



Audio Analytics and Other Upgrades in Correctional Surveillance Systems

Lessons Learned from Two Minnesota Facilities

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In 2017, the Urban Institute began working with the Minnesota Department of Corrections (MnDOC) to evaluate its efforts to optimize the surveillance systems in the housing units of two state prisons: Minnesota Correctional Facility–Stillwater (STW) and Minnesota Correctional Facility–Moose Lake (ML). Improvements included new high-definition cameras, repositioning of existing cameras, software and hardware updates, and the installation of aggression detection technology (a type of audio analytic technology) in one of the units. This brief highlights MnDOC’s experience with the system update, the benefits and challenges of the new system, and recommendations for the field regarding how to improve the effectiveness and efficiency of correctional surveillance systems.

Prison misconducts—which include assaults, riots, drug distribution and use, and other less serious infractions—can be a serious safety concern for people who are incarcerated and for correctional staff (Bottoms 1999; Dilulio 1987; Gendreau, Goggin, and Law 1997; Toman 2017). It is therefore crucial for staff to monitor facilities and implement policies and strategies that can improve safety and reduce violations. One such strategy that correctional facilities across the country use is video and audio surveillance technologies (Allard, Wortley, and Stewart 2006).

Research suggests that surveillance systems are most effective when staff strategically place cameras, actively monitor camera feeds, and continuously manage and review their systems for performance (Goodale, Menzel, and Hodgson 2005; La Vigne et al. 2011; Shukla et al. 2020). However, this can be difficult for correctional staff because of their other on-the-job responsibilities. Video and

audio analytic technology—that is, software that integrates with surveillance systems to automatically identify people, patterns, sounds, and objects—can therefore help corrections departments by enhancing their ability to detect, prevent, and respond to instances of crime and misconduct (Nilsson 2009).

BOX 1

Audio and Video Analytics in Correctional Settings

Video and audio analytics can have various applications in correctional settings, four of which we detail here. First, they can be used for *crowd detection* to alert staff when a group of people have collected at a location. This can be particularly useful in locations where large gatherings are prohibited or an indicator of misconduct or violence. Second, facilities may use them for *object detection* to identify and locate objects, such as knives or other contraband items. Third, they may be used for *perimeter detection* to alert staff when a person or object crosses a certain perimeter (for instance, someone jumping over a wall or a drone flying over facility grounds). Fourth, facilities may use them for *person tracking*, tracking someone’s movements from one area to another without the operators having to switch camera views.

Project Setting

Drawing on previous work around surveillance systems and analytic technologies, Urban received funding from the National Institute of Justice to partner with MnDOC. This partnership involved identifying strategies for upgrading and optimizing existing camera networks in two prison housing units and evaluating the impact of these upgrades on safety and security. The two housing units were located in the Stillwater and Moose Lake correctional facilities.¹ The full project team included MnDOC leadership, administrators and key staff from STW and ML, and the Urban research team. We selected the intervention units after an initial walk-through of several units in both facilities, during which we reviewed their architectural layouts and identified weaknesses and areas for improvement in their camera networks. We then analyzed misconduct data and met with facility staff to determine which locations would benefit most from the proposed intervention.

Once housing units were selected, we interviewed MnDOC staff and surveyed people incarcerated in both housing units to help identify specific areas that would benefit most from an improved surveillance system (e.g., blind spots in the units where people were being assaulted). We then worked with MnDOC to identify strategies for upgrading and optimizing each unit’s surveillance system (see Shukla and coauthors [2021] for more information about this process). Upgrades included replacing outdated analog cameras with internet protocol cameras (which are clearer and have more functionality) and repositioning cameras and adding new ones to strategic locations to reduce the number of blind spots. In total, MnDOC replaced 65 analog cameras with internet protocol cameras and added 27 cameras in the STW and ML units.

In addition, MnDOC upgraded the viewing stations in both facilities where staff monitor camera feeds. In STW, MnDOC created a live viewing station inside the housing unit the upgrades occurred in. Previously, officers in the unit did not have the capability to view the feeds from these cameras. Conversely, in-unit officers in ML already had access to the camera feeds, so the upgrades in that facility focused on adding larger high-resolution screens that were better equipped for monitoring feeds from multiple internet protocol cameras at once.

Lastly, we worked with ML staff to install audio analytic aggression detectors in their upgraded camera system. The software was integrated into the facility's internet protocol cameras and microphones to alert on-unit staff through a visual and audio alert when it detected sounds associated with anger, fear, or verbal aggression (e.g., shouting or crashing noises). Moose Lake leadership placed microphones and focused their aggression detection technology in areas within the selected housing unit where there were frequent violent misconducts and limited video surveillance: bathrooms and showers. Staff received the audio analytic alerts in the unit's viewing station, after which they would pull up feeds of nearby cameras and, as needed, deploy officers to the source of the alert to respond and investigate.

Methods

To understand staff experiences with the upgraded surveillance systems, we conducted numerous site visits to observe the use of the systems and interviewed correctional staff and leadership at ML and STW. The interviews and observations occurred before, during, and after the facilities upgraded and installed new surveillance technologies in the intervention housing units. Our goal was to collect information on staff's experiences with the upgraded surveillance systems and identify recommendations for optimal use of surveillance systems in the correctional setting.

We conducted semistructured interviews with leadership and staff at both housing units who directly use or work with video surveillance and/or have been involved in decisionmaking around the camera upgrades and audio analytics implementation. This included interviews with prison wardens, correctional officers, security leads, and information technology (IT) leads involved in the installation, configuration, and maintenance of infrastructure and cameras. The interviews focused on staff's perceptions of safety within the two facilities, violent and nonviolent misconducts, the transition to the new cameras and upgrades, logistical and training needs, and perceived benefits of and challenges with the surveillance upgrades.

We supplemented the interviews with in-depth facility observations, which included a walk-through of the two facilities during which we observed the new cameras, camera placements, and viewing stations. In ML, we also saw a demonstration of the aggression detection technology and how staff view and manage alerts in the viewing stations. We also requested and received logs of the alerts received by ML staff through the aggression detection technology, which included the time and location of each incident and information on how each was classified upon investigation (i.e., as physical fights, shouting/verbal altercations, nuisance alerts, or false alerts). The interviews and observations were

hand coded and analyzed to identify high-level themes, and data on alerts were descriptively analyzed to better understand the types of alerts that staff receive.

Findings

The interviews and observations revealed that the upgraded technology had benefits and challenges. This section details our main findings.

Staff Found the Technology Valuable, but Application Was Problematic

Staff reported that the camera upgrades, repositioning of the old cameras, and the upgraded viewing stations were beneficial, but there were some issues involving application. The improved camera resolution, increased coverage, reduced blind spots, and improved visibility in low-light settings were perceived as significant improvements. The older cameras had a grainy picture quality, and staff monitoring the feeds could not zoom in when trying to examine something far away or small. The footage quality of the new cameras is substantially better and staff can zoom in on specific people and events. In fact, the video quality is clear enough for staff to clearly see individual identification cards when zooming in, making it easier to identify people when misconducts happen and providing clear evidence in cases involving formal misconduct complaints and hearings.

With the old system, we couldn't tell inmate from staff. We couldn't determine the person's race or any other identifying factor. The new camera quality is so great. There are also more cameras in the dorms, so there are fewer blind spots.

—Correctional officer

Despite these advantages, staff reported that applying the technology was problematic. For instance, although correctional officers responsible for monitoring the viewing stations have access to live camera feeds, they do not have access to archived footage. This means that if officers need to observe an incident requiring further investigation, they cannot rewind the recorded footage to view it again. Instead, they have to reach out to lieutenants and other supervisors who can further investigate incidents, often leading to delayed responses. Staff expressed that if they could access archived footage—even if they can only rewind the footage by five minutes—they could respond faster to misconducts, especially violent incidents that may require immediate attention.

Furthermore, staff in both facilities reported that they had not been offered formal trainings on using the new surveillance systems and had instead learned the functions on the job, with some assistance from supervisors, IT technicians, and general electricians. Though they were able to grasp the

basics, they were unaware of some of the more complex functions that they were interested in learning about but could not owing to time restraints and concerns about “messaging up the settings.”

In ML, there was an additional concern about the audio analytics alerts. The viewing setup includes monitors with live views of the hallway and dormitory. If an alert is set off, it is automatically displayed over the previously observed camera views on that monitor. Officers consider this detrimental to real-time response because they cannot easily track people who may be involved in an incident across camera feeds until they respond to the alert. This is coupled with an MnDOC policy preventing line officers from reviewing archived footage. Thus, line officers were concerned they would not be able to identify potential perpetrators and respond to incidents in a timely manner. Staff recommended setting up a separate monitor for the alerts so that the live views are not disturbed when an alert goes off. Despite these issues, staff also noted that the process of integrating alerts into their surveillance system has provided the opportunity to build much-needed technical capacity. As a result, ML has leveraged this knowledge and integrated other types of alerts (e.g., fence detections and door intrusions) into its surveillance system.

Perceived Improvements in Safety and Accountability

Staff in both facilities reported feeling safer after the upgrades because of the improved surveillance coverage, which made staff feel that more people were being observed and made misconducts easier to investigate. The improved camera quality and reduced blind spots make it easier not only to monitor incarcerated residents, but to observe their colleagues conducting their hourly rounds. As a result, staff feel more secure when making rounds and conducting inspections because they know an officer is watching them through the new system with clear video feeds. In addition, the surveillance systems are used by lieutenants and supervisors to conduct random checks on staff to ensure they follow protocol and complete their rounds according to schedule, increasing staff accountability.

Some evidence suggests that incarcerated residents also feel more secure. The impact on certain types of misconducts has been more pronounced. For instance, ML staff note that the additional cameras in their facility’s dorms act as a deterrent for sexual assaults, which were common before the upgrades. Similarly, gambling, theft, and offenses involving contraband (especially dangerous contraband, like drugs and weapons) are easier to catch and investigate with the new systems, increasing overall safety in both facilities. Staff use the new cameras to look for unusual group gatherings, and they are quick to break these gatherings up if there seems to be a potential for fights or other delinquent behavior.

Staff also reported that incarcerated residents feel safer in the housing units with the new surveillance systems than residents in units using the older systems. Some incarcerated residents in ML who were concerned about their safety had requested a transfer to the unit with the upgraded system. Although it was unclear whether these people knew about the unit’s surveillance upgrades, there was a perception that the unit was generally safer than others. This is noteworthy because the unit where the upgrades occurred was selected because it had higher rates of misconducts than other units when the

project began. It is therefore possible that the upgrades improved perceptions of safety by making it easier for staff to investigate misconduct incidents.

An inmate recently requested to be moved back to this housing unit because he felt safer here. It's actually pretty common among transferred inmates.

—Correctional officer

Displacement

Despite perceptions of increased safety, staff report that overall misconducts have not been significantly reduced. This was corroborated with analyses by the research team, which found no significant reductions in the number of violent or nonviolent infractions in the intervention units. However, staff report that the number of assaults and misconducts occurring in certain areas with historically high rates of violence, like restrooms, has declined since the surveillance upgrades. Although this is clearly beneficial, staff also report that incarcerated residents are quick to identify areas not covered by cameras and engage in delinquent behavior there. For instance, staff advised that some fights shifted from the restrooms to the janitorial closets and laundry rooms, areas that are not monitored by new cameras and are away from audio analytics.

Furthermore, although the addition of new cameras focusing on the dorms in ML and cells in STW have significantly reduced blind spots, a few still exist because of the arrangement of beds and desks. These blind spots were considered during the upgrades but could not be addressed because of challenges with hardware and wiring. Staff report that some incarcerated residents are aware of these issues and continue to engage in delinquent behaviors in areas outside of the camera views. Staff had addressed these challenges by focusing their physical inspections on blind spots, but they acknowledged that these areas are difficult to monitor at all times.

Challenges with Calibrating Audio Analytics

Interviewees considered audio analytics promising but reported issues with the execution. The alarm is frequently triggered by common sounds like the public announcement system and people sneezing or singing loudly. It is rarely triggered by “real” aggression-related noises (e.g., people yelling and fighting) or other serious incidents (e.g., people throwing garbage cans). A closer look at the alerts data from late February 2019 through July 2019 corroborated this. More than 97 percent of the 184 alerts from that period were categorized as nuisance alerts (alerts triggered by people talking loudly to each other or other nonaggressive sounds) and the rest were categorized as false alerts (alerts without an obvious or perceptible audio trigger). None of the alerts were caused by fights or other aggressive behavior.

These problems mainly stem from maladjusted calibration settings. In interviews, IT personnel at ML suggested a discrepancy in system settings between the vendor of the camera system and the vendor of the aggression detector. The facility's IT department was able to change calibration settings in the camera system, but these changes did not necessarily overwrite the settings originally set by the aggression detection vendor. Despite communicating with the vendors, IT personnel were unable to fix the recurring calibration issues during the study period. As a result, although it appears that this technology has not worked owing to problems with implementation, the research team was unable to test whether the calibrated method would have worked in a correctional setting.

Moreover, ML staff note that incarcerated residents often know not to make loud noises when in a physical fight because doing so draws attention from officers. Staff recommend that audio analytics could be more effective if it were programmed to detect and alert on other noises associated with fights. For example, staff note that the sound of shoes squeaking on floors is common during scuffles and is something residents cannot prevent.

I don't think I've seen a real alert in a while. Most alerts are nuisance or false alerts, and we do get them, they take over the monitor with hallway views. That's a problem.

—Correctional officer

Takeaways and Conclusions

Overall, prison staff are satisfied with the upgrades to their surveillance systems and believe they have made the facilities safer. However, there are some lingering concerns regarding implementation, the system's effectiveness at reducing overall rates of misconducts, and the utility of the audio analytics technology. Additional discussions with staff helped us identify changes that could help the units overcome these challenges. Five such takeaways are summarized in this section and are helpful for other departments of corrections to consider when upgrading their surveillance systems or integrating audio analytics.

First, a successful correctional surveillance system requires **detailed planning, collaborative decisionmaking, strategic investments, and extensive training**. Corrections policymakers and stakeholders must consider the many factors necessary for improving and optimizing surveillance systems. Although this brief provides a quick overview of lessons learned from implementation of new surveillance systems, the research team has also produced a detailed guidebook with step-by-step instructions for carefully upgrading and optimizing surveillance systems in correctional facilities (Shukla et al. 2021).

Second, although the safety of correctional officers is often the focal point of facility changes, policymakers should **speak with incarcerated residents about their experiences and concerns**. Residents often have intimate knowledge of safety issues that improved surveillance operations would benefit. Of course, consulting with residents needs to be done in a way that protects those willing to provide information about their facility, either through third-party research organizations that can protect residents' identities or other methods to facilitate anonymous recommendations to avoid retaliation from other residents. This may be done through confidential and/or anonymous surveys or informal, private interviews with incarcerated people. Similarly, speaking with correctional officers before, during, and after upgrades will provide additional information to make the system as efficient and effective as possible. The people who actively use the software and cameras as part of their daily work will know the areas where changes are needed or additional trainings are necessary.

Third, it is crucial for departments to **work closely with technology vendors** when purchasing and installing technology, especially during initial setup to ensure settings are calibrated to the facilities' requirements. Even after implementation, departments should maintain close communication with vendors and report any issues to rectify them in a timely manner. For instance, staff at ML had been in constant communication with the vendor of their audio analytic technology for assistance adjusting the calibration settings of the aggression detector. (Even after making these adjustments, the technology has performed poorly in detecting noises of real aggression and is better suited for picking up general "nuisance" noises. Thus, this tool may not be helpful for correctional agencies looking to detect and prevent fighting and other forms of serious misconduct.)

Fourth, **vendors can be a great resource for trainings** on how to efficiently use newly purchased technology and upgraded systems. Departments can work with vendors to design introductory and refresher trainings for staff who regularly work with cameras. Because these trainings can be expensive, departments may find it helpful to design trainings around specific staff needs. It can be helpful for department leadership to regularly have discussions with camera operators and other staff working closely with surveillance systems about their training needs.

Lastly, departments should consider **revisiting their policies and, if necessary, making revisions** to maximize the efficiency of their surveillance systems. For example, line staff who monitored cameras in ML lacked the authorization to review archived footage, which they described as a major challenge to institutional safety because they could not investigate misconducts in a timely manner. In response, ML administrators revised their policies to provide staff access to one minute of archived footage, which could help staff rapidly respond to possible safety concerns.

Note

¹ Stillwater is the state's largest close-security prison for adult males. Built in 1910, it has seven cell-style housing units within the main perimeter housing nearly 1,600 people, and a minimum-security housing unit outside the perimeter housing approximately 100. Moose Lake, which was converted to a correctional facility from the Moose Lake Regional Treatment Center in 1988, is a medium-security prison for adult males. With a population of more than 1,000, ML has nine dormitory-style housing units and offers a variety of programming and treatment services.

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