effects of

CCTV on crime in public space (Welsh & Farrington, 2002; see also Welsh & Farrington, 2003, 2004, 2006a). Twenty-two evaluations met the inclusion criteria for their review at that time and were carried out in three public settings: city and town centers, public transport, and car parks. From a meta-analysis of those studies that provided the requisite data (19 in total), it was found that CCTV produced a nonsignificant and rather small 8% reduction in crime (in experimental areas compared to control areas). Of the three settings, CCTV was most effective in reducing crime in car parks, with a significant and sizeable 41% reduction. The effects of CCTV on crime in the other two settings were small and nonsignificant: city and town centers (7% reduction) and public transport (6% reduction). The review also showed that CCTV systems in the UK were far more effective in preventing crime than those implemented in the USA and Canada.

A national evaluation of CCTV in the UK soon followed (Gill & Spriggs, 2005; see also Farrington, Gill, Waples, & Argomaniz, 2007). Interestingly, the results of the national study were highly concordant with the results of the Home Office systematic review: CCTV had an overall small desirable effect on crime, was most effective in car parks, and had a marginal effect on crime in city and town centers (as well as in public housing).²

The main aim of this paper is to present the results of an updated systematic review and meta-analysis of the effects of CCTV on crime in public space.³ Importantly, this review goes beyond the sterile debate of “Does it work?” It examines the specific conditions and contexts under which CCTV may have an effect on crime, and explores the mechanisms that bring about a reduction in crime. The review focuses on public area surveillance. By public areas we mean those places that individuals can make use of or visit in a free and unencumbered way. Typical public places include city and town centers, public transportation facilities like subway systems, parking lots or car parks that are available for public use, and public housing communities. Our focus on public places is not meant to diminish the importance of efforts to reduce crime in private space. Instead, it allows for a more comprehensive examination of one aspect of the current debate on CCTV surveillance and crime prevention. This focus is also driven by the growing use of CCTV to reduce crime in public places.

Methodology

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, De Li, Larson, and McCullough (2000, p. 35), systematic reviews “essentially take an epidemiological look at the methodology and results

2. It is important to note that none of the sites in the national evaluation were included in the Home Office systematic review.

3. It draws upon a report prepared for the Swedish National Council for Crime Prevention (Welsh & Farrington, 2007).

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 paper to discuss all of the features of systematic reviews, but interested readers should consult key volumes on the topic (see Petticrew & Roberts, 2006; Welsh & Farrington, 2006b).

Criteria for Inclusion of Evaluation Studies

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

- (1) 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. It is desirable to include only evaluations where CCTV was the main intervention, because in other cases it is impossible to disentangle the effects of these main interventions from the effects of others.
- (2) There was an outcome measure of crime. The most relevant crime outcomes were violent and property crimes.
- (3) The evaluation design was of high methodological quality, with the minimum design involving before-and-after measures of crime in experimental and (mostly) comparable control areas. According to Cook and Campbell (1979) and Shadish, Cook, and Campbell (2002), this is the minimum design that is interpretable. Control areas are needed to counter threats to internal validity.
- (4) 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 in experimental and control areas 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:

- (1) Searches of electronic bibliographic databases. The following 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, Psychological, Educational, and Criminological Trials Register (C2-SPECTR); Google Scholar; and Medline.⁴ These databases were selected because they had the most comprehensive coverage of criminological, criminal justice, and social science literatures. They are also among the top databases recommended by the Campbell Collaboration Crime and Justice Group, and other systematic reviews of interventions in the field of crime and justice have used them (e.g., Braga, 2005; Sherman et al., 2005). The following terms were used to search these databases: closed circuit television, CCTV, cameras, social control, surveillance, video 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.
- (2) Searches of literature reviews on the effectiveness of CCTV in preventing crime. The key reviews we searched included: Eck (2006), Gill (2006), Phillips (1999), Poyner (1993), Ratcliffe (2006), and Wilson and Sutton (2003).
- (3) Searches of bibliographies of evaluation reports of CCTV studies.
- (4) Contacts with leading researchers.

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 (two non-English language evaluation reports are included in the review).

Results

The search strategies (over the two periods of time) resulted in the identification of 95 evaluations. Of these, 93 were obtained and analyzed; the other two, which may or may not have met the criteria for inclusion, could not be obtained. Of these 93 evaluations, 44 met the criteria for inclusion and 49 did not and thus were excluded from the systematic review.⁵ Table 1 presents summary information on each of the 44 included evaluations.

To assess the effectiveness of CCTV in preventing crime, meta-analytic techniques were used. A meta-analysis is essentially a statistical summary of

4. 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 authors. In their place, two new electronic databases were searched: Google Scholar and Medline.

5. Information on the unobtainable and excluded evaluations is available from the first author.

Table 1 Summary of CCTV evaluations

Author and publication date		Location	Camera coverage	Monitoring	Other interventions	Outcome measure	Follow-up period (in months)
Brown (1995)		Newcastle, UK	100% (most vulnerable premises)	Active	None	Police records	15
Brown (1995)		Birmingham, UK	14 cameras	Active (by police)	None	Victim survey	12
Sarno (1996)		London Borough of Sutton, UK	11 cameras	n.a. ¹	None	Police records	12
Skins (1998)		Doncaster, UK	63 cameras	Active (by police)	47 help points	Police records	24
Squires (1998)		Ilford, UK	n.a.	n.a.	None	Police records	7
Armitage et al. (1999)		Burnley, UK	n.a.	n.a.	None	Police records	12
Diton and Short (1999)		Airdrie, UK	12 cameras	Active (by police)	None	Police records	24
Sarno, Hough, and Bulos (1999)		London Borough of Southwark (Elephant and Castle), UK	34 cameras	Active (by security)	Notices of CCTV	Police records	24
Sarno et al. (1999)		London Borough of Southwark (Camberwell), UK	17 cameras	Active (by security, police)	Notices of CCTV	Police records	12
Sarno et al. (1999)		London Borough of Southwark (East Street), UK	12 cameras	Active (by security, police)	Notices of CCTV	Police records	12
Mazerolle, Hurley, and Chamlin (2002)		Cincinnati (Northside)	n.a.	Passive	None	Police records	6
Mazerolle et al. (2002) Cincinnati (Hopkins Park)		n.a.	n.a.	Passive	None	Police records	4
Mazerolle et al. (2002) Cincinnati (Findlay Market)		n.a.	n.a.	Passive	None	Police records	3.5
Blix (2003)		Malmö, Sweden	100%	Passive	Social improvement programs (begun years prior)	Police records	12

Author and publication date	Location	Camera coverage	Monitoring	Other interventions	Outcome measure	Follow-up period (in months)
Sivaraajasingham, Shepherd, and Mathews (2003)	Multiple sites, UK	n.a.	Active (by police)	None	Police and ED ² records	24
Winge and Knutsson (2003)	Oslo, Norway	6 cameras	Active (links to police)	Notices of CCTV	Police records	12
Gill and Spriggs (2005) ³	Borough Town, UK	70%	Active (one-way link to police)	None	Police records	12
Gill and Spriggs (2005)	Market Town, UK	34%	Active (direct line to police)	Community wardens, car park	Police records	12
Gill and Spriggs (2005)	Shire Town, UK	76%	Active	Community wardens	Police records	12
Gill and Spriggs (2005)	South City, UK	72%	Active (police in room)	Community wardens, police	Police records	12
Farrington, Bennett, and Welsh (2007)	Cambridge, UK	30 cameras	n.a.	None	Police records, victim survey	11
Griffiths (n.d.)	Gillingham, UK	n.a.	Active	Improved lighting, neighborhood watch	Police records	60
Musheno, Levine, and Palumbo (1978)	New York City	Cameras in lobby and elevators	Monitors in Public Housing (n = 9)	None	Victim survey	3
Williamson and McLafferty (2000)	Brooklyn, NY	105 cameras	Active (by police)	None	Police records	18

Table 1 (Continued)

Table 1 (Continued)

Author and publication date	Location	Camera coverage Monitoring	Other interventions	Outcome measure	Follow-up period (in months)
Hood (2003)	Glasgow, UK	n.a.	Active	None	20
Gill and Spriggs (2005)	Deploy Estate, UK	34%	Active (one-way link to police)	None	12
Gill and Spriggs (2005)	Dual Estate, UK	9%	Active (two-way link to police)	None	12
Gill and Spriggs (2005)	Southcap Estate, UK	73%	Active (one-way link to police)	Youth inclusion project	6
Gill and Spriggs (2005)	Eastcap Estate, UK	29%	Active (two-way link to police)	Improved lighting	12
Gill and Spriggs (2005)	Northern Estate, UK	87%	Active (one-way link to police)	None	12
Gill and Spriggs (2005)	Westcap Estate, UK	62%	Active	Youth inclusion project	12
Burrows (1980)	"Underground" subway (southern sector), London, UK	n.a.	Public Transport (n = 4) Active (by BTP) ⁴	Notices of CCTV	12
Webb and Laycock (1992)	"Underground" subway (northern line), London, UK	7-14 per station	Active (by BTP)	Passenger alarms, kiosks, improved mirrors, lighting	26
Webb and Laycock (1992)	"Underground" subway (Oxford Circus station), London, UK	30 cameras	Active (by BTP)	Passenger alarms, BTP patrols	32

Author and publication date	Location	Camera coverage	Monitoring	Other interventions	Outcome measure	Follow-up period (in months)
Grandmaitson and Tremblay (1997)	"Metro" subway, Montreal, Canada	130 cameras (10 per station)	Active (by police)	None	Police records	18
Poyner (1991)	University of Surrey, Guildford, UK	100% (almost all)	Active	Improved lighting, foliage cut back	Security records	10
Tilley (1993)	Hartlepool, UK	n.a.	Active	Security officers, notices of CCTV, payment scheme	Police records	30
Tilley (1993)	Bradford, UK	n.a.	Active	Notices of CCTV, improved lighting, painting	Police records	12
Tilley (1993)	Coventry, UK	n.a.	Active	Lighting, painting, fencing	Police records	8 months (E) and 16 months (C) ⁶
Sarno (1996)	London Borough of Sutton, UK	n.a.	n.a.	Multiple (e.g., locking overnight, improved lighting)	Police records	12
Gill and Spriggs (2005)	Hawkeye, UK	95-100%	Active (one-way link to BTP)	fencing, security	Police records	12

Table 1 (Continued)

Table 1 (Continued)

Author and publication date	Location	Camera coverage	Monitoring	Other interventions	Outcome measure	Follow-up period (in months)
Gill and Spriggs (2005)	City Outskirts (residential), UK	68%	Active (direct line to police)	Improved lighting, anti-burglary schemes	Police records	12
				None	Police records	12
				Leaflets, posters, improved lighting, police operations	Police records	12
Gill and Spriggs (2005)	Borough (residential), UK	Low (8 re-deployable)	n.a.			
Gill and Spriggs (2005)	City Hospital, UK	76%	Active (direct line to police)			

¹n.a. = not available; ²ED = Emergency Department; ³the location names for the evaluations by Gill and Spriggs (2005) are pseudonyms; ⁴BTP = British Transport Police; ⁵E = experimental area; ⁶C = control area.

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 & 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 (OR) 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 OR, therefore, was 1.12/0.79 or 1.42.

The OR effect size has a very simple and meaningful interpretation. It indicates the proportional change in crime in the control area compared with the experimental area. An OR greater than 1.0 indicates a desirable effect of the intervention, and an OR less than 1.0 indicates an undesirable effect. 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 following formula is used to calculate the effect size:

$$OR = (a * d) / (b * c)$$

where *a*, *b*, *c*, and *d* are the numbers of crimes, which are derived from the following:

	Before	After
Experimental	<i>a</i>	<i>b</i>
Control	<i>c</i>	<i>d</i>

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).

This 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, Farrington, & Blumstein,

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*) may exceed the number of crimes (*N*). The overdispersion factor (*D*) is expressed as:

$$D = \text{VAR} / N$$

Where there is overdispersion, *V* (LOR) should be multiplied by *D*. Farrington, Gill, Waples, and Argomaniz (2007) estimated *VAR* from monthly numbers of crimes and found the following equation:

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

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.⁶

Forty-one of the 44 studies could be used in the meta-analysis. OR effect sizes could not be calculated for three studies because numbers of crimes were not reported in the city and town center schemes in Ilford or (for the control area) Sutton or for the public housing scheme in Brooklyn.

Also important to this review are the issues of displacement of crime and diffusion of crime prevention benefits. Displacement can be defined as the unintended increase in crimes following from the introduction of a crime reduction scheme.⁷ This is the notion that offenders simply move around the corner or resort to different methods to commit crimes once a crime prevention project has been introduced. 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, on the other hand, can be defined as the unintended decrease in non-targeted crimes following from a crime reduction scheme, or the “complete reverse” of displacement (Clarke & Weisburd, 1994). Here, instead of a crime prevention project displacing crime, the project’s crime prevention benefits are diffused to the surrounding area, for example. Clarke and Weisburd (1994) contend that diffusion occurs in one of two ways: by affecting offenders’ assessment of risk (deterrence) or by affecting offenders’ assessment of effort and reward (discouragement).

6. For a more detailed discussion of the variance in this case, see Farrington, Gill, Waples, and Argomaniz (2007).

7. For a discussion of “benign” or desirable effects of displacement, see Barr and Pease (1990).

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.⁸

City and town centers

Twenty-two evaluations were carried out in city and town centers. Seventeen of these were carried out in the UK, three in the USA, one in Sweden, and one in Norway. Only some of the studies reported the coverage of the CCTV cameras. For example, in the Newcastle and Malmö studies, camera coverage of the target or experimental area was 100%. Many more studies 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 reduced.

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 recordings of camera footage at a later time. In some of the schemes, such as Newcastle and Birmingham, 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., by a one-way radio, direct line telephone).

On average, the follow-up period in the 22 evaluations was 15 months, ranging from a low of 3 months to a high of 60 months. Six programs included other interventions in addition to the main intervention of CCTV. For example, in the Doncaster program 47 “help-points” were established within the target area to aid the public in contacting the main CCTV control room. Four other studies used notices of CCTV to inform the public that they were 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, the remainder of the city) were used in many more of the evaluations. Where control and adjacent areas were used, we analyzed control areas. Schemes usually showed evidence of no displacement rather than displacement or diffusion of benefits.

In pooling the data from the 20 studies for which effect sizes could be calculated, there was evidence that CCTV led to a small but nonsignificant reduction in crime in city and town centers. The weighted mean effect size was an odds ratio of 1.08, which corresponds to a 7% reduction in crimes in experimental

8. It was considered necessary to categorize these three schemes separately from the others because of the differences in the settings in which they were implemented as well as their small numbers.

areas compared with control areas. However, when these 20 studies were disaggregated by country, the 15 UK studies showed a slightly larger effect on crime (a 10% decrease), while the five others showed no effect on crime (see Table 2). An analysis of heterogeneity showed that the 20 effect sizes were significantly heterogeneous ($Q = 143.9$, $df = 19$, $p < .0001$). This means that they were not randomly distributed about the average effect size. The 15 UK studies were also significantly heterogeneous ($Q = 118.6$, $df = 14$, $p < .0001$), as were the five other studies ($Q = 14.02$, $df = 4$, $p = .007$). Therefore, random effects models were used in calculating weighted mean effect sizes.

Public housing

Nine evaluations were carried out in public housing. Seven were carried out in the UK and two in the USA. Camera coverage ranged from a low of 9% (in Dual

Table 2 Meta-analysis of CCTV evaluations in city and town centers

Evaluation	Odds ratio	95% confidence interval	p
Newcastle	0.90	0.79-1.01	.077
Birmingham	1.91	1.24-2.96	.004
Doncaster	1.42	1.24-1.63	.0001
Burnley	1.37	1.19-1.58	.0001
Airdrie	1.79	1.56-2.05	.0001
Southwark-EC ¹	1.05	0.89-1.25	ns
Southwark-C ²	1.10	0.95-1.28	ns
Southwark-E ³	0.95	0.81-1.10	ns
Cincinnati-N ⁴	0.98	0.86-1.13	ns
Cincinnati-H ⁵	0.91	0.77-1.07	ns
Cincinnati-F ⁶	1.00	0.89-1.13	ns
Malmö	2.32	1.27-4.23	.006
Multiple Centers ⁷	0.91	0.79-1.06	ns
Oslo	0.76	0.62-0.94	.010
Borough Town	1.12	0.89-1.42	ns
Market Town	0.79	0.61-1.01	.060
Shire Town	1.22	0.98-1.51	.078
South City	0.99	0.88-1.12	ns
Cambridge	0.85	0.73-0.99	.038
Gillingham	1.48	1.28-1.71	.087
All 20 studies ⁸	1.08	0.97-1.20	ns
15 UK studies ⁸	1.11	0.98-1.27	ns
5 other studies ⁸	0.97	0.83-1.13	ns

¹Southwark-EC = Elephant and Castle; ²Southwark-C = Camberwell; ³Southwark-E = East Street; ⁴Cincinnati-N = Northside; ⁵Cincinnati-H = Hopkins Park; ⁶Cincinnati-F = Findlay Market; ⁷Multiple Centers = multiple city and town center study by Sivarajasingam et al. (2003); ⁸Random effects model used in analysis.

Estate) to a high of 87% (in Northern Estate) in the six evaluations that reported this information. Active monitoring was used in all of the schemes, with monitoring in the Brooklyn evaluation conducted by police. In the six British schemes evaluated by Gill and Spriggs (2005), security personnel who monitored the cameras had some form of communication link with police (i.e., a one-way or two-way radio). On average, the follow-up period in the nine evaluations was 12 months, ranging from a low of 3 months to a high of 18 months. Only three schemes included other interventions in addition to the main intervention of CCTV (Southcap, Eastcap, and Westcap Estates). These involved improved lighting and youth inclusion projects, which are community run programs designed to “include socially excluded young people in mainstream society” through the provision of youth work, sport, and other activities (Bottoms & Dignan, 2004, p. 152). 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 but nonsignificant reduction in crime in public housing. The weighted mean effect size was an odds ratio of 1.07, which corresponds to a 7% reduction in crimes in experimental areas compared with control areas (see Table 3). The eight effect sizes were significantly heterogeneous ($Q = 47.94$, $df = 7$, $p < .0001$). Therefore, a random effects model was used to calculate weighted mean effect sizes.

Public transport

Four evaluations were carried out in public transportation systems. All of them were conducted in underground railway systems: three in the London Underground and one in the Montreal Metro. 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. For example, in the Montreal program a total of 130 cameras (approximately 10 per station) were installed in

Table 3 Meta-analysis of CCTV evaluations in public housing

Evaluation	Odds ratio	95% confidence interval	p
New York City	0.89	0.38-2.07	ns
Glasgow	1.43	1.19-1.72	.0001
Deploy Estate	0.85	0.70-1.04	ns
Dual Estate	0.78	0.63-0.97	.023
Southcap Estate	0.76	0.57-1.02	.067
Eastcap Estate	1.03	0.75-1.42	ns
Northern Estate	1.34	0.84-2.12	ns
Westcap Estate	1.85	1.44-2.37	.0001
All 8 studies ¹	1.07	0.83-1.39	ns

¹Random effects model used in analysis.

the experimental stations. Each of the schemes involved active monitoring on the part of police; in the London Underground this meant the British Transport Police.

With the exception of the Montreal program, each evaluation included other interventions in addition to CCTV. In the first Underground evaluation by Burrows (1980), special police patrols were in operation prior to the installation of CCTV.⁹ For the two other Underground schemes, some of the other interventions included passenger alarms, kiosks to monitor CCTV, and mirrors. For each of the three Underground schemes, CCTV was, however, the main intervention. The follow-up periods ranged from a low of 12 months to a high of 32 months. Only two of the studies measured diffusion of benefits or displacement, with one showing evidence of diffusion (Underground-N) and the other showing evidence of displacement (Underground-S).

Table 4 shows the results of a meta-analysis of the CCTV evaluations in public transport settings. In pooling the data from the four studies, there was evidence that CCTV led to a sizeable but nonsignificant reduction in crime in public transport. The weighted mean effect size was an odds ratio of 1.30, which corresponds to a 23% reduction in crimes in experimental areas compared with control areas. The substantial reduction in robberies and thefts in the first Underground evaluation (an overall 61% decrease) was the main reason for this large average effect size over all four studies. The four effect sizes were significantly heterogeneous ($Q = 30.94$, $df = 3$, $p < .0001$).

Car parks

Six CCTV evaluations met the criteria for inclusion and were conducted in car parks. All of the programs were implemented in the UK between the early 1980s and early 2000s. Camera coverage was near 100% in the two schemes that reported on it (Guildford and Hawkeye). All of the schemes, with the exception

Table 4 Meta-analysis of CCTV evaluations in public transport

Evaluation	Odds ratio	95% confidence interval	p
Underground-S ¹	2.58	1.84-3.61	.0001
Underground-N ²	1.32	0.87-2.01	ns
Underground-C ³	0.89	0.74-1.07	ns
Montreal	1.02	0.86-1.22	ns
All 4 studies ⁴	1.30	0.87-1.94	ns

¹Underground-S = southern line; ²Underground-N = northern line; ³Underground-C = Oxford Circus;

⁴Random effects model used in analysis.

9. 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 (Burrows, 1980).

Table 5 Meta-analysis of CCTV evaluations in car parks and other places

Evaluation	Odds ratio	95% confidence interval	p
Car Parks			
Guildford	0.23	0.02-2.38	ns
Hartlepool	1.78	1.25-2.52	.001
Bradford	2.67	1.43-4.98	.002
Coventry	1.95	1.41-2.71	.0001
Sutton	1.49	1.16-1.91	.002
Hawkeye	3.34	2.73-4.08	.0001
All 6 studies ¹	2.03	1.39-2.96	.0003
Other			
City Outskirts	1.34	1.16-1.54	.0001
Borough	0.80	0.63-1.02	.075
City Hospital	1.38	0.80-2.40	ns
23 violence	1.03	0.96-1.10	ns
22 vehicle crimes ¹	1.35	1.10-1.66	.004
34 UK ¹	1.24	1.10-1.39	.0005
7 non-UK ¹	0.97	0.86-1.09	ns
All 41 studies ¹	1.19	1.08-1.32	.0008

¹Random effects model used in analysis.

of Sutton that did not provide data, involved active monitoring on the part of security staff. The large-scale, multi-site Hawkeye scheme 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 Coventry, for example, improved lighting, painting, and fencing were also part of the package of measures implemented to reduce vehicle crimes. In each program, however, CCTV was the main intervention. The follow-up periods ranged from a low of 10 months to a high of 24 months. Most studies did not measure either diffusion of benefits or displacement.

As shown in Table 5, 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, meaning that crime decreased by half (51%) in experimental areas compared with control areas. The six effect sizes were significantly heterogeneous ($Q = 31.93$, $df = 5$, $p < .0001$).

Crime Type

The major crime types that were reported were violence (including robbery) and vehicle crimes (including thefts of and from vehicles). Violence was reported in

23 evaluations, but CCTV had a desirable effect in reducing violence in only three cases (Airdrie, Malmö, and Shire Town). Overall, there was no effect of CCTV on violence ($OR = 1.03$; see Table 5). The 23 effect sizes were not significantly heterogeneous ($Q = 30.87$, $df = 22$, $n.s.$), so a fixed effects model was used to calculate weighted mean effect sizes.

Vehicle crimes were reported in 22 evaluations, and CCTV had a desirable effect in reducing them in 10 cases: in five of the six car park evaluations (all except Guildford), in three city or town center evaluations (Burnley, Gillingham, and South City), and in City Outskirts and City Hospital. As shown in Table 5, over all 22 evaluations CCTV reduced vehicle crimes by 26% ($OR = 1.35$). The 22 effect sizes were significantly heterogeneous ($Q = 115.1$, $df = 21$, $p < .0001$). The greatest effect was in the large-scale, multi-site Hawkeye study, but there was a significant effect even if this study was excluded ($OR = 1.28$, corresponding to a 22% decrease in crimes).

Country Comparison

Of the 41 evaluations that were included in the meta-analysis, the overwhelming majority of them were carried out in the UK ($n = 34$). Four were from the USA and one each from Canada, Norway, and Sweden. As shown in Table 5, 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 UK than in other countries. In the British studies, CCTV had a significant desirable effect, with an overall 19% reduction in crime ($OR = 1.24$). The British studies were significantly heterogeneous ($Q = 350.5$, $df = 33$, $p < .0001$). In the other studies, CCTV showed no desirable effect on crime ($OR = 0.97$). The other studies were also significantly heterogeneous ($Q = 14.51$, $df = 6$, $p = .024$). Importantly, the significant results for the British studies were largely driven by the effective programs in car parks.

Pooled Effects

Figure 1 summarizes the results of the 41 studies in a forest graph. This shows the odds ratio for total crime measured in each study plus its 95% confidence interval. The 41 studies are ordered according to magnitudes of their odds ratios. It can be seen that more than one-third ($n = 15$) showed evidence of a desirable effect of CCTV on crime, with odds ratios of 1.34 or greater (from City Outskirts upward, not including City Hospital). Fourteen of the 15 effective studies were carried out in the UK; the other was carried out in Sweden (Malmö). Three other studies showed a significant undesirable effect (Oslo, Cambridge, and Dual Estate), and the remaining 23 studies showed no significant effect. The overall odds ratio of 1.19 indicates a modest but significant 16% reduction in the crime rate in these 41 studies. The 41 CCTV evaluation

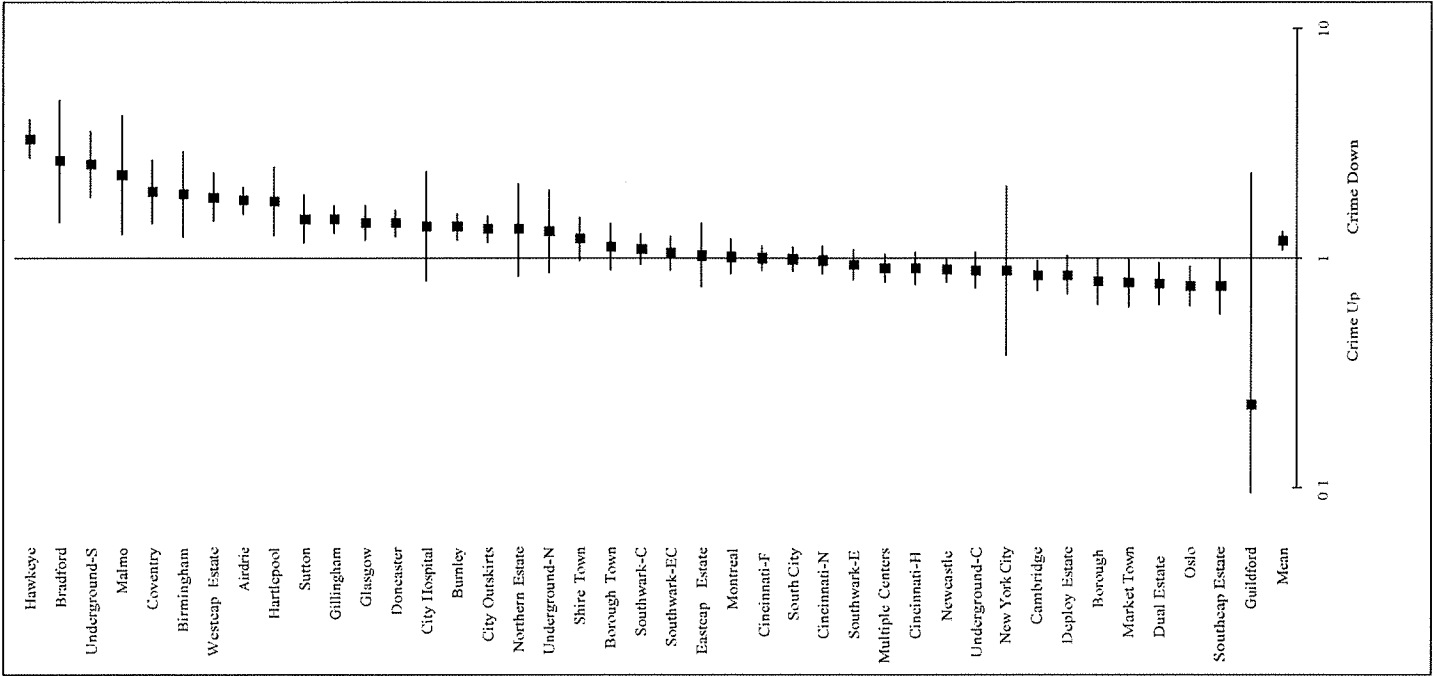


Figure 1 Odds ratios and 95% confidence intervals for total crime by study.

studies were significantly heterogeneous in their effect sizes ($Q = 389.5$, $df = 40$, $p < .0001$).

Discussion and Conclusions

Policy Implications

On the basis of the highest quality available research evidence, this systematic review and meta-analysis found that CCTV is most effective in reducing crime in car parks, is most effective in reducing vehicle crimes, and is more effective in reducing crime in the UK than in other countries. These findings are consistent with those of our initial review (Welsh & Farrington, 2002).

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 important 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 British evaluation of the effectiveness of CCTV,¹⁰ Farrington, Gill, Waples, and Argomaniz (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 guards. It is plausible to suggest that CCTV schemes with high coverage and other interventions and targeted on vehicle crimes are effective.

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 of studies involved other interventions. These CCTV schemes, as well as those focused on public transport, did not have a significant effect on crime.

Part of the difficulty in attempting to explain why CCTV schemes were more effective in reducing crime in car parks compared to other settings was that important information on implementation was not always reported in the evaluation studies (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?). Of course, this lack of information is a problem in evaluations of other interventions as well.

Another interesting finding to emerge from this review is that CCTV schemes in the UK 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 no effect on crime. The Malmö, Sweden, city center scheme was the only effective one.) What might account for this? Or, more

10. Fourteen of the 44 studies included in this review were part of this national evaluation of CCTV in Britain.

importantly, what lessons can be drawn from the British studies to help improve the crime prevention effectiveness of CCTV use in other countries, especially the USA? There were some differences in key characteristics between the British and other country CCTV schemes that may help to address these questions.

First, the average follow-up period of the eight other country CCTV schemes was substantially lower than for the 36 British schemes: 9.6 months versus 15.9-16.1 months. (Four of the other country 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 other country 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 other country studies showed evidence of either a null or uncertain effect on crime). Longer follow-up periods, as in the majority of the British studies, seem to be warranted for future CCTV experiments in other countries, particularly in the USA.

Second, and perhaps most importantly, not one of the eight schemes from the other countries used other interventions alongside CCTV, while half of the 36 British 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 UK and involved other interventions), this leaves 12 out of 30 British studies that used other interventions. It is possible that the absence of other situational or social crime prevention measures in the other country CCTV schemes may be a contributing factor to their overall poor effect in reducing crime; for example, CCTV on its own may not be seen as 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 British CCTV schemes and those in other countries is the cultural context. In the UK, there is a high level of public support for the use of CCTV cameras in public settings to prevent crime (Norris & Armstrong, 1999; Phillips, 1999). In the USA, the public has been less accepting of and more apprehensive of "Big Brother" implications arising from this surveillance technology (Murphy, 2002). However, this view may be changing. An ABC News and *Washington Post* national poll conducted in July 2007 found that 7 out of every 10 (71%) Americans support increased use of surveillance cameras in public places to reduce crime; only 25% of respondents opposed this (Washington Post, 2007). In the USA, resistance to the use of CCTV in public places also takes the form of legal action and constitutional challenges under the U.S. Constitution's Fourth Amendment prohibition against unreasonable searches and seizures (Nieto, 1997). 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 support (and maybe even political

support) for the schemes, which, in turn, may have resulted in reduced program funding, the police assigning lower priority to the schemes, or attempts to discourage desirable media coverage, for example. Each of these factors could potentially undermine the effectiveness of CCTV schemes. In contrast, the British Home Office, who funded many of the UK evaluations, wanted to show that CCTV was effective because it had invested so much money in these schemes. With the current “roll out” of public area video surveillance in the USA, it will be interesting to see if the federal departments of Justice and Homeland Security follow a similar path.

Social Costs

It is important to investigate the potential social costs associated with public video surveillance and weigh these costs against any crime reduction benefits. Von Hirsch (2000) argues that there are two major issues that confront the “proper uses and limits” of surveillance for crime prevention in public places. The first issue pertains to privacy concerns. We expand on this to include other social costs that may infringe on public interests or violate legal or constitutional protections. The second issue concerns the matter of the “legitimising role of crime prevention,” or as von Hirsch (2000, p. 61) posits, “To what extent does crime prevention legitimise impinging on any interests of privacy or anonymity in public space?”

In car parks, there may be little resistance to the installation of CCTV cameras. In part, this is because the public space is utilized for one rather inconsequential purpose—parking vehicles. It is also the case that a car park is a well defined and clearly marked physical space, meaning that individuals know that it is a car park and can choose to park their vehicle there or not (providing there are other alternatives). These points stand in sharp contrast with how individuals come into contact with CCTV in other public settings (see below).

One could take issue with CCTV cameras in public car parks. For the period of time that the vehicle is parked, including leaving and returning to the vehicle and exiting the car park, the individual is being monitored in some capacity. To some or possibly many this is an invasion of privacy; to others, this is a slight inconvenience for the added safety that is afforded to their vehicle by the presence of the cameras. On balance, the crime reduction benefits of the use of CCTV in car parks seem to outweigh any social costs.

CCTV in other public settings such as city and town centers, public housing communities, and transportation facilities evokes more resistance on the basis of threats to privacy and other civil liberties, and is associated with a larger number of social harms, including the reinforcement of the notion of a fortress society and the social exclusion of marginalized populations (Clarke, 2000). Indeed, it is often these settings that are at the center of the debate over how best to strike a balance between the potential crime reduction benefits and social costs associated with CCTV (Savage, 2007).

Take city and town centers, for example. Here, the coverage of the cameras is much less than in car parks, but there is often a greater number of cameras extending over a larger area. For instance, a person walking down a street in an urban center could be caught on camera 20, 30, or 40 times, depending on the concentration of cameras in the area. In London and other major cities in the UK, it is this concentration as well as its widespread use in other public (and private) places that contributed to the estimate that the average Briton is caught on camera roughly 300 times a day (Associated Press, 2007). A more targeted approach, like that characterized in car parks, may go some way toward reducing the pervasiveness of the threat to the general public's privacy and other civil liberties in city and town centers and other public settings. Regular crime analysis by the police, such as used in Compstat, could be used to identify those places that are at greatest risk for certain crimes, which, in turn, could be used to guide the implementation of video surveillance. The advent of mobile and redeployable CCTV cameras may make this a more feasible and perhaps less costly option (Waples & Gill, 2006).

In these other public settings, CCTV may also result in the social exclusion of vulnerable or marginalized populations such as unemployed youths who are "hanging out" and the homeless. The fear is that, instead of providing assistance for these groups to get off the street so to speak, CCTV, among other interventions like police and security guard patrols, may push them further away from available services and cause increased harm in the form of crime, victimization, or both. Efforts to reduce any social exclusion effect associated with CCTV in these settings would need to involve other services.

Other Potential Benefits

One of the issues that this paper was not able to explore was that public video surveillance might produce other important benefits beyond a reduction in crime rates. CCTV also serves other purposes in public places. To our knowledge, few of these other uses have been the subject of high quality evaluations. Indeed, our reporting of program effects on crime—over and above our focus on surveillance and crime prevention—was driven largely by what high quality evaluations have measured.

There seem to be a number of potential benefits associated with CCTV. For the police, the potential benefit of CCTV in reducing crime by deterring offenders from committing an illegal activity may be much lower on its list of priorities than the apprehension of suspects who were caught on camera committing a crime (see Norris & McCahill, 2006). The use of a camera image to aid in the identification and apprehension of a suspect, as well as to help secure a conviction in criminal court, is a common justification that is used by police and prosecutors alike in many US cities that are currently experimenting with increased use of video surveillance in public places (Ballou, 2007; McCarthy, 2007).

Police officer safety is another potential benefit associated with CCTV. This has come about through the installation of CCTV cameras in patrol cars to record the events of roadside stops, for example. The use of CCTV in city and town centers and other public places could also potentially contribute to improved police officer safety. CCTV could also result in increased pedestrian and traffic safety. This could follow from the use of speed cameras and red light cameras (i.e., to record vehicles going through red lights at intersections), which are already used extensively in some cities in the USA and elsewhere.

Another potential benefit associated with CCTV is the prevention of terrorist activities, whether it be through the identification of suspicious persons or packages that prevent the act from taking place or to aid in the identification, apprehension, and conviction of suspects after the act. It was mainly this latter function of CCTV that was used to justify its widespread implementation in both public and private places throughout Britain in the 1990s (Rosen, 2004) and, following the suicide bombings on the London Underground in July 2005, reaffirm its utility there (Hier, Walby, & Greenberg, 2006). Similarly, in the USA, the terrorist acts perpetrated on September 11, 2001, have contributed to an increased use of CCTV surveillance cameras in this country (Murphy, 2002).

Directions for Research

Advancing knowledge about the effectiveness of CCTV in preventing crime in public places should begin with attention to the methodological rigor of the evaluation designs. The use of a comparable control area in most of the included evaluations went some way toward ruling out some of the major threats to internal validity, such as selection, maturation, history, and instrumentation. It is desirable in future evaluations to compare several experimental areas with several comparable adjacent and control areas. Adjacent and nonadjacent areas are needed to test hypotheses about displacement and diffusion of benefits. If crime decreased in an experimental area, increased in an adjacent control area, and stayed constant in a nonadjacent control area, this might be evidence of displacement. If crime decreased in an experimental area and in an adjacent control area but stayed constant or increased in a nonadjacent control area, this might be evidence of diffusion of benefits.

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). 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 as well as the persistence of any effects on crime. The contamination of control areas (i.e., by the CCTV intervention) was another, albeit less common, problem that faced the evaluations.

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). In addition, future evaluations should include interviews with potential offenders and potential victims to find out what they know about the surveillance scheme and their views on associated social costs, to test hypotheses about mediators between CCTV and crime. Research is also needed on the financial costs and benefits of CCTV programs.

Overall, it might be concluded that public area CCTV reduces crime in some circumstances. In light of the mixed results and potential social costs, future CCTV schemes should be carefully implemented in different settings and should employ high quality evaluation designs with long follow-up periods.

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