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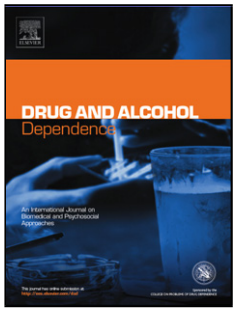

Title: Longitudinal changes in psychological distress in a cohort of people who inject drugs in Melbourne, Australia

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Longitudinal changes in psychological distress in a cohort of people who inject drugs in Melbourne, Australia

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Highlights

- Psychological distress was examined in a cohort of people who inject drugs (PWID)
- We found higher levels of psychological distress in PWID than the general population
- Average levels were consistent over time, masking within-individual change
- Assault and intentional overdose predicted increases in psychological distress
- Environmental factors may drive higher levels of distress reported by women

ABSTRACT

Background: Previous research into psychological distress among people who inject drugs (PWID) is predominantly cross-sectional; we determined longitudinal predictors of change in psychological distress among a cohort of PWID. **Method**: We examined Kessler Psychological Distress Scale (K10) scores from 564 PWID (66% male) enrolled in the Melbourne Injecting Drug User Cohort Study. Gender-stratified linear models with fixed effects for each participant were used to examine correlates of change in individual K10 scores. Further linear regressions of adjusted K10 scores were used to measure correlations between demographic variables. R**esults**: Participants reported higher K10 scores (higher psychological distress) than the general Australian population (mean K10 scores 23.4 (95%CI 22.6-24.2) and 14.5 (95%CI 14.3-14.7) respectively). The cohort's mean K10 score did not significantly differ over time, but indivdual variations were common. Women reported higher K10 scores than men (mean baseline K10 scores 25.2 (95%CI 23.9-26.6) and 22.4 (95%CI 21.5-23.3) respectively), however no significant differences remained after controlling for temporal factors. Key predictors of increases in K10 scores were being the victim of an assault in the past six months (*P*<.001 for women and men) and intentionally overdosing in the past 12 months (*P*=.010 for women and *P*<.001 for men). **Conclusions:** PWID experience higher levels of psychological distress than the general population. Temporal rather than individual factors may account for the higher levels of psychological distress reported among women. Interventions to reduce rates of assault and/or intentional overdose should be explored to reduce high levels of psychological distress among PWID.

KEYWORDS: Injecting drug use; heroin use; psychological distress; mental health; cohort study; longitudinal research

1 INTRODUCTION

People who inject drugs (PWID) typically have high rates of mental illness and associated problems. For example, in a survey of PWID conducted as part of the Australian Illicit Drug Reporting System (IDRS), 44% reported experiencing at least one mental health problem (depression 29%, anxiety 20%) in the previous six months, more than double the rate of past-year mental health problems (20%) in the general Australian population (Australian Bureau of Statistics, 2008; Stafford and Burns, 2014). Similar findings have been published for PWID in other countries, including Canada (43% with a diagnosis of anxiety disorder and 29% a mood disorder; Roy et al., 2015), China (75% with severe depression; Li et al., 2015), India (84% with symptoms of depression, 71% anxiety, 53% suicidal ideation; Armstrong et al., 2013b), the USA (27% reporting at least one episode of depression; Sapra et al., 2013) and Russia (78% with at least mild depressive symptoms; Walley et al., 2014).

PWID commonly experience stressors that can negatively impact mental health, including loss of income (Lemstra et al., 2011), social isolation (Beynon et al., 2009; Darke and Ross, 2002), involvement in crime (Kinner et al., 2009), death of friends (Beynon et al., 2009), poor family relations (Li et al., 2015), concurrent alcohol use (Conner et al., 2008; Kennedy et al., 2015), overdose (Pabayo et al., 2013), non-sexual assault, and sexual assault (Lemstra et al., 2011; Shaw et al., 2015). On the other hand, individual factors such as age, duration of injecting career and education may also play important roles (Darke and Ross, 2002).

One way to examine mental health among PWID is by studying psychological distress. Psychological distress refers to a non-specific and broad range of unpleasant, confusing and/or upsetting symptoms and internal experiences, and is associated with affective disorders (Callaly et al., 2001; Cornelius et al., 2013; Kessler et al., 2002). Psychological distress can interfere with everyday functioning (Middleton and Shaw, 2000). Psychological distress is commonly studied using the Kessler Psychological Distress Scale (K10), a 10-item measure of psychological distress over the past four weeks (Kessler et al., 2002). The K10 was developed as a screening tool, with higher scores indicating higher levels of distress (Kessler et al., 2002). The K10 has good psychometric properties and is able to identify clinical symptoms of psychological distress as measured by the Diagnostic and Statistical Manual of Mental Disorders (Cornelius et al., 2013; Kessler et al., 2002) and has shown high levels of reliability and validity among PWID (Hides et al., 2007).

Past research using the K10 is mostly cross-sectional and often examines psychological distress as a covariate rather than an outcome of interest (e.g., Betts et al., 2015; Gibbie et al., 2011; Kinner et al., 2009; McKetin et al., 2008; Topp et al., 2010). Cross-sectional research shows PWID have higher psychological distress on the K10 than the general population in Australia (Stafford and Burns, 2014). Higher psychological distress indexed by the K10 has been associated with recent criminal activity (Kinner et al., 2009), unemployment and homelessness (Topp et al., 2010), non-fatal overdose (Betts et al., 2015), and personality disorders (Gibbie et al., 2011) in other cross-sectional research with PWID. Of particular relevance is that similar to the general population, rates of mental illness among PWID are thought to be influenced by gender, with women being more likely than men to experience mental illness, particularly depression (Kang and Deren, 2009; Lambdin et al., 2013; Pettes et al., 2015). However, cross-sectional research cannot reveal how temporal stressors influence the experience of psychological distress by PWID.

Unlike cross-sectional studies, longitudinal research can explore how psychological distress manifests in response to temporal factors. The only known relevant longitudinal study in this area

involved a cohort of PWID after release from prison and used the K10 as a covariate; the authors found that very high psychological distress on the K10 pre-release predicted post-release overdose (Winter et al., 2015). No known studies have examined K10 scores longitudinally with community-based PWID. To fill this gap, we explored longitudinal relationships between temporal factors and psychological distress among PWID, expecting that relationships observed in previous cross-sectional studies would also hold in longitudinal analysis.

2 METHODS

2.1 Participants and interviews

Participants were PWID enrolled in the Melbourne Injecting Drug User Cohort Study (MIX), a prospective cohort study of 688 PWID recruited between April, 2008 and January, 2010. An additional 69 participants, members of another cohort known as Networks II, were rolled into the study in 2011 (henceforth 'MIX participants' refers to all 757 participants; a comparison of original and Networks II participants is provided in the supplementary material[1]). Experienced fieldworkers interview participants face-to-face approximately annually to obtain detailed information about living circumstances, health, and drug use history. Individuals were eligible for inclusion if they had injected heroin or methamphetamine at least six times during the previous six months. MIX was approved by the Victorian Department of Human Services (now Department of Health) and Monash University Human Research Ethics Committees. Written informed consent was obtained from all participants after the nature of procedures was fully explained. As at 13 February, 2015, 2,862 interviews had been conducted. Details of the MIX cohort are provided in the supplementary material, and are also described elsewhere (Horyniak et al., 2013).

2.2 Measures

[1] Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:...

Continuous K10 scores were used for regression analysis and categorisations of low (10-15), moderate (16-21), high (22-29) or very high (30-50) psychological distress were used to compare transitions over time, based on categories used in the IDRS (Stafford and Burns, 2014a, 2014b). K10 questions were included in MIX interviews from November, 2010 onwards; scores were available for 62% (1770/2862) of interviews, with 75% (564/757) of participants having at least one recorded score.

2.3 Variables

Relevant MIX variables were classified as stable or temporal. Stable variables were:

- age at baseline;
- country of birth (Australia, other);
- language other than English spoken (Y/N);
- education (<year 10, year 10-11, year 12 or higher);
- length of injecting career at baseline; and
- incarceration history at baseline (none, once, twice, three or more times).

Temporal variables were:

- income type (none, wage, government pension, other);
- employment (Y/N);
- accommodation type (owner-occupied, private rental, public housing, unstable);
- drug used most in the past month (categorised as heroin, methamphetamine, cannabis, other);
- alcohol use as measured by scores on a variant of the Alcohol Use Disorders Identification Test Consumption (AUDIT-C) scale (Bush et al., 1998) (with scores of 0, 1-7 and >=8 classified according to (Dietze et al., 2013) as abstinent, low risk or high risk respectively);
- injection frequency (total reported injections, of all drugs, in the past week) ;
- injected more than usual in the past six months (Y/N) ;
- injected alone more than 80% of the time (Y/N) ;
- BBV transmission risk (Blood Borne Virus Transmission Risk Assessment Questionnaire – Short Version score; BBV-TRAQ-SV) (Stoové and Fry, 2006);
- OST status (Y/N);

- GP attendance in the past month (Y/N);
- attended psychiatrist/psychologist/social worker/drug counsellor in the past month (Y/N);
- attended an emergency department (ED) in the past month (Y/N);
- heroin overdose in the past six months (Y/N);
- intentionally overdosed in the past 12 months (Y/N);
- been the victim of an assault in the past six months (Y/N); and
- been arrested in the past six months (Y/N).

2.4 Data analysis

2.4.1 Comparison of K10 scores to the general population. Percentiles of K10 scores for the MIX cohort were compared to those for the general Australian population as measured in the 2007 Australian National Survey of Mental Health and Wellbeing (Slade et al., 2011). The K10 score distribution for MIX participants was created using the first questionnaire each participant completed (N=564).

Longitudinal studies of PWID (albeit mostly involving people in drug treatment rather than community samples such as ours) have generally shown a small but significant decline of depressive symptoms over time (Conner et al., 2008). To measure changes within the MIX cohort, the distribution and cumulative distribution of K10 scores was compared across the first three occasions of administration. To minimise attrition bias, only participants who completed the K10 on three or more occasions (N=401) were included.

2.4.2 Transitions in K10 scores. To show typical trajectories of psychological distress within the sample, categorised K10 scores were cross-tabulated for participants' first-second and second-third consecutive questionnaires. All data were used to generate these tables (i.e., the 491 participants with two or more K10 questionnaires had their first-second K10 trajectories considered, and the 401 participants with three or more questionnaires had their second-third K10 trajectories considered).

2.4.3 Measuring the effects of temporal covariates on K10 scores. Associations between changes in temporal variables and changes in individuals' continuous K10 scores were measured using linear models with fixed effects for each participant. This method was used in preference to a generalized estimating equation, as by using participants as their own controls rather than sample population averages, more accurate measurement of the change in K10 score in response to changes in exposure variables was possible. All interviews with a valid K10 score (i.e., 1,770 interviews from 564 participants) were used for this analysis. By focusing on changes within individuals, this method also helps to control for attrition bias. To control for differences between men and women in the sample, the data were stratified by gender and coefficients estimated using independent models. Standard errors were clustered on participants to minimise repeated measurement bias. Covariates that were non-significant at the 90% level were removed and the models were re-run to determine the size of any correlations (categorical variables were determined to be non-significant if none of the outcomes had a significant coefficient and a composite Wald test combining all outcomes was non-significant).

2.4.4 Differences in K10 scores by demographics. Before comparing K10 scores across stable variables, confounding temporal variables were controlled for by assigning an adjusted K10 score to each participant. To calculate adjusted K10 scores, the previous models were re-run with matching sets of covariates. This involved extending each gender's set of remaining independent variables to include all of those in the other gender's model (i.e., if one variable was significant among men but not among women, it was included in both models). Adjusted K10 scores were then defined as participants' fixed effects added to the constant term of the new (gender-specific) models, and were assigned only on the first occasion a participant completed the questionnaire. These scores represent predicted values at the base outcome of all temporal variables (or zero for continuous variables); for example, if becoming unemployed decreased K10 scores by an average of two points, adjusted scores would include a two-point deduction for participants who were employed. Controlling for the effects of temporal variables in this way meant that a less confounded analysis of

stable variables was possible. This was because adjusted K10 scores account for the effects of events that may influence psychological distress but that had only been experienced by a proportion of participants, such as recent assault.

3 RESULTS

At baseline, the median age was 27.9 years, interquartile range 24.6-30.0 years. The median length of injecting career was 10.4 years, mean injection frequency was 8.9 times per week, 38% (n=285) were enrolled in OST, 61% (n=454) had a history of incarceration and 59% (n=441) reported heroin as the illicit drug used most in the past month (followed by 20% cannabis, n=149; 15% other—including other opioids and benzodiazepines—n=117; and 6% methamphetamine, n=45). There were minimal differences between participants with only one and participants with more than one K10 completion (see supplementary material[2]).

3.1 Comparison of K10 scores to the general population

Significantly higher levels of psychological distress were found among MIX participants than in the general Australian population (Figure 1, right). The mean K10 score (from participants' first questionnaires) was 23.4 (95%CI 22.6-24.2), while the mean K10 score for the Australian general population was 14.5 (95%CI 14.3-14.7) (Slade et al., 2011).

There was no clear trend over time in the MIX sample's distribution of K10 scores (Figure 2). The mean K10 scores from the first three questionnaires were 23.4 (95%CI 22.6-24.2), 22.2 (95%CI 21.4-23.0) and 22.5 (95%CI 21.6-23.4). Although the second questionnaire recorded slightly lower scores than the first (slight left shift in Figure 2, right), the third questionnaire results were between the previous two, indicating that even small changes were not consistent in direction

3.2 Transitions in categorized K10 scores

[2] Supplementary material can be found by accessing the online version of this paper at http://dx.doi.org and by entering doi:...

Despite the consistency of K10 score distributions across the whole cohort and interview waves, variations for individuals were common. Participants who reported low or very high levels of psychological distress were less likely to report a different level of distress in their following interview than participants who reported moderate or high psychological distress (Table 1). Few participants who reported low or moderate psychological distress in one interview reported very high levels in subsequent interviews.

3.3 Measuring the effects of temporal variables on K10 scores

Table 2 shows the regression coefficients for the remaining temporal variables in each model. Being the victim of an assault in the past six months and intentionally overdosing in the past 12 months were associated with higher K10 scores in both men and women. Psychological distress was also: positively associated with having seen a GP (among women); positively associated with injecting more than usual (among men); and negatively associated with being employed and having used cannabis the most in the past month, rather than heroin (among men).

3.4 Measuring the effects of stable variables on K10 scores

After adjusting K10 scores to control for the effects of temporal variables, there were no remaining correlations between stable variables and psychological distress.

3.5 Comparison of K10 scores to adjusted K10 scores

On average, women reported higher K10 scores than men; the mean K10 scores were 25.2 (95%CI 23.9-26.6) and 22.4 (95%CI 21.5-23.3) respectively. Both male and female distributions shifted towards less psychological distress after controlling for temporal variables and were no longer significantly different; the mean female and male adjusted K10 scores were 20.2 (95%CI 19.3-21.2) and 20.8 (95%CI 20.1-21.5) respectively, significantly lower than the original K10 scores. The greater shift among women is consistent with the more positive (as opposed to negative)

associations observed in Table 2. Figure 3 shows the distribution of K10 scores among men and women before and after adjusting for temporal variables.

4 DISCUSSION

We determined the degree of psychological distress and predictors of changes in psychological distress among a community-based cohort of PWID in Melbourne. As anticipated, PWID reported significantly higher psychological distress than the general Australian population. Average scores were consistent over time, but longitudinal analysis revealed significant variation in individuals' distress, reflecting the important role of the temporal factors. For example, being assaulted in the past six months and intentionally overdosing in the past 12 months was significantly associated with increases in psychological distress, and among men becoming employed was significantly associated with decreases in psychological distress.

Consistent with previous research, women in our study reported higher psychological distress than men (Kang and Deren, 2009; Lambdin et al., 2013); but this difference was no longer apparent after adjusting for temporal variables. This suggests that within our sample, temporal factors accounted for these gender-based differences better than intrinsic differences between individuals, which may indicate an increased vulnerability of women in the social context of injecting drug use (Rhodes, 2002; Rhodes, 2009). For example, recent assault was not only reported more frequently by women, but the association between recent assault and psychological distress was stronger among women. This may be related to differences in the types of assault perpetrated against each gender: sexual assault was experienced far more frequently by female PWID in our sample, and mental illness manifests more severely among victims of sexual assault than victims of non-sexual assault (Badour et al., 2013). The stronger association may also be related to post-traumatic distress disorder, which has been observed in relation to intimate partner violence (Cavanaugh et al., 2010; Ford et al., 2007) and at higher rates among women than men (Mackesy-Amiti et al., 2012) in research involving PWID. Although some researchers have studied associations

between assault and mental health (Marshall et al., 2008; Torok et al., 2008), further longitudinal work is needed to understand the influence of gender on the relationship between both sexual and non-sexual assault and measures of mental health and wellbeing, particularly given the high rates of female sex work among PWID (Marshall et al., 2008).

We found correlations with temporal factors. Intentional overdose was significantly associated with an increase in psychological distress among both men and women, but given the unknown relative timings of the increase in psychological distress and the intentional overdose episode we are unable to draw any conclusions in relation to causality. Other factors associated with changes in psychological distress were different between genders, possibly due to the different environmental contexts experienced by men and women. Among men we found that injecting more than usual was associated with an increase in psychological distress, which is consistent with previous research identifying higher injecting frequency as a risk factor for depressive symptoms (German and Latkin, 2012; Lemstra et al., 2011). Changing drug of choice from heroin to cannabis was associated with a decrease in psychological distress among men, perhaps simply reflecting a decrease in injecting frequency. A change in employment status was negatively associated with a change in psychological distress, which highlights the importance of individuals having social and economic participation in society. Among women, we found that recently seeing a GP was associated with higher levels of psychological distress, potentially indicating help-seeking behaviour.

Once we controlled for temporal factors, our analysis of adjusted K10 scores did not detect any associations with individual characteristics previously associated with mental health among PWID, including duration of injecting career and educational attainment (Darke and Ross, 2002). This could be because these variables are typically confounded by circumstantial and temporal variables in other studies, and highlights the importance of longitudinal data to consider injecting drug use in its entire context. For example, longer injecting careers might be associated with more of the negative outcomes such as experiencing assault that we controlled for in the analysis.

In contrast to previous cross-sectional research on mental health in PWID (German and Latkin, 2012; Johnson et al., 2002; Lemstra et al., 2011; Nambiar et al., 2014), our longitudinal analysis findings were inconclusive with respect to changes in OST status, seeing mental health professionals (with the exception of GPs among women), ED attendance, past six month accidental heroin overdose, arrest in the past six months and BBV transmission risk. This may be a result of the fixed effects analysis used, which was deliberately chosen to consider only changes in independent exposures when estimating the effects of exposure on psychological distress. For example, if the number of participants who initiated OST during follow-up was low, the regression model may have suffered from low power to detect a significant association between OST and changes in levels of psychological distress. This may also explain why, in contrast to previous researchers (Havard et al., 2006), we found no association between initiating OST and a change in psychological distress, although OST has previously been associated with reduced injecting frequency in this sample (Scott et al., 2015).

Our study has several limitations. Although the K10 is recommended as a screening tool for psychological distress among PWID (Hides et al., 2007), clinical measures for assessing depression and anxiety are more powerful than the K10, which is designed as a generalized screening tool for both (Gonzalez et al., 2011). Use of a generalised, non-specific measure might have limited our findings; for example, one study found that depression, but not anxiety, was associated with risk behaviours among PWID in India (Armstrong et al., 2013a). The data we examined come from a single sample of PWID in Melbourne, and care should be taken in generalising to broader populations or geographic locations. It is also unclear whether participants lost to follow-up experienced different levels of psychological distress to the sample retained, biasing results, and possibly explaining why no clear trends were seen in distribution of K10 scores over time, contrasting with previous research that identified small but significant declines of depressive symptoms in longitudinal studies of PWID (Conner et al., 2008). As mentioned above, there are also limitations to the fixed effects analysis used, which only considers changes in independent exposures when estimating the effects of exposure on psychological distress. However, this method was chosen in order utilize the longitudinal nature of the data, and is appropriate for detecting associations with exposures likely to change over time, such as recent experience of violence and intentional overdose. Finally, there was some error inherent in comparing variables with different timescales in the model. For example, the outcome relates to psychological distress over the previous four weeks, while exposure variables such as injecting frequency, being the victim of assault and intentional overdose relate to time frames of one week, 6 months and 12 months respectively.

MIX participants reported significantly higher levels of psychological distress than the general population, with average levels that were consistent over time; however, variation within individuals was common, highlighting the importance of temporal factors. In particular, key predictors of increases in psychological distress included being a recent victim of assault and intentional overdose in the past 12 months. Women reported higher psychological distress than men but within our sample temporal factors accounted for these differences, indicating that women may be more vulnerable in the broader environment in which injecting drug use takes place. The high prevalence and ongoing nature of psychological distress, and the lack of influence of OST and mental health professional attendance on psychological distress in this sample highlight the need to improve the effectiveness and accessibility of these services. Further research is needed on how to identify distressed individuals for mental health interventions, and to further examine the role of assault in psychological distress.

Contributors

EC conducted the literature review and led the writing of the manuscript. NS conducted the data analysis. PD is the chief investigator on the MIX study and oversaw the research process. MS, CA, PH and SC contributors as staff members of MIX. All authors contributed to the writing of the manuscript and approved the final manuscript.

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Conflict of interest disclosures

PD, MS and PH have received funding from Gilead Sciences Inc for work unrelated to this study. PD has received funding from Reckitt Benckiser for work unrelated to this study. EC, NS, SC and CA have nothing to disclose.

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REFERENCES

Armstrong, G., Jorm, A.F., Samson, L., Joubert, L., Nuken, A., Singh, S., Kermode, M., 2013a. Association of depression, anxiety, and suicidal ideation with high-risk behaviors among men who inject drugs in Delhi, India. J. AIDS 64, 502-510.

Armstrong, G., Nuken, A., Samson, L., Singh, S., Jorm, A.F., Kermode, M., 2013b. Quality of life, depression, anxiety and suicidal ideation among men who inject drugs in Delhi, India. BMC Psychiatry 13, 1.

Australian Bureau of Statistics, 2008. 4326.0 - National Survey of Mental Health and Wellbeing: Summary of Results, 2007. http://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/4326.0Main%20Features32007?opendocument&tabname=Summary&prodno=4326.0&issue=2007&num=&view=.accessed on 8/7/2015.

Badour, C.L., Feldner, M.T., Babson, K.A., Blumenthal, H., Dutton, C.E., 2013. Disgust, mental contamination, and posttraumatic stress: Unique relations following sexual versus non-sexual assault. J. Anxiety Disord. 27, 155-162.

Betts, K.S., McIlwraith, F., Dietze, P., Whittaker, E., Burns, L., Cogger, S., Alati, R., 2015. Can differences in the type, nature or amount of polysubstance use explain the increased risk of non-fatal overdose among psychologically distressed people who inject drugs? Drug Alcohol Depend. 154, 76-84

Beynon, C.M., Roe, B., Duffy, P., Pickering, L., 2009. Self reported health status, and health service contact, of illicit drug users aged 50 and over: a qualitative interview study in Merseyside, United Kingdom. BMC Geriatrics 9, 45.

Bush, K., Kivlahan, D.R., McDonell, M.B., Fihn, S.D., Bradley, K.A., 1998. The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Arch. Internal Med. 158, 1789-1795.

Callaly, T., Trauer, T., Munro, L., Whelan, G., 2001. Prevalence of psychiatric disorder in a methadone maintenance population. Aust. N.Z. J. Psychiatry 35, 601-605.

Conner, K.R., Pinquart, M., Duberstein, P.R., 2008. Meta-analysis of depression and substance use and impairment among intravenous drug users (IDUs). Addiction 103, 524-534.

Cornelius, B.L., Groothoff, J.W., van der Klink, J.J., Brouwer, S., 2013. The performance of the K10, K6 and GHQ-12 to screen for present state DSM-IV disorders among disability claimants. BMC Public Health 13, 128.

Darke, S., Ross, J., 2002. Suicide among heroin users: rates, risk factors and methods. Addiction 97, 1383-1394.

Dietze, P., Jenkinson, R., Aitken, C., Stoove, M., Jolley, D., Hickman, M., Kerr, T., 2013. The relationship between alcohol use and injecting drug use: impacts on health, crime and wellbeing. Drug Alcohol Depend. 128, 111-115.

German, D., Latkin, C.A., 2012. Boredom, depressive symptoms, and HIV risk behaviors among urban injection drug users. AIDS Behav. 16, 2244-2250.

Gibbie, T.M., Hides, L.M., Cotton, S.M., Lubman, D.I., Aitken, C., Hellard, M., 2011. The relationship between personality disorders and mental health, substance use severity and quality of life among injecting drug users. Med, J, Aust, 195, S16-21.

Gonzalez, J.S., Psaros, C., Batchelder, A., Applebaum, A., Newville, H., Safren, S.A., 2011. Clinician-assessed depression and HAART adherence in HIV-infected individuals in methadone maintenance treatment. Ann. Behav. Med, 42, 120-126.

Havard, A., Teesson, M., Darke, S., Ross, J., 2006. Depression among heroin users: 12-month outcomes from the Australian Treatment Outcome Study (ATOS). J. Subst. Abuse Treat. 30, 355-362.

Hides, L., Lubman, D.I., Devlin, H., Cotton, S., Aitken, C., Gibbie, T., Hellard, M., 2007. Reliability and validity of the Kessler 10 and Patient Health Questionnaire among injecting drug users. Aust. N.Z. J. Psychiatry 41, 166-168.

Horyniak, D., Higgs, P., Jenkinson, R., Degenhardt, L., Stoove, M., Kerr, T., Hickman, M., Aitken, C., Dietze, P., 2013. Establishing the Melbourne Injecting Drug User Cohort Study (MIX): rationale, methods, and baseline and twelve-month follow-up results. Harm Reduct. J. 10, 11.

Johnson, M.E., Yep, M.J., Brems, C., Theno, S.A., Fisher, D.G., 2002. Relationship among gender, depression, and needle sharing in a sample of injection drug users. Psychol. Addict. Behav. 16, 338-341.

Kang, S.-Y., Deren, S., 2009. Factors mediating and moderating the relationship between gender and utilization of health care among Puerto Rican drug users in New York. Drug Alcohol Depend. 102, 138-143.

Kennedy, M.C., Marshall, B.D., Hayashi, K., Nguyen, P., Wood, E., Kerr, T., 2015. Heavy alcohol use and suicidal behavior among people who use illicit drugs: a cohort study. Drug Alcohol Depend. 151, 272-277.

Kessler, R.C., Andrews, G., Colpe, L.J., Hiripi, E., Mroczek, D.K., Normand, S.L., Walters, E.E., Zaslavsky, A.M., 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. Psychol. Med. 32, 959-976.

Kinner, S.A., George, J., Campbell, G., Degenhardt, L., 2009. Crime, drugs and distress: patterns of drug use and harm among criminally involved injecting drug users in Australia. Aust. N.Z. J. Public Health 33, 223-227.

Lambdin, B.H., Bruce, R.D., Chang, O., Nyandindi, C., Sabuni, N., Zamudio-Haas, S., McCurdy, S., Masao, F., Ivo, Y., Msami, A., Ubuguy, O., Mbwambo, J., 2013. Identifying programmatic gaps:

inequities in harm reduction service utilization among male and female drug users in Dar es Salaam, Tanzania. PLoS One 8, 6.

Lemstra, M., Rogers, M., Thompson, A., Moraros, J., Buckingham, R., 2011. Risk indicators of depressive symptomatology among injection drug users and increased HIV risk behaviour. Can. J. Psychiatry 56, 358-366.

Li, J., Gu, J., Lau, J.T., Chen, H., Mo, P.K., Tang, M., 2015. Prevalence of depressive symptoms and associated factors among people who inject drugs in China. Drug Alcohol Depend. 151, 228-235.

Mackesy-Amiti, M.E., Donenberg, G.R., Ouellet, L.J., 2012. Prevalence of psychiatric disorders among young injection drug users. Drug Alcohol Depend. 124, 70-78.

Marshall, B.D., Fairbairn, N., Li, K., Wood, E., Kerr, T., 2008. Physical violence among a prospective cohort of injection drug users: a gender-focused approach. Drug Alcohol Depend. 97, 237-246.

McKetin, R., Ross, J., Kelly, E., Baker, A., Lee, N., Lubman, D.I., Mattick, R., 2008. Characteristics and harms associated with injecting versus smoking methamphetamine among methamphetamine treatment entrants. Drug Alcohol Rev. 27, 277-285.

Middleton, H., Shaw, I., 2000. Distinguishing mental illness in primary care: we need to separate proper syndromes from generalised distress. Br. Med. J.320, 1420-1421.

Nambiar, D., Stoove, M., Dietze, P., 2014. A cross-sectional study describing factors associated with utilisation of GP services by a cohort of people who inject drugs. BMC Health Serv. Res. 14, 308.

Pabayo, R., Alcantara, C., Kawachi, I., Wood, E., Kerr, T., 2013. The role of depression and social support in non-fatal drug overdose among a cohort of injection drug users in a Canadian setting. Drug Alcohol Depend. 132, 603-609.

Pettes, T., Kerr, T., Voon, P., Nguyen, P., Wood, E., Hayashi, K., 2015. Depression and sexual risk behaviours among people who inject drugs: a gender-based analysis. Sex. Health 12, 224-230.

Rhodes, T., 2002. The 'risk environment': a framework for understanding and reducing drug-related harm. Int. J. Drug Policy 13, 85-94.

Rhodes, T., 2009. Risk environments and drug harms: a social science for harm reduction approach. Int. J. Drug Policy 20, 193-201.

Roy, É., Jutras-Aswad, D., Bertrand, K., Dufour, M., Perreault, M., Laverdière, É., Bene-Tchaleu, F., Bruneau, J., 2015. Anxiety, mood disorders and injection risk behaviors among cocaine users: results from the COSMO study. Am. J. Addict. 24, 654-660.

Sapra, K.J., Crawford, N.D., Rudolph, A.E., Jones, K.C., Benjamin, E.O., Fuller, C.M., 2013. Social network members' roles and use of mental health services among drug users in New York City. J. Behav. Health Serv. Res. 40, 476-487.

Scott, N., Caulkins, J.P., Ritter, A., Dietze, P., 2015. How patterns of injecting drug use evolve in a cohort of people who inject drugs. Trends Issues Crime Criminal Justice 502.

Shaw, S.A., El-Bassel, N., Gilbert, L., Terlikbayeva, A., Hunt, T., Primbetova, S., Rozental, Y., Chang, M., 2015. Depression among people who inject drugs and their intimate partners in Kazakhstan. Community Mental Health J. epub ahead of print.

Slade, T., Grove, R., Burgess, P., 2011. Kessler psychological distress scale: normative data from the 2007 Australian National Survey of Mental Health and Wellbeing. Aust. N.Z. J. Psychiatry 45, 308-316.

Stafford, J., Burns, L., 2014. Findings from the Illicit Drug Reporting System (IDRS). Australian Drug Trend Series No. 109. Sydney, National Drug and Alcohol Research Centre, UNSW Australia.

Stoové, M., Fry, C., 2006. The Blood Borne Virus Transmission Risk Assessment Questionnaire–Short Version (BBV-TRAQ-SV): Administration and Procedures Manual. Fitzroy, Victoria: Turning Point Alcohol and Drug Center Inc.

Topp, L., Hudson, S.L., Maher, L., 2010. Mental health symptoms among street-based psychostimulant injectors in Sydney's Kings Cross. Subst. Use Misuse 45, 1180-1200.

Torok, M., Darke, S., Kaye, S., Ross, J., McKetin, R., 2008. Comparative Rates Of Violent Crime Amongst Methamphetamine And Opioid Users: Victimisation And Offending. National Drug Law Enforcement Research Fund (NDLERF), Hobart, Tasmania.

Walley, A.Y., Cheng, D.M., Coleman, S.M., Krupitsky, E., Raj, A., Blokhina, E., Bridden, C., Chaisson, C.E., Lira, M.C., Samet, J.H., 2014. Risk factors for recent nonfatal overdose among HIV-infected Russians who inject drugs. AIDS Care 26, 1013-1018.

Winter, R.J., Stoove, M., Degenhardt, L., Hellard, M.E., Spelman, T., Jenkinson, R., McCarthy, D.R., Kinner, S.A., 2015. Incidence and predictors of non-fatal drug overdose after release from prison among people who inject drugs in Queensland, Australia. Drug Alcohol Depend. 153, 43-49.

FIGURE LEGENDS

Figure 1: K10 scores: Distribution of K10 scores from the Melbourne Injecting Drug User Cohort Study on the first occasion participants completed the questionnaire (MIX, left), and comparison of K10 score percentiles (10, 25, 50, 75, 90, 95 and 99%) between the MIX and the general Australian 25-34 year old population (right).

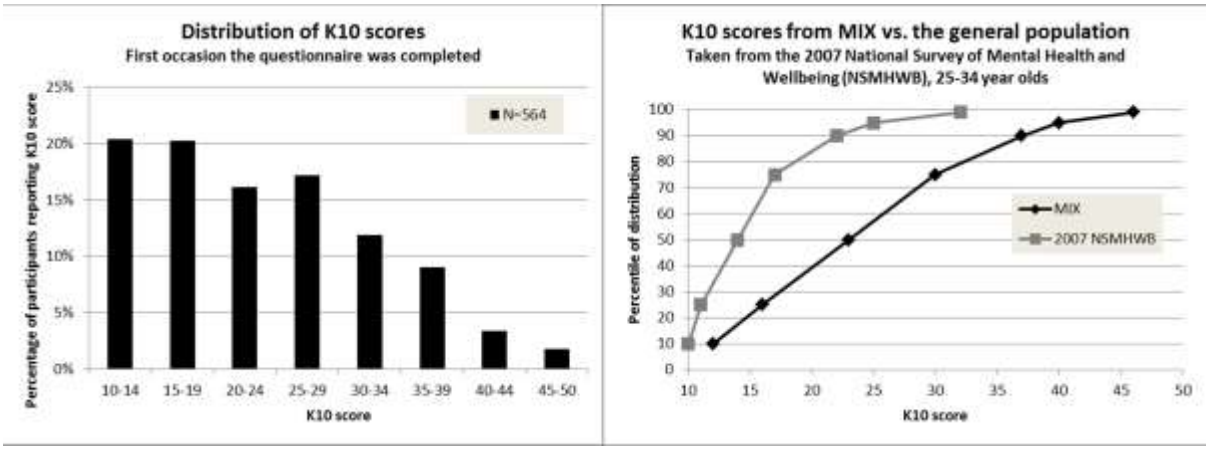

Figure 2. K10 scores over time: Distributions (left) and cumulative distributions (right) of Melbourne Injecting Drug User Cohort Study participants' K10 scores on the first three occasions the questionnaire was completed, only for the 401 participants who have taken the questionnaire three or more times.

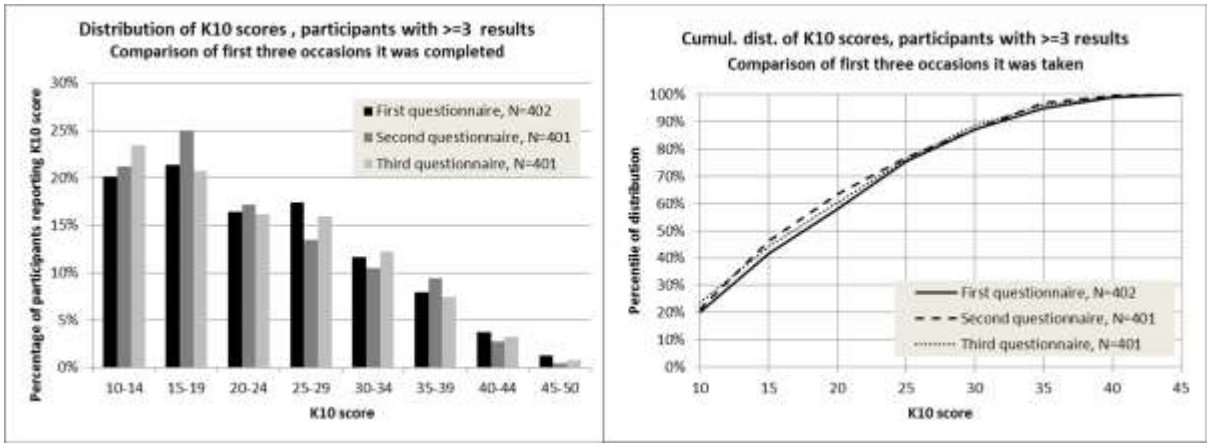

Figure 3, adjusted distributions: Distribution of K10 scores by gender before adjusting for temporal variables (left), and adjusted K10 scores by gender (right); the first occasion participants completed the questionnaire.

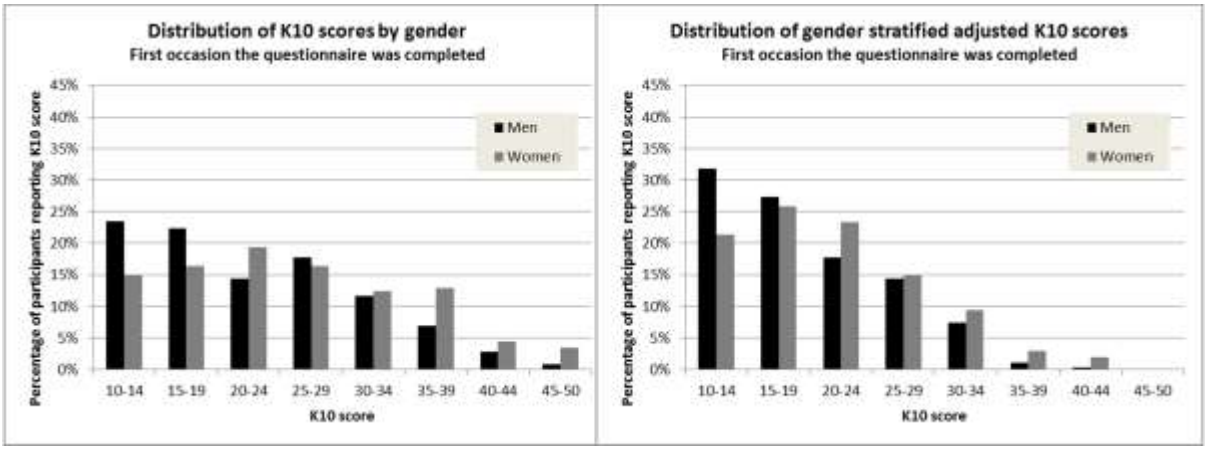

Table 1, the percentage of participants who changed levels of psychological distress between consecutive questionnaires.

	First questionnaire to second questionnaire[a] % of row, (N)				**Second questionnaire to third questionnaire[b] % of row, (N)**			
Initial level of psychological distress (K10 score)	Final level of psychological distress				Final level of psychological distress			
	Low	Moderate	High	Very high	Low	Moderate	High	Very high
Low (10–15)	52% (62)	29% (35)	15% (18)	3% (4)	56% (58)	21% (22)	16% (17)	7% (7)
Moderate (16–21)	28% (32)	36% (41)	24% (27)	12% (13)	32% (35)	33% (36)	26% (28)	8% (9)
High (22–29)	17% (23)	22% (29)	32% (43)	29% (39)	17% (16)	22% (21)	34% (33)	27% (26)
Very high (30–50)	15% (19)	17% (21)	22% (28)	46% (57)	4% (4)	15% (14)	24% (22)	57% (53)

[a]Using data from the 491 participants with two or more K10 questionnaires
[b]Using data from the 401 participants with three or more K10 questionnaires

Table 2. Linear regression results using participant fixed effects, retained temporal variables.

	K10 Range: 10 (low distress) - 50 (high distress)					
	Women			Men		
	Adjusted coefficient	95%CI	P-value	Adjusted coefficient	95%CI	P-value
Employed (vs. no)						
Yes				-1.55**	(-2.67, -0.43)	0.010
Drug used most in the past month (vs. heroin)						
Methamphetamine				0.92	(-1.23, 3.06)	0.400
Cannabis				-1.78*	(-3.16, -0.41)	0.010
Other				-1.12	(-2.54, 0.30)	0.120
Inject more than usual in the past month (vs. no)						
Yes				1.20*	(0.13, 2.27)	0.030
Alcohol use (vs. abstinent)						
AUDIT C score <8	0.45	(-1.22, 2.13)	0.590			
AUDIT C score >=8	1.92	(-0.43, 4.27)	0.110			
Attended GP in past month (vs. no)	0	0	.			
Yes	1.57*	(0.25, 2.89)	0.020			
Intentional overdose in past 12 months (vs. no)						
Yes	3.59*	(0.74, 6.43)	0.010	4.26**	(1.39, 7.12)	<0.001
Assault victim in past six months (vs. no)						
Yes	4.46***	(2.92, 5.99)	<0.001	1.80**	(0.64, 2.95)	<0.001
Constant	21.29***	(15.75, 26.82)	<0.001	19.53***	(14.7, 24.37)	<0.001
N	651			1118		

*P<0.05, **P<0.01, ***P<0.001