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Frequency and factors associated with providing injection initiation assistance in Tallinn, Estonia

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Abstract

Injection drug use is expanding in numerous regions in the world. Persons who inject drugs (PWID) play an important role encouraging new persons into injecting, by providing injection initiation assistance (“assisting” behaviors) and stimulating interest in injection (“promoting” behaviors).

Objectives: To describe the prevalence of assisting and promoting behaviors, and to identify factors associated with assisting, among PWID in Tallinn, Estonia.

Methods: In 2016, PWID were recruited through respondent-driven sampling (RDS), interviewed, and HIV tested. RDS weights were used to estimate the prevalence of assisting and promoting behaviors and, in multivariable regression modeling, to identify factors associated with assisting.

Results: Among 299 PWID recruited, 13.7% had ever assisted a non-PWID with their first injection. Regarding past-six-month promoting behaviors: 9.4% talked positively about injecting to non-PWID, 16.2% injected in front of non-PWID, and 0.6% offered to help with a first injection. Significant predictors of ever assisting with a first injection included: gender (men: aOR 6.31, 95% CI 2.02–19.74); age (30 years or younger: aOR 3.89, 95% CI 1.40–10.16); receptive sharing of syringes or needles (aOR 4.73, 95% CI 1.32–16.98); ever testing for HIV (aOR 8.44, 95% CI 1.15–62.07); and having peers who helped someone with their first injection (aOR 3.44, 95% CI 1.31–9.03).

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Contributions

DDJ and AU designed the study and wrote the first draft of the manuscript. DMB, ST and AT contributed to the design and implementation of the research, to the analysis of the results and to the writing of the manuscript. MR did the statistical analysis. AT supervised the data collection. All authors read and approved the final manuscript.

Conflict of interest

No conflict declared.

Data statement

The data is unavailable to access due to the confidentiality requirements.

Conclusion: Demographic and drug-use related factors are associated with having initiated someone into injecting. Interventions targeting PWID and non-PWID are needed to prevent injection initiation.

Keywords

Injection drug use; Initiation; Providing injection initiation assistance; Initiation of non-Injectors

1. Introduction

Injection drug use (IDU) is an important driver of the HIV and HCV epidemics worldwide. It is also a significant source of other morbidities (non-lethal overdose, attempted suicide, skin and soft tissue infections) and mortality. While over the last decades, IDU has generally been declining in Western Europe and North American countries (Roy et al., 2016), it has increased in Eastern European countries (Harrison and Blonigen, 2017). In several Eastern European countries, prevalence estimates for injection drug use are high (EMCDDA, 2010). Additionally, new IDU epidemics have occurred in Asia (i.e., Vietnam and Pakistan) (Giang et al., 2013), Africa (Reid, 2009; Samo et al., 2013) and in Eastern Europe (Niaz, 2013).

According to a global review of injection drug use and HIV epidemiology at a regional level, the prevalence of injection drug use varied from 0.09% (95% UI 0.07–0.11) in South Asia to 1.30% (0.71–2.15) in eastern Europe (Degenhardt et al., 2017). In Estonia, as in several other Eastern European countries, the high prevalence of persons who inject drugs (PWID) is coupled with high HIV prevalence among PWID (Degenhardt et al., 2017), with estimates ranging from 40% to 90% (Platt et al., 2006; Uusküla et al., 2015). A recent study conducted in Tallinn, Estonia's capital and largest city, revealed that new injectors (PWID injecting no longer than three years) exhibited both substantial rates of high-risk behavior and an HIV prevalence of about 20% (Uusküla et al., 2017).

A recent systematic review of interventions to prevent the initiation of injection drug use documented a scarcity of data and called for increased research and development of strategies to prevent IDU initiation (Werb et al., 2013; Werb et al., 2016).

Importantly, although it is possible to learn to inject oneself without the help of PWID, this is difficult and rare (Crofts et al., 1996; Doherty et al., 2000; Day et al., 2005; Kermode et al., 2007; Rotondi et al., 2014). Among samples of experienced injectors, the proportion who have ever helped with first injections has ranged from 14 percent (Hamida et al., 2018) to 47 percent (Bluthenthal et al., 2014; Crofts et al., 1996; Day et al., 2005; Hunt et al., 1998; Rhodes et al., 2011), although in one study this rate was 69 percent (Kermode et al., 2007). These data suggest that a minority of PWIDs help with others' first injection, yet account for the great majority of incident injection drug use episodes. Accordingly, identifying PWID who are most likely to provide injection initiation assistance, and the contexts that contribute to these behaviors, ought to be important public health concerns.

Initiation into IDU from the perspective of the initiate has been well studied (Werb et al., 2013; Guise et al., 2017), but data are more limited on the predictors and perspectives of experienced PWID assisting novices with their first injections. Studies of those who help

with first injections have shown that assisting is associated with various demographic factors (Crofts et al., 1996; Hamida et al., 2018; Kermode et al., 2007; Rotondi et al., 2014), a range of drug-use patterns and injection promoting behaviors (e.g., talking positively about injection to novices, injecting in front of persons who do not inject drugs (non-PWID)) (Bluthenthal et al., 2014; Bryant and Treloar 2008; Crofts et al., 1996; Day et al., 2005; Hamida et al., 2018; Kermode et al., 2007; Rotondi et al., 2014), and other factors (Bluthenthal et al., 2014; Bryant and Treloar, 2008). Few variables have emerged from more than one study as significant predictors of assisting, in part because of limited overlap in the predictors examined. Positive predictors of assisting that have been identified in more than one study are: number of years injecting (Bryant and Treloar, 2008; Day et al., 2005; Rotondi et al., 2014), non-injection cocaine use (Bluthenthal et al., 2014; Hamida et al., 2018; Kermode et al., 2007), injection promoting behaviors (Bluthenthal et al., 2014; Rotondi et al., 2014), lending used syringes (Bryant and Treloar, 2008; Rotondi et al., 2014), and being unemployed (Kermode et al., 2007; Rotondi et al., 2014). Past experience of being injected by others was identified as a negative predictor of assisting (Bryant and Treloar, 2008; Crofts et al., 1996). A US qualitative study found that PWID who help with first injections cited two benefits of assisting: benefits to the initiate – as a way to minimize harm – and benefits to the initiator – as a tool for securing resources for everyday needs (Wenger et al., 2016).

Most of the foregoing research was conducted in North American, Australian, and English samples. We do not assume that predictors of initiating others into injection drug use in these contexts are the same as predictors in other regions, such as Eastern Europe generally, or Estonia in particular. This is all the more true in light of the varied findings across North America, England, and Australia. Given the spread of injection drug use in other regions, there is a critical need to obtain data from these regions to either inform geographically specific interventions to reduce assisting or to suggest a broader theory to inform more universal interventions. Ultimately, such interventions can reduce transitions to injection, thereby reducing the harmful health, social, and economic consequences of injecting drug use. The current study describes, among current PWID in Tallinn, Estonia, the prevalence of assisting with someone's first injection ("assisting" behaviors); of engaging in specific actions that, intentionally or not, potentially promote injection drug use among non-PWID ("promoting" behaviors), and factors associated with assisting. We include promoting behaviors among our outcomes on the basis of their strong empirical (Bluthenthal et al., 2014; Rotondi et al., 2014) and conceptual links to assisting behaviors.

2. Material and methods

2.1. Data collection

Data were collected in a cross-sectional study of 299 injectors in Tallinn from August 2016 to January 2017 using respondent-driven sampling (RDS). Potential participants were eligible for the study if: they were at least 18 years of age, spoke Estonian or Russian, reported having injected in the previous two months, and were able and willing to provide informed consent. Recruitment began with the purposive selection of "seeds" (n = 8) known to the field team to represent PWID diverse by age, gender, ethnicity, main type of drug

used, and HIV status. After study participation, subjects were provided coupons for recruiting up to three peers who inject drugs. Coupons were uniquely coded to link participants to their survey responses and to biological specimens, and for monitoring recruitment lineages. Participants who completed the study received a primary incentive (a 10-euro grocery store voucher) for participating in the study and a secondary incentive (a 5-euro grocery store voucher) for each peer recruited. Peers had to come to the study site, be found eligible, and complete the study procedures for the recruiter to receive the secondary incentive.

We used an interviewer-administered structured questionnaire, containing multiple choice answer options and rating scales, based on the WHO Drug Injecting Study Phase II survey (Des Jarlais et al., 2006). Our primary outcome was ever providing injection initiation assistance (“assisting”). We defined “assisting” to participants as explaining, describing or demonstrating how to inject to a non-PWID who then injects for his/her first time in front of you, or actually injecting a non-PWID. Participants were asked about the number of non-PWID they had ever assisted, the number they had assisted in the last six months, and perceived likelihood of assisting in the future. For the last instance of assisting only, we asked about relationships to those assisted, reasons for assisting, sharing syringes with the person assisted, and thoughts about having assisted. We also asked about PWIDs past six-month experience with injection *promoting* behaviors (i.e., speaking positively about injecting to non-PWIDs, injecting in front of non-PWIDs, and offering to give a first injection to non-PWIDs), and about the number of non-PWIDs with whom they engaged in each of the three injection promoting behaviors. We note that *assisting* behaviors are distinct from *promoting* behaviors. Whereas the former by definition (see above) intentionally lead directly to someone’s first injection, promoting behaviors may or may not lead to someone’s first injection. Questions also elicited information on PWIDs’ demographics, injection and other drug use, sexual risk behaviors, and use of various HIV/harm reduction-related services. Other questions elicited information on the size of PWIDs’ injecting and non-injecting drug-using networks (using standard RDS network questions (CDC, 2012)). To assess external norms, we asked participants to estimate the proportion of their PWID peers who have assisted with first injections in the last six months. Regarding perceptions of stigma, we drew one question each from two stigma instruments that address two major types of stigma. One question, assessing internalized (self-) stigma (“I feel guilty or embarrassed that I am an injection drug user”), was drawn from Kalichman’s six-item AIDS-Related Stigma Scale, validated in Africa and North America (Kalichman et al., 2009). To assess injection drug use stigma, we adapted the item to refer to injection drug use rather than HIV. A second question, assessing anticipated external stigma (“I feel that people look down on me because I am an injection drug user”) was drawn from Pinel’s Stigma Consciousness Questionnaire, extensively validated in relation to many stigmatized groups (Pinel, 1999). We adapted the item to refer to injection drug use.

Venous blood was collected from participants and tested for the presence of HIV antibodies using commercially available test kits (ADVIA Centaur CHIV Ag/Ab Combo (SIEMENS)). The study protocol included pre- and post-HIV test counseling for study participants.

Ethical approval for the study was obtained from the Ethics Review Board of the University of Tartu, Estonia and from the Mount Sinai Beth Israel Medical Center Institutional Review Board in New York, USA (i.e., the home institution of the US collaborators). Written informed consent was secured from all participants.

2.2 Statistical analysis

We used statistical environment R (R Core Team, 2016) with packages RDS (Handcock et al., 2012) and survey (Lumley, 2004) for analyses. The recruitment data (i.e., the number of potential participants that the respondent knew within the target population and the coupon numbers of each respondent and his/her recruiter) were used to derive RDS sequential sampling (SS) estimates for the mean value or the prevalence (with 95% CIs) of the variables of interest (Gile, 2011). Sample means and proportions and RDS-weighted estimates were computed, and RDS estimates are presented in the Abstract and Results section. Descriptive statistics (i.e., proportions and means) for background demographic, drug use, HIV, and assisting and promoting behavior variables are presented.

Based on the response to the question “Have you ever helped anyone inject drugs for their first time who had never injected before?” we categorized respondents as either (ever) initiators or non-initiators. We defined “assisting” as: demonstrating injection to someone who then injects for the first time in front of you and/or actually injecting such a novice. We defined “promoting” behaviors as: talking positively about injecting to someone who has never injected before, injecting in front of someone who has never injected before, and offering to give a first injection to someone. We measured each promoting behavior separately. Bootstrap tests (Gile, 2011) were used to compare initiators and non-initiators across a range of variables. To identify independent factors associated with ever assisting, a backward stepwise logistic regression with 0.2 threshold for p -values (Maldonado and Greenland, 1993) was run using RDS SS weights to estimate adjusted odds ratios (aOR's). Injection promoting behaviors were not included in the multivariable model as they were considered potentially being on the causal pathway between predictors and assisting.

RDS weights were used in regression analyses to correct RDS sample estimates for over-/under-recruitment of individuals related to network size and homophily.

The homophily index, which estimates how similar recruiters and recruits are on given characteristics (Heckathorn, 1997), was calculated for key variables (age, sex, education, employment status, main injection drug, HIV status, methadone treatment status, main source of needles, ever assisting with someone's first injection). A homophily index of $H = 1.0$ reflects 100% homophily for a specific characteristic, indicating that all recruitment ties are formed with those having the same value on the characteristic. In contrast, $H = -1.0$ reflects 100% heterophily, indicating that all recruitment ties are formed with those having the opposite value on the characteristic. RDS assumes that participants recruit randomly from their social networks, so high positive or negative homophily is an indication that a sample does not form one interconnected social network but rather may form multiple, separate social networks.

3. Results

3.1 RDS characteristics

Overall, the crude estimates (sample proportions) did not significantly differ from the RDS adjusted estimates. Estimates for homophily indexes (not shown) for key independent variables in the study sample were close to zero, suggesting a single underlying population and no biases in participants' recruiting of new participants. Estimates for homophily indexes for both ever (index = 0.04) and never (index = -0.05) assisting someone with a first injection was also close to zero, indicating that respondents recruited other respondents without regard to their having assisted others with a first injection.

3.2 Demographic characteristics

The mean age of the sample was 33.2 (SD 6.7; sample median 33) years, ranging from 18 to 58 years. Over three-quarters of the PWID were men (76.7%, 95% CI 67.0–86.4%), close to half had 10 or more years of formal education (46.3%, 95% CI 34.5–58.0%) and were employed (52.1%, 95% CI 40.0–64.1%), and 16.6% (95% CI 5.3–27.9%) had unstable places of residence (e.g., they lived primarily in the street, a park, or in a shelter).

3.3 Injection drug use

One-tenth of the PWID (10.0% 95% CI 4.1–15.9%) had injected drugs for five years or less, about half (49.8% 95% CI 37.8–61.8%) were mainly injecting fentanyl, and two-thirds reported non-injection drug use in parallel with injecting (67.5% 95% CI 55.8–79.2%). Receptive and distributive sharing of syringes and needles (i.e., getting and giving) over the past six months were, respectively, reported by 9.2% (95% CI 5.3–13.2%) and 16.8% (95% CI 11.7–21.9%) of PWID. Experiencing internalized stigma in relation to injection drug use was reported by 38.2% (95% CI 27.6–48.8%) and anticipation of being devalued by others if their PWID identity became known (anticipated stigma) by 26.2% (95% CI 18.1–34.3%) of PWID.

3.4 HIV infection prevalence and testing (Table 1)

Close to half (46.2%, 95% CI 34.4–58.0%) of participants were HIV infected, and a large majority (94.3%, 95% CI 87.7–100.0%) reported having tested for HIV before the study. Of those HIV infected, 66.2% (95% CI 49.1–83.3%) were on ART.

3.5 Assisting with a first injection

Of the 299 PWID, 54 (RDS estimate: 13.7%, 95% CI 7.7–19.6%) reported ever assisting someone with their first injection; 14 had done so in the last six months (4.3%, 95% CI 1.2–7.4%). The rate of initiating (providing injection initiation assistance to) a non-PWID was 7.9 (95% CI 3.7–16.8) per annum per 100 PWID. The rate of readiness to provide injection initiation assistance in the future was moderate: about one-fourth of the sample (23.5%, 95% CI 15.4–31.6%) reported that they might do so in the future. Rates of perceiving assisting as at all possible differed between those who had ever assisted and those who had never assisted. While 48.2% (95% CI 19.4–77.0) of those who had ever assisted perceived future

assisting as possible, only 19.6% (95% CI 11.5–27.8) of those who had never assisted did so ($p = .001$).

3.6 Recent injection promoting behaviors

In the last six months, close to one-tenth of PWID (9.4%, 95% CI 1.4–17.4%) talked positively about injecting in front of non-PWID and 16.2% (95% CI 9.5–22.9%) injected in front of non-PWID. Offering injection initiation assistance was exceedingly rare (0.6%, 95% CI 0.1–1.2%). In all, about one-fourth of PWID (23.6%, 95% CI 13.7–33.5%) reported any of these behaviors in the last six months. Also, in the past 6 months, 14.3% (95% CI 8.8–19.9%) of PWID had been asked to assist with a first injection, by three persons on average (95% CI 1.9–4.1).

3.7 Bivariable associations with ever assisting

In bivariable analyses (Table 1), ever assisting with a first injection was associated with younger age, receptive sharing, and having PWID friends who assisted with first injections in the last six months. Ever assisting was also associated with having been asked in the last six months to assist and with engaging in two of the three promoting behaviors in the last six months (offering to give a first injection, injecting in front of non-PWID).

3.8 Multivariable analysis of factors associated with ever assisting (Table 1)

In this analysis, assisting someone with a first injection was associated with gender, age, receptive sharing, ever being tested for HIV, and external norms. Odds for ever assisting someone with their first injection were higher among: men (aOR 6.31 95% CI 2.02–19.74); PWID aged 30 years or less (aOR 3.89 95% CI 1.40–10.16); those reporting receptive sharing (aOR = 4.73 95% CI 1.32–16.98); those ever tested for HIV (aOR = 8.44 95% CI 1.15–62.07); and those having peers who assisted in the last six months with someone's first injection (aOR 3.44 95% CI 1.31–9.03).

3.9 The last episode of assisting with a first injection

Participants who had ever assisted with a first injection were asked questions about the last episode of assisting. Specifically, initiators were asked about their relationship with the first-time injector and their reasons for assisting. In this last episode, PWID assisted acquaintances (42.2%), friends (35.2%), sexual partners (13.2%), and strangers (7.6%). The main reasons for assisting were the novice's lack of injection skills ("S/he did not know how to inject") (78.1%), agitated state ("S/he was shaking/nervous") (45.8%), and direct request ("S/he asked me to") (44.4%). (Participants could endorse more than one reason.) In about one-third of episodes (32.6%), drugs were shared and in only a few cases (2.0%), money was paid for assisting. One-fifth (21.1%) of the initiators did so to share the experience of injecting drugs. Syringes were shared 7.2% of the time in the last episode of assisting.

4. Discussion

The significant role that experienced PWID play initiating others, and thereby sustaining injection drug use across cohorts (White et al., 2015), has principally been studied in North America, Australia and the United Kingdom. However, the geography of new and

continuing injection drug use epidemics extends to diverse legal, political, socio-cultural, economic, and drug-using contexts. In this study we describe providing injection initiation assistance and promoting behaviors, and predictors of the former, in a sample of PWID in Tallinn, Estonia.

The proportion in our sample who had ever assisted with a first injection (13.7%) was low, compared with other samples (Bluthenthal et al., 2014; Bryant and Treloar, 2008; Crofts et al., 1996; Day et al., 2005; Hamida et al., 2018; Hunt et al., 1998; Kermode et al., 2007; Rhodes et al., 2011; Rotondi et al., 2014). However, the proportion assisting in the last six months was more consistent with other studies (Hamida et al., 2018; Rotondi et al., 2014).

An alternative measure used in the research to quantify initiation is estimating the average number of novices assisted by PWID (using either the number of assisting PWID or all PWID in a sample as the denominator). Bluthenthal et al. (2014), in an urban California sample, found that those who had ever assisted had helped 15.5 persons on average and those who had assisted in the last 12 months helped an average of 9.8 persons during that period (for the latter, in our sample, the corresponding estimate is an average of 1.6 persons). In two other studies (Bryant and Treloar, 2008; Kermode et al., 2007), initiators had ever initiated an average of 2.3 and 5 injection-naïve individuals, respectively. However, these studies included only those injecting five or fewer years and aged 19–28, respectively. In a study of PWID aged 25 or younger (Crofts et al., 1996), the full sample (i.e., initiators and non-initiators) initiated an average of 0.6 persons into injection per year. In our full sample, PWID initiated an average of 0.079 persons per year.

There is an important possible explanation for the discrepancy between our findings and those of prior studies. Our finding of a low average number of individuals initiated into injection is consistent with evidence of a subsiding injection drug use epidemic in Estonia (Uusküla et al., 2013, 2015, 2017).

Directly *offering* assistance with a first injection without being asked was exceedingly rare in our sample. Importantly, however, about one-sixth of PWID (14.3%) had *been asked* for assistance with a first injection in the last six months. In a California sample of PWID, 71 percent had *ever* been asked to assist with a first injection (Bluthenthal et al., 2014). Both our and the California data suggest a fundamental dynamic of transitioning: novices asking for assisting with first injection more often than PWID offer assistance.

However, while directly offering help was rare, frequencies of other promoting behaviors were considerably higher. About one-tenth and one-sixth of PWID engaged, respectively, in talking positively about injection to a non-PWID and injecting in front of a non-PWID. These behaviors may serve to normalize injection in the community, making it easier for non-injecting drug users to progress to injection. Speaking positively about and describing injecting to non-injectors have positively predicted initiating novices in other samples (Bluthenthal et al., 2014; Rotondi et al., 2014).

Our finding that younger subjects are more likely to have ever assisted with first injections suggests that norms for initiating others may have changed among PWID. Alternatively, this may suggest that initiators among the older PWID have discontinued injecting or have not

survived due to overdose or HIV infection. The finding that males were more likely to be initiators than females is consistent with one other study (Hamida et al., 2018); Day et al. (2005), however, reported no gender difference. To the best of our knowledge, no other studies have examined the relationship between receptive sharing of injection equipment and providing injection initiation assistance. Our finding of a positive relationship between receptive sharing and assisting high-lights injection as a more social or transactional activity for initiators versus non-initiators. Our finding that initiators were more likely to have tested for HIV parallels a similar finding between assisting and HCV testing in another study (Bryant and Treloar, 2008). Altruism as a motivator for assisting with the first injection – the desire to minimize injecting harms to novices by assisting with the first injection – has been discussed in two recent qualitative studies (Kolla et al., 2015; Wenger et al., 2016). We note the absence of findings of an association between assisting and stigma. This may be explained by the fact that PWID and non-PWID interact together in closed networks, where injecting is a norm, and not stigmatized. In addition, the absence of an association may be due to our two-item assessment not adequately capturing stigma. We also note the absence of an association between methadone maintenance and assisting. As observed in North American studies, we expected that participating in methadone maintenance might inhibit assisting. We attribute the absence of inhibiting effects of methadone maintenance on assisting in our sample to the low intensity (including relatively low doses of methadone and limited adjunct social services) and low coverage (Raben, 2014; NIHD, 2008) of methadone treatment in Estonia. We note as well the absence of an association between ART and assisting. We expected to see an inhibitory effect between ART and assisting and attribute the absence of an effect to the low threshold of ART in Estonia.

Factors found to be associated with initiating others mark areas that could inform prevention interventions in Estonia, and potentially more broadly. First, our identification of knowing PWID who have assisted with first injections as a predictor of assisting behavior is an indication for implementing a peer-driven intervention. This finding suggests that brief, user-friendly, peer-driven interventions for reducing injection initiation might readily effect norm change. Second, our identification of young men as more likely to assist with first injections argues for the importance of tailoring programs for them. Third, our findings also suggest the utility of combined interventions that integrate strategies for reducing injection initiation behavior, injection risk reduction, and HIV testing (Werb et al., 2016). Fourth, our findings suggest that interventions to reduce injection initiation behavior ought to address altruistic motivations to assist novices the initiator knows. This conclusion proceeds from findings that initiators primarily assisted those they knew (e.g., friends and acquaintances) and that their main reasons for assisting were the novice's lack of skills, nervousness, and a direct request for help. With both initiators and non-initiators moved by altruistic motives, it would seem prudent to include both types of injectors in any interventions to reduce injection initiation. Still, such interventions might be differently tailored for those who have ever assisted with a first injection and those who have not.

Our findings are generally similar to the findings from North America. One difference is our aforementioned finding of an association between knowing PWID who were initiators with being an initiator oneself. However, we note that there is considerable variation in questions used to identify factors associated with assisting with first injections. We suggest that

researchers work towards adopting a common set of questions. This would permit greater clarity in identifying regional differences as well as facilitating meta-analyses.

Our study has limitations that should be noted. The cross-sectional design imposes well-known limits for causal inference. Many of the variables that were significantly associated with having ever assisted with a first injection were measured for the six months prior to the interview, while most instances of assisting occurred prior to this six-month period. Though some of these past six-month behaviors may extend back in time and pre-date assisting with first injections, caution is nevertheless warranted in making any inferences about these factors acting as causes for assisting with a first injection. Additional data on factors measured *prior* to assisting is needed before formal causal models of assisting can be constructed. Social desirability and recall bias are potential sources of bias – especially associated with self-disclosure of sensitive information (including material related to social norms against initiating novices into injection among PWID) and illegal behaviors. We also note limitations of RDS analysis. While RDS is efficient for sampling, RDS samples may suffer from a bias that we cannot detect. Further, the performance of the inference methods is not certain due to the reliance on multiple assumptions of the sampling process that may not be met (White et al., 2012). However, such potential limitations seem unlikely to account for the clear patterns observed in this study.

In conclusion, our results support the utility of implementing peer-driven interventions to reduce injection initiation assistance behavior and its risk factors among PWID. This is especially because of associations obtained between social factors (e.g., knowing PWID who have helped with first injections) and assisting behavior in PWID. A powerful example is the “Change the Cycle” intervention shown to be efficacious among PWID in North America and the United Kingdom (Hunt et al., 1998; Strike et al., 2014). Our results have also expanded the list of predictors of assisting with first injections – including male gender, younger age, history of HIV testing, receptive sharing of needles and syringes, and having PWID peers who have assisted with others’ first injections. The generalizability of our findings to other regions and time periods is unknown. Future research is indicated to determine this. This knowledge base is needed to improve efforts to decrease provision of injection initiation assistance among PWID, to ultimately decrease transitions to injection drug use, and to reduce the health, social and economic harms associated with injection drug use.

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Table 1

Factors associated with providing injection initiation assistance among current PWID in Tallinn (in 2016).

Variable	Group	Ever initiators as a proportion of each subgroup	Bivariable analysis	Multivariable analysis
		Crude n/N (%)	RDS OR (95%CI), p-value	RDS AOR (95%CI), p-value
Socio-demographic characteristics				
Age	> 30	28/185 (15.1%)	8.93% (4.73–13.12)	1
	< = 30	26/112 (23.2%)	20.58% (8.14–33.03)	2.63 (1.20–5.78), p = .0165
Gender	Female	6/69 (8.7%)	8.23% (–3.07–19.53)	1
	Male	48/230 (20.9%)	15.23% (8.42–22.04)	1.98 (0.51–7.70), p = .3245
				6.31 (2.02–19.74), p = 0.0018
Education	< 10 years	31/158 (19.6%)	16.09% (6.72–25.46)	1
	> = 10 years	23/141 (16.3%)	10.93% (5.15–16.71)	0.64 (0.29–1.39), p = .2581
Employment	Not employed	22/142 (15.5%)	9.01% (1.75–16.28)	1
	Employed	32/155 (20.6%)	18.03% (8.60–27.46)	2.22 (0.99–5.00), p = .0544
Place of residence	Non-permanent	8/35 (22.9%)	16.90% (1.58–32.23)	1
	Permanent	46/264 (17.4%)	13.01% (7.06–18.96)	0.73 (0.22–2.44), p = .6067
Injection drug use				
Length of injection drug use	< = 5 years	4/34 (11.8%)	9.80% (1.07–18.54)	1
	> 5 years	50/262 (19.1%)	14.18% (7.74–20.61)	1.49 (0.41–5.42), p = .5426
Main drug injected, last 6 months	Other	20/108 (18.5%)	12.00% (4.62–19.39)	1
	Fentanyl	34/191 (17.8%)	15.37% (5.45–25.29)	1.34 (0.59–3.05), p = .4818
Any non-injection drug use, last 6 months	No	16/98 (16.3%)	15.32% (4.33–26.32)	1
	Yes	38/201 (18.9%)	12.96% (6.16–19.76)	0.82 (0.34–1.95), p = .6542
Injecting daily, last 4 weeks	Daily	16/74 (21.6%)	19.98% (–3.65–43.61)	1
	Less frequent	37/224 (16.5%)	12.20% (6.53–17.86)	0.56 (0.24–1.29), p = .1724
Receptive sharing ¹ , last 6 months	No	40/255 (15.7%)	11.09% (5.36–16.82)	1
	Yes	14/43 (32.6%)	39.43% (11.90–66.97)	1
				4.73 (1.32–16.98), p = 0.0181
Distributive sharing ² , last 6 months	No	34/228 (14.9%)	11.85% (5.76–17.94)	1
	Yes	20/70 (28.6%)	23.11% (7.31–38.91)	2.24 (0.96–5.23), p = .0641

Variable	Group	Ever initiators as a proportion of each subgroup	Bivariable analysis	Multivariable analysis
		Crude n/N (%)	RDS% (95%CI)	RDS OR (95%CI), p-value
Sexual behavior (last 6 months)				
Any sex partners	Yes	43/253 (17.0%)	14.37% (8.20–20.54)	1
	No	11/44 (25.0%)	11.69% (–3.74–27.12)	0.79 (0.28–2.24), p = .6568
Any unprotected sex	Yes	25/185 (13.5%)	11.71% (5.22–18.21)	1
	No	18/65 (27.7%)	23.82% (7.32–40.32)	2.34 (0.94–5.84), p = .0685
HIV infection				
HIV seropositivity	Positive	26/164 (15.9%)	14.71% (3.47–25.96)	1
	Negative	28/135 (20.7%)	12.89% (6.67–19.12)	0.87 (0.39–1.93), p = .7276
Aware of HIV+ status	No	3/21 (14.3%)	14.01% (–28.01–56.03)	1
	Yes	23/143 (16.1%)	14.82% (4.41–25.23)	1.09 (0.18–6.55), p = .9272
Services utilization				
Currently on methadone	No	40/215 (18.6%)	13.19% (6.49–19.89)	1
	Yes	14/84 (16.7%)	15.79% (8.93–22.65)	1.24 (0.54–2.83), p = .6065
Main source of new syringes, last 6 months	Other	18/88 (20.5%)	17.01% (3.23–30.78)	1
	NSP ¹	36/210 (17.1%)	12.15% (5.56–18.74)	0.67 (0.28–1.59), p = .3617
Ever tested for HIV	No	1/12 (8.3%)	2.06% (–6.27–10.39)	1
	Yes	53/287 (18.5%)	14.42% (8.14–20.69)	7.58 (0.83–68.87), p = .0729
Currently on ART	Yes	14/110 (12.7%)	12.90% (0.99–24.81)	1
	No	12/54 (22.2%)	18.34% (4.60–41.29)	1.46 (0.45–4.75), p = .5274
Stigma				
Internalized	Yes	19/113 (16.8%)	14.54% (4.39–24.68)	1
	No	34/184 (18.5%)	13.18% (5.88–20.48)	0.88 (0.38–2.04), p = .7724
Externalized	Yes	21/92 (22.8%)	17.72% (7.73–27.72)	1
	No	33/206 (16.0%)	12.26% (5.38–19.14)	0.65 (0.29–1.45) p = .2941
Peer network size				
Injecting drug users	< = 10	26/155 (16.8%)	12.44% (5.79–19.09)	1
	> 10	28/143 (19.6%)	19.39% (–0.88–39.67)	1.68 (0.78–3.60), p = .1836
Non-injecting drug users	> 3	21/123 (17.1%)	10.66% (5.01–16.30)	1
	< = 3	33/176 (18.8%)	15.02% (6.98–23.06)	1.47 (0.67–3.24), p = .3397

Variable	Group	Ever initiators as a proportion of each subgroup Crude n/N (%)	RDS% (95%CI)	Bivariable analysis RDS OR (95%CI), p-value	Multivariable analysis RDS AOR (95%CI), p-value
External norms					
Any friends who helped initiate, last 6 months	No	16/123 (13.0%)	8.83% (3.41–14.25)	1	1
	Yes	21/71 (29.6%)	26.58% (10.30–42.86)	3.75 (1.52–9.29), p = .0047	3.44 (1.31–9.03), p = 0.0132
Recent (with in last 6 months) helping and promoting behaviors					
Helping					
Has helped 1 st time	Yes	14/14 (100.0%)	100.00% (100.00–100.00)	1	
	No	40/285 (14.0%)	9.83% (4.52–15.13)	NA	
Has been asked to help 1 st time	No	36/239 (15.1%)	9.86% (4.59–15.14)	1	
	Yes	18/60 (30.0%)	36.47% (11.29–61.65)	5.27 (2.22–12.51),	
Promoting					
Has talked positively	No	43/278 (15.5%)	11.92% (5.76–18.08)	1	
	Yes	11/21 (52.4%)	30.62% (9.92–51.33)	3.33 (0.91–12.28), p = .0713	
Has offered to give a first injection to non-PWID	Yes	3/3 (100.0%)	100.00% (100.00–100.00)	1	
Has injected in front of non-PWIDs	No	51/289 (17.6%)	13.66% (7.44–19.88)	NA	
	No	32/218 (14.7%)	10.48% (4.33–16.62)	1	
	Yes	22/77 (28.6%)	31.08% (9.18–52.97)	3.73 (1.58–8.82), p = .0029	

¹Receptive sharing – getting used syringes or needles to use for own injections.

²Distributive sharing – giving, lending, renting, or selling syringes or needles that the individual has already used to someone else to inject with.

³NSP – Needle and syringe program.