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No conflict declared.

Highlights:

-ED use was common among individuals with substance-related disorders (SRD).

-High ED users with SRD presented more complex and severe conditions.

-High ED users mostly visited for subacute or non-urgent problems.

-Moderate users had more alcohol-induced disorders and acute common mental disorders.

-Moderate ED users mostly visited for non-urgent care.

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Project administration and resources: M-J.F.; article conceptualization and methodology: M-J.F. and L.P.; analyses: L.G.; original draft preparation: L.P., G.G. and M-J.F.; review: C.H. and L.G. All authors have read and approved the final manuscript.

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Variables associated with low, moderate and high emergency department use among patients with substance-related disorders

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Abstract

Aims: This study identified factors associated with frequency of emergency department (ED) use for medical reasons among patients with substance-related disorders (SRD) in Quebec (Canada) for 2014-15.

Methods: Participants (n=4,731) were categorized as: 1) low (1 visit/year), 2) moderate (2 visits/year), and 3) high (3+ visits/year) ED users. Independent variables included predisposing, enabling and needs factors based on the Andersen Behavioral Model. Multinomial logistic regression identified associated variables.

Results: Factors positively associated with moderate and high ED use included adjustment disorders, suicidal behavior, alcohol-induced disorders, less urgent to non-urgent illness acuity, referral to local health community services centers (LHCSC) at discharge, and living in a materially deprived area. Factors positively associated with high ED use only included anxiety disorders, alcohol use disorders, drug use disorders, chronic physical illness, subacute problems, prior ED use for MD and/or SRD, prior LHCSC medical interventions, physician consultation within one month after discharge, living in very deprived or middle-class areas, and, negatively, being hospitalized for medical reasons in second ED visit. Moderate ED use only was negatively associated with alcohol intoxication and being referred to a GP at ED discharge.

Conclusions: Compared to low ED users, most high users with SRD were men presenting more complex and severe conditions. They visited ED mainly for subacute or non-urgent problems. Compared to low ED users, most moderate users had alcohol-induced disorders, less alcohol intoxication, and acute common MD. They visited ED

mainly for non-urgent care. Diverse strategies should be implemented to reduce ED visits, targeting each group.

Keywords

Emergency department users; high users; associated variables; substance-related disorders; substance use disorders; Andersen Behavioral Model

Highlights:

-ED use was common among individuals with substance-related disorders (SRD).

-High ED users with SRD presented more complex and severe conditions.

-High ED users presented mainly with subacute or non-urgent problems.

-Moderate users had more alcohol-induced disorders and acute common mental disorders.

-Moderate ED users mainly visited for non-urgent care.

1. INTRODUCTION

Individuals with substance use disorders (SUD) are significant users of emergency departments (ED). In 2011, US patients with SUD made over 5 million ED visits (Bernstein and D'Onofrio, 2013; Wani et al., 2019). Studies indicate that patients with SUD have higher risk of repeat ED use than those without SUD (Bahorik et al., 2018; Cherpitel and Ye, 2012). As well, 2-3% of all ED visits are directly related to problematic drug use (Beaudoin et al., 2015), with alcohol use another major cause in 10% of visits (Cherpitel and Ye, 2012). Patients with SUD are more likely to visit ED for mental health (MH) and/or medical reasons than those without SUD (Bakke et al., 2016; Vandyk et al., 2013). Other research found that the proportion of ED visits for MH reasons including SUD ranged from 4-12% (Barratt et al., 2016; Weiss et al., 2006).

Most studies on ED use among patients with SUD, often recognized as high users, have focused on their frequency of use (Kim et al., 2018; McConville et al., 2018), with high use defined as 3-4 or more ED visits yearly (Chaput and Lebel, 2007; Hunt et al., 2006; Ledoux and Minner, 2006). Research found that, among high ED users, those with SUD accounted for 25%-40% of visits for medical reasons (Urbanoski et al., 2018). Moreover, up to 35% of high ED users for MH reasons also had SUD (Vandyk et al., 2013). Improved health care management, access and continuity of care would likely prevent ED visits, leading to more appropriate patient care and allocation of financial resources (Florence et al., 2016; Hensel et al., 2016). In order to reduce ED visits, high ED use needs to be better understood. Using the Andersen Behavioral Model (Andersen, 1995), the dominant analytical framework in service use studies (Doran et al., 2014; Gasperini et al., 2017), research may identify variables associated with ED visits,

classifying them as needs, predisposing and enabling factors. Needs factors include clinical variables (e.g. diagnoses), predisposing factors relate to sociodemographic characteristics, while enabling factors refer to previous health care use which may determine future service use (Hamilton et al., 2016).

The few available studies involving patients diagnosed with SUD, and focused on variables associated with high ED use for all medical reasons, identified two related needs factors: co-occurring SUD/mental disorders (MD) (Curran et al., 2008; Huynh et al., 2016) and SUD/physical illness (Bahorik et al., 2018; Ngamini-Ngui et al., 2014). However, another study found that co-occurring SUD/MD/chronic physical illness reduced ED use (Huynh et al., 2016). In terms of predisposing factors, older age and socio-economic disadvantage were more frequent among high ED users (Ngamini-Ngui et al., 2014; Sacamano et al., 2018). Concerning enabling factors, having private health insurance (Sacamano et al., 2018), and prior ED use (Huynh et al., 2016) were positively associated with more frequent visits. Research also found that lack of care continuity seemed to increase ED use among patients (Hussey et al., 2014; Nyweide and Bynum, 2017).

Studies examining variables associated with ED visits for MH reasons among patients in general are more numerous, (Barratt et al., 2016; Smith et al., 2015) than studies investigating ED use for all medical reasons among patients diagnosed with SUD, or MD including SUD. Yet examining associated variables for all medical reasons in SUD groups would better capture the overall impact of ED use for adequacy of care, whether in relation to MH/SUD or medical problems. Studies have found high prevalence rates for co-occurring physical illness in populations with SUD (Huynh et al., 2016; Vu et

al., 2015), and also determined that physical illnesses were often the main drivers of ED visits among patients with MD including SUD (Fleury et al., 2019a). Moreover, alcohol and drug intoxication are often studied separately from alcohol and drug use disorders in ED studies (Bakke et al., 2016; Vardy et al., 2016); yet this does not shed light on the broad pattern of service use for patients with substance-related disorders (SRD). Finally, no known studies have compared subgroups of patients diagnosed with SUD based on their ED use for all medical reasons.

Using the Andersen Model (Andersen, 1995), this study aimed to determine needs, predisposing, and enabling factors in relation to the frequency of ED use for all medical reasons (MH/SUD and physical illness) among low (1 visit/year), moderate (2 visits/year) and high (3+ visits/year) ED users in a sample of 4,731 patients diagnosed with SRD using different types of ED services in Quebec (Canada). Based on existing literature, we hypothesized that needs factors would be more strongly associated with high ED use than other factors. We further hypothesized that enabling factors would be associated with frequency of ED visits; specifically, that high users would experience insufficiently continuous, intense or diversified care, especially from primary care providers, in response to their needs.

2. METHODS

2.1 Study population and design

This retrospective cohort study included 4,731 patients diagnosed with SRD. Data were collected from clinical administrative databanks over a three-year period (2012-13/2014-15). Participants were at least 12 years of age, and eligible for Quebec healthcare

insurance which covers 99% of the population (Mossialos et al., 2016). They made at least one visit to any of six Quebec ED from April 1, 2014 to March 31, 2015 (index year) for MH reasons, including SRD. The selected ED operated in different local health networks representing the three largest cities in Quebec. Three were psychiatric ED integrated with general ED; one a general ED with a psychiatric department located at a separate site; one a psychiatric ED in a MH University Institute; and the last a general ED without psychiatric services. The ethics committee of a MH university Institute and the Quebec Information Access Commission approved the study.

2.2 Data sources

Data were collected from the *Régie d'Assurance Maladie du Québec* (RAMQ) databanks, which contain medical administrative information including billing files for medical services provided by physicians (general practitioners (GP), psychiatrists) on a fee-for-service basis. Only 6% of physician billing occurred outside the public system in 2016-17 (Régie de l'assurance maladie du Québec, 2017). Patient demographic and socioeconomic information, including material and social deprivation indices (Pampalon et al., 2009), were included. Other data were provided by the hospitalization/discharge databank (*Maintenance et exploitation de données pour l'étude de la clientèle hospitalière:* MED-ECHO), and the local community health service centers (LCHSC) databank (*Système d'information clinique et administrative des centres locaux de services communautaires*) which gathers information on biopsychosocial services provided in primary healthcare, including GP interventions and MH services. Finally, the Quebec emergency databank (*Banque de données commune des urgences*: BDCU) provided

complementary information (e.g. illness acuity, reasons for ED visits, having a family physician).

2.3 Variables

The dependent variable measured ED use among patients with SRD who used ED at least once in 2014-15 for MH reasons, categorized as low ED users (1 visit/year); moderate ED users (2 visits/year); and high ED users (3+ visits/year). While no consensus exists on the definition of high ED use, 3-4+ yearly visits is often used (Chaput and Lebel, 2007; Hunt et al., 2006; Ledoux and Minner, 2006); 3+ yearly visits was the benchmark for high use in two previous Quebec studies (Chaput and Lebel, 2007; Fleury et al., 2019c; Gaulin et al., 2019). While patients making two ED visits were considered at possible risk for becoming high ED users, the tendency of others to make only one ED visit in a year may be considered more "accidental", due to lack of alternative health resources. According to existing research, 20-23% of adults visit ED yearly for all reasons combined (Chan et al., 2001). The low use group was the case control for other group comparisons.

In the Andersen Behavioral Model (**Figure 1**), independent variables related to needs included: SRD and MD as defined in the International Classification of Diseases Ninth Revision (ICD-9), the RAMQ databank, and Tenth Revision of the ICD (ICD-10-CA) for the MED-ECHO and BDCU databanks (**Table 1**). SRD included: alcohol use disorders, drug use disorders, alcohol-induced disorders, drug-induced disorders, alcohol intoxication and drug intoxication (Fleury et al., 2018, 2019c; Huynh et al., 2016). MD included: depressive, anxiety and adjustment disorders, schizophrenia, bipolar disorders,

personality disorders and other MD (e.g. psychotic conditions, eating disorder). Suicidal behavior for 2014-15 was also included. Having chronic physical illness, or not, and severity were also measured using the Elixhauser Comorbidity Index (Quan et al., 2005). Different combinations of MD, SRD and chronic physical illness were recorded. For each participant, presence of MD and SRD had to be reported at least once in the previous two years (2012-13/2013-14), twice in the RAMQ databank, or once in the MED-ECHO for chronic physical illness (Blais et al., 2014). The required two-year period for determining a diagnosis of MD or SRD was based on the expectation that the course of these disorders will exceed one year (Jääskeläinen et al., 2013; Penninx et al., 2011). Based on the Canadian Triage Acuity Scale (CTAS) (Canadian Association of Emergency Physicians, 2012), illness acuity was measured on a five-level scale and used to determine ED treatment priority, ranging from level 1 (most urgent) to level 5 (least urgent). Cases triaged to levels 4 and 5 were considered more appropriate for ambulatory care.

Predisposing factors included sex, age, and material and social deprivation. The material deprivation index combines three indicators from the 2011 Canadian Census data (Pampalon et al., 2009), including proportion of individuals without a high school diploma, employment-to-population ratio, and average income. The social deprivation index includes incidences of single-parent families; individuals living alone; and individuals separated, divorced, or widowed (Pampalon et al., 2009). Material and social deprivation were classified in quintiles, the fifth quintile representing highest level of deprivation.

Enabling factors included health service use within 12 months prior to first ED visit for the index year, and healthcare quality indicators. Health service use comprised

GP consultation for MD and/or SRD or physical illness (0, 1-2, 3+), outpatient psychiatrist consultation (0, 1-2, 3-4, 5+), prior ED consultation, or hospitalization for MD and/or SRD or physical illness, prior LCHSC interventions, including general (0, 1-5, 6+), specific MD/SUD (0, 1-2, 3+) or medical interventions (0, 1, 2+). Quality indicators included: having a family physician (index year), referral at ED discharge (none; hospitalization for all medical reasons; referral to community-based services or LCHSC; GP), and physician consultation within one month after discharge from ED or hospital. For low ED users, these indicators were reported after the first visit, and for moderate and for high users, after the second visit.

2.4 Data analysis

Less than 1% missing data were imputed and replaced using multiple imputation methods (Baraldi and Enders, 2010). Descriptive analyses included two-way frequency tables for each independent variable, in association with the three dependent variables (low, moderate, and high ED use). Significant variables were then entered sequentially into a multinomial logistic regression from needs, to predisposing, to enabling factors (alpha value: $p<.05$). Low ED users were the reference category for the multinomial model. Two odds ratios were calculated for each independent variable: moderate ED users vs. low ED users, and high ED users vs. low ED users (95% CI). Highly correlated independent variables were eliminated to avoid inducing collinearity.

3. RESULTS

Table 2 presents sample characteristics. Regarding needs factors for two years prior to

initial ED visit, 82% of patients were diagnosed with MD; 52% with common MD (e.g. adjustment and anxiety disorders) and 47% with serious MD (e.g. bipolar and personality disorders); 44% presented for suicidal behavior. A small majority (56%) was diagnosed with SRD prior to initial ED visit. A third (35%) had chronic physical illness. The most common co-occurring disorders were MD/SRD (44%) and MD/chronic physical illness (31%). Illness acuity mainly registered at level 3 (subacute but stable condition) (33%) or level 4 (less urgent care) (29%). Concerning predisposing factors, 40% were 25-44 years old, and 57% male; 35% lived in the most socially deprived areas. Regarding enabling factors in the previous 12 months, 66% had not consulted a GP or outpatient psychiatrist for MD and/or SRD. However, 67% consulted a GP for physical illness. Thirty-seven percent made prior ED visits for MD and/or SRD and 52% for physical illness; 26% were hospitalized for MD and/or SRD and 17% for physical illness. A majority (56%) did not have a family physician, and 61% were not referred to follow-up care at ED discharge. Only 20% received a medical consultation within a month following ED visit.

ED users with SRD (n=4,731) made an average of 4,19 visits (standard deviation: 7,05; median: 2) in 2014-15, ranging from 1 to 157 visits; and the modal value for ED visits was 1; 26% were low users, 25% moderate users, and 49% high users. High ED users made seven ED visits in the index year, on average, ranging from 3-157 visits. Reasons for ED visit, as evaluated by ED triage nurses, included physical illness (58%), MD (41%) including suicidal behaviors, and SRD-related conditions (1%). Significant independent variables from the bivariate analyses are presented in **Table 2**.

Table 3 presents results for the multinomial logistic regression. Concerning needs factors, having adjustment disorders, suicidal behavior, alcohol-induced disorders, and

illness acuity levels 4-5 were positively associated with both moderate and high ED use, compared with low use. Anxiety, alcohol use, and drug use disorders, chronic physical illness, and illness acuity level 3 were positively associated with high ED use only. Moderate ED use was negatively associated with alcohol intoxication. Regarding predisposing factors, living in areas with material deprivation index 4 were positively associated with moderate or high ED use, compared with low use. Male gender and living in areas with material deprivation indexes 3 and 5 were positively associated with high ED use only. Concerning enabling factors, referral at ED discharge to community-based services or LCHSC were positively associated with moderate and high ED use, compared with low use. High ED use only was positively associated with prior ED consultation for MD and/or SRD, two or more LCHSC interventions, physician consultation within one month after ED discharge or hospitalization; and, negatively, by hospitalization following a second ED visit. Moderate ED use only was negatively associated with GP referral at ED discharge. Needs factors accounted for 68% of the total variance in the model, enabling factors 27%, and predisposing factors 5%.

4. DISCUSSION

This study identified factors associated with low, moderate and high ED use among patients diagnosed with SRD, using the Andersen Model (Andersen, 1995).

Results indicated that roughly half of participants were high ED users, which was a higher incidence than previously reported (Moulin et al., 2018; Sacamano et al., 2018). The high number of visits for physical illness, presence of co-occurring MD among 82% of patients, and inclusion of SRD as well as SUD in the sample may explain the higher ED

use in this study. This findings were supported by a recent Quebec study on ED use confirming that many more patients with SRD and co-occurring MD/SRD used ED in 2014-15 than patients without SRD (Fleury et al., 2019b). As reported by triage nurses, only 1% of ED visits involved SRD directly. Under-identification of SUD by healthcare professionals commonly occurs (Mitchell et al., 2012; Rockett et al., 2003), explaining perhaps why very few patients received a SRD diagnosis in the 2 years prior to ED visit. Numerous treatment barriers among patients with SUD may also explain these results.

Findings confirmed our first hypothesis that needs factors would be more strongly associated with frequency of ED visits for all medical reasons than other factors; and are supported by previous research (Huynh et al., 2016; Ngamini-Ngui et al., 2014). As well, our hypothesis that high ED users with SRD would present more severe and complex conditions than low or moderate users was confirmed. Concerning needs factors, our finding that adjustment disorders and suicidal behavior were positively associated with high and moderate ED use confirmed previous findings (Fegan and Doherty, 2019; Walsh et al., 2015), reflecting the difficulty of coping with crisis events (Moore et al., 2019). SUD and co-occurring SUD/MD were found to increase the risk of suicidal behavior (Norström and Rossow, 2016; Poorolajal et al., 2016). Results also confirmed associations between high and moderate ED use and alcohol induced disorders such as withdrawal and alcohol-induced psychosis which have been found to increase readmission rates (Soyka et al., 2013; Yedlapati and Stewart, 2018). High or moderate ED use were also associated with severe physical symptoms experienced during withdrawal (American Psychiatric Association, 2013). Moreover, while illness acuity levels 4-5 were positively associated with moderate and high ED use, problems of

treatment access may possibly drive patients with complex SUD to ED for less urgent illness acuity (McCormack et al., 2015).

Concerning factors associated with high ED use only, previous research found associations between anxiety disorders and high ED use (Huynh et al., 2016; Wooden et al., 2009), possibly due to the interpretation of anxiety-related physical symptoms as signaling a serious medical condition (Buccelletti et al., 2013; Carleton et al., 2014). Moreover, the high prevalence of co-occurring anxiety disorders among patients with SUD is well known (Kingston et al., 2017). Surprisingly, psychotic and personality disorders were not associated with higher ED use, contrary to findings in other studies (Chang et al., 2014; Huynh et al., 2016). Concerning alcohol and drug use disorders, strong links between SUD and high ED use are repeatedly shown (Curran et al., 2008; Krieg et al., 2016). Studies have also reported high ED use among patients with SUD and co-occurring chronic physical illness (Larson et al., 2006; Ngamini-Ngui et al., 2014). Patients with co-occurring SUD/MD have also tended to have higher rates of chronic physical illness (Han et al., 2018; Onyeka et al., 2019; Wu et al., 2018), which may explain high rates of ED use for medical reasons and for level 3 illness acuity (Han et al., 2018; Wu et al., 2018).

Contrary to previous research (Kim et al., 2018; Klein et al., 2018), alcohol intoxication were negatively associated with moderate ED use in this study. Low ED use may include isolated binge drinking behavior in younger patients (Levinson et al., 2017). Alternatively, a single ED visit for alcohol intoxication may have encouraged patients to seek help or change behavior, helping explain the negative association with moderate ED use.

Findings also confirmed the second hypothesis that enabling factors would impact the frequency of ED visits, with high users lacking sufficiently continuous, intense or diversified care to meet their needs. Non-urgent illness acuity was already mentioned as a driver for high and moderate ED use as opposed to ambulatory care. However, both moderate and high ED users were more often referred from ED to LCHSC, a reasonable referral orientation, as LCHSC provide services for vulnerable populations with high biopsychosocial support needs (Ministère de la santé et des services sociaux, 2005).

In terms of enabling factors influencing high ED use only, previous research confirms that prior high ED use for MD and/or SRD is often associated with recurrent ED use, defined as ED use over several years (Hansagi et al., 2012; Kanzaria et al., 2017). Reasons for choosing ED services over ambulatory care may be related to satisfaction with prior ED treatment (Fortin et al., 2018; Ruud et al., 2016), difficulties accessing ambulatory care (Ayangbayi et al., 2017; Nesper et al., 2016), stigmatization in ambulatory care (Keyes et al., 2010; van Boekel et al., 2015), and underfunding of SUD programs (Fleury et al., 2016b) or of integrated treatment for SUD/MD (Fleury, 2014). Primary care physicians are often reluctant to follow such patients (Ross et al., 2015; van Boekel et al., 2015), previously identified as treatment resistant (Edlund et al., 2009; Mojtabai and Crum, 2013), and presenting multiple psychosocial problems (Khan, 2017; Moulin et al., 2018). Concerning prior medical interventions in LCHSC, the fact that they offered specialized SUD programs tailored to patients with complex needs may explain the association of these prior interventions with high ED use. Interestingly, hospitalization following ED use was protective for high ED users, possibility offering to treat severe symptoms and organize more intensive follow-up. Yet 62% were discharged

from ED without further referral, despite having complex needs. Even though follow-up with physicians within 30 days of ED use or hospitalization denoted good care continuity, this practice was insufficient to prevent high ED use. Studies also found that high ED users frequently use other services (Pasic et al., 2005; Richard-Lepouriel et al., 2015), possibly due to the inadequacy of care or lack of services continuity in responding to their needs.

GP referral after ED discharge was the only significant enabling factor, and negatively associated with moderate ED use only. Low ED users may present less acute MD disorders, but more urgent illness acuity in the ED triage process compared with moderate ED users. It is also possible that patients, notably those with co-occurring SUD/serious MD, receive relatively high intensity care, reducing ED use. Previous MH reforms mandated increased programming for assertive community treatment and intensive case management to reduce ED use among patients with serious MD, usually with SRD (Fleury et al., 2016a). Prior GP consultation, ED visits and hospitalization for physical illness were not significantly associated with ED use compared with visits for MH reasons, including SRD. This was surprising, as patients with SUD generally have co-occurring physical disorders (Han et al., 2018; Onyeka et al., 2019).

Concerning predisposing factors, the positive association between male sex and high ED use only was confirmed by previous studies (Ayangbayi et al., 2017; Krieg et al., 2016). Men use less services, and mainly use ED for acute health problems (Möller-Leimkühler, 2002; Wang et al., 2005). Also, the association between higher socio-economic deprivation and higher ED use is well known (Baillargeon et al., 2008; Vanstone et al., 2014). In this study, patients living in areas with material deprivation

indexes 3, 4 and 5 were high users, whereas those in areas indexed 4 were moderate ED users. A recent Canadian study found that low and middle income groups had worse access to care than high income groups (Dahrouge et al., 2018). The association with living in areas with material deprivation indexes 3 to 5 implied that high ED users were diverse, including the poorest individuals (index 5), but also some middle-income groups (index 3). As SUD imply financial difficulties, even patients with SRD living in middle-class areas may risk facing poverty and associated stress, increasing risks for ED visits (Parkman et al., 2017).

This study has certain limitations. First, administrative databanks were primarily developed for financial purposes, not clinical investigation. Second, key data such as homelessness, race/ethnicity or MD symptom severity that could be associated with ED use were not available from Quebec databanks. Third, while ED referral after discharge was associated with ED use, no data were available on patient compliance with referrals. Fourth, the sample consisted of patients with at least one ED visit for MH reasons in 2014-15, which explained the high prevalence of MD (82%) in the sample. Fifth, the study results were based on group comparisons for 1, 2 or 3+ ED visits; other groupings of ED users may have led to different conclusions. These inclusion criteria and setting of the research in the Quebec healthcare system, may limit generalizability of the findings to other healthcare systems, particularly those without universal coverage.

5. CONCLUSIONS

This was the first study to examine factors associated with moderate and high ED use versus low use for medical reasons using the Andersen Behavioral Model among patients

with SRD. Compared with low users, high ED users presented more complex and severe conditions. They had more SUD, common MD and chronic physical illness, visiting ED mainly for subacute or non-urgent problems. Repeat ED users with MD and/or SRD were usually seen within 30 days post-discharge by physicians and used more LCHSC medical interventions. Most ED users were men living in deprived or, in some cases, middle-class areas. Compared with low ED users, moderate users had more alcohol-induced disorders, less alcohol intoxication, and acute episodes involving common MD. Like high ED users, they usually visited ED for non-urgent care, and were less often referred to GP after discharge than low ED users. However, like high ED users, they were referred to community-based services and LCHSC. These findings suggest strategies for reducing high ED use, such as assertive community treatment, integrated treatment, and chronic disease management. Intensive case management and adequate access to crisis centers and other community-based services could be strengthened for moderate ED users. Overall, screening for substance use in ED settings should be greatly reinforced among patients with SRD, while also including brief intervention and referral to appropriate outpatient treatments. As well, continuity of care in both primary and specialized services should be significantly improved, and outreach programs enhanced.

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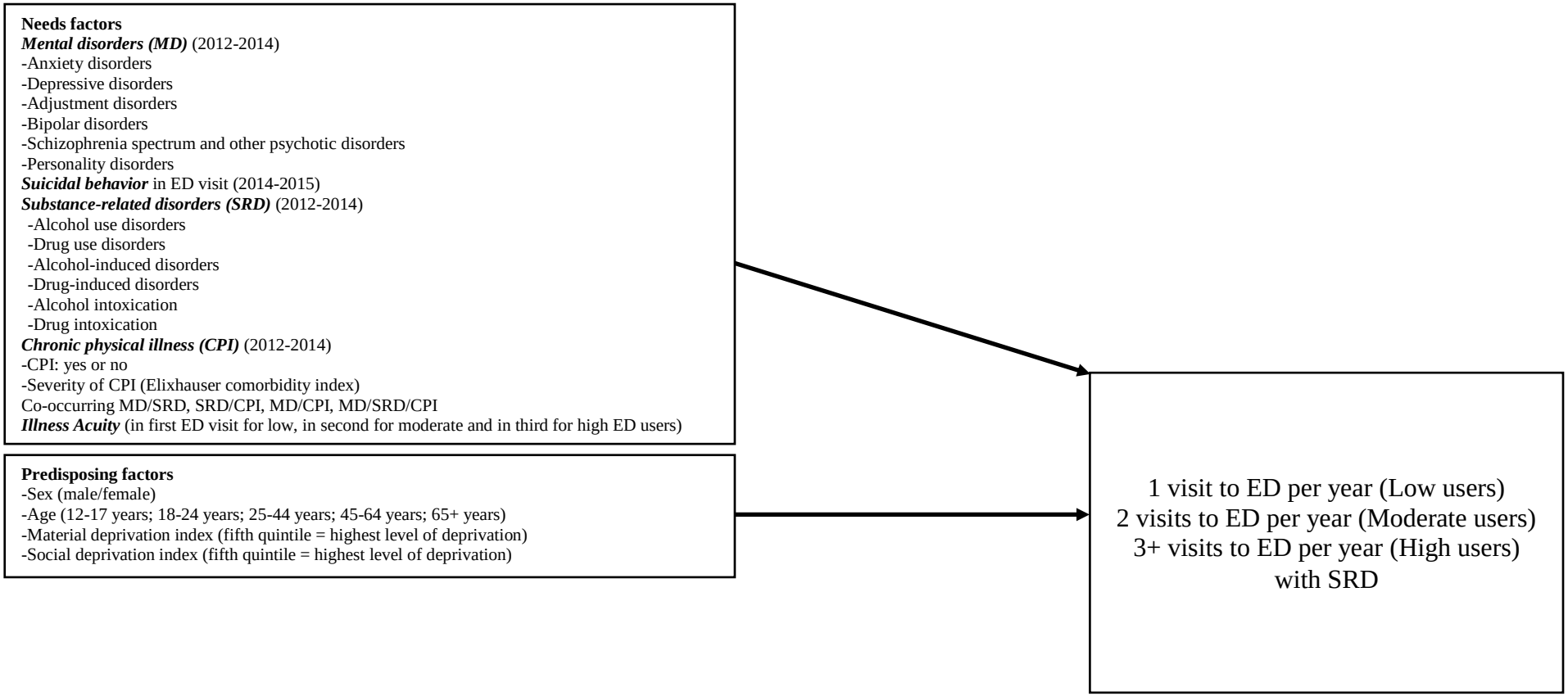
Figure


Needs factors
Mental disorders (MD) (2012-2014)
-Anxiety disorders
-Depressive disorders
-Adjustment disorders
-Bipolar disorders
-Schizophrenia spectrum and other psychotic disorders
-Personality disorders
Suicidal behavior in ED visit (2014-2015)
Substance-related disorders (SRD) (2012-2014)
-Alcohol use disorders
-Drug use disorders
-Alcohol-induced disorders
-Drug-induced disorders
-Alcohol intoxication
-Drug intoxication
Chronic physical illness (CPI) (2012-2014)
-CPI: yes or no
-Severity of CPI (Elixhauser comorbidity index)
Co-occurring MD/SRD, SRD/CPI, MD/CPI, MD/SRD/CPI
Illness Acuity (in first ED visit for low, in second for moderate and in third for high ED users)
Predisposing factors
-Sex (male/female)
-Age (12-17 years; 18-24 years; 25-44 years; 45-64 years; 65+ years)
-Material deprivation index (fifth quintile = highest level of deprivation)
-Social deprivation index (fifth quintile = highest level of deprivation)
1 visit to ED per year (Low users)
2 visits to ED per year (Moderate users)
3+ visits to ED per year (High users)
with SRD

Enabling factors (in the 12 months prior to first ED visit)
-Consultation for MD and/or SRD with general practitioner (GP)
-Consultation for physical illness with GP
-Consultation with outpatient psychiatrist
-Prior ED consultation for MD and/or SRD
-Prior ED consultation for physical illness
-Prior hospitalization for MD and/or SRD
-Prior hospitalization for physical illness
-Number of interventions in local community health service centers (LCHSC)
General interventions
Specific MD/substance use disorder interventions
Medical interventions

Quality indicators
-Having a family physician (2014-2015)
-Referral at ED discharge (in first ED visit for low, in second for moderate and high ED users)
None
Hospitalization for all medial reasons
Community-based services or LCHSC
GP
-Physician consultation within one month after ED visit or hospitalization (after first ED visit for low, and after second for moderate and high ED users)

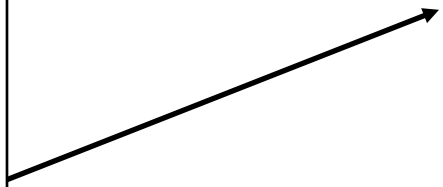


Figure legend

Figure 1. Conceptual framework of variables tested for associations with low, moderate, and high levels of emergency department (ED) visits among patients with substance-related disorders (SRD) (2014-2015).

Table 1. Codes for mental disorders (MD) and substance related disorders (SRD) according to the International Classification of Diseases, 9th and 10th revisions

Diagnoses	International Classification of Diseases, Ninth Revision (ICD-9)	International Classification of Diseases, Tenth Revision (ICD-10)
Alcohol use disorders	303.0, 303.9, 305.0	F10.1-F10.2
Drug use disorders	304, 305.2-305.7, 305.9	F11.1, F11.2, F12.1, F12.2, F13.1, F13.2, F14.1, F14.2, F15.1, F15.2, F16.1, F16.2, F18.1, F18.2, F19.1, F19.2, F55.
Alcohol-induced disorders	291.0-291.5, 291.8, 291.9	F10.3-F10-9
Drug-induced disorders	292.0-292.2, 292.8, 292.9	F11.3-F11.9, F12.3-F12.9, F13.3-F13.9, F14.3-F14.9, F15.3-F15.9, F16.3-F16.9, F18.3-F18.9, F19.3-F19.9
Alcohol intoxication	980.0, 980.1, 980.8, 980.9	F10.0, T51.0, T51.1, T51.8, T51.9
Drug intoxication	965.0, 965.8, 967.0, 967.6, 967.8, 967.9, 969.4-969.9, 970.8, 982.0, 982.8	F11.0, F12.0 F13.0, F14.0, F15.0, F16.0, F18.0, F19.0, T40, T42.3, T42.4, T42.6, T42.7, T43.5, T43.7-T43.9, T50.9, T52.8, T52.9
Depressive disorders	300.4, 311	F32-F34
Anxiety disorders	300, except 300.4	F40-F48, F68
Adjustment disorders	308, 309, 313	F93.0, F94.0
Schizophrenia spectrum and other psychotic disorders	295, 297, 298	F20, F21, F22, F23, F24, F25, F28, F29, F32.3, F33.3, F44.89
Bipolar disorders	296	F30, F31, F38, F39
Personality disorders	301	F60, F070, F340, F341, F488, F61, F62, F681, F688, F69
Other MD (e.g., other organic psychotic conditions, eating disorders)	293, 294,302 (except 302.6) 307, 310, 312, 315	F04-F09, F17, F38, F39, F50-F59, F61-F69 (except F64.2), F80-89, F90-99

Table 2

Table 2. Characteristics of participants with substance-related disorders (SRD) according to frequency of emergency department (ED) visits in 2014-2015

Characteristics	Total		Low users (1 ED visit)		Moderate users (2 ED visits)		High users (3+ ED visits)		p
	N	%	N	%	N	%	N	%	
Overall	4,731	100	1,244	26.3	1,165	24.6	2,322	49.1	
Needs factors									
Mental disorders (MD) (2012-2014)	3,896	82.4	855	68.7	942	80.9	2,099	90.4	<.001
Common MD	2,435	51.5	467	37.5	559	48.0	1,409	60.7	<.001
Depressive disorders	1,415	29.9	280	22.5	310	29.2	825	35.5	<.001
Anxiety disorders	1,713	36.7	315	25.3	366	31.4	1,056	45.5	<.001
Adjustment disorders	1,008	21.3	185	14.9	236	20.3	587	25.3	<.001
Serious MD	2,227	47.1	459	36.9	501	43.0	1,267	54.6	<.001
Schizophrenia spectrum and other psychotic disorders	1,275	26.9	288	23.2	287	24.6	700	30.1	<.001
Bipolar disorders	1,036	21.9	204	16.4	226	19.4	606	26.1	<.001
Personality disorders	880	18.6	145	11.7	179	15.4	556	23.9	<.001
Suicidal behaviors in ED visit (2014-2015)	2,083	44.0	395	31.8	517	44.4	1,171	50.4	<.001
Substance related disorders (SRD) (2012-2014)	2,626	55.5	618	49.7	600	51.5	1,408	60.6	<.001
Alcohol use disorders	1,760	37.2	412	33.1	388	33.3	960	41.3	<.001
Drug use disorders	1,382	29.2	261	21.0	295	25.3	826	35.6	<.001
Alcohol-induced disorders	895	18.9	165	13.3	204	17.5	526	22.7	<.001
Drug-induced disorders	760	16.1	140	11.3	155	13.3	465	20.0	<.001
Alcohol intoxication	333	7.0	116	9.3	62	5.3	155	6.7	<.001
Drug intoxication	625	13.2	121	9.7	126	10.8	378	16.3	<.001
Chronic physical illnesses (CPI) (2012-2014)	1,675	35.4	304	24.4	387	33.2	984	42.4	<.001
Elixhauser Comorbidity Index[a]									<.001
0	3,298	69.7	993	79.8	829	71.2	1476	63.6	
1	392	8.3	72	5.8	86	7.4	234	10.1	
2	284	6.0	52	4.2	70	6.0	162	7.0	
3+	757	16.0	127	10.2	180	15.5	450	19.4	
Co-occurring disorders (2012-2014)									
Co-occurring MD/SRD	2,082	44.0	383	30.8	452	38.8	1,247	53.7	<.001
Co-occurring SRD/CPI	911	19.3	142	11.4	185	15.9	584	25.2	<.001
Co-occurring MD/CPI	1,473	31.1	241	19.4	326	28.0	906	39.0	<.001
Co-occurring MD/SRD/CPI	772	16.3	101	8.1	142	12.2	529	22.8	<.001
Illness acuity (in first ED visit for low, in second for moderate, and in third for high ED users)									<.001

Level 1 (acute situation with vital risk)	149	3.1	53	4.3	43	3.7	53	2.3	
Level 2 (urgent situation without vital risk, but risk of deterioration)	1,032	21.8	322	25.9	232	19.9	478	20.6	
Level 3 (subacute but stable condition)	1,571	33.2	445	35.8	341	29.3	785	33.8	
Level 4 (less urgent care)	1,378	29.1	286	23.0	388	33.3	704	30.3	
Level 5 (non-urgent care)	601	12.7	138	11.1	161	13.8	302	13.0	
Predisposing factors									
Age									<.001
12-17 years	200	4.2	62	5.0	56	4.8	82	3.5	
18-24 years	892	18.9	281	22.6	190	16.3	421	18.1	
25-44 years	1,913	40.4	500	40.2	496	42.6	917	39.5	
45-64 years	1,312	27.7	306	24.6	316	27.1	690	29.7	
65+ years	414	8.8	95	7.6	107	9.2	212	9.1	
Sex									<.001
Male	2,694	56.9	756	60.8	672	57.7	1,266	54.5	
Female	2,037	43.1	488	39.2	493	42.3	1,056	45.5	
Material Deprivation Index									<.001
1: Least deprived	958	20.2	303	24.4	243	20.9	412	17.7	
2	662	14.0	187	15.0	161	13.8	314	13.5	
3	883	18.7	241	19.4	202	17.3	440	18.9	
4	815	17.2	181	14.5	214	18.4	420	18.1	
5: Most deprived	933	19.7	218	17.5	229	19.7	486	20.9	
Not assigned[b]	480	10.1	114	9.2	116	10.0	250	10.8	
Social Deprivation Index									<.001
1: Least deprived	463	9.8	167	13.4	114	9.8	182	7.8	
2	479	10.1	139	11.2	114	9.8	226	9.7	
3	635	13.4	157	12.6	153	13.1	325	14.0	
4	1,009	21.3	265	21.3	253	21.7	491	21.1	
5: Most deprived	1,665	35.2	402	32.3	415	35.6	848	36.5	
Not assigned[b]	480	10.1	114	9.2	116	10.0	250	10.8	
Enabling factors (in the 12 months prior to first ED visit)									
Number of consultations with general practitioners (GP) for MD and/or SRD									<.001
0 consultations	3,127	66.1	1,442	62.1	803	68.9	882	70.9	
1-2 consultations	668	14.1	166	13.3	149	12.8	353	15.2	
3+ consultations	936	19.8	196	15.8	213	18.3	527	22.7	
Number of consultations with general practitioners (GP)									

for physical illness									.33
0 consultations	1,564	33.1	433	34.8	392	33.6	739	31.8	
1-2 consultations	1,412	29.8	357	28.7	335	28.8	720	31.0	
3+ consultations	1,755	37.1	454	36.5	438	37.6	863	37.2	
Number of outpatient psychiatrist consultations									<.001
0 consultations	3,131	66.2	896	72.0	804	69.0	1,431	61.6	
1-2 consultations	370	7.8	83	6.7	91	7.8	196	8.4	
3-4 consultations	219	4.6	46	3.7	52	4.5	121	5.2	
5+ consultations	1,011	21.4	219	17.6	218	18.7	574	24.7	
Prior ED consultation for MD and/or SRD	1,755	37.1	313	25.2	368	31.6	1074	46.3	<.001
Prior ED consultation for physical illness	2,447	51.7	652	52.4	612	52.5	1,183	50.9	.58
Prior hospitalization for MD and/or SRD	1,215	25.7	228	18.3	260	22.3	727	31.3	<.001
Prior hospitalization for physical illness	809	17.1	212	17.0	202	17.3	395	17.0	.97
Number of interventions in local community health service centers (LCHSC)									
General interventions									<.001
0 interventions	2,715	57.4	840	67.5	706	60.6	1,169	50.3	
1-5 interventions	1,149	24.3	246	19.8	265	22.7	638	27.5	
6+ interventions	867	18.3	158	12.7	194	16.7	515	22.2	
Specific MD/substance use disorder interventions									<.001
0 interventions	3,734	78.9	1046	84.1	962	82.6	1,726	74.3	
1-2 interventions	411	8.7	88	7.1	66	5.7	257	11.1	
3+ interventions	586	12.4	110	8.8	137	11.8	339	14.6	
Medical interventions									<.001
0 interventions	3,810	80.5	1061	85.3	961	82.5	1,788	77.0	
1 intervention	342	7.2	71	5.7	87	7.5	184	7.9	
2+ interventions	579	12.2	112	9.0	117	10.0	350	15.1	
Quality indicators									
Having a family physician (2014-2015)	2,058	43.5	547	44.0	507	43.5	1,004	43.2	0.915
Referral at ED discharge (in first ED visit for low, in second for moderate, and high ED users)									<.001
None	2,867	60.6	739	59.4	679	58.3	1,449	62.3	
Hospitalization for all medical reasons	1,120	23.7	348	28.0	348	29.9	424	18.3	
Community-based services or LCHSC	412	8.7	58	4.7	75	6.4	279	12.0	
GP	332	7.0	99	8.0	63	5.4	170	7.3	

Physician consultation within one month after ED visit or after hospitalization (after first ED visit for low, and after second for moderate and high ED users)	954	20.2	162	13.0	139	11.9	653	28.1	<.001

[a] Chronic physical illness included: chronic pulmonary disease, cardiac arrhythmias, tumor w/o metastasis, renal disease, fluid electrolyte disorders, myocardial infarction, congestive heart failure, metastatic cancer, dementia, stroke, neurological disorders, liver disease, pulmonary circulation disorders, coagulopathy, weight loss, paralysis, AIDS/HIV

[b] Missing address or living in an area where index assignment is not feasible (e.g. residents of long-term health care units)

Table 3

Table 3. Estimations of regression coefficients and odds ratios on emergency department (ED) visits in population with substance related disorders (SRD), from the multinomial logistic regression model. Reference group of the model is low ED users

Variables[a]	Moderate users: 2 ED visits				High users: 3+ ED visits			
	Coefficients	P-Value	OR	95% CI	Coefficients	P-Value	OR	95% CI
Needs Factors								
Mental disorders (MD) (2012-2014)								
Depressive disorders	-0.03	0.80	0.97	0.78-1.21	0.07	0.50	1.07	0.88-1.30
Anxiety disorders	-0.02	0.84	0.98	0.80-1.21	0.25	0.01	1.29	1.07-1.55
Adjustment disorders	0.30	0.02	1.34	1.06-1.71	0.24	0.04	1.27	1.07-1.57
Schizophrenia spectrum and other psychotic disorders	-0.05	0.72	0.96	0.74-1.23	0.03	0.80	1.03	0.88-1.30
Bipolar disorders	0.03	0.84	1.03	0.80-1.32	0.15	0.18	1.17	0.93-1.46
Personality disorders	0.08	0.64	1.08	0.83-1.42	0.17	0.17	1.18	0.93-1.50
Suicidal behaviors in ED visit (2014-2015)	0.70	0.00	2.00	1.67-2.41	0.88	0.00	2.43	2.05-2.87
Substance related disorders (SRD) (2012-2014)								
Alcohol use disorders	-0.03	0.85	0.97	0.75-1.30	0.30	0.02	1.34	1.06-1.70
Drug use disorders	0.26	0.06	1.29	0.99-1.70	0.66	0.00	1.94	1.52-2.47
Alcohol-induced disorders	0.43	0.01	1.54	1.13-2.11	0.57	0.00	1.77	1.33-2.36
Drug-induced disorders	0.29	0.40	1.31	0.69-2.50	0.39	0.18	1.48	0.83-2.63
Alcohol intoxication	-0.42	0.04	0.66	0.44-0.97	-0.30	0.09	0.75	0.53-1.05
Drug intoxication	-0.34	0.29	0.71	0.37-1.35	-0.33	0.26	0.72	0.40-1.28
Chronic physical illness[b] (2012-2014)	0.14	0.51	1.15	0.76-1.75	0.58	0.00	1.79	1.24-2.58
Elixhauser Comorbidity Index								
1	0.27	0.31	1.21	0.79-2.17	0.16	0.49	1.17	0.75-1.83
2	0.27	0.33	1.31	0.76-2.24	-0.10	0.68	0.90	0.56-1.46
3+	0.35	0.14	1.41	0.89-2.24	0.10	0.64	1.10	0.73-1.65
Illness acuity (in first ED visit for low, in second for moderate, and in third for high ED users)								
Level 2 (urgent situation without vital risk, but risk of deterioration)	-0.29	0.22	0.75	0.48-1.18	0.16	0.46	1.18	0.76-1.86
Level 3 (subacute but stable condition)	0.00	0.99	1.00	0.64-1.57	0.63	0.01	1.87	1.20-2.92
Level 4 (less urgent care)	0.65	0.05	1.91	1.21-2.99	1.07	0.00	2.92	1.86-4.59
Level 5 (non-urgent care)	0.62	0.01	1.86	1.14-3.03	1.01	0.00	2.76	1.70-4.46
Predisposing factors								
Age								
18-24 years	-0.42	0.05	0.65	0.43-1.00	-0.05	0.81	0.95	0.63-1.43
25-44 years	-0.07	0.72	0.93	0.62-1.40	0.02	0.92	1.02	0.69-1.52
45-64 years	-0.13	0.55	0.88	0.57-1.35	0.10	0.63	1.10	0.73-1.67
65+ years	-0.15	0.57	0.86	0.52-1.44	0.08	0.74	1.09	0.67-1.76

Sex: Female	-0.12	0.16	0.88	0.74-1.05	-0.24	0.00	0.79	0.67-0.93
Material Deprivation Index								
2	0.06	0.70	1.06	0.80-1.40	0.25	0.06	1.29	0.99-1.67
3	0.11	0.36	1.12	0.88-1.41	0.40	0.00	1.48	1.20-1.85
4	0.39	0.01	1.47	1.12-1.93	0.64	0.00	1.89	1.47-2.45
5: Most deprived	0.22	0.10	1.24	0.96-1.62	0.56	0.00	1.75	1.38-2.24
Enabling factors (in the 12 months prior to first ED visit)								
Number of consultations for MD and/or SRD with general practitioners (GP)								
1 visit	-0.15	0.25	0.86	0.66-1.1	-0.05	0.66	0.95	0.75-1.20
2+ visits	-0.01	0.92	0.99	0.77-1.27	-0.03	0.80	0.97	0.78-1.22
Number of outpatient psychiatrist consultations								
1-2 consultations	0.03	0.86	1.03	0.73-1.46	0.05	0.98	1.05	0.77-1.44
3-4 consultations	0.08	0.74	1.08	0.69-1.69	0.18	0.39	1.20	0.80-1.80
5+ consultations	-0.20	0.21	0.82	0.60-1.12	0.04	0.76	1.04	0.79-1.39
Prior Ed consultation for MD and/or SRD	0.22	0.07	1.24	0.98-1.57	0.49	0.00	1.64	1.33-2.02
Prior hospitalization for MD and/or SRD	0.01	0.99	1.01	0.76-1.32	0.01	0.92	1.01	0.79-1.30
Specific MD/substance use disorder interventions in local community health service centers (LCHSC)								
1-2 interventions	-0.36	0.85	0.97	0.74-1.28	0.02	0.91	1.02	0.73-1.43
3+ interventions	-0.03	0.09	0.70	0.47-1.05	0.02	0.85	1.02	0.80-1.30
Medical interventions in LCHSC								
1 intervention	0.31	0.08	1.36	0.97-1.90	0.29	0.07	1.33	0.98-1.82
2+ interventions	0.08	0.61	1.08	0.81-1.44	0.40	0.02	1.49	1.16-1.92
Quality indicators								
Referral at ED discharge (in first ED visit for low, in second for moderate and high ED users)								
Hospitalization for all medical reasons	0.07	0.52	1.07	0.87-1.31	-0.63	0.00	0.53	0.44-0.65
Community-based services or LCHSC	0.47	0.01	1.59	1.09-2.31	0.97	0.00	2.63	1.91-3.62
GP	-0.51	0.00	0.59	0.42-0.85	-0.11	0.45	0.89	0.66-1.20
Physician consultations within one month after ED visit or after hospitalization (after first ED visit for low, and after second for moderate and high ED users)	-0.12	0.37	0.89	0.69-1.15	0.98	0.00	2.67	2.17-3.28

[a] Reference groups for independent variables with multiple categories are: 0 comorbidity index score, 1 triage priority level, age 12-17 years, gender male, deprivation index 1: least deprived, 0 consultations for MD or SRD with GP, 0 consultation with outpatient psychiatrist, 0 interventions for MD/SRD programs at LCHSC, 0 medical interventions in LCHSC, and no follow-up after ED discharge

[b] Chronic physical illness included: chronic pulmonary disease, cardiac arrhythmias, tumor w/o metastasis, renal disease, fluid electrolyte disorders, myocardial infarction, congestive heart failure, metastatic cancer, dementia, stroke, neurological disorders, liver disease, pulmonary circulation disorders, coagulopathy, weight loss, paralysis, AIDS/HIV