JOURNAL OF BEHAVIORAL HEALTH, 2019
VOL 8, NO. 3, PAGE 111–121
10.5455/jbh.20181023074620

REVIEW ARTICLE

Open Access

Straight to the point: A systematic review of needle exchange programs in the United States

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ABSTRACT

As injection drug use increases, needle exchange programs (NEPs) are one method of reducing infectious disease transmission and improving health outcomes for this population. The purpose of this paper is to examine the effectiveness of NEPs. A comprehensive review of the literature was conducted to investigate the study aim. Specific inclusion criteria included 1) studies published in English, 2) studies examining needle exchange, 3) studies conducted in the United States, 4) studies conducted between 2007 and 2017, and 5) studies focusing on injection drug users. Exclusion criteria are also included. A total of 12 studies examining NEPs were found. The research team evaluated all 12 studies and emergent themes included: (1) reduction in risk behaviors, (2) sex differences in use and behaviors, (3) overall perceptions of needle/syringe exchange programs, and (4) methodological flaws and implementation. This review indicates that NEPs are effective in reducing infectious disease and improving health outcomes. Lack of consistent methods in NEP research may be an issue. In addition, community and health professional attitudes may need to be addressed to enhance effectiveness. Programs and initiatives aimed at educating community members and others may be warranted.

ARTICLE HISTORY

Received October 23, 2018
Accepted April 10, 2019
Published April 27, 2019

KEYWORDS

Needle exchange; drugs; opioids; harm reduction

Introduction

Over the past decade, injection drug use has become a prevalent public health problem. Injection drug use is a common method of administering a drug through a vein, skin, or muscle [1]. An estimated 15.9 million people are injecting drugs worldwide [2]. Even more alarming is the 109% rise in use among those who are 18–25 years old and live in the United States (U.S.) [3]. Commonly injected drugs include opioids, such as heroin, stimulants, such as cocaine and amphetamines, and dissociate drugs, such as ketamine and steroids [4].

The growth of injection drug use is becoming a public health crisis due to the increase in blood-borne infections [3]. Unfortunately, young people who are using injection drugs and their communities are being affected by these blood borne infections with rates more than doubling from 2010 to 2014 [5]. The increase in injection drug users (IDUs) has influenced the spread of blood borne infections in certain communities that do not have appropriate prevention interventions readily available [6]. As these statistics continue to rise, there is an urgency to find solutions to this growing problem.

Over 60% of the population who inject drugs are infected with a blood borne infection [7]. Those who share needles and syringes to inject drugs are at a greater risk for contracting Hepatitis C Virus (HCV) and other blood-borne infections, such as HIV [8]. Specific to Hepatitis C, the reported cases have doubled from 2010 to 2014, which is attributed to the rise of injection drug use [5]. Additionally, according to the World Health Organization [9], 10% of all new HIV infections result from injection drug use. With the current effect injection drug use has on rapid spread of infection among individuals and their communities, more research on current interventions is needed.

Needle exchange programs (NES), also known as syringe exchange programs, are one

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population-based strategy implemented to reduce the spread of blood borne infection by offering clean needles to IDUs [10]. NES have been developed and adopted in multiple countries around the world including Australia, India and the Ukraine as well as in 33 U.S. states [11,12]. Data suggest blood-borne infection rates have decreased in areas where programs are available [13].

Similarly, in combination with other factors, researchers found NEPs in Amsterdam were associated with a lower incidence of HIV and HCV infections when programs were combined with medication-assisted treatment for substance abuse [14]. Similar results found in Tallinn, Estonia suggested the most effective tool in reducing incidence of HIV in IDUs is combining NEPs and antiretroviral treatment [15]. In addition to decreasing HIV and HCV rates, research by Kidorf et al. [16] indicated NEPs are successful platforms for IDUs to enroll in substance use treatment programs. Examining the research on NES programs is crucial as such information may yield benefits to professionals working with such programs. Unfortunately, the research is limited and inconsistent on the most effective components of these programs. Such information is necessary to aid NEPs in developing and adopting best practices. In so doing, improving the health outcomes for IDUs and also providing an avenue for access to treatment may be accomplished.

Purpose of the present study

A paucity of research has examined the effectiveness of NEPs. The study purpose is to examine the efficacy of NEPs in the U.S. Specifically, the following research questions were examined: 1) How effective are NEPs in reducing negative outcomes related to heroin and other injection drug use?, 2) Do sex differences exist in health outcomes for NEPs?, 3) What are community members' attitudes toward NEPs? 4) What are health professionals' attitudes toward NEPs?

Methods

A comprehensive literature search was conducted using PUBMED, Academic Search Primer, and MEDLINE+ for the period 2007–2017. The following search terms were used: heroin, opioids, injection drug use, injection drug user (IDU), harm reduction, NEPs, syringe exchange programs, needle exchange, needle disposal, disposals bins, needles, syringes, syringe, and drop boxes. The study inclusion criteria included: 1) studies published in English, 2) studies examining health and treatment outcomes of NEPs, 3) studies conducted in the United States, 4) studies published between 2007 and 2017, and 5) studies focusing specifically on IDUs' use of NEPs. The exclusion criteria for this study included: 1) studies not conducted in the US, 2) studies published in a language other than English, 3) studies conducted before 2007, 4) and studies focusing on drugs use other than heroin and injection drug use. An initial search of key terms yielded 547 articles. After review, a total of 12 articles fit the inclusion criteria. The research team then created summaries for the articles. This way, concurrent themes and discussions could be identified and elucidated.

Results

As previously mentioned in the methods, a total of 12 articles fit the search criteria/study inclusion criteria. Though each article varied in scope and methodology, a series of key themes were identified related to the efficacy of needle/syringe exchange programs. A summary is presented in Table 1. The following factors were identified highlighting the potential benefits and problems of needle/syringe exchange programs: (1) reduction in risk behaviors, (2) sex differences in use and behaviors, (3) overall perceptions of needle/syringe exchange programs, and (4) methodological flaws and implementation.

Reduction in injurious/hazardous behaviors

Several interventions were designed to reduce injection-risk related behaviors among current IDUs. Injection-risk related behaviors include sharing needles, lending used needles to others, bleaching needles for reuse, and sharing other drug paraphernalia [17]. Huo and Ouellet [17] used two frameworks—National Institute on Drug Abuse (NIDA) community-based outreach model and an indigenous leader outreach model—to effectively diminish risk behaviors related to needle sharing and needle reuse. For a total of three years, 901 current IDUs used NEPs operated at a variety of storefronts and a motor-home. There was no limit to the number of needles exchanged, and an assortment of behavioral health services (e.g., HIV education, client-centered risk reduction counseling, and HIV testing) were provided to participants.

Huo and Ouellet [11] reported a considerable decrease (18%) in needle sharing among current IDUs and a 27% decrease in NEP nonusers.

Table 1. Overview of needle exchange program studies.

Study	Sample Size and Description	Theory or Model Used in Program	Intervention Description	Duration	Evaluation Method	Major Findings
Needle exchange and injection-related risk behaviors in Chicago: a longitudinal study. Authors: Huo and Ouellet [17]	*N* = 907; 729 NEP users; 172 NEP nonusers. The purpose of this study was to examine whether NEP among IDUs affects injection risk behaviors over time.	NIDA Community-Based Outreach Model; Indigenous Leader Outreach Model.	Over 3 years, NEP operated at storefronts and a motor-home, for which there was no limit for number of needles exchanged. Other behavioral health services were provided.	3 years	Logistic regression; chi-square; Wilcoxon-sum rank test	A majority of participants reported using a NEP program. NEP users were more likely to be HIV positive. NEP users were less likely to share needles, pass used needles, or share other injection substances.
The syringe gap: an assessment of sterile syringe need and acquisition among syringe exchange program participants in New York City. Authors: Heller et al. [18]	478 IDUs from New York City. The study assessed the "syringe gap" between the number of injections by IDUs and the number of syringes they receive by a particular program.	Not stated	Participants were recruited from seven SEPs in New York City. Participants were asked if they have received an adequate number of sterile syringes and reasons for injection. A subset (*N* = 115) were asked questions of why they took a specific number of needles on a particular day.	4 months	Logistic regression; qualitative data	Nearly half of IDUs in New York City reported injecting in a public place in the past month and lacking inadequate needle coverage. Program limits and fear of being stopped by police were reasons for not taking enough needles.
Doing harm reduction better: syringe exchange in the United States. Authors: Des Jarlais et al. [19]	131 NSEP directors. The present study tracked the progress and development of syringe exchange programs in the United States since 1994–95.	Not stated	Surveys were mailed each year to NSEP directors regarding characteristics of NEPs. Follow-up interviews were conducted for missing data.	13 years	Frequencies and descriptive statistics	Services such as peer education and extra supplies were present. A majority of NEPs provided other health services. Ample problems (e.g. staff burnout, shortage) were present.
Cost-effectiveness of needle and syringe exchange for the prevention of HIV in New York City Authors: Belani and Muennig [20]	The purpose of this study was to evaluate the effectiveness of a needle syringe exchange program in New York City for patients in enrolled in Medicaid, and how the program affects quality of life measures.	Decision-analysis model	A decision-analysis model was used to estimate the average and probabilistic costs of needle syringe exchange programs.	1 year	Univariate and bivariate analyses	The needle syringe exchange program was effective and saved capital ($1,000-$3,000) for each client on health and quality of life measure costs.

continued

Study	Sample Size and Description	Theory or Model Used in Program	Intervention Description	Duration	Evaluation Method	Major Findings
The influence of needle exchange programs on injection risk behaviors and infection with hepatitis C virus among young injection drug users in select cities in the United States, 1994–2004. Authors: Holtzman et al. [21]	The total sample at baseline (***N*** = 4,663) and a sub-sample (***N*** = 1,288) were used from 3 longitudinally cohort-based studies in the United States. The purpose of this study was to evaluate the relationship between injection drug use behaviors and participation in NEPs.	Not stated	1994–2004, three Collaborative Injection Drug Users Studies were carried out at four sites from four major cities (Baltimore, MS; Chicago, IL; Los Angeles, CA; and New York, NY). IDUs who participated in the studies were asked questions concerning the availability of NSEPs in the area and the acquisition of sterile needles/ syringes.	10-year period	Bivariate correlations; multiple logistic regression; Hosmer and Lemeshow Goodness-of-Fit test	Involvement in NEP showed a reduction in injection risk behaviors (e.g., sharing needles). Those who injected daily were more likely to contract HCV than those who did not inject daily.
Approval of syringe exchange programs in California: results from a local approach to HIV prevention. Authors: Bluthenthal et al. [22]	24 program directors; information was obtained from the California State Office of AIDS survey, California and North American Syringe Exchange Network, and geographic information systems (GIS) to assess the efficacy of NEPs.	Not stated	Number of SEPs were determine annually and categorized based on policies. Program characteristics (e.g., efficacy, number of staff, monetary costs, number of needles used) were also evaluated.	3 years	Descriptive statistics; repeated-measures random-effects regression models	The total number of NEPs grew by 46% from 2000 to 2002. However, no programs were enacted in high-risk counties. Total syringes exchanged increased and so did total budget funding.
Syringe disposal among injection drug users in San Francisco. Authors: Wenger et al. [23]	*N* = 602; information was obtained from geographic information system (GIS) from 1000 blocks within 11 San Francisco neighborhoods to examine the prevalence of improperly disposed syringes and syringe disposal practices of IDUs	Not stated	Using GIS, a research assistant walked around the blocks and inspected areas, including gutters and grassy areas, to look for improperly disposed syringes. A quantitative survey was distributed asking about syringe disposal practices	11 months	Mantel-Haenszel chi-square; logistic regression	An estimated 108 syringes were found. Most of them were not easily accessible. 67% of IDUs reported improper syringe disposal over the past 30 days. Those who injected crack, obtained syringes from an unauthorized source, or injected in a public place had a higher odds of improper syringe disposal.

continued

Study	Sample Size and Description	Theory or Model Used in Program	Intervention Description	Duration	Evaluation Method	Major Findings
Lessons learned from a peri-urban needle exchange. Authors: Knittel et al. [24]	*N* = 88; the purpose of the present study was to evaluate a small NEP program and its associated efficacy within an urban community	Transtheoretical model	The HIV/AIDS Resource Center (HARC) serves as a NSEP in Ypsilanti Michigan, providing sterile needles/syringes and other services. Over a four-year time period NSEP users were interviewed and provided surveys.	3 years	Descriptive statistics; Logistic regression; paired *t*-tests;	A small, urban NEP can produce substantive changes and reduction in improper needle exchange behaviors. However, the frequency of injection does not change from baseline to follow-up represents a growing problem within NEP design and creation.
Multilevel Community-Based Intervention to Increase Access to sterile Syringes Among Injection Drug Users Through Pharmacy Sales in New York. Author: Fuller et al. [25]	***N*** = 1496 community residents, 131 pharmacists, and 728 IDUs. The purpose of this study was to use a multi-level intervention to increase syringe access through a new health policy.	Not stated	A community based participatory approach was used to target residents, pharmacists and IDUs. Attitudes, opinions, practices and behaviors regarding syringe behaviors and perceptions were assessed pre- and post-interventions from the populations stated above regarding ESAPs.	1 year	Chi-square tests	A multilevel intervention is efficacious to increase positive opinions and decrease negative options regarding syringe exchange. In addition, there was a significant decrease in syringe reuse, as well as an increase in pharmacy use among African-American IDUs.
Pharmacy participation in non-prescription syringe sales in Los Angeles and San Francisco counties, 2007. Authors: Cooper et al. [26]	*N* = 238 pharmacies (67 in San Francisco, 171 in Los Angeles). The present study examined non-prescription sales of syringes (NPSS) and factors associated with NPSS.	Not stated	Quantitative surveys assessing registration and syringe sales, refusals to do so, attitudes, and perceptions were filled out by retail pharmacies. Phone interviews were conducted regarding pharmacy practices.	1 year	Multivariate logistic regression; bivariate correlations; Chi-square; Fischer's Exact test	42% of the pharmacies reported NPSS in the past year; however, some pharmacies sold NPSS without being registered. A total of 39% of pharmacies reported never refusing NPSS. Pharmacists were more likely to sell syringes if they thought that HIV was a problem in their area.

continued

Study	Sample Size and Description	Theory or Model Used in Program	Intervention Description	Duration	Evaluation Method	Major Findings
The significance of harm reduction as a social and health care intervention for injecting drug users: An exploratory study of needle exchange program in Fresno, California Authors: Clarke et al. [27]	*N* = 106 community residents. The purpose of this study was to investigate injection drug use in participants that were in a needle exchange program in Fresno, CA.	Not stated	Convenience sampling was used to recruit IDUs. A survey was delivered to assess current drug use and status of the needle exchange program.	4 months	Descriptive statistics; chi-square analysis; Wilcoxon rank sum score; Mid-P Exact method	Attending a community NEP showed a reduction in needle harm behaviors (reusing, sanitizing) and reduction in HIV and HCV.
Against the odds: Syringe exchange policy implementation in Indiana. Authors: Meyerson et al. [28]	*N* = 75 key informants from 24 different counties. The purpose of this study was to understand syringe exchange policy in 24 Indiana counties.	Analytic framework of health commons	Telephone and email correspondence with 75 informants and 50 participant observations at state-level SEP meetings.	11 months	Mixed-method qualitative and quantitative	Though early, implementation of NEPs in counties are still vague and further research is required of these programs.

Additionally, NEP users were less likely to share needles (OR = 0.33, pass used needles (OR = 0.55), and share other drug-related injection paraphernalia (OR = 0.70), suggesting that high involvement in NEP may perhaps reduce dangerous health behaviors related to needle sharing. Moroever, Holtzman et al. [21] looked at NEP participation (N = 4,663) from four major cities (Baltimore, Chicago, Los Angeles, and New York) that were enrolled in three Collaborative Drug Users studies, and stated that those who participated in a NEP were less likely to share needles (p = 0.001) and share injection paraphernalia (p = 0.04).

Clarke et al. [27] looked at a community-based approach to extrapolate needle exchange behaviors in Fresno, California. Convenience sampling among those enrolled already in a NEP and a $5 card to use on groceries yielded 106 participants. Over a 4 months period of time, a survey asking about injection risk behaviors was distributed. A total of 48% reported sharing needles before attending the NEP with the majority reporting no needle sharing after the NEP was complete. Furthermore, 18% of participants reported no longer reusing needles after receiving services from the NEP. Furthermore, Knittel et al. [24] implemented an NEP in an urban community, and reported a reduction in sharing needles, reusing needles, and an increase in health behaviors (e.g., cleaning skin after injection, using sanitization).

Sex differences in risk behaviors

Previous research indicates males are more likely to engage in substance use behaviors than women [29]. With respect to injection drug use behaviors, the results remain unclear, with some research suggesting that men and women initiate at the same age and have similar risk behaviors at initiation [31]. Thus, clarification is needed when examining gender differences among IDUs.

Huo and Ouellet [17] found no gender differences with respect to length of time injecting; however, they did observe that women were less likely than men to reuse their needles. Heller et al. [18] examined adequate syringe acquisition among current NEP participants and New York City, and concluded that males were 1.6 times more likely to have inadequate syringe exchange coverage. Additionally, Clark et al. [27] found that males were more likely to be HIV positive, but found no sex differences in reusing of needles or needle sharing. Furthermore, Holtzman et al. [21] examined injection-drug related behaviors among IDUs who recently participated in a NEP, and concluded that women were 1.1 times more likely to share needles, 1.2 times more likely to share paraphernalia, and 1.1 times more likely than men to inject daily.

Additional findings

Insufficient research on sex differences based on NEP/SEP participation still persists. Additional research is vital to determine if there are differences and if such differences need to be addressed through these programs. Future research should seek to examine sex differences in NEP use and outcomes.

Enhanced education and safety practices

Perceptions and knowledge can either motivate or repress psychological/psychosocial attitudes towards certain health behaviors [30]. Therefore, it is critical to clarify perceptions and overall approaches towards needle/syringe exchange programs to measure public health efficiency. Clarke et al. [27] reported that after NEP attendance, IDUs were more likely to report using extra safety precautions (i.e., not sharing needles, not reusing needles with others), suggesting that NEPs can have an educational effect on reducing risky injection behaviors.

Community members and health professionals perceptions of needle/syringe exchange programs

Fuller et al. [25] used a multilevel community-based approach to assess opinions of community members (N = 1,496) and pharmacists (N = 131) regarding nonprescription sales of syringes— Exchange Syringe Access Program (ESAP) in a New York pharmacy. Among pharmacists, 27% of did not support ESAP, while 23% were undecided. However, most pharmacists agreed that ESAP would reduce HIV transmission. There were no differences among male and female pharmacists regarding whether or not ESAP would be effective at reducing injection drug use. Only around half of IDUs knew pharmacies carried syringes for sale. Black IDUs were more likely to use pharmacies than Whites and Hispanics.

Cooper et al. [26] also examined non-prescription sales of syringes (NPSS) in pharmacies and the associated attitudes with increased and/or decreased sales in different counties in Los Angeles and San Francisco. Surveys assessing attitudes regarding NPSS were handed out to certain pharmacies. 39% of pharmacists reported never refusing sales. Factors related to refusal of selling syringes

were unfamiliar customers (65%), safety concerns (67%), and excessive purchases (47%).

When examining NPSS sales at 238 pharmacies in California, Cooper et al. [26] discovered that though 34% of the pharmacies were registered by the state, 42% of pharmacies reported sales, suggesting that some pharmacies sold without being registered. Also of concern was that 25% of pharmacies reported sometimes or often refusing to sell NPSS. Reasons included risk of theft, safety concerns, disheveled appearance, and concerns about unsafe disposal. Additionally, pharmacists' attitudes were related to sales, with some pharmacists more likely to sell syringes if they thought HIV was a problem and some pharmacists (N = 72) refusing sales of NPSS, even though they agreed HIV was a problem in their community.

Additional findings

There is insufficient literature and findings on attitudes and perceptions of the efficiency of NEPs. More research is to be necessitated to adequately assess public views on NEPs.

Barriers to NEP implementation

Research indicates that NEPs are one method of reducing health care costs and increasing safety practices among IDUs. Belani and Muennig [20] reported a total annual savings of around $1,000–$3,000. However, a number of problems with NEP implementation still persist regarding the application of NEPs in large and local communities. For one, operational issues among staff still persevere. Des Jarlais et al. [19] assessed the current states of NEPs through surveys filled out by administrative staff across the United States. Key findings included 47% of SEPs had shortage of staff, 18% lacked community support, 29% reported police harassment of participants, and 33% of staff at NEPs admitted to burnout.

Second, vague interpretations and messaging of certain NEPs may perhaps be insufficient to reduce risk behaviors related to injection drug use. Meyerson et al. [28] interviewed key informants (N =75) from 24 different counties in one state in the United States. Email correspondence and telephone interviews were conducted to assess NEPs policies and implementation. Results indicated significant uncertainty and issues with resources. For example, informants reported little assistance or technical support with NEP implementation, development, or renewal. In addition, there was a scarcity of meetings related to state funding of NEPs implementation.

Likewise, Bluthenthal et al. [22] used geographic information systems (GIS) to assess the efficacy of NEPs from the California State Office of AIDS Survey and North American Syringe Exchange Network. Using GIS, the number of NEPs were determined and categorized based on what each service provided. Program characteristics were also evaluated. Though the total number of NEPs grew by 46% in 2 years, the total budget funding increased, and the number of total syringes exchanged increased, zero NEPs were enacted in high-risk counties. This represents a major public health gap needed to be examined, given that Wenger et al. [23] examined improper syringe disposal among 602 IDUs and found that 67% improperly disposed of their syringe within a 30-day time period.

Research methodology issues

It is also of foremost concern the majority of the studies (N = 8) did not utilize theory or a particular framework guiding their intervention or program. Understanding and applying a certain context in health interventions may show a reduction in particular health behaviors [30]. Those that did apply a model showed significant improvements not only in health, but also in quality of life and health costs. Huo and Ouellet [17] used a NIDA community-based approach model and saw significant reductions in harmful behaviors, suggesting an improvement in quality of life and health. Belani and Muennig [20] used a decision analysis model, which estimates costs and outcomes of implementing a needle and syringe exchange (NSE), to assess quality of life measures and health care costs for people enrolled in Medicaid living in New York City. Application of a decision analysis model regarding NSE provided an accurate depiction of savings per person. For example, continuation of the NSE reduced HIV costs by $325,000 per patient and deterred 4–7 HIV infections per 1,000 patients, producing more savings.

Discussion

In this review, NEPs were found to reduce risky behaviors including reusing needles, sharing needles with others, and sharing other injection paraphernalia and substances. The studies included in this review found significant decreases in needle sharing and reuse indicating NEPs may be an effective strategy for reducing risky needle use. Such findings could be used to advocate for additional

NEPs and also decrease stigma surrounding such programs.

Research examining sex differences in injection drug use is mixed. Similar findings exist for differences in the impact of NEPs on injection drug use. One study in this review found that males were more likely than females to have inadequate access to NEPs [18]. Ensuring consistent access to NEPs for both males and females is important. In addition, no published study was found as part of this review that examined specific characteristics of current NEP users. Studies examining characteristics of NEP users are also critical in order to increase access to care and to reach out to others who may not be using NEPs currently.

One study identified in this review examined opinions of community members as well as health professionals regarding NEPs as well as non-prescription sales of needles. An intervention targeting attitudes and behaviors was found to increase positive attitudes towards NEPs [25]. This is an important step in increasing the number of NEPs while also reducing stigma associated with such programs. Research suggests that NEPs are an effective strategy in reducing risky health behaviors and increasing positive health outcomes. Yet, controversy over NEPs remains a barrier to implementing them in many communities. Injection drug use holds a high level of stigma as many individuals view this type of drug use as a criminal behavior rather than a medical problem [32]. Reducing stigma is a critical step in increasing access to clean needles, NEPs, and to reducing negative health outcomes associated with injection drug use.

Specific to health professionals, limited studies were conducted that examined health professionals' attitudes and behaviors with NEPs. One study of pharmacists found more than one in three pharmacists were not supportive of NEPs with another third undecided. Surprisingly, the majority of pharmacists agreed NEPs reduced HIV. Despite recognizing NEPs have positive health outcomes, the lack of support for NEPs may suggest that pharmacists hold stigma-related attitudes toward such programs. Another study of pharmacists cited safety concerns, theft, disheveled appearance, and concerns about unsafe needle disposal as reasons for not supporting NEPs [26]. Educational initiatives are warranted to reduce these barriers. It appears the benefits (reducing infectious diseases) may not outweigh the barriers to NEPs. Health agencies have identified community pharmacies as a key location for NEPs and other syringe initiatives [33]. As such, pharmacists may play a crucial role in needle exchange and targeting this group with education may increase their comfort and willingness to participate in NEPs.

Specific study methodologies were not criterion for inclusion in this paper. In examining the methods of the included studies, several areas of concern emerged. The majority of studies did not use a theoretical framework to guide their intervention or research. Interestingly, studies that used a model demonstrated significant reductions in negative health outcomes and increase in quality of life [17,20]. With the controversy of NEPs continuing, using evidence-based models and theories to evaluate such programs may bolster the argument for the need for NEPs.

Overall, the CDC recommends comprehensive services as part of any NEP [34]. In addition to providing needles, the CDC suggests needle disposal services, education on harm reduction and safer sex practices, and naloxone for overdoses. Providing referral services to infection disease prevention and treatment as well as substance abuse treatment are also encouraged. It is apparent that NEPs may be beneficial above and beyond needle exchange and also serve as a bridge to care for individuals with a drug addiction. Based on this review, it appears NEPs vary in services offered to clients. Programs following the CDC recommendations should be evaluated for effectiveness.

Limitations

The following limitations should be noted. This paper presents a narrative review and is not a quantitative meta-analysis. Quantitative measures, such as effect sizes and correlation coefficients, cannot be established from this review. Moreover, specific research designs, such as controlled clinical trials, were not a criterion for this review. Program interventions included in this review must have been published in English, published between 2007 and 2017, and focused on IDUs. Studies outside of these criteria were not included in this review.

Conclusion

This paper provides a review of NEPs and health outcomes associated with such programs. Based on the programs reviewed, it appears NEPs have a positive effect on health outcomes among IDUs. Increasing strong methods in research evaluations would enhance the current research and increase evidence of effectiveness. Additional research on

characteristics of NEP users would also be beneficial. It also appears that some community members and even health professionals hold negative attitudes toward NEPs. Future research examining specific health professionals' (e.g., nurses, physicians, and physician assistants) perceptions of needle exchange is warranted.

In addition, intervention programs were found to reduce stigma related to NEP and increase positive attitudes. Additional intervention programs are warranted. In light of increases in injection drug use, a global approach to reducing infectious disease and improving health outcomes for IDUs are needed. NEPs may play a critical role in addressing these issues and promoting positive health for users.

Compliance with ethical standards

No funding was received for the present study.

Ethical approval

This article does not contain any studies with human participants performed by any of the authors.

Disclosure of interest

The authors declare no conflict of interest.

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