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Research Paper

Informal recycling, income generation and risk: Health and social harms among people who use drugs

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ABSTRACT

Background: Informal recycling refers to the street-based collection of discarded materials for reuse, resale, or return to a recycling facility for money. While qualitative research has explored experiences and perceptions of informal recycling, little is known about the scope and exposures associated with informal recycling among people who use drugs (PWUD).

Methods: Using data from two prospective longitudinal cohorts of PWUD, we examined the prevalence of informal recycling and its association with social, structural and health risks, including criminal justice system involvement.

Results: Between June 2010 and May 2015, of 1664 participants, 557 (33.5%) reported engaging in informal recycling during the study period. In multivariable generalised estimating equations (GEE) analyses, informal recycling was positively associated with injection drug use (Adjusted Odds Ratio (AOR) = 1.43, 95% Confidence Interval (CI) 1.21–1.68), public injection (AOR = 1.27, 95% CI 1.09–1.49), methamphetamine use (AOR = 1.35, 95% CI 1.05–1.72), difficulty finding harm reduction equipment (AOR = 1.16, 95% CI 1.02–1.32), and police interactions (AOR = 1.35, 95% CI 1.18–1.55). Sub-analyses revealed PWUD engaged in informal recycling were more likely to be told to move on, ticketed, stopped for jaywalking, and directed to services by police.

Conclusions: These findings suggest informal recycling as a situated practice for PWUD, with potential indications for higher-risk drug use, experiencing greater surveillance, and difficulty accessing health and addiction treatment services. This research highlights the significance of the broader risk environment and the need for health-promoting policies for socioeconomically marginalised PWUD engaged in informal recycling.

Introduction

Informal recycling is a common form of income generation for socio-economically marginalised individuals involving the collection of discarded material to reuse, resell or recycle for money (Binion & Gutberlet, 2012; Gowan, 1997; Tremblay, Gutberlet, & Peredo, 2010; Wittmer & Parizeau, 2016). Previous research suggests people engage in informal recycling primarily out of economic necessity and that they depend on informal recycling either as a single source of income or as a supplement to income assistance (Gowan, 1997; Tremblay et al., 2010; Wittmer & Parizeau, 2016). People who use illicit drugs (PWUD) may face considerable social, structural, and environmental barriers to safe and stable employment, such as criminalisation, employer prejudice, or unstable housing (Callahan et al., 2015; Richardson, Wood, Li, & Kerr, 2010; Richardson, Wood, & Kerr, 2013). Without adequate funds for basic necessities of safety and survival, PWUD may need to generate income through activities that are illegal (i.e. drug dealing, acquisitive crime) or prohibited (i.e. sex work, panhandling, squeegeeing or washing car windows, informal recycling) with negative sanctions through legal, regulatory or socio-cultural channels (DeBeck et al., 2007, 2011; Richardson et al., 2010). Previous studies document risks specifically associated with such activity, including criminal justice

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system involvement (Cheng et al., 2016; DeBeck et al., 2007; Ti et al., 2014). However, there have been few quantitative assessments focused on the social and structural determinants of health among informal recyclers. We therefore undertook the current study to examine linkages between informal recycling and health-related harms to further explore income generation as a potential determinant of health among vulnerable and marginalised drug-using populations.

As a street-based form of income generation, informal recycling occurs in public spaces where individuals are seen collecting, sorting, and transporting large quantities of recyclables around the city (Wittmer & Parizeau, 2016). Its heightened visibility and perceived connection with economic disadvantage render informal recycling a highly stigmatised activity, in which informal recyclers are "symbolically connected" to waste (Gowan, 1997; Parizeau, 2017; Wittmer & Parizeau, 2016). Previous ethnographic work has documented this stigma through research in various locations around the world, including Vancouver, Canada, where informal recycling is a common income-generating activity (Binion & Gutberlet, 2012; Gowan, 1997; Gutberlet, Tremblay, Taylor, & Divakarannair, 2009; Parizeau, 2015, 2017; Tremblay et al., 2010; Wittmer & Parizeau, 2016). These studies note informal recyclers' perceived judgement for working with waste, using drugs, or living in the Downtown East Side (DTES), a neighbourhood in Vancouver, Canada, characterised as having high levels of homelessness, HIV infection, an active drug scene, poverty, and elevated police activity (Liu & Blomley, 2013; Parizeau, 2017; Wittmer & Parizeau, 2016). These distinct but interrelated stigma surrounding drug use and the DTES have been linked to a reluctance to access health services or drug treatment and other health consequences for PWUD engaged in informally recycling (Wittmer & Parizeau, 2016).

Further stigmatisation and marginalisation occur through the regulation and policing of space, as demonstrated by ordinances restricting access to public space and charging informal recyclers with "public disorder," such as the British Columbia Safe Streets Act (2004) (Kerr, Small, & Wood, 2005; Parizeau, 2017; Safe Streets Act of 2004, 2004; Wittmer & Parizeau, 2016). Vancouver City Council addressed informal recycling specifically with the passage of "Solid Waste By-law No. 8417," which expressly prohibits the "remov[al] of (a) any recyclable material from the premises of that owner or occupier, or (b) any recyclable material from the blue box recycling container or recycling cart," and issues fines for lack of compliance (Solid Waste By-law No. 8417, 2001). Amidst a growing focus on harm reduction in law enforcement policy in Vancouver since mid-2000s (Vancouver Police Department, 2006), the extent to which these ordinances are enforced among PWUD remains unknown, though anecdotally people who informally recycle note that these ordinances are currently rarely enforced by police. Previous research on the policing of drug use in the DTES has linked certain policing practices (e.g., crackdowns) with additional health harms, but has also found that police facilitate access to care and treatment (Aitken, Moore, Higgs, Kelsall, & Kerger, 2002; DeBeck et al., 2008; Kerr et al., 2005; Small, Kerr, Charette, Schechter, & Spittal, 2006). The extent to which either of these is the case for PWUD who informally recycle is also unknown. The relationships between policy, the situated practice of policing and its impacts, and socioeconomically marginalised populations are complex, but exploring these dynamics are critical to understanding the health risks among PWUD.

Considering the public nature of informal recycling and its association "with the stigma of poverty and disorder" (Wittmer & Parizeau, 2016), Rhodes' Risk Environment Framework is helpful for understanding how interactions between the economic (e.g., social assistance policies), spatial (e.g., locale), social (e.g., stigma) and legal factors (e.g., policing) situate PWUD who informally recycle at increased risk of harm (Rhodes, 2002; Wittmer & Parizeau, 2016). Prior qualitative research has used similar ecological frameworks to understand the lived experiences of informal recyclers (Binion & Gutberlet, 2012; Gowan, 1997; Gutberlet et al., 2009; Tremblay et al., 2010; Wittmer & Parizeau, 2016), including an analysis of socioeconomically marginalised residents' "geographies of survival" or the "spaces and spatial relations that structure not only how people may live, but especially *whether* they may live" (Mitchell & Heynen, 2009, p. 611). Informal recyclers in Vancouver adapt their geographies of survival to leverage their resources in the face of the insufficiency of income assistance, stigmatisation, and restrictions to the use of public space (Wittmer & Parizeau, 2016). There nevertheless remains a dearth of quantitative or longitudinal data on how the broader risk environment of informal recycling may be associated with health and social impacts for PWUD who face particular configurations of marginalisation. We therefore undertook the current quantitative analysis as an exploratory study to identify the prevalence and correlates of informal recycling as a source of income for PWUD. Drawing from previous qualitative research, we hypothesise that informal recycling is linked with specific social, spatial, and legal factors that constitute a social and structural risk environment for PWUD that may implicate their existing vulnerability to health-related harm.

Methods

Data for the current study are derived from the Vancouver Injection Drug Users Study (VIDUS) and AIDS Care Cohort to evaluate Exposure to Survival Services (ACCESS), two long-standing, ongoing prospective cohort studies of HIV-seronegative participants who inject drugs (VIDUS) and HIV-seropositive participants who use drugs, defined as an illicit drug other than or in addition to cannabis (ACCESS). Previously described in detail (Urban Health Research Initiative, 2013), participants in these cohorts have been enrolled since 1996 through street outreach and self-referral, a method of sampling widely employed with street-based populations of PWUD (Garfein et al., 2007; Horyniak et al., 2013; Reback, Fletcher, Shoptaw, & Grella, 2013). Both cohorts employ harmonised data collection procedures to permit pooled analyses. At baseline and semi-annually thereafter, VIDUS and ACCESS participants complete an interviewer-administered questionnaire that collects data on sociodemographic characteristics, income generation activities, alcohol and drug use patterns, access to social and health services, health status, and HIV- and drug-related risk activity and exposures. Participants additionally provide blood samples for HIV and Hepatitis C serologic testing. All participants are offered $30CAD honorarium for each study visit. Both studies received ethics approval from the University of British Columbia/Providence Health Care Research Ethics Board.

The current analysis includes all VIDUS and ACCESS baseline and follow up visits conducted between June 2010 and May 2015. Our primary outcome of interest is informal recycling as a source of income, which is derived from the question, "In the last six months, what were your sources of income?" Potential covariates included age, sex (female vs. male), ethnicity (nonwhite vs. white), and education (high school graduate or higher vs. less than high school). We additionally incorporated binary variables indicative of social and structural vulnerabilities: homelessness; residence in Vancouver's Downtown East Side; being victim to violence; recent incarceration; police confrontations (i.e. being stopped, searched, and/or detained); encountering security guards; and receiving area restrictions (i.e. legal prohibitions from entering particular areas) (McNeil, Cooper, Small, & Kerr, 2015). We also included covariates related to drug use: any injection of drugs; daily or greater use of heroin, cocaine, methamphetamines, or crack; public injection drug use; non-fatal overdose; and difficulty accessing clean pipes, syringes, or other equipment to inject drugs. Other health status indicators included HIV and HCV seropositivity and a time-updated measure of ever having been diagnosed with a mental health disorder. All responses to aforementioned variables, with the exception of sociodemographic and mental health indicators, refer to the six months prior to follow up interview.

In initial analyses, we considered descriptive characteristics of the sample and the prevalence of informal recycling throughout the study

period. We assessed baseline sociodemographic characteristics, patterns of drug use and drug-related risk, social and structural vulnerabilities, and health stratified between those who did and did not report informal recycling at any point during our study period using Pearson's χ^2 analyses for dichotomous variables and the Wilcoxon rank-sum test for continuous variables. Next, we used generalised estimating equations (GEE) with a logit link for our dichotomous outcome of interest to explore associations with informal recycling, accounting for within-subject correlations and serial correlation for unbalanced longitudinal observations over the course of the study with a two-stage model building approach. In the first stage, we used bivariate analyses to determine potential covariates. Variables that were significant at $p < 0.10$ in bivariate analysis were considered for inclusion in the multivariable model in the second stage of our analysis. In this stage, as with previous analyses in this area of research (Argento et al., 2014; Zhang et al., 2018), the quasilikelihood under independence model criterion (QIC) with a backward model selection procedure was used to indicate the multivariable model with the best fit as determined by the lowest QIC value (Pan, 2016). Finally, informed by previous research on policing and PWUD (Aitken et al., 2002; DeBeck et al., 2008; Kerr et al., 2005; Small et al., 2006), we conducted sub-analyses to assess the nature of police interactions, derived from the questions, "In the last 6 months, have you had direct contact with the police?" and "If yes, what was the nature of the contact?" From the total number of reported police interactions, we further examined the frequencies and bivariate associations between informal recycling (yes vs. no) and the nature of police encounters (for example, being ticketed) using GEE with logit link function. All *p*-values were two-sided and significant at 0.05. SAS 9.4 (Cary, North Carolina, USA) was used to complete all statistical analyses.

Results

Between June 2010 and May 2015, 929 VIDUS and 739 ACCESS participants completed at least one follow up (median = 8, interquartile range [IQR] = 4 to 10). Over this period, 4 participants seroconverted and switched from the VIDUS to the ACCESS cohort and the nesting of participants was accounted for through the use of unique identifiers in analyses. Overall, 1664 unique VIDUS and ACCESS participants provided a total of 11,048 study observations. The prevalence of informal recycling ranged from 10.9% to 17.7% of the sample through the follow up period, with no clear trend of increasing or decreasing involvement in informal recycling among cohort participants over time. A total of 557 (33.5%) participants reported engagement in informal recycling at least once over the study period. The median age of participants at baseline was 45 (IQR = 38 to 51) years, 564 (33.9%) identified as female, 704 (42.3%) identified as non-white, and 810 (48.7%) participants reported high school or higher educational attainment.

Baseline characteristics stratified by reported involvement in informal recycling at any point during the study period are listed in Table 1. Participants engaged in informal recycling were more likely to be male; reside in the DTES; have less than a high school education; encounter security guards; have experienced recent incarceration; inject drugs; inject in public; report at least daily methamphetamine use; have difficulty finding harm reduction equipment; and be diagnosed with HCV (all $p < 0.05$).

In final multivariable GEE analyses (Table 2), daily or greater methamphetamine use (Adjusted Odds Ratio (AOR) = 1.35, 95% Confidence Interval (CI) = 1.05–1.72), injection drug use (AOR = 1.43, 95% CI = 1.21–1.68), public injection (AOR = 1.27, 95% CI = 1.09–1.49), police confrontations (AOR = 1.35, 95% CI = 1.18–1.55), and difficulty finding harm reduction equipment (AOR = 1.16, 95% CI = 1.02–1.32) were positively associated with informal recycling. Female sex was negatively and significantly associated with informal recycling (AOR = 0.57, 95% CI = 0.46–0.72).

Of 11,048 total study observations, there were 1280 (11.6%) reports of police confrontations, with PWUD who informally recycle being more likely to have police confrontations (17.9% vs. 10.5%). We used an additional 10,806 observations that included participant self-reports of the characteristics of police interaction (Table 3). Among the 10,806 police interactions reported, there were 10,495 (97.1%) reports of being ticketed, 10,410 (96.3%) reports of being directed to services (i.e. health services, shelter, or a supervised consumption facility), 128 (1.2%) reports of being told to move on, and 41 (0.4%) reports of being stopped for jaywalking. In bivariate exploration of these police interactions (Table 3), GEE results indicated PWUD who informally recycle were slightly more likely to be ticketed (99.1% vs. 96.8%), told to move on (2.5% vs. 1.0%), and stopped for jaywalking (1.1% vs. 0.2%) (all $p < 0.05$). PWUD engaged in informal recycling were also more likely to be directed to services by police (98.9% vs. 95.9%) ($p < 0.05$).

Discussion

In this study, approximately one-third of our sample reported involvement with informal recycling during the five-year study period. In multivariable analysis, multiple social, structural and health risks were associated with informal recycling, and these associations remained significant after controlling for sociodemographic, social, structural, drug use and health-related variables. In sub-analyses, PWUD engaged in informal recycling were more likely to have certain negative interactions with police but also more likely to report receiving referrals to services.

Characteristics specific to the economic, physical, social, and legal environment in which informal recycling occurs may situate PWUD for particular health-related harms. In the context of our study, data show PWUD who informally recycle are more likely to inject drugs in public and to experience difficulty accessing harm reduction equipment. Considering the time PWUD who informally recycle spend traveling around Vancouver to undertake this work, these findings may highlight the potential distance between where PWUD work, and supervised injection facilities (SIFs), indoor places to inject, or facilities distributing harm reduction equipment. With the quantities of recyclables they carry, PWUD who recycle may be unable to go indoors to access services without leaving their recyclables outside to be potentially lost or stolen (Binion & Gutberlet, 2012). Further, syringe exchanges and other health and social service facilities may be concentrated in areas like the DTES under heavy surveillance, which PWUD may avoid given the penalties for informal recycling. Moreover, as documented in earlier research in Vancouver (Wittmer & Parizeau, 2016), PWUD and informal recyclers may feel stigmatised by health and social service providers and resistant to utilising these resources. These potential barriers to accessing harm reduction equipment are troublesome considering the previously documented health risks associated with public injecting and restricted access to harm reduction services, including syringe exchange (Cooper, Moore, Gruskin, & Krieger, 2005; DeBeck et al., 2007; McKnight et al., 2007; Small, Rhodes, Wood, & Kerr, 2007).

Our findings indicate associations between informal recycling and certain drug use patterns among the study sample, specifically the use of crystal methamphetamine and injection drugs. Given the long hours and considerable movement involved in informal recycling (Gowan, 1997; Tremblay et al., 2010), individuals who informally recycle may use methamphetamines as a means of working harder and staying awake. Conversely, people who use methamphetamines may view informal recycling as a more viable form of income generation compatible with their drug use patterns. Among people who inject drugs, informal recycling may provide the flexibility to acquire additional income to sustain higher intensity drug use. Additionally, locality and the built environment may shape exposure to drug-related risk. Informal recyclers may operate along routes in areas characterised by high levels of street disorder, positioning them at increased vulnerability for exposure to higher risk drug use, including drug injection. Conversely, PWUD

Table 1
Baseline characteristics of people who use drugs in Vancouver, Canada, stratified by self-report of informal recycling, 2010–2015 (n = 1664).

Characteristic	Total (%) (n = 1664)	Informal Recycling		p - value
		Yes (%) (n = 557)	No (%) (n = 1107)	
Sociodemographic				
Age (median, IQR)	45 (38-51)	45 (38–50)	45 (38–51)	0.741
Female	564 (33.9)	168 (30.2)	396 (35.8)	0.023
Non-White Ethnicity	704 (42.3)	248 (44.5)	456 (41.2)	0.194
Minimum high school education	810 (48.7)	243 (43.6)	567 (51.2)	0.003
Social and Structural Vulnerability				
Homelessness[a]	370 (22.2)	127 (22.8)	243 (22.0)	0.701
DTES residency[a]	989 (59.4)	369 (66.2)	620 (56.0)	< 0.001
Victim of violence[a]	246 (14.8)	94 (16.9)	152 (13.7)	0.094
Incarceration[a]	143 (8.6)	61 (11.0)	82 (7.4)	0.015
Police confrontations[a]	294 (17.7)	103 (18.5)	191 (17.3)	0.532
Encounters with security guards[a]	131 (7.9)	56 (10.1)	75 (6.8)	0.020
Area restrictions[a]	134 (8.1)	54 (9.7)	80 (7.2)	0.085
Drug use and drug-related variables				
Daily or greater heroin use[a]	264 (15.9)	83 (14.9)	181 (16.4)	0.405
Daily or greater cocaine use[a]	98 (5.9)	41 (7.4)	57 (5.1)	0.076
Daily or greater crystal methamphetamine use[a]	98 (5.9)	43 (7.7)	55 (5.0)	0.027
Daily or greater crack use[a]	396 (23.8)	160 (28.7)	236 (21.3)	0.001
Any injection drug use[a]	1010 (60.7)	391 (70.2)	619 (55.9)	< 0.001
Public injection[a]	374 (22.5)	156 (28.0)	218 (19.7)	< 0.001
Non-fatal overdose[a]	85 (5.1)	30 (5.4)	55 (5.0)	0.724
Difficulty finding harm reduction equipment[a]	351 (21.1)	138 (24.8)	213 (19.2)	0.015
Health				
Mental health diagnosis	983 (59.1)	346 (62.1)	637 (57.5)	0.073
HCV[a]	1413 (84.9)	495 (88.9)	918 (82.9)	0.001
HIV[a]	735 (44.2)	244 (43.8)	491 (44.4)	0.832

IQR, Interquartile range; DTES, Downtown Eastside; HCV, Hepatitis C Virus.
[a] In the 6 months prior to interview.

Table 2
Bivariate and multivariable GEE analysis of factors associated with informal recycling among people who use drugs in Vancouver, Canada, 2010–2015 (n = 1664).

Characteristic	Unadjusted		Adjusted	
	Odds Ratio (95% CI)	p - value	Odds Ratio (95% CI)	p - value
Sociodemographic				
Age (per 10 years increase)	1.06 (0.96 – 1.17)	0.272		
Female	0.57 (0.46 – 0.72)	< 0.001	0.57 (0.46 – 0.72)	< 0.001
Non-white Ethnicity	1.01 (0.82 – 1.24)	0.961		
Minimum high school education	0.85 (0.68 – 1.04)	0.120		
Social and Structural Vulnerability				
Homelessness[a]	1.16 (1.01 – 1.34)	0.040		
DTES residence[a]	1.21 (1.04 – 1.41)	0.012	1.16 (1.00 – 1.35)	0.055
Victim of violence[a]	1.23 (1.05 – 1.44)	0.009		
Incarceration[a]	0.93 (0.73 – 1.19)	0.559		
Police confrontations[a]	1.51 (1.31 – 1.73)	< 0.001	1.35 (1.18 – 1.55)	< 0.001
Encounters with security guards [a]	1.15 (0.90 – 1.46)	0.259		
Area restrictions[a]	1.05 (0.85 – 1.31)	0.650		
Drug use-related variables				
Daily or more frequent heroin use[a]	1.13 (0.94 – 1.36)	0.198		
Daily or more frequent cocaine use[a] useuse[†]	1.11 (0.87 – 1.42)	0.384		
Daily or more frequent methamphetamine use[a]	1.48 (1.13 – 1.93)	0.004	1.35 (1.05 – 1.72)	0.018
Daily or more frequent crack use[a]	1.09 (0.95 – 1.26)	0.214		
Any injection drug use[a]	1.61 (1.39 – 1.87)	< 0.001	1.43 (1.21 – 1.68)	< 0.001
Public injection[a]	1.50 (1.29 – 1.73)	< 0.001	1.27 (1.09 – 1.49)	0.002
Non-fatal overdose[a]	1.41 (1.15 – 1.73)	0.001		
Difficulty finding harm reduction equipment[a]	1.23 (1.09 – 1.39)	0.001	1.16 (1.02 – 1.32)	0.020
Health				
Mental health diagnosis	1.18 (0.96 – 1.45)	0.115		
HCV[a]	1.12 (0.83 – 1.52)	0.463		
HIV[a]	0.95 (0.77 – 1.17)	0.650		

GEE, generalised estimating equations; DTES, Downtown Eastside; HCV, Hepatitis C Virus.
[a] In the 6 months prior to interview.

Table 3
GEE analysis of bivariate associations and characteristics of police interactions among PWUD who engage in informal recycling in Vancouver, Canada, 2010–2015 (N = 10,806).[a]

Interactions	Total, N (%)	Recycling Yes, n (%)	Recycling No, n (%)	p – value[†]
Positive encounters[b]				
Yes	476 (4.4)	82 (5.2)	394 (4.3)	0.052
No	10,330 (95.6)	1493 (94.8)	8837 (95.7)	
Directed to services				
Yes	10,410 (96.3)	1557 (98.9)	8853 (95.9)	0.027
No	396 (3.7)	18 (1.1)	378 (4.1)	
Property confiscated				
Yes	10765 (99.6)	1571 (99.7)	9194 (99.6)	0.881
No	41 (0.4)	4 (0.3)	37 (0.4)	
Told to move on				
Yes	128 (1.2)	40 (2.5)	88 (1.0)	0.015
No	10678 (98.8)	1535 (97.5)	9143 (99.0)	
Victim of a crime				
Yes	132 (1.2)	17 (1.1)	115 (1.2)	0.878
No	10674 (98.8)	1558 (98.9)	9116 (98.8)	
Charged				
Yes	205 (1.9)	41 (2.6)	164 (1.8)	0.423
No	10601 (98.1)	1534 (97.4)	9067 (98.2)	
Arrested				
Yes	627 (5.8)	113 (7.2)	514 (5.6)	0.848
No	10179 (94.2)	1462 (92.8)	8717 (94.4)	
Ticketed				
Yes	10495 (97.1)	1561 (99.1)	8934 (96.8)	0.029
No	311 (2.9)	14 (0.9)	297 (3.2)	
Jaywalking (stopped)				
Yes	41 (0.4)	18 (1.1)	23 (0.2)	< 0.001
No	10765 (99.6)	1557 (98.9)	9208 (99.8)	

[a] Total number of reports of interactions in follow up period.
[b] Positive encounters with police included simple greetings, police outreach activities, safety and wellbeing checks, and other forms of assistance.
[†] p-value of generalised estimating equations model.

engaged in higher risk drug use might seek to avoid exposure and therefore seek to access recyclables in isolated areas. Establishing such links between space, movement, and patterns of drug use for PWUD who informally recycle distinguishes features of informal recycling as a specific income-generating activity.

Another feature of configurations between space, movement, and drug use is that engaging in these activities increases the exposure of people who informally recycle. Tremblay et al. (2010) have documented this movement among Vancouver-based informal recyclers, who reported spending 10–12 hours per day working, traveling great distances around the city and gathering recyclables along self-designated routes, referred to as "traplines" (Tremblay et al., 2010). Due to the visible nature of this activity and the travel required, PWUD engaged in informal recycling may be at greater risk of being surveilled or targeted by police, either through their recycling activities or through public injection drug use, as discussed previously. In addition, results showed informal recycling was significantly and positively associated with increased interactions with police in Vancouver. Though many reported interactions were negative, other police interactions were beneficial, evident in our finding that police were directing PWUD who informally recycle to social and health services. These findings suggest the impacts of heightened visibility of PWUD who informally recycle are mixed, subjecting them to increased likelihood of apprehension as well as creating situations in which police may notice and respond to PWUD in need. These results highlight the opportunities for law enforcement to increase their familiarity of the circumstances of PWUD who informally recycle in order to foster further positive interactions.

Our findings draw attention to several strategies to alleviate health harms for PWUD, ranging from micro-level interventions to macro-level structural and policy changes. From a social standpoint, PWUD who informally recycle could benefit from community-building and stigma-reduction initiatives. In a review of informal recycling research, scholars noted cooperatives "strengthen the organizational base of recyclers" with the aim of facilitating discussion, disseminating knowledge, and enabling access to social services (Binion & Gutberlet, 2012, p. 49). For instance, the Binners' Project (Binners' Project, 2016) in Vancouver has engaged over 300 informal recyclers across the city in efforts to build community. The project aims to reduce stigma through such initiatives as the "Binners' Hook," a programme in which residences purchase designated hooks to hang recyclables so they can be safely collected by informal recyclers (Binners' Project, 2016). Another programme in Victoria, Canada focuses on developing relationships with businesses, where informal recyclers are given recyclables in exchange for small services (Gutberlet et al., 2009). Such programmes represent feasible strategies to highlight the contributions of informal recyclers, and potentially reduce bias toward PWUD who recycle.

Several provincial and municipal policies have potential to contribute to the social and structural violence toward PWUD engaged in informal recycling. One study in British Columbia found income assistance cutbacks from 1995 to 2002 were associated with an increase in the number of informal recyclers in Vancouver (Tremblay et al., 2010). Further, income assistance rates have remained frozen since 2007 and recipients are often prohibited from earning supplemental income, despite the fact that income assistance rates are less than half of the Canadian Low Income Cutoff Poverty measure for single individuals (Henkel, 2011). While a recent change in the government Party in the British Columbia legislature has been accompanied by the announcement of a $100 increase in income assistance rates, it remains to be seen whether this increase will successfully reduce marginalised individuals' reliance on informal income generation and any associated harms therewith. Additionally, policies that serve to penalise PWUD engaged in informal recycling may compel PWUD to adapt their geographies of survival in order to avoid surveillance, and thus remain reluctant to access services. Ordinances such as the aforementioned Solid Waste By-law, when enforced, are particularly harmful, in that they target PWUD who informally recycle for undertaking these activities (Safe Streets Act of 2004, 2004; Solid Waste By-law No. 8417, 2001). Removing these ordinances or replacing them with more health-promoting regulations could redirect police efforts to other more critical areas. Changes to these policies could also mitigate associated social and health harms, including financial penalties, surveillance, and policies that inhibit service providers from accommodating the specific needs of informal recyclers, such as providing secure spaces to leave recyclables while they access social and health services. To further reduce negative interactions with law enforcement, training could be offered to educate police on the barriers faced by informal recyclers and potential measures to improve their circumstances, including referrals to healthcare or addiction treatment facilities.

Given the health and social advantages of safe and stable employment (Callahan et al., 2015; DeBeck et al., 2007; Henkel, 2011; Richardson et al., 2010; Richardson, Sherman, & Kerr, 2012; Ti et al., 2014), PWUD may benefit from increased availability of accessible and appropriate employment opportunities to reduce the economic necessity of engaging in informal recycling. In studies of PWUD engaged in prohibited income-generating activities, participants reported they would willingly give up these activities if offered alternative low-threshold employment, but compared to PWUD engaged in drug dealing, sex work, and theft, fewer PWUD engaged in recycling were likely to give up these activities (Cheng et al., 2016; DeBeck et al., 2007, 2011). Informal recycling may be perceived as a safer activity, making it source of income PWUD would not forgo. Additionally, informal recycling may provide needed flexibility for PWUD to work when and where they are able. To be an attractive alternative, low-threshold employment must therefore offer employment protections and accommodate time off for ongoing health and social service utilization as well as episodic absences from labour market participation due to health comorbidities (Richardson, Small, & Kerr, 2016).

This study has some limitations. First, VIDUS and ACCESS data were collected from non-random samples and may not be generalisable to all PWUD. However, cohort studies are a robust method of collecting data from populations of PWUD given the considerable challenges of developing and using representative sampling frames. Second, our results may be subject to unmeasured confounding as variables not included in the model may affect our results. Third, the sensitivity of topics reflected in our data may subject data to response bias. Nevertheless, the longstanding nature of the study and the robust relationships between participants and staff may help reduce systematic underreporting of behaviour commonly perceived as undesirable. Finally, it should be noted that our exploratory modelling strategy does not assess causal relationships.

Earlier ethnographic research has established that many socio-economically marginalised individuals engage in informal recycling to meet their basic needs, despite the associated stigma. Informal recycling remains highly visible and public, and in Vancouver, as in many cities, contravenes established provincial and local ordinances. The current study examines how the economic, social, spatial, and legal characteristics specific to informal recycling contribute to a risk environment for PWUD. In providing empirical support for the social-structural production of health risk, our data show PWUD who informally recycle are more likely to inject drugs, inject in public, use methamphetamines at least daily, experience police confrontations, and have difficulty accessing harm reduction equipment. To our knowledge this is the first quantitative study to examine informal recycling among PWUD and it highlights a crucial need to amend policies that restrict or police the use of public spaces, as well as implement specific interventions to provide avenues for low-threshold employment, and improve access to harm reduction and treatment services for PWUD who informally recycle. This research extends existing research that documents income generation as a critical social determinant of health and as a key locus of disadvantage for PWUD (DeBeck et al., 2007; Richardson et al., 2010, 2016), while highlighting opportunities for changes that would better support socio-economically marginalised individuals.

Contributors

LR conceptualized and designed the study. TK, KH, and MJM designed and oversee the study cohorts. KJ managed the literature searches and HD conducted statistical analyses. KJ and LR prepared the first draft of the manuscript. All authors contributed to the main content of the manuscript and provided critical comments on the final draft, and read and approved the manuscript prior to submission.

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Competing interests

None. MJM's institution has received an unstructured gift from NG Biomed, Ltd., to support his research.

Ethics approval

VIDUS and ACCESS have received ethics approval from Providence Health Care/University of British Columbia's Research Ethics Board.

Provenance and peer review

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