RUTGERS Center on Public Security

BRIEF

# Is the Punishment More Certain? An Analysis of CCTV Detections and Enforcement*

*Eric L. Piza, Joel M. Caplan & Leslie W. Kennedy | October 2012*

## Introduction

While scholars have offered a wide range of mechanisms by which CCTV may prevent crime, the practical application of CCTV predominately relates to deterrence. However, little thought has been given to precisely how CCTV can generate deterrence. It is implicitly assumed that the simple presence of cameras is sufficient to deter offenders. However, previous empirical research suggests that CCTV's deterrent effects may go beyond camera presence and are related to its ability to generate increased law enforcement actions in target areas, thus increasing offenders' perceived certainty of punishment. The current study addresses this relationship[1]. CCTV detections and 9-1-1 calls-for- service (CFS) occurring over a three-year period in Newark, NJ are compared on case processing times and closure rates (e.g. whether the incident resulted in a police enforcement action). In addition, we examine the frequency of CCTV activity and the impact of various factors on its (downward) linear trend. While our findings support the notion that CCTV increases punishment certainty on a case-by-case basis, a drastic reduction of surveillance activity caused by specific "surveillance barriers"—namely, the rapid installation of cameras absent an increase in personnel—likely compromised the benefits of the enhanced enforcement.

## Research Questions and Findings

***Research Question 1: Are Case Process Times Shorter with CCTV, as compared to CFS?***

For research question 1, a series of Mann-Whitney U tests compared the queue time, response time, and total process time (queue time+ response time) of CCTV and CFS across eight incident categories. The findings displayed an inconsistent pattern, with results favoring CCTV and CFS in different instances. For overall incidents, CFS had significantly shorter time intervals than CCTV incidents. CCTV incidents displayed significantly shorter queue times for both drug and disorder offenses. In respect to priority levels, CFS had significantly shorter queue times for high-priority incidents and response times for high- and intermediate-priority incidents. CCTV had significantly shorter queue times for low-priority incidents. Process times for overall cases were significantly lower in respect to CFS. This was also the case in respect to high-priority and intermediate-priory incidents. CCTV incidents exhibited significantly lower process times in respect to drug offenses, disorder offenses, and low-priority incidents. The cumulative findings of the Mann-Whitney U tests suggests the answer of research question 1 "Are case process times shorter with CCTV?" to be "No." CCTV did not consistently demonstrate quicker process times than CFS, and in many instances CFS were processed more quickly than CCTV incidents.

*Table 1. Mann-Whitney U Tests of differences of mean ranks of queue minutes, response minutes, and total process minutes.*

| CATEGORY | QUEUE MINUTES | | | RESPONSE MINUTES | | | TOTAL PROCESS MINUTES | | |
|---|---|---|---|---|---|---|---|---|---|
| | CCTV Mean Rank | CFS Mean Rank | p. | CCTV Mean Rank | CFS Mean Rank | p. | CCTV Mean Rank | CFS Mean Rank | p. |
| **Overall Crime** | 4702.3 | 4263.63 | 0.000** | 4880.68 | 4225.73 | 0.000** | 4864.08 | 4228.64 | 0.000** |
| **Violence** | 1806.67 | 1865.25 | 0.482 | 1697.1 | 1870.66 | 0.037 | 1756.24 | 1867.74 | 0.181 |
| **Disorder Offenses** | 898.18 | 1057.38 | 0.000** | 1040.3 | 992.53 | 0.000** | 916.24 | 1049.14 | 0.000** |
| **Drug Offenses** | 394.92 | 622.45 | 0.000** | 573.91 | 521.69 | 0.008** | 415.35 | 610.27 | 0.000** |
| **Other Crime** | 624.52 | 653.2 | 0.328 | 624.98 | 653.12 | 0.339 | 628.37 | 652.54 | 0.411 |
| **High Priority Incidents** | 1605.42 | 1223.28 | 0.000** | 1636.83 | 1218.95 | 0.000** | 1734.43 | 1205.52 | 0.000** |
| **Intermediate Priority Incidents** | 2296.57 | 2257.24 | 0.318 | 2441.87 | 2221.5 | 0.000** | 2355.28 | 2242.17 | 0.020** |
| **Low Priority Incidents** | 707.81 | 831.55 | 0.000** | 825.81 | 802.34 | 0.888 | 725.26 | 827.23 | 0.001** |

***statistically significant after Holm-Bonferroni correction*

***Research Question 2: Does CCTV Produce a Higher Level of Enforcement than CFS?***

Despite not being processed quicker than CFS, CCTV incidents consistently demonstrated higher enforcement rates than CFS, both in respect to arrest and other enforcement actions. The highest CCTV arrest rates were observed in respect to drug offenses (20.6%) and high-priority incidents (21.5%). High-priority incidents were especially impacted by CCTV, with an observed arrest rate nearly three times the expected rate (7.7%). For all statistically significant categories, observed arrest rates for CFS were lower than the expected rates. Regarding enforcement actions besides arrests, CCTV had significantly higher enforcement rates than CFS for overall crime, drug offenses, high-priority crime, and intermediate-priority crime. With an observed closure rate more than four times the expected rate (20.8% vs. 5.1%), high-priority incidents were particularly susceptible to CCTV effect. When case closure via any enforcement action (arrest or "other") served as the dependent variable, CCTV incidents experienced significantly higher closure rates than CFS for six of the eight crime categories: overall crime, disorder offenses, drug offenses, other crime, high-priority incidents, and intermediate-priority incidents. Drug offenses and high-priority incidents again displayed much larger than expected clearance rates. The observed rate for high-priority incidents was more than three times the expected rate (42.2% vs. 12.9%) while the observed rate for drug offenses was nearly twice the statistically expected rate (44.5% vs. 29.1%), as identified by the Fisher's Exact test.

The results of the cumulative Fisher's Exact tests suggest the answer to research question 2, "Does CCTV produce a higher level of enforcement than CFS?" to be "yes." Across all enforcement types, most incident categories experienced significantly higher closure rates via CCTV than CFS while CFS did not exhibit higher closure rates than CCTV in a single instance.

***Table 2. Fisher's Exact tests for overall enforcement***

| | OVERALL ENFORCEMENT | | | | | | |
|---|---|---|---|---|---|---|---|
| | CCTV | | | 9-1-1 | | | p. |
| | Obs. (Exp.) | % Obs. | (% Exp.) | Obs. (Exp.) | % Obs. | (% Exp.) | |
| **OVERALL CRIME** | | | | | | | |
| Yes | 459 (273.1) | 33.1% (19.7%) | | 1141 (1326.9) | 17.0% (19.7%) | | 0.000** |
| No | 926 (1111.9) | 66.9% (80.3%) | | 5589 (5403.1) | 83.0% (80.3%) | | |
| **VIOLENCE** | | | | | | | |
| Yes | 32 (23.6) | 18.3% (13.5%) | | 471 (479.4) | 13.3% (13.5%) | | 0.069 |
| No | 143 (151.4) | 81.7% (86.7%) | | 3078 (3069.6) | 86.7% (86.5%) | | |
| **DISORDER OFFENSES** | | | | | | | |
| Yes | 204 (179.8) | 32.3% (28.5%) | | 370 (394.2) | 26.8% (28.5%) | | 0.011** |
| No | 427 (451.2) | 67.7% (71.5%) | | 1013 (988.8) | 73.2% (71.5%) | | |
| **DRUG OFFENSES** | | | | | | | |
| Yes | 173 (113.1) | 44.5% (29.1%) | | 141 (200.9) | 20.4% (29.1%) | | 0.000** |
| No | 216 (275.9) | 55.5% (70.9%) | | 550 (490.1) | 79.6% (70.9%) | | |
| **OTHER CRIME** | | | | | | | |
| Yes | 50 (30.6) | 26.3% (16.1%) | | 159 (178.4) | 14.4% (16.1%) | | 0.000** |
| No | 140 (159.4) | 73.7% (83.9%) | | 948 (928.6) | 85.6% (83.9%) | | |
| **HIGH-PRIORITY INCIDENTS** | | | | | | | |
| Yes | 128 (39) | 42.2% (12.9%) | | 179 (268) | 8.6% (12.9%) | | 0.000** |
| No | 175 (264) | 57.8% (87.1%) | | 1903 (1814) | 91.4% (87.1%) | | |
| **INTERMEDIATE-PRIORITY INCIDENTS** | | | | | | | |
| Yes | 268 (180.3) | 30.6% (20.6%) | | 617 (704.7) | 18.0% (20.6%) | | 0.000** |
| No | 608 (695.7) | 69.4% (79.4%) | | 2806 (2718.3) | 82.0% (79.4%) | | |
| **LOW-PRIORITY INCIDENTS** | | | | | | | |
| Yes | 63 (58.7) | 30.6% (28.5%) | | 345 (349.3) | 28.2% (28.5%) | | 0.505 |
| No | 143 (147.3) | 69.4% (71.5%) | | 880 (875.7) | 71.8% (71.5%) | | |

***statistically significant after Holm-Bonferroni correction*

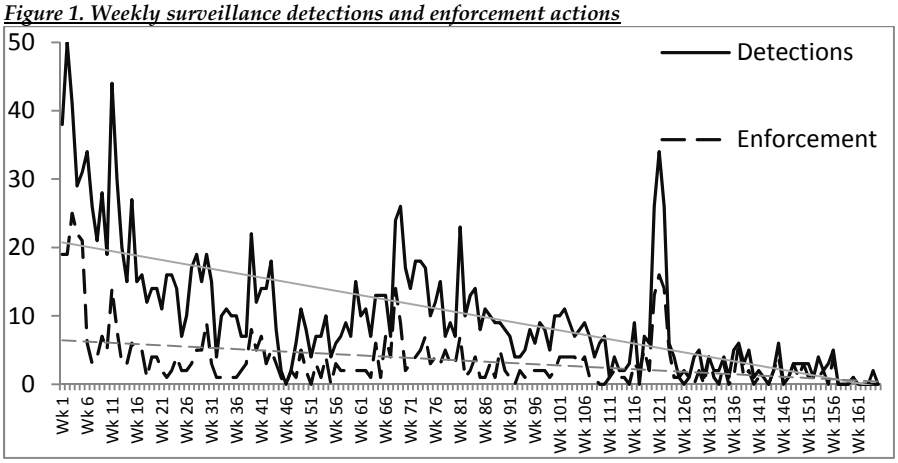


***Research Question 3: "How Often did Surveillance Activity occur over the Study Period?"***

Over the 165 week study period, an average of 10.19 detections and 3.41 enforcement actions occurred per week. The highest levels of activity were evident at the beginning of the CCTV operation, after which detections and enforcement actions both experienced a sharp and steady decline after the initial phases of the program. An average of 26.84 CCTV detections occurred per week during camera phase 1. Each subsequent camera phase brought about a reduced amount of detections. Average weekly detections dropped to a low of 2.11 during phase 5, a number more than 92% lower than the phase 1 average. A similar pattern was observed for the enforcement actions. An average of 9.47 enforcement actions occurred per week during phase 1 and decreased during phase 2 (3.00) and phase 3 (2.93). While enforcement increased by less than 1 incident per week during phase 4 (3.68), weekly enforcement actions fell to a low of 1.22 during Phase 5. ANOVA tests confirmed that the observed differences for both detections and enforcement were statistically significant ($p = 0.00$). Research question 3 was "How often did surveillance activity occur over the study period?" ANOVA tests suggest that while detections and enforcement occurred frequently during the beginning of the CCTV operation, surveillance activity became somewhat rare.

***Figure 1. Weekly surveillance detections and enforcement actions***




***Research Question 4: What Effect did Various Surveillance Barriers have on the Linear Trend of Surveillance Activity?***

A series of negative binomial regression models were conducted in order to identify factors that influenced the weekly occurrence of CCTV detections and enforcement actions. In the first model, the number of weekly detections served as the dependent variable; in the second model, weekly enforcement actions was the dependent variable. The independent variables represented potential "surveillance barriers" operating in Newark: the installation phase of the camera program (an ordinal variable from 1 to 5); the four-week average of the footage requests made to the surveillance unit during the month; a dichotomous variable identifying whether the gunshot detection system was installed yet (1) or not (0); a dichotomous variable identifying if the week was after the November 2010 layoffs (1) or not (0); and a dichotomous variable identifying if the week was in the year 2010 (1) or not (0). Two additional covariates were included as controls for features of weather that may influence street-level activity and, consequently, the amount of surveillance activity: the average daily high temperature for each week (Temperature) and the number of days in the week with either rain or snow (Precipitation).

The detections model found camera phase, footage requests, after layoffs, after gunshot detection, and temperature to be statistically significant. "Footage requests" was the only significant variable with a positive incidence rate ratio (IRR) (1.05). Four of the five variables exhibited negative IRR values. The IRR for "camera phase" suggests that with each installation of a new wave of cameras weekly detections reduced by approximately 47%. Similarly, the introduction of the gunshot detection system was associated with a 29% reduction in weekly detections while the period after layoffs was associated with an over 86% reduction. Temperature was statistically significant, but not in the expected direction. The results show that for every 1 degree increase in the temperature, weekly detections decreased by approximately 1%.

In the enforcement model, camera phase, year 2010, and temperature were all statistically significant. Camera phase (IRR = 0.53) and temperature (IRR = 0.98) were associated with enforcement decreases. The "year 2010" findings were somewhat surprising, with that variable being associated with a doubling of weekly enforcement levels. Year 2010 was conceptualized as the period when the police department was shifting resources in preparation for the impending police layoffs; it was thus unexpected for the "year 2010" and "after layoffs" variables to be correlated with enforcement in opposite directions. Newark Police officials provided a potential explanation for this seemingly counterintuitive



observation. A main concern of the Newark Police Department was maintaining adequate levels of officers on the street after the layoffs. Therefore, a number of officers in administrative posts were reassigned to patrol duties throughout 2010 in order to prepare them to take over for the street officers who were slated for termination. The immediate effect was an increased number of officers patrolling the streets of Newark; the "replacements" were on the street along with the officers currently assigned to patrol (who would later be terminated). Newark police officials suggested that this increase in street-level personnel may have enhanced the department's ability to respond to CCTV detections, leading to higher levels of enforcement actions.

The fourth research question was "What effect did various surveillance barriers have on the steady reduction of surveillance activity?" Results suggest that the expansion of the camera system (e.g. the "camera phase" variable) and the police layoffs significantly contributed to the downward trend in CCTV detections. In respect to enforcement, results suggest that while "year 2010" provided a temporary increase to the weekly number of enforcement actions, the ensuing police layoffs resulted in a significant decrease in the weekly enforcement actions.

***Table 3. Negative binomial results for weekly surveillance detections and surveillance enforcement actions: Incidence Rate Ratios.***

| COVARIATES | DETECTIONS | | | | ENFORCEMENT ACTIONS | | | |
|---|---|---|---|---|---|---|---|---|
| | IRR | S.E. | 95% C.I. | | IRR | S.E. | 95% C.I. | |
| | | | Lower | Upper | | | Lower | Upper |
| Camera Phase | 0.53** | 0.52 | 0.44 | 0.64 | 0.53** | 0.08 | 0.40 | 0.71 |
| Footage Requests | 1.05** | 0.02 | 1.01 | 1.09 | 1.04 | 0.03 | 0.98 | 1.10 |
| After Gun-Shot Detection | 0.71* | 0.12 | 0.51 | 0.98 | 0.74 | 0.19 | 0.44 | 1.24 |
| After Layoffs | 0.13** | 0.10 | 0.03 | 0.60 | 0.00 | 0.00 | 0.00 | 0.00 |
| Year 2010 | 1.36 | 0.29 | 0.904 | 2.05 | 2.42** | 0.76 | 1.30 | 4.48 |
| Temperature | 0.99** | 0.00 | 0.98 | 0.99 | 0.99** | 0.04 | 0.98 | 0.10 |
| Precipitation | 1.01 | 0.03 | 0.95 | 1.07 | 0.97 | 0.05 | 0.88 | 1.07 |

***p<0.01, *p<0.05*

## Conclusion

Despite having relatively similar process times, CCTV detections led to enforcement actions against suspects much more often that CFS for five of the seven incident categories included in the analysis. When enforcement is restricted to arrests, violence was the only category to not achieve statistical significance. This finding may be due to the fact that surveillance cameras may alert police to pertinent factors of street crime not typically captured by CFS or officers on the street. For example, the primary author once heard the following radio exchange between a Lieutenant of Newark's Narcotics Division (who was monitoring cameras) and undercover officers in the field: "The guys I saw selling on [street name] yesterday are now on [street name #2]. They just served [sold drugs to] a guy in a white Lexus. The kid who made the actual transaction is wearing a turquoise t-shirt. The other 2 dealers are on [street name #3]: [one is wearing a] red shirt, hat and a beard; the other one has a white t-shirt and thinner beard … they keep walking to the back of the building; I think that's where the stash [of drugs] is." As the quote illustrates, CCTV footage provided field officers with insight into a number of factors—such as drug stash location and additional suspects—which may have been difficult for the officers to observe on their own.

Unfortunately, the increased effectiveness of the cameras may have been negated by the fact that CCTV detections and, by extension, enforcement became rare occurrences as the system expanded. The "camera phase" and "after layoffs" variables were most associated with lower levels of detections and enforcement. These findings suggest that the Newark Police may have suffered from expanding the CCTV system absent the ability to maintain early levels of surveillance activity.

These findings also dispute the commonly held notion of CCTV as a "force multiplier." A perceived benefit of CCTV cameras is that they provide additional "eyes on the street" that increase police presence. However, this fails to realize that the human component of CCTV is what makes observation possible. While the cameras record footage of the target areas, a human operator is needed to review said footage for investigatory purposes, or to discover infractions in real time. Therefore, increased resources towards "human aspects" of surveillance may be necessary to ensure maximum efficiency of CCTV. A seemingly obvious solution would be for police departments to provide maximum staffing for their surveillance units to keep the camera-to-operator ratio as low as possible. Despite the likely benefits this would generate—in respect to increased detections and enforcement—the current fiscal situation of many police agencies likely precludes the possibility of dedicating additional resources to surveillance. A more realistic option may be for police to



incorporate CCTV cameras into current proactive operations of their agency. In Baltimore, for example, surveillance operators routinely monitored cameras in targets areas patrolled by proactive units and directly alerted the officers via two-way radio when an incident was observed (La Vigne et al., 2011)[2]. Such a policy can maximize CCTV functionality by enabling operators to detect incidents of concern that may have gone unobserved had they been tasked with monitoring all of the system's cameras for the entirety of their shift.

Findings of this study suggest that cities should design their CCTV systems in a manner that allows for maximum proactive activity. Police should ensure that they have the capacity to actively monitor cameras and swiftly respond to any incidents observed by the operators. Officials should also be mindful of this fact when deciding to expand their existing systems. While positive effects may be experienced in the initial stages of a CCTV system (e.g. when there are fewer cameras), these effects may not be sustainable as the system expands, especially if additional personnel are not able to be allocated to the CCTV operation. While CCTV may also provide police investigatory benefits and reduce fear of crime the explicit goal of police agencies is often the detection and prevention of street-level crime. However, the expansion of existing systems may require agencies to re-consider their CCTV strategy and mission over time.

**Endnotes**

[1] Piza, E., Caplan, J., and Kennedy, L. (2012, online first). Is the punishment more certain? An analysis of CCTV detections and enforcement. *Justice Quarterly.*

[2] La Vigne, N., Lowry, S., Markman, J., Dwyer, A. (2011). *Evaluating the use of public surveillance cameras for crime control and prevention.* US Department of Justice, Office of Community Oriented Policing Services. Urban Institute, Justice Policy Center: Washington, DC.

