



CCTV

Toolkit technical report

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This report is produced in collaboration with staff from the Campbell Collaboration Secretariat. It is a derivative product, which summarises information from Campbell systematic reviews, and other reviews, to support evidence-informed decision making’.

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Plain language summary

This technical report reviews the evidence on the effect of CCTV on the involvement of children and young people in crime and violence. This technical report is based primarily on a recent systematic review and meta-analysis by Piza et al. (2019), with additional information from a process evaluation by Gill and Spriggs (2005).

CCTV surveillance is a form of situational crime prevention, meaning that it changes the physical environment in order to reduce the number of crimes committed in the target area. CCTV is often implemented alongside additional interventions, such as signage, improved lighting, police operations, security guards, access control, community outreach, and communications systems. For evaluations included in the Piza et al. (2019) which were from the UK, a relatively equal numbers of evaluations examined the impact of CCTV alone (n = 12), compared to CCTV implemented alongside one other intervention (n = 10), or with multiple additional interventions (n = 12). Of these, nearly half (n = 15; 44.1%) were in in city centre locations. Other locations include car parks (n = 6; 17.6%), housing complexes (n = 7; 20.6%), residential areas (n = 2; 5.9%), and public transport (n = 3; 8.8%).

The main mechanism by which CCTV reduces crime is based on a rational choice perspective. That is, when faced with an opportunity to commit an offence, an offender will make a decision based on the “potential rewards and inherent risks” associated with the offence (Piza et al., 2019; p. 137). As such, situational crime interventions such as CCTV works by targeting these factors, particularly by increasing the inherent risks. Specific mechanisms may include increased offender apprehension, increased natural surveillance, publicity, improved citizen awareness, assisting policing following an offence, provision of visual evidence and securing guilty pleas (Ashby, 2017; Gill & Spriggs, 2005; Piza et al., 2019; Ratcliffe, 2006). There is also the possibility of a negative impact of CCTV on crime rates when measured using police data. This is because CCTV may lead to an increase in crimes being detected or an increase in the public reporting crime to the police. There may also be an actual adverse effect of CCTV as this may instil a false sense of confidence in members of the public. This may lead to a lack of vigilance and create an increased opportunities for crimes to take place.

Overall, the effect size suggests that CCTV had a desirable impact although the mean effect size is low (4% reduction) and not statistically significant. The effect on crime is larger (10.1%) and significant, as is the effect from evaluations in the UK (an 18% reduction in crime). The effect is largest for reducing crime in car parks. The evidence rating for these effects is 2, marked down for being an indirect effect as it refers to all crime, not specifically that committed by children and young people.

The design and implementation issues have been identified in a review of 13 projects in the UK relating to: (i) scheme objectives, which were often not clear and so schemes may be poorly planned; (ii) management, in which reliance on technical consultants may lead to design issues, especially if there was no end user consultation; (iii) camera density, coverage and positioning varied widely because of lack of guidance, and was not always appropriate; (iv) technical characteristics of cameras need to be appropriate for intended use; and (iv) operation of the control room plays an important role, especially the ability to communicate with the police.

Start-up costs were the largest part of project costs. Benefit-cost ratios were variable and sometimes less than one.

Objective and approach

The objective of this technical report is to review the evidence on the effect of CCTV on the involvement of children and young people in crime and violence. This technical report is based primarily on a recent systematic review and meta-analysis by Piza et al. (2019). The following inclusion and exclusion criteria were used to inform the selection of systematic reviews. In addition, we present evidence on implementation and costs from a study of 13 Closed Circuit Television Camera (CCTV) projects which were implemented in a range of contexts, including town centres, city centres, car parks, on public transport, hospitals, and residential areas (Gill and Spriggs, 2005). The schemes in that evaluation were funded under a Home Office scheme to support the expansion of CCTV.

Inclusion criteria

Included in this technical report were systematic reviews and meta-analyses of the effectiveness of either CCTV on crime and violence outcomes. Piza et al. (2019) reported the most recent systematic review and meta-analysis of CCTV surveillance in relation to crime prevention.

Exclusion criteria

Reviews were excluded for the following reasons:

- Review was a previous version of a more recent updated systematic review and meta-analysis. For example, Piza et al. (2019) updated earlier reviews by Welsh & Farrington (2002, 2007, 2008, 2009).
- Review was concerned with other, related, situational crime prevention approaches, such as streetlighting (Welsh et al., 2021) as these were considered for a separate Toolkit strand.

Outcomes

Multiple outcomes are typically included in reviews of the effectiveness of CCTV surveillance. Piza et al. (2019) evaluated the effect of CCTV surveillance on different types of crimes, such as, disorder, drug crime, property crime, vehicle crime and violent crime. The focus of this technical report is the impact of CCTV on violence.

Description of interventions

CCTV surveillance is described by Piza et al. (2019) as a mainstream form of crime prevention that refers to the use of surveillance cameras in public places. CCTV can be used on its own, as a “stand-alone crime deterrent” or as part of a “proactive place-based patrol strategies” (Piza et al., 2019, p. 136). As a form of situational crime prevention, CCTV thus refers to changes to the physical environment (i.e., the placement of surveillance cameras) in order to reduce the number of crimes committed in the target area.

Piza et al. (2019, p. 146) state that CCTV is often implemented alongside additional interventions, such as signage, improved lighting, police operations, security guards, access control, community outreach, and communications systems. Whilst 36 evaluations included in the review included only CCTV surveillance, 14 evaluations included CCTV plus signs (which also included flashing lights on cameras) to alert members of the public to the presence of cameras. Moreover, CCTV surveillance was also implemented alongside improved lighting in 9 other evaluations, of which 2 evaluations included only CCTV and improved lighting. Specifically in the UK, Piza et al. (2019) report that approximately equal numbers of evaluations examined the impact of CCTV alone ($n = 12$), alongside one other intervention ($n = 10$), or with multiple additional interventions ($n = 12$).

Implementation setting and personnel

In the United Kingdom, the impact of CCTV surveillance has been examined in a range of settings. For example, Piza et al. (2019) found that 44.1% ($n = 15$) of all UK evaluations examined CCTV in city centre locations. Other locations include car parks ($n = 6$; 17.6%), housing complexes ($n = 7$; 20.6%), residential areas ($n = 2$; 5.9%), and public transport ($n = 3$; 8.8%).

CCTV surveillance involves an element of monitoring, that is, a person or a team of people that monitor images. Monitoring can be implemented either passively or actively. Active monitoring refers to CCTV surveillance cameras that are linked to a live feed and have individuals monitoring imagery as it is captured. In contrast, passive monitoring of CCTV refers to cameras that are not monitored but instead record images which can be accessed at a later date if needed. All evaluations of CCTV surveillance in the United Kingdom examined actively

monitored CCTV ($n = 30$; 88.2%) or the type of monitoring was not specified. Piza et al. (2019) did not identify any evaluations of CCTV surveillance conducted in the UK where passive CCTV was evaluated.

Duration and scale

The follow-up period in evaluations of the impact of surveillance cameras on crime included in the review of Piza et al. (2019) ranged from 2 to 60 months. The average was 17.47 months. However, in theory the duration of CCTV interventions should be indefinite, subject to regular maintenance of physical cameras and software to process images. The scale of CCTV is also dependent on the number of cameras and the breadth of the area covered and surveyed.

Theory of change: the presumed causal mechanisms for the effect of CCTV on crime

CCTV surveillance is an example of situational crime prevention (Piza et al., 2019). The theory for the effect on crime, therefore, relies on the idea that changes to the physical environment where crimes occur can cause reductions in the numbers of crimes committed. Fundamentally, this relies on a 'rational choice' perspective (Piza et al., 2019) whereby, crime can be prevented by reducing the number of opportunities for an offence to be committed and increasing the risk of offending. The rational choice perspective states that when faced with an opportunity to commit an offence, an offender will make a decision based on the "potential rewards and inherent risks" associated with the offence (Piza et al., 2019; p. 137). As such, situational crime interventions such as CCTV surveillance work by targeting these factors, particularly by increasing the inherent risks.

Piza et al. (2019) outline a number of presumed causal mechanisms in CCTV surveillance. These mechanisms include: increased offender apprehension, increased natural surveillance, publicity, improved citizen awareness, assisting policing following an offence, provision of visual evidence and securing guilty pleas (Ashby, 2017; Gill & Spriggs, 2005; Piza et al., 2019; Ratcliffe, 2006). There is also the possibility of a negative impact of CCTV on crime. When crime is measured using police data CCTV may lead to an increase in the detection of offences and reporting of offences by the public. There may also be an actual adverse effect of CCTV by instilling a false sense of confidence in members of the public leading to a lack of vigilance, and therefore increased opportunities for crimes to take place.

Evidence base

Descriptive overview

Piza et al. (2019) included effect sizes from 76 evaluations in their meta-analysis. The authors categorised evaluations of CCTV surveillance based on the location of the intervention. The largest number of evaluations were conducted in city and town centres ($n = 33$). Eight evaluations considered CCTV in car parks and 4 evaluations considered CCTV implemented in/or on public transport. A further 10 evaluations evaluated CCTV in public housing complexes and 16 evaluations evaluated CCTV in residential areas. An additional 5 evaluations were labelled as 'other' (Piza et al., 2019). The largest share of evaluations by country were conducted in the UK ($n = 34$), followed by the United States ($n = 24$). The remaining evaluations were conducted in Canada ($n = 6$), South Korea ($n = 3$), Sweden ($n = 4$), or 'other' ($n = 5$).

Assessment of the evidence rating

We have confidence that, at the time of writing, the review by Piza et al. (2019) represents the best available evidence on the effectiveness of CCTV surveillance on crime outcomes. Our decision rule for determining the evidence rating is summarised in the technical guide.

A modified version of the AMSTAR2 critical appraisal tool was used to appraise the reviews that inform the current technical report. According to this tool, the review by Piza et al. (2019) was rated 'low'.

Piza et al. (2019) included 76 evaluations of CCTV surveillance in their meta-analysis. Included interventions were those where CCTV was the main focus, either explicitly stated by the author of the primary evaluation or determined by the review team. Evaluations also had to report an outcome measure of crime and there had to be at least 20 incidences of crime in experimental and control areas (Piza et al., 2019). Included evaluations had to use at least a before-and-after measures of crime in treatment and control areas before the intervention (Piza et al., 2019).

Piza et al. (2019) reported using a robust and thorough search strategy and searched multiple databases. They also contacted experts, screened bibliographies, and used citation searches.

No information about whether the searches and screening were performed in duplicate is provided.

Piza et al. (2019) do not provide a table outlining information about included evaluations and a risk of bias assessment was not performed, beyond undertaking an analysis of publication bias. Piza et al. (2019) report the results of a series of moderator analysis to explore variations in primary effect sizes, and information about the heterogeneity between effect sizes is reported (see Note on Figure 1, p. 142). The source of funding for the review by Piza et al. (2019) is reported, but any conflict of interest, or lack of conflict of interest, is not provided.

Piza et al. (2019) report an indirect effect of CCTV surveillance on the involvement of children and young people in crime and violence. The mean effect size for violent crime was chosen as our headline impact estimate. It is considered an indirect effect because the effect size includes violent crimes committed by adults and a separate effect for children and young people could not be computed.

Overall, there was a significant amount of heterogeneity between these evaluations ($I^2 = 86.4\%$). The review was rated as 'low' according to the AMSTAR tool, and the mean effect does not refer to crimes attributed to children and young people specifically. The authors included both randomised and non-randomised designs in their analysis, but the numbers of evaluations used to estimate the effect on either violent crime or all crime, according to the methodology is not provided. Thus, the evidence rating for the violent crime outcome is 2, marked down for the indirect nature of the effect size, the low confidence in the review as measured using the AMSTAR tool and unclear heterogeneity.

Impact

Summary impact measure

Overall, the findings from a systematic review and meta-analysis indicates that CCTV surveillance had a desirable impact on violent crime outcomes.

Piza et al. (2019) also report the mean effect size from 29 evaluations that report the impact of CCTV on violent crime. Overall, the effect size suggests that CCTV had a desirable impact

although the mean effect size is low (4% reduction) and not statistically significant (RES = 1.05; 95% CI 0.954, 1.16; $p = .32$). The effect on all crime outcomes is larger (10.1%) and significant.

Table 1

Mean effect sizes from Piza et al. (2019) review

Review	<i>n</i> studies	ES (RES)	95% CI	% reduction	Evidence rating on crime and violence
Piza et al. (2019); all crime outcomes	76	RES = 1.14 d = 0.072	(1.07, 1.22)	10.1%	2
Piza et al. (2019); violent crime*	29	RES = 1.05 d= 0.027	(0.95, 1.16)	3.7%	2

Note: ES = the weighted mean effect size; RES = relative effect size; * = headline impact estimate

Piza et al. (2019) report the mean effect size for the impact of streetlighting as a relative effect size. The formula for calculating such an effect is analogous to the odds ratio, and therefore, we applied Lipsey and Wilson’s (2001) formula to transform the RES to a *d* value.

In order to transform the *d* value to a percentage relative change in the outcome, we assumed that there were 200 crimes recorded and an equal numbers of observations to the intervention and the treatment groups. Thus, if we assume that 17% of the crimes recorded involved violence, the RES of 1.05 reported by Welsh et al. (2021) translates to a 3.7% decrease in violence. Further explanation of this transformation is provided in Annex 1.

Moderators and mediators

In addition to the overall mean effect reported in Table 1, Piza et al. (2019) report a number of mean effect sizes for various moderators. Potentially most important for the purpose of this technical report, Piza et al. (2019) report that overall, evaluations of CCTV surveillance conducted in the United Kingdom ($n = 34$) found a desirable effect on crime outcomes (RES = 1.26; 95% CI 1.12, 1.41; $p < .001$) – equivalent to a reduction in crime of 18.3%.

In addition, Piza et al. (2019) found that the mean effect sizes for the impact of CCTV were largest for drug crimes (RES = 1.25; 95% CI 1.01, 1.55; $p = .044$; $n = 6$ evaluations) followed by measures of vehicle crimes (RES = 1.16; 95% CI 1.02, 1.34; $p = .03$; $n = 23$ evaluations) or property crimes (RES = 1.16; 95% CI 1.02, 1.32; $p = .021$; $n = 22$ evaluations). Piza et al. (2019) found that CCTV had a marginal undesirable effect on disorder crimes (RES = 0.99; 95% CI 0.85, 1.16; $p = .936$; $n = 5$ evaluations) but the effect size was not statistically significant.

When the setting for CCTV was included as a moderator, Piza et al. (2019) found that CCTV surveillance implemented in car park settings were associated with the largest effects on crime outcomes (RES = 1.59; 95% CI 1.05, 2.39; $p = .027$; $n = 8$ evaluations). This is equivalent to a 39% reduction in crime outcomes.

There was also a statistically significant difference between the effect sizes for 'active' CCTV surveillance ($n = 54$) compared to 'passive' CCTV surveillance ($Q = 12.62$, $df = 1$, $p < .001$). Actively monitored CCTV surveillance was associated with a significantly larger impact on crime outcomes (RES = 1.17; 95% CI 1.08, 1.27, $p < .001$) in comparison to passively monitored CCTV surveillance (RES = 1.02; 95% CI 0.95, 1.08, $p = .633$). CCTV surveillance was also associated with larger impact on crime outcomes when included alongside multiple other interventions (RES = 1.51, 95% CI 1.22, 1.88; $p < .001$; $n = 14$ evaluations) in comparison to mean effect sizes for evaluations that implemented CCTV alone (RES = 1.083, 95% CI 0.99, 1.18; $p = .057$; $n = 36$ evaluations) or in conjunction with one other intervention (RES = 1.076, 95% CI 0.98, 1.18; $p = .103$; $n = 26$ evaluations).

Implementation and Cost analysis

Implementation

The evaluation of 13 CCTV initiatives across England identified six design and implementation characteristics which influenced the effectiveness of this intervention (Gill and Spriggs, 2005). These six characteristics are discussed in turn.

Scheme objectives

A lack of clear objectives and an associated lack of appropriate planning, compounded by a lack of necessary data for planning, meant that schemes may be poorly designed. This

situation was exacerbated by the availability of funds specifically for CCTV, which encouraged bids where CCTV may not have been necessary and without considering alternatives.

Management

The design of some schemes relied excessively on technical consultants who may lack the necessary local knowledge. Later consultations with end users, notably the police, resulted in modifications to the design of the schemes. A lack of consultation with end users during the planning phase also undermined the police's future engagement with the scheme. Having a suitable project manager who was known and contactable was important, but finding qualified people willing to manage the project and the relationships needed proved difficult.

Camera density, coverage, and positioning

A lack of guidance led to wide variations in the density and coverage of the CCTV. Just over half of the schemes had an explicit procedure for determining camera location, with police input being invaluable in this process. Greater density of CCTV coverage was not necessarily associated with larger effects on crime, but at the same time incomplete coverage meant people could not be properly tracked. Positioning decisions made during the winter sometimes suffered from foliage cover in summer. Positioning was constrained by other factors such as underground wiring and the location of buildings and trees. In some cases simple technical errors were made, such as positioning a camera too high or using a moveable camera when a static one would have been appropriate.

Technical characteristics

Positioning decisions were usually made during the daytime without sufficient consideration for night-time use. Cameras in several schemes performed poorly at night. Cameras which automatically rotated were felt by operators to be easily avoidable and had the potential to miss essential moments of an incident. The teams managing new digital cameras which were being introduced at the time were unsure they would be able to manage them properly.

Operation of the control room

The key factors in the control room were the hours of coverage and the ability to communicate with the police. Control rooms often had no direct means of communicating

with the police and would watch crimes occurring but be unable to do anything other than call 999, with their calls being given no priority over other calls. Having police in the control room was seen as very useful because of their expert knowledge, their ability to contact the police and listen into police radios.

Economic analysis

The set-up costs for CCTV are high and accounted for the bulk of project costs. Analysis of cost effectiveness and cost-benefit analysis show highly variable results, but on average a low return. This is partly because one of the largest effects of CCTV is on car theft, which is a low-cost crime.

What do we need to know? What don't we know?

There are many evaluations of CCTV, with studies of effectiveness being greater in number than process evaluation. An updated process evaluation of the design and management of CCTV systems would be useful (noting there may be such internal documents already).

References

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Annex 1: Effect size calculation

This annex shows the calculation based on the results and assumptions given in the text. We assume 200 crimes recorded in study areas, evenly divided between treatment and control groups. That means there are 100 recorded crimes in the control area and 100 recorded crimes the treatment areas. Assuming that 17% of crimes recorded in the control area a violent offence, the mean effect sizes reported by Piza et al. (2019) can be easily transformed to a percentage change in violence.

If the effect size for the violent crime is $RES = 1.05$ (Piza et al., 2019), then using the table below and the formula for an RES, we can estimate the value of X. The RES is estimated as: $A*D/B*C$, where A is the number of observed crimes that did not involve a violent offence in the treatment group, B is the number of observed crimes that did involve a violent offence treatment group, C is the number of observed crimes that did not involve a violent offence in the control group, and D the number of observed crimes that did involve a violent offence in the control group. Therefore, the value of X is 16.32 for violent crime outcome reported by Piza et al. (2019).

	No		
	violence	Violence	Total
Treatment	100-x	x	100
Control	83	17	100

Therefore, the relative reduction in crime is $(17 - 16.32)/17 = 4\%$.

The prevalence of violent crime is likely to vary between studies and across study areas. Furthermore, it can be influenced by a number of different factors such as the type of behaviour, the type of report (i.e., self-reported or official records of arrests or convictions), or the time frame in which behaviours occurred (i.e., the past 3 months or lifetime prevalence).). If we were to adjust our assumption that 17% of crimes recorded in control areas involved violence, the relative change in the intervention area is not greatly affected.

For example, if we assume that that 33% of crimes recorded in the control area involved violence, following the implementation of CCTV, the 2x2 table would be as follows for and the value of X is 31.93. Therefore, the relative reduction is 3.2% (i.e., $(33 - 31.93)/33$).

	No		
	violence	Violence	Total
Treatment	100-x	X	100
Control	67	33	100

Similarly, if we assume that 5% of crimes recorded in the control area involved violence, following the implementation of CCTV, the value of X is 4.77 and the relative reduction is 4.6%. Given the difference in the assumed prevalence of violent crime amongst observed crimes, the percentage relative reduction does not vary in a similar fashion.

To transform the mean effect size for the overall crime outcome, we used the assumption that 25% of the control group committed an offence. Sensitivity analysis then used 10% and 40% assumed prevalence. Table 4 shows this further.

Table 4

Variation of the relative reduction in outcomes reported by Piza et al. (2019).

	Piza et al. (2019); violent crime RES = 1.05		Piza et al. (2019); all crime RES = 1.14
Assumed number of observations involving violence	Relative reduction	Assumed number of observations involving violence	Relative reduction
5%	3.2%	10%	11.2%
17%	4%	25%	9.52%
33%	4.6%	40%	7.75%

Annex 2: Process evaluation evidence

	Success factors	Challenges	What parents and children say

Annex 3 – AMSTAR Quality Rating

Modified AMSTAR item		Scoring guide	CCTV
1	Did the research questions and inclusion criteria for the review include the components of the PICOS?	To score 'Yes' appraisers should be confident that the 5 elements of PICO are described somewhere in the report	Yes
2	Did the review authors use a comprehensive literature search strategy?	At least two bibliographic databases should be searched (partial yes) plus at least one of website searches or snowballing (yes).	Yes

3	Did the review authors perform study selection in duplicate?	Score yes if double screening or single screening with independent check on at least 5-10%	No
4	Did the review authors perform data extraction in duplicate?	Score yes if double coding	No
5	Did the review authors describe the included studies in adequate detail?	Score yes if a tabular or narrative summary of included studies is provided.	No
6	Did the review authors use a satisfactory technique for assessing the risk of bias (RoB) in individual studies that were included in the review?	Score yes if there is any discussion of any source of bias such as attrition, and including publication bias.	No
7	Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?	Yes if the authors report heterogeneity statistic. Partial yes if there is some discussion of heterogeneity.	No
8	Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?	Yes if authors report funding and mention any conflict of interest	Partial Yes
	Overall		Low



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