The relationship between outpatient service use and emergency department visits among people treated for mental and substance use disorders: analysis of population-based administrative data in British Columbia, Canada

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Abstract

Background: Research findings on the association between outpatient service use and emergency department (ED) visits for mental and substance use disorders (MSUDs) are mixed and may differ by disorder type.

Methods: We used population-based linked administrative data in British Columbia, Canada to examine associations between outpatient primary care and psychiatry service use and ED visits among people ages 15 and older, comparing across people treated for three disorder categories: common mental disorders (MDs) (depressive, anxiety, and/or post-traumatic stress disorders), serious MDs (schizophrenia spectrum and/or bipolar disorders), and substance use disorders (SUDs) in 2016/7. We used hurdle models to examine the association between outpatient service use and odds of any ED visit for MSUDs as well count of ED visits for MSUDs, stratified by cohort in 2017/8.

Results: Having had one or more MSUD-related primary care visit was associated with lower odds of any ED visit among people treated for common MDs and SUDs but not people treated for serious MDs. Continuity of primary care was associated with slightly lower ED use in all cohorts. One or more outpatient psychiatrist visits was associated with lower odds of ED visits among people treated for serious MDs and SUDs, but not among people with common MDs.

Conclusion: Findings highlight the importance of expanded access to outpatient specialist mental health services, particularly for people with serious MDs and SUDs, and collaborative models that can support primary care providers treating people with MSUDs.

Keywords: Mental disorders, Substance use disorders, Ambulatory care, Primary care, Continuity of care, Emergency services, Emergency department visits, Administrative data

Background

Emergency departments (EDs) provide timely access to acute care for mental and substance use disorders (MSUDs) and fill gaps for people who cannot otherwise access services [1–3]. On the other hand, ED visits for MSUDs may suggest that peoples’ conditions were poorly
managed in the community, that they had difficulty accessing outpatient primary care and/or psychiatry services when they needed them [1, 4–6]. Improving appropriate use of EDs for MSUDs is a topic of ongoing policy consideration in many jurisdictions, particularly as people visiting the ED for MSUDs treatment often present frequently [5, 7, 8]. Information about the relationship between outpatient service use and ED visits is essential to inform policy and system planning.

While there is a large body of literature examining factors shaping ED service use generally [9–12], research on factors shaping ED visits for MSUDs is limited and findings are mixed. Studies have found that primary care and outpatient psychiatric care use is associated with greater [5, 7, 8, 13–20], lower [14, 15, 20–25], or no difference [17, 18] in ED utilization. These inconsistent findings demonstrate the need for further research, and in particular studies that account for disorder type as associations may differ between disorders [5, 14, 15]. Additionally, much of the existing research focuses on outpatient service use among ED users, excluding people who only use outpatient services. There is a consequent gap in information on the relationship between outpatient service use and any subsequent ED visits, in addition to count or frequency of visits.

We used province-wide population-based linked data in British Columbia (BC), Canada to examine the associations between outpatient service use (all primary care visits, primary care visits for MSUDs, continuity of primary care, outpatient psychiatry visits) and ED visits. We compared results between people treated only for common MDs (depressive disorders and/or anxiety disorders and/or posttraumatic stress disorder (PTSD)), people treated for serious MDs (schizophrenia spectrum and/or bipolar disorders, alone or concurrently with common MDs), and people treated for substance use disorders (SUDs) (including alcohol-related disorders, opioid-related disorders, cannabis-related disorders, stimulant-related disorders, and other substance use/abuse, alone or concurrently with common and/or serious MDs). We model both odds of any ED service use as well as count of ED visits.

**Methods**

**Study setting**

BC is the westernmost province in Canada and has a population of approximately 5 million people as of 2020. The province is organized into five regional Health Authorities which are responsible for the organization and delivery of hospital and ED services within their respective geographic regions. The provincial health insurance program (Medical Services Plan or MSP) covers all permanent residents, except for approximately 4% of the population covered under federal health insurance programs (including members of the Canadian Armed Forces). BC residents insured under MSP receive first-dollar coverage for all medically necessary services provided by licensed physicians or in hospital. Primary care plays a gatekeeping role, which means access to psychiatrists and other specialists requires a referral from primary care. Primary care is provided mostly by family physicians in private, fee-for-service family practices and walk-in clinics. Outpatient psychiatry is similarly reimbursed on a fee-for-service basis, with alternate payments predominantly for non-clinical duties [26]. It is individual physicians’ responsibility to arrange coverage for after-hours or weekend care, and patients may be directed to the ED if services are needed outside of practice hours.

**Data**

We used individual-level de-identified data holdings from the BC Ministry of Health that are linked using both deterministic and probabilistic approaches and made accessible through Population Data BC [27]. Data included all people ages 15+ who are insured under the provincial insurance plan and who were treated for MSUDs. We used patient registry information to define the study cohort and to describe individual characteristics such as age, sex/gender, and location of residence [28]. ED visits were captured using the National Ambulatory Care Reporting System (NACRS) [29] and MSP physician billing data [30]. Physician service use was captured using billing data as well, and hospitalizations were identified using the Discharge Abstract Database [31]. Vital statistics deaths data was used to identify and exclude people who died during the study period [32].

**Study population**

The study population includes all BC residents aged 15 years and older who were alive and registered for provincial health insurance between April 1 2016 and March 31 2018, and who had two or more outpatient visits, and/or one hospitalization for MSUDs (Appendix Table 4) in 2016/7. We excluded people with missing data for age or sex/gender.

**Measures**

**Mental and substance use disorders** We grouped people into three cohorts considering prevalence, typical severity of disorders, and treatment. Common disorders included depressive disorders, anxiety disorders, and PTSD. These are more prevalent, on average less severe, and frequently are managed in primary care settings [33–36]. Serious mental disorders included schizophrenia spectrum and bipolar disorders. These are less prevalent
multi-morbidity. This index categorizes diagnosis file developed and maintained by Statistics Canada [44, 45]. The COCI identifies the number of primary physicians providing services to a patient and the percentage of care provided by each physician. We scaled this to range from 0 (no visit/all visits to different physicians) to 10 (all visits with one physician) for clearer interpretation of regression parameters. People with only 1 primary care visit would have a value of 10. For this reason we included categories for people with 1 or 2 primary care visits in models as adjustment variables but focus our interpretation on parameter estimates for 3+ visits. We also examined psychiatrist outpatient visits (excluding visits with a hospital, day surgery, or ED service location code). For all patients seen in the ED in 2017/8, we examined outpatient service use in the 365 days preceding their first ED visit in 2017/8. For patients with no ED visits, we examined service use in the 2016/7 fiscal year.

**Individual characteristics** Age was obtained from BC’s MSP registration file. Sex/gender is collected at time of MSP registration. The field is labeled “Gender” on the registration form but only the options “M” and “F” are provided. It is not possible to distinguish sex at birth, legal sex, and gender, based on this information, so we labelled this variable “sex/gender.” Health Authority was determined based on patient residential address, not location of service use. Neighbourhood income quintile was determined based on 2016 census enumeration area of residence, assigned using postal code conversion file developed and maintained by Statistics Canada [44, 45]. We used the Charlson-Deyo Comorbidity Index to measure multimorbidity. This index categorizes diagnosis codes based on 17 weighted categories [46, 47]. We identified people with hospitalizations for MSUDs, including involuntary hospitalizations under BC’s Mental Health Act in 2016/7 as a proxy indicator of severity.

**MD ED visits (outcome)** Two data sources capture ED visits in BC: NACRS [29] and MSP payment information [30]. NACRS was developed by the Canadian Institute of Health Information to collect data on ED and other ambulatory visits. This captured 73% of ED visits in BC in 2017/8 as not all EDs submit data. All physician services delivered in EDs not reporting to NACRS are captured within the MSP billing data.

We identified MSP claims with a service location in the ED or corresponding to fee items billed only in the ED (Appendix Table 5). We also extracted all ED visits to BC facilities recorded in NACRS data. To ensure visits were not double counted across sources or when multiple MSP claims were submitted for a single patient, we retained only one ED record per patient, per day. Where multiple records contained different diagnoses, we retained records for MSUDs. We counted ED visits for MDs (including substance use) in 2017/8 as our outcome variable. We also report the number of ED visits for all other reasons in 2017/8.

**Analyses** We report descriptive statistics for individual characteristics and health services use for the three cohorts. We report treatment for MSUDs in 2017/8 by disorder group. Patients with two outpatient visits or one hospitalization (within a 365-day period) for the disorders listed in Appendix Table 4 were considered to have been treated for the disorder [48]. We used hurdle regression, with a logistic model (does a person have any vs no MSUD ED visits), and a left-truncated negative binomial model of the number of visits (among people with one or more visits) [11]. We report both unadjusted and adjusted results for service use variables. Adjusted models include all outpatient service use variables simultaneously, as well as sex/gender, age, health authority, rurality, income, MSUD diagnosis, Charlson-Deyo index, as well as binary flags for previous hospital admissions (all MSUD and involuntary) as indicators of severity. These variables are thought to be associated with outpatient service use and may also shape ED use [5, 8, 11, 15] and so we focus on adjusted odds ratios and rate ratios in interpretation to reflect the least biased estimates of the association between outpatient service use and ED visits.
Ethics approval
This study was approved by the University of British Columbia, Providence Health Care Research Institute, and Simon Fraser University research ethics boards (REB number H17–00506). All inferences, opinions and conclusions drawn in this article are those of the authors, and do not reflect the opinions or policies of the data stewards.

Results
We identified 336,973 people who were treated for MSUDs in 2016/7 and who were alive and registered throughout the study period, with final cohorts of 241,177 people treated for common MDs, 48,138 people treated for serious MDs, and 47,658 treated for SUDs (Table 1). Fewer than five people were excluded because of missing demographic data in each cohort.

| Table 1 | Individual characteristics of patients treated for mental disorders (MDs) in 2016/7, by cohort. N(%) except where indicated |
|---------|----------------------------------------------------------------------------------------------------------------------------------|
|         | Common mental disorders                                                                                                           |
|         | Serious mental disorders                                                                                                            |
|         | Substance use disorders                                                                                                             |
|         | 241,177 (71.6%)                                                                                                                    |
|         | 48,138 (14.3%)                                                                                                                     |
|         | 47,658 (14.1%)                                                                                                                     |
| Concurrent disorders |                                                                                                                                  |
| Also treated for common MD | N/A                                                                 | N/A                                                                 | 27,135 (48.2%)                                                                 | 21,866 (45.9%)                                                                 |
| Also treated for serious MD | N/A                                                                 | N/A                                                                 | N/A                                                                 | N/A                                                                 | 8109 (17.0%)                                                                 |
| Sex/gender |                                                                                                                                  |
| Female | 164,373 (68.2%)                                                                                                                   |
| Male   | 76,804 (31.8%)                                                                                                                     |
| Age |                                                                                                                                  |
| 15–24 | 28,150 (11.7%)                                                                                                                     |
| 25–44 | 78,793 (32.7%)                                                                                                                     |
| 45–64 | 88,857 (36.7%)                                                                                                                     |
| 65+   | 45,647 (18.9%)                                                                                                                     |
| Health Authority |                                                                                                                                  |
| Interior | 44,561 (18.5%)                                                                                                                   |
| Fraser | 85,244 (35.3%)                                                                                                                     |
| Vancouver Coastal | 51,243 (21.2%)                                                                                                                   |
| Vancouver Island | 48,000 (19.9%)                                                                                                                   |
| Northern | 11,969 (5.0%)                                                                                                                    |
| Unknown | 160 (0.1%)                                                                                                                        |
| Rural-Urban Residence |                                                                                                                                  |
| Metropolitan (SACTYPE 1) | 161,712 (67.1%)                                                                                                                   |
| Small urban (SACTYPE 2–3) | 51,674 (21.4%)                                                                                                                   |
| Rural/remote (SACTYPE 4–7) | 27,624 (11.5%)                                                                                                                   |
| Unknown | 167 (0.1%)                                                                                                                        |
| Neighbourhood income quintile |                                                                                                                                  |
| Q1 (lowest) | 49,483 (20.5%)                                                                                                                   |
| Q2    | 47,486 (19.7%)                                                                                                                     |
| Q3    | 48,494 (20.1%)                                                                                                                     |
| Q4    | 49,671 (20.6%)                                                                                                                     |
| Q5 (highest) | 43,770 (18.1%)                                                                                                                   |
| Missing | 2273 (0.9%)                                                                                                                       |
| Income assistance prescription drug coverage (plan C) | 25,818 (10.7%)                                                                                                                   |
| Charlson-Deyo index (mean, SD) | 0.8 ± 1.6                                                                                                                         |
| Hospital admission in 2016/7 |                                                                                                                                  |
| MSUD hospital admission | 7350 (3.0%)                                                                                                                        |
| Involuntary hospitalisation | 2845 (1.2%)                                                                                                                       |

Notes: Cohorts were based on prevalence and typical severity of the disorders. Common mental disorders included depressive disorders, anxiety disorders, and post-traumatic stress disorder. Serious mental disorders comprised schizophrenia spectrum, and bipolar disorders. People treated for both a common and serious MD were grouped into the serious MD cohort. Substance use disorders included alcohol-related disorders, opioid-related disorders, cannabis-related disorders, stimulant-related disorders, and other substance use/abuse. People treated for both a MD (common and/or serious) and a SUD were grouped into the SUDs cohort.
Among people treated for serious MDs, 27,135 (48.2%) were also treated for common MDs. Among people treated for SUDs, 21,866 (45.9%) were also treated for a common MD and 8109 (17.0%) were also treated for a serious MD. Among people treated for common MDs 31.8% were male, while 43.7% of people treated for serious MDs, and 62.9% of people treated for SUDs were male. Higher percentages of people treated for serious MDs were aged 45 years and older and a higher relative percentage lived in Vancouver Coastal health authority. Greater percentages of people treated for serious MDs and SUDS lived in lower income neighbourhoods and had prescriptions drug coverage tied to income assistance than people treated for common MDs. The Charlson-Deyo index for physical comorbidities was 0.8 among people treated for common MDs, 0.9 among people treated for serious MDs, and 1.0 among people treated for SUDs. Respective rates for total MSUD and involuntary hospital admission were 3.0 and 1.2% for common MDs, 19.5 and 13.2% for serious MDs, and 34.2 and 16.4% for SUDs (Table 1).

We observed that 5.9% of people treated for common MDs, 14.1% of people treated for serious MDs, and 29.1% of people treated for SUDs in 2016/7 had one or more MSUD ED visits in 2017/8 (Table 2). Within these cohorts, 29.4, 26.4, and 31.2% had a non-MSUD ED visit in 2017/8 among people with common MDs, serious MDs, and SUDs, respectively. As our study cohorts included people treated for MSUDs in 2016/7 (including services provided by primary care, other outpatient services, and in hospital), access to primary care was generally high, with only 1.2% of people with common MDs and 7.1% of people with serious MDs, and 8.8% of people with SUDs having no primary care visits. The three cohorts were similar with respect to number of primary care visits, with an average of 9.8 and 10.5 per person, per year across cohorts (Table 2); of these, between 3.2 and 3.7 visits were for MSUD services. Continuity of care was slightly lower for people treated for SUDs. Among people treated for SUDs they also had an additional 13.5 visits annually with a primary care provider related to opioid agonist therapy, on average. About a fifth (17.8%) of people with common MDs and 76.3% of people with serious MDs had one or more visits with a psychiatrist, whereas psychiatric care was much less common, at only 24.3%, among people with SUDs.

Associations between ED visits and outpatient service use differed by cohort (Table 3). In adjusted analysis, having 3+ primary care visits for any reasons showed different patterns. Among people with common and serious MDs it was associated with lower odds of any ED visit, but it was not associated with rate of ED visits. The reverse pattern was observed for people with SUDs. Having 3+ primary care visits was not associated with any ED visit but with a lower rate of ED visits. Having one or more MSUD-related primary care visit was associated with lower odds of any ED visits among people treated for common MDs and SUDs but not among people with serious MDs. Continuity of primary care was consistently associated with both slightly lower odds of any ED visits and count of ED visits among all three cohorts (Table 3). Having one or more outpatient psychiatrist visits was associated with lower odds of an ED visit among people treated for serious MDs and with lowers odds of both any ED visit and count of ED visits among people treated for SUDs (Table 3).

Discussion
The characteristics of people treated for MSUDs in this large BC cohort mirror those described in other jurisdictions. Our findings indicate that fewer men than women were treated for MDs, especially for common MDs, while fewer women were treated for SUDS, reflecting gendered differences seen elsewhere [35, 49, 50]. That fewer men were treated for MD's potentially signals men's reticence to acknowledge and seek help for mental health concerns [51], and/or a preference for self-management [52]. Consistent with the well-established association between poverty and serious MDs [53] more people with serious MDs lived in low-income neighbourhoods and received prescription drug coverage associated with income assistance. Also unsurprisingly, people with serious MDs and SUDs had higher rates of both voluntary and involuntary hospitalizations, reflecting more complex needs overall.

Associations between outpatient service use and ED visits varied substantially across cohorts. Primary care may have a particularly important role to play among people with common MDs, for whom having 3+ primary care visits for any reason, and one or more MSUD-related primary care visits, were associated with lower odds of any ED visit. This is consistent with primary care providers’ capacity and expertise in managing common disorders, compared to serious MDs and SUDs which generally require greater specialization [39–42].

Among people with serious MDs having 3+ primary care visits for any reason and one or more psychiatry visits (but not one or more primary care visits for MSUDs) were associated with lower odds of any ED visit. Similarly, among people with SUDs having one or more outpatient psychiatrist visit was associated with
|                            | Common mental disorders (N=241,177) | Serious mental disorders (N=48,138) | Substance use disorders (N=47,658) |
|---------------------------|-------------------------------------|-------------------------------------|-----------------------------------|
| **Emergency department visits in 2017/8** |                                     |                                     |                                   |
| MSUD ED visits (mean, SD) | 0.1 ± 0.5 (94.1%)                   | 0.3 ± 1.2 (85.9%)                  | 0.9 ± 3.2 (70.9%)                |
| 0                         | 227,018 (94.1%)                     | 41,373 (85.9%)                     | 33,783 (70.9%)                   |
| 1                         | 10,084 (4.2%)                       | 3594 (7.5%)                        | 6378 (13.4%)                     |
| 2–5                       | 3798 (1.6%)                         | 2763 (5.7%)                        | 5668 (11.9%)                     |
| 6–11                      | 238 (0.1%)                          | 330 (0.7%)                         | 1242 (2.6%)                      |
| 12+                       | 39 (0.0%)                           | 78 (0.2%)                          | 587 (1.2%)                       |
| **Other ED visits**       | 708,36 (29.4%)                      | 12,708 (26.4%)                     | 14,848 (31.2%)                   |
| **Outpatient service use 2016/7 or 365 days before first ED visit in 2017/8** |                                     |                                     |                                   |
| Primary care visits (mean, SD) | 105 ± 8.5 (1.2%)                    | 9.8 ± 9.2 (2.3%)                   | 10.4 ± 100 (22.8%)               |
| 0 visits                  | 2794 (1.2%)                         | 3417 (7.1%)                        | 4176 (8.8%)                      |
| 1 visit                   | 5565 (2.3%)                         | 2475 (5.1%)                        | 2905 (6.1%)                      |
| 2 visits                  | 10618 (4.4%)                        | 2735 (5.7%)                        | 2904 (6.1%)                      |
| 3+ visits                 | 222,200 (92.1%)                     | 39511 (82.1%)                      | 37,673 (79.0%)                   |
| MSUD primary care visits (mean, SD) | 3.2 ± 3.1 (7.7%)                    | 3.2 ± 4.2 (27.9%)                  | 3.7 ± 50 (28.4%)                 |
| 0 visits                  | 18,521 (7.7%)                       | 1,3414 (27.9%)                     | 13,537 (28.4%)                   |
| 1 visit                   | 49,340 (20.5%)                      | 7862 (16.3%)                       | 7288 (15.3%)                     |
| 2 visits                  | 54,478 (22.8%)                      | 6683 (13.9%)                       | 5714 (12.0%)                     |
| 3+ visits                 | 118,438 (49.1%)                     | 20,179 (41.9%)                     | 21,119 (44.3%)                   |
| Continuity of care index  | 5.8 ± 3.4 (2.7%)                    | 5.5 ± 3.7 (2.7%)                   | 4.3 ± 3.5                       |
| Psychiatrist Visits (mean, SD) | 1.0 ± 4.1 (82.2%)                   | 5.5 ± 7.8 (82.2%)                  | 1.5 ± 4.7                       |
| 0 visits                  | 198,185 (82.2%)                     | 11,442 (23.8%)                     | 36,091 (75.7%)                   |
| 1 visit                   | 10,750 (4.5%)                       | 3307 (6.9%)                        | 3011 (6.3%)                      |
| 2 visits                  | 6597 (2.7%)                         | 4231 (8.8%)                        | 1684 (3.5%)                      |
| 3+ visits                 | 25,645 (10.6%)                      | 291,58 (60.6%)                     | 6872 (14.4%)                     |

**Notes:** Common mental disorders included depressive disorders, anxiety disorders, and post-traumatic stress disorder. Serious mental disorders comprised schizophrenia spectrum, and bipolar disorders. People treated for both a common and serious MD were grouped into the serious MD cohort. Substance use disorders included alcohol-related disorders, opioid-related disorders, cannabis-related disorders, stimulant-related disorders, and other substance use abuse. People treated for both a MD (common and/or serious) and a SUD were grouped into the SUDs cohort.
### Table 3  Odds/rate ratios (95%CI) of mental disorder (MD) emergency department (ED) visits and outpatient service use

| Common mental disorders | Unadjusted | Adjusted |
|-------------------------|------------|----------|
| Any MSUD ED visit       |            |          |
| 1 primary care visit (vs. 0) | 0.54 | 0.47 | 0.62 | 0.82 | 0.68 | 1.00 |
| 2 primary care visits (vs. 0) | 0.36 | 0.32 | 0.41 | 0.84 | 0.70 | 1.02 |
| 3+ primary care visits (vs. 0) | 0.34 | 0.31 | 0.38 | 0.70 | 0.59 | 0.83 |
| 1+ primary care visit related to MSUD (vs. 0) | 0.53 | 0.50 | 0.56 | 0.80 | 0.75 | 0.87 |
| Continuity of Care Index (range 0–10) | 0.93 | 0.92 | 0.93 | 0.96 | 0.96 | 0.97 |
| 1+ psychiatrist visit (vs. 0) | 1.69 | 1.62 | 1.76 | 0.98 | 0.93 | 1.03 |
| **Count of MSUD ED visits** | **RR** | **95% CI** | **RR** | **95% CI** |
| 1 primary care visit (vs. 0) | 0.71 | 0.54 | 0.93 | 0.85 | 0.64 | 1.13 |
| 2 primary care visits (vs. 0) | 0.89 | 0.69 | 1.15 | 1.04 | 0.79 | 1.37 |
| 3+ primary care visits (vs. 0) | 0.71 | 0.58 | 0.87 | 0.88 | 0.69 | 1.12 |
| 1+ primary care visit related to MSUD (vs. 0) | 1.01 | 0.91 | 1.12 | 1.06 | 0.93 | 1.20 |
| Continuity of Care Index (range 0–10) | 0.98 | 0.97 | 0.99 | 0.97 | 0.96 | 0.99 |
| 1+ psychiatrist visit (vs. 0) | 1.48 | 1.36 | 1.60 | 1.06 | 0.98 | 1.14 |

| Serious mental disorders | Unadjusted | Adjusted |
|-------------------------|------------|----------|
| Any MSUD ED visit       |            |          |
| 1 primary care visit (vs. 0) | 0.84 | 0.74 | 0.96 | 0.92 | 0.74 | 1.14 |
| 2 primary care visits (vs. 0) | 0.72 | 0.63 | 0.82 | 1.10 | 0.87 | 1.37 |
| 3+ primary care visits (vs. 0) | 0.61 | 0.56 | 0.67 | 0.75 | 0.62 | 0.89 |
| 1+ primary care visits related to MSUD (vs. 0) | 0.94 | 0.88 | 0.99 | 1.09 | 0.99 | 1.20 |
| Continuity of Care Index (range 0–10) | 0.93 | 0.92 | 0.94 | 0.97 | 0.96 | 0.98 |
| 1+ psychiatrist visit (vs. 0) | 1.12 | 1.05 | 1.19 | 0.78 | 0.72 | 0.85 |
| **Count of MSUD ED visits** | **RR** | **95% CI** | **RR** | **95% CI** |
| 1 primary care visit (vs. 0) | 0.89 | 0.70 | 1.13 | 0.92 | 0.77 | 1.10 |
| 2 primary care visits (vs. 0) | 1.03 | 0.81 | 1.31 | 1.13 | 0.93 | 1.37 |
| 3+ primary care visits (vs. 0) | 0.85 | 0.73 | 1.00 | 1.04 | 0.89 | 1.21 |
| 1+ primary care visit related to MSUD (vs. 0) | 0.95 | 0.85 | 1.05 | 1.02 | 0.92 | 1.12 |
| Continuity of Care Index (range 0–10) | 0.97 | 0.96 | 0.98 | 0.98 | 0.97 | 1.00 |
| 1+ psychiatrist visit (vs. 0) | 1.34 | 1.19 | 1.51 | 1.04 | 0.95 | 1.14 |

| Substance use disorders | Unadjusted | Adjusted |
|-------------------------|------------|----------|
| Any MSUD ED visit       |            |          |
| 1 primary care visit (vs. 0) | 0.81 | 0.74 | 0.90 | 1.01 | 0.88 | 1.17 |
| 2 primary care visits (vs. 0) | 0.76 | 0.69 | 0.84 | 1.21 | 1.05 | 1.41 |
| 3+ primary care visits (vs. 0) | 0.59 | 0.55 | 0.63 | 0.98 | 0.87 | 1.09 |
| 1+ primary care visits related to MSUD (vs. 0) | 0.52 | 0.50 | 0.55 | 0.80 | 0.74 | 0.86 |
| Continuity of Care Index (range 0–10) | 0.87 | 0.87 | 0.88 | 0.93 | 0.92 | 0.94 |
| 1+ psychiatrist visit (vs. 0) | 1.47 | 1.41 | 1.54 | 0.69 | 0.64 | 0.74 |
| **Count of MSUD ED visits** | **RR** | **95% CI** | **RR** | **95% CI** |
| 1 primary care visit (vs. 0) | 0.92 | 0.78 | 1.08 | 0.89 | 0.76 | 1.04 |
| 2 primary care visits (vs. 0) | 1.00 | 0.85 | 1.18 | 0.97 | 0.82 | 1.14 |
| 3+ primary care visits (vs. 0) | 0.84 | 0.76 | 0.93 | 0.78 | 0.69 | 0.88 |
| 1+ primary care visit related to MD (vs. 0) | 1.16 | 1.07 | 1.25 | 1.22 | 1.11 | 1.34 |
| Continuity of Care Index (range 0–10) | 0.96 | 0.96 | 0.97 | 0.97 | 0.96 | 0.98 |
| 1+ psychiatrist visit (vs. 0) | 1.30 | 1.21 | 1.40 | 0.86 | 0.79 | 0.93 |

Notes: Odds Ratios (OR) represent the association between primary care visits, continuity of care index, psychiatrist visits (predictors) and any ED visits (outcome). Rate Ratios (RR) represent the association between primary care visits, continuity of care index, psychiatrist visits (predictors) and count of ED visits (outcome) among those with ≥1 ED visits.

Adjusted models include all outpatient service use variables as well as individual characteristics displayed in Table 1.
both lower odds of any ED visit and a lower count of ED visits. Findings point to the importance of specialized expertise in managing more serious conditions [41, 42] and mirror associations observed elsewhere [14, 15, 20, 23–25].

Only a quarter of people with SUDs had an outpatient visit with a psychiatrist, despite the fact that over half had co-occurring MDs. That so few people in the SUD cohort saw a psychiatrist is alarming, though not unexpected as concurrent MSUDs are associated with higher levels of unmet need [54]. This trend may indicate concurrent MSUDs are not receiving concurrent, coordinated, or integrated care despite evidence that integrative rather than sequential treatment is best for people with concurrent disorders [55–57].

Continuity of primary care was associated with somewhat lower ED use (both odds and rate ratios) across all three cohorts, as has been found in other studies [7, 24, 25, 58, 59]. However, it is also possible that some of the association between continuity of care and ED visits reflects unmeasured confounding. Though we control for measures of income, it is possible that people with more resources (e.g., social support) or stability (e.g., residing in the same location) are better able to consistently visit the same primary care provider, and are also less likely to seek care in EDs [60]. Similarly, while psychiatry visits were associated with reduced ED visits for serious MDs and SUDs, we cannot determine if these visits helped to stabilize individuals and avert them from the ED or if psychiatry visits signal preceding stability (e.g., organizational skills needed to navigate access).

Findings reflect that service remains fragmented and collaborative models are not widely implemented in BC [57]. Roughly a quarter of people with serious MDs and three quarters of people with SUDs had no psychiatry visits and roughly a quarter also had no visits with a primary care provider related to MDs. This signals barriers to accessing integrated care for people with serious MDs [61, 62] and a lack of capacity for collaborative care between primary care and psychiatry services [39, 40, 42]. Collaborative and integrative care models may better support primary care providers treating people with serious MDs and SUDs [41, 42], which is especially important given the relative lack of access to outpatient psychiatric, and psychological services in Canada [62, 63].

Strengths and limitations
Our study includes all people treated for MSUDs within a publicly funded health insurance system. The availability of province-wide linked administrative data permits the analysis of associations between outpatient services use and ED visits within large, population-based cohorts of people treated for mental disorders. Use of population-based data make it possible to examine associations with any ED visits, not just frequency of ED visits within cohorts identified in ED, as has been typical in other studies (e.g., [49]). We expect findings may apply in other settings with a gatekeeping model of primary care, and where there is limited implementation of collaborative or integrated models of mental health service delivery within primary care.

As our analysis is restricted to people who were already accessing publicly funded services, it does not capture people with untreated conditions, people seeking informal and/or private supports, people receiving psychotherapy or counselling in mental health community centres, or people struggling to access care for whom an ED visit was their first-ever MSUD service use (approximately 25% of ED contacts in BC) [64]. Findings are also limited by the fact that data were not collected for research. MSUD severity is an important consideration for treatment and health services provisions [65, 66]; while hospitalization can serve as a proxy for severity, administrative data does not otherwise capture disorder severity. We grouped disorders based on the most common or typical severity of the disorder, alongside prevalence, but some people may have been misclassified. We also collapsed people with MD and SUD into the SUD cohort, future research should disentangle these two groups. In addition, individuals with MDs have diverse needs that can benefit from support from a variety of providers (e.g., nurses, psychologists, social workers, occupational therapists); however, interactions with these providers cannot be observed in our data. Future research examining the impact of other supports and services (e.g., nursing, psychological services, social work, peer support, occupational therapy, etc.) on ED visits for MDs is needed. Finally, our data do not measure access to housing, social, or economic supports that have consistent associations with ED visits [18, 19, 67, 68].

Conclusions
Associations between outpatient service use and ED visits varied across cohorts. While access to continuous primary care is important for everyone, use of outpatient psychiatry services was associated with lower ED use among people with serious MDs and particularly among people with SUDs. Findings point to the urgent need for expanded access to specialist mental health services, as well as collaborative and integrated care models that can better support primary care providers treating people with MSUDs.
### Appendix

#### Table 4 Disorder groupings and associated diagnosis codes in British Columbia administrative data

| Disorder Grouping                                                                 | ICD-9 Codes (MSP claims) | ICD-10 Codes (Hospital Discharge Data) | NACRS Codes |
|-----------------------------------------------------------------------------------|---------------------------|----------------------------------------|-------------|
| Common mental disorders                                                           |                           |                                        |             |
| Depressive disorders                                                              | 311                       | F32, F33, F34                           | F329        |
| Anxiety disorders                                                                 | 300                       | F40, F41                                | F419        |
| Anxiety/depression (code unique to MSP)                                            | 508                       | n/a                                    | n/a         |
| Post-Traumatic Stress Disorder                                                    | 308, 309                  | F43                                    | n/a         |
| Serious mental disorders                                                          |                           |                                        |             |
| Bipolar and related disorders                                                     | 296                       | F31, F34 (excluding F34.1), F38, F39   |             |
| Schizophrenia spectrum and other psychotic disorders                              | 295, 297, 298             | F20, F21, F22, F23, F24, F25, F28, F29 |             |
| Substance use disorders                                                           |                           |                                        |             |
| Alcohol-related disorders                                                         | 291, 303                  | F10                                    | F100, F103, T510 |
| Opioid-related disorders                                                          | 292, 304, 305             | F11                                    | F119, T401  |
| Cannabis-related disorders                                                        | 292, 304, 305             | F12                                    | F129, T407  |
| Stimulant-related disorders                                                       | 292, 304, 305             | F14                                    | F149, F159, T405 |
| Other substance use abuse                                                         | 292, 304, 305             | F13, F16, F17, F18, F19                |             |

#### Table 5 List of fee codes included in identification of ED visits using Medical Services Plan Payment data

| Fee Item | Description                                      |
|----------|--------------------------------------------------|
| 1811     | LEVEL I EMERGENCY CARE - DAY                     |
| 1812     | 01812 LEVEL II EMERGENCY CARE - DAY             |
| 1813     | 01813 LEVEL III EMERGENCY CARE - DAY            |
| 1821     | 01821 LEVEL I EMERGENCY CARE - EVENING          |
| 1822     | 01822 LEVEL II EMERGENCY CARE - EVENING         |
| 1823     | 01823 LEVEL III EMERGENCY CARE - EVENING        |
| 1831     | 01831 LEVEL I EMERGENCY CARE - NIGHT            |
| 1832     | 01832 LEVEL II EMERGENCY CARE - NIGHT           |
| 1833     | 01833 LEVEL III EMERGENCY CARE - NIGHT          |
| 1841     | 01841 LEVEL I EMERGENCY CARE - SAT, SUN, OR STAT HOL |
| 1842     | 01841 LEVEL I EMERGENCY CARE - SAT, SUN, OR STAT HOL |
| 1843     | 01841 LEVEL I EMERGENCY CARE - SAT, SUN, OR STAT HOL |
| 96,801   | 96,801 APB-LEVEL I EMERGENCY CARE - DAY         |
| 96,802   | 96,802 APB-LEVEL II EMERGENCY CARE - DAY        |
| 96,803   | 96,803 APB-LEVEL III EMERGENCY CARE - DAY       |
| 96,804   | 96,804 APB-LEVEL IV EMERGENCY CARE - DAY        |
| 96,805   | 96,805 APB-LEVEL V EMERGENCY CARE - DAY         |
| 96,811   | 96,811 APB-LEVEL I EMERGENCY CARE - EVENING     |
| 96,812   | 96,812 APB-LEVEL II EMERGENCY CARE - EVENING    |
| 96,813   | 96,813 APB-LEVEL III EMERGENCY CARE - EVENING   |
| 96,814   | 96,814 APB-LEVEL IV EMERGENCY CARE - EVENING    |
| 96,815   | 96,815 APB-LEVEL V EMERGENCY CARE - EVENING     |
| 96,821   | 96,821 APB-LEVEL I EMERGENCY CARE - NIGHT       |
| 96,822   | 96,822 APB-LEVEL II EMERGENCY CARE - NIGHT      |
| 96,823   | 96,823 APB-LEVEL III EMERGENCY CARE - NIGHT     |
| 96,824   | 96,824 APB-LEVEL IV EMERGENCY CARE - NIGHT      |
| 96,825   | 96,825 APB-LEVEL V EMERGENCY CARE - NIGHT       |
| 36,347   | 36,347 NP - VISIT, EMERGENCY (BETWEEN 0800 AND 1800 HRS) |
| 36,440   | 36,440 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 50–59) |
| 36,441   | 36,441 NP - EMERGENCY DEPARTMENT VISIT (AGE 50–59) |
| 36,447   | 36,447 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 2–19) |
| 36,448   | 36,448 NP - EMERGENCY DEPARTMENT VISIT (AGE 2–19) |
| 36,601   | 36,601 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 0–1) |
| 36,602   | 36,602 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 2–59) |
| 36,603   | 36,603 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 2–59) |
| 36,604   | 36,604 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 60–69) |
| 36,605   | 36,605 NP - SIMPLE/FASTRACK VISIT IN EMERGENCY (AGE 80+) |
| 36,606   | 36,606 NP - VISIT IN EMERGENCY DEPARTMENT (AGE 0–1) |
| 36,607   | 36,607 NP - VISIT IN EMERGENCY DEPARTMENT (AGE 2–59) |
| 36,608   | NP - VISIT IN EMERGENCY DEPARTMENT (AGE 60–69) |
| 36,609   | NP - VISIT IN EMERGENCY DEPARTMENT (AGE 70–79) |
| 36,610   | NP - VISIT IN EMERGENCY DEPARTMENT (AGE 80+) |
Abbreviations
BC: British Columbia; COCI: Continuity of Care Index; ED: Emergency Department; MD: Mental Disorder; MSP: Medical Service Plan; MSUD: Mental and Substance Use Disorder; NACRS: National Ambulatory Care Reporting System; PTSD: Posttraumatic Stress Disorder; SUD: Substance Use Disorder.

Supplementary Information
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Authors’ contributions
RL led planning of this analysis and drafting of the manuscript. JL contributed to the conception of the paper and literature review. MS analyzed linked data. WL, TN, CS, AV, HS, JR, RK, and MK contributed to planning the analysis, interpreting findings, and made critical revisions to the manuscript. WS oversaw all aspects of this study and assisted in the interpretation of findings. All authors read and approved the final manuscript.

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Availability of data and materials
The data that support the findings of this study are available from Population Data BC following submission of a data access request (https://www.popdata.bc.ca/data_access). De-identified data were provided to the research team. We are not permitted to share the research extract used in this analysis with other researchers.

Declarations
Ethics approval and consent to participant
Approval for this research was granted by UBC – Providence Health Care Research Institute certificate number H17–00506. All methods and procedures were in accordance with the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS2) and with the 1964 Declaration of Helsinki.

Consent for publication
Not applicable.

Competing interests
The authors have no relevant financial or non-financial interests to disclose.

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