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Research Paper

Identifying injection drug use and estimating population size of people who inject drugs using healthcare administrative datasets

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ABSTRACT

Background: Large linked healthcare administrative datasets could be used to monitor programs providing prevention and treatment services to people who inject drugs (PWID). However, diagnostic codes in administrative datasets do not differentiate non-injection from injection drug use (IDU). We validated algorithms based on diagnostic codes and prescription records representing IDU in administrative datasets against interview-based IDU data.

Methods: The British Columbia Hepatitis Testers Cohort (BC-HTC) includes ~1.7 million individuals tested for HCV/HIV or reported HBV/HCV/HIV/tuberculosis cases in BC from 1990 to 2015, linked to administrative datasets including physician visit, hospitalization and prescription drug records. IDU, assessed through interviews as part of enhanced surveillance at the time of HIV or HCV/HBV diagnosis from a subset of cases included in the BC-HTC (n = 6559), was used as the gold standard. ICD-9/ICD-10 codes for IDU and injecting-related infections (IRI) were grouped with records of opioid substitution therapy (OST) into multiple IDU algorithms in administrative datasets. We assessed the performance of IDU algorithms through calculation of sensitivity, specificity, positive predictive, and negative predictive values.

Results: Sensitivity was highest (90–94%), and specificity was lowest (42–73%) for algorithms based either on IDU or IRI and drug misuse codes. Algorithms requiring both drug misuse and IRI had lower sensitivity (57–60%) and higher specificity (90–92%). An optimal sensitivity and specificity combination was found with two medical visits or a single hospitalization for injectable drugs with (83%/82%) and without OST (78%/83%), respectively. Based on algorithms that included two medical visits, a single hospitalization or OST records, there were 41,358 (1.2% of 11–65 years individuals in BC) recent PWID in BC based on health encounters during 3- year period (2013–2015).

Conclusion: Algorithms for identifying PWID using diagnostic codes in linked administrative data could be used for tracking the progress of programing aimed at PWID. With population-based datasets, this tool can be used to inform much needed estimates of PWID population size.

Background

People who inject drugs (PWID) are at high risk of acquiring hepatitis C virus (HCV), hepatitis B virus (HBV), HIV and other blood-borne infections (BBI) (Bagheri Amiri, Mostafavi, & Mirzazadeh, 2016; Degenhardt et al., 2016; Hope et al., 2013; Nelson et al., 2011; Platt et al., 2016; Ray Saraswati et al., 2015). They are subject to socio-economic marginalization and have multiple co-occurring conditions

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including mental illnesses and problematic alcohol use (Butt et al., 2017; Janjua, Yu et al., 2016; Larney, Peacock, Mathers, Hickman, & Degenhardt, 2017; Larney, Randall, Gibson, & Degenhardt, 2013; Miller et al., 2011; Prussing et al., 2015). Substance use, co-occurring infections and social conditions are associated with high morbidity and mortality among PWID (Mathers et al., 2013). Monitoring occurrence of syndemics of substance use, infections, risk behaviours and social conditions, requires the identification and enumeration of the PWID population as does the planning and provision of services for management of these conditions (Degenhardt et al., 2017). The recent opioid overdose crisis in Canada and in the United States has highlighted the need for accurate estimates of the population size of people who use drugs, including PWID, at small geographic levels to ensure optimal response. Various techniques, including capture-recapture methods, have been utilized to estimate the population size of PWID and other at-risk populations across the world (Leclerc et al., 2014; Ruiz, O'Rourke, & Allen, 2016; Xu, Fyfe, Walker, & Cowen, 2014). However, these techniques do not provide the individual level indicators of IDU required for surveillance, research and evaluation.

Linked surveillance and healthcare utilization datasets, where available, could provide a cost-effective and efficient mechanism to characterize syndemics, and better inform intervention programs and monitoring of disease outcomes among PWID (Bansal, Chowell, Simonsen, Vespignani, & Viboud, 2016; Islam et al., 2017; Janjua, Kuo, Chong et al., 2016; Janjua, Kuo, Yu et al., 2016). However, diagnostic codes in administrative datasets do not distinguish injection from non-injection drug use. Although assessment of overall illicit drug use is important, the risk of HCV transmission and re-infection are mainly related to IDU and sharing of drug use equipment (Islam et al., 2017; Larney et al., 2015a; Midgard et al., 2016). PWID are also at high risk of developing injecting-related infections (IRI) such as skin and soft tissue infections, osteomyelitis, and endocarditis (Cooper et al., 2007; Iversen, Page, Madden, & Maher, 2015; Larney et al., 2017; Lloyd-Smith et al., 2008; Tookes, Diaz, Li, Khalid, & Doblecki-Lewis, 2015). Thus, an algorithm that combines diagnostic codes for drug use and injecting-related infections could be used to identify potential PWID in administrative datasets. Large administrative datasets based on the coverage of entire population of a geographic area could provide an efficient mechanism for estimating PWID population size in that geographic area. In this paper, we identified and validated algorithms based on diagnostics codes and prescription records representing IDU in linked administrative datasets against interview-based IDU data. We utilized an algorithm with optimal characteristics to estimate the PWID population size in British Columbia.

Methods

The cohort and setting

The British Columbia (BC) Hepatitis Testers Cohort (BC-HTC) includes all individuals (~1.7 million) tested for HCV, HIV or reported as a case of HBV, HCV, HIV or active TB between 1990 and 2015 in BC. These datasets are integrated with data on individuals' demographics (6-digit postal code and socioeconomic status), medical visits (medical services plan), hospitalizations (discharge abstract database), cancers, chronic diseases, emergency department visits, prescription drugs and mortality using the unique personal health number assigned to each resident of BC to create a comprehensive longitudinal history for each member of the BC-HTC (BC Vital Statistics Agency (creator), 2014; British Columbia Cancer Agency (creator), 2013; British Columbia Ministry of Health (creator), 2013a, 2013b, 2013c, 2013d). More than 95% of HCV serology and all HCV RNA testing in BC are performed at the BCCDC-Public Health Laboratory. All dispensed prescriptions in BC including HCV treatments and opioid substitution therapy (OST), are recorded in a central system called PharmaNet. Details of the cohort creation and epidemiological characteristics have been reported previously (Janjua, Kuo, Chong et al., 2016; Janjua, Kuo, Yu et al., 2016).

Study population, validation dataset and self-reported injection drug use assessment

The study population for the validation of algorithms to identify IDU in administrative datasets included individuals ages 11–65 years who were interviewed by public health nurses for risk factors assessment using standard case report forms at the time of their HIV, HBV or HCV diagnosis as part of provincial surveillance of blood borne infections according to provincial guidelines (BC Centre for Disease Control, 2009, 2010, 2013a). In BC, all newly diagnosed cases of HIV, acute HBV, and acute HCV, who were reachable, were followed and interviewed at the time of diagnosis. Risk factor data for HIV was available between 1996- 2015 while for acute HBV and acute HCV, systematic data using standardised case report forms was available between 2000 and 2015. Thus, these data include a subset of all HIV, HBV and HCV (n = 6559) cases diagnosed in BC between 1996 and 2015 and are included in the cohort. Risk factor data are recorded in the provincial surveillance systems maintained by BCCDC and integrated in the BC-HTC. The HIV questionnaire inquired about the history of syringe sharing for drug use while the HBV and HCV questionnaires inquired about history of IDU within past 12 months. Based on the answers to the IDU questions, we created a variable on the history of IDU before HBV, HCV or HIV diagnoses (2009, 2010, 2013a). To drive the IDU algorithms based on administrative datasets, we used diagnostic codes from medical visits and hospitalizations, and dispensed prescription drugs from 1990 to 2015.

Assessment of IDU in administrative datasets: diagnostic codes and algorithms

IDU was identified through diagnostic codes for drug use and injecting-related infections such as skin and soft tissue infections from medical visit and hospitalization datasets and dispensation records of prescription drug used for the management of opioid addiction including methadone and buprenorphine/naloxone. We used international classification of diseases version 9 (ICD 9) and version 10 (ICD10) codes for IDU and injecting-related infections from existing literature and corresponding coding dictionaries in Canada, presented in Table 1 (Cooper et al., 2007; Heinzerling et al., 2006; Takahashi, Maciejewski, & Bradley, 2010; Tookes et al., 2015). For IDU, we excluded codes that are known to be not injected such as cannabis and solvents. We developed the following algorithms:

1. **Drug misuse**: We developed three algorithms based on a) a single occurrence of drug related codes in the medical visit data or single occurrence in the hospitalization data; b) two occurrences in the medical visit data or one occurrence in the hospitalization data and; c) three occurrences in the medical visit data or one occurrence in the hospitalization data. It was expected that the variable requiring 3 medical visits for drug use related codes would be more specific than the one requiring a single medical visit.
2. **Injection drug use (IDU)**: This set of variables included drug misuse-related codes and excluded known non-injectable drugs such as cannabis and solvents. We also assessed this algorithm by including prescription records of OST. This variable was also assessed as 1–3 medical visits or 1 hospitalization.
3. **Combination of IDU and/or injecting-related infections**: In this set of variables, we required receiving services for an injecting-related infections within 1 or 2 years of IDU. Injecting-related infections included skin and soft tissues infections, osteomyelitis and endocarditis (Table 1). The variable requiring injecting-related infections within one year of drug use related codes was expected to be highly specific but less sensitive. We also evaluated additional