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Longitudinal analysis of change in individual-level needle and syringe coverage amongst a cohort of people who inject drugs in Melbourne, Australia

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ABSTRACT

Background: Needle and syringe program (NSP) coverage is often calculated at the individual level. This method relates sterile needle and syringe acquisition to injecting frequency, resulting in a percentage of injecting episodes that utilise a sterile syringe. Most previous research using this method was restricted by their cross-sectional design, calling for longitudinal exploration of coverage.

Methods: We used the data of 518 participants from an ongoing cohort of people who inject drugs in Melbourne, Australia. We calculated individual-level syringe coverage for the two weeks prior to each interview, then dichotomised the outcome as either "sufficient" (≥100% of injecting episodes covered by at least one reported sterile syringe) or "insufficient" (< 100%). Time-variant predictors of change in recent coverage (from sufficient to insufficient coverage) were estimated longitudinally using logistic regression with fixed effects for each participant.

Results: Transitioning to methamphetamine injection (AOR:2.16, p = 0.004) and a newly positive HCV RNA test result (AOR:4.93, p = 0.001) were both associated with increased odds of change to insufficient coverage, whilst change to utilising NSPs as the primary source of syringe acquisition (AOR: 0.41, p = 0.003) and opioid substitution therapy (OST) enrolment (AOR:0.51, p = 0.013) were protective against a change to insufficient coverage.

Conclusions: We statistically tested the transitions between time-variant exposure sub-groups and transitions in individual-level syringe coverage. Our results give important insights into means of improving coverage at the individual level, suggesting that methamphetamine injectors should be targeted, whilst both OST prescription and NSP should be expanded.

1. Introduction

Needle and syringe program (NSP) coverage is often calculated at the individual level, according to the method devised by Bluthenthal et al. (2007a). This method relates sterile needle and syringe (hereafter "syringe/s") acquisition to injecting frequency, resulting in a percentage of injecting episodes that utilise a sterile syringe. Compared to population-level measurements, such as those proposed by UNAIDS (Burrows, 2006a) and the WHO (WHO, 2011), which often distort coverage estimates via aggregation, individual-level measures of syringe coverage capture the individual risk elements of people who inject drugs (PWID) and rightly consider PWID as a heterogeneous population.

Previous research on individual-level coverage amongst PWID using Bluthenthal et al.'s measure (Bluthenthal et al., 2007a; Bryant et al., 2012; Iversen et al., 2012; McCormack et al., 2016; Noroozi et al., 2015; O'Keefe et al., 2016) shows consistent findings that opioid substitution therapy (OST) prescription and the utilisation of NSPs as a source of syringe acquisition (as opposed to acquiring syringes from pharmacies or informal sources such as friends/partners/dealers) are associated with sufficient coverage (defined as ≥100% of injecting episodes that utilise a sterile syringe) (Bryant et al., 2012; Iversen et al., 2012; O'Keefe et al., 2016). Insufficient coverage (< 100%) has been associated with receptive syringe sharing, syringe reuse, increased injecting frequency and hepatitis C virus (HCV) infection (Bluthenthal et al., 2007a; Bryant et al., 2012; Iversen et al., 2012; Noroozi et al., 2015; O'Keefe et al., 2016). However, most of these studies were restricted by their cross-sectional designs, and their inferences subsequently limited by only a single point of observation.

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The need to analyse individual-level coverage longitudinally was identified by Bluthenthal et al. in their original 2007 paper (Bluthenthal et al., 2007a). Whilst they made specific reference to the causal association between syringe dispensation policy and coverage, the cross-sectional associations found in other research show that there are many causative paths to low coverage. For example, levels of service funding (Burrows, 2006b), syringe dispensation policy (Bluthenthal et al., 2007b), aggressive police operations (Cooper et al., 2005; Wood et al., 2003), geographic proximity to services (Cooper et al., 2012), hours of operation (Wood et al., 2002) and injecting network characteristics (Bryant et al., 2012) have been shown to impact upon service access and therefore, coverage. Longitudinal analysis is required to identify temporal factors that influence an individual's ability to achieve sufficient coverage. The results of such analysis would enable the design of policies that minimise exposure to any detrimental factors.

We previously described the longitudinal characteristics of individual-level syringe coverage amongst a cohort of PWID in Melbourne, Australia. We showed that many participants in the Melbourne Injecting Drug User Cohort (MIX) study (Horyniak et al., 2013) fluctuated between states of sufficient and insufficient coverage over time (O'Keefe et al., 2016) and that at each interview wave between 22% and 36% of the cohort reported insufficient coverage, percentages similar to those found in other cross-sectional Australian research (Bryant et al., 2012; Iversen et al., 2012; McCormack et al., 2016). However, we did not examine factors associated with these fluctuations. Such an examination is needed, as 45% of the sample oscillated between states of sufficient and insufficient coverage over time, suggesting the presence of temporal mediators of the ability to adequately cover injecting episodes (O'Keefe et al., 2016). These can be identified using a fixed effects regression analysis, which controls for individual characteristics and measures only associations between changes in temporal variables and changes in coverage (Scott et al., 2016).

In this study, we expand upon our previous analysis and explore the temporal factors of change in syringe coverage (from sufficient to insufficient coverage). We analysed seven years of data from an ongoing cohort of PWID in Melbourne, Australia, aiming to:

- describe and analyse the longitudinal successions between states of sufficient and insufficient coverage; and
- identify time-varying predictors of change between states of sufficient and insufficient coverage via logistic regression using fixed effects to control for individual characteristics.

2. Methods

Our data come from the MIX study, which has been described in detail elsewhere (Horyniak et al., 2013). Briefly, participants are administered an annual, structured questionnaire with blood sample testing for HIV, HCV and hepatitis B virus. Recruitment of the original 688 MIX participants occurred between 2008 and 2010, though an additional 69 participants were included in the cohort in 2011 via past involvement in the Networks II cohort (Sacks-Davis et al., 2012), resulting in 757 participants. Both MIX and Networks II sought to recruit PWID who injected regularly. The characteristics of the cohorts at baseline (2005 for Networks II) were comparable (Scott et al., 2016).

Eligibility criteria for the original MIX cohort were being aged 18–30 years and reporting injecting of heroin and/or methamphetamine regularly (at least once a month in the six months prior to recruitment).

2.1. Participant sample

The most recently available MIX dataset (May 2016) includes 3312 interviews over nine interview waves. Coverage questions were not introduced into the MIX questionnaire until June 2010. Consequently, all interviews prior to this date (902 interviews, including 176 participants who were not interviewed after June 2010) were excluded from analysis. Due to the longitudinal nature of this study, we further excluded those participants with only one interview after June 2010 (63 interviews, 63 participants). The final, amended dataset consisted of 518 participants and 2347 interviews across a maximum of seven separate interview waves, occurring between June 2010 and May 2016. Attrition was low, with 88% of remaining participants completing at least three interviews within the amended dataset, and a mean 1851 (range: 308, 2889) days of study time within our sample, equivalent to a mean 5.1 years.

The exclusion process is described in Fig. 1.

2.2. Coverage parameters

The MIX questionnaire includes the following questions to record the three primary coverage parameters (syringe acquisition, peer-to-peer syringe distribution and injecting frequency):

*"In the last **two weeks** how many new (needles and) syringes in total did you get?"*

*"In the last **two weeks** how many new (needles and) syringes did you give away or sell to others?"*

Past week injecting frequencies for 18 different drug types were

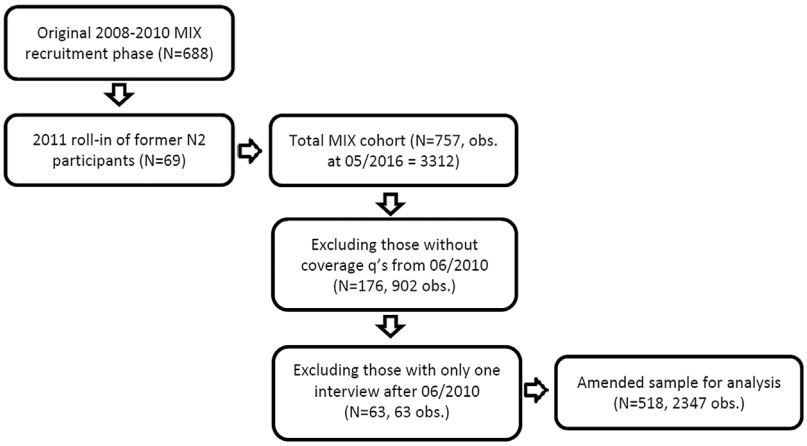

Fig. 1. The initial 2008–2010 MIX cohort recruitment phase (N = 688) and the additional roll-in of former N2 participants in 2011 (N = 69), gave a total of 757 participants. Our sample first excluded those without an interview after June 2010 (after introducing necessary coverage questions, N = 176), then excluded those with only one interview after June 2010 (inappropriate for longitudinal analysis, N = 63), leaving a final amended sample of 518 participants and 2347 longitudinal observations.