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Development of a Systematic Social Observation Tool for Monitoring Use of Harm Reduction Supplies

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Abstract

BACKGROUND: Harm reduction services such as safer injection supply distribution are essential to reducing morbidity and mortality among people who use drugs (PWUD); however, local use of harm reduction supplies (e.g., tourniquets, saline solution) is difficult to routinely and systematically monitor. The purpose of this study was to develop and validate a systematic social observation tool designed to assess use of harm reduction supplies at the street block level.

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Ethical approval: This research was reviewed by the Institutional Review Board at the University of Pennsylvania and deemed non-human subjects research. All procedures performed were in accordance with the ethical standards of the University of Pennsylvania Institutional Review Board and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Ethics approval
This research did not use human subjects data and was deemed non–human participant research by the University of Pennsylvania Institutional Review Board. All procedures performed were in accordance with the ethical standards of the University of Pennsylvania's Institutional Review Board and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: This research is not human subjects research, and informed consent was not necessary.

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EDN: Conceptualization, methodology, project administration, formal analysis, writing - original draft; SA: Conceptualization, project administration, writing - original draft; AJM: conceptualization, methodology, writing - review & editing. DFH: conceptualization, methodology, writing - review & editing.

Declaration of interests
The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

METHODS: Data collection took place on a random sample of 150 blocks located throughout the Kensington neighborhood of North Philadelphia from November 2021 to January 2022. We measured inter-rater reliability by two-way mixed-effects intra-class correlation coefficients (ICC) with the consistency agreement definition and internal consistency reliability using Cronbach's alpha and McDonald's omega. Exploratory factor analysis with principal component extraction and promax rotation assessed internal consistency. We validated scales against locations of public syringe disposal boxes, a proxy measure for areas of concentrated drug use, using logistic regression.

RESULTS: Naloxone canisters, syringe caps, saline and sterile water solution bottles showed the highest reliability (ICC≥0.7). Items also showed high internal consistency (alpha, omega>0.7). Exploratory factor analysis identified one, three-item scale with high internal consistency: syringe caps, vials, and baggies (alpha=0.85; omega=0.85)—all supplies used concurrently with drug injection but not discarded in syringe disposal boxes. Drug use (OR=1.784, 95% CI=(1.48, 2.23)), harm reduction (OR=3.53, 95% CI=(2.20, 6.12)), and EFA scales (OR=1.85, 95%CI=(1.51, 2.34)) were significantly and positively associated with being within walking distance (≤0.25 miles or 0.4 km) of a syringe disposal box.

CONCLUSION: This study provides an efficient tool with high reliability and validity metrics to assess community uptake of harm reduction supplies designed for use by community organizations, policy makers, or other groups providing resources to PWUD.

Keywords

harm reduction; naloxone; syringe; systematic social observation; neighborhood; drug use

INTRODUCTION

The U.S. overdose crisis is a continuing public health emergency, with over half a million opioid-related deaths from 1999–2020 along with increased incidence of opioid use-associated infections from HIV, hepatitis B and hepatitis C, and other bacterial infections (e.g., endocarditis) (Centers for Disease Control and Prevention, 2022). At the same time, morbidity and mortality from psychostimulants (e.g., methamphetamine, cocaine), benzodiazepines, and other synthetic compounds (e.g., xylazine), often concurrent with opioid use, has increased (Ciccarone, 2021; Friedman et al., 2022). Harm reduction services such as syringe exchange programs for safer injection and naloxone distribution are essential to reducing morbidity and mortality among people who use drugs (PWUD), particularly opioids (Hawk et al., 2015; Winhusen et al., 2020). Studies conducted in the U.S., U.K., Australia, and Canada have shown that community-based harm reduction programs that distribute naloxone and safer injection supplies such as sterile syringes, medical-grade tourniquets, sterile water, alcohol pads, and cookers have shown positive effects at the population level. These programs are cost-effective (Langham et al., 2018; Naumann et al., 2019; Townsend et al., 2020), are associated with reduced community fatal opioid overdose rates (McDonald & Strang, 2016), and limit the transmission of injection-related bloodborne pathogens (e.g., HIV, hepatitis C) (Platt et al., 2017; Puzhko et al., 2022).

While harm reduction services organizations can track their organizational dispensing of harm reduction supplies, it is difficult to track if and where distributed supplies are actually used (Dolatshahi et al., 2019). These data, if programs were able to collect them, could help guide distribution efforts and assist programs in more specifically targeting areas where people need services most. Currently, the most common ways to monitor use of harm reduction supplies are when PWUD return to a distribution point to replenish supplies or when outreach teams who distribute supplies ask individuals about recent activities via surveys. However, PWUD may be reluctant to tell service providers that they do not use or inconsistently use harm reduction supplies because of fears of stigma and social desirability bias (Davis et al., 2014; Falk et al., 2020; Latkin et al., 2017). Naloxone recipients may not want to answer questions about when and where they participated in an overdose reversal because of fear of legal repercussions or because they do not want to spend time doing so (French et al., 2021). Participant and staffing costs associated with survey recruitment and analysis may also be prohibitive for harm reduction services organizations (Behrends et al., 2022; Bonevski et al., 2014). The changing nature of syringe service provision also impedes monitoring supply use via surveys. Most harm reduction organizations encourage secondary exchange where PWUD exchange used syringes on behalf of peers who did not personally attend the program (Des Jarlais et al., 2015). Increasing popularity of alternative syringe delivery mechanisms including secondary distribution, home delivery, mobile units, and mail-based delivery results in less frequent visits to brick-and-mortar harm reduction services programs and fewer opportunities for staff interaction, increasing difficulty for survey recruitment (Hayes et al., 2021). The use of GPS monitoring systems to track supply use has been suggested, but ethical concerns about surveillance among PWUD limit the practicability of this approach (Lai et al., 2020). In addition, aside from syringes or naloxone, the use of other commonly-distributed harm reduction supplies found in safer injection kits, such as tourniquets and saline solution, is not routinely and systematically monitored. Consequently, harm reduction service providers may benefit from additional evidence-based tools that do not directly involve surveying PWUD to bolster their assessment of the use of harm reduction supplies to inform and strengthen their efforts.

Research from Spain has shown that tracking discarded syringes (i.e., syringe litter) is a useful tool for positioning community harm reduction services such as syringe exchange, as well as monitoring open-air drug market location changes in response to police interventions (Barbaglia et al., 2021). This research has not been extended to other harm reduction products. Systematic social observation (SSO) offers a possible method for monitoring use of harm reduction supplies. SSO is a standardized approach for directly observing the physical, social, and economic characteristics of neighborhoods (Sampson & Raudenbush, 1999). Observations of naturally-occurring events or characteristics are recorded according to explicit rules that facilitate replication; the SSO method is particularly useful for assessing physical conditions and social interactions within neighborhood settings that may not be accurately captured or described via surveys or interviews (Sampson & Raudenbush, 1999). In our study, trained researchers recorded items such as harm reduction supplies (e.g., naloxone canisters, medical-grade tourniquets, sterile water ampules, and syringes) using a standardized assessment tool on the street block-level. Previously-validated SSO instruments have been designed to record neighborhood indicators of drug use including crack/cocaine, marijuana, and alcohol (Furr-Holden et al., 2008, 2010; Furr-Holden, Milam, Nesoff, Garoon, et al., 2016; Milam et al., 2016), but to our knowledge no tools record comprehensive indicators of the use of harm reduction supplies.

Philadelphia, Pennsylvania, the site of this study, has both the highest fatal overdose rate and highest poverty rate of any large city the U.S. (Philadelphia Department of Public Health, 2018; The Pew Charitable Trusts, 2018), and multiple harm reduction organizations and community groups provide syringe services and other safer use supplies to PWUD (Aronowitz et al., 2021; French et al., 2021). Kensington, a neighborhood in North Philadelphia, had the highest number of fatal and non-fatal overdoses in the city in 2021 (Higgins et al., 2022). This neighborhood has made US news for its extremely potent fentanyl supply, common public drug use, and contentious efforts to clear homeless encampments (Metraux et al., 2019; Percy, 2018). Because of open-air drug markets, lack of a safer consumption site, and high rates of unstable housing among PWUD in certain areas of the city (half of Philadelphia's homeless population lives in Kensington) (Philadelphia Department of Public Health, 2019), many PWUD in neighborhoods such as Kensington use substances outdoors (Roth et al., 2021). Kensington is also disproportionately impacted by non-resident PWUD looking to purchase and consume drugs (Rosenblum et al., 2014). Non-resident PWUD may commonly use drugs in public or semi-public spaces (e.g., parks, cars) as they may wish to avoid the stigma of drug use at home while also avoiding detection by police and the general public (Darke et al., 2001; Sutter et al., 2019). This confluence of factors results in syringe litter, which the Department of Public Health and community groups address via safe syringe disposal boxes and periodic neighborhood clean-ups (Roth et al., 2021). However, many other harm reduction and substance use supplies are not cleaned up as they do not present the same infectious disease risk as discarded syringes (Figure 1). Nevertheless, the Kensington neighborhood is not a monolith, and drug use is not uniform throughout the area. Additional evidence-based tools to discern where, exactly, drug use occurs may help better locate harm reduction, outreach, and cleanup efforts. In this study, we describe the development of a tool for monitoring use of harm reduction supplies, the tool's reliability and validity metrics, and its potential to be used for a variety of research and community needs.

METHODS

Tool Development and Measures

The Neighborhood Inventory for Environmental Typology (NIfETy) is a standardized inventory designed to assess characteristics of the neighborhood environment related to violence, alcohol, and other drug (VAOD) exposures (Furr-Holden et al., 2008; Milam, Furr-Holden, Cooley-Strickland, et al., 2014). It has been widely used in previous studies to examine the impact of neighborhood characteristics on drug use risk factors (Furr-Holden, Lee, et al., 2011; Milam, Furr-Holden, Harrell, et al., 2014; Nesoff et al., 2022), exposure to community violence (Furr-Holden, Milam, et al., 2011; Rossen et al., 2011), and other injury outcomes (Nesoff et al., 2019). NIfETy includes over 160 items operationalized into 7 domains: physical layout, types of dwellings, adult activity, youth activity, physical disorder, social disorder, and VAOD indicators (Furr-Holden et al., 2008). NIfETy has strong psychometric properties; ICC for the total inventory is 0.84, and 0.67 to 0.79 across coders (Furr-Holden et al., 2010). Validity metrics are also strong (Furr-Holden et al., 2010). In this study, we modified existing NIfETy measures and added new measures specifically for assessing uptake of harm reduction supplies.

NIfETy's VAOD subscale includes drug use measures (e.g., syringes, blunts, baggies), but it does not include harm reduction supplies measures. We developed 11 items on harm reduction supplies (e.g., naloxone canisters, medical-grade tourniquets, sterile water ampules, and other safer injection supplies) and included five previously-validated VAOD measures (Furr-Holden et al., 2010) (Table 1). We consulted with community partners in harm reduction to ensure our list of supplies was robust and useful for harm reduction surveillance purposes; we included an open-ended question for "other supplies" to capture new and emerging drug use and harm reduction supplies less commonly distributed at the time of data collection. We then trialed our new harm reduction tool on four non-study blocks in Kensington, Philadelphia, and refined the tool based on what we observed. For example, because of periodic neighborhood clean-up activities in Kensington, syringe barrels and needles which present a risk for infectious disease transmission are often collected, but syringe caps are not (Figure 1). Therefore, we segregated the "syringe" variable into "syringes (barrels and/or needles)" and "syringe caps & plungers" with the instruction that the "syringe cap" item should only to be recorded if the cap is not still attached to or next to a syringe (Table 1). Naloxone canisters, including canister packaging, were measured as a continuous count variable. All other drug use and harm reduction variables were measured on an ordinal scale of "Zero;" "1–3;" "4–7;" "8 or more" (Table 1). This ordinal scale was selected to facilitate data collection expediency amid safety concerns for coders on the block and to align with previously-validated items in the original NIfETy (Furr-Holden et al., 2010).

Data Collection

Like most observational assessments, NIfETy uses systematic sampling of blocks to obtain an overall representation of neighborhood characteristics (Bader et al., 2015; Day et al., 2006; Furr-Holden et al., 2008; Odgers et al., 2012). Data collection took place on a random sample of 150 city blocks located in the Kensington neighborhood in North Philadelphia (sample size was determined by calculating the number of subjects required in a reliability study, where reliability is measured using intraclass correlation (Walter et al., 1998; Zou, 2012); we included additional blocks in case some blocks could not be completed) (Figure 2). We used publicly-available planimetric maps of Philadelphia to generate a sampling frame of Kensington streets (City of Philadelphia, 2014). A street block is defined as the distance from one intersection to the next intersection, a distance of approximately 0.1 miles (0.16 km) (Nesoff et al., 2018). Streets categorized as "expressways" or "ramps" were eliminated from the sampling frame. We then used a random number generator to select our sample of street blocks.

To assess neighborhood presence of harm reduction supplies, seven coders who were familiar with the Kensington neighborhood and had experience working with PWUD in community settings were recruited to perform data collection. While there is some discussion in environmental observation methods that coders familiar with a neighborhood may interpret characteristics differently than coders to whom the neighborhood is unfamiliar (Furr-Holden et al., 2008; 2014), in this case we recruited coders familiar with Kensington to ensure their comfort walking around the neighborhood and ability to respond to situations common to the area, such as overdoses. The seven coders were all harm reduction community organizers; four were nursing students who participated in this study to fulfill a 14-hour research residency requirement, and the other three worked in harm reduction-related jobs part-time. Coders took part in a 60-minute training reviewing the study's purpose, protocol, and definitions of all terms with pictures and were given a field guide with the same information. They then visited seven non-study blocks to practice data collection and met with study staff for an additional hour to discuss any confusion on measures or other concerns. As a safety measure and to ensure coders could see smaller items, coders were instructed to collect data during daylight hours (9 a.m. to dusk) and to remain on public sidewalks (i.e., data collection did not include vacant lots or alleyways) (Furr-Holden et al., 2008). Coders were also instructed to skip blocks they perceived as unsafe based on their personal judgment.

We initially intended to use Fulcrum, a cloud-based platform that facilitates data collection on mobile devices (Giovenco & Spillane, 2019), as we thought study staff would be less conspicuous on the block looking at their phones than walking with paper and a clipboard. However, coders did not feel comfortable using their phones to record data, and using paper forms helped them resemble street outreach and neighborhood cleanup teams common in the neighborhood.

Two coders visited each street block separately to create two independent assessments (Furr-Holden et al., 2008). Coders were instructed to walk the block as many times as necessary to thoroughly collect all measures. Each assessment took approximately 15 minutes to complete. Data were coded on paper forms the size of a half sheet of paper, and coders were instructed to send study staff pictures or scans of their coded forms at the end of each coding session to facilitate social distancing necessitated by the COVID-19 pandemic. Coders were instructed not to discuss or share their assessments with other coders, and project staff reviewed completed sheets after each coding session to check the same blocks were not coded on the same days (Furr-Holden et al., 2008). We aimed for approximately 30 days between data collection visits to conservatively evaluate consistent presence of items on blocks. Data sheets were also reviewed by project staff to assess comprehensiveness and accuracy of data collection after each coding session. Data collection took place from November 2021 to January 2022.

Analysis

Data sheets collected from the two independent coders were entered into SPSS 25 by a research assistant and then reviewed by the primary investigators for accuracy. Inter-rater reliability was assessed for each observation pair using intra-class correlation coefficients (ICC); with ordinal data, ICC and weighted kappa are roughly equivalent (de Raadt et al., 2021; Fleiss & Cohen, 1973). Average rater reliability is reported for the two-way mixed-effects ICC model from Shrout and Fleiss (1979) with the consistency agreement definition. ICC estimates ranging from 0 to 0.2 were classified as poor, 0.2 to 0.4 as fair, 0.4 to 0.6 as moderate, 0.6 to 0.8 as substantial, and estimates between 0.8 and 1.0 as almost perfect (Landis & Koch, 1977). Certain items did not show any variability across locations and are labeled "Constant," indicating their consistent presence or absence from the block.

Internal consistency reliability was measured using Cronbach's alpha and McDonald's omega (using the SPSS macro from Hayes & Coutts (2020)) for the drug use indicators, harm reduction indicators, and all items combined. Cronbach's alpha and McDonald's omega range from 0 to 1, with higher values indicating a more reliable scale (Cortina, 1993).

Exploratory factor analysis (EFA) was employed to assess internal consistency of drug use and harm reduction scales in STATA 17. The purpose of EFA was to identify possible latent constructs measured by our drug use and harm reduction items, as well as to identify clusters of homogenous variables that could be used to assess the presence of drug use and harm reduction supplies without having to collect the entire data form. Because we did not have a preconceived idea of the number of latent constructs or underlying factor structure of the variables, EFA was appropriate (Child, 1990). We examined the pairwise correlation matrix (available from the authors upon request), and Bartlett's test of sphericity was used to ensure that the correlation matrix was not random; the Kaiser-Meyer-Olkin (KMO) statistic was required to be above a minimum of 0.50 (Bartlett, 1954; Kaiser, 1974; Watkins, 2018). After confirming that the correlation matrix was factorable, we performed EFA with principal component extraction and promax rotation (Finch, 2006). Eigenvalues of greater than 1 were used as criterion for factor extraction; items with loadings of less than 0.2 and double-loaded items were dropped. Only items that loaded more strongly on to their corresponding factors were retained to ensure discriminant validity. A Cronbach's alpha and McDonald's omega of 0.6 or greater was accepted as a measure of internal consistency for each scale (Cortina, 1993).

To evaluate external validity for the drug use and harm reduction measures as well as scales developed through EFA, we evaluated the relative distance of sampled blocks to public syringe disposal box locations, a proxy measure for areas of concentrated public drug use (De Montigny et al., 2010). The Philadelphia Department of Public Health maintains syringe disposal boxes in Kensington targeted to areas with high concentrations of public drug use; these disposal boxes are publicly accessible 24 hours a day, seven days a week, and can hold approximately 1,500 syringes each (n=27) (Feldman, 2018; Philadelphia Department of Public Health, 2021). We calculated the Euclidean distance from each sampled block to the location of the closest syringe disposal box. We then stratified by whether the block was ≤ 0.25 miles (0.4 km) from the closest syringe disposal box, a widely-used standard for walking distance in urban environments (Furr-Holden, Milam, Nesoff, Johnson, et al., 2016; Milam et al., 2016; Nesoff et al., 2020; Rossen et al., 2011; Salbach et al., 2015). We used univariable logistic regression to model the relationship between individual variables, drug use, harm reduction, and EFA scales and being in walking distance to a syringe disposal box (yes vs. no).

RESULTS

Data collection could not be completed on four blocks (2.6%) because of safety concerns from active drug dealing. Only one set of measures was collected on 13 blocks (8.6%) because of COVID-19 infections among our research team. A total of 127 blocks (84.7%) had two independent sets of measures and were included in data analysis. Mean difference in days between rater block visits was 35.2 days (sd=27.9) (Median=29 days). The prevalence of items ranged from 0.0% to 67.7% (Table 2). Reusable supplies (e.g., tourniquets) and supplies that are distributed infrequently (e.g., "stems" and "bubble pipes" for safer smoking) were the least prevalent on sampled blocks (<10% of blocks). Supplies that are not commonly collected by clean-up crews such as baggies, vials, and syringe caps were the most prevalent on the sampled blocks (>50% of blocks). This may also explain the higher prevalence of syringe caps (57.5%) compared to complete syringes (22.8%). Other drug use and harm reduction supplies not specifically measured were observed on 22.0% of blocks and included fentanyl test strips, home drug test packets, cottons, poppers, nitrous oxide canisters, syringe wrappers, rolling papers, heroin spoons, empty lube packets, Kratom packets, K2 packets, empty prescription pill bottles, and pre-rolled joint canisters. Street cleanup and outreach teams were only observed on 1.6% (n=2) of blocks. Mean distance to closest public syringe disposal box was 0.59 miles (sd=0.40) (Range: 0.03 to 1.33 miles) or 0.95 km (sd=0.60) (Range: 0.05 to 2.14 km).

Inter-rater reliability estimates are presented in Table 2. Overall, items showed strong reliability. Presence of syringe caps, sterile water ampules, and naloxone canisters showed the highest reliability with ICC≥0.7. Syringe needles and barrels, vials, and baggies showed moderate agreement (ICC 0.4–0.6). Tourniquets, buprenorphine film wrappers, pipes/stems, cooker caps, and wound care supplies showed moderate to fair reliability (ICC≤0.4). Pipes/stems and cooker caps showed poorer reliability, possibly influenced by their low prevalence on blocks. However, all drug use and harm reduction items together showed high internal consistency (alpha=0.80, omega=0.88). The drug use items separately showed high internal consistency (alpha=0.77, omega=0.86), while internal consistency for harm reduction items was more moderate (alpha=0.63, omega=0.55).

During EFA, all harm reduction and drug use variables were highly correlated. The results of Bartlett's test of sphericity indicated that the correlation matrix was not random ($\chi^2(105)=26.5$, $p<0.001$)(Bartlett, 1954; Watkins, 2018), and the KMO statistic was 0.76, above the minimum standard for conducting factor analysis (Kaiser, 1974; Watkins, 2018). Therefore, it was determined that the correlation matrix was appropriate for factor analysis. Several items loaded onto multiple factors and were dropped. This produced one, three-item scale with high internal consistency: syringe caps, vials, and baggies (alpha=0.85, omega=0.85) (Table 3). Higher scores (range 0–9) indicate higher levels of drug use supplies on a block.

Logistic regression showed significant positive relationship between almost all individual items and being within walking distance (≤0.25 miles or 0.4 km) of a syringe disposal box (p<0.05) (Table 4). Because of low prevalence on sampled blocks, associations with some items (e.g., naloxone canisters) could not be estimated or were not significant. The full drug use and harm reduction scales were both positively associated with being in walking distance of a syringe disposal box. The odds of being within walking distance of a syringe disposal box increased 78% for each unit increase in drug use items (OR=1.784, 95% CI=(1.48, 2.23), p<0.001) and 3.5 times for each unit increase in harm reduction items (OR=3.53, 95% CI=(2.20, 6.12), p<0.001). The three-item EFA scale also showed a significant positive relationship. For each unit increase in the EFA scale, the odds of being within walking distance of a syringe disposal box increased 84.6% (OR=1.846, 95%CI=(1.51, 2.34), p<0.001).

DISCUSSION

This study provides support for a systematic social observation method to assess neighborhood presence of substance use and harm reduction supplies and compliments existing methods of tracking the use of harm reduction supplies (such as surveys and interviews with PWUD). Inter-rater reliability metrics were high for the majority of items (ICC≥0.7), and drug use and harm reduction items showed high internal consistency. EFA yielded one neighborhood supplies scale with high internal consistency—syringe caps, vials, and baggies. We further validated the drug use and harm reduction scales and the three-item EFA scale against locations of public syringe disposal boxes, a proxy measure for areas of concentrated drug use (De Montigny et al., 2010; Feldman, 2018). We found that drug use, harm reduction, and EFA scales were significantly and positively associated with being within walking distance (≤0.25 miles or 0.4 km) of a syringe disposal box. These scales included items that are not commonly collected by cleanup crews or disposed of in syringe disposal boxes but are used concurrently with syringes for drug injecting; therefore, we would expect to see more of these items in closer proximity to syringe disposal boxes.

Previous SSO tools and other spatiotemporal studies of discarded drug use supplies conducted in Spain, Canada, and the U.S. only included syringe counts as a measure of neighborhood-level risk of exposure to bloodborne pathogens or neighborhood physical and social disorder more broadly (Barbaglia et al., 2021; Ben-Joseph et al., 2013; Conover et al., 2021; De Montigny et al., 2010, 2011). This study provides a novel method for assessing use of harm reduction supplies designed for community organizations, policy makers, or other groups providing resources to PWUD. While harm reduction organizations or departments of public health may not have the funds to pay staff to regularly collect data via this tool, it may be used by clean-up or outreach crews who are already canvassing neighborhoods to dispose of syringe litter or meet clients. Outreach/clean-up crews might use this tool to note areas where they are seeing clusters of supplies litter (signaling that people might use substances on those blocks frequently), or, alternatively, areas where there is evidence of substance use (syringes, baggies) but no other supplies (potentially signaling a need for harm reduction supplies like sterile water or cookers). Systematic tracking of this information can inform future outreach efforts in these areas. It can be used to assess the prevalence of used naloxone canisters in neighborhoods after a naloxone distribution event or target locations for placement of sharps containers for safe syringe disposal. The tool can also be implemented along with other NIfETy measures to assess harm reduction supplies use in the community context. For example, the tool can be used to assess specific characteristics of neighborhoods such as liquor stores (Nesoff et al., 2021) to locate community features that are commonly located on blocks with indicators of drug use or harm reduction. In addition, the three-item scale can be used to assess overall neighborhood drug paraphernalia use without having to collect all items, saving time and resources when rapid data collection is necessary for pressing public health and health policy issues.

Limitations merit discussion. This study only assessed discarded drug use and harm reduction supplies in one U.S. metropolitan area. Certain aspects of drug use and harm reduction activities in Philadelphia and the Kensington neighborhood more specifically may limit the generalizability of findings to other urban settings. Cities with less organized community cleanups may see a higher prevalence of complete syringes including needles than syringe caps only as our study found. Public drug use in Kensington is high, which may not be the norm in other cities and may limit generalizability. PWUD in Kensington may also experience easier access to harm reduction supplies with more types of supplies available, potentially influencing what is discarded. However, public drug use is common across U.S. cities, particularly among PWUD experiencing homelessness or unstable housing (Sutter et al., 2019); cities with large homeless populations and/or frequent public drug use may resemble Kensington. Further studies in other geographic areas in the U.S. and other nations would aid in evaluating the generalizability of this tool. Data collection was limited to public sidewalks for safety considerations; estimates of harm reduction supplies use may be affected by excluding other common locations of semi-public drug use such as abandoned buildings. Mean difference in days between coder block visits was over 30 days; this time lag possibly contributed to discrepancies in observations across coders but also provided more conservative estimates of consistent drug use across blocks. Weather may also have impacted inter-rater reliability: 15% of blocks were visited on windy days, and 11% of blocks were visited within two days of rain or snow. It is possible that weather conditions may have pushed small supplies off sidewalks and into gutters or vacant lots, accounting for discrepancies across coders. Measures of community drug use rates such as fatal or nonfatal drug overdose locations were not available; consequently, we used locations of public syringe disposal boxes as a proxy measure for locations of concentrated drug use. Research on public syringe disposal boxes is limited. While previous research from Canada on public disposal boxes supports our assumption that locations of disposal boxes are proxy locations for areas of concentrated drug use (De Montigny et al., 2010), it is possible that box locations do not consistently overlap with areas of concentrated drug use. Future research should evaluate the tool against other drug use indicators such as overdose locations.

In addition, because some harm reduction supplies are both scarce and potentially reusable (e.g., glass pipes for safer smoking), PWUD may choose to keep rather than discard them after use, limiting our ability to track their use via this tool (Johnson et al., 2008). A study of PWUD across eight U.S. cities found that reuse of injection equipment was common, with 43% of participants reporting reuse of cookers, 27% reusing syringes, 33% reusing cottons, and 39% reusing water (Sutter et al., 2019). Reuse of these supplies may account for lower prevalence on blocks and lower inter-rater reliability.

The data collection experience and its impact on reliability also merit discussion. During data collection, our research assistants reported observing obvious drug dealing (n=4 blocks) and sex work (n=1 block), and two of our coders administered naloxone to reverse an overdose. Coupled with the high prevalence of drug use and harm reduction supplies observed across blocks, the data collection experience may have affected anxiety in our coders, who potentially rushed their data collection on blocks they perceived as unsafe (Furr-Holden, Milam, Nesoff, Johnson, et al., 2016). However, we believe we mitigated this possibility somewhat by hiring coders familiar and generally comfortable with the neighborhood. Hiring PWUD and clients of harm reduction programs who are familiar with the surrounding neighborhoods and locations where PWUD live and use drugs could prove mutually beneficial.

We are aware that use of this tool may not be realistic for some harm reduction organizations, as many such programs are under-resourced and may not have staff available to collect data. This data collection can be time consuming and is likely not the priority at many organizations. However, we believe that sharing our experience developing and testing this tool allows organizations to consider the tool's use, especially if they are trying to target outreach efforts to new areas or collect data about how and where different supplies are used by program participants; these activities may also provide useful data to present to policymakers, funders, or other key stakeholders. We imagine that this tool might be most realistically used by clean-up and outreach crews who are already canvassing neighborhoods.

Conclusion

In this study, we identified an efficient tool with high reliability and validity metrics to assess community uptake of harm reduction supplies. This novel instrument can be employed for a variety of research, health services, and community needs. Community organizations serving PWUD need additional tools to target outreach and distribution of harm reduction supplies to ensure that individuals hesitant to visit brick and mortar harm reduction services programs can access supplies (Gibson & Hutton, 2021). Our tool compliments existing methods of tracking the use of harm reduction supplies (such as surveys and interviews with PWUD) and can be used to assist community organizations and public health departments in tracking the use of harm reduction supplies, as well as targeting community distribution or cleanup activities. Future research should evaluate the tool in different geographic settings and against other drug use indicators such as overdose locations to further support its utility.

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HIGHLIGHTS

- Harm reduction services reduce morbidity, mortality for people who use drugs (PWUD)
- Harm reduction item use (naloxone, saline, cooker cap) not routinely monitored
- Efficient tool with high reliability & validity metrics
- Can track discarded items without monitoring the people who use them
- Designed for community outreach, policy makers, health services groups for PWUD

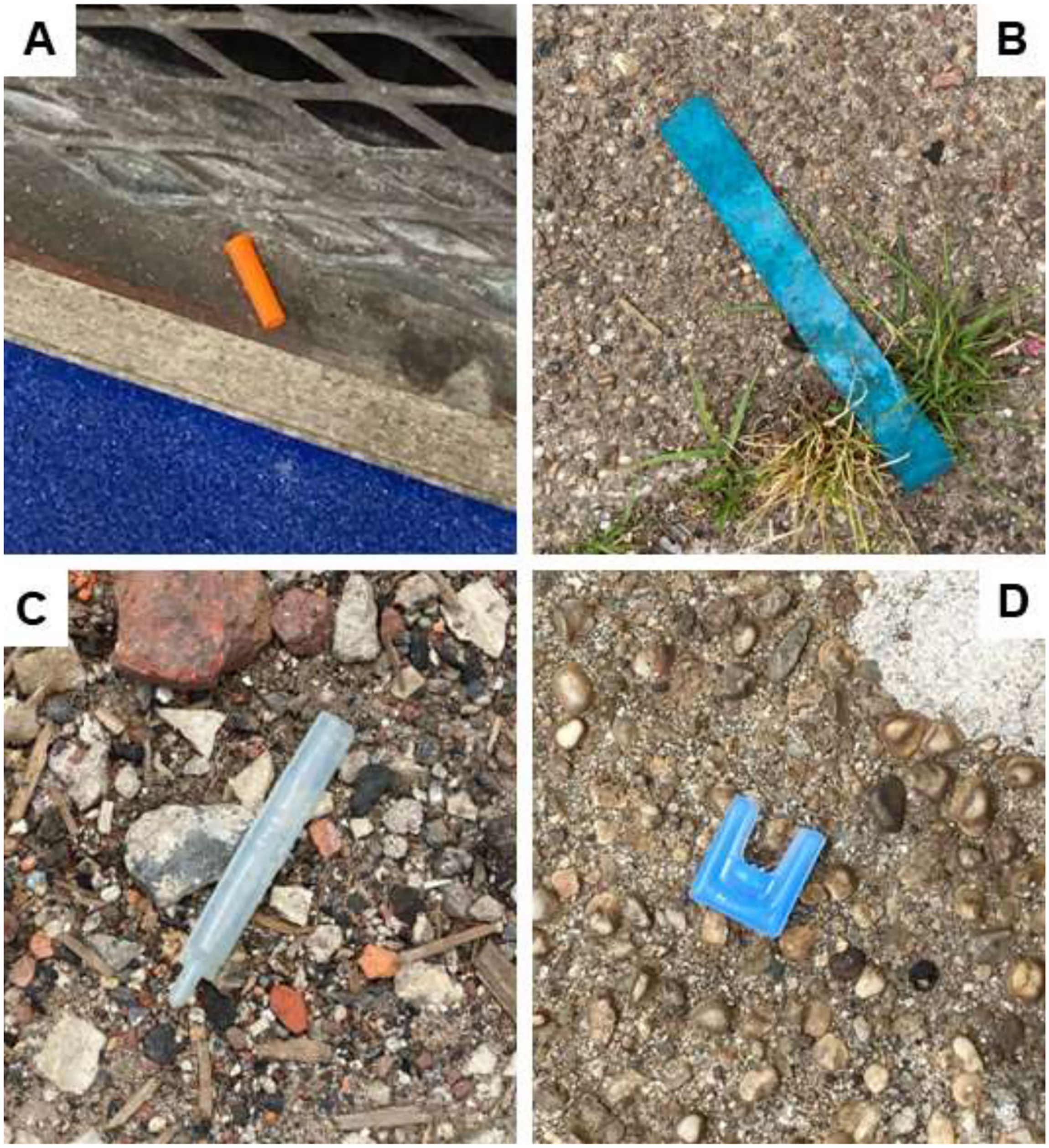

Figure 1.
Examples of harm reduction supplies discarded on Philadelphia streets: (A) Syringe cap; (B) Tourniquet; (C) Sterile water ampule; (D) Sterile water ampule twist-and-pull top.
Note: Images are not to scale. Photographs by S.V. Aronowitz.

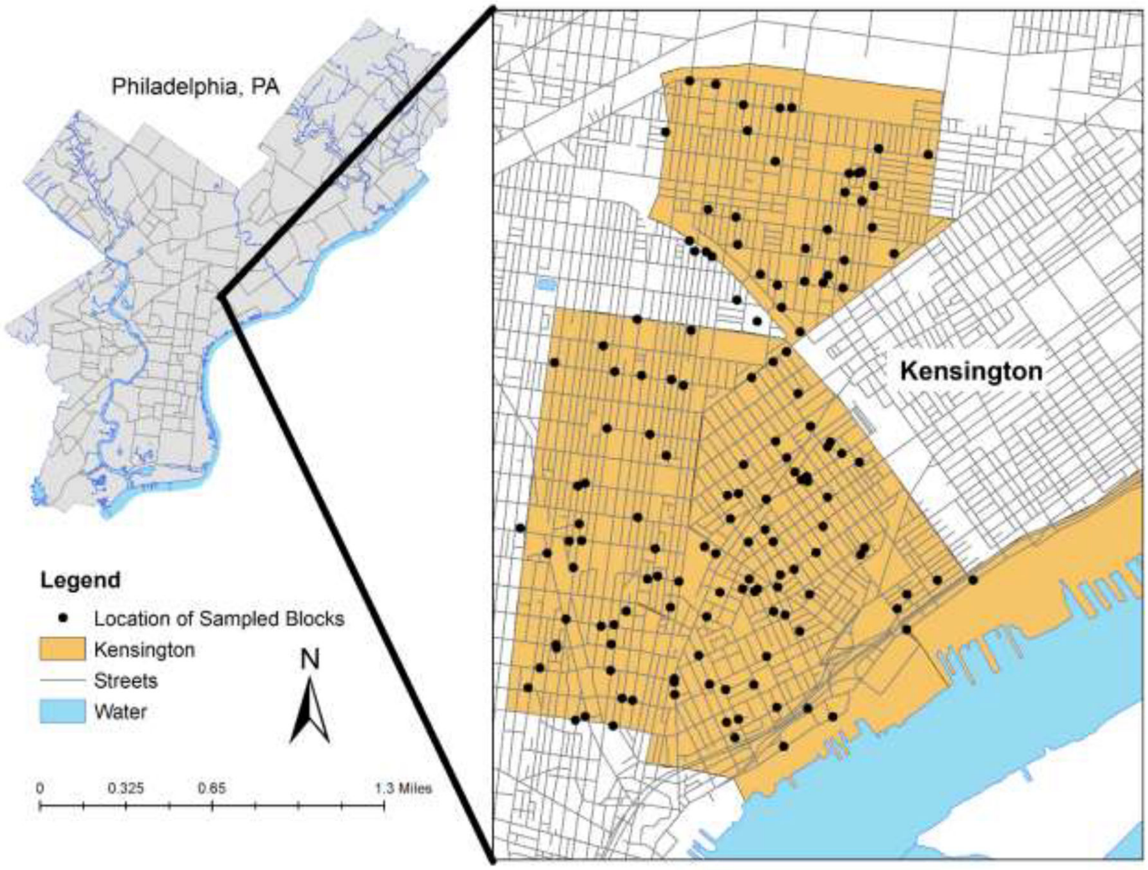

Figure 2.
Locations of blocks randomly selected for data collection in the Kensington neighborhood of Philadelphia (n=150)

Table 1.

Drug use and harm reduction supplies measures and definitions

Measure	Definition*
Drug use items	
Syringes (barrels and/or needles)	Used or unused syringes, with or without needle tips. Do not count each component separately (i.e., cap, barrel, needle, and plunger count as 1 syringe)
Syringe caps & plungers	Syringe caps or plungers only when the rest of the syringe (barrel and/or needle) is missing. If cap and/or plunger are still attached to or next to a syringe, then only record as part of "Syringe" item
Baggies≠	Small drug baggies
Vials≠	Drug vials and vial caps
Blunt guts/wrappers≠	Evidence that marijuana cigars were assembled using legal cigars, including packaging
Marijuana (pot) roaches≠	Evidence of blunt or joint butts or "roaches." Roaches may be attached to instruments used to hold a burning marijuana cigarette (e.g., paperclip, hairpin, etc.)
Pipes & stems	Pipes and stems, often handmade, used to smoke crack, heroin, or meth. Can be made of glass, metal, or foil
Bubble pipes	Items used for safer smoking (e.g., meth)
Other drug supplies	Other drug supplies not captured in previous items (e.g., heroin spoons, rolling paper pack, fentanyl test strips)
Harm reduction	
Naloxone canisters	Count the total number of naloxone canisters, including outside packaging of canisters
Tourniquets	Medical-grade tourniquets distributed for safer injecting
Sterile water ampules	Sterile water and saline single-use containers
Cooker caps	Cooker caps given out in harm reduction kits (aluminum rinse caps). Do not include regular, commercial bottle caps (e.g., from soda/pop bottles)
Used condoms & wrappers≠	Count the total number of used condoms and empty condom wrappers
Wound care supplies	Wound care supplies distributed in harm reduction kits (e.g., bandages, dressings, bacitracin packets, cotton swabs & pads, rubber gloves)
Buprenorphine film packaging	Packaging for buprenorphine sublingual film (e.g., Suboxone)

*Naloxone canisters and Used condoms & wrappers were measured as continuous count variables. All other items were measured on an ordinal scale of "Zero;" "1–3;" "4–7;" "≥8," selected to facilitate data collection expediency amid safety concerns for research assistants and to align with previously-validated items in original NIfETy.

≠Items developed in the original NIfETy VAOD scale

Table 2.

Inter-Rater Reliability and Validity of Drug Use and Harm Reduction Items

Item	Prevalence (%)	ICC	95% CI	P-value	Internal consistency	
					Cronbach's alpha	McDonald's omega
Drug use					**0.766**	**0.856**
Syringes (barrels and/or needles)	22.8	0.626	0.468, 0.737	<0.001		
Syringe caps & plungers	57.5	0.807	0.726, 0.864	<0.001		
Baggies	58.3	0.562	0.378, 0.692	<0.001		
Vials	67.7	0.605	0.438, 0.722	<0.001		
Blunt Guts/Wrappers	67.7	0.392	0.134, 0.572	0.003		
Marijuana (Pot) Roaches	6.3	−0.068	−0.522, 0.250	0.642		
Pipes & Stems	1.6	−0.016	−0.448, 0.286	0.535		
Bubble pipes (items used for safer smoking)	0.0	Constant				
Other Drug Supplies	22.0	0.035	−0.374, 0.322	0.421		
Harm reduction					**0.627**	**0.554**
Naloxone canisters & packaging	1.6	0.799	0.714, 0.859	<0.001		
Tourniquets	11.0	0.336	0.055, 0.533	0.012		
Sterile water ampules	19.7	0.692	0.563, 0.783	<0.001		
Cooker caps	3.9	−0.033	−0.469, 0.274	0.571		
Used Condoms & Wrappers	17.3	0.375	0.111, 0.560	0.005		
Wound care supplies	37.8	0.097	−0.284, 0.365	0.284		
Buprenorphine film packaging	13.4	0.260	−0.052, 0.479	0.047		
All drug use and harm reduction items together					**0.799**	**0.876**

"Constant" indicates no variability across locations (item not observed)

Table 3.

Discarded drug use and harm reduction supplies scale developed in Exploratory Factor Analysis

Item	Cronbach's alpha	McDonald's omega
Syringe caps & plungers	0.848	0.850
Baggies		
Vials		

Note: Higher scores (range 0–9) indicate higher levels of drug use and harm reduction supplies on a block

Table 4.

Univariable logistic regression results for odds of drug use and harm reduction scales and individual items within walking distance (≤0.25 miles or 0.4 km) of a syringe disposal box, Philadelphia, 2021–2022

Item	OR (95% CI)	p
Drug use	1.78 (1.48, 2.23)	<0.001
Syringes (barrels and/or needles)	5.19 (2.18, 12.85)	<0.001
Syringe caps & plungers	25.30 (7.11, 161.79)	<0.001
Baggies	10.41 (3.76, 37.08)	<0.001
Vials	14.04 (3.95, 89.72)	<0.001
Blunt Guts/Wrappers	6.05 (2.18, 21.54)	0.002
Marijuana (Pot) Roaches	4.34 (1.01, 22.15)	0.053
Pipes & Stems	2.38 (0.09, 61.22)	0.544
Bubble pipes (items used for safer smoking)	--	--
Other Drug Supplies	2.57 (1.07, 6.16)	0.034
Harm reduction	3.45 (2.17, 5.94)	<0.001
Naloxone canisters & packaging	2.38 (0.09, 61.22)	0.544
Tourniquets	20.08 (5.07, 134.46)	<0.001
Sterile water ampules	18.67 (6.61, 62.34)	<0.001
Cooker caps	--	0.987
Used Condoms & Wrappers	2.89 (1.12, 7.51)	0.028
Wound care supplies	4.64 (2.10, 10.65)	<0.001
Buprenorphine film packaging	4.18 (1.47, 12.54)	0.008

Note: Three-item supplies scale developed with Exploratory Factor Analysis (syringe caps, baggies, vials): OR=1.846, 95%CI=(1.51, 2.34), p<0.001

-- Low or no variability on blocks prohibited estimation