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Research Preview

Jeremy Travis, Director

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Using Gunshot Detection Technology in High-Crime Areas

A summary of a presentation by Lorraine Green Mazerolle

Gunshot detection systems use acoustic sensing technology to identify, discriminate, and report gunshots to the police within seconds of the shot being fired. A gunshot detection system is comprised of sensors to detect the sound of a gunshot, transmitters to send a message to the police dispatch center, and a computer to receive and display that message. When a signal arrives at the police station, the dispatcher decides whether or not to send a unit to respond to the signal. Gunshot detection systems cannot detect shots that are fired indoors or that are blocked by a building or other obstruction. The systems may be in boxes mounted on poles, disguised as birdhouses or rooftop vents, or otherwise unobtrusively located.

Researchers at the University of Cincinnati have undertaken an NIJ-sponsored study to answer three critical questions about gunshot detection technology:

- How accurate are gunshot detection systems?
- What impact do gunshot detection systems have on police response times?
- What impact do gunshot detection systems have on police workloads?

To answer these questions, the researchers undertook field trials of two systems at two sites, testing Trilon Technology's ShotSpotter™ in Redwood City, California, and Alliant Techsystems' SECURES™ in Dallas, Texas.

How accurate are gunshot detection systems?

Researchers used a test area in Redwood City, California, to determine the accuracy of Trilon Technology's ShotSpotter System. ShotSpotter uses a triangulation algorithm to pinpoint the location of the apparent gunfire and allows users to replay the sound of the gunfire noise. The test area covered about 1 square mile, which was divided into 319 sectors, each identified as either a "hot spot" (one with a relatively large amount of gunshot activity) or a "cold spot" (one with a relatively small amount of gunshot activity). On June 26 and 27, 1997, blank rounds were fired at 32 locations—22 hot spots and 10 cold spots—using one of three weapons at each site: an MP–5 assault rifle, a .38 caliber pistol, and a 12 gauge shotgun. (Note that blank shots are much more difficult to detect than live ammunition.)

The researchers determined that the ShotSpotter accurately detected 80 percent of the shots fired in the field test; 72 percent of the shots were also triangulated, with a 25-foot margin of error in pinpointing the exact location of the gunshot. The type of weapon fired affected the system's ability to detect the shot: The MP–5 rounds were much more difficult for the system to detect than either the pistol or shotgun rounds.

What impact do gunshot detection systems have on police response times?

Researchers conducted a 2-month field trial (October 25–December 16, 1996) of the System for Effective Control for Urban Environment Security (SECURES), developed and manufactured by Alliant Techsystems, in the Oak Cliff neighborhood of Dallas, Texas. As in Redwood City, the test area was about 1 square mile. Eighty-six SECURES units were installed on poles in the test area, primarily at intersections.

Police response times to technology-generated reports of gunfire were compared to response times to citizen-generated reports both before and during the test period. For the most part, there was little difference between response times to technology-generated reports of gunfire during the test period and response times to citizen-generated reports *before* the test period. However, the mean response time to citizen-generated reports of gunfire *during* the test period (about 30 minutes) was about 30 percent less than the mean response time to technology-generated reports (about 45 minutes). Nonetheless, the overall mean response time during the test period (to the technology- and citizen-generated reports combined) was about 41 minutes, just 2 minutes longer than the mean response time before the test period (to citizen-generated reports only). Researchers concluded that using the technology did not change in any substantial way the speed with which the police responded to reports of gunfire.

What impact do gunshot detection systems have on police workloads?

The researchers used the data from the SECURES field test to evaluate the impact of gunshot detection systems on police workloads. During the test period, SECURES reported 182 shots fired. Dispatchers linked citizen- and technology-identified calls about random gunfire when they believed the alerts were about the same incident. During the trial period, police were dispatched to 151 random gunfire events identified only by SECURES and to 39 events identified by citizens (some of which were corroborated by SECURES). The extra 151 SECURES-dispatched events (in addition to the 39 citizen-identified dispatched events) represent a 287-percent increase in the number of police dispatches to random gunfire problems.

There are two possible explanations for this significant increase in police workloads: First, gunshot detection technology may generate some false alerts. Given the design of the evaluation and the relatively early stage of this technology's development, this first possible explanation could not be explored in more detail. Second, Dallas may have a high rate of unreported gunfire, at least in the Oak Cliff neighborhood; if so, this finding could have significant ramifications for future crime analysis and crime prevention activities that seek to control the random gunfire problem in Dallas.

Conclusions

Gunshot detection systems have at least three potential uses: They can serve as a rapid response tool, as a problem-solving tool, and as a crime prevention tool. Three concerns arise if a gunshot detection system is intended for use as a rapid response tool (that is, to trigger immediate police response to the sound of a gunshot). First, the police department may not have a rapid response policy or the resources to implement such a policy. Second, if the tool is inaccurate, police resources may be wasted by dispatching units to false alarms. Third, a police department that is committed to community policing may prefer to focus its resources on preventive measures, rather than on rapid response measures.

As a problem-solving tool, gunshot detection reports can be used with police data (e.g., citizen reports of gunfire) and physical features of a neighborhood (e.g., parks or liquor stores) to identify neighborhood hot spots. If demographics (e.g., income level or gun ownership) are considered, the data can be used to analyze various dimensions of the problem and to evaluate the effectiveness of responses to the problem.

Using gunshot detection systems to prevent crime depends on whether deterrence is a factor. The police could publicize an increased likelihood of apprehension for people who fire weapons. Randomly moving the system to strategic locations will increase the range of detection coverage without greatly increasing the cost of operating the technology.

The initial research into the effectiveness of gunshot detection systems is very promising, particularly in terms of the technology's usefulness in identifying and solving problems and deterring crime. As the technology develops and becomes both more accurate and more portable, these systems could prove to be highly effective tools for local police departments.

This Research Preview is based on a presentation by Lorraine Green Mazerolle, Ph.D., Director of the Center for Criminal Justice Research at the University of Cincinnati. This University of Cincinnati project was supported by a grant (#96–MU–MU–0018) awarded by the National Institute of Justice.

As part of NIJ's Research in Progress Seminar Series, Dr. Mazerolle discussed her study with an audience of researchers and criminal justice professionals and practitioners. A 60-minute VHS videotape, *Using Gunshot Detection Technology in High-Crime Areas,* is available for $19 ($24 in Canada and other countries). Please ask for NCJ 167027. Use the order form on the next page to obtain this videotape and any of the other tapes now available in the series.

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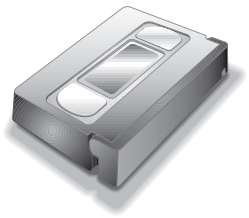

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