The crime reduction effects of public closed circuit television cameras: A multimethod spatial approach

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18 cameras in 10 locations

First camera installed in July 2006, remaining installed by November 2006

Study period: January 2005 – August 2007

Currently

- 220 cameras operational
- Estimated installation cost of $10 million
- With another $3.5 Million per year maintenance cost...

$5m per year for 100 new officer

Cost of camera maintenance equivalent to 70 officers
Camera Types- PODSS vs PTZ

- **PODSS- “Portable Overt Digital Surveillance System”**
  - Moveable
  - Self-contained
  - High visibility strobe light
  - Not monitored by police

- **PTZ- “Pan, Tilt, & Zoom”**
  - Ability to pan, tilt, and zoom
  - Continuously monitored by police in real time
  - High resolution
CCTV in the Philadelphia

- Evaluation conducted by PPD
  - PODSS cameras
    - 8.4% reduction in reported crimes
    - 37% reduction in violent crime
  - PTZ cameras
    - 8.5% increase in reported crimes
  - 87 arrests directly related to the cameras
CCTV in the Philadelphia- Research questions

- Does the presence of CCTV cameras reduce crime?
  - Serious crime
  - Disorder crime
- Does the presence of CCTV cameras displace crime into surrounding areas?
- Does the type of camera make a difference?
Methodology - Challenges

- Defining areas of camera impact
  - Individual perception vs. camera viewsheds
Camera Locations

Broad & Butler, Broad & Venango, Germantown & Lehigh

Germantown & Lehigh

Chew & Chelton, Wayne & Seymour, Wayne & Logan

Broad & Susquehanna, Broad & Girard, 7th & Girard & Chelton

Barratt Middle School
Methodology

- Multi-method analysis
  - Hierarchical linear modeling (HLM)
  - Weighted displacement quotients (WDQ)

- Crimes in analysis

<table>
<thead>
<tr>
<th>Serious Crimes</th>
<th>Disorder Crimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homicides</td>
<td>Vandalism</td>
</tr>
<tr>
<td>Rape</td>
<td>Graffiti</td>
</tr>
<tr>
<td>Robbery</td>
<td>Prostitution</td>
</tr>
<tr>
<td>Assault</td>
<td>Solicitation</td>
</tr>
<tr>
<td>Burglary</td>
<td>Drug crimes</td>
</tr>
<tr>
<td>Theft</td>
<td>Disorderly conduct</td>
</tr>
<tr>
<td>Vehicle Theft</td>
<td>Loitering</td>
</tr>
</tbody>
</table>
Methodology - Hierarchical linear modeling

Observations

Cameras

Neighborhood 1

Time \( t_n \)

Neighborhood 2

Time \( t_n \)
Methodology- Hierarchical linear modeling

- **Outcome**
  - Monthly count of crime occurring in target area

- **Model specified as Poisson with overdispersion**

- **Variables in equation**
  - Length of month- Number of days
  - Linear temporal trends
  - Seasonality- Average daily, average monthly temperature

- **Camera Implementation**
  - 0 = no camera
  - 1 = camera on
Methodology - Weighted displacement quotients

- Used to identify
  - Positive implementation effect
  - Displacement of crime
  - Diffusion of benefits

- Defining operational areas
  - Target area - Location of crime reduction strategy
  - Displacement area - Most likely location of displacement
  - Control area - Control over general trends
Methodology - Weighted displacement quotients

\[
WDQ = \frac{(B_{t1}/C_{t1} - B_{t0}/C_{t0})}{(A_{t1}/C_{t1} - A_{t0}/C_{t0})}
\]

- A = count of crime in target area
- B = count of crime in displacement area
- C = count of crime in control area
- t0 = time before camera implementation
- t1 = time after camera implementation

Buffer Displacement Measure
Success Measure
Methodology - Weighted displacement quotients

- If buffer displacement measure is
  - Positive (+) = Possible displacement
  - Negative (-) = Diffusion of benefits

- If success measure is
  - Positive (+) = Crime was not reduced
  - Negative (-) = Crime was reduced

- If weighted displacement quotient value is
  - Positive (+) = Reduced crime, diffusion of benefits
  - Negative (-) = Reduced crime, but offset by displacement
Limitations of each methodology

- HLM approach
  - Cannot investigate the impact of camera type

- WDQ approach
  - Not sensitive to seasonal or ongoing trends
  - Cannot assess statistical significance of changes

- Both methods
  - Sensitive to defining treatment, buffer areas
  - Do not assess impact of other environmental characteristics
### Results - Hierarchical linear modeling

<table>
<thead>
<tr>
<th></th>
<th>Disorder Crime (IRR)</th>
<th>Serious Crime (IRR)</th>
<th>Total Crime (IRR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of month</td>
<td>1.05*</td>
<td>1.07</td>
<td>1.06**</td>
</tr>
<tr>
<td>Ongoing temporal trend</td>
<td>1.01*</td>
<td>1.00</td>
<td>1.01</td>
</tr>
<tr>
<td>Seasonality</td>
<td>1.01**</td>
<td>1.00</td>
<td>1.01**</td>
</tr>
<tr>
<td>Camera Implementation</td>
<td>0.84***</td>
<td>0.95</td>
<td>0.87***</td>
</tr>
</tbody>
</table>

* < .05, ** < .01, *** < .001

- **18% reduction in disorder crimes post camera implementation**
- **Not significant**
## Results - Weighted displacement quotients

<table>
<thead>
<tr>
<th>Site</th>
<th>Target (%)</th>
<th>Buffer (%)</th>
<th>Control (%)</th>
<th>Success measure</th>
<th>Displacement measure</th>
<th>WDQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>14</td>
<td>-12</td>
<td>-7</td>
<td>0.0015</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>-5</td>
<td>-3</td>
<td>0.0013</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-5</td>
<td>-10</td>
<td>0</td>
<td>2</td>
<td>-0.0006</td>
<td>-0.0003</td>
<td>0.51</td>
</tr>
<tr>
<td>6</td>
<td>-6</td>
<td>-24</td>
<td>-16</td>
<td>0.0002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>4</td>
<td>-2</td>
<td>-3</td>
<td>0.0014</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>-9</td>
<td>9</td>
<td>4</td>
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<td>0.0017</td>
<td>-0.43</td>
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<tr>
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<td>-34</td>
<td>-17</td>
<td>-5</td>
<td>-0.0102</td>
<td>-0.0043</td>
<td>0.42</td>
</tr>
<tr>
<td>10</td>
<td>-5</td>
<td>14</td>
<td>8</td>
<td>-0.0042</td>
<td>0.0047</td>
<td>-1.11</td>
</tr>
</tbody>
</table>

Positive value indicates no crime reduction in target area. Negative value indicates crime reduction in target area.

1 PTZ camera, 1 PODSS camera
## Results - Weighted displacement quotients

<table>
<thead>
<tr>
<th>Site</th>
<th>PODSS</th>
<th>All crime</th>
<th>Serious</th>
<th>Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3 - 5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3 - 5</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>All crime</th>
<th>Serious</th>
<th>Disorder</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.51</td>
<td>1.852</td>
<td>-3.454</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>2.914</td>
<td></td>
</tr>
<tr>
<td>3 - 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Crime reduced with displacement and significant improvements.
Results- Research questions revisited

- Does the presence of CCTV cameras reduce crime? Yes
  - Serious crime? No, but...
  - Disorder crime? Yes

- Does the presence of CCTV cameras displace crime into surrounding areas? Maybe...

- Does the type of camera make a difference? Maybe...
Discussion

- Impact on crime varies by location
  - Environmental factors
  - Camera type
- Impact varies by crime type
  - Most likely has to do with volume of crime
- Results of this analysis compared to preliminary findings
  - Did not find reduction in crime as strong as reported
  - Did not find increase in crime
  - Could not find differences between camera type
  - PTZ
  - PODSS

Average crime count

(+)

(−)
Discussion

- Recommendations for future CCTV siting decisions
  - Prioritize location decisions based on volume of crime
  - PTZ cameras can often ‘see’ several intersection -- Find clusters of high crime intersections
Research agenda

- Assess recently implemented cameras
  - Utilize greater statistical power
- Evaluate perceptions of public safety
  - "I believe if the cameras are out on the streets there will be less violence."
  - "I’m just glad. It's about time -- long over due... It makes me feel a little safer."
- However, empirical evidence is less supportive
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