

Document Title: **Evaluability Assessment of
Trace Detection Technology**

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Evaluability Assessment of Trace Detection Technology

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NIJ Guidance

The National Institute of Justice (NIJ) recommends that applicants consider evaluating this technology along cost effectiveness lines, whether the application is sited in Pima County or some other system. While Pima County uses their technology in a mail room, other systems might use the technology to screen visitor possessions or suspicious parcels found in facilities. Applicants are encouraged to consider such outcome variables as numbers of items detected, persons prosecuted, and inmates sanctioned. On the cost side, evaluations should consider all possible costs including startup, training, and maintenance. Applicants may also want to consider that an effective detection technology may drive traffickers of contraband to explore other avenues of penetration, so that measurement of outcomes needs to account for possible displacement effects.

Technology Summary: In recent years, several systems have become available for the detection of trace amounts of drugs and explosives. This report discusses the range of technologies and focuses specifically on the use of ion mobility spectrometry for detecting illegal drugs. In this process, a swab is taken from the area in question. Inside a scanner, the sample is heated until particles of the substance are vaporized. These vaporized ions are then analyzed and compared against a library of potential narcotics and other substances, and any positive matches are identified.

Scope of Evaluation: Illegal drugs can be transported into jails and prisons by visitors and incoming inmates, by corrupt guards and other officials, and through the mail. Pima County officials felt that corruption was absent among Pima County guards and that visitors could not transport drugs because the jail does not permit personal contact. Jail officials used trace detection technology to periodically check inmates returning from community release and to routinely examine incoming mail. An evaluation would examine (1) the effectiveness of trace detection technology at intercepting illegal drugs coming in through the mail, (2) the consequence that successful detection has for drug use in the jail, and (3) the effect that reducing drug use has on day-to-day jail operations. These three questions are progressively more difficult to answer.

Summary of Evaluability Assessment Activity: During the evaluability assessment, Abt Associates, Inc., conducted a thorough search of manufacturer reports and field uses of trace detection technologies in the United States. We also interviewed individuals from Sandia Laboratories, the Specialized Crimes and Narcotics Task Force of Kingsville, TX, and staff from the Pima County Adult Detention Center. We completed a site visit at the Pima County Detention Center in order to view the technology in practice.

Finding: We find trace detection technologies to be evaluable. Three designs are suggested which attempt to quantify the end benefit of this technology rather than simply the process outcomes.

1. Initial Screening

Background

Drug and explosive detection technology is frequently divided into two categories: bulk detection and trace detection systems. While bulk detection is used to identify large masses of visible substances, trace detection is used to identify the minuscule, sometimes invisible, residue of substances. Traditionally, law enforcement officers have used specially trained canines to aid in the detection of contraband (in its bulk and trace forms). However, the increased versatility of electronic detection technology has allowed law enforcement to test large amounts of potentially contaminated materials (for example, the thousands of letters that pass through a prison mail room each day) with an efficiency that may not be feasible with the use of a canine. (NLETC, 2003)

Trace detection technology is capable of identifying chemicals—be they illegal drugs or explosives—in the form of gas vapors or particulate matter.

- *Gas vapors*: The detection of vapors involves the use of vacuum technology with a sensitivity to gas-phase molecules. All solids and liquids emit varying amounts of gas vapors, which are dependent on a variety of environmental conditions. At particular temperatures, the amount of vapor that a substance emits can allow trace detection technology to identify the substance at hand. (Thiesan, 2004) One of the advantages of gas vapor technology is that such equipment need not touch a potentially contaminated service to detect the presence of an illicit substance.
- *Particulate matter*: The detection of particulate matter involves the use of sampling-pad technology that swipes contaminated surfaces to collect microscopic solids. A few micrograms in weight is sufficient for identifying an illegal drug. Because trace detection of particles involves touching a potentially contaminated surface, technicians who use this equipment must engage in special procedures to avoid cross-contaminating surfaces. (Thiesan, 2004) It is important to note that the amount of particulate matter present on a given item can be related very loosely to the amount of a contraband substance present in a given environment. Cross-contamination is very common, and can occur through second-hand contact, even if no contraband material is present. (Parmeter, 2000)

Trace detection technology comes in seven principal forms, three of which are commonly used to detect narcotics: ion mobility spectrometry, chemical reagents, and mass spectrometry.¹ *Ion mobility spectrometry* can operate in vapor mode (by collecting air samples) or in particle mode (by swiping a surface), and can detect the presence of narcotics through the collection of as few as 100 picograms. Ion mobility spectrometry identifies chemical substances by measuring the drift speed of ions. *Chemical reagents* detect particle matter through the use of aerosol sprays and swipes, which are calibrated to change color in the presence of different substances. Chemical reagents, for example, have been developed to identify the presence of cocaine or marijuana on surfaces, and can identify material with a concentration of as few as 5 picograms. (B. Butler, 2002 and Thiesan, 2004) *Mass spectrometry* identifies trace substances by swiping contaminated surfaces to identify a material's molecular weight and fragmentation patterns. Thiesan, et al. (2004) describe it primarily as a “mass

¹ The other four technologies—chemiluminescence, thermo-redox, surface acoustic wave, and ultraviolet fluorescence technology—are used principally in the detection of explosives (Thiesan, 2004, pp. 33-40).

filtering technique,” in which a substance is collected, ionized, and passed through a filter that identifies its charge-to-mass ratio. Like ion mobility spectrometry, mass spectrometry has a minimum detection level of 100 picograms for any given substance. (B. Butler, 2002)

What is the background/history of this technology?

Maturity (i.e., lab prototype? Field roll-out? Multiple generations/manufacturers?)

Trace detection technology is widely available for law enforcement purposes, with several private manufacturers supplying well-tested, increasingly advanced equipment.

Time in the field?

No report or article that we obtained gave an estimated date at which trace detection technology first became available to correctional officers in the field. Within the past decade, however, NIJ and the Federal Bureau of Prisons began to focus on providing trace detection equipment to help prisons curtail the amount of drugs that are smuggled into jails through visitors or mail services. (Wright, 2001)

Prevalence in the field? (Is site a first/early adopter?)

Trace detection technology itself has been widely available for many years. In recent years, its sensitivity and accuracy has increased substantially, and the price of many models has become more affordable, making it a more attractive option for correctional facilities. We have no definitive estimate of the number of prison facilities that employ trace detection technology, but with more manufacturers marketing to the correctional “market,” we believe that the number is increasing. NIJ’s evaluation of contraband detection technology in its Mailroom Scenario Evaluation (2000-2002), as well as its three-day experiment in Pima County’s jail mailroom (2002), may have increased the visibility of such technology, while showcasing the versatility that it can offer to correctional facilities.

What do we already know about technologies like these?

At this time, most of the literature on the use of trace detection technology in correctional facilities discusses the results of studies that were funded by NIJ and its National Law Enforcement and Corrections Technology Center. The Mailroom Scenario Evaluation tested the success rates of different trace detection technologies at identifying the presence of multiple narcotics, and a three-day “experiment” at Pima County compared two different ion mobility spectrometers. Butler, R.F. (2002) described the mailroom evaluation as a “limited” scenario evaluation, which simulated a prison mailroom environment by modeling an evaluation center after the mailroom center at the U.S. Penitentiary in Leavenworth, Kansas. This evaluation tested various ion mobility spectrometers and a chemical reagent spray to measure their ability to identify a number of drugs, including marijuana, cocaine, heroin, methamphetamine, ecstasy, and LSD. (R.F. Butler, 2002) One of the principal findings of this evaluation was that the minimum detection levels taken from the literature of vendors is not necessarily accurate, and that minimum detection levels are dependent on a variety of factors, including drug type and environmental conditions. (Wright, 2001) The three-day Pima County experiment was, to a large degree, designed to better understand the needs of mailroom staff with regard to the ease-of-use of particular equipment. Several officers at Pima County, for example, appreciated the portability of one of the ion mobility spectrometers, which allowed staff to test letters after they had been opened by inmates, or swab in particular areas of the facility after visitors have left. (Falcon, 2005)

The results of these two evaluations highlighted a number of key factors that correction facilities need to consider when deciding which type of trace detection technology to purchase. These factors include, among other things: purchasing costs, maintenance cost, screening speed (which involves amount of time it takes a system to identify trace matter), the sensitivity of the system to different types of drugs, system portability, ease of use (which includes training requirements), and safety issues. (Parmeter, 2000) Other issues mentioned in both evaluations involved the varying rates of false-positives given by almost all detection equipment, much of which was attributed to cross-contamination. Trace detection technology, for example, cannot distinguish between mail that contains smuggled drugs, and mail that was simply touched by hands that had previously handled a certain drug. (Falcon, 2005) Mail contamination can also occur when tainted mail touches clean mail and thereby contaminates it. (USDOJ, 2004) While this contamination will continue to remain an unavoidable problem for correctional facilities that employ trace detection technology, there is nevertheless training that staff can undertake to limit the extent to which they themselves become the unwitting agents of cross-contamination through poor handling procedures.

What could an evaluation of this technology add to current knowledge?

Illegal drugs enter jails and prisons through various vectors, including the mail. An evaluation would not test the reliability and specificity of the trace detection technology at detecting illegal drugs, because the performance of the technology is not in question. Rather, the question is how the technology works in an operational setting: How much illegal drugs are removed from entering a jail through the mail and at what cost? What proportion of illegal drugs used in jails is transported through the mail, and hence, what is the benefit of using trace detection technology?

Interdicting a drug shipment is not necessarily the final step when applying the technology. Identifying a drug shipment is sometimes a trigger for investigating an offender's conduct by using telephone taps and by investigating the letter's source. This can lead to prosecutions of the sender, the recipient, or both.

Which audience(s) would benefit from this evaluation?

- Law enforcement agencies and correctional facilities
- Database companies and developers who sell such technology

What could they do with the findings?

The use of trace detection technology to inspect incoming mail is only one step toward reducing drug use in jails and prisons. Presuming that a jail is able to control other vectors into the jail (visitors, incoming inmates, corrupt guards), then the jail could use the results from the research to judge whether the additional reduction in imported drugs would be worth the staffing and equipment costs of implementing trace detection tools in the mailroom.

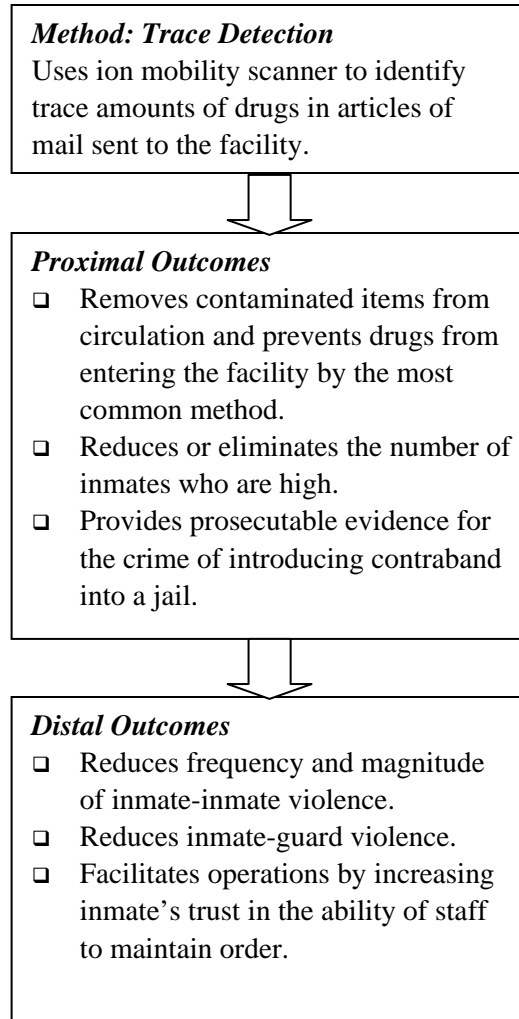
At what stage of adoption/implementation is the technology?

Pima County has been using the IonScan system (from Smiths Detection) since July of 2005. It has been in continuous use in the mailroom since that time with little change in protocol. The system is used at least every other day to test suspicious mail items.

What efficiencies or primary/secondary outcomes are expected?

Sketch the logic by which technology use should affect goals (see Exhibit 1)

Exhibit 1: Logic Model



Are there operational alternatives that could be used for comparison?

No system in place at Pima County Adult Detention Center provides the same accuracy or speed as the IonScan system. However, the Center has used several alternatives for the detection of incoming contraband materials. These include:

- ❑ Visual inspection: Mailroom staff inspect each item of personal mail by hand. In some cases, an ultra-violet light may be used to highlight stains or non-ink lettering. This method usually cannot identify the specific drug or concentration.
- ❑ X-ray: All mail entering the facility is X-rayed (the only “search” permitted in legal mail). X-rays will identify bulk materials in the mail and have some ability to distinguish between organic materials (less dense) and metallic materials (more dense). However, the X-ray machine is not very specific and cannot identify trace amounts.

- ❑ **Drug dogs:** The Pima County Detention Center has on occasion used drug dogs to confirm the presence of drugs in suspect mail. However, the mail must be separated widely so that the dog can specifically identify the item in question. This can be time-consuming and does not eliminate the possibility of cross-contamination from other items of mail.
- ❑ **Lab results:** Each positive result on the IonScan is confirmed at the county laboratory through chemical assays of the material. This process is as accurate as the IonScan machine, but requires additional training and is more time consuming. It also cannot be accomplished without damaging the letter in question.

However, the trace detection technology augments rather than replaces extant technology. The identification of drugs through trace detection technology is necessarily “value added” because it can be applied to a large number of parcels, which is impractical for laboratory analysis.

Is the site interested in being evaluated?

Pima County Adult Detention Center would be willing to participate in an evaluation. They have previously cooperated in NIJ studies such as the Adult Drug Abuse Monitoring program.

Is the site planning an evaluation?

No evaluation is currently planned.

Data Sources

What data systems exist that would facilitate evaluation?

The IonScan system can produce a printed receipt with the time, the name of the drug, and the amount detected. Currently Pima County staff prints a receipt for every positive test above the usable threshold (approx. 3-4 on a scale of 20). Copies of these receipts are kept after the letter itself is sent to the county lab. In addition to paper receipts, the Pima County staff keeps a logbook of all of the positives identified. In the first 14 months of use, 81 items were found to have usable quantities of drugs. This is approximately one to two per week. Currently the logbook is in handwritten form and no electronic version is available. In addition to the Pima County Detention Center materials, each sample is sent to the county lab for confirmation. The lab results are then reported with detailed information on the type and amount of drug identified.

What key data elements are contained in these systems?

The logbook contains the same information as the printed receipt from the IonScan machine. Mailroom staff writes the date of discovery, the item in question, and the type and amount of drug found.

Are there data to estimate unit costs of labor and capital?

The data on labor and capital costs have not yet been specifically collected, but could be identified with little additional effort. There are several costs associated with the use of the IonScan system:

- ❑ IonScan unit: ~\$60,000

- ❑ Training: two hour training for mailroom staff (unknown cost)
- ❑ Maintenance: There are several “consumables” associated with the IonScan system. Swabs can be used up to 25 times (if only negative results) before they must be discarded. The carbon filter and tubes must be replaced periodically. If contaminated by a very high dose of drugs, the system may need service from the vendor. Pima County staff suggested annual maintenance costs were \$500-700.

Currently the system is used approximately daily to check mail that is *suspicious* based on a visual inspection of the opened letter. Drugs are smuggled by dissolving them into a fluid that is then used to write the letter. Gel pens are especially useful. The bulk amount of fluid may cause damage to the paper surface, and the bulk amount of ink or crayon or other material may raise suspicion.

The amount of mail deemed suspicious and hence subject to trace the number of mailroom personnel limits detection analysis. Adding staff would add costs.

Furthermore, the identification of contraband may trigger an extended investigation of the sender and the recipient. Although this might be limited to interviews, it sometimes involves wiretaps of phone calls and criminal investigation and prosecution. This adds costs to the process.

Offsetting some of these costs, the system is portable and has been used on occasion to check inmates as they return from visits (including employment) outside the jail. Because of the amount of ambient drugs in areas where prisoners travel when released temporarily, testing positive is not necessarily indicative of recent drug use, but it can precipitate questioning and investigation.

Are there data for possible comparison technologies or other solutions?

Currently each positive “hit” on Pima County’s IonScan device is confirmed by lab analysis of the suspect item. Lab analysis is operationally more difficult because it is offsite, requires significant training, and can only test a small portion of the item in question. (Usually a small piece of a letter is removed and prepared for lab analysis.) The two systems are not independent because Pima County mail staff tells county lab technicians where on the letter the drug is to be found. However, lab reports on the items can be compared to the IonScan paper receipts to confirm the amount and type of drug tested. Visual inspection of mail (the method used prior to introduction of the IonScan device) did identify some instances of incoming drugs, but no records are available from that period of time.

In general, how useful are the data systems to an impact evaluation?

The printed receipt from the IonScan device is a useful record for an impact evaluation, however it does not show the number of items that were tested but shown to be negative (mailroom staff estimate that about 20% of items that were tested were positive), nor the proportion of mail that passes through the mailroom untested. Protocols could be put in place to record both positive and negative readings over the course of an evaluation.

Nevertheless, the log is a definitive count of those that tested positive, and we presume that few such suspicious items were detected prior to the use of IonScan. Thus the log provides a definitive measure of drugs removed from prison circulation. Furthermore, the log provides a time series, so an evaluator could derive a measure of the deterrent effectiveness of using the IonScan. Given a longer time series,

an evaluator might correlate the receipt of drug-infused mail with disciplinary actions or prosecutions of mail senders or recipients, providing an assessment of whether those collateral actions are a further deterrent to mailing drugs to prisoners.

2. Site Visit Screening

The Intervention

Has the organization implemented a policy or training for the technology's use?

Two types of knowledge are required to use this system effectively. In Pima County, only suspect mail is tested, so the first skill is the ability to recognize an item of mail that is likely to be contaminated. Mailroom staff lacks explicit training in this, but with experience they acquire an ability to recognize paper that may have been tampered with. The second is training in the use of the detection system itself. This training is conducted by Smiths Detection and takes approximately two hours. During that time, the trainee learns not only how to run the IonScan device, but how to service it when maintenance is required. In Pima County, outside help from the vendor was required only once since the beginning of the trial in July of 2005.

Who are the users?

Users are correctional officers and mailroom staff who need to identify trace amounts of drugs in mail or on an inmate's person.

Who/what are the targets?

In Pima County, trace detection is primarily used in the mailroom. It is used to detect drugs in incoming personal mail before it reaches the recipient. Currently the system is only used to test items that are identified by the staff as suspicious. The system is portable and can be transported to other locations for testing the hands of visitors or inmates returning from a work-release program.

Who/what gets excluded as a user or target?

The law protects legal mail (mail from an attorney to his client) from search prior to delivery to the recipient. In the event that legal mail looks suspicious, jail authorities will contact the mailing attorney to assure that the attorney actually sent the letter, because a prisoner's associates sometime counterfeit the attorney's letterhead. Attorneys may give permission to open a suspicious letter. Otherwise, legal mail cannot be opened and tested with the IonScan device.

Mail that does not catch the attention of mailroom staff may pass through to an inmate without testing. Although checking every item of mail would be too time consuming for the available staff, a random check of some proportion (~20%) could identify other instances of contraband entering the jail. An evaluation could show the frequency at which mail not deemed suspicious actually contained contraband.

Have the characteristics of the user or target population changed over time?

The characteristics of the user and target population have not changed significantly over time. Mailroom staff have become more adept at identifying the area of a suspicious letter most likely to contain drug compounds. Also, the number of positive “hits” in proportion to total mail has decreased since the system was put in place. This is attributed to increased awareness among inmates and inmates’ contacts of the likelihood of detection and a decrease in attempts to send drugs through the mailroom.

What values/outcomes do users see/envision in the technology?

The primary goal of the use of this technology in Pima County is to prevent the introduction of drugs into the facility. By detecting trace amounts of drugs, mailroom staff can remove the contaminated item from circulation and prevent inmates from using the drugs. The use of drugs in a correctional facility causes problems on many levels. Inmates who are high are more likely to be violent towards one another and to correctional officers. In addition, a trade in drugs promotes debts and antagonisms between inmates that can lead to gang-related violence. If drugs are entering a jail or prison, inmates lose trust in the ability of correctional officers to maintain order, and may resort to making homemade weapons for self-defense from other inmates. Use of these weapons greatly increases the number of severe injuries inflicted. Pima County staff estimate that 90% of contraband materials enter the prison through the mailroom. Trace detection technology can eliminate or greatly reduce this source of contraband materials and thus promote a less violent population.

Trace detection can also be used to test individuals, and has been used at the nearby Mission prison to test inmates returning from a work-release program. In this case, trace detection can be used as an enforcement technology, allowing prison staff to identify inmates who have broken work-release rules by using drugs. In one testing, 10 inmates admitted using drugs when confronted by the evidence of trace amounts of drugs on their hands. The evidence can be used in some cases to prosecute individuals, either who break parole by consuming drugs or who anticipate receipt of drugs through the mailroom. Pima County has successfully prosecuted five cases of attempting to bring contraband into a facility over the course of the 18 months since the use of trace detection technology began.

What are the limitations/obstacles to using the technology?

The small-scale trace detection machines now available are all based on swabbing an item and testing the residue on the swab. (Large non-swab technologies such as the phone-booth sized “sniffers” used in airports are available, but are significantly more expensive.) On a contaminated item there may be only a single area that contains contraband material. This means that a user must know where to test in order to obtain a positive result. This becomes an important issue when trace detection is used in other arenas. For example, border control officers must know where to take samples in a car that is being inspected. Each swab covers only a few inches of material, so there is a possibility that significant quantities of drugs may pass undetected if they are in an area that is not tested. Drug dogs, in contrast, can find drugs at a distance. However, the benefits of specificity and ease of use make trace detection machines very useful despite the limitation of swabs.

Although not a limitation, another concern in the use of trace detection technology is that it is extremely sensitive. Pima County officials worked with the county lab staff to agree upon a threshold of concern. Trace amounts less than that threshold were considered not high enough to represent a

usable amount and may be the result of cross-contamination. Because mail can easily be cross-contaminated, staff must be trained to test the inside of mail rather than just the envelope in order to avoid positive results that may not indicate deliberate attempts to send contraband. Any study should note not just the detection of a drug, but the amount detected to avoid the inclusion of trace amounts so small that they represent only cross-contamination.

What outcomes could be assessed? Using what measures?

The primary outcome that can be assessed is the number and type of drugs prevented from entering a facility through the mailroom. Specific process measures include:

- ❑ Proportion of mail tested.
- ❑ Proportion of tested mail that tests positive (above threshold).
- ❑ Type and amount of drug detected for each positive item.
- ❑ Type and amount of drug confirmed through county lab results.
- ❑ Reduction in attempts to send contraband through the mailroom as evidenced by a reduction in the number of items that test positive since the introduction of trace detection technology in 2005.
- ❑ Disciplinary actions and prosecutions initiated because of mailroom detection.

These are process measures. Outcome measures involve the amount of illegal drug use in the jail. Collecting such outcome measures would require separate data collection. Potential outcome measures are:

- ❑ Drug use in the jail.
- ❑ Sequela of drug use in the jail.

Absent random urine testing (which does not appear to happen in the Pima County jail), there seems to be no way of monitoring drug use over time. An evaluator might acquire a snapshot of drug use within the jail using a survey. It would require clever survey technology to acquire valid responses. Furthermore, the utility of the survey would be limited to identifying the prevalence of illegal substance use and the method of acquisition.

Designing a Study

Are there other operational environments for which the technology is well-suited?

What are the constraints in such environments?

The technology is applicable to long-term and medium-term detention. Pima County officials noted that mail inspection is unnecessary for short-term detention, because short-term detainees do not receive mail. Trace detection has also been used by border-control officers to test automobiles entering the country. However, particulate matter trace detectors are limited by the officers' ability to recognize where to take a sample. This technology is only useful in environments where the area to be searched is small.

Do the technology "events" permit randomly generated applications of the technology?

If not, can comparison samples be formed? With what difficulties?

A true randomized experiment would be difficult to design. An evaluator could select a random sample of jails and then assign some to the treatment condition and some to the control condition, but this design seems impractical. For one, given differences across jails, the sample of jails would have to be large to assure adequate statistical power. For another, trace detection technology (and staff to administer the technology) is expensive. Thus, an evaluator might ask: How has trace detection technology affected drug use in the Pima County jail or in some other jail?

There appears to be no way to induce randomly generated events. If perpetrators (e.g., those who mail drugs into jails) were deterred by mail inspection, then a random pulse of inspection would cause a deterrent effect that would contaminate any random period of abatement.

Moreover, the first research question is whether or not the introduction of trace detection technology results in a higher discovery rate of contraband than would have been true in the absence of trace detection technology but in the presence of routine mail inspection (opening the mail, performing visual inspection, and using x-ray). Prior to the introduction of trace detection technology, mailroom inspectors sometimes sent mail to a laboratory for testing. We presume (but we did not ask) that the earlier laboratory results are available, so that an evaluator could determine the frequency at which contraband was detected by laboratory analysis prior to the introduction of trace detection methodology. This frequency could be compared with the frequency at which contraband was confirmed through the combination of trace detection technology and laboratory confirmation after the introduction of trace detection technology. An inference about the effectiveness of trace detection technology at identifying contraband could be determined from inspecting the time series.

A remaining question is the rate at which the trace detection technology misses mailed contraband because of the relatively high threshold for “suspicion” necessitated by the number of mailroom staff. A stratified random sample of non-suspicious mail could provide an estimate of what is missed by the current application of the technology. This is a useful evaluation question because the jail could increase mailroom staff if that would be worthwhile, and research findings could provide evidence useful for justifying a larger budget for the mailroom.

How many times would the technology be applied in one year?

The technology is applied throughout the year on an almost daily basis. Given greater staffing resources, an evaluation could involve using the technology significantly more frequently with minimal additional costs in terms of “consumable” resources.

Will modest but statistically significant effect sizes be detectable given sample sizes?

Sample size should not be an issue. The power of detecting an effect from the time series should be high unless there is a great deal of variance from period to period in the frequency of positive laboratory tests during the period predating the use of trace detection technology. Before the introduction of trace detection techniques, we suspect that the number of positive tests approaches zero on a monthly basis. Thereafter, the number approaches about 10-15 on a monthly basis. This should provide ample statistical power.

When sampling the non-suspicious mail and testing it for embedded drugs, the sample need not be large. An evaluator is not testing a hypothesis about the frequency of embedded drugs in suspicious and non-suspicious mail. The evaluator is simply attempting to estimate the frequency of embedded

drugs in the non-suspicious mail. If this were a simple random sample, the standard error for the estimate would be $\sqrt{P(1-P)/N}$, where P is the proportion of drug-positive letters in the non-suspicious mail and N is the sample size. An evaluator who tests 25 mailed items per day for 48 weeks would have a sample of 6000, which seems more than adequate to estimate the proportion of non-suspicious letters that contain contraband.

How many units—if any—would have to be procured for an evaluation?

None unless this evaluation was to be done in a jail that does not currently have the technology. Manpower, not the machinery, appears to be the constraint. We presume that Pima County would allow an evaluation team to use the Pima County equipment to test non-suspicious mail provided that the evaluator provides the manpower and pays for the incremental costs.

What does a control/comparison group receive?

Based on the time series, the comparison group would receive visual inspection, x-ray scan, and occasional laboratory testing. The treated group would receive visual inspection, x-ray scan, use of IonScan, and subsequent laboratory testing.

Based on the random selection of non-suspicious mail, the treatment group (e.g., the non-suspicious mail) would receive visual inspection, x-ray scan, and IonScan; the comparison group would not receive the IonScan.

What kinds of data elements are available from existing data sources?

The Pima County Jail mailroom maintains a log of contaminated mail that was intercepted since the program's inception. In addition to this log, they keep copies of a "receipt" printed for every positive result from the IonScan machine

What specific input, process, and outcome measures would they support?

Extant data, when incorporated into the time-series design, can help identify patterns in the detection of contraband embedded in inmate mail, but these data are insufficient to support the entire evaluation. Currently, the data include only information such as the time and date of the test, the amount and type of drug found, and lab confirmation on the drug found. Additional information on legal outcomes such as prosecution is only available for a very few cases. Final outcomes, such as reduction in drug use, are not monitored.

To elaborate, the detection of embedded contraband is one step in a process. Once the contraband is detected, jail authorities may talk with the inmate or they may take investigative steps that can culminate in a prosecution. An evaluator should carefully trace the steps taken when contraband is detected in the mail and the results from internal and external investigations.

Additionally, while removing contraband from the mail is important, that act itself does not provide that the jail has made a major impact on within-jail drug use. We understand that the jail does not perform routine random urine testing, so there is not extant data regarding drug use. It seems unlikely that an investigator could perform random urine testing in a jail setting, and furthermore urine testing

would not explain all that would be of interest to an evaluation. An inmate survey that asks inmates to report the prevalence of drug use in the jail and to assess how drugs move into the prison could prove more valuable. This would be a difficult survey to design. It might be part of a larger health survey that would also ask about illicit drug use, and it might ask respondents to report on general drug use in the jail population. Despite the difficulty of asking about drug use, a useful survey might only need to provide an estimate of how drugs move into the jail. If jail officials are correct that 80% of drugs move into the jail through the mail, then this fact alone can tell an evaluator the importance of intercepting drugs in the mailroom.

An evaluator might propose to conduct a time series of the rate at which contraband is discovered in the mail. The time series would run for a period before the introduction of trace detection technology and for a period after the introduction of trace detection technology. If there were a deterrent effect, we would expect the frequency of detecting drugs to peak with the introduction of the technology (perhaps following a break-in period) and then to moderate to a fairly steady state. We understand that the jail has experienced a few significant events relating to discipline/prosecution of inmate traffickers. An evaluator should identify those events and see if they have an effect on reducing the importation of illegal drugs.

How complete are data records? (Attain samples if possible.)

We requested but did not receive data records.

Can user and/or target populations be followed over time?

We did not discuss this during the site visit. It may be worthwhile to track patterns in the use of mail to import drugs into the jail. Presumably the same inmate has little or no chance to repeat his or her behavior, so there would be little reason to track a target population over time. But there may be patterns such that inmates from particular places, or inmates that are associated with particular gangs, have higher smuggling rates than do other inmates.

Can the dosage of technology used be identified?

Yes, the threshold dosage is that currently used in Pima County. The effect of any other dosage could be inferred from the sample of non-suspicious mail.

Can data systems help diagnose implementation problems?

Yes, the random sample of non-suspicious mail can help diagnose implementation problems in the form of non-optimal search rules or in the form of understaffing.

What threats to a sound evaluation are most likely to occur?

Because the analysis would be based on a time series, there is the prospect that the time series would not adequately control for external factors. This would be mitigated by the sharp interruption that the use of trace detection technology would introduce into the time series.

We are uncertain about inmates' willingness to report on drug use in custody. However, questions about the general vector of drugs into the jail would seem to be less threatening than would questions about substance use per se.

What changes is the site director willing to make to support the evaluation?

We did not discuss the proposed structure of this evaluation with jail administrators. However, the proposed design does not impose heavy costs of jail administrators.

3. Overall

Would you recommend that the technology be evaluated? Why or why not?

We recommend that the technology be evaluated, but we do not see value in simply answering the question about whether or not the use of trace detection technology helps identify drug-embedded mail. The utility of preventing such mail from entering the jail depends on whether interdiction appreciably reduces the volume of drug use in the jail. This cannot be inferred from interception rates without confirmation that the mail is the principal vector of drugs into the jail. A survey seems like the best way to get at this information.

Furthermore, the question remains: What is the advantage of reducing drug use in the jail? Jail administrators have an explanation, which we sketched above in the logic model. Can an evaluator confirm that the presence of drugs has this deleterious effect? We doubt that this can be demonstrated empirically, but testimonial evidence would be valuable.

What type of evaluation design would you recommend?

See above. We recommend an interrupted time-series analysis of the number of drug-embedded letters intercepted in the jail mail. We recommend experimental testing of a stratified random sample of non-suspicious mail to estimate the percentage of contraband intercepted by the current mail inspection program and how that percentage could be increased by expanding the use of trace detection technology.

We recommend a process analysis to understand how the trace detection works in practice and especially to understand how jail administrators use the results of mailroom inspections beyond the obvious step of interdicting the drug-embedded item of mail. We recommend that special events of public discipline and prosecution be introduced into the time-series analysis to test for deterrence.

We recommend a survey of jail inmates to understand how drugs enter into the jail. If an appreciable proportion of drugs enter the jail through other vectors, then the effectiveness of mail intercepts is necessarily diminished.

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