PRIORITY Criminal Justice NEEDS INITIATIVE

A project of the RAND Corporation, the Police Executive Research Forum, RTI International, and the University of Denver

Leveraging Technology to Enhance Community Supervision

Identifying Needs to Address Current and Emerging Concerns

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EXECUTIVE SUMMARY

On behalf of the National Institute of Justice (NIJ), the RAND Corporation and the University of Denver convened an expert workshop to explore how technology can be leveraged to address the key challenges facing community corrections agencies. The goal of the workshop was to produce a set of prioritized needs that can help inform NIJ's research agenda and contribute to the national discussion of how technology can improve agency operations and offender outcomes.[1] The workshop participants included correctional administrators and researchers. Their recommendations are presented in this report.

WHAT WE FOUND

One major theme that emerged during group discussions was the need to leverage technology to better train and support officers in the performance of their duties. The participants discussed the enormous potential of virtual reality and augmented reality to support more-effective training. They also discussed the need for potential solutions that incorporate wearable technologies for staff or officers, such as location tracking and vital signs monitoring, into a single device. Such a system could detect emergency situations based on an officer's physiological indicators, determine the officer's location, and alert authorities to respond to that location. Participants also noted that efforts to improve safety are hindered by a lack of data on the risks faced by community supervision officers on a daily basis. The participants recommended that data be collected regularly on community supervision officer deaths, assaults, and injuries while on the job.

Community corrections agencies are increasingly emphasizing behavioral change objectives in accordance with evidence-based practices. The participants identified several needs associated with targeting criminogenic

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RESULTS

- Automated tools are needed to quickly identify the most important criminogenic risks or needs to target for each case.
- Technology should be leveraged to identify prosocial behaviors, deliver positive reinforcement, and support incentive programs for offenders.
- Technology is needed to support more-effective officer training, assess whether training is implemented with fidelity, and facilitate timely feedback to the officer.
- Research is needed to evaluate the impact of a more mobile workforce on outcomes; best practices are needed to guide agencies as they implement mobility strategies.
- Evaluations of technology-based approaches to supervising lower-risk offenders are needed.
- Modern methods of communicating with offenders (e.g., text, chat, and social media) should be evaluated for effectiveness.
- Research is needed to guide more-effective implementation of location-monitoring technologies.
- Research is needed to determine the predictive value of offender data (e.g., movement patterns) on recidivism.
- Analytic and visualization tools should be leveraged to convert voluminous data sets into actionable intelligence.
- Research is needed on the effectiveness of automated reminder strategies to reduce failure to appear violations.
- Best practices are needed to guide the procurement and implementation of information technology solutions.
- Advanced emergency duress systems should be evaluated for their potential to improve officer safety in the field.
- Agencies need cost-effective approaches to meet their victim notification responsibilities.

risk and needs factors, supporting offender prosocial development, and preventing negative outcomes. For example, community supervision officers are increasingly expected to understand and apply evidence-based strategies when interacting with offenders. Of particular concern were situations in which officers must handle a general caseload, which is very common in smaller agencies. Such officers are responsible for many offenders with varying risks and needs. Panel members articulated the need for evaluation of existing—or the development of new—tools that can access case records and quickly prompt an officer on an offender's primary risk or needs areas, highlight current issues or concerns, and identify engagement strategies accordingly.

Offenders serving a period of community supervision are obligated to comply with certain conditions laid out by the court or paroling body. These conditions are meant to ensure public safety while supporting prosocial behaviors. Participants identified several needs in this area, including improving location monitoring and substance use monitoring. For example, according to the participants, the field would benefit from research into innovative, cost-effective approaches to detect synthetic drug use. Tests that focus on the most-common elements used in synthetic drugs, as opposed to exact chemical matches, might be a more realistic and sustainable objective that yields equally useful information.

Leveraging technology can help an agency improve operational effectiveness, providing the opportunity to allocate scarce resources more wisely. Community supervision agencies gather and maintain voluminous amounts of data, but the participants noted that most fail to fully leverage these data to inform policy and practice. Data related to sudden changes in an offender's dynamic risk or needs factors and other metrics, such as reporting or movement patterns, might be indicative of problematic future behaviors. The participants argued that research is needed to identify which—if any—factors might be correlated with criminal activity.

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TECHNOLOGY IN COMMUNITY CORRECTIONS

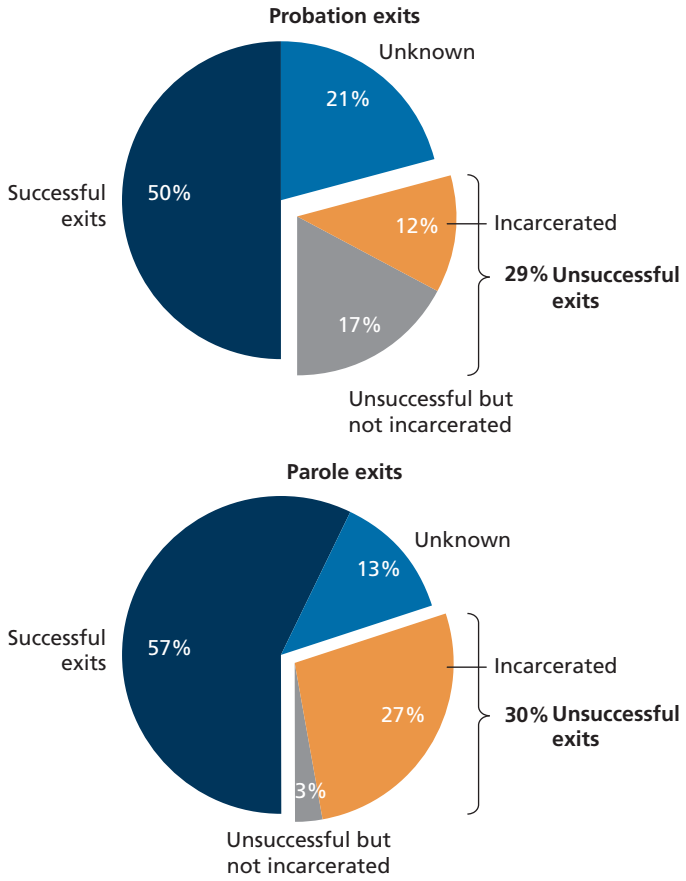
The use of technology in community corrections has expanded greatly in the past decade. The need to manage increasing caseloads with diminishing resources has driven the field to embrace innovations designed to improve the delivery of community corrections services. Examples of innovations that have been adopted include offender location-tracking systems, advanced drug and alcohol testing methods, automated reporting systems, offender computer-monitoring tools, and automated risk or needs assessment instruments. *Community corrections* is a broad term used to identify strategies to execute noncustodial sanctions imposed by either a court or a parole board. These sanctions can be applied (1) as a form of pretrial release or diversion, (2) postconviction as a term of probation or another alternative to incarceration initiative, or (3) postincarceration in the form of parole. Community corrections programs can be operated by federal, state, county, and municipal governments. Furthermore, private providers (nonprofit or for-profit) can be authorized to operate programs. Offenders serving community-based sentences are supervised by a community corrections organization and must demonstrate law-abiding behavior in exchange for the privilege of living in the community. There are often additional conditions or treatment requirements that must be met during the term of supervision.

Community corrections organizations have multiple objectives. For example, they are responsible for protecting the public in a cost-effective manner by maintaining offender accountability and delivering or brokering rehabilitation services in support of positive behavioral change.

Managing offenders in the community presents difficult and complex challenges and, overall, the corrections sector has not produced the results that the public expects. Community corrections initiatives have been perceived as both ineffective in changing offender behavior and insufficient as a punishment (Taxman, 2010). Indeed, successful probation and parole completion rates are on the decline, and those who violate the terms of their sentences often end up in jail or prison, contributing to the current state of mass incarceration (Klingele, 2013) (see Figure 1).

Increasing workloads and resource limitations are significant contributing factors to these poor outcomes. Although the concept of mass incarceration has captured the public's attention, relatively little has been written about the rapid growth of the population under community supervision. Indeed, this

Figure 1. Probation and Parole Exits, 2016



SOURCE: Adapted from Pew Charitable Trusts, 2018, Figure 6, p. 9.
NOTES: In the unsuccessful exits category, *incarcerated* individuals are those sent to prison with a new sentence, those completing an original sentence, those receiving treatment, or those in jail or prison for other or unknown reasons. For parole exits, *incarcerated* individuals also include those sent to prison with a revocation. In the unsuccessful exits category, *unsuccessful but not incarcerated* refers to individuals who are discharged to a warrant, individuals who abscond, or those who have other unsatisfactory exits. The *unknown* category includes those who have died and those whose outcomes have not been reported.

Managing offenders in the community presents difficult and complex challenges and, overall, the corrections sector has not produced the results that the public expects.

group has increased more than threefold since 1980 (see Figure 2). As of 2016, more than 4.5 million adults—or more than one in 55 adults—are under probation or parole supervision in the United States (Pew Charitable Trusts, 2018). Despite the large number of people they serve, community corrections agencies are generally underfunded: Although nearly 69 percent of the corrections population are under some sort of community supervision, only 12 percent of corrections spending is directed to probation and parole operations (Kaeble and Cowhig, 2018; Pew Center on the States, 2009). Furthermore, agencies often are burdened with an array of unfunded mandates, such as conducting DNA screenings and continual sex offender registration checks, which compound these problems (Pew Center on the States, 2009).

Given that many agencies are stretched to capacity, effective community supervision can be accomplished only if all available resources are fully leveraged. Agencies often look to technology to help them do more with less. As part of its multiyear research effort supporting NIJ, the Priority Criminal Justice Needs Initiative convened an expert panel to examine the key issues related to the management of offenders in the community and how technology can be leveraged to improve outcomes.

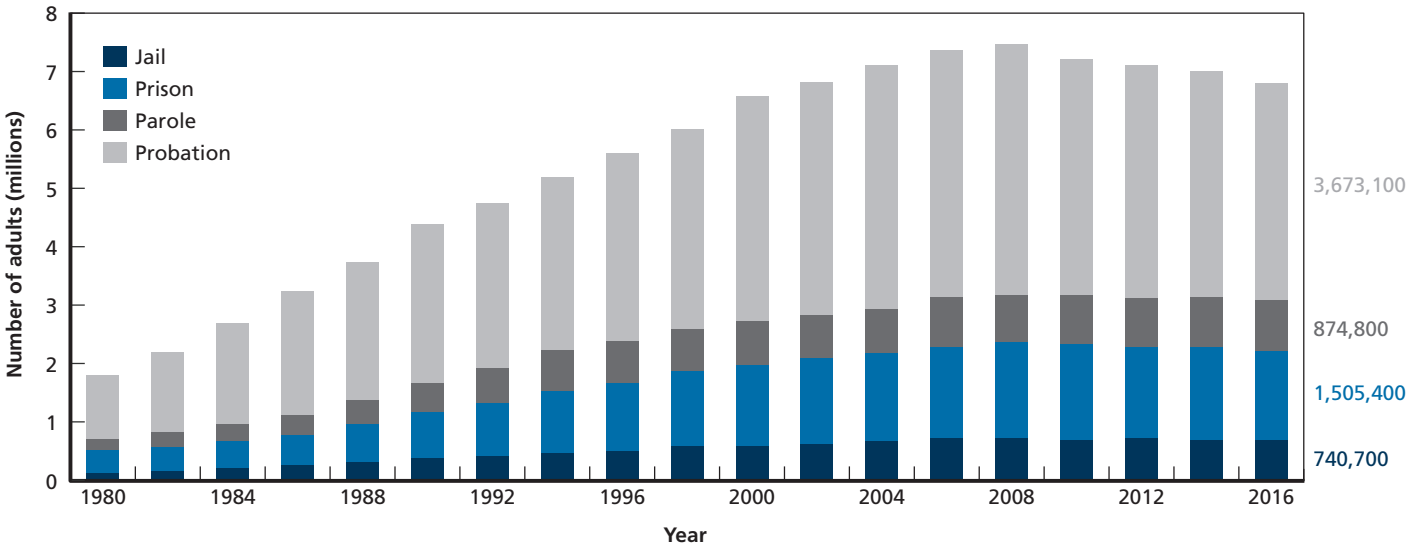
Participants were brought together for a two-day workshop. The research team used a structured brainstorming approach to develop a set of needs—a term used in our work for a specific requirement—tied to either solving a problem or taking advantage of an opportunity to help the community corrections sector better address a challenge. To organize workshop discussions, the research team identified six general categories reflecting key objectives of community corrections agencies: facilitating positive behavioral change, holding offenders accountable, protecting the public, improving operational effectiveness, and improving competencies. The sixth category was for any other needs: Time was allocated for discussion of topics that did not fit neatly into one of these categories.

Participants discussed the challenges associated with each category, and these deliberations yielded a total of 44 needs, which we organize into four major themes: managing human resources, facilitating positive behavioral change, holding offenders accountable, and improving operational effectiveness. Participants ranked these needs and identified the 18 highest-priority (top-tier) needs. See Table 1 for these 18 needs, organized by theme.

METHODOLOGY

To explore how technology and innovation can be deployed to improve community supervision outcomes, NIJ tasked RAND and the University of Denver (DU) to assemble an expert workshop of correctional administrators and academics. The major task was to produce a set of prioritized needs to help inform NIJ's research agenda. A pool of candidate participants was identified through a review of published documents and recommendations from various organizations. The research

Figure 2. Criminal Justice Populations, by Type, 1980–2016



SOURCE: Adapted from Pew Charitable Trusts, 2018, Figure 1, p. 4.

Table 1. Top-Tier Needs Across Themes

Theme	Problem or Opportunity	Associated Need
Managing human resources	There are several emerging technologies that can be used to alert agencies when officers are hurt or in distress.	• Analyze emerging technologies for their potential to improve officer safety.
	Newer training technologies (e.g., virtual reality [VR] or augmented reality [AR]) are underused.	• Assess the costs, risks, and benefits of using VR or AR for skill development (for staff and offenders).
	It can be difficult to know whether officers are applying the skills (e.g., motivational interviewing) they have learned with fidelity.	• Explore the viability of using automated video analytics to assess the quality of interventions.
	Feedback on the quality of targeted interventions (i.e., officer-offender interactions) is often delayed.	• Identify and evaluate wearable communication technologies that could be used to improve feedback (e.g., earpieces, heads up displays).
Facilitating positive behavioral change	Failures to appear at required appointments are costly and disruptive to the offender and the agency.	• Evaluate the impact of automated reminder technologies (e.g., smartphone applications, texts) on appearance rates and officer workloads.
	Offenders who maintain their commitments often are not recognized or rewarded for their compliance.	• Identify best practices and potential benefits of incentive programs (both manual and automated).
	Existing tools are not designed to help officers quickly identify the criminogenic needs to address with offenders.	• Identify existing tools or develop new tools that can be used as interactive cheat sheets to prompt officers about the primary issues to consider when engaging with offenders.
	More agencies are leveraging technology to support mobile, community-based supervision approaches versus traditional office-based or "fortress probation" approaches. However, there is insufficient evidence on the effectiveness of these approaches.	• Conduct research into the relative effectiveness of mobile, community-based supervision versus office-based supervision approaches.
	Agencies need guidance to effectively support and manage a more mobile workforce (e.g., technology requirements, operational policies, data security issues).	• Conduct research to identify effective strategies to prepare officers to work primarily in the field.
Holding offenders accountable	Agencies have limited evidence regarding which offenders should be part of location-monitoring programs and for how long.	• Conduct research to identify the populations best served and optimal periods of monitoring.
	Agencies have limited evidence regarding the most appropriate technology-based strategies to monitor lower-risk offenders.	• Conduct research to identify the most effective strategies that would account for differences in offender characteristics.

Table 1.—Continued

Theme	Problem or Opportunity	Associated Need
Improving operational effectiveness	It can be costly and time-consuming for agencies to provide victims with required information.	• Research the risks and benefits of victim portals where victims can access relevant offender or case information.
	Evaluating and selecting technology—particularly software tools—can be difficult.	• Identify best practices with regard to common issues related to choice of technology (e.g., purchasing commercial off-the-shelf solutions versus developing solutions in-house; selecting a data model; creating sample requests for proposal and contract language).
	There is potential for more-efficient internal coordination and coordination with local services through the use of geographic information systems (GIS).	• Develop case studies that highlight the potential benefits of leveraging GIS and associated best practices.
	Many agencies rely on outdated methods to communicate with offenders and need to exploit modern methods.	• Identify best practices for implementing modern communication technologies (e.g., chat, email, social media, video).
	The value of offender management systems is diminished when officers cannot readily access and use the information previously collected on offenders.	• Develop dashboards or other improved user interfaces that reduce effort and improve the ability of officers to extract insights needed to do their jobs from the data. • Develop case studies demonstrating the impact of improved user interfaces on decisionmaking and supervision outcomes.
	Agencies have large quantities of data that could be analyzed for predictive purposes (e.g., precursors to success or failure).	• Research the predictive value of data, such as stable employment, location patterns, drug test results, and failure to appear.

team sought representation from different geographic regions, types of organization (e.g., federal, state, county), and organization size. Ultimately, a group of 12 was convened. The list of participants and their organizations is included in the "Participants" box earlier in this report.

Participants were asked to identify key challenges related to leveraging technology to improve community supervision and specific needs to address each challenge. Once the needs were identified in each category, the research team used a variant of the Delphi Method, a process designed to bring a group of experts closer to consensus (RAND Corporation, undated). The team asked the participants to first individually and then collaboratively rank each need based on its expected benefit (i.e., how important they thought it would be if the need was met) and the probability of success of actually meeting the need (reflecting both technical and practical constraints that might make it difficult to do so). The participants rated each need on a scale of 1 to 9 using an electronic ranking system via a handheld remote control. After each rating, the participants saw the results in real time as a bar graph of the rankings assigned to each need. Where there was apparent disagreement, the group had the opportunity to discuss the need and the rankings. In some cases, this discussion identified and resolved differences in interpretations of the need that had led to different rankings. In other cases, there were simply differences of opinion regarding how individuals judged the value or difficulty of meeting a need.

After the discussion, voting was reopened and the participants were given the opportunity to adjust their scores. These second-round results represented the final group rankings of the needs. These ratings were multiplied to produce an expected value score, which reflects the value of meeting the need weighted by the likelihood of doing so successfully. These scores were used to cluster the needs into three tiers, from the highest-scoring (Tier 1) to the lowest-scoring (Tier 3). The research team used a clustering algorithm to identify the best splits among the three groups of needs, where *best* was defined mathematically, minimizing differences between different assignments of needs to the groups. Because the participants ranked each category of needs separately immediately after they were discussed, the participants received a hard copy showing the full list of needs identified and their corresponding tiers at the end of the workshop. This step was intended to allow the participants the opportunity to reality check the results as a whole and flag whether there were needs that—in their view—were in too high or too low a tier relative to the other needs. If

a participant thought that needs were misplaced, they indicated that on the hard copy. Needs that received enough up or down votes (which were converted to numerical adjustments to each need's expected value score) changed ranking tier for the final results. This process produced a final prioritized list of needs, broken into groups from high to low priority. A more detailed discussion of the methodology is available in the appendix to this report.

The needs identified and the priorities assigned to them are—as with all subjective assessments involving a limited number of participants—reflective of the views of the members of the workshop. Although the research team sought to include a broadly representative group of participants, it is likely that a different group would produce somewhat different results.

In the following sections, we summarize the workshop discussions and recommendations, organized by the four major themes that emerged: managing human resources, facilitating positive behavioral change, holding offenders accountable, and improving operational effectiveness.

Managing Human Resources

One major theme that emerged during group discussions was the need to leverage technology to better train and support officers in the performance of their duties. Needs were identified that touched on staff skills development and maintaining officer safety in the field. The list of needs related to this theme can be found in Table 2.

Improving Officer Competencies

The workgroup identified several areas where technology could be better leveraged to improve officer competencies, which is key to achieving better outcomes. Some of these opportunities exist even before an individual joins an agency. For example, the participants noted that many academic programs do not provide students with the relevant skills (e.g., evidence-based practices, motivational interviewing) necessary to be immediately effective upon hire. The participants called for exploration of partnerships with educational institutions to develop online certification programs so that prospective officers can obtain these critical skills and competencies as part of their academic training.

Table 2. Needs Identified Related to Managing Human Resources

Tier	Problem or Opportunity	Associated Need
1	There are several emerging technologies that can be used to alert agencies when officers are hurt or in distress.	• Analyze emerging technologies for their potential to improve officer safety.
	Newer training technologies (e.g., VR or AR) are underused.	• Assess the costs, risks, and benefits of using VR or AR for skill development (for staff and offenders).
	It can be difficult to know whether officers are applying the skills (e.g., motivational interviewing) they have learned with fidelity.	• Explore the viability of using automated video analytics to assess the quality of interventions.
	Feedback on the quality of targeted interventions (i.e., officer-offender interactions) is often delayed.	• Identify and evaluate wearable communication technologies that could be used to improve feedback (e.g., earpieces, heads up displays).
2	Training curricula and delivery methods often are not aligned with the needs of modern learners.	• Develop model microlearning curricula (e.g., sample training videos) tailored to the needs of community corrections.
3	As agencies migrate to mobile community supervision models (versus office-based or fortress probation models), staff might be exposed to more risks.	• Evaluate command centers for their impacts on costs and benefits (outcomes and effectiveness).
	There is no national data set for tracking the daily risks and injuries faced by officers.	• Conduct research to compile these data.
	Academic programs often are not producing graduates who have the relevant skills to be immediately effective after hiring.	• Develop or assess the effectiveness of online certification programs for probation and parole competencies around evidence-based practices.
	New technologies can be leveraged to enhance officer safety in the field.	• Assess the feasibility, risks, and benefits of deploying remote-monitoring technologies (e.g., unmanned aerial vehicles) to aid situational awareness.

Participants recommended the development of a model microlearning curriculum tailored specifically for community supervision that could be evaluated for efficacy.

The participants also discussed the enormous potential of VR and AR to support more-effective training. The U.S. military has been leveraging this technology for years, and decreasing hardware costs are making it more accessible to criminal justice agencies (Goldstein, 2017). For example, the New York City Police Department is piloting a VR-based active shooter training drill (Kim, Hartmann, and Sowa, 2019), and the Chicago Police Department is exploring VR to help train officers to deal with people experiencing mental health episodes (Gorner, 2019). Participants noted that these tools also could be valuable for community supervision agencies and recommended assessments of the costs and benefits of incorporating VR and AR tools into training to support a variety of officer skills, including motivational interviewing and search-and-seizure tactics. This technology also is being used to help longtime prison inmates prepare themselves for reentry. For example, the Colorado Department of Corrections is using VR to teach inmates basic skills, such as how to use an ATM card and how to use a self-scan device in a grocery store checkout lane (Lewis, 2018). The immersive quality of VR also allows inmates to practice being in unfamiliar settings, such as a crowded street. Participants recommended exploring similar applications (e.g., treatment, counseling, and life skills development) specifically designed for offenders on community supervision.

Once officers are trained, they generally work independently. Therefore, it can be difficult for supervisors to know whether officers are applying their new skills with fidelity, which is particularly important with respect to evidence-based interventions. The participants called for research into best practices for applying video analytic technology to help supervisors make these determinations. For example, body-worn camera or other recordings of an interaction between an officer and an offender could be analyzed automatically to determine whether and how well the principles of motivational interviewing (e.g., open-ended questions, positive affirmations, reflective listening) were adhered to during the session. These results could allow supervisors to identify officers in need of additional training or support. Ideally, the feedback loop to the officer could be shortened with wearable communication technology. The participants called for evaluation of systems that leverage earpieces or heads-up displays that could be used to communicate critiques or instruction in near-real time. Research in this area should include implications on the supervision process (i.e., officer-offender relationship dynamics) and privacy issues.

Finally, the workgroup participants argued that current curricula and delivery methods in many agencies are not geared toward modern learning styles. Agencies should therefore consider approaches that incorporate microlearning. The primary characteristics of microlearning include short time duration, online or video delivery, and narrow topic areas that can be put into action immediately (Driver, 2018). Participants recommended the development of a model microlearning curriculum tailored specifically for community supervision that could be evaluated for efficacy.

Improving Officer Safety

Community supervision officers are routinely exposed to a variety of dangerous situations. They interact with offenders who might be violent or addicted to drugs. They often work alone in the field, visiting offenders' homes and other environments where their safety might be compromised. As the profession increasingly emphasizes field work and officer mobility, staff could be exposed to more risk. Furthermore, policies on the use of weapons and protective equipment vary by jurisdiction; many officers are unarmed. To do their jobs effectively, officers must be protected. The participants identified several needs in this area.

The highest-priority need was related to emerging duress systems. The participants discussed the need for potential solutions that incorporate wearable technologies, such as location tracking and vital signs monitoring, into a single device. Such a system could detect emergency situations based on an officer's physiological indicators, determine the officer's location, and alert authorities to respond to that location. Although this is

technically feasible, the participants argued that research is needed to determine the efficacy and cost-effectiveness of such an approach in a community supervision context.

The participants also discussed the various strategies agencies use to respond to officers in need of assistance. In many agencies, officers simply provide their supervisor (or coworker) with a detailed itinerary for the day, noting the offenders and locations they will be visiting. These officers might be provided with a cell phone or a radio in case of emergency. A very small number of agencies operate their own command or dispatch centers, which have the responsibility of maintaining contact with officers in the field, like in most law enforcement operations. The participants called for assessments of command centers to determine whether this strategy improves officer safety and justifies the cost of operation.

Workshop participants, acknowledging the rapid growth of unmanned aerial vehicles (UAVs), discussed ways to leverage this innovation to enhance safety. Because officers often make unannounced home visits or execute warrants, they can happen upon dangerous situations (e.g., congregation of gang members, clandestine drug labs). Participants reported believing that it would be valuable to explore the viability—including analysis of legal and ethical issues—of using UAVs equipped with cameras and other sensors to provide advance remote scouting of particular locations before officers approach.

Finally, participants noted that efforts to improve safety are hindered by a lack of data on the risks faced by community supervision officers on a daily basis. Although the Federal Bureau of Investigations' (FBI's) Uniform Crime Reporting Program compiles statistics on law enforcement officers killed and assaulted in the line of duty, no such data are collected for probation and parole officers (FBI, Uniform Crime Reporting Program, 2018). This omission is an impediment to the development of targeted strategies to mitigate risks at the local level but also hampers efforts to identify national trends. The participants recommended that data be collected regularly on community supervision officer deaths, assaults, and injuries while on the job.

Facilitating Positive Behavioral Change

Community corrections agencies are increasingly emphasizing behavioral change objectives in accordance with evidence-based practices. The participants identified several needs associated with targeting criminogenic risk and needs factors, supporting offender prosocial development, and preventing negative outcomes. We show the full list of these needs in Table 3.

Because officers often make unannounced home visits or execute warrants, they can happen upon dangerous situations (e.g., congregation of gang members, clandestine drug labs).

Evaluating Risk and Needs Assessment Tools

One theme that emerged from the group discussions centered on risk and needs assessment (RNA) tools. These tools are designed to measure an offender's criminal risk factors and identify specific needs that, if addressed, will reduce the likelihood of future criminal behavior (Andrews, Bonta, and Hoge, 1990). Such tools range from homegrown assessments created and used by individual jurisdictions to commercial actuarial instruments deployed by agencies across the country. Regardless of origin, RNA instruments should be independently validated for both their intended purpose and the intended population; however, the group noted that, in many cases, these instruments are not sufficiently validated before implementation and, furthermore, often are never revalidated. Revalidation is particularly important following significant changes in the jurisdiction's ecosystem (e.g., changes in law, policing strategies, community demographics) (Casey et al., 2014). In the case of commercial tools, validation services might be provided by the vendor, which could create conflicts.

Several interrelated needs emerged from these discussions. For example, participants argued that best practices are needed to provide guidance on how to develop and validate their homegrown RNA tools. Regardless of whether the tool used is homegrown or commercial, the panel members believed that these tools should be evaluated objectively. They called for an exploration of the feasibility of forming an independent research group or consortium to assess the accuracy and validity of existing RNA instruments. They also called for research to identify the obstacles to conducting revalidations (e.g., cost,

Table 3. Needs Identified Related to Facilitating Positive Behavioral Change

Tier	Problem or Opportunity	Associated Need
1	Failures to appear at required appointments are costly and disruptive to the offender and the agency.	• Evaluate the impact of automated reminder technologies (e.g., smartphone applications, texts) on appearance rates and officer workloads.
	Offenders who maintain their commitments often are not recognized or rewarded for their compliance.	• Identify best practices and potential benefits of incentive programs (both manual and automated).
	Existing tools are not designed to help officers quickly identify the criminogenic needs to address with offenders.	• Identify existing tools or develop new tools that can be used as interactive cheat sheets to prompt officers about the primary issues to consider when engaging with offenders.
	More agencies are leveraging technology to support mobile, community-based supervision approaches versus traditional office-based or "fortress probation." However, there is insufficient evidence on the effectiveness of these approaches.	• Conduct research into the relative effectiveness of mobile, community-based supervision versus office-based supervision approaches.
	Agencies need guidance to effectively support and manage a more mobile workforce (e.g., technology requirements, operational policies, data security issues).	• Conduct research to identify effective strategies to prepare officers to work primarily in the field.
2	Failures to appear at required appointments are costly and disruptive to the offender and the agency.	• Evaluate the impact of innovative public/private transportation partnerships.
	Offenders who violate conditions of supervision often are sanctioned. However, the effectiveness of various sanction approaches is unknown.	• Conduct research to identify best practices and potential benefits from sanction programs (both manual and automated).
	Modern analytic methods might help agencies identify the type of interventions and optimal timing of such interventions to produce better offender outcomes.	• Conduct exploratory research to determine the efficacy of such approaches as data mining, big data analytics, and machine learning.
3	Community support (e.g., resources and services) is not well organized and discoverable; the results of program and other support referrals often are unknown.	• Develop an online interface to aid access to a wide variety of community services, ideally with a feedback loop to the agency.
	Off-the-shelf risk and needs assessment (RNA) tools often are not independently or locally validated.	• Conduct research to independently assess the accuracy and validity of existing RNA tools.
	Some agencies have homegrown RNA tools that have not been validated sufficiently.	• Conduct research to identify best practices for developing and validating RNA tools.
	Revalidating RNA tools is a costly and time-consuming process.	• Investigate obstacles to proper revalidation and explore methods to overcome these challenges.

time) and potential strategies to mitigate or overcome these challenges.

Targeting Needs

Community supervision officers are increasingly expected to understand and apply evidence-based strategies when interacting with offenders. The participants acknowledged that this can be challenging for a variety of reasons (e.g., lack of training, officer or public safety versus rehabilitation orientation). Of particular concern were situations in which officers must handle a general, as opposed to a specialized, caseload, which is very common in smaller agencies. Such officers are responsible for a multitude of offenders, and those offenders can have widely varying risks and needs. Furthermore, when an officer is on leave, a colleague or supervisor often assumes responsibility for the officer's cases. The panelists believed that technology can provide an opportunity to assist in these situations. Panel members articulated the need for evaluation of existing—or the development of new—tools that can access case records and quickly prompt an officer on an offender's primary risk or needs areas, highlight current issues or concerns, and identify engagement strategies accordingly.

The participants also discussed opportunities to better leverage the internet to connect offenders with critical services in the community. One participant cited a platform called "The Good Grid" as a model that could be replicated. This platform connects offenders and others in need of assistance with service providers, volunteers, and employers in an effort to improve

lives (Thompson, 2016). Participants called for research to expand this type of platform to include supervision agencies so that they can keep abreast of services provided to their offenders.

Improving Compliance

Those under supervision often lead chaotic lives and can struggle to keep up with daily activities. For example, they might miss important events, such as court appearances, appointments with their officers, scheduled drug tests, or required programming. When this occurs, negative consequences can ensue for both the offender and the criminal justice system. In some cases, a warrant might be issued and the offender could be jailed until a hearing is scheduled. This is costly for the criminal justice system and further disrupts the lives of the offender and his or her family. The participants discussed ways in which technology can be leveraged to change these negative behavioral patterns. One approach discussed was automated reminder systems (e.g., texts, emails, phone calls, smartphone applications). Although there is some evidence that automated reminders can reduce failure to appear rates (Elek, Sapia, and Keilitz, 2017), the participants called for more research to quantify the impact of different approaches on such measures as offender compliance, success on supervision, and officer workload. The research also should examine the reminder systems that are most effective with different offender groups.

Lack of transportation is one factor that negatively affects offender compliance with reporting requirements. The participants called for examination of the viability of partnerships between jurisdictions and on-demand ride-sharing companies (e.g., Uber, Lyft) to provide free transportation for offenders to required activities. Similar programs are in place to reduce the number of no-shows to doctor's appointments, which have negative health impacts on patient outcomes (Lovelace, 2018). Participants thought that a relatively small investment in this area could return significant financial and societal benefits; however, a demonstration pilot would be useful to determine efficacy. It is interesting to note that, subsequent to the workshop, celebrity Kim Kardashian West announced a partnership with Lyft during a White House briefing on criminal justice reform. The partnership provides formerly incarcerated individuals with ride-share credits to go to job interviews or attend work (Sandler, 2019).

Part of the supervision process involves identifying problematic behaviors and responding accordingly. Participants argued that more guidance is needed to direct policy regarding officer intervention. For example, although many agencies have developed sanction grids that outline possible responses to various forms of noncompliance, there is a lack of evidence demonstrating which sanctions are most effective in changing behavior. Furthermore, participants noted that agencies tend to focus on detecting and responding to noncompliance as opposed to recognizing and rewarding compliance or progress. The field would benefit from the development and dissemination of best practices highlighting how agencies can incorporate technology to deliver positive and timely feedback to reinforce desired behaviors. Best practices would include guidance on developing incentive programs that provide tangible rewards to offenders in a way that would not burden staff.

Where Supervision Occurs: Officer Mobility

Where supervision is performed can have a major impact on an agency's ability to effect positive change. Technology is allowing officers to work in the field more productively than ever, and the participants identified multiple needs associated with this shift.

The participants noted that agencies across the country are beginning to leverage technology advances in support of a transition away from the fortress probation model. *Fortress probation* emerged in the mid-1990s as a common description of the traditional operations of community supervision officers (Hanser, 2018). In this model, officers generally worked Monday through Friday from 8:00 a.m. to 5:00 p.m., and offenders were expected to appear at the agency offices for regular meet-

The participants called for examination of the viability of partnerships between jurisdictions and on-demand ride-sharing companies (e.g., Uber, Lyft) to provide free transportation for offenders to required activities.

ings. Over time, more community supervision agencies began to emphasize the importance of working in the field, contacting offenders in their homes, meeting with service providers (e.g., counselors and therapists), and engaging with communities. The thinking is that effective supervision is best accomplished where offenders live and work.

The participants discussed the technological tools and policy issues required to support such a shift, but they also identified a larger issue. Although increased officer mobility might appear to be advantageous, participants noted a lack of evidence on the effectiveness of this approach. For example, working primarily in the field might be desirable from the perspective of community engagement, but inadequate access to quiet spaces could hinder an officer's efforts to deliver targeted interventions. Participants recommended more research to guide policy in this area.

Beyond evaluating issues of general effectiveness, the participants argued that the field would benefit from guidance on the implementation of officer mobility strategies. For example, it is understood that officers require certain basic equipment to work productively in the field (e.g., vehicles, laptops, remote access to case management records, internet connectivity, and portable printers), but agencies need help to identify and select the most-appropriate tools. Furthermore, the shift toward increased mobility represents a significant change for the officer, and agencies require effective strategies to handle the workforce-management issues that might develop (e.g., additional technical training, adjustment to change in work conditions).

The participants noted that an increasingly mobile workforce could introduce information security risks. Mobility relies on the ability to access offender case management information securely, ideally when no wireless services exist and synchronizing information when services are restored. Data must be protected while in transit and encrypted on the devices used. Access to the devices must be protected with robust authentication methods. Best practices are needed to guide agencies in managing such risks to data security.

Finally, case studies and research are needed to determine the impact of increased officer mobility on offender outcomes, community support, officer safety, and officer job satisfaction and retention.

Holding Offenders Accountable

Offenders serving a period of community supervision are obligated to comply with certain conditions laid out by the court or paroling body. These conditions are meant to ensure public safety while supporting prosocial behaviors. The group identified several areas where technology could be better leveraged to increase offender accountability. We provide a list of needs in this theme in Table 4.

Location Monitoring

In some cases, offenders might be subject to location monitoring for a period of time. Location monitoring is currently accomplished primarily with Global Positioning System (GPS) tracking devices. Although this technology has been deployed for more than 20 years, the participants identified two areas for improvement: research into how the technology can be best applied to achieve desired supervision objectives and guidance on prioritizing alerts. According to the participants, evidence is lacking with respect to such factors as which offender groups respond best to this type of monitoring, the optimal duration of monitoring, and whether concurrent participation in a treatment program produces better results. From an operational perspective, the participants noted that these systems produce a voluminous number of alerts (e.g., low battery, tamper indication, zone violation) that can overwhelm staff. Agencies need guidance to identify which types of alerts are more important and how they should respond, given limited resources. For example, research might be able to identify relationships that could exist among offender risk level, types of alerts, and recidi-

Over time, more community supervision agencies began to emphasize the importance of working in the field, contacting offenders in their homes, meeting with service providers (e.g., counselors and therapists), and engaging with communities.

Table 4. Needs Identified Related to Holding Offenders Accountable

Tier	Problem or Opportunity	Associated Need
1	Agencies have limited evidence regarding which offenders should be part of location-monitoring programs and for how long.	• Conduct research to identify the populations best served and optimal periods of monitoring.
	Agencies have limited evidence regarding the most appropriate technology-based strategies to monitor lower-risk offenders.	• Conduct research to identify the most effective strategies that would account for differences in offender characteristics.
2	New synthetic drugs are difficult and expensive to detect after consumption.	• Research more–cost-effective approaches for detecting new synthetic drugs (e.g., testing for common chemical compounds rather than exact matches).
	It can be challenging to monitor an offender's online behaviors.	• Research is needed to determine risk (i.e., which offenders should be monitored). • Best practices are needed to inform and guide agencies about available monitoring tools and how to deploy them.
	Current deception-detection technologies are both costly and cumbersome for agencies.	• Research potential solutions that are more affordable, reliable, and portable and that can be administered easily.
	Identity-management practices are outdated, cumbersome, and not conducive to interagency sharing.	• Identify the risks and benefits of emerging identity-management techniques (e.g., facial recognition, social media entity resolution).
3	Agencies have limited evidence regarding the most appropriate alcohol abuse–monitoring technologies.	• Conduct research to evaluate the effectiveness of available technologies (with and without treatment).
	It is difficult to monitor offender compliance with mandated prescription drug use.	• Research the readiness and accuracy of newer technologies for monitoring prescription drug use (e.g., chip on or under the skin, smart pill).
	Current drug-testing approaches (e.g., urinalysis) are costly and vulnerable to manipulation.	• Research the readiness and accuracy of newer technologies for substance abuse monitoring (e.g., chip under the skin, eye scans, fingerprint sweat analysis).
	Location-monitoring devices generate a significant number of alerts, and there is insufficient evidence to support appropriate response.	• Best practices are needed to determine the most appropriate response (and timing of response) based on such factors as type of alert, offender risk level, and agency workload.
	Emerging supervision technology (e.g., sensors, cameras) can record an offender's environment and inadvertently affect the privacy of third parties.	• Best practices are needed to integrate emerging technologies into operations.

vism so that appropriate actions can be taken to produce the best public safety outcome.

Substance Use Monitoring

Monitoring substance use is a critical function of community corrections agencies. Indeed, substance use disorders are between four and nine times higher among probationers and parolees compared with their nonsupervised counterparts (Fearn et al., 2016). Furthermore, the relationship between substance use and crime is well established, and research indicates that the two behaviors are mutually reinforcing (Gaines and Kremling, 2013). Although urinalysis remains the gold standard for drug testing, participants argued that alternative approaches could be more cost-effective, gender-neutral (i.e., no need for same-sex specimen collectors), and less vulnerable to contamination or manipulation. Participants called for research into the accuracy and applicability of such emerging techniques as fingerprint sweat analysis and eye scans. Participants also expressed interest in exploring the feasibility of biosensors, or microchips injected under the skin of the offender to detect and wirelessly communicate the presence of drugs and alcohol in the offender's system. Similar to the other techniques mentioned, an assessment of accuracy and reliability would be necessary. Equally important is the need to explore the legality and suitability of these approaches in a criminal justice context,

Given that officers' time is scarce, technology should be leveraged to monitor lower-risk cases, which would free up time to work with higher-risk individuals.

given that implants and microchips are the subject of intense ethical and social debate.

Synthetic drugs (e.g., Flakka, K2, Spice, and Bath Salts) are a growing problem, according to the participants. These drugs are chemically produced, and manufacturers often slightly modify the molecular structure to evade legal and regulatory issues. As a result, tests for these substances can be cost-prohibitive because laboratories are constantly chasing a moving target. According to the participants, the field would benefit from research into innovative, cost-effective approaches to detect synthetic drug use. For example, tests that focus on the most-common elements used in synthetic drugs, as opposed to exact chemical matches, might be a more realistic and sustainable objective that yields equally useful information.

Participants also discussed the use of technology to monitor offender alcohol use. Agencies currently have a variety of products from which to choose, including ignition interlock devices that control vehicle operation; body-worn, continuous transdermal analysis bracelets; portable, home-based, or kiosk-based breathalyzers; and oral fluids testing devices. Although these innovations fill a void, the participants argued that agencies require better information to implement these options most effectively. Specifically, independent evaluations are needed to document product performance, and research is needed to determine the impact of the technology (with and without a treatment component) on desired outcomes.

Finally, some of those on community supervision suffer from serious mental illness and might require medications to manage symptoms. In some cases, adherence to a medication regimen is a special condition of release imposed by the courts. In other cases, medication is not specifically mandated, but could be critical to an individual's success on supervision. Participants noted that, when an individual suffering from mental illness discontinues medications, he or she often decompensates and acts out. It is therefore important to monitor medication compliance.[2] They called for research to assess the feasibility of technological advances, including "digital smart pills," which combine prescription drugs with digital ingestion-tracking systems that determine whether the pill has been ingested. Here again, legal and ethical implications should be explored.

Lower-Risk Offenders

During discussions, the participants wrestled with the challenges associated with supervising lower-risk offenders. Although evidence-based practices dictate that resources should be prioritized toward managing higher-risk offenders (Andrews, Bonta, and Hoge, 1990), agencies have an obligation to ensure that all offenders are complying with their supervision conditions. Given that officers' time is scarce, technology should be leveraged to monitor lower-risk cases, which would free up time to work with higher-risk individuals. To support broader implementation of this strategy, evidence is needed to demonstrate which approaches (e.g., reporting kiosks, telephone call-in systems, smartphone applications) are best suited to achieve desired objectives in a cost-effective manner.

Other Surveillance

According to the participants, offenders often attempt to hide criminal or inappropriate behaviors from supervision officers. The participants argued that agencies need better technologies to uncover these behaviors and identified two opportunities for improvement. For example, polygraph examinations often are used to detect deception; however, the participants noted that they are expensive and require licensed experts to administer. Therefore, other options are needed, and research and development efforts should focus on solutions that are better suited for community corrections. Ideally, these solutions would be relatively inexpensive, accurate, reliable, portable for use in the field, and able to be administered with minimal training. Monitoring offender behaviors online was another concern. Because the internet has become an essential element of modern life, many courts are hesitant to ban offenders from using it. Therefore, supervising an offender's virtual activities (e.g., social media use) has become more important. According to the participants, research is needed in the area of cyber-risk assessment to determine which offender groups require higher levels of online surveillance. Furthermore, assessments are needed to identify the most-appropriate tools and strategies to monitor or manage this population's computer use.

Finally, the participants noted that technologies intended to hold offenders accountable (e.g., body-worn cameras, smartphone applications, emerging sensors) could capture and record images and other information about people in the offender's environment who are not under supervision. Best practices are needed to guide agencies on the effective use of emerging technologies while maintaining sensitivity to the privacy of third parties.

Identity Management

The participants noted that current offender identity management systems are cumbersome and hinder efforts to share information across criminal justice agencies. As a result, crimes might go unsolved. Offender accountability could be improved by deploying emerging automated techniques (e.g., facial recognition, social media entity resolution), and the participants argued for research examining the risks and benefits of these approaches.

Improving Operational Effectiveness

Leveraging technology can help an agency improve operational effectiveness, providing the opportunity to allocate scarce resources more wisely. The participants identified several needs related to this theme. We provide the full list of needs in Table 5.

Leveraging Data and Analytics

Community supervision agencies gather and maintain voluminous amounts of data, but the participants noted that most fail to fully leverage these data to inform policy and practice. Sev-

Table 5. Needs Identified Related to Improving Operational Effectiveness

Tier	Problem or Opportunity	Associated Need
1	It can be costly and time-consuming for agencies to provide victims with required information.	• Research the risks and benefits of "victim portals" where victims can access relevant offender or case information.
	Evaluating and selecting technology—particularly software tools—can be difficult.	• Identify best practices with regard to common issues (e.g., purchasing commercial off-the-shelf solutions versus developing solutions in-house; selecting a data model; creating sample requests for proposal and contract language).
	There is potential for more-efficient internal coordination and coordination with local services through the use of GIS.	• Develop case studies that highlight the potential benefits of leveraging GIS and associated best practices.
	Many agencies rely on outdated methods to communicate with offenders and need to exploit modern methods.	• Identify best practices for implementing modern communication technologies (e.g., chat, email, social media, video).
	The value of offender management systems is diminished when officers cannot readily access and use the information previously collected on offenders.	• Develop dashboards or other improved user interfaces that reduce effort and improve the ability of officers to extract insights needed to do their jobs from the data. • Develop case studies demonstrating the impact of improved user interfaces on supervision outcomes.
	Agencies have large quantities of data that could be analyzed for predictive purposes (e.g., precursors to success or failure).	• Research the predictive value of data, such as stable employment, location patterns, drug test results, and failure to appear.
2	Strategies to leverage technology to improve agency efficiencies (e.g., going paperless, virtual offices) are not well understood.	• Develop and disseminate case studies that highlight success stories and best practices to provide models for the field.
3	Voice-to-text technologies have the potential to improve efficiencies.	• Research solutions that can be integrated into existing case-management systems.
	Despite past research and development efforts, automated voice translation services are not yet able to meet agency needs.	• Conduct research to evaluate the state of the market for voice translation services, identify current gaps, and suggest how to close them.
	Identifying technology solutions and connecting with other agency users to get feedback is challenging.	• Online forums are needed for practitioners to share knowledge on technology and best practices.
	Body-worn cameras might have the potential to improve offender and agency- or officer-related outcomes.	• Conduct pilots to assess the costs, benefits, risks, and preliminary outcomes related to body-worn cameras.

> [A]s the U.S. population grows more diverse, it is increasingly important that officers be able to communicate with offenders.

eral needs were identified to help bridge this gap. For example, data related to sudden changes in an offender's dynamic risk or needs factors and other metrics, such as reporting or movement patterns, might be indicative of problematic future behaviors. The participants argued that research is needed to identify which—if any—factors might be correlated with criminal activity. If predictive value is demonstrated, best practices are needed to identify these patterns and develop appropriate interventions.

In a related need, the participants noted that agencies need assistance in transforming their data into actionable intelligence. The group called for the evaluation of existing tools or the development of new data visualization tools (e.g., dashboards) that can provide staff at various levels with the specific and timely information they require to intervene in an appropriate manner. Furthermore, to demonstrate the utility of these tools, the group recommended the development of case studies that highlight how data analytics and visualization tools can improve mission performance. These studies should be structured in a way that is easily generalizable so that the examples can be replicated in other agencies.

Participants identified GIS as a primary example of an underused resource that would maximize the value of existing data. Such data as crime trends, offender residence density, location of treatment and support services, location of community supervision offices, and public transportation systems should inform strategic planning and operational or tactical practices. The participants called for research to identify best practices and the development of case studies to highlight the impact on agency operations of employing GIS.

General Operations

The participants identified the need to optimize voice-to-text technologies that would allow officers to verbally create accurate case notes that could be integrated seamlessly into existing case-management systems. Furthermore, as the U.S. population grows more diverse, it is increasingly important that officers be able to communicate with offenders. Participants noted that existing automated voice translation services are not adequately accurate or reliable, and research is needed to further refine these systems.

The group discussed the variety of ways in which officers maintain contact with offenders. Most contact occurs in person, whether in agency offices or during visits to the offender's home. However, technology can be leveraged to connect officers and offenders between these events. Noting that many agencies still use outdated communication methods (e.g., telephone calls, letters), the participants argued that there is a need to leverage emerging technologies (e.g., smartphone-based or computer-based video, instant messaging apps, texts, email, social media). These newer forms of communication can be effective, but might also introduce policy challenges. For example, in some jurisdictions, a directive to an offender via text instructing him or her to report for a drug test might not meet legal standards for notification. The participants therefore called for evaluations of the impact of nontraditional communication methods on supervision objectives and the development of best practices to help guide agencies making this paradigm shift.

In many jurisdictions, community supervision agencies are responsible for providing victims of crimes with information about the status of their cases. Although many agencies enter into agreements with private companies, others handle this internally. The process can be labor-intensive, and the group called for cost-benefit analyses and risk assessments of automated notification systems and web portals that victims could use to get information on demand without the need for staff assistance.

The participants articulated several challenges with respect to identifying and deploying technology solutions. For example, with respect to information technology, many agencies struggle with purchasing commercial off-the-shelf software versus developing a solution internally; selecting a data model for their systems; and building a data storage center versus using a contracted, cloud-based option. Guidance is required on procuring information technology solutions, including model requests for proposal or information, contract language (e.g., details about service-level agreements and data ownership),

lessons learned, and common pitfalls. To the extent possible, guidance should account for the different types of agencies, levels of government, and jurisdictional dynamics. Furthermore, gathering basic information across the spectrum of emerging technologies can be challenging. Participants noted that online forums where agencies can exchange knowledge on technology applications, experiences, and best practices for leveraging solutions to meet operational objectives would benefit the field.

Finally, the participants discussed body-worn cameras as an emerging tool with the potential to yield important benefits related to several objectives, including offender outcomes (e.g., providing an important training tool to improve targeted interventions) and officer safety (e.g., reducing chances of offender aggression, protection against false allegations). Because only a handful of community supervision agencies currently use body-worn cameras, the field would benefit from pilot tests and case studies that assess the costs, benefits, and lessons learned, including implementation issues, privacy considerations, and officer or labor union acceptance.

Conclusion

Community corrections is a critical component of the criminal justice system. However, the sector faces mounting pressures to reduce institutional overcrowding while safely managing offenders in the community. With limited resources, agencies are expected to both protect the public and facilitate positive change in offenders. Technology and innovation can help agencies overcome these challenges and meet their objectives. The 18 high-priority needs identified during the workshop can help shape a plan for action by researchers, technology experts, and institutional actors to better leverage technology to improve community supervision. We categorized those high-priority needs into the following four themes:

- **Managing human resources:** Technology can be leveraged to train officers more effectively on basic skills and evidence-based interventions, assess whether they are implementing that training with fidelity, and facilitate a timely feedback loop to the officers. Given an increasing emphasis on providing supervision services in the communities where offenders live and work, technology should be leveraged to enhance officers' safety in the field. Advanced emergency duress systems should be developed and evaluated to determine their impact on lone-worker safety.
- **Facilitating positive behavioral change:** Technology can support officers and assist in the delivery of evidence-based interventions known to reduce recidivism. Automated tools are needed to help officers quickly identify the most important criminogenic risks or needs to target with a particular offender. Technology should be better leveraged to identify prosocial behaviors automatically and deliver positive reinforcement as part of incentive programs. Innovation also can foster better offender outcomes. Research is needed on the effectiveness of various automated reminder strategies to reduce failure to appear violations. As agencies consider the transition from fortress probation to more–community-based supervision, research is needed to evaluate the impact of a more mobile workforce on outcomes. Best practices are needed to guide agencies as they implement mobility strategies.
- **Holding offenders accountable:** The use of location-monitoring technologies is increasing, and there are significant associated costs in terms of equipment and officer workload. Research is needed to guide more-effective implementation of these technologies to achieve desired outcomes. Evaluations are needed to determine the most effective technology-based approaches to supervising lower-risk offenders.
- **Improving operational effectiveness:** The group identified multiple opportunities to improve operational or administrative efficiencies, which would allow for better use of scarce resources. For example, decisions about selecting, procuring, and implementing information technology solutions can have significant fiscal and operational implications if not handled properly; guidance is needed through documentation and dissemination of successful strategies. Victim notification was specifically discussed; the group participants argued that cost-effective, web-based approaches are needed. The use of modern communication methods (e.g., text, chat, social media) should be explored as a way to maintain contact between in-person interactions. Community supervision agencies collect voluminous amounts of data on offenders; however, it is challenging to convert these data into actionable intelligence. Accessible analytic and visualization tools (e.g., GIS) should be better leveraged so that agencies can identify important patterns, trends, and opportunities to improve effectiveness. Furthermore, research is needed to determine the predictive value of offender data (e.g., movement patterns) on recidivism so that timely interventions can take place.

The group identified several needs related to developing tools to help the community corrections sector more effectively and more efficiently perform its mission, but the development of tools is only part of the equation: Implementing innovations in a way that maximizes utility can be far more challenging. Although evidence-based community supervision practices can guide the implementation of technology, in most cases, technology far outpaces research or offers possibilities that have yet to be investigated. Therefore, rigorous evaluation of innovations is required to determine their effectiveness. The development of technology solutions and the evaluation of these solutions—such as those prioritized by the workshop participants—can be an essential component of a community corrections system that meets the needs of the public moving forward.

TECHNICAL APPENDIX

In this appendix, we present additional details on the workshop agenda and the process for identifying and prioritizing technology and other needs specific to community supervision. Through this process, we developed the research agenda that structured the topics presented in the main report. The descriptions in this appendix are adapted from those in previous Priority Criminal Justice Needs Initiative publications and reflect adjustments to the needs identification and prioritization process implemented at this workshop.

Pre-Workshop Activities

University of Denver and RAND researchers recruited the panel members by identifying knowledgeable individuals through existing professional and social networks (e.g., LinkedIn) and by reviewing literature published on the topic. We then extended invitations to participate to those individuals and provided a brief description of the workshop's focus areas.

The workshop agenda and discussion were structured as shown in Table A.1.

Identification and Prioritization of Needs

To develop and prioritize a list of technology and policy issues that are likely to benefit from research and investment, we followed a process that has been used in previous Priority Criminal Justice Needs Initiative workshops (see, for example, Jackson et al., 2015, and Jackson et al., 2016 and references therein). Participants discussed and refined problems related to each category and identified potential solutions (or needs) that could address each problem. In addition, needs could be framed in response to opportunities to improve performance by adopting or adapting a new approach or practice (e.g., applying a technology or tool that had not been used before).

At the end of the discussion of each topic, participants were given an opportunity to review and revise the list of problems and opportunities they had identified. The participants' combined lists for each topic were displayed one by one using Microsoft PowerPoint slides that were edited in real time to incorporate revisions and comments.

Once the panel agreed on the wording of each slide, we asked participants to anonymously vote using a handheld device (specifically, the ResponseCard RF LCD from Turning Technologies). Each participant was asked to individually score each problem or opportunity and its associated need using a 1–9 scale for two dimensions: (1) importance and (2) probability of success.

For the *importance* dimension, participants were instructed that 1 was a low score and 9 was a high score. Participants were told to score a need's importance with a 1 if it would have little or no impact on the problem and with a 9 if it would reduce the impact of the problem by 20 percent or more. Anchoring the scale with percentage improvements in the need's performance is intended to help make rating values more comparable from participant to participant.

Table A.1. Workshop Agenda

Day 1	Day 2
Welcome, Overview, and Introductions	Improving Efficiencies: Challenges and Solutions
Facilitating Positive Behavioral Change: Challenges and Solutions	Other Challenges/Opportunities
Protecting the Public: Challenges and Solutions	Discuss/Rank Overall Needs
Holding Offenders Accountable: Challenges and Solutions	Meeting Wrap Up/Administrative Issues
Improving Competencies: Challenges and Solutions	

For the *probability of success* dimension, participants were instructed to treat the 1–9 scale as a percentage chance that the need could be met and implemented successfully. That is, they could assign the need's chance of success between 10 percent (i.e., rating of 1) and 90 percent (i.e., rating of 9). This dimension was intended to include not only technical concerns (i.e., whether the need would be hard to meet) but also the effect of factors that might lead courts to not adopt the new technology, policy, or practice even if it were developed. Such factors could include cost, staffing concerns, and societal concerns.

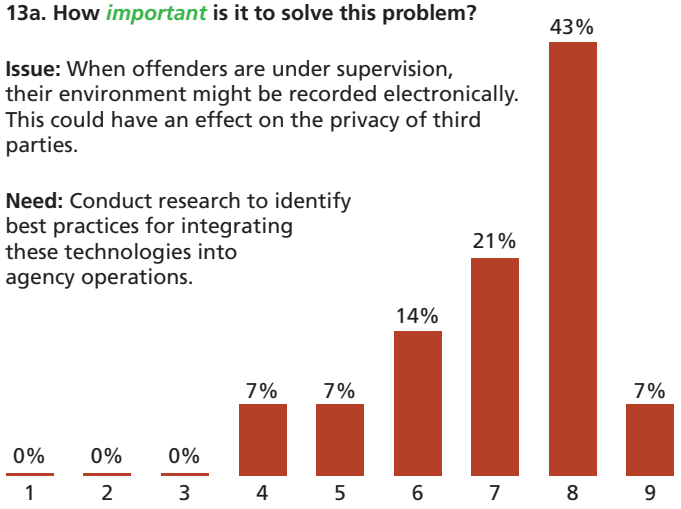
After the participants rated the needs displayed on a particular slide (i.e., for either importance or probability of success), we displayed a histogram-style summary of their responses. If there was significant disagreement among the panel (the degree of disagreement was determined by the research team's visual inspection of the histogram), the participants were asked to discuss or explain their votes at one end of the spectrum or the other. If a second round of discussion occurred, participants were given an opportunity to adjust their ratings on the same question. This second-round rating was optional, and any rating submitted by a participant would replace his or her first-round rating. This process was repeated for each question and dimension at the end of each topic area. Figure A.1 is an example of a slide on the importance dimension, with related issue, need, and histogram. Figure A.2 shows a slide on the probability of success dimension.

Once the participants had completed this rating process for all topic areas, we prioritized needs in a single list. We ordered the list by calculating an expected value using the method outlined in Jackson and colleagues, 2016. For each need, we multiplied the final (second-round) ratings for importance and probability of success to produce an expected value. We then calculated the median of that product across all of the respondents and used that as the group's collective expected value score for the need.

We clustered the resulting expected value scores into three tiers using a hierarchical clustering algorithm. The algorithm we used was the "ward.D" spherical algorithm from the "stats" library in the R statistical package, version 3.5. We chose this algorithm to minimize within-cluster variance when determining the breaks between tiers. The choice of three tiers is arbitrary but was done in part to remain consistent across the set of technology workshops we have conducted for NIJ. Also, the choice of three tiers represents a manageable system for policymakers. Specifically, the top-tier needs are the priorities that should be the primary policymaking focus, the second-tier needs should be examined closely, and the third-tier needs are probably not worth much attention in the near term (unless, for example, they can be addressed with existing technology or approaches that can be readily and cheaply adapted).

Because the participants initially rated the needs by one topic area at a time, we gave them an opportunity at the end of the workshop to review and weigh in on the tiered list of all identified needs. The intention of this step was to let the panel members see the needs in the context of the other tiered needs and allow them to consider whether there were needs that appeared too high or low relative to the others. To collect these assessments, we printed the entire tiered list and distributed it

Figure A.1. Example Slide for Importance



NOTE: Percentages on each question did not always sum to 100 percent due to rounding and variation in the number of participants who voted on each need.

Figure A.2. Example Slide for Probability of Success

to the participants. Participants were then asked to examine where each of the needs landed on the overall tiered list and whether this ordering was appropriate or needed fine-tuning. Participants had the option to indicate whether each problem and need pairing should be voted up or down on the list. An example of this form is provided in Table A.2.

We then tallied the participants' third-round responses and applied those votes to produce a final list of prioritized and tiered needs. To adjust the expected values using the up and down votes from the third round of prioritization, we implemented a method equivalent to the one we used in previous work (Hollywood et al., 2016). Specifically, if every panel member voted "up" for a need that was at the bottom of the list, then the collective effect of those votes would be to move the need to the top. (The opposite would happen if every panelist voted "down" for a need that was at the top of the list.) To determine the point value of a single vote, we divided the full range of expected values by the number of participants voting.

To prevent the (somewhat rare) situation in which small numbers of votes have an unintended outsized impact—for example, when some or all of the needs in one tier have the same or very similar expected values—we required that at least 25 percent of the workshop participants must have voted on that need (and then rounded to the nearest full participant). There were 12 participants in this workshop, so for any votes to have an effect, at least four participants would have had to have voted to move the need up or down.

After applying the up and down vote points to the second-round expected values, we compared the modified scores with the boundary values for the tiers to see whether the change was enough to move any needs up or down in the prioritization. (Note that there were gaps between these boundaries, so some of the modified expected values could fall between tiers. See Figure A.3.) As with prior work, we set a higher bar for a need to move up or down two tiers (from Tier 1 to Tier 3 or vice versa) than for a need to move to the tier immediately above or below. Specifically, a need could *increase by one tier* if its

Table A.2. Example of the Delphi Round 3 Voting Form

Question	Tier	Vote Up	Vote Down
Tier 1			
Issue: Agencies need guidance to effectively support and manage a more mobile workforce (e.g., technology requirements, operational policies, data security issues). **Need:** Conduct research to identify effective strategies to prepare officers to work primarily in the field.	1		
Issue: There are several emerging technologies that can be used to alert agencies when officers are hurt or in distress. **Need:** Analyze emerging technologies for their potential to improve officer safety.	1		
Tier 2			
Issue: Failures to appear at required appointments are costly and disruptive to the offender and the agency. **Need:** Evaluate the impact of innovative public/private transportation partnerships.	2		
Issue: It can be challenging to monitor an offender's online behaviors. **Need:** Best practices are needed to inform and guide agencies about available monitoring tools and how to deploy them.	2		
Tier 3			
Issue: Location-monitoring devices generate a significant number of alerts, and there is insufficient evidence to support appropriate response. **Need:** Best practices are needed to determine the most appropriate response (and timing of response) based on such factors as type of alert, offender risk level, and agency workload.	3		
Issue: Body-worn cameras might have the potential to improve offender and agency- or officer-related outcomes. **Need:** Conduct pilots to assess the costs, benefits, risks, and preliminary outcomes related to body-worn cameras.	3		

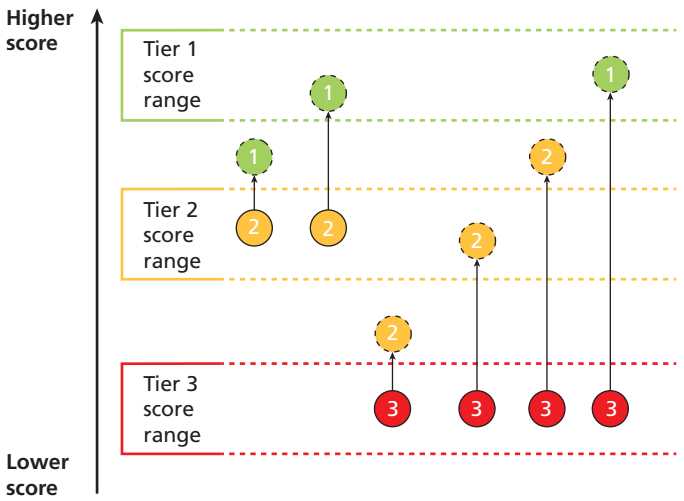
NOTE: Shaded cells indicate that up or down votes were not possible (e.g., Tier 1 is the top tier, so it was impossible to upvote items in that tier).

modified expected value was higher than the highest expected value score in its initial tier. A need could *decrease by one tier* if its modified expected value was lower than the lowest expected value in its initial tier. However, *to increase or decrease by two tiers* (which was only possible for needs that started in Tier 1 or Tier 3), the score had to increase or decrease by an amount that fully placed the need into the range two tiers away. For example, for a Tier 3 need to jump to Tier 1, its expected value score had to fall within the boundaries of Tier 1, not just within the gap between Tier 1 and Tier 2. Figure A.3 illustrates the greater score change required for a need to move two tiers (i.e., the need on the far right of the figure) compared with one tier (all other examples shown).

Applying these decision rules to integrate the participants' third-round inputs into the final tiering of needs resulted in numerical separations between tiers that were less clear than the separations that resulted when we used the clustering algorithm in the initial tiering. This can occur because, for example, when the final expected value score for a need that was originally in Tier 3 falls just below the boundary value for Tier 1, that need's final score could be higher than that of some other needs in the item's new tier (Tier 2). See Figure A.4, which shows the distribution of the needs by expected value score after the second-round rating process and after the third-round voting process.

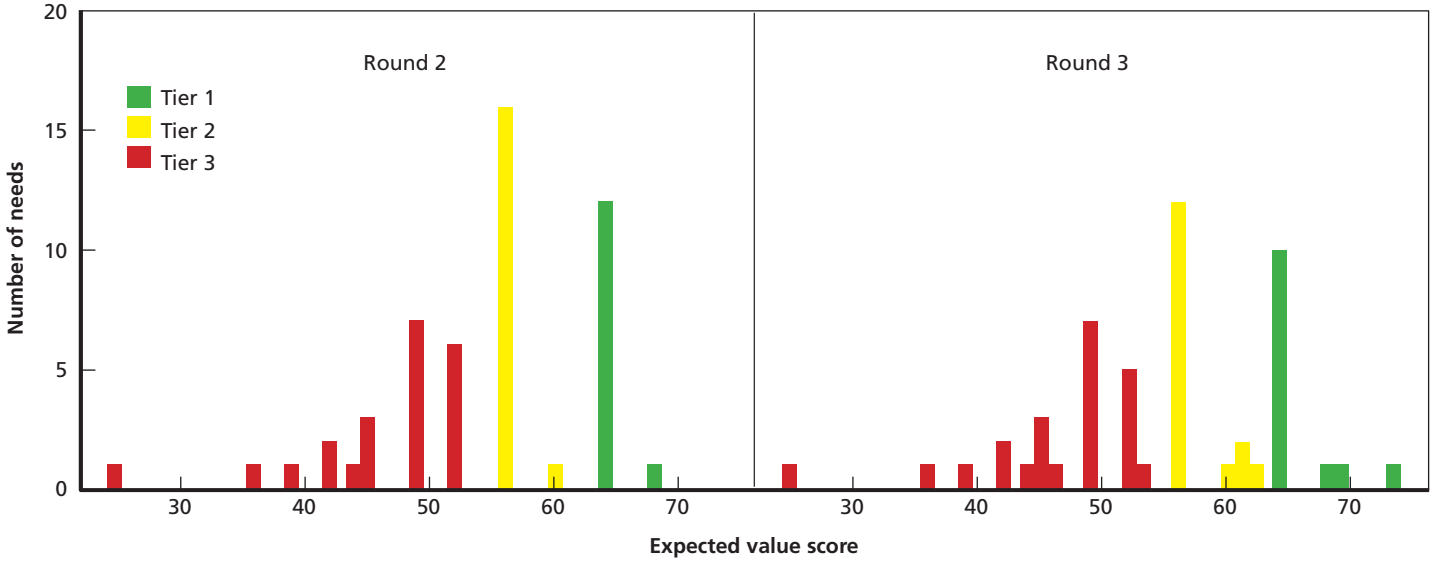
As of the third round of voting, 45 needs did not change their position, one need fell by a tier, and one need rose one tier. No needs changed by two tiers. The output from this process became the final ranking of the panel's prioritized results.

Figure A.3. How a Need's Increase in Expected Value Might Result in Its Movement Across Tier Boundaries



NOTE: Each example need's original tier is shown by a circle with a solid border (the two needs starting in Tier 2 and the four needs starting in Tier 3). Each need's new tier after the third-round score adjustment is shown by the connected circle with a dotted border.

Figure A.4. Distribution of the Tiered Needs Following Rounds 2 and 3



Notes

[1] We use the term *offender* to refer to individuals who are under community supervision. We acknowledge that the term risks implying that all of these individuals are currently offending rather than nearing completion of their terms of custody and supervision.

[2] According to participants in a previous workshop on managing people with serious mental illness in corrections, some individuals do not receive adequate supplies of medication upon release from correctional facilities (Shaffer et al., 2019).

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The RAND Justice Policy Program

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About This Report

On behalf of the U.S. Department of Justice, National Institute of Justice (NIJ), the RAND Corporation, in partnership with the Police Executive Research Forum (PERF), RTI International, and the University of Denver, is carrying out a research effort to assess and prioritize technology and related needs across the criminal justice community. This initiative is a component of NIJ's National Law Enforcement and Corrections Technology Center (NLECTC) System and is intended to support innovation within the criminal justice enterprise. For more information about the NLECTC Priority Criminal Justice Technology Needs Initiative, see www.rand.org/jie/justice-policy/projects/priority-criminal-justice-needs.

This report is one product of that effort. It presents the results of an expert workshop focused on identifying and prioritizing ways to address institutional security concerns in the corrections sector. This report and the results it presents should be of interest to planners from corrections agencies, research and operational criminal justice agencies at the federal level, private-sector technology providers, and policymakers who are active in the criminal justice field. Mentions of products do not represent approval or endorsement by NIJ or the RAND Corporation.

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