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A case-control study on predicting population risk of suicide using health administrative data: A research protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2022-066423
Article Type:	Protocol
Date Submitted by the Author:	06-Jul-2022
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Keywords:	Suicide & self-harm < PSYCHIATRY, PUBLIC HEALTH, PSYCHIATRY, HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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A case-control study on predicting population risk of suicide using health administrative data: A research protocol

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Abstract

Introduction: Suicide has a complex etiology and is a result of the interaction among the risk and protective factors at the individual, healthcare system, and population levels. Therefore, policy and decision makers and mental health service planners can play an important role in suicide prevention. Although a number of suicide risk predictive tools have been developed, these tools were designed to be used by clinicians for assessing individual risk of suicide. There have been no risk predictive models to be used by policy and decision makers for predicting population risk of suicide. This paper aimed to describe the rationale and methodology for developing risk predictive models for population risk of suicide.

Methods and analysis: A nested case-control study design will be used to develop sex-specific risk predictive models for population risk of suicide, using statistical regression and machine learning techniques. Routinely collected health administrative data in Quebec, Canada, and community level social deprivation and marginalization data will be used. The developed models will be transformed into synthetic estimation models that can be readily used by policy and decision makers. Two rounds of qualitative interviews with end-users and other stakeholders were proposed to understand their views about the developed models and potential systematic, social and ethical issues for implementation; the first round of qualitative interviews have been completed. We included 9440 suicide cases (7234 males and 2206 females) and 661,780 controls for model development. Three hundred and forty seven variables at individual, healthcare system and community levels have been identified and will be included LASSO regression for feature selection.

Ethics and dissemination: This study is approved by the Health Research Ethics Committee of Dalhousie University, Canada. This study takes an integrated knowledge translation approach, involving knowledge users from the beginning of the process.

Strengths and limitations of this study:

- This is the first study on developing risk predictive models for population risk of suicide, which are to be used policy and decision makers, shifting the paradigm from predicting individual risk of suicide.
- The candidate predictors included variables at individual, healthcare system and community levels, which reflected the complex etiology of suicide.
- This study used routinely collected health administrative data, which are readily accessible to policy and decision makers. If successful, the implementation of the models in the process of policy and decision making will have better sustainability.
- This study used a nested case-control study design, which included all suicide cases (n = 9,440) in Quebec. The inclusion of all suicide cases maximized the data efficiency and the generalizability of the models.
- Predicting population risk of suicide is new. The methodology of model development and validation needs to be improved.

Introduction

Suicide is a major international public health problem. Each year, over 4,500 Canadians take their own life,⁽¹⁾ and more than 700,000 people die because of suicide worldwide,⁽²⁾ imposing enormous impacts on families, communities and societies. As such, suicide prevention has been a top priority of many countries.

Suicide has a complex etiology and is a result of the interaction among the risk and protective factors at the individual, healthcare system, and population levels.^(3–5) Therefore, policy and decision makers and mental health service planners can play an important role in suicide prevention. To facilitate suicide prevention planning, mechanisms should be in place that enable policy and decision makers to make informed decisions and mobilize resources to high-risk populations at the right places, before tragic events occur. This vision requires us to shift the paradigm from predicting individual risk to predicting population risk of suicide. However, the existing suicide risk assessment/predictive tools are not suitable for predicting population risk. Most of the existing risk assessment/risk predictive tools for suicide were designed to be used by clinicians; they were not designed for policy and decision makers.⁽⁶⁾ Clinicians often use these tools to determine if individual patients are at high risk of suicide presently or in short term (e.g., next week). Whereas policy and decision makers are more concerned about the rate of suicide at the community level (e.g., health regions, provinces/states) in the medium or long term (e.g., in the next 5 or 10 years), driven partly by budgetary decisions that are often made on yearly basis. Clinicians and policy/decision makers may have different emphases on risk predictive tools as well. For clinicians, an ideal suicide risk predictive tool should have high discriminative power (e.g., a large C statistics), high sensitivity, specificity and positive predictive value. For policy and decision makers, a tool with excellent calibration (i.e., how closely the predicted risk agrees with actual risk in the population) is more useful. To facilitate policy development in suicide prevention at the population level, risk predictive models specifically designed for policy and decision makers are needed.

Ideally, risk predictive models for population risk of suicide are based on large data from the target population. For example, Gradus and colleagues developed sex-specific machine learning algorithms for suicide using data from eight Danish national health and social registries which cover more than 90% of the Danish population.⁽⁷⁾ Kessler et al.'s machine learning algorithms targeted US Army soldiers who were hospitalized.⁽⁸⁾ Accordingly, these risk predictive algorithms may potentially be used for forecasting the risk of suicide in Danish general population and in the US Army population, respectively. Furthermore, predictive models for population risk may use not only individual data, but also health system level (e.g., quality of mental health care, mental health budget), and community level data (e.g., unemployment rate and social deprivation levels in the community). For instance, Marks and colleagues developed a predictive model for identifying counties at high risk of overdose mortality, which included county-level education, poverty rate, unemployment rate, overdose gravity, and other county-level indicators, among the 3106 counties in the United States.⁽⁹⁾ Given the complex etiology of suicide, predicting population risk of suicide may benefit greatly from the integration of data at the individual, health system and community levels.

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5 We undertook a project to develop sex-specific risk predictive models to be used by policy and
6 decision makers to forecast population risk of suicide at the health region level, using routinely
7 collected health administrative data, and to identify the barriers and facilitators to
8 implementation and explore the ethical and privacy issues of the prediction program. In this
9 manuscript, we aimed to describe the methodology of the project, to inform methodological
10 discussions and suicide prevention strategies.
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12 13 **Methods**

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15 This project encompasses the components of quantitative and qualitative investigations and an
16 integrated knowledge translation (IKT). IKT is a model of research co-production, whereby
17 knowledge users are integrated throughout the research process and who can use the research
18 recommendations in practice or policy.(10) IKT approaches are used to improve the relevance
19 and impact of research. The quantitative research involved developing and validating risk
20 prediction models for suicide using advanced ML and visualization methods. The qualitative
21 research is to understand the potential implementation, social, ethics and legal issues
22 associated with the risk prediction program. Inline with IKT principles, we involved policy and
23 decision makers at the provincial and national levels, and people with lived experience of
24 suicidality from the beginning of the project. The methodology of each component is described
25 below.
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30 ***Model development and validation***

31 *Target population:* The general population residing in the province of Quebec, Canada. The
32 province had a population of over 8.6 million people in 2021, and about 95% of the population
33 reported being able to conduct a conversation in French. In Quebec, health services are
34 planned and delivered through 18 health regions, 22 integrated health and social services
35 centres, and 166 Centres locaux de santé Communautaire (CLSCs). Budgetary decisions are
36 made at the levels of province and health regions/integrated .health and social services centres.
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40 *Data sources:* We will develop the prediction tools by linking the suicide database, the Ministry
41 of Health and Social Services (MSSS) public financial reports (Contour financier - Publications du
42 ministère de la Santé et des Services sociaux (gouv.qc.ca), and the Canadian Urban
43 Environmental Health Research (CANUE) data. The suicide database gathers individual-level
44 data annually based on residents health insurance number from five administrative databases:
45 the vital statistics death database, the physician claims database, the hospital discharge
46 database, the Insured Person Registration File and the public drug plan. These databases cover
47 up to 98% of the population in Quebec and contain data for over 20,000 suicides occurred since
48 1996. With the suicide database and other linkable Ministry financial databases, individual (e.g.,
49 sex, age), program (e.g., hospitalization, emergency department visits), and system (e.g.,
50 mental health and addiction budgets) level indicators can be identified, and the indicators at
51 each level may be classified into the broad categories of input and process.(4)
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CANUE is a Canadian consortium aiming to build a unique repository of standardized metrics of urban, sub-urban, and rural characteristics, as well as the tools used to produce them (www.canue.ca). The CANUE data contain indicators for unemployment, social deprivation, access to health services and built environment at the community level, and can be linked with health administrative data by postal codes. The CANUE is open and free for research projects. The data linkage was performed at the Quebec Institute of Public Health (INSPQ) where the suicide data are kept. Linking the databases provides an unprecedented sample size and the capability of examining individual, neighborhood, programmatic and systemic indicators of population suicide risk.

Study design: Because the base rate of suicide in the population is low, we proposed to use a nested case-control study design to develop sex-specific suicide risk predictive algorithms, using both logistic regression modeling and machine learning (ML) techniques. We selected all suicide cases that occurred from January 1st 2002 to December 31st 2010.(11) The control group was a 1% random sample of living individuals in Quebec each year, identified from the suicide database. The cases and controls were not matched to allow for maximum variability in predictors.

Predictors: Individual, programmatic, systemic and community factors (see Appendix I) measured five years prior to the suicide events were used to develop the risk predictive algorithms. The selection of candidate predictors are determined by content knowledge (i.e., known relationships between suicide or suicide behaviors and individual and local area level quality of health care), feasibility of routine data collection, clinical utility and policy relevance. Therefore, the pre-determination of candidate predictors was a joint effort between the team members, collaborators, health policy and decision makers and other stakeholders.

ML can produce complex estimations by searching data for relevant pieces of information and their complex interactions. Therefore, ML is best suited to tackle the combined challenges of high dimensional data analysis associated with risk prediction for suicide. Some predictors that may change over time (e.g., diagnoses, medications, service use, etc.) will be dummy-coded to create time-varying predictors (i.e., intervals of 0-3,0-6, 0-12, 0-24, 0-36,0-48, and 0-60 months before the first day of the suicide month). Because we included all suicide cases and a sample of controls, the proportion of suicide in the sample is different from that in the general population. Therefore, sampling weights (inversed probability of being selected) were assigned to the controls, while the weight of 1 was assigned to the cases, to ensure the models are applicable to the whole population.

Model development – Machine learning (ML).

ML is a part of Artificial intelligence (AI) that aims to construct systems that automatically improve through experience using advanced statistical and probabilistic techniques. ML has provided significant benefits to a range of fields. Recent research has shown a range of advantages of ML that can assist in detecting, diagnosing, predicting suicide, and treating mental health problems.(12,13) ML methods are divided into categories, i.e., supervised, semi-supervised, unsupervised, and reinforcement. To predict the population risk of suicide, we will develop supervised learning models such as logistic regression, Random Forest, XGBoost, and

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3 Multilayer perceptron with an optimized model architecture. These models' predictive capacity
4 will be assessed by generating the receiver operating characteristic (ROC) curves calculating its
5 AUC and various operating characteristics, including sensitivity, specificity, and positive
6 predictive value for a variety of thresholds. From that, we will make simulations of changes
7 coming from policies by modifying the population composition for reflecting the effect of
8 policies change (e.g., mental health diagnoses, socio-economic factors, health system resources
9 allocation) and evaluate their effect on the suicide rates predicted, comparing these with rates
10 obtained with the current population and population modified differently. Moreover,
11 interpretability is essential when we deal with healthcare data. It is significant because it is
12 necessary to understand the casualty of learned representations for decision support also helps
13 to assess whether the model is considering the right features while making a specific prediction.
14 Feature-based model explainability technique, such as Shapley Additive Explanations (SHAP),
15 was derived from game theory; each player decides to contribute to a coalition of players to
16 produce a total value that will be superior to the sum of their individual values. SHAP relies on
17 the Shapley value of both local and global explanations. Shapley's values are model-agnostic,
18 and the marginal contribution of each feature can be calculated by using the input data and the
19 predictions.^(14,15) SHAP will use with the global explanation of how much the input features
20 contribute to a model's output.
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26 Model development – logistic regression.

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29 As the first step of model development, we will include all variables in penalized least absolute
30 shrinkage and selection operator (LASSO) regression. The LASSO penalization factor selects
31 important predictors by shrinking coefficients for weaker predictors toward zero, excluding
32 predictors with estimated zero coefficients from the final sparse prediction model. We will
33 perform a correlation analysis among variables selected by the LASSO regression, and identify
34 variables that are strongly correlated (e.g., $\gamma \geq 0.60$). Correlated variables will be discussed by
35 team members, and the variables that have better policy implication and clinical utility will be
36 kept and become the candidate predictors for model development.
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40 We will use fixed effect logistic regression to develop the sex-specific statistical models that
41 accounted for clusterings at the health regions. Backward selection method will be used to
42 identify the model with the best calibration and discrimination. The decisions of model
43 selection will be initially based on the changes in the values of Akaike Information Criterion
44 (AIC) and Bayesian Information Criterion (BIC).⁽¹⁶⁾ Since BIC penalizes for the complexity of the
45 model more than AIC, selection with BIC will generally lead to smaller models than selection
46 with AIC.⁽¹⁶⁾ Once a model is developed, prediction accuracy will be assessed by the
47 discrimination and calibration of the model. Discrimination is the ability of a prediction model
48 to separate those who experienced the outcome events from those who did not. We will
49 quantify this by calculating the C statistic, analogous to the area under a receiver operating
50 characteristic curve. Calibration measures how closely predicted outcomes agree with actual
51 outcomes. For this, we will use D'Agostino's version of the Hosmer-Lemeshow Chi square
52 statistic. Discrimination and calibration compete with each other. Given that the program will
53 be used to forecast population risk of suicide, we will prioritize calibration over discrimination.
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Stakeholders from different perspectives and scientific backgrounds will meet to determine the content and performance of the risk prediction models developed by statistical and ML techniques, the appropriate formats of data visualization that are acceptable to policy and decision makers, and the feasibility of implementation, which will in turn inform the revision of the models.

The second step of the model development is to estimate the synthetic rates, consisting of two stages. First, for each predictor, the proportions of individuals within each category of that predictor in the initial modeling will be computed, separately by regions. For instance, if hospitalization due to suicide attempt in the past 5 years is a predictor in the model, the proportion of individuals with this attribute in a specific health region is calculated. If age is a continuous variable in the model, the mean age of the population in a health region is estimated. A syntax program will then be prepared to apply the regression coefficients to the corresponding proportions and means in the data set, and to calculate the logit estimates for each of health regions. The resulting logit values for each of the health region will then be converted into probabilities, giving the estimated risk of suicide in the health region. The region's population counts from Statistics Canada Census data or the provincial health administrative database multiplied by the estimated risk will yield the estimated number of suicide in this health region.

The fitted logistic regression model described above estimates the proportion of suicide in the population at a given moment of time as a function of its risk factors in the past. This model is fundamentally etiologic, where the natural reference-point is the moment of the outcome's occurrence, corresponding to the zero time on the etiologic time scale. However, assessment of population risk of suicide over a particular span of time in the future involves a prognostic outlook, where the natural reference-point is the time of prognostication, corresponding to the zero time on the prognostic time scale. Predictive models for individual risk are often developed using a cohort/closed study-population and express the risk of future occurrence of the outcome as a function of current risk factors, and involves consideration of the values of the risk factors at issue at the prognostic time zero only. Whereas population risk models are applied in the context of a dynamic/open population and the estimated risk is a function of risk factors not only at the prognostic time-zero but also throughout the time span at issue. For example, the risk of suicide in the next 5 years in a health region may not only depend on the proportions of people with major depression and of hospitalization due to suicide attempt in the past, but also on whether there will be a reduction or increase in these parameters over the next 5 years, if so in which year. Thus, the population risk of suicide may be projected using the developed model to each future year over a pre-defined time interval. The cumulative incidence of suicide ($CI_{0 \text{ to } t}$) from time $T = 0$ to $T = t$ can be estimated as a function of time- and profile specific risk operating over that time interval:(17)

$$CI_{0 \text{ to } t} = 1 - \exp \left[- \int_0^t (ID_u) du \right]$$

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3 The estimated cumulative risk represents the estimated risk of suicide of a health region over
4 the time period at issue conditionally on the health region's risk profile.
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7 Validation:

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9 For model validation, we will use the suicide data from January 1st, 2011 to December 31st,
10 2019. We will first calculate the yearly, 5-year and 10-year incidence of suicide death at the
11 provincial and health regional levels in males and females (i.e., observed risk). We will apply the
12 developed models in the validation data to estimate the yearly, 5-year and 10-year incidence of
13 suicide death at the provincial and health regional levels in males and females (i.e., predicted
14 risk). We will visually compare and calculate the differences between the predicted and
15 observed risks; smaller differences indicate better calibration with the data and model
16 accuracy. We will use four indicators for assessing model performance: mean average error
17 (MAE), root mean square error (RMSE), Spearman's r , and proportion of correct identification
18 of high risk regions.(9) The MAE is the average magnitude of the difference between the
19 predicted and observed suicide death rate for each health region. The RMSE is the square root
20 of the average magnitude of the difference squared, therefore is similar to MAE but penalises
21 prediction errors with greater magnitude. More accurate predictions will result in smaller MAE
22 and RMSE. Spearman's r compares the predicted ranking of health regions by suicide death rate
23 compared with the actual observed rankings; results closer to 1 indicate that the model was
24 more effective at rank-ordering regions based on suicide death rate. To assess the extent to
25 which high risk regions are correctly identified, we will first disaggregate the predicted and
26 observed suicide rates into quartile groups and categorised all health regions into their
27 corresponding quartiles for both predicted and observed suicide rates. The proportion of health
28 regions observed in the top quartile of observed suicide death rates that were rightly predicted
29 to be in the top quartile will be calculated.
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36 **Qualitative study**

37 The objective of the qualitative study is to investigate the end-users' views about predicting
38 population risk of suicide, and the potential social, legal, ethical, and privacy issues and
39 mitigation strategies for implementing such a predictive system. Using snowballing techniques,
40 we have invited policy and decision makers at the federal and provincial levels, mental health
41 professionals, individuals who have extensive experience in working with policy and decision
42 makers and who have expertise in suicide prevention, social and health policy, as well as health
43 administrative data, people with lived experience, and advocates for families bereaved by
44 suicide. The qualitative study consists of two rounds of interviews. The first round of interviews
45 were carried out after the general team meeting held in July 2021, at which the study design
46 was finalized. The second round of interviews will be organized once the predictive models are
47 developed. The first round interviews were held through zoom meetings, and follow a series of
48 semi-structured interview questions related to the objectives. Qualitative data collected during
49 the focus groups and qualitative interviews are audio recorded, transcribed, and analyzed with
50 the support of QDA Miner (Provalis).(18) The second round of interviews will be conducted
51 once the prototype models are developed and presented at the second general team meeting
52 which is to be held in late 2022. We will perform an inductive thematic analysis of the focus
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group and individual interview material, which will be fed by answers to the open questions regarding potential (i) perceptions about the developed prediction models, (ii) social issues, (iii) legal issues, (iv) ethical and privacy issues, and (v) mitigation strategies for implementing such a system. Transcripts will be coded in order to demarcate segments within each of them. We will look for words or short phrases that demonstrate how the associated data segments inform our research objectives. Detailed results from the qualitative analysis of this material will be presented in a separate paper.

Patient and Public Involvement

Engagement with relevant stakeholders (e.g., policy/decision makers, and people with lived experience) through IKT is critical for developing equitable risk predictive algorithms and for maximizing the potential for future implementation. For this project, we have identified and engaged policy/decision makers from the Public Health Agency of Canada and from the INSPQ, as well as 8 people with lived experience. The representatives of INSPQ (EP, PL, VM, LR) were involved in study conceptualization and grant application. PL has been facilitating data extraction, participated in the bi-weekly team meetings. As described above, we have engaged people with lived experience through the qualitative interviews. The next round of qualitative interviews will be held after the prototype of the risk predictive models are developed to have a better understanding about privacy, ethics and implementation issues.

Ethics and dissemination

This study will use routinely collected health administrative data. The analysis of secondary de-identified data at the INSPQ where the data are kept will not incur physical and psychological harms. The results of the study will be vetted by analysts at the INSPQ to ensure no privacy and confidentiality will be breached. The data used for this study will be kept at INSPQ for 15 years. The results will be presented in peer-reviewed journals, at academic conferences, and shared with knowledge users who were engaged from the beginning.

Through this study, we aimed to develop risk prediction models to be used by policy and decision makers to forecast population risk of suicide at the provincial and health region levels, using routinely collected health administrative data and other publicly available area-level data. The potential utility of such predictive tools has been attested by the active involvement by the policy and decision makers at the federal and provincial levels and people with lived experience. Nevertheless, predicting population risk of suicide is new and has not been well studied. There are a number of methodological and implementation challenges to be addressed.

Routinely collected health administrative data and population health survey data represent a unique opportunity for population health projection because it covers a majority of the general population in catchment areas, and the data can be readily accessed by policy and decision makers. Many risk predictive models have been developed for physical and mental health problems in the general population. For example, individual data from population health

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3 surveys and health administrative databases have been used to develop risk predictive models
4 for diabetes,(19) heart disease,(20) and major depression.(21,22) These models may be used to
5 identify high risk individuals in the community; they can also be used to forecast the population
6 risk in the future. However, few models have integrated individual, healthcare system, and
7 community level predictors in the same model. In this study, we proposed to include data from
8 these different levels in model development, and convert the models into synthetic estimation
9 models. There may be different approaches for integrating data from different levels for
10 population risk prediction. Future studies are needed to explore the best method for data
11 integration.
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16 The performance of a risk predictive model is commonly assessed by indicators of model
17 discrimination and calibration.(23) Whereas model discrimination is critical for individual risk
18 predictive models, policy and decision makers' focus is on the whole population rather than
19 individuals. Therefore, model calibration plays a more important role in the performance of a
20 population risk model. We proposed four indicators for assessing model performance.
21 However, it is not clear how much error (the difference between predicted and observed risks)
22 policy and decision makers may tolerate for population risk prediction, how they perceive the
23 importance of model discrimination, whether other indicators exist for assessing population
24 risk prediction models. We will explore these aspects through our qualitative study, and also
25 encourage others to consider these in future studies. Similarly, we welcome discussions and
26 debates about the methods for validating population risk predictive models. An individual risk
27 predictive model is often developed using longitudinal cohort/closed population data and
28 validated in a different but related cohort/closed population. This poses challenges for
29 population risk predictive models because the population in a community/health region is open
30 and dynamic. Appropriate methods for model validation and acceptability need to be
31 developed and agreed by the research community and policy and decision makers.
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37 Despite the challenges for developing population risk predictive model for suicide, research is
38 urgently needed to address this important population health issue. This study represents one of
39 the early steps in building such risk predictive models and methodology development, as part
40 of the collective efforts for moving the field forward.
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Authors' contribution:

JLW drafted the manuscript. All co-authors were involved in study design, grant application, manuscript review and approval.

Funding statement:

This study is supported by a New Frontiers for Research Funds grant from Tri-Agency Institutional Programs Secretariat, Government of Canada, and by a Tier I Canada Research Chair award to JLW. The funders play no role in design and operation of this study.

Competing interests: none

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APPENDIX I_1: CANDIDATE PREDICTORS

i. PSYCHIATRIC DISORDERS DIAGNOSIS¹

- Substance use disorder²
 - o Alcohol use disorder
 - o drug use disorder
- Mood disorder
 - Major depressive disorder
 - Bipolar disorder
- Anxiety disorder
- Schizophrenia
- Personality disorders
- ADHD
- Other diagnosis

derived variables ³⁴	variable name
Substance use disorder	psydx_subuse_3
Substance use disorder	psydx_subuse_6
Substance use disorder	psydx_subuse_12
Substance use disorder	psydx_subuse_24
Substance use disorder	psydx_subuse_36
Substance use disorder	psydx_subuse_48
Substance use disorder	psydx_subuse_60
Alcohol use disorder	Psydx_alcoholuse_3
Alcohol use disorder	Psydx_alcoholuse_6
Alcohol use disorder	Psydx_alcoholuse_12
Alcohol use disorder	Psydx_alcoholuse_24
Alcohol use disorder	Psydx_alcoholuse_36
Alcohol use disorder	Psydx_alcoholuse_48
Alcohol use disorder	Psydx_alcoholuse_60
Drug use disorder	Psydx_druguse_3
Drug use disorder	Psydx_druguse_6
Drug use disorder	Psydx_druguse_12
Drug use disorder	Psydx_druguse_24
Drug use disorder	Psydx_druguse_36
Drug use disorder	Psydx_druguse_48
Drug use disorder	Psydx_druguse_60

The candidate predictors were captured using timeframes of prior 3, 6, 12, 24, 36, 48, and/or 60 months, indicated by the last digits of the variable name. For instance, "psydx_subuse_3" and "psydx_subuse_6" refer to a diagnosis of substance use disorder in the prior 3 and 6 months, respectively

1		
2		
3	mood disorder	Psydx_mood_3
4	mood disorder	Psydx_mood_6
5	mood disorder	Psydx_mood_12
6	mood disorder	Psydx_mood_24
7	mood disorder	Psydx_mood_36
8	mood disorder	Psydx_mood_48
9	mood disorder	Psydx_mood_60
10	mood disorder	Psydx_mood_60
11	Anxiety disorder	psydx_anx_3
12	Anxiety disorder	psydx_anx_6
13	Anxiety disorder	psydx_anx_12
14	Anxiety disorder	psydx_anx_24
15	Anxiety disorder	psydx_anx_36
16	Anxiety disorder	psydx_anx_48
17	Anxiety disorder	psydx_anx_60
18	Anxiety disorder	psydx_anx_60
19	Major Depressive Disorder	Psydx_dep_3
20	Major Depressive Disorder	Psydx_dep_6
21	Major Depressive Disorder	Psydx_dep_12
22	Major Depressive Disorder	Psydx_dep_24
23	Major Depressive Disorder	Psydx_dep_36
24	Major Depressive Disorder	Psydx_dep_48
25	Major Depressive Disorder	Psydx_dep_60
26	Major Depressive Disorder	Psydx_dep_60
27	Bipolar disorder	Psydx_bipolar_3
28	Bipolar disorder	Psydx_bipolar_6
29	Bipolar disorder	Psydx_bipolar_12
30	Bipolar disorder	Psydx_bipolar_24
31	Bipolar disorder	Psydx_bipolar_36
32	Bipolar disorder	Psydx_bipolar_48
33	Bipolar disorder	Psydx_bipolar_60
34	Bipolar disorder	Psydx_bipolar_60
35	Schizophrenia	psydx_scz_3
36	Schizophrenia	psydx_scz_6
37	Schizophrenia	psydx_scz_12
38	Schizophrenia	psydx_scz_24
39	Schizophrenia	psydx_scz_36
40	Schizophrenia	psydx_scz_48
41	Schizophrenia	psydx_scz_60
42	Schizophrenia	psydx_scz_60
43	Personality disorder	psydx_pd_3
44	Personality disorder	psydx_pd_6
45	Personality disorder	psydx_pd_12
46	Personality disorder	psydx_pd_24
47	Personality disorder	psydx_pd_36
48	Personality disorder	psydx_pd_48
49	Personality disorder	psydx_pd_48
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59		
60		

Personality disorder	psydx_pd_60
ADHD	psydx_adhd_3
ADHD	psydx_adhd_6
ADHD	psydx_adhd_12
ADHD	psydx_adhd_24
ADHD	psydx_adhd_36
ADHD	psydx_adhd_48
ADHD	psydx_adhd_60
Other diagnosis	psydx_otr_3
Other diagnosis	psydx_otr_6
Other diagnosis	psydx_otr_12
Other diagnosis	psydx_otr_24
Other diagnosis	psydx_otr_36
Other diagnosis	psydx_otr_48
Other diagnosis	psydx_otr_60

ii. PHARMACOLOGICAL TREATMENTS FOR MENTAL HEALTH DISORDERS

- Typical antipsychotics
- Atypical antipsychotics
- Clozapine
- Antidepressant for anxiety or depression
- Antidepressants for other reasons
- Mood stabilizer
- Anxiolytic
- ADHD medication

derived variables⁵	variable name
Typical antipsychotics	rx_psy_antipsych_typ_3
Typical antipsychotics	rx_psy_antipsych_typ_6
Typical antipsychotics	rx_psy_antipsych_typ_12
Typical antipsychotics	rx_psy_antipsych_typ_24
Typical antipsychotics	rx_psy_antipsych_typ_36
Typical antipsychotics	rx_psy_antipsych_typ_48
Typical antipsychotics	rx_psy_antipsych_typ_60
Atypical antipsychotics	rx_psy_antipsych_atyp_3
Atypical antipsychotics	rx_psy_antipsych_atyp_6
Atypical antipsychotics	rx_psy_antipsych_atyp_12
Atypical antipsychotics	rx_psy_antipsych_atyp_24
Atypical antipsychotics	rx_psy_antipsych_atyp_36
Atypical antipsychotics	rx_psy_antipsych_atyp_48

1		
2		
3	Atypical antipsychotics	rx_psy_antipsych_atyp_60
4	Clozapine	rx_psy_clozapine_3
5	Clozapine	rx_psy_clozapine_6
6	Clozapine	rx_psy_clozapine_12
7	Clozapine	rx_psy_clozapine_24
8	Clozapine	rx_psy_clozapine_36
9	Clozapine	rx_psy_clozapine_48
10	Clozapine	rx_psy_clozapine_60
11	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_3
12	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_6
13	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_12
14	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_24
15	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_36
16	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_48
17	antidepressant for anxiety or depression	rx_psy_antidep_anxdep_60
18	antidepressant for other reasons	rx_psy_antidep_otr_3
19	Antidepressant for other reasons	rx_psy_antidep_otr_6
20	Antidepressant for other reasons	rx_psy_antidep_otr_12
21	Antidepressant for other reasons	rx_psy_antidep_otr_24
22	Antidepressant for other reasons	rx_psy_antidep_otr_36
23	Antidepressant for other reasons	rx_psy_antidep_otr_48
24	Antidepressant for other reasons	rx_psy_antidep_otr_60
25	mood stabilizer	rx_psy_mdestb_3
26	mood stabilizer	rx_psy_mdestb_6
27	mood stabilizer	rx_psy_mdestb_12
28	mood stabilizer	rx_psy_mdestb_24
29	mood stabilizer	rx_psy_mdestb_36
30	mood stabilizer	rx_psy_mdestb_48
31	mood stabilizer	rx_psy_mdestb_60
32	anxiolytics	rx_psy_anx_3
33	anxiolytics	rx_psy_anx_6
34	anxiolytics	rx_psy_anx_12
35	anxiolytics	rx_psy_anx_24
36	anxiolytics	rx_psy_anx_36
37	anxiolytics	rx_psy_anx_48
38	anxiolytics	rx_psy_anx_60
39	ADHD medication	rx_psy_adhd_3
40	ADHD medication	rx_psy_adhd_6
41	ADHD medication	rx_psy_adhd_12
42	ADHD medication	rx_psy_adhd_24
43	ADHD medication	rx_psy_adhd_36
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ADHD medication	rx_psy_adhd_48
ADHD medication	rx_psy_adhd_60

iii. NON-PHARMACOLOGICAL TREATMENTS FOR MENTAL HEALTH DISORDERS

- duration of hospitalisations for mental health reasons (continuous, sum of days)
- number of hospitalisations for mental health reasons (continuous)
- duration of hospitalisations for suicide attempt (continuous, sum of days)
- number of hospitalisations for suicide attempt (continuous)
- Number of care center visits for mental health reasons (continuous)
- number of general practitioner visits for mental health reasons (continuous)
- number of emergency room visits for mental health reasons (continuous)
- number of outpatient psychiatrist visits (continuous)
- number of other specialist visits for mental health reasons (continuous)
- number of psychotherapy visits with a psychiatrist (continuous)
- number of psychotherapy visits with a general practitioner (continuous)
- number of psychotherapy visits with another specialist (continuous)
- Number of outpatient paediatrician visits (continuous)
- No mental health services
- number of ECT treatments received (continuous)
- Acute ECT received (dichotomous)
- Maintenance ECT received (dichotomous)

derived variables	variable name
Duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_3
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_6
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_12
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_24
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_36
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_48
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_60
# of hospit for suicide attempt (continuous)	#_hosp_suicide_3
# of hospit for suicide attempt (continuous)	#_hosp_suicide_6
# of hospit for suicide attempt (continuous)	#_hosp_suicide_12
# of hospit for suicide attempt (continuous)	#_hosp_suicide_24
# of hospit for suicide attempt (continuous)	#_hosp_suicide_36
# of hospit for suicide attempt (continuous)	#_hosp_suicide_48
# of hospit for suicide attempt (continuous)	#_hosp_suicide_60
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_3
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_6
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_12
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_24
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_36
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_48
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_60

1		
2		
3		
4	# of hospit for mh reasons (continuous)	#_hosp_mh_3
5	# of hospit for mh reasons (continuous)	#_hosp_mh_6
6	# of hospit for mh reasons (continuous)	#_hosp_mh_12
7	# of hospit for mh reasons (continuous)	#_hosp_mh_24
8	# of hospit for mh reasons (continuous)	#_hosp_mh_36
9	# of hospit for mh reasons (continuous)	#_hosp_mh_48
10	# of hospit for mh reasons (continuous)	#_hosp_mh_60
11	# of hospit for mh reasons (continuous)	#_hosp_mh_60
12	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_3
13	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_6
14	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_12
15	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_24
16	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_36
17	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_48
18	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_60
19	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_60
20	# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_60
21	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_3
22	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_6
23	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_12
24	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_24
25	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_36
26	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_48
27	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_60
28	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_60
29	Number of Care center for mental health reasons (continuous)	#_Carectr_mh_60
30	# of emergency visits for mh reasons (continuous)	#_ER_mh_3
31	# of emergency visits for mh reasons (continuous)	#_ER_mh_6
32	# of emergency visits for mh reasons (continuous)	#_ER_mh_12
33	# of emergency visits for mh reasons (continuous)	#_ER_mh_24
34	# of emergency visits for mh reasons (continuous)	#_ER_mh_36
35	# of emergency visits for mh reasons (continuous)	#_ER_mh_48
36	# of emergency visits for mh reasons (continuous)	#_ER_mh_60
37	# of emergency visits for mh reasons (continuous)	#_ER_mh_60
38	# of emergency visits for mh reasons (continuous)	#_ER_mh_60
39	# of GP visits for mh reasons (continuous)	#_gp_mh_3
40	# of GP visits for mh reasons (continuous)	#_gp_mh_6
41	# of GP visits for mh reasons (continuous)	#_gp_mh_12
42	# of GP visits for mh reasons (continuous)	#_gp_mh_24
43	# of GP visits for mh reasons (continuous)	#_gp_mh_36
44	# of GP visits for mh reasons (continuous)	#_gp_mh_48
45	# of GP visits for mh reasons (continuous)	#_gp_mh_60
46	# of GP visits for mh reasons (continuous)	#_gp_mh_60
47	# of GP visits for mh reasons (continuous)	#_gp_mh_60
48	# of GP visits for mh reasons (continuous)	#_gp_mh_60
49	# of outpatient psychiatrist visits (continuous)	#_psy_mh_3
50	# of outpatient psychiatrist visits (continuous)	#_psy_mh_6
51	# of outpatient psychiatrist visits (continuous)	#_psy_mh_12
52	# of outpatient psychiatrist visits (continuous)	#_psy_mh_24
53	# of outpatient psychiatrist visits (continuous)	#_psy_mh_36
54	# of outpatient psychiatrist visits (continuous)	#_psy_mh_48
55	# of outpatient psychiatrist visits (continuous)	#_psy_mh_48
56		
57		
58		
59		
60		

# of outpatient psychiatrist visits (continuous)	#_psy_mh_60
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_3
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_6
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_12
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_24
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_36
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_48
# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_60
# of other specialist visits for mh reasons (conti)	#_spc_mh_3
# of other specialist visits for mh reasons (conti)	#_spc_mh_6
# of other specialist visits for mh reasons (conti)	#_spc_mh_12
# of other specialist visits for mh reasons (conti)	#_spc_mh_24
# of other specialist visits for mh reasons (conti)	#_spc_mh_36
# of other specialist visits for mh reasons (conti)	#_spc_mh_48
# of other specialist visits for mh reasons (conti)	#_spc_mh_60
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_3
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_6
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_12
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_24
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_36
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_48
# of psychotherapy visits with a GP (conti)	#_psychotx_gp_60
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_3
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_6
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_12
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_24
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_36
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_48
# of psychotherapy visits with other specialist (conti)	#_psychotx_other_60
No mental health services	No_mh_services_3
No mental health services	No_mh_services_6
No mental health services	No_mh_services_12
No mental health services	No_mh_services_24
No mental health services	No_mh_services_36
No mental health services	No_mh_services_48
No mental health services	No_mh_services_60
number of ECT received (continuous)	ECT_#_3
number of ECT received (continuous)	ECT_#_6
number of ECT received (continuous)	ECT_#_12
number of ECT received (continuous)	ECT_#_24
number of ECT received (continuous)	ECT_#_36

number of ECT received (continuous)	ECT_#_48
number of ECT received (continuous)	ECT_#_60
acute ECT (dichotomous)	ECT_acute_3
acute ECT (dichotomous)	ECT_acute_6
acute ECT (dichotomous)	ECT_acute_12
acute ECT (dichotomous)	ECT_acute_24
acute ECT (dichotomous)	ECT_acute_36
acute ECT (dichotomous)	ECT_acute_48
acute ECT (dichotomous)	ECT_acute_60
Maintenance ECT (dichotomous)	ECT_maintenance_3
Maintenance ECT (dichotomous)	ECT_maintenance_6
Maintenance ECT (dichotomous)	ECT_maintenance_12
Maintenance ECT (dichotomous)	ECT_maintenance_24
Maintenance ECT (dichotomous)	ECT_maintenance_36
Maintenance ECT (dichotomous)	ECT_maintenance_48
Maintenance ECT (dichotomous)	ECT_maintenance_60

iv. PHYSICAL DIAGNOSIS

- Dementia
- Neurological disease
- Endocrine system disorder
- Trauma
- Respiratory disorder
- Infectious disease
- Digestive disorder
- Cardiovascular disorder
- Cancer
- Other physical disorder
- Charlson/elixhauser index with psy (continuous)⁶
- Charlson/elixhauser index without psy (continuous)

derived variables	variable name
dementia	physdx_dem_3
dementia	physdx_dem_6
dementia	physdx_dem_12
dementia	physdx_dem_24
dementia	physdx_dem_36
dementia	physdx_dem_48
dementia	physdx_dem_60
neurological disease	physdx_neuro_3
neurological disease	physdx_neuro_6

1	neurological disease	physdx_neuro_12
2	neurological disease	physdx_neuro_24
3	neurological disease	physdx_neuro_36
4	neurological disease	physdx_neuro_48
5	neurological disease	physdx_neuro_60
6	endocrine system disorder	physdx_endo_3
7	endocrine system disorder	physdx_endo_6
8	endocrine system disorder	physdx_endo_12
9	endocrine system disorder	physdx_endo_24
10	endocrine system disorder	physdx_endo_36
11	endocrine system disorder	physdx_endo_48
12	endocrine system disorder	physdx_endo_60
13	trauma	physdx_trauma_3
14	trauma	physdx_trauma_6
15	trauma	physdx_trauma_12
16	trauma	physdx_trauma_24
17	trauma	physdx_trauma_36
18	trauma	physdx_trauma_48
19	trauma	physdx_trauma_60
20	respiratory disorder	physdx_resp_3
21	respiratory disorder	physdx_resp_6
22	respiratory disorder	physdx_resp_12
23	respiratory disorder	physdx_resp_24
24	respiratory disorder	physdx_resp_36
25	respiratory disorder	physdx_resp_48
26	respiratory disorder	physdx_resp_60
27	infectious disease	physdx_infec_3
28	infectious disease	physdx_infec_6
29	infectious disease	physdx_infec_12
30	infectious disease	physdx_infec_24
31	infectious disease	physdx_infec_36
32	infectious disease	physdx_infec_48
33	infectious disease	physdx_infec_60
34	digestive disorder	physdx_diges_3
35	digestive disorder	physdx_diges_6
36	digestive disorder	physdx_diges_12
37	digestive disorder	physdx_diges_24
38	digestive disorder	physdx_diges_36
39	digestive disorder	physdx_diges_48
40	digestive disorder	physdx_diges_60
41	cardiovascular disorder	physdx_cvd_3

1		
2		
3	cardiovascular disorder	physdx_cvd_6
4	cardiovascular disorder	physdx_cvd_12
5	cardiovascular disorder	physdx_cvd_24
6	cardiovascular disorder	physdx_cvd_36
7	cardiovascular disorder	physdx_cvd_48
8	cardiovascular disorder	physdx_cvd_60
9	cardiovascular disorder	physdx_cvd_60
10	cancer	physdx_cncr_3
11	cancer	physdx_cncr_6
12	cancer	physdx_cncr_12
13	cancer	physdx_cncr_24
14	cancer	physdx_cncr_36
15	cancer	physdx_cncr_48
16	cancer	physdx_cncr_60
17	other physical disorders	physdx_otr_3
18	other physical disorders	physdx_otr_6
19	other physical disorders	physdx_otr_12
20	other physical disorders	physdx_otr_24
21	other physical disorders	physdx_otr_36
22	other physical disorders	physdx_otr_48
23	other physical disorders	physdx_otr_60
24	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_3
25	charlson/elixhauser index with psy (conti)	physdx_comorbid_withpsy_6
26	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_12
27	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_24
28	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_36
29	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_48
30	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_60
31	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_3
32	charlson/elixhauser index without psy (conti)	physdx_comorbid_withoutpsy_6
33	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_12
34	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_24
35	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_36
36	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_48
37	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
38	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
39	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
40	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
41	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
42	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
43	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
44	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
45	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
46	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
47	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
48	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
49	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
50	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
51	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
52	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
53	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
54	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
55		
56		
57		
58		
59		
60		

charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_48
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60

V. PHARMACOLOGICAL TREATMENTS FOR PHYSICAL HEALTH DISORDERS

- Medication for diabetes
- Medication for cardiovascular disease
- Medication for respiratory diseases
- Medication for gastro-intestinal disorder
- Anti-infective agent
- Pain medication
- Contraceptive
- Other medication

derived variables	variable name
medication for diabetes	rx_phys_diabetes_3
medication for diabetes	rx_phys_diabetes_6
medication for diabetes	rx_phys_diabetes_12
medication for diabetes	rx_phys_diabetes_24
medication for diabetes	rx_phys_diabetes_36
medication for diabetes	rx_phys_diabetes_48
medication for diabetes	rx_phys_diabetes_60
medication for cardiovascular disease	rx_phys_cvd_3
medication for cardiovascular disease	rx_phys_cvd_6
medication for cardiovascular disease	rx_phys_cvd_12
medication for cardiovascular disease	rx_phys_cvd_24
medication for cardiovascular disease	rx_phys_cvd_36
medication for cardiovascular disease	rx_phys_cvd_48
medication for cardiovascular disease	rx_phys_cvd_60
medication for respiratory disease	rx_phys_resp_3
medication for respiratory disease	rx_phys_resp_6
medication for respiratory disease	rx_phys_resp_12
medication for respiratory disease	rx_phys_resp_24
medication for respiratory disease	rx_phys_resp_36
medication for respiratory disease	rx_phys_resp_48
medication for respiratory disease	rx_phys_resp_60
medication for gastro-intestinal disorder	rx_phys_gi_3
medication for gastro-intestinal disorder	rx_phys_gi_6
medication for gastro-intestinal disorder	rx_phys_gi_12
medication for gastro-intestinal disorder	rx_phys_gi_24
medication for gastro-intestinal disorder	rx_phys_gi_36
medication for gastro-intestinal disorder	rx_phys_gi_48

1		
2		
3		
4	medication for gastro-intestinal disorder	rx_phys_gi_60
5	anti-infective agents	rx_phys_antiinfec_3
6	anti-infective agents	rx_phys_antiinfec_6
7	anti-infective agents	rx_phys_antiinfec_12
8	anti-infective agents	rx_phys_antiinfec_24
9	anti-infective agents	rx_phys_antiinfec_36
10	anti-infective agents	rx_phys_antiinfec_48
11	anti-infective agents	rx_phys_antiinfec_60
12		
13	pain medication	rx_phys_pain_3
14	pain medication	rx_phys_pain_6
15	pain medication	rx_phys_pain_12
16	pain medication	rx_phys_pain_24
17	pain medication	rx_phys_pain_36
18	pain medication	rx_phys_pain_48
19	pain medication	rx_phys_pain_60
20		
21	contraceptives	rx_phys_contracep_3
22	contraceptives	rx_phys_contracep_6
23	contraceptives	rx_phys_contracep_12
24	contraceptives	rx_phys_contracep_24
25	contraceptives	rx_phys_contracep_36
26	contraceptives	rx_phys_contracep_48
27	contraceptives	rx_phys_contracep_60
28		
29	other medication	rx_phys_otr_3
30	other medication	rx_phys_otr_6
31	other medication	rx_phys_otr_12
32	other medication	rx_phys_otr_24
33	other medication	rx_phys_otr_36
34	other medication	rx_phys_otr_48
35	other medication	rx_phys_otr_60
36		
37		
38		
39		
40		
41		

vi. NON-PHARMACOLOGICAL TREATMENTS FOR PHYSICAL HEALTH DISORDERS

- duration of hospitalisations for physical health reasons (continuous, sum of days)
- number of hospitalisations for physical health reasons (continuous)
- care center visits/plays for physical health reasons*
- number of general practitioner visits for physical reasons (continuous)*
- number of emergency room visits for physical reasons (continuous)*
- number of outpatient specialist visits for physical health reasons (continuous)*
- number of outpatient paediatrician visits (continuous)*

derived variables	variable name
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_3
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_6
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_12

Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_24
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_36
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_48
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_60
# of hospit for phys reasons (continuous)	#_hosp_phys_3
# of hospit for phys reasons (continuous)	#_hosp_phys_6
# of hospit for phys reasons (continuous)	#_hosp_phys_12
# of hospit for phys reasons (continuous)	#_hosp_phys_24
# of hospit for phys reasons (continuous)	#_hosp_phys_36
# of hospit for phys reasons (continuous)	#_hosp_phys_48
# of hospit for phys reasons (continuous)	#_hosp_phys_60
Care center for physical health reasons	Carectr_phys_3
Care center for physical health reasons	Carectr_phys_6
Care center for physical health reasons	Carectr_phys_12
Care center for physical health reasons	Carectr_phys_24
Care center for physical health reasons	Carectr_phys_36
Care center for physical health reasons	Carectr_phys_48
Care center for physical health reasons	Carectr_phys_60
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_3
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_6
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_12
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_24
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_36
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_48
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_60
# of GP visits for phys reasons (continuous)	#_gp_phys_3
# of GP visits for phys reasons (continuous)	#_gp_phys_6
# of GP visits for phys reasons (continuous)	#_gp_phys_12
# of GP visits for phys reasons (continuous)	#_gp_phys_24
# of GP visits for phys reasons (continuous)	#_gp_phys_36
# of GP visits for phys reasons (continuous)	#_gp_phys_48
# of GP visits for phys reasons (continuous)	#_gp_phys_60
# of emergency visits for phys reasons (continuous)	#_ER_phys_3
# of emergency visits for phys reasons (continuous)	#_ER_phys_6
# of emergency visits for phys reasons (continuous)	#_ER_phys_12
# of emergency visits for phys reasons (continuous)	#_ER_phys_24
# of emergency visits for phys reasons (continuous)	#_ER_phys_36
# of emergency visits for phys reasons (continuous)	#_ER_phys_48
# of emergency visits for phys reasons (continuous)	#_ER_phys_60

vii. INDIVIDUAL SOCIO-DEMOGRAPHIC VARIABLES

- Age (continuous)
- age group: 15-24
- age group: 25-34
- age group: 35-44
- age group: 45-54

- age group: 55-64
- age group: 65-74
- age group: 75-84
- age group: ≥85
- Sex
- Location – rural
- Location – non-rural
- Location – missing data
- rss 01 bas saint-laurent
- rss 02 saguenay-lac-saint-jean
- rss 03 capitale-nationale
- rss 04 mauricie et centre-du-québec
- rss 05 estrie
- rss 06 montréal
- rss 07 outaouais
- rss 08 abitibi-témiscamingue
- rss 09 côte-nord
- rss 10 nord-du-québec
- rss 11gaspésie-îles-de-la-madeleine
- rss 12 chaudière-appalaches
- rss 13 laval
- rss 14 lanaudière
- rss 15 laurentides
- rss 16 montérégie
- Adherence to the public drug plan (RAMQ) (dichotomous)

derived variables	variable name
Age (continuous)	Age_continuous
age group: 15-24	age_15-24
age group: 25-34	age_25-34
age group: 35-44	age_35-44
age group: 45-54	age_45-54
age group: 55-64	age_55-64
age group: 65-74	age_65-74
age group: 75-84	age_75-84
age group: ≥85	age_85+
sex male	sex_m
sex female	sex_f
rss 01 bas-saint-laurent	loc_rss_01_3
rss 01 bas-saint-laurent	loc_rss_01_6
rss 01 bas-saint-laurent	loc_rss_01_12
rss 01 bas-saint-laurent	loc_rss_01_24
rss 01 bas-saint-laurent	loc_rss_01_36

1		
2		
3		
4	rss 01 bas-saint-laurent	loc_rss_01_48
5	rss 01 bas-saint-laurent	loc_rss_01_60
6	rss 02 saguenay-lac-saint-jean	loc_rss_02_3
7	rss 02 saguenay-lac-saint-jean	loc_rss_02_6
8	rss 02 saguenay-lac-saint-jean	loc_rss_02_12
9	rss 02 saguenay-lac-saint-jean	loc_rss_02_24
10	rss 02 saguenay-lac-saint-jean	loc_rss_02_36
11	rss 02 saguenay-lac-saint-jean	loc_rss_02_48
12	rss 02 saguenay-lac-saint-jean	loc_rss_02_60
13	rss 03 capitale-nationale	loc_rss_03_3
14	rss 03 capitale-nationale	loc_rss_03_6
15	rss 03 capitale-nationale	loc_rss_03_12
16	rss 03 capitale-nationale	loc_rss_03_24
17	rss 03 capitale-nationale	loc_rss_03_36
18	rss 03 capitale-nationale	loc_rss_03_48
19	rss 03 capitale-nationale	loc_rss_03_60
20	rss 04 mauricie et centre-du-québec	loc_rss_04_3
21	rss 04 mauricie et centre-du-québec	loc_rss_04_6
22	rss 04 mauricie et centre-du-québec	loc_rss_04_12
23	rss 04 mauricie et centre-du-québec	loc_rss_04_24
24	rss 04 mauricie et centre-du-québec	loc_rss_04_36
25	rss 04 mauricie et centre-du-québec	loc_rss_04_48
26	rss 04 mauricie et centre-du-québec	loc_rss_04_60
27	rss 05 estrie	loc_rss_05_3
28	rss 05 estrie	loc_rss_05_6
29	rss 05 estrie	loc_rss_05_12
30	rss 05 estrie	loc_rss_05_24
31	rss 05 estrie	loc_rss_05_36
32	rss 05 estrie	loc_rss_05_48
33	rss 05 estrie	loc_rss_05_60
34	rss 06 montréal	loc_rss_06_3
35	rss 06 montréal	loc_rss_06_6
36	rss 06 montréal	loc_rss_06_12
37	rss 06 montréal	loc_rss_06_24
38	rss 06 montréal	loc_rss_06_36
39	rss 06 montréal	loc_rss_06_48
40	rss 06 montréal	loc_rss_06_60
41	rss 07 outaouais	loc_rss_07_3
42	rss 07 outaouais	loc_rss_07_6
43	rss 07 outaouais	loc_rss_07_12
44	rss 07 outaouais	loc_rss_07_24
45		
46		
47		
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49		
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51		
52		
53		
54		
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56		
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58		
59		
60		

1		
2		
3		
4	rss 07 outaouais	loc_rss_07_36
5	rss 07 outaouais	loc_rss_07_48
6	rss 07 outaouais	loc_rss_07_60
7	08 abitibi-témiscamingue	loc_rss_08_3
8	rss 08 abitibi-témiscamingue	loc_rss_08_6
9	rss 08 abitibi-témiscamingue	loc_rss_08_12
10	rss 08 abitibi-témiscamingue	loc_rss_08_24
11	rss 08 abitibi-témiscamingue	loc_rss_08_36
12	08 abitibi-témiscamingue	loc_rss_08_48
13	rss 08 abitibi-témiscamingue	loc_rss_08_60
14	rss 08 abitibi-témiscamingue	loc_rss_08_60
15	rss 09 côte-nord	loc_rss_09_3
16	rss 09 côte-nord	loc_rss_09_6
17	rss 09 côte-nord	loc_rss_09_12
18	rss 09 côte-nord	loc_rss_09_24
19	rss 09 côte-nord	loc_rss_09_36
20	rss 09 côte-nord	loc_rss_09_48
21	rss 09 côte-nord	loc_rss_09_60
22	rss 10 nord-du-québec	loc_rss_10_3
23	rss 10 nord-du-québec	loc_rss_10_6
24	rss 10 nord-du-québec	loc_rss_10_12
25	rss 10 nord-du-québec	loc_rss_10_24
26	rss 10 nord-du-québec	loc_rss_10_36
27	rss 10 nord-du-québec	loc_rss_10_48
28	rss 10 nord-du-québec	loc_rss_10_60
29	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_3
30	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_6
31	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_12
32	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_24
33	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_36
34	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_48
35	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_60
36	rss 12 chaudière-appalaches	loc_rss_12_3
37	rss 12 chaudière-appalaches	loc_rss_12_6
38	rss 12 chaudière-appalaches	loc_rss_12_12
39	rss 12 chaudière-appalaches	loc_rss_12_24
40	rss 12 chaudière-appalaches	loc_rss_12_36
41	rss 12 chaudière-appalaches	loc_rss_12_48
42	rss 12 chaudière-appalaches	loc_rss_12_60
43	rss 13 laval	loc_rss_13_3
44	rss 13 laval	loc_rss_13_6
45	rss 13 laval	loc_rss_13_12
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

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2		
3		
4	rss 13 laval	loc_rss_13_24
5	rss 13 laval	loc_rss_13_36
6	rss 13 laval	loc_rss_13_48
7	rss 13 laval	loc_rss_13_60
8	rss 14 lanaudière	loc_rss_14_3
9	rss 14 lanaudière	loc_rss_14_6
10	rss 14 lanaudière	loc_rss_14_12
11	rss 14 lanaudière	loc_rss_14_24
12	rss 14 lanaudière	loc_rss_14_36
13	rss 14 lanaudière	loc_rss_14_48
14	rss 14 lanaudière	loc_rss_14_60
15	rss 15 laurentides	loc_rss_15_3
16	rss 15 laurentides	loc_rss_15_6
17	rss 15 laurentides	loc_rss_15_12
18	rss 15 laurentides	loc_rss_15_24
19	rss 15 laurentides	loc_rss_15_36
20	rss 15 laurentides	loc_rss_15_48
21	rss 15 laurentides	loc_rss_15_60
22	rss 16 montérégie	loc_rss_16_3
23	rss 16 montérégie	loc_rss_16_6
24	rss 16 montérégie	loc_rss_16_12
25	rss 16 montérégie	loc_rss_16_24
26	rss 16 montérégie	loc_rss_16_36
27	rss 16 montérégie	loc_rss_16_48
28	rss 16 montérégie	loc_rss_16_60
29	location nonrural	nonrural_3
30	location nonrural	nonrural_6
31	location nonrural	nonrural_12
32	location nonrural	nonrural_24
33	location nonrural	nonrural_36
34	location nonrural	nonrural_48
35	location nonrural	nonrural_60
36	location rural	rural_3
37	location rural	rural_6
38	location rural	rural_12
39	location rural	rural_24
40	location rural	rural_36
41	location rural	rural_48
42	location rural	rural_60
43	location missing data	loc_missing_3
44	location missing data	loc_missing_6
45		
46		
47		
48		
49		
50		
51		
52		
53		
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55		
56		
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58		
59		
60		

location missing data	loc_missing_12
location missing data	loc_missing_24
location missing data	loc_missing_36
location missing data	loc_missing_48
location missing data	loc_missing_60
adherence to the public drug plan (RAMQ)	PublicRxPlan_3
adherence to the public drug plan (RAMQ)	PublicRxPlan_6
adherence to the public drug plan (RAMQ)	PublicRxPlan_12
adherence to the public drug plan (RAMQ)	PublicRxPlan_24
adherence to the public drug plan (RAMQ)	PublicRxPlan_36
adherence to the public drug plan (RAMQ)	PublicRxPlan_48
adherence to the public drug plan (RAMQ)	PublicRxPlan_60

ENVIRONMENTAL VARIABLES

i. DEPRIVATION INDEX

- Material deprivation (from 1, least deprived to 5, most deprived)
- Social deprivation (from 1, least deprived to 5, most deprived)

derived variables⁷	variable name
material deprivation (1-5)	matdep_3
material deprivation (1-5)	matdep_6
material deprivation (1-5)	matdep_12
material deprivation (1-5)	matdep_24
material deprivation (1-5)	matdep_36
material deprivation (1-5)	matdep_48
material deprivation (1-5)	matdep_60
social deprivation (1-5)	socdep_3
social deprivation (1-5)	socdep_6
social deprivation (1-5)	socdep_12
social deprivation (1-5)	socdep_24
social deprivation (1-5)	socdep_36
social deprivation (1-5)	socdep_48
social deprivation (1-5)	socdep_60

SYSTEM VARIABLES

i. HEALTH SYSTEM ENVIRONMENT (HEALTH SYSTEM)

- Mental health budget

- Bas-Saint-Laurent
- Saguenay-Lac-Saint-Jean
- Capitale-Nationale
- Mauricie et Centre-du-Québec
- Estrie
- Montréal
- Outaouais
- Abitibi-Témiscamingue
- Côte-Nord
- Nord-du-Québec
- Gaspésie-îles-de-la-Madeleine
- Chaudière-Appalaches
- Laval
- Lanaudière
- Laurentides
- Montérégie
- Addictions budget
 - Bas-Saint-Laurent
 - Saguenay-Lac-Saint-Jean
 - Capitale-Nationale
 - Mauricie et Centre-du-Québec
 - Estrie
 - Montréal
 - Outaouais
 - Abitibi-Témiscamingue
 - Côte-Nord
 - Nord-du-Québec
 - Gaspésie-îles-de-la-Madeleine
 - Chaudière-Appalaches
 - Laval
 - Lanaudière
 - Laurentides
 - Montérégie
- regional mental health budget (\$/capita)
 - 2018-2019
 - 2017-2018
 - 2016-2017
 - 2015-2016
- regional addictions health budget (\$/capita)
 - 2018-2019
 - 2017-2018
 - 2016-2017
 - 2015-2016

derived variables	variable name
rss 01 bas-saint-laurent mental health budget	rss_01_mh_3
rss 01 bas-saint-laurent mental health budget	rss_01_mh_6
rss 01 bas-saint-laurent mental health budget	rss_01_mh_12

1		
2		
3		
4	rss 01 bas-saint-laurent mental health budget	rss_01_mh_24
5	rss 01 bas-saint-laurent mental health budget	rss_01_mh_36
6	rss 01 bas-saint-laurent mental health budget	rss_01_mh_48
7	rss 01 bas-saint-laurent mental health budget	rss_01_mh_60
8		
9	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_3
10	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_6
11	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_12
12	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_24
13	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_36
14	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_48
15	rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_60
16		
17	rss 03 capitale-nationale mental health budget	rss_03_mh_3
18	rss 03 capitale-nationale mental health budget	rss_03_mh_6
19	rss 03 capitale-nationale mental health budget	rss_03_mh_12
20	rss 03 capitale-nationale mental health budget	rss_03_mh_14
21	rss 03 capitale-nationale mental health budget	rss_03_mh_36
22	rss 03 capitale-nationale mental health budget	rss_03_mh_48
23	rss 03 capitale-nationale mental health budget	rss_03_mh_60
24		
25	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_3
26	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_6
27	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_12
28	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_24
29	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_36
30	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_48
31	rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_60
32		
33	rss 05 estrie mental health budget	rss_05_mh_3
34	rss 05 estrie mental health budget	rss_05_mh_6
35	rss 05 estrie mental health budget	rss_05_mh_12
36	rss 05 estrie mental health budget	rss_05_mh_24
37	rss 05 estrie mental health budget	rss_05_mh_36
38	rss 05 estrie mental health budget	rss_05_mh_48
39	rss 05 estrie mental health budget	rss_05_mh_60
40		
41	rss 06 montréal mental health budget	rss_06_mh_3
42	rss 06 montréal mental health budget	rss_06_mh_6
43	rss 06 montréal mental health budget	rss_06_mh_12
44	rss 06 montréal mental health budget	rss_06_mh_24
45	rss 06 montréal mental health budget	rss_06_mh_36
46	rss 06 montréal mental health budget	rss_06_mh_48
47	rss 06 montréal mental health budget	rss_06_mh_60
48		
49	rss 07 outaouais mental health budget	rss_07_mh_3
50	rss 07 outaouais mental health budget	rss_07_mh_6
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1		
2		
3		
4	rss 07 outaouais mental health budget	rss_07_mh_12
5	rss 07 outaouais mental health budget	rss_07_mh_24
6	rss 07 outaouais mental health budget	rss_07_mh_36
7	rss 07 outaouais mental health budget	rss_07_mh_48
8	rss 07 outaouais mental health budget	rss_07_mh_60
9		
10	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_3
11	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_6
12	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_12
13	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_24
14	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_36
15	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_48
16	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_60
17		
18	rss 09 côte-nord mental health budget	rss_09_mh_3
19	rss 09 côte-nord mental health budget	rss_09_mh_6
20	rss 09 côte-nord mental health budget	rss_09_mh_12
21	rss 09 côte-nord mental health budget	rss_09_mh_24
22	rss 09 côte-nord mental health budget	rss_09_mh_36
23	rss 09 côte-nord mental health budget	rss_09_mh_48
24	rss 09 côte-nord mental health budget	rss_09_mh_60
25		
26	rss 10 nord-du-québec mental health budget	rss_10_mh_3
27	rss 10 nord-du-québec mental health budget	rss_10_mh_6
28	rss 10 nord-du-québec mental health budget	rss_10_mh_12
29	rss 10 nord-du-québec mental health budget	rss_10_mh_24
30	rss 10 nord-du-québec mental health budget	rss_10_mh_36
31	rss 10 nord-du-québec mental health budget	rss_10_mh_48
32	rss 10 nord-du-québec mental health budget	rss_10_mh_60
33		
34	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_3
35	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_6
36	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_12
37	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_24
38	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_36
39	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_48
40	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_60
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43	rss 12 chaudière-appalaches mental health budget	rss_12_mh_6
44	rss 12 chaudière-appalaches mental health budget	rss_12_mh_12
45	rss 12 chaudière-appalaches mental health budget	rss_12_mh_24
46	rss 12 chaudière-appalaches mental health budget	rss_12_mh_36
47	rss 12 chaudière-appalaches mental health budget	rss_12_mh_48
48	rss 12 chaudière-appalaches mental health budget	rss_12_mh_60
49		
50	rss 13 laval mental health budget	rss_13_mh_3
51		
52		
53		
54		
55		
56		
57		
58		
59		
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1		
2		
3		
4	rss 13 laval mental health budget	rss_13_mh_6
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6	rss 13 laval mental health budget	rss_13_mh_24
7	rss 13 laval mental health budget	rss_13_mh_36
8	rss 13 laval mental health budget	rss_13_mh_48
9	rss 13 laval mental health budget	rss_13_mh_60
10	rss 13 laval mental health budget	rss_13_mh_60
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12	rss 14 lanaudière mental health budget	rss_14_mh_6
13	rss 14 lanaudière mental health budget	rss_14_mh_12
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42	rss 16 montérégie mental health budget	rss_16_mh_12
43	rss 16 montérégie mental health budget	rss_16_mh_24
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	rss 01 bas-saint-laurent addictions budget	rss_01_a_48
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	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_6
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	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_12
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	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_48
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	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60

1		
2		
3		
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9	rss 03 capitale-nationale addictions budget	rss_03_a_48
10	rss 03 capitale-nationale addictions budget	rss_03_a_60
11	rss 03 capitale-nationale addictions budget	rss_03_a_60
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13	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_6
14	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_12
15	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_24
16	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_36
17	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_48
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22	rss 05 estrie addictions budget	rss_05_a_6
23	rss 05 estrie addictions budget	rss_05_a_12
24	rss 05 estrie addictions budget	rss_05_a_24
25	rss 05 estrie addictions budget	rss_05_a_36
26	rss 05 estrie addictions budget	rss_05_a_48
27	rss 05 estrie addictions budget	rss_05_a_60
28	rss 05 estrie addictions budget	rss_05_a_60
29	rss 05 estrie addictions budget	rss_05_a_60
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56		
57		
58		
59		
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1		
2		
3		
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7	rss 09 côte-nord addictions budget	rss_09_a_12
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11	rss 09 côte-nord addictions budget	rss_09_a_60
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14	rss 10 nord-du-québec addictions budget	rss_10_a_6
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17	rss 10 nord-du-québec addictions budget	rss_10_a_36
18	rss 10 nord-du-québec addictions budget	rss_10_a_48
19	rss 10 nord-du-québec addictions budget	rss_10_a_60
20		
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22	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_6
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25	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_36
26	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_48
27	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
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34	rss 12 chaudière-appalaches addictions budget	rss_12_a_48
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42	rss 13 laval addictions budget	rss_13_a_48
43	rss 13 laval addictions budget	rss_13_a_60
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46	rss 14 lanaudière addictions budget	rss_14_a_6
47	rss 14 lanaudière addictions budget	rss_14_a_12
48	rss 14 lanaudière addictions budget	rss_14_a_24
49	rss 14 lanaudière addictions budget	rss_14_a_36
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56		
57		
58		
59		
60		

rss 14 lanauidière addictions budget	rss_14_a_48
rss 14 lanauidière addictions budget	rss_14_a_60
rss 15 laurentides addictions budget	rss_15_a_3
rss 15 laurentides addictions budget	rss_15_a_6
rss 15 laurentides addictions budget	rss_15_a_12
rss 15 laurentides addictions budget	rss_15_a_24
rss 15 laurentides addictions budget	rss_15_a_36
rss 15 laurentides addictions budget	rss_15_a_48
rss 15 laurentides addictions budget	rss_15_a_60
rss 16 montérégie addictions budget	rss_16_a_3
rss 16 montérégie addictions budget	rss_16_a_6
rss 16 montérégie addictions budget	rss_16_a_12
rss 16 montérégie addictions budget	rss_16_a_24
rss 16 montérégie addictions budget	rss_16_a_36
rss 16 montérégie addictions budget	rss_16_a_48
rss 16 montérégie addictions budget	rss_16_a_60
regional mental health budget (\$/capita)	region_mhbudget_2018-2019
regional mental health budget (\$/capita)	region_mhbudget_2017-2018
regional mental health budget (\$/capita)	region_mhbudget_2016-2017
regional mental health budget (\$/capita)	region_mhbudget_2015-2016
regional addictions budget (\$/capita)	region_abudget_2018-2019
regional addictions budget (\$/capita)	region_abudget_2017-2018
regional addictions budget (\$/capita)	region_abudget_2016-2017
regional addictions budget (\$/capita)	region_abudget_2015-2016

ii. QUALITY OF CARE INDICATORS (QUALITYCARE)

- quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)
- quality of mental health services depression disorder mental health services follow-up in primary care (continuous)
- quality of substance use disorder mental health services follow-up in primary care (continuous)
- quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)
- quality of mental health services follow-up in primary care after suicide attempt (continuous)
- quality of community mental health services (continuous)
- quality of community mental health services of patients with severe mental illness (continuous)
- quality of community mental health services of patients with common mental disorders (continuous)
- quality of community mental health services of patients with personality disorders (continuous)
- adequate use of emergency room for mental health service (continuous)

derived variables	variable name
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_3
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_6
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_12
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_24
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_36
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_48
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_60
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_3
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_6
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quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_24
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_36
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_48
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_60
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_3
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_6
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_12

quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_24
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_36
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_48
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_60
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_3
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_6
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_12
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_24
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_36
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_48
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_60
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_3
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_6
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_12
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_24
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_36
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_48
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_60
quality of community mental health services (continuous)	qcomserv_3

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2	(continuous)	
3	quality of community mental health services	qcomserv_12
4	(continuous)	
5	quality of community mental health services	qcomserv_24
6	(continuous)	
7	quality of community mental health services	qcomserv_36
8	(continuous)	
9	quality of community mental health services	qcomserv_48
10	(continuous)	
11	quality of community mental health services	qcomserv_60
12	(continuous)	
13	quality of community mental health services of	qcomserv_severe_3
14	patients with severe mental illness (continuous)	
15	quality of community mental health services of	qcomserv_severe_6
16	patients with severe mental illness (continuous)	
17	quality of community mental health services of	qcomserv_severe_12
18	patients with severe mental illness (continuous)	
19	quality of community mental health services of	qcomserv_severe_24
20	patients with severe mental illness (continuous)	
21	quality of community mental health services of	qcomserv_severe_36
22	patients with severe mental illness (continuous)	
23	quality of community mental health services of	qcomserv_severe_48
24	patients with severe mental illness (continuous)	
25	quality of community mental health services of	qcomserv_severe_60
26	patients with severe mental illness (continuous)	
27	quality of community mental health services of	qcomserv_cmd_3
28	patients with common mental disorders	
29	(continuous)	
30	quality of community mental health services of	qcomserv_cmd_6
31	patients with common mental disorders	
32	(continuous)	
33	quality of community mental health services of	qcomserv_cmd_12
34	patients with common mental disorders	
35	(continuous)	
36	quality of community mental health services of	qcomserv_cmd_24
37	patients with common mental disorders	
38	(continuous)	
39	quality of community mental health services of	qcomserv_cmd_36
40	patients with common mental disorders	
41	(continuous)	
42	quality of community mental health services of	qcomserv_cmd_48
43	patients with common mental disorders	
44	(continuous)	

quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_60
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_3
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_6
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_12
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_24
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_36
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_48
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_60
adequate use of emergency room for mental health service (continuous)	aduse_er_3
adequate use of emergency room for mental health service (continuous)	aduse_er_6
adequate use of emergency room for mental health service (continuous)	aduse_er_12
adequate use of emergency room for mental health service (continuous)	aduse_er_24
adequate use of emergency room for mental health service (continuous)	aduse_er_36
adequate use of emergency room for mental health service (continuous)	aduse_er_48
adequate use of emergency room for mental health service (continuous)	aduse_er_60

APPENDIX A: CLASSES_MEDICAMENTS_CAROLINE SIROIS 30

AVRIL.XLSX

Mental health mediation

Psychotropic medications						
Group	Sub-group	Medications	Common denomination codes			

Antipsychotics				
	Typical			
		Chlopromazine	1924	
		Flupenthixol	41863	
			43202	
		Fluphenazine	4056	
			4069	
			34284	
		Haloperidol	4394	
			43540	
			43826	
			46292	
		Loxapine	34219	
			37612	
			40745	
		Methotrimeprazine	6045	
		Perphenazine	7176	
			46011	(In combination with amitryptiline)
		Pimozide	33465	
		Pipotiazine	41707	
		Prochlorperazine	45458	
			45528	
			8125	
		Thioridazine	9594	
		Thiopropazine	9568	
		Trifluoperazine	9802	
			34440	
			46108	(In combination with isopropamide)
		Zuclopenthixol	47136	
			47137	
			47138	
	Atypical	Asenapine	47921	
		Aripiprazole	47801	
		Brexpiprazole	48153	
		Clozapine	45580	
		Lurasidone	47939	

		Olanzapine	46318	
			47197	
		Paliperidone	47708	
			47861	
		Quetiapine	47267	
		Risperidone	46156	
			47052	
		Ziprazidone	47717	
Antidepressants - Those mostly used for depression and anxiety disorders				
	SSRIs	Citalopram	46543	
			47317	
		Escitalopram	47553	
			47971	
		Fluoxetine	45504	
		Fluvoxamine	45633	
		Paroxetine	47061	
		Sertraline	45630	
	SNRIs	Desvenlafaxine	47770	
		Duloxetine	47714	
		Levomilnacipran	48075	
		Venlafaxine	46244	
			47118	
	NDRIs	Bupropion	46435	(Also used for tobacco cessation)
			47285	
			48205	(In combination with naltrexone)
	NaSSAs	Mirtazapine	46744	(Also used in low doses for insomnia)
			47408	
	MAOI	Phenelzine	7280	

		Tranlycypromine	9698		
	IRMA	Moclobemide	46427		
			47005		
	SRI+ 5HT1a partial agonist	Vilazodone	48227		
	Serotonin modulator	Vortioxetine	48038		
Other antidepressants - Those mostly used for other indications than depression or anxiety disorders					
	Tricyclics	Amitryptiline	429		
			46011	(Combination with perphenazine)	
		Clomipramine	14781		
		Desipramine	2522		
		Doxepine	3198		
		Imipramine	4784		
		Nortriptyline	6578		
		Trimipramine	9906		
	Inh. S recap + antag 5-HT2	Trazodone	43137		
Mood stabilizers (other than antipsychotics and other medications included in other classes)					
		Carbamazepine	1404		
			10270		
		Gabapentin	46229		
			47100		
		Lamotrigine	47110		
			46248		
		Lithium	47071		
			47237		

			47589	
			5330	
		Oxcarbazepine	46805	
			47430	
		Topiramate	46359	
			47229	
		Valproic acid	38951	
			39393	
			44073	
	Anxiolytics			
	Benzodiazépines	Alprazolam	43501	
		Bromazepam	43488	
		Chlordiazépoxide	1807	
		Clobazam	45591	
		Clonazépam	37872	
		Clorazépate	14768	
		Diazépam	2717	
		Flurazépam	4095	
		Lorazépam	37950	
		Nitrazépam	42045	
		Oxazepam	6786	
		Temazepam	41590	
		Triazolam	39029	
	Buspirone	Buspirone	45609	
	ADHD			
		Amphetamine	507	
			47601	
			48001	
		Amphetamine/dexamphetamine	47486	
		Atomoxetine	47547	
		Dexamphetamine	2626	
		Lisdexamfetamine	47818	
			48000	
		Methylphenidate	48003	

			39302	
		Guanfacine	47979	
Alzheimer's disease				
	Inh. Acetylcholinesterase	Donepezil	47352	
		Galantamine	47415	
			46767	
		Rivastigmine	47726	
			46673	
			47368	
	NMDA	Memantine	47542	

Medication classes – other

MAIN CLASSES	Sub-classes that may be studied	AHFS codes or Medications					
Diabetes		AHFS sub-class					
		68:20	Antidiabetes				
Cardiovascular diseases							
		AFHS sub-class					
	Antithrombotics	20:12	Antithrombotics (anticoagulants, antiplatelets)				et ajouter les CODES DÉNOMINATIONS COMMUNE ASPIRINE: 143 et 46353
	Antihypertensive agents	24:08	Antihypertensives (alpha-agonists, vasodilators)				
		24:20	Alpha-blockers				
		24:24	Beta-blockers				
		24:28	Calcium channel blockers				
		24:32	ACE inhibitors and ARBs				

		40:28	Diuretics			
	Antiarrhythmic and cardiotonic	24:04	Cardiotropic (antiarrhythmics, cardiotonics)			
	Hypolipemians	24:06	Hypolipemians (statins, fibrates, etc)			
	Vasodilators	24:12	Nitrates and other vasodilators			
Respiratory diseases (mediations used to treat COPD and asthma)						
		Medications		Code denomination commune		
		Acclidinium		47986		
		Glycopyrronium		47949		
		Tiotropium		46856		
		Uméclidinium		48109		
		Formotérol		47916		
		Indacatérol		47923		
		Salmétérol		46247		
				47112		
		Olodatérol				
		Glycopyrronium/indacatérol		48033		
		Uméclidinium/vilantérol		48224		
				48029		
		Acclidinium/formotérol				
		Tiotropium/Olodatérol		48064		
		Budésonide/formotérol		47428		
				46800		
				47917		
				47925		
		Fluticasone/salmétérol		46597		
				47335		
		Fluticasone/vilantérol		48006		
		Salbutamol		10530		Exclure les codes de forme: 116, 203,435, 2262, 2088, 2117, 4147
				33634		
				46737		

		Terbutaline		34180			
		Ipratropium		43124		Exclure les codes de forme: 4321, 5582, 5583	
				46640			
		Fénotérol/ipratropium		46288			
		Salbutamol/ipratropium		46302			
				47186			
		Roflumilast		47854			
		Théophyline		9464			
				9490			
				9503			
		Oxtriphylline		43475			
		Aminophylline		46428			
				364			
		Béclométhasone		780			
		Budénoïde		45499			
		Ciclésonide		47626			
		Fluticasone		47712			
				47050			
				46345			
		Fluticasone/azélastine		48092			
		Fluticasone/vilantérol/um éclidinium		48224			
		Fluticasone/salmétérol		47335			
				46597			
		Mométasone		47299			
		Mométasone/Formotérol		48115			
				47914			
				47884			
		Montélukast		47303			
				47302			
				46467			
		Zafirlukast		46401			
				47266			
	Gastro-intestinal disorders	AHFS class		(Example of sub-classes that are included in the 56. class)			
		56.xx		56:08	Antidiarrhea agents		

				56:14	Cholelitholytics	
				56:16	Digestives	
				56:22	Anti-emetics	
				56:28	Anti-acids	
				56:32	Pro-kinetics	
				56:36	Gastro-intestinal anti-inflammatory drugs	
				56:92	Miscellaneous	
Anti-infective agents		AHFS class		(Example of sub-classes that are included in the the 08. class)		
		08.xx		8:08	Anthelmintics	
				8:12	Antibacterials	
				8:14	Antifungals	
				8:16	Antimycobacterials	
				8:18	Antivirals	
				8:30	Antiprotozoals	
				8:36	Urinary Anti-infectives	
				9:32	Anti-Infectives, Miscellaneous	
Antineoplastic agents		AHFS class				
		10.xx				
Pain		AHFS subclass				
		28:08	Analgesic and antipyretics (NSAIDs, opioids, etc)			SAUF
		Specific medications		Codes denomination commune		
		Cyclobenzaprine		46516		
				38873		

		Baclofene		41447			
				46337			
		Orphenadrine		46094			
				46254			
				6734			
	Contraceptives	AHFS subclass	68:12	Anovulants			
	Not included: Glaucoma, Osteoporosis, ear/eyes/nose drugs, corticosteroids, skin medications, Parkinson disease						

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APPENDIX I_2: LIST OF THE CANDIDATE INDICATORS AT THE PROGRAMMATIC AND SYSTEM LEVELS SUPPORTED BY THE HEALTH SERVICES AND PUBLIC HEALTH LITERATURE OR PRACTICES

TABLE 2
List of the candidate indicators at the programmatic and system levels supported by the health services and public health literature or practices

Candidate indicators	Aim	Literature support	Description	Measure	Data sources
1. Quality of anxiety or depressive disorders mental health services follow-up in primary care	Determine adequate care for patient diagnosed with anxiety and depressive disorders in primary care	Based on number of physician visits by Wang, et al. ⁴⁴ and other studies ^{47,48}	Denominator: Individuals aged 15+ years with an anxiety or depressive disorder diagnosis by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received an anxiety or depressive disorder diagnosis with ≥ 4 visits for mental health	QICDSS
2. Quality of depression disorder mental health services follow-up in primary care	Determine adequate care for patient diagnosed with depression in primary care	Based on number of physician visits by Wang, et al. ⁴⁴ and other studies ^{47,48}	Denominator: Individuals aged 15+ years with a diagnosis of depression by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received a depression diagnosis with ≥ 4 visits for mental health	QICDSS
3. Quality of substance use disorder mental health services follow-up in primary care	Determine adequate care for patient diagnosed with substance use disorder in primary care	Based on 4 visits with a family physician for counseling as recommended by NICE ⁵⁶ and the guidelines for American primary care clinicians ⁵⁸	Denominator: Individuals aged 15+ years with a diagnosis of substance use disorder by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received a substance use disorder diagnosis with ≥ 4 visits for mental health	QICDSS
4. Quality of mental health care services follow-up after hospitalization: readmission within 30 days	Determine the quality of mental specialist health care and in-hospital care	Based on the work of the Canadian Institute for Health Information (CIHI) ^{45,47,48}	Denominator: Individuals aged 15+ years admitted in a hospital with a mental health diagnosis in a given year Numerator: Individual readmitted for mental health within 30 days of initial discharge	Prevalence of individuals 15+ years who were readmitted to a hospital for a mental health diagnosis within 30 days of initial discharge	QICDSS
5. Quality of mental health services follow-up in primary care after suicide attempt	Determine the quality of mental health care of readmission rates in the region compared to others	Based on the work of the Canadian Institute for Health Information (CIHI) ^{45,47,48}	Denominator: Individuals aged 15+ years admitted to a hospital for suicide attempt in a given year Numerator: Received ≥ 1 visit to a physician for mental health within 30 days of hospital discharge for suicide attempt	Prevalence of individuals 15+ years who received ≥ 1 visit from a physician within 30 days of initial discharge for suicide attempt	QICDSS (linked to MedEcho for suicide attempt) ^{60,61,50}
6. Quality of community mental health services	Determine the balance of the community-oriented mental health care system	Based on the typologies of primary and specialist (including in-hospital care) ^{45,46,54} mental health care used in the study of suicide attempts ⁵⁵	Denominator: Individuals aged 15+ years with a mental health diagnosis in a given year Numerator: Individuals with exclusively outpatient services – psychiatric or general practitioner (GP)	Prevalence of individuals 15+ years who received a mental health disorder diagnosis with exclusively outpatient services (psychiatric or GP)	QICDSS
7. Quality of community mental health services of patients with severe mental illness	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{45,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with exclusively a GP or a psychiatric outpatient visit for psychotic disorder Numerator: Number of individuals with exclusively a GP or psychiatrist outpatient visits	Prevalence of individuals 15+ years who received a severe mental illness disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
8. Quality of community mental health services of patients with common mental disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{45,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with a psychiatric or a GP outpatient visit for depression Numerator: Number of individuals with exclusively GP outpatient visits	Prevalence of individuals 15+ years who received a common mental disorder diagnosis and used exclusively outpatient services by a GP	QICDSS

Continued on the following page

TABLE 2 (continued)
List of the candidate indicators at the programmatic and system levels supported by the health services and public health literature or practices

Candidate indicators	Aim	Literature support	Description	Measure	Data sources
9. Quality of community mental health services of patients with substance use disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with a psychiatric or a GP outpatient visit for substance use disorder Numerator: Number of individuals with exclusively GP outpatient visits	Prevalence of individuals 15+ years who received a substance use disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
10. Quality of community mental health services of patients with personality disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with exclusively a GP or a psychiatric outpatient visit for personality disorder Numerator: Number of individuals with exclusively a GP or psychiatric outpatient visits	Prevalence of individuals 15+ years who received a personality disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
11. Adequate use of emergency room for mental health services	Determine the balance of utilization of emergency room (ER) for mental health reasons ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{46,60,61}	Denominator: Individuals aged 15+ years with a diagnosis of a mental health disorder Numerator: Number of individuals with ER visits without being admitted	Prevalence of individuals 15+ years who received a diagnosis of mental health disorder with exclusively ER visits without being admitted	QICDSS
12. Program expenditures for mental health services	Determine the strength of the relationship between changes in suicide rates and expenditures for mental health (regional and provincial)	Based on associations found between mental health budget and suicide rates ^{21,23}	Refer to the Gouvernement du Québec ⁴³	Dollars per capita spent on mental health programs (provincial and regional)	Annual financial reports from the Ministère de la santé et des services sociaux (MSSS) ⁴³
13. Program expenditures for addiction services	Determine the strength of the relationship between changes in suicide rates and expenditures for addiction services (regional and provincial)	Based on associations found between mental health budget and suicide rates ^{21,23}	Refer to the Gouvernement du Québec ⁴³	Dollars per capita spent on health programs for addiction services (provincial and regional)	Annual financial reports from the MSSS ⁴³

Abbreviations: CIHI, Canadian Institute for Health Information; ER, emergency room; GP, general practitioner; MSSS, Ministère de la santé et des services sociaux; QICDSS, Quebec Integrated Chronic Disease Surveillance System.

¹ Profile 1: psychiatric inpatient care; profile 2: hospital emergency room (ER); profile 3: psychiatric outpatient care; profile 4: general practitioner (GP) clinics; and profile 5: other medical specialist.

BMJ Open

A case-control study on predicting population risk of suicide using health administrative data: A research protocol

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2022-066423.R1
Article Type:	Protocol
Date Submitted by the Author:	16-Nov-2022
Complete List of Authors:	Wang, JianLi; Dalhousie University, Department of Community Health and Epidemiology Gholi Zadeh Kharrat, Fatemeh; Laval University, Department of Electrical Engineering and Computer Engineering Pelletier, Jean-François; University of Montreal, Department of Psychiatry Rochette, Louis ; Institut national de sante publique du Quebec Pelletier, Eric; INSPQ Lévesque, Pascale; Institut national de santé publique du Québec (INSPQ) Massamba, Victoria; Institut national de santé publique du Québec (INSPQ) Brousseau-Paradis, Camille; University of Montreal, Department of Psychiatry Mohammed, Mada; Dalhousie University, Department of Community Health and Epidemiology Gariépy, Geneviève; Public Health Agency of Canada; University of Montreal, Department of Social and Preventive Medicine Gagné, Christian; Laval University, Electrical Engineering Lesage, Alain ; Institut universitaire en sante mentale de Montreal
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Public health
Keywords:	Suicide & self-harm < PSYCHIATRY, PUBLIC HEALTH, PSYCHIATRY, HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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A case-control study on predicting population risk of suicide using health administrative data: A research protocol

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Abstract

Introduction: Suicide has a complex etiology and is a result of the interaction among the risk and protective factors at the individual, healthcare system, and population levels. Therefore, policy and decision makers and mental health service planners can play an important role in suicide prevention. Although a number of suicide risk predictive tools have been developed, these tools were designed to be used by clinicians for assessing individual risk of suicide. There have been no risk predictive models to be used by policy and decision makers for predicting population risk of suicide at the national, provincial and regional levels. This paper aimed to describe the rationale and methodology for developing risk predictive models for population risk of suicide.

Methods and analysis: A case-control study design will be used to develop sex-specific risk predictive models for population risk of suicide, using statistical regression and machine learning techniques. Routinely collected health administrative data in Quebec, Canada, and community level social deprivation and marginalization data will be used. The developed models will be transformed into the models that can be readily used by policy and decision makers. Two rounds of qualitative interviews with end-users and other stakeholders were proposed to understand their views about the developed models and potential systematic, social and ethical issues for implementation; the first round of qualitative interviews have been completed. We included 9440 suicide cases (7234 males and 2206 females) and 661,780 controls for model development. Three hundred and forty seven variables at individual, healthcare system and community levels have been identified and will be included LASSO regression for feature selection.

Ethics and dissemination: This study is approved by the Health Research Ethics Committee of Dalhousie University, Canada. This study takes an integrated knowledge translation approach, involving knowledge users from the beginning of the process.

Strengths and limitations of this study:

- This study will use routinely collected health administrative data, which are readily accessible to policy and decision makers.
- The candidate predictors include variables at individual, healthcare system and community levels, which reflect the complex etiology of suicide.
- The methodology of model development and validation needs to be improved.
- Some individuals in the control group might have suicide behaviors, which could not be ascertained by health administrative data.
- Important factors such as education, employment and income are not routinely collected by health administrative databases, which is a limitation of this study.

Introduction

Suicide is a major international public health problem. Each year, over 4,500 Canadians take their own life,⁽¹⁾ and more than 700,000 people die because of suicide worldwide,⁽²⁾ imposing enormous impacts on families, communities and societies. As such, suicide prevention has been a top priority of many countries.

Suicide has a complex etiology and is a result of the interaction among the risk and protective factors at the individual, healthcare system, and population levels.^(3–10) Therefore, policy and decision makers and mental health service planners can play an important role in suicide prevention. To facilitate suicide prevention planning, mechanisms should be in place that enable policy and decision makers to make informed decisions and mobilize resources to high-risk populations at the right places, before tragic events occur. This vision requires us to shift the paradigm from predicting individual risk to predicting population risk of suicide. However, the existing suicide risk assessment/predictive tools are not suitable for predicting population risk. Most of the existing risk assessment/risk predictive tools for suicide were designed to be used by clinicians; they were not designed for policy and decision makers.⁽¹¹⁾ Clinicians often use these tools to determine if individual patients are at high risk of suicide presently or in short term (e.g., next week). Whereas policy and decision makers are more concerned about the rate of suicide at the community level (e.g., health regions, provinces/states) in the medium or long term (e.g., in the next 5 or 10 years), driven partly by budgetary decisions that are often made on a yearly basis. Clinicians and policy/decision makers may have different emphases on risk predictive tools as well. For clinicians, an ideal suicide risk predictive tool should have high discriminative power (e.g., a large C statistics), high sensitivity, specificity and positive predictive value. For policy and decision makers, a tool with excellent calibration (i.e., how closely the predicted risk agrees with actual risk in the population) is more useful. To facilitate policy development in suicide prevention at the population level, risk predictive models specifically designed for policy and decision makers are needed.

Ideally, risk predictive models for population risk of suicide are based on large data from the target population. For example, Gradus and colleagues developed sex-specific machine learning algorithms for suicide using data from eight Danish national health and social registries which cover more than 90% of the Danish population.⁽¹²⁾ Kessler et al.'s machine learning (ML) algorithms targeted US Army soldiers who were hospitalized.⁽¹³⁾ Accordingly, these risk predictive algorithms may potentially be used for forecasting the risk of suicide in Danish general population and in the US Army population, respectively. Furthermore, predictive models for population risk may use not only individual data, but also health system level (e.g., quality of mental health care, mental health budget), and community level data (e.g., unemployment rate and social deprivation levels in the community). For instance, Marks and colleagues developed a predictive model for identifying counties at high risk of overdose mortality, which included county-level education, poverty rate, unemployment rate, overdose gravity, and other county-level indicators, among the 3106 counties in the United States.⁽¹⁴⁾ Given the complex etiology of suicide, predicting population risk of suicide may benefit greatly from the integration of data at the individual, health system and community levels.

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4 We undertook a project to develop and validate sex-specific risk predictive models to be used
5 by policy and decision makers to forecast population risk of suicide at the health region level,
6 using routinely collected health administrative data, and to identify the barriers and facilitators
7 to implementation and explore the ethical and privacy issues of the prediction program. In this
8 manuscript, we aimed to describe the methodology of the project, to inform methodological
9 discussions and suicide prevention strategies.
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11

12 **Methods**

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15 This project encompasses the components of quantitative and qualitative investigations and an
16 integrated knowledge translation (IKT). IKT is a model of research co-production, whereby
17 knowledge users are integrated throughout the research process and who can use the research
18 recommendations in practice or policy.⁽¹⁵⁾ IKT approaches are used to improve the relevance
19 and impact of research. The quantitative research involved developing and validating risk
20 prediction models for suicide using advanced ML and visualization methods. The qualitative
21 research is to understand the potential implementation, social, ethics and legal issues
22 associated with the risk prediction program. In line with IKT principles, we involved policy and
23 decision makers at the provincial and national levels, and people with lived experience of
24 suicidality from the beginning of the project. The methodology of each component is described
25 below.
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30 ***Model development and validation***

31 *Target population:* The general population residing in the province of Quebec, Canada. The
32 province had a population of over 8.6 million people in 2021, and about 95% of the population
33 reported being able to conduct a conversation in French. In Quebec, health services are
34 planned and delivered through 18 health regions, 22 integrated health and social services
35 centres, and 166 Centres locaux de santé Communautaire (CLSCs). Budgetary decisions are
36 made at the levels of province and health regions/integrated health and social services centres.
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40 *Data sources:* We will develop the prediction tools by linking the suicide database, the Ministry
41 of Health and Social Services (MSSS) public financial reports (Contour financier - Publications du
42 ministère de la Santé et des Services sociaux (gouv.qc.ca) which include the five health
43 administrative databases below, and the Canadian Urban Environmental Health Research
44 (CANUE) data. The suicide database gathers individual-level data annually based on residents
45 health insurance number from five administrative databases: the vital statistics death database,
46 the physician claims database, the hospital discharge database, the Insured Person Registration
47 File and the public drug plan. The data of these databases (e.g., billing and service procedures
48 codes, service dates) are routinely submitted by clinics and hospitals for billing and
49 administration purposes; no self-reported data were collected from patients. These databases
50 cover up to 98% of the population in Quebec and contain data for over 20,000 death by suicide
51 cases occurred since 1996. Death by suicide cases were those ascertained by Quebec's Coroner
52 office after investigation. The decision is registered in the Quebec vital statistics database. The
53 latter is linked with other health administrative databases of the Quebec Integrated Chronic
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3 Disease Surveillance System (QICDSS) managed by the Quebec's Public Health Agency.(16) With
4 the suicide database and other linkable Ministry financial databases, individual (e.g., sex, age),
5 program (e.g., hospitalization, emergency department visits), and system (e.g., mental health
6 and addiction budgets) level indicators can be identified.(17)
7
8

9 CANUE is a Canadian consortium aiming to build a unique repository of standardized metrics of
10 urban, sub-urban, and rural characteristics, as well as the tools used to produce them
11 (www.canue.ca). The CANUE data contain indicators for unemployment, social deprivation,
12 access to health services and built environment at the community level, and can be linked with
13 health administrative data by postal codes. The CANUE is open and free for research projects.
14 The data linkage was performed at the Quebec Institute of Public Health (INSPQ) where the
15 suicide data are kept. Linking the databases provides an unprecedented sample size and the
16 capability of examining individual, neighborhood, programmatic and systemic indicators of
17 population suicide risk.
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21 Because this study used existing de-identified health administrative data, informed consent
22 from individual patients was waived. This study was approved by the Research Ethics Board of
23 Dalhousie University.
24
25

26 *Study design:* Because the base rate of suicide in the population is low, we proposed to use a
27 case-control study design to develop sex-specific suicide risk predictive algorithms, using both
28 logistic regression modeling and machine learning (ML) techniques. We selected all death by
29 suicide cases that occurred from January 1st 2002 to December 31st 2010.(18) The control group
30 was a 1% random sample of living individuals in Quebec each year, identified from the suicide
31 database. The cases and controls were not matched to allow for maximum variability in
32 predictors.
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36 *Predictors:* Individual, programmatic, systemic and community factors (see Appendix I)
37 happened five years prior to the suicide events will be used as candidate predictors to develop
38 the risk predictive algorithms. For example, we extracted the data about the diagnosis of major
39 depression (an individual level factor) in the past 6, 12, 24, 48 and 60 months, as 5 separate
40 candidate predictors. Similarly, we extracted mental health and addiction budget of each health
41 region (a systemic level factor) in the past 5 years as candidate predictors. The QICDSS(16)
42 provided all the variables drawn from health administrative databases. It covers 98% of the
43 Quebec's population since 1996. The security and continuous quality and maintenance are the
44 responsibility of the Quebec Public health Institute (INSPQ). Information is for administrative
45 (i.e. age, hospital or outpatient contact dates) and clinician reporting (i.e. diagnoses) purposes.
46 Validation of QICDSS physical diagnoses has been achieved by chart reviews(16) and by
47 outcomes for QICDSS psychiatric diagnoses.(19,20) The QICDSS has been exploited over the
48 past decade by a network of INSPQ officers and academic researchers, many are co-authors of
49 publications on the characteristics of patients receiving rare psychiatric interventions,(21) and
50 on personality disorders, schizophrenia and substance use disorders in relation to mortality,
51 including suicide.(22,23) The quality of the data is also reflected by the minimal missing data
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3 associated with the variables, which ranges from 0.87% and 4.12% of the variables in the
4 databases.

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6 The initial selection of candidate predictors is determined by content knowledge (i.e.,
7 known relationships between suicide or suicide behaviors and individual and local area level
8 variables), feasibility of routine data collection, clinical utility and policy relevance through team
9 meetings. Therefore, the pre-determination of candidate predictors was a joint effort between
10 the team members, collaborators, health policy and decision makers and other stakeholders,
11 with the expertise of clinical psychiatry, psychiatric epidemiology, mental health services
12 research, health administrative data, computer science, and mental health policy.

13
14 For the objective of this study, we will use both statistical (e.g., logistic regression
15 modeling) and machine learning (ML) approaches to develop the risk prediction models so that
16 we may compare which approach performs better in predicting population suicide risk and is
17 more feasible to implement. ML can produce complex estimations by searching data for
18 relevant pieces of information and their complex interactions. Therefore, ML is best suited to
19 tackle the combined challenges of high dimensional data analysis associated with risk
20 prediction for suicide. Some predictors that may change over time (e.g., diagnoses,
21 medications, service use, etc.) will be dummy-coded to create time-varying predictors (i.e.,
22 intervals of 0-3,0-6, 0-12, 0-24, 0-36,0-48, and 0-60 months before the first day of the suicide
23 month). Because we included all suicide cases and a sample of controls, the proportion of
24 suicide in the sample is different from that in the general population. Therefore, sampling
25 weights (inversed probability of being selected) were assigned to the controls, while the weight
26 of 1 was assigned to the cases, to ensure the models are applicable to the whole population.

31 *Model development – Machine learning (ML).*

32 ML is a part of Artificial intelligence (AI) that aims to construct systems that automatically
33 improve through experience using advanced statistical and probabilistic techniques. ML has
34 provided significant benefits to a range of fields. Recent research has shown a range of
35 advantages of ML that can assist in detecting, diagnosing, predicting suicide, and treating
36 mental health problems.(24,25) ML methods are divided into categories, i.e., supervised, semi-
37 supervised, unsupervised, and reinforcement.

38
39 Imbalanced classes are a common problem in ML classification, where each class has a
40 disproportionate ratio of observations. To predict the population risk of suicide, Dataset will be
41 imbalanced because of rare cases of suicide as compared with a control group. To address the
42 imbalanced Dataset, we will over-sample the minority class. We will "artificially" duplicate
43 samples from the minority class to over-sample the minority class to correct imbalanced
44 datasets, even though doing so does not provide the model with any new data. In the
45 literature, this method was known as the Synthetic Minority Over-sampling Technique
46 (SMOTE). Then, we will develop supervised learning models such as logistic regression, Random
47 Forest, XGBoost, and Multilayer perceptron with an optimized model architecture. These
48 models' predictive capacity will be assessed by generating the receiver operating characteristic
49 (ROC) curves calculating its AUC and various operating characteristics, including sensitivity,
50 specificity, and positive predictive value for a variety of thresholds.

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52 Interpretability is essential when we deal with healthcare data. It is significant because it
53 is necessary to understand the casualty of learned representations for decision support also
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3 helps to assess whether the model is considering the right features while making a specific
4 prediction. Feature-based model explainability technique, such as Shapley Additive
5 Explanations (SHAP), was derived from game theory; each player decides to contribute to a
6 coalition of players to produce a total value that will be superior to the sum of their individual
7 values. SHAP relies on the Shapley value of both local and global explanations. Shapley's values
8 are model-agnostic, and the marginal contribution of each feature can be calculated by using
9 the input data and the predictions.(26,27) SHAP will use with the global explanation of how
10 much the input features contribute to a model's output.
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14 Model development – logistic regression.

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17 As the first step of model development, we will include all pre-selected variables in penalized
18 least absolute shrinkage and selection operator (LASSO) regression. The LASSO penalization
19 factor selects important predictors by shrinking coefficients for weaker predictors toward zero,
20 excluding predictors with estimated zero coefficients from the final sparse prediction model.
21 We will perform a correlation analysis among variables selected by the LASSO regression, and
22 identify variables that are strongly correlated (e.g., $\gamma \geq 0.60$). Correlated variables will be
23 discussed by team members, and the variables that have better policy implication and clinical
24 utility will be kept and become the candidate predictors for model development.
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28 We will use fixed effect logistic regression to develop the sex-specific statistical models that
29 accounted for clustering at the health regions by including a variable of health region. After
30 LASSO, there may still be a large number of candidate predictors. Backward selection method
31 will be used to eliminate unproductive variables and to identify the model with the best
32 calibration and discrimination. The decisions of model selection will be initially based on the
33 changes in the values of Akaike Information Criterion (AIC) and Bayesian Information Criterion
34 (BIC).(28) Since BIC penalizes for the complexity of the model more than AIC, selection with BIC
35 will generally lead to smaller models than selection with AIC.(28) Once a model is developed,
36 prediction accuracy will be assessed by the discrimination and calibration of the model.
37 Discrimination is the ability of a prediction model to separate those who experienced the
38 outcome events from those who did not. We will quantify this by calculating the C statistic,
39 analogous to the area under a receiver operating characteristic curve. Calibration measures
40 how closely predicted outcomes agree with actual outcomes. For this, we will use D'Agostino's
41 version of the Hosmer-Lemeshow Chi square statistic. Discrimination and calibration compete
42 with each other. Given that the program will be used to forecast population risk of suicide, we
43 will prioritize calibration over discrimination. Stakeholders from different perspectives and
44 scientific backgrounds will meet to determine the content and performance of the risk
45 prediction models developed by statistical and ML techniques, the appropriate formats of data
46 visualization that are acceptable to policy and decision makers, and the feasibility of
47 implementation, which will in turn inform the revision of the models.
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52 The second step of the model development is to estimate the synthetic rates, consisting
53 of two stages. First, for each predictor, the proportions of individuals within each category of
54 that predictor in the initial modeling will be computed, separately by regions. For instance, if
55 hospitalization due to suicide attempt in the past 5 years is a predictor in the model, the
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3 proportion of individuals with this attribute in a specific health region is calculated. If age is a
4 continuous variable in the model, the mean age of the population in a health region is
5 estimated. A syntax program will then be prepared to apply the regression coefficients to the
6 corresponding proportions and means in the data set, and to calculate the logit estimates for
7 each of health regions. The resulting logit values for each of the health region will then be
8 converted into probabilities, giving the estimated risk of suicide in the health region. The
9 region's population counts from Statistics Canada Census data or the provincial health
10 administrative database multiplied by the estimated risk will yield the estimated number of
11 suicide in this health region.
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13
14 The fitted logistic regression model described above estimates the proportion of suicide
15 in the population at a given moment of time as a function of its risk factors in the past. This
16 model is fundamentally etiologic, where the natural reference-point is the moment of the
17 outcome's occurrence, corresponding to the zero time on the etiologic time scale. However,
18 assessment of population risk of suicide over a particular span of time in the future involves a
19 prognostic outlook, where the natural reference-point is the time of prognostication,
20 corresponding to the zero time on the prognostic time scale. Predictive models for individual
21 risk are often developed using a cohort/closed study-population and express the risk of future
22 occurrence of the outcome as a function of current risk factors, and involves consideration of
23 the values of the risk factors at issue at the prognostic time zero only. Whereas population risk
24 models are applied in the context of a dynamic/open population and the estimated risk is a
25 function of risk factors not only at the prognostic time-zero but also throughout the time span
26 at issue. For example, the risk of suicide in the next 5 years in a health region may not only
27 depend on the proportions of people with major depression and of hospitalization due to
28 suicide attempt in the past, but also on whether there will be a reduction or increase in these
29 parameters over the next 5 years, if so in which year. Thus, the population risk of suicide may
30 be projected using the developed model to each future year over a pre-defined time interval.
31 The cumulative incidence of suicide (CI_{0 to t}) from time T = 0 to T = t can be estimated as a
32 function of time- and profile specific risk operating over that time interval:(29)
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$$39 \quad CI_{0 \text{ to } t} = 1 - \exp \left[- \int_0^t (ID_u) du \right]$$

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44 The estimated cumulative risk represents the estimated risk of suicide of a health region over
45 the time period at issue conditionally on the health region's risk profile.
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47 Validation:

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50 For model validation, we will use the suicide data from January 1st, 2011 to December 31st,
51 2019. We will first calculate the yearly, 5-year and 10-year incidence of suicide death at the
52 provincial and health regional levels in males and females (i.e., observed risk). We will apply the
53 developed synthetic models in the validation data to estimate the yearly, 5-year and 10-year
54 incidence of suicide death at the provincial and health regional levels in males and females (i.e.,
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3 predicted risk). We will visually compare and calculate the differences between the predicted
4 and observed risks; smaller differences indicate better calibration with the data and model
5 accuracy. We will use four indicators for assessing model performance: mean average error
6 (MAE), root mean square error (RMSE), Spearman's r , and proportion of correct identification
7 of high risk regions.(14) The MAE is the average magnitude of the difference between the
8 predicted and observed suicide death rate for each health region. The RMSE is the square root
9 of the average magnitude of the difference squared, therefore is similar to MAE but penalises
10 prediction errors with greater magnitude. More accurate predictions will result in smaller MAE
11 and RMSE. Spearman's r compares the predicted ranking of health regions by suicide death rate
12 compared with the actual observed rankings; results closer to 1 indicate that the model was
13 more effective at rank-ordering regions based on suicide death rate. To assess the extent to
14 which high risk regions are correctly identified, we will first disaggregate the predicted and
15 observed suicide rates into quartile groups and categorised all health regions into their
16 corresponding quartiles for both predicted and observed suicide rates. The proportion of health
17 regions observed in the top quartile of observed suicide death rates that were rightly predicted
18 to be in the top quartile will be calculated.

23 24 **Qualitative study**

25 The objective of the qualitative study is to investigate the end-users' views about predicting
26 population risk of suicide, and the potential social, legal, ethical, and privacy issues and
27 mitigation strategies for implementing such a predictive system. Using snowballing techniques,
28 we have invited policy and decision makers at the federal and provincial levels, mental health
29 professionals, individuals who have extensive experience in working with policy and decision
30 makers and who have expertise in suicide prevention, social and health policy, as well as health
31 administrative data, people with lived experience, and advocates for families bereaved by
32 suicide. The qualitative study consists of two rounds of interviews. The first round of interviews
33 were carried out after the general team meeting held in July 2021, at which the study design
34 was finalized. The second round of interviews will be organized once the predictive models are
35 developed. The first round interviews were held through zoom meetings, and follow a series of
36 semi-structured interview questions related to the objectives (see supplementary file#1).
37 Qualitative data collected during the focus groups and qualitative interviews are audio
38 recorded, transcribed, and analyzed with the support of QDA Miner (Provalis).(30) The second
39 round of interviews will be conducted once the prototype models are developed and presented
40 at the second general team meeting which is to be held in late 2022. We will perform an
41 inductive thematic analysis of the focus group and individual interview material, which will be
42 fed by answers to the open questions regarding potential (i) perceptions about the developed
43 prediction models, (ii) social issues, (iii) legal issues, (iv) ethical and privacy issues, and (v)
44 mitigation strategies for implementing such a system. Transcripts will be coded in order to
45 demarcate segments within each of them. We will look for words or short phrases that
46 demonstrate how the associated data segments inform our research objectives. Detailed
47 results from the qualitative analysis of this material will be presented in a separate paper.

53 54 **Patient and Public Involvement**

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3 Engagement with relevant stakeholders (e.g., policy/decision makers, and people with lived
4 experience) through IKT is critical for developing equitable risk predictive algorithms and for
5 maximizing the potential for future implementation. For this project, we have identified and
6 engaged policy/decision makers from the Public Health Agency of Canada and from the INSPQ,
7 as well as 8 people with lived experience. The representatives of INSPQ (EP, PL, VM, LR) were
8 involved in study conceptualization and grant application. PL has been facilitating data
9 extraction, participated in the bi-weekly team meetings. As described above, we have engaged
10 people with lived experience through the qualitative interviews. The next round of qualitative
11 interviews will be held after the prototype of the risk predictive models are developed to have a
12 better understanding about privacy, ethics and implementation issues.
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16 **Ethics and dissemination**

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19 This study will use routinely collected health administrative data. The analysis of secondary de-
20 identified data at the INSPQ where the data are kept will not incur physical and psychological
21 harms. The results of the study will be vetted by analysts at the INSPQ to ensure no privacy and
22 confidentiality will be breached. The data used for this study will be kept at INSPQ for 15 years.
23 The results will be presented in peer-reviewed journals, at academic conferences, and shared
24 with knowledge users who were engaged from the beginning.
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28 Through this study, we aimed to develop risk prediction models to be used by policy and
29 decision makers to forecast population risk of suicide at the provincial and health region levels,
30 using routinely collected health administrative data and other publicly available area-level data.
31 For example, policy and decision makers may use the models to project the proportion and
32 number of suicide deaths in specific health regions/communities over the next 5 years, and
33 decide how resources and community level interventions may be mobilized to the high risk
34 regions/communities. Furthermore, the models can inform policy and decision makers about
35 the potential impacts of these community level intervention on suicide prevention. The
36 potential utility of such predictive tools has been attested by the active involvement by the
37 policy and decision makers at the federal and provincial levels and people with lived
38 experience. Nevertheless, predicting population risk of suicide is new and has not been well
39 studied. There are a number of methodological and implementation challenges to be
40 addressed.
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45 Routinely collected health administrative data and population health survey data represent a
46 unique opportunity for population health projection because it covers a majority of the general
47 population in catchment areas, and the data can be readily accessed by policy and decision
48 makers. Many risk predictive models have been developed for physical and mental health
49 problems in the general population. For example, individual data from population health
50 surveys and health administrative databases have been used to develop risk predictive models
51 for diabetes,(31) heart disease,(32) and major depression.(33,34) These models may be used to
52 identify high risk individuals in the community; they can also be used to forecast the population
53 risk in the future. However, few models have integrated individual, healthcare system, and
54 community level predictors in the same model. In this study, we proposed to include data from
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3 these different levels in model development, and convert the models into synthetic estimation
4 models. There may be different approaches for integrating data from different levels for
5 population risk prediction. Future studies are needed to explore the best method for data
6 integration.
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10 The performance of a risk predictive model is commonly assessed by indicators of model
11 discrimination and calibration.⁽³⁵⁾ Whereas model discrimination is critical for individual risk
12 predictive models, policy and decision makers' focus is on the whole population rather than
13 individuals. Therefore, model calibration plays a more important role in the performance of a
14 population risk model. We proposed four indicators for assessing model performance.
15 However, it is not clear how much error (the difference between predicted and observed risks)
16 policy and decision makers may tolerate for population risk prediction, how they perceive the
17 importance of model discrimination, whether other indicators exist for assessing population
18 risk prediction models. We will explore these aspects through our qualitative study, and also
19 encourage others to consider these in future studies. Similarly, we welcome discussions and
20 debates about the methods for validating population risk predictive models. An individual risk
21 predictive model is often developed using longitudinal cohort/closed population data and
22 validated in a different but related cohort/closed population. This poses challenges for
23 population risk predictive models because the population in a community/health region is open
24 and dynamic. Appropriate methods for model validation and acceptability need to be
25 developed and agreed by the research community and policy and decision makers.
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31 This study relied on routinely collected health administrative data for model development and
32 validation, rather than collecting primary data. Therefore, we have a little information about
33 suicide behaviors among the individuals in the control group, which are strongly associated
34 with suicide deaths. In the model development, we included hospitalization and emergency
35 department visits due to suicide attempt, which may reduce the bias related to the lack of
36 information about suicide behaviors. Nevertheless, this is a limitation of routinely collected
37 health administrative data.
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41 Despite the challenges for developing population risk predictive model for suicide, research is
42 urgently needed to address this important population health issue. This study represents one of
43 the early steps in building such risk predictive models and methodology development, as part
44 of the collective efforts for moving the field forward.
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Authors' contribution:

JLW drafted the manuscript. JLW, FGZK, J-FP, LR, EP, PL, GG, CG, and AL were involved in study design, conceptualization and funding application. JLW, FGZK, J-FP, LR, EP, PL, VM, CB-P, MM, GG, CG, and AL were involved in manuscript review, discussion, revision, and final approval.

Funding statement:

This study is supported by a New Frontiers for Research Funds grant (2019-00471) from Tri-Agency Institutional Programs Secretariat, Government of Canada, and by a Tier I Canada Research Chair award to JLW. The funders play no role in design and operation of this study.

Competing interests: none

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3 Supplementary file #1:
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5
6 Guiding questions for qualitative interviews.
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- 8 1) What are the currently policies and practices for suicide prevention that you know?
9 2) What are the challenges you are facing in suicide prevention at population level?
10 3) What are your views on using risk predictive tools for facilitating suicide prevention in
11 the population? The advantages and drawbacks?
12 4) what are your thoughts about using artificial intelligence and machine learning for
13 suicide prevention? The potential pros and cons?
14 5) From your view, how an ideal risk prediction tool should look like, that assists in your
15 decision making?
16 6) What visualization formats you have been using, and what are the limits of these
17 visualization methods?
18 7) What do you think of the visualization model presented to you?
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APPENDIX I_1: CANDIDATE PREDICTORS

i. PSYCHIATRIC DISORDERS DIAGNOSIS¹

- Substance use disorder²
 - o Alcohol use disorder
 - o drug use disorder
- Mood disorder
 - Major depressive disorder
 - Bipolar disorder
- Anxiety disorder
- Schizophrenia
- Personality disorders
- ADHD
- Other diagnosis

derived variables ³⁴	variable name
Substance use disorder	psydx_subuse_3
Substance use disorder	psydx_subuse_6
Substance use disorder	psydx_subuse_12
Substance use disorder	psydx_subuse_24
Substance use disorder	psydx_subuse_36
Substance use disorder	psydx_subuse_48
Substance use disorder	psydx_subuse_60
Alcohol use disorder	Psydx_alcoholuse_3
Alcohol use disorder	Psydx_alcoholuse_6
Alcohol use disorder	Psydx_alcoholuse_12
Alcohol use disorder	Psydx_alcoholuse_24
Alcohol use disorder	Psydx_alcoholuse_36
Alcohol use disorder	Psydx_alcoholuse_48
Alcohol use disorder	Psydx_alcoholuse_60
Drug use disorder	Psydx_druguse_3
Drug use disorder	Psydx_druguse_6
Drug use disorder	Psydx_druguse_12
Drug use disorder	Psydx_druguse_24
Drug use disorder	Psydx_druguse_36
Drug use disorder	Psydx_druguse_48
Drug use disorder	Psydx_druguse_60

The candidate predictors were captured using timeframes of prior 3, 6, 12, 24, 36, 48, and/or 60 months, indicated by the last digits of the variable name. For instance, "psydx_subuse_3" and "psydx_subuse_6" refer to a diagnosis of substance use disorder in the prior 3 and 6 months, respectively

mood disorder	Psydx_mood_3
mood disorder	Psydx_mood_6
mood disorder	Psydx_mood_12
mood disorder	Psydx_mood_24
mood disorder	Psydx_mood_36
mood disorder	Psydx_mood_48
mood disorder	Psydx_mood_60
Anxiety disorder	psydx_anx_3
Anxiety disorder	psydx_anx_6
Anxiety disorder	psydx_anx_12
Anxiety disorder	psydx_anx_24
Anxiety disorder	psydx_anx_36
Anxiety disorder	psydx_anx_48
Anxiety disorder	psydx_anx_60
Major Depressive Disorder	Psydx_dep_3
Major Depressive Disorder	Psydx_dep_6
Major Depressive Disorder	Psydx_dep_12
Major Depressive Disorder	Psydx_dep_24
Major Depressive Disorder	Psydx_dep_36
Major Depressive Disorder	Psydx_dep_48
Major Depressive Disorder	Psydx_dep_60
Bipolar disorder	Psydx_bipolar_3
Bipolar disorder	Psydx_bipolar_6
Bipolar disorder	Psydx_bipolar_12
Bipolar disorder	Psydx_bipolar_24
Bipolar disorder	Psydx_bipolar_36
Bipolar disorder	Psydx_bipolar_48
Bipolar disorder	Psydx_bipolar_60
Schizophrenia	psydx_scz_3
Schizophrenia	psydx_scz_6
Schizophrenia	psydx_scz_12
Schizophrenia	psydx_scz_24
Schizophrenia	psydx_scz_36
Schizophrenia	psydx_scz_48
Schizophrenia	psydx_scz_60
Personality disorder	psydx_pd_3
Personality disorder	psydx_pd_6
Personality disorder	psydx_pd_12
Personality disorder	psydx_pd_24
Personality disorder	psydx_pd_36
Personality disorder	psydx_pd_48

Personality disorder	psydx_pd_60
ADHD	psydx_adhd_3
ADHD	psydx_adhd_6
ADHD	psydx_adhd_12
ADHD	psydx_adhd_24
ADHD	psydx_adhd_36
ADHD	psydx_adhd_48
ADHD	psydx_adhd_60
Other diagnosis	psydx_otr_3
Other diagnosis	psydx_otr_6
Other diagnosis	psydx_otr_12
Other diagnosis	psydx_otr_24
Other diagnosis	psydx_otr_36
Other diagnosis	psydx_otr_48
Other diagnosis	psydx_otr_60

ii. PHARMACOLOGICAL TREATMENTS FOR MENTAL HEALTH DISORDERS

- Typical antipsychotics
- Atypical antipsychotics
- Clozapine
- Antidepressant for anxiety or depression
- Antidepressants for other reasons
- Mood stabilizer
- Anxiolytic
- ADHD medication

derived variables⁵	variable name
Typical antipsychotics	rx_psy_antipsych_typ_3
Typical antipsychotics	rx_psy_antipsych_typ_6
Typical antipsychotics	rx_psy_antipsych_typ_12
Typical antipsychotics	rx_psy_antipsych_typ_24
Typical antipsychotics	rx_psy_antipsych_typ_36
Typical antipsychotics	rx_psy_antipsych_typ_48
Typical antipsychotics	rx_psy_antipsych_typ_60
Atypical antipsychotics	rx_psy_antipsych_atyp_3
Atypical antipsychotics	rx_psy_antipsych_atyp_6
Atypical antipsychotics	rx_psy_antipsych_atyp_12
Atypical antipsychotics	rx_psy_antipsych_atyp_24
Atypical antipsychotics	rx_psy_antipsych_atyp_36
Atypical antipsychotics	rx_psy_antipsych_atyp_48

Atypical antipsychotics	rx_psy_antipsych_atyp_60
Clozapine	rx_psy_clozapine_3
Clozapine	rx_psy_clozapine_6
Clozapine	rx_psy_clozapine_12
Clozapine	rx_psy_clozapine_24
Clozapine	rx_psy_clozapine_36
Clozapine	rx_psy_clozapine_48
Clozapine	rx_psy_clozapine_60
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_3
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_6
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_12
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_24
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_36
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_48
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_60
antidepressant for other reasons	rx_psy_antidep_otr_3
Antidepressant for other reasons	rx_psy_antidep_otr_6
Antidepressant for other reasons	rx_psy_antidep_otr_12
Antidepressant for other reasons	rx_psy_antidep_otr_24
Antidepressant for other reasons	rx_psy_antidep_otr_36
Antidepressant for other reasons	rx_psy_antidep_otr_48
Antidepressant for other reasons	rx_psy_antidep_otr_60
mood stabilizer	rx_psy_mdestb_3
mood stabilizer	rx_psy_mdestb_6
mood stabilizer	rx_psy_mdestb_12
mood stabilizer	rx_psy_mdestb_24
mood stabilizer	rx_psy_mdestb_36
mood stabilizer	rx_psy_mdestb_48
mood stabilizer	rx_psy_mdestb_60
anxiolytics	rx_psy_anx_3
anxiolytics	rx_psy_anx_6
anxiolytics	rx_psy_anx_12
anxiolytics	rx_psy_anx_24
anxiolytics	rx_psy_anx_36
anxiolytics	rx_psy_anx_48
anxiolytics	rx_psy_anx_60
ADHD medication	rx_psy_adhd_3
ADHD medication	rx_psy_adhd_6
ADHD medication	rx_psy_adhd_12
ADHD medication	rx_psy_adhd_24
ADHD medication	rx_psy_adhd_36

ADHD medication	rx_psy_adhd_48
ADHD medication	rx_psy_adhd_60

iii. NON-PHARMACOLOGICAL TREATMENTS FOR MENTAL HEALTH DISORDERS

- duration of hospitalisations for mental health reasons (continuous, sum of days)
- number of hospitalisations for mental health reasons (continuous)
- duration of hospitalisations for suicide attempt (continuous, sum of days)
- number of hospitalisations for suicide attempt (continuous)
- Number of care center visits for mental health reasons (continuous)
- number of general practitioner visits for mental health reasons (continuous)
- number of emergency room visits for mental health reasons (continuous)
- number of outpatient psychiatrist visits (continuous)
- number of other specialist visits for mental health reasons (continuous)
- number of psychotherapy visits with a psychiatrist (continuous)
- number of psychotherapy visits with a general practitioner (continuous)
- number of psychotherapy visits with another specialist (continuous)
- Number of outpatient paediatrician visits (continuous)
- No mental health services
- number of ECT treatments received (continuous)
- Acute ECT received (dichotomous)
- Maintenance ECT received (dichotomous)

derived variables	variable name
Duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_3
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_6
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_12
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_24
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_36
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_48
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_60
# of hospit for suicide attempt (continuous)	#_hosp_suicide_3
# of hospit for suicide attempt (continuous)	#_hosp_suicide_6
# of hospit for suicide attempt (continuous)	#_hosp_suicide_12
# of hospit for suicide attempt (continuous)	#_hosp_suicide_24
# of hospit for suicide attempt (continuous)	#_hosp_suicide_36
# of hospit for suicide attempt (continuous)	#_hosp_suicide_48
# of hospit for suicide attempt (continuous)	#_hosp_suicide_60
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_3
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_6
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_12
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_24
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_36
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_48
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_60

# of hospit for mh reasons (continuous)	#_hosp_mh_3
# of hospit for mh reasons (continuous)	#_hosp_mh_6
# of hospit for mh reasons (continuous)	#_hosp_mh_12
# of hospit for mh reasons (continuous)	#_hosp_mh_24
# of hospit for mh reasons (continuous)	#_hosp_mh_36
# of hospit for mh reasons (continuous)	#_hosp_mh_48
# of hospit for mh reasons (continuous)	#_hosp_mh_60
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_3
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_6
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_12
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_24
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_36
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_48
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_60
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_3
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_6
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_12
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_24
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_36
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_48
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_60
# of emergency visits for mh reasons (continuous)	#_ER_mh_3
# of emergency visits for mh reasons (continuous)	#_ER_mh_6
# of emergency visits for mh reasons (continuous)	#_ER_mh_12
# of emergency visits for mh reasons (continuous)	#_ER_mh_24
# of emergency visits for mh reasons (continuous)	#_ER_mh_36
# of emergency visits for mh reasons (continuous)	#_ER_mh_48
# of emergency visits for mh reasons (continuous)	#_ER_mh_60
# of GP visits for mh reasons (continuous)	#_gp_mh_3
# of GP visits for mh reasons (continuous)	#_gp_mh_6
# of GP visits for mh reasons (continuous)	#_gp_mh_12
# of GP visits for mh reasons (continuous)	#_gp_mh_24
# of GP visits for mh reasons (continuous)	#_gp_mh_36
# of GP visits for mh reasons (continuous)	#_gp_mh_48
# of GP visits for mh reasons (continuous)	#_gp_mh_60
# of outpatient psychiatrist visits (continuous)	#_psy_mh_3
# of outpatient psychiatrist visits (continuous)	#_psy_mh_6
# of outpatient psychiatrist visits (continuous)	#_psy_mh_12
# of outpatient psychiatrist visits (continuous)	#_psy_mh_24
# of outpatient psychiatrist visits (continuous)	#_psy_mh_36
# of outpatient psychiatrist visits (continuous)	#_psy_mh_48

1		
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4	# of outpatient psychiatrist visits (continuous)	#_psy_mh_60
5	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_3
6	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_6
7	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_12
8	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_24
9		
10	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_36
11	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_48
12	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_60
13	# of other specialist visits for mh reasons (conti)	#_spc_mh_3
14	# of other specialist visits for mh reasons (conti)	#_spc_mh_6
15	# of other specialist visits for mh reasons (conti)	#_spc_mh_12
16	# of other specialist visits for mh reasons (conti)	#_spc_mh_24
17	# of other specialist visits for mh reasons (conti)	#_spc_mh_36
18	# of other specialist visits for mh reasons (conti)	#_spc_mh_48
19	# of other specialist visits for mh reasons (conti)	#_spc_mh_60
20	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_3
21	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_6
22	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_12
23	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_24
24	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_36
25	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_48
26	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_60
27	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_3
28	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_6
29	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_12
30	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_24
31	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_36
32	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_48
33	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_60
34	No mental health services	No_mh_services_3
35	No mental health services	No_mh_services_6
36	No mental health services	No_mh_services_12
37	No mental health services	No_mh_services_24
38	No mental health services	No_mh_services_36
39	No mental health services	No_mh_services_48
40	No mental health services	No_mh_services_60
41	number of ECT received (continuous)	ECT_#_3
42	number of ECT received (continuous)	ECT_#_6
43	number of ECT received (continuous)	ECT_#_12
44	number of ECT received (continuous)	ECT_#_24
45	number of ECT received (continuous)	ECT_#_36
46		
47		
48		
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57		
58		
59		
60		

number of ECT received (continuous)	ECT_#_48
number of ECT received (continuous)	ECT_#_60
acute ECT (dichotomous)	ECT_acute_3
acute ECT (dichotomous)	ECT_acute_6
acute ECT (dichotomous)	ECT_acute_12
acute ECT (dichotomous)	ECT_acute_24
acute ECT (dichotomous)	ECT_acute_36
acute ECT (dichotomous)	ECT_acute_48
acute ECT (dichotomous)	ECT_acute_60
Maintenance ECT (dichotomous)	ECT_maintenance_3
Maintenance ECT (dichotomous)	ECT_maintenance_6
Maintenance ECT (dichotomous)	ECT_maintenance_12
Maintenance ECT (dichotomous)	ECT_maintenance_24
Maintenance ECT (dichotomous)	ECT_maintenance_36
Maintenance ECT (dichotomous)	ECT_maintenance_48
Maintenance ECT (dichotomous)	ECT_maintenance_60

iv. PHYSICAL DIAGNOSIS

- Dementia
- Neurological disease
- Endocrine system disorder
- Trauma
- Respiratory disorder
- Infectious disease
- Digestive disorder
- Cardiovascular disorder
- Cancer
- Other physical disorder
- Charlson/elixhauser index with psy (continuous)⁶
- Charlson/elixhauser index without psy (continuous)

derived variables	variable name
dementia	physdx_dem_3
dementia	physdx_dem_6
dementia	physdx_dem_12
dementia	physdx_dem_24
dementia	physdx_dem_36
dementia	physdx_dem_48
dementia	physdx_dem_60
neurological disease	physdx_neuro_3
neurological disease	physdx_neuro_6

1		
2		
3	neurological disease	physdx_neuro_12
4	neurological disease	physdx_neuro_24
5	neurological disease	physdx_neuro_36
6	neurological disease	physdx_neuro_48
7	neurological disease	physdx_neuro_60
8	neurological disease	physdx_neuro_60
9	endocrine system disorder	physdx_endo_3
10	endocrine system disorder	physdx_endo_6
11	endocrine system disorder	physdx_endo_12
12	endocrine system disorder	physdx_endo_24
13	endocrine system disorder	physdx_endo_36
14	endocrine system disorder	physdx_endo_48
15	endocrine system disorder	physdx_endo_60
16	endocrine system disorder	physdx_endo_60
17	trauma	physdx_trauma_3
18	trauma	physdx_trauma_6
19	trauma	physdx_trauma_12
20	trauma	physdx_trauma_24
21	trauma	physdx_trauma_36
22	trauma	physdx_trauma_48
23	trauma	physdx_trauma_60
24	trauma	physdx_trauma_60
25	respiratory disorder	physdx_resp_3
26	respiratory disorder	physdx_resp_6
27	respiratory disorder	physdx_resp_12
28	respiratory disorder	physdx_resp_24
29	respiratory disorder	physdx_resp_36
30	respiratory disorder	physdx_resp_48
31	respiratory disorder	physdx_resp_60
32	respiratory disorder	physdx_resp_60
33	infectious disease	physdx_infec_3
34	infectious disease	physdx_infec_6
35	infectious disease	physdx_infec_12
36	infectious disease	physdx_infec_24
37	infectious disease	physdx_infec_36
38	infectious disease	physdx_infec_48
39	infectious disease	physdx_infec_60
40	infectious disease	physdx_infec_60
41	digestive disorder	physdx_diges_3
42	digestive disorder	physdx_diges_6
43	digestive disorder	physdx_diges_12
44	digestive disorder	physdx_diges_24
45	digestive disorder	physdx_diges_36
46	digestive disorder	physdx_diges_48
47	digestive disorder	physdx_diges_60
48	digestive disorder	physdx_diges_60
49	cardiovascular disorder	physdx_cvd_3
50		
51		
52		
53		
54		
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56		
57		
58		
59		
60		

1		
2		
3	cardiovascular disorder	physdx_cvd_6
4	cardiovascular disorder	physdx_cvd_12
5	cardiovascular disorder	physdx_cvd_24
6	cardiovascular disorder	physdx_cvd_36
7	cardiovascular disorder	physdx_cvd_48
8	cardiovascular disorder	physdx_cvd_60
9	cardiovascular disorder	physdx_cvd_60
10	cancer	physdx_cncr_3
11	cancer	physdx_cncr_6
12	cancer	physdx_cncr_12
13	cancer	physdx_cncr_24
14	cancer	physdx_cncr_36
15	cancer	physdx_cncr_48
16	cancer	physdx_cncr_60
17	other physical disorders	physdx_otr_3
18	other physical disorders	physdx_otr_6
19	other physical disorders	physdx_otr_12
20	other physical disorders	physdx_otr_24
21	other physical disorders	physdx_otr_36
22	other physical disorders	physdx_otr_48
23	other physical disorders	physdx_otr_60
24	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_3
25	charlson/elixhauser index with psy (conti)	physdx_comorbid_withpsy_6
26	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_12
27	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_24
28	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_36
29	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_48
30	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_60
31	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_3
32	charlson/elixhauser index without psy (conti)	physdx_comorbid_withoutpsy_6
33	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_12
34	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_24
35	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_36
36	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_48
37	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
38	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
39	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
40	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
41	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
42	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
43	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
44	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
45	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
46	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
47	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
48	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
49	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
50	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
51	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
52	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
53	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
54	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
55		
56		
57		
58		
59		
60		

charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_48
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60

V. PHARMACOLOGICAL TREATMENTS FOR PHYSICAL HEALTH DISORDERS

- Medication for diabetes
- Medication for cardiovascular disease
- Medication for respiratory diseases
- Medication for gastro-intestinal disorder
- Anti-infective agent
- Pain medication
- Contraceptive
- Other medication

derived variables	variable name
medication for diabetes	rx_phys_diabetes_3
medication for diabetes	rx_phys_diabetes_6
medication for diabetes	rx_phys_diabetes_12
medication for diabetes	rx_phys_diabetes_24
medication for diabetes	rx_phys_diabetes_36
medication for diabetes	rx_phys_diabetes_48
medication for diabetes	rx_phys_diabetes_60
medication for cardiovascular disease	rx_phys_cvd_3
medication for cardiovascular disease	rx_phys_cvd_6
medication for cardiovascular disease	rx_phys_cvd_12
medication for cardiovascular disease	rx_phys_cvd_24
medication for cardiovascular disease	rx_phys_cvd_36
medication for cardiovascular disease	rx_phys_cvd_48
medication for cardiovascular disease	rx_phys_cvd_60
medication for respiratory disease	rx_phys_resp_3
medication for respiratory disease	rx_phys_resp_6
medication for respiratory disease	rx_phys_resp_12
medication for respiratory disease	rx_phys_resp_24
medication for respiratory disease	rx_phys_resp_36
medication for respiratory disease	rx_phys_resp_48
medication for respiratory disease	rx_phys_resp_60
medication for gastro-intestinal disorder	rx_phys_gi_3
medication for gastro-intestinal disorder	rx_phys_gi_6
medication for gastro-intestinal disorder	rx_phys_gi_12
medication for gastro-intestinal disorder	rx_phys_gi_24
medication for gastro-intestinal disorder	rx_phys_gi_36
medication for gastro-intestinal disorder	rx_phys_gi_48

medication for gastro-intestinal disorder	rx_phys_gi_60
anti-infective agents	rx_phys_antiinfec_3
anti-infective agents	rx_phys_antiinfec_6
anti-infective agents	rx_phys_antiinfec_12
anti-infective agents	rx_phys_antiinfec_24
anti-infective agents	rx_phys_antiinfec_36
anti-infective agents	rx_phys_antiinfec_48
anti-infective agents	rx_phys_antiinfec_60
pain medication	rx_phys_pain_3
pain medication	rx_phys_pain_6
pain medication	rx_phys_pain_12
pain medication	rx_phys_pain_24
pain medication	rx_phys_pain_36
pain medication	rx_phys_pain_48
pain medication	rx_phys_pain_60
contraceptives	rx_phys_contracep_3
contraceptives	rx_phys_contracep_6
contraceptives	rx_phys_contracep_12
contraceptives	rx_phys_contracep_24
contraceptives	rx_phys_contracep_36
contraceptives	rx_phys_contracep_48
contraceptives	rx_phys_contracep_60
other medication	rx_phys_otr_3
other medication	rx_phys_otr_6
other medication	rx_phys_otr_12
other medication	rx_phys_otr_24
other medication	rx_phys_otr_36
other medication	rx_phys_otr_48
other medication	rx_phys_otr_60

vi. NON-PHARMACOLOGICAL TREATMENTS FOR PHYSICAL HEALTH DISORDERS

- duration of hospitalisations for physical health reasons (continuous, sum of days)
- number of hospitalisations for physical health reasons (continuous)
- care center visits/plays for physical health reasons*
- number of general practitioner visits for physical reasons (continuous)*
- number of emergency room visits for physical reasons (continuous)*
- number of outpatient specialist visits for physical health reasons (continuous)*
- number of outpatient paediatrician visits (continuous)*

derived variables	variable name
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_3
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_6
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_12

Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_24
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_36
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_48
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_60
# of hospit for phys reasons (continuous)	#_hosp_phys_3
# of hospit for phys reasons (continuous)	#_hosp_phys_6
# of hospit for phys reasons (continuous)	#_hosp_phys_12
# of hospit for phys reasons (continuous)	#_hosp_phys_24
# of hospit for phys reasons (continuous)	#_hosp_phys_36
# of hospit for phys reasons (continuous)	#_hosp_phys_48
# of hospit for phys reasons (continuous)	#_hosp_phys_60
Care center for physical health reasons	Carectr_phys_3
Care center for physical health reasons	Carectr_phys_6
Care center for physical health reasons	Carectr_phys_12
Care center for physical health reasons	Carectr_phys_24
Care center for physical health reasons	Carectr_phys_36
Care center for physical health reasons	Carectr_phys_48
Care center for physical health reasons	Carectr_phys_60
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_3
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_6
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_12
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_24
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_36
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_48
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_60
# of GP visits for phys reasons (continuous)	#_gp_phys_3
# of GP visits for phys reasons (continuous)	#_gp_phys_6
# of GP visits for phys reasons (continuous)	#_gp_phys_12
# of GP visits for phys reasons (continuous)	#_gp_phys_24
# of GP visits for phys reasons (continuous)	#_gp_phys_36
# of GP visits for phys reasons (continuous)	#_gp_phys_48
# of GP visits for phys reasons (continuous)	#_gp_phys_60
# of emergency visits for phys reasons (continuous)	#_ER_phys_3
# of emergency visits for phys reasons (continuous)	#_ER_phys_6
# of emergency visits for phys reasons (continuous)	#_ER_phys_12
# of emergency visits for phys reasons (continuous)	#_ER_phys_24
# of emergency visits for phys reasons (continuous)	#_ER_phys_36
# of emergency visits for phys reasons (continuous)	#_ER_phys_48
# of emergency visits for phys reasons (continuous)	#_ER_phys_60

vii. INDIVIDUAL SOCIO-DEMOGRAPHIC VARIABLES

- Age (continuous)
- age group: 15-24
- age group: 25-34
- age group: 35-44
- age group: 45-54

- age group: 55-64
- age group: 65-74
- age group: 75-84
- age group: ≥85
- Sex
- Location – rural
- Location – non-rural
- Location – missing data
- rss 01 bas saint-laurent
- rss 02 saguenay-lac-saint-jean
- rss 03 capitale-nationale
- rss 04 mauricie et centre-du-québec
- rss 05 estrie
- rss 06 montréal
- rss 07 outaouais
- rss 08 abitibi-témiscamingue
- rss 09 côte-nord
- rss 10 nord-du-québec
- rss 11gaspésie-îles-de-la-madeleine
- rss 12 chaudière-appalaches
- rss 13 laval
- rss 14 lanaudière
- rss 15 laurentides
- rss 16 montérégie
- Adherence to the public drug plan (RAMQ) (dichotomous)

derived variables	variable name
Age (continuous)	Age_continuous
age group: 15-24	age_15-24
age group: 25-34	age_25-34
age group: 35-44	age_35-44
age group: 45-54	age_45-54
age group: 55-64	age_55-64
age group: 65-74	age_65-74
age group: 75-84	age_75-84
age group: ≥85	age_85+
sex male	sex_m
sex female	sex_f
rss 01 bas-saint-laurent	loc_rss_01_3
rss 01 bas-saint-laurent	loc_rss_01_6
rss 01 bas-saint-laurent	loc_rss_01_12
rss 01 bas-saint-laurent	loc_rss_01_24
rss 01 bas-saint-laurent	loc_rss_01_36

1		
2		
3		
4	rss 01 bas-saint-laurent	loc_rss_01_48
5	rss 01 bas-saint-laurent	loc_rss_01_60
6	rss 02 saguenay-lac-saint-jean	loc_rss_02_3
7	rss 02 saguenay-lac-saint-jean	loc_rss_02_6
8	rss 02 saguenay-lac-saint-jean	loc_rss_02_12
9	rss 02 saguenay-lac-saint-jean	loc_rss_02_24
10	rss 02 saguenay-lac-saint-jean	loc_rss_02_36
11	rss 02 saguenay-lac-saint-jean	loc_rss_02_48
12	rss 02 saguenay-lac-saint-jean	loc_rss_02_60
13	rss 03 capitale-nationale	loc_rss_03_3
14	rss 03 capitale-nationale	loc_rss_03_6
15	rss 03 capitale-nationale	loc_rss_03_12
16	rss 03 capitale-nationale	loc_rss_03_24
17	rss 03 capitale-nationale	loc_rss_03_36
18	rss 03 capitale-nationale	loc_rss_03_48
19	rss 03 capitale-nationale	loc_rss_03_60
20	rss 04 mauricie et centre-du-québec	loc_rss_04_3
21	rss 04 mauricie et centre-du-québec	loc_rss_04_6
22	rss 04 mauricie et centre-du-québec	loc_rss_04_12
23	rss 04 mauricie et centre-du-québec	loc_rss_04_24
24	rss 04 mauricie et centre-du-québec	loc_rss_04_36
25	rss 04 mauricie et centre-du-québec	loc_rss_04_48
26	rss 04 mauricie et centre-du-québec	loc_rss_04_60
27	rss 05 estrie	loc_rss_05_3
28	rss 05 estrie	loc_rss_05_6
29	rss 05 estrie	loc_rss_05_12
30	rss 05 estrie	loc_rss_05_24
31	rss 05 estrie	loc_rss_05_36
32	rss 05 estrie	loc_rss_05_48
33	rss 05 estrie	loc_rss_05_60
34	rss 06 montréal	loc_rss_06_3
35	rss 06 montréal	loc_rss_06_6
36	rss 06 montréal	loc_rss_06_12
37	rss 06 montréal	loc_rss_06_24
38	rss 06 montréal	loc_rss_06_36
39	rss 06 montréal	loc_rss_06_48
40	rss 06 montréal	loc_rss_06_60
41	rss 07 outaouais	loc_rss_07_3
42	rss 07 outaouais	loc_rss_07_6
43	rss 07 outaouais	loc_rss_07_12
44	rss 07 outaouais	loc_rss_07_24
45		
46		
47		
48		
49		
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51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1		
2		
3		
4	rss 07 outaouais	loc_rss_07_36
5	rss 07 outaouais	loc_rss_07_48
6	rss 07 outaouais	loc_rss_07_60
7	08 abitibi-témiscamingue	loc_rss_08_3
8	rss 08 abitibi-témiscamingue	loc_rss_08_6
9	rss 08 abitibi-témiscamingue	loc_rss_08_12
10	rss 08 abitibi-témiscamingue	loc_rss_08_24
11	rss 08 abitibi-témiscamingue	loc_rss_08_36
12	08 abitibi-témiscamingue	loc_rss_08_48
13	rss 08 abitibi-témiscamingue	loc_rss_08_60
14	rss 08 abitibi-témiscamingue	loc_rss_08_60
15	rss 09 côte-nord	loc_rss_09_3
16	rss 09 côte-nord	loc_rss_09_6
17	rss 09 côte-nord	loc_rss_09_12
18	rss 09 côte-nord	loc_rss_09_24
19	rss 09 côte-nord	loc_rss_09_36
20	rss 09 côte-nord	loc_rss_09_48
21	rss 09 côte-nord	loc_rss_09_60
22	rss 10 nord-du-québec	loc_rss_10_3
23	rss 10 nord-du-québec	loc_rss_10_6
24	rss 10 nord-du-québec	loc_rss_10_12
25	rss 10 nord-du-québec	loc_rss_10_24
26	rss 10 nord-du-québec	loc_rss_10_36
27	rss 10 nord-du-québec	loc_rss_10_48
28	rss 10 nord-du-québec	loc_rss_10_60
29	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_3
30	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_6
31	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_12
32	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_24
33	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_36
34	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_48
35	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_60
36	rss 12 chaudière-appalaches	loc_rss_12_3
37	rss 12 chaudière-appalaches	loc_rss_12_6
38	rss 12 chaudière-appalaches	loc_rss_12_12
39	rss 12 chaudière-appalaches	loc_rss_12_24
40	rss 12 chaudière-appalaches	loc_rss_12_36
41	rss 12 chaudière-appalaches	loc_rss_12_48
42	rss 12 chaudière-appalaches	loc_rss_12_60
43	rss 13 laval	loc_rss_13_3
44	rss 13 laval	loc_rss_13_6
45	rss 13 laval	loc_rss_13_12
46		
47		
48		
49		
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1		
2		
3	rss 13 laval	loc_rss_13_24
4	rss 13 laval	loc_rss_13_36
5	rss 13 laval	loc_rss_13_48
6	rss 13 laval	loc_rss_13_60
7	rss 13 laval	loc_rss_13_60
8	rss 14 lanaudière	loc_rss_14_3
9	rss 14 lanaudière	loc_rss_14_6
10	rss 14 lanaudière	loc_rss_14_12
11	rss 14 lanaudière	loc_rss_14_12
12	rss 14 lanaudière	loc_rss_14_24
13	rss 14 lanaudière	loc_rss_14_36
14	rss 14 lanaudière	loc_rss_14_36
15	rss 14 lanaudière	loc_rss_14_48
16	rss 14 lanaudière	loc_rss_14_60
17	rss 14 lanaudière	loc_rss_14_60
18	rss 15 laurentides	loc_rss_15_3
19	rss 15 laurentides	loc_rss_15_6
20	rss 15 laurentides	loc_rss_15_12
21	rss 15 laurentides	loc_rss_15_12
22	rss 15 laurentides	loc_rss_15_24
23	rss 15 laurentides	loc_rss_15_36
24	rss 15 laurentides	loc_rss_15_48
25	rss 15 laurentides	loc_rss_15_60
26	rss 15 laurentides	loc_rss_15_60
27	rss 16 montérégie	loc_rss_16_3
28	rss 16 montérégie	loc_rss_16_6
29	rss 16 montérégie	loc_rss_16_12
30	rss 16 montérégie	loc_rss_16_24
31	rss 16 montérégie	loc_rss_16_24
32	rss 16 montérégie	loc_rss_16_36
33	rss 16 montérégie	loc_rss_16_48
34	rss 16 montérégie	loc_rss_16_60
35	location nonrural	nonrural_3
36	location nonrural	nonrural_6
37	location nonrural	nonrural_6
38	location nonrural	nonrural_12
39	location nonrural	nonrural_12
40	location nonrural	nonrural_24
41	location nonrural	nonrural_36
42	location nonrural	nonrural_48
43	location nonrural	nonrural_60
44	location nonrural	nonrural_60
45	location rural	rural_3
46	location rural	rural_6
47	location rural	rural_12
48	location rural	rural_12
49	location rural	rural_24
50	location rural	rural_36
51	location rural	rural_48
52	location rural	rural_60
53	location rural	rural_60
54	location missing data	loc_missing_3
55	location missing data	loc_missing_6
56		
57		
58		
59		
60		

location missing data	loc_missing_12
location missing data	loc_missing_24
location missing data	loc_missing_36
location missing data	loc_missing_48
location missing data	loc_missing_60
adherence to the public drug plan (RAMQ)	PublicRxPlan_3
adherence to the public drug plan (RAMQ)	PublicRxPlan_6
adherence to the public drug plan (RAMQ)	PublicRxPlan_12
adherence to the public drug plan (RAMQ)	PublicRxPlan_24
adherence to the public drug plan (RAMQ)	PublicRxPlan_36
adherence to the public drug plan (RAMQ)	PublicRxPlan_48
adherence to the public drug plan (RAMQ)	PublicRxPlan_60

ENVIRONMENTAL VARIABLES

i. DEPRIVATION INDEX

- Material deprivation (from 1, least deprived to 5, most deprived)
- Social deprivation (from 1, least deprived to 5, most deprived)

derived variables⁷	variable name
material deprivation (1-5)	matdep_3
material deprivation (1-5)	matdep_6
material deprivation (1-5)	matdep_12
material deprivation (1-5)	matdep_24
material deprivation (1-5)	matdep_36
material deprivation (1-5)	matdep_48
material deprivation (1-5)	matdep_60
social deprivation (1-5)	socdep_3
social deprivation (1-5)	socdep_6
social deprivation (1-5)	socdep_12
social deprivation (1-5)	socdep_24
social deprivation (1-5)	socdep_36
social deprivation (1-5)	socdep_48
social deprivation (1-5)	socdep_60

SYSTEM VARIABLES

i. HEALTH SYSTEM ENVIRONMENT (HEALTH SYSTEM)

- Mental health budget

- Bas-Saint-Laurent
- Saguenay-Lac-Saint-Jean
- Capitale-Nationale
- Mauricie et Centre-du-Québec
- Estrie
- Montréal
- Outaouais
- Abitibi-Témiscamingue
- Côte-Nord
- Nord-du-Québec
- Gaspésie-îles-de-la-Madeleine
- Chaudière-Appalaches
- Laval
- Lanaudière
- Laurentides
- Montérégie
- Addictions budget
 - Bas-Saint-Laurent
 - Saguenay-Lac-Saint-Jean
 - Capitale-Nationale
 - Mauricie et Centre-du-Québec
 - Estrie
 - Montréal
 - Outaouais
 - Abitibi-Témiscamingue
 - Côte-Nord
 - Nord-du-Québec
 - Gaspésie-îles-de-la-Madeleine
 - Chaudière-Appalaches
 - Laval
 - Lanaudière
 - Laurentides
 - Montérégie
- regional mental health budget (\$/capita)
 - 2018-2019
 - 2017-2018
 - 2016-2017
 - 2015-2016
- regional addictions health budget (\$/capita)
 - 2018-2019
 - 2017-2018
 - 2016-2017
 - 2015-2016

derived variables	variable name
rss 01 bas-saint-laurent mental health budget	rss_01_mh_3
rss 01 bas-saint-laurent mental health budget	rss_01_mh_6
rss 01 bas-saint-laurent mental health budget	rss_01_mh_12

rss 01 bas-saint-laurent mental health budget	rss_01_mh_24
rss 01 bas-saint-laurent mental health budget	rss_01_mh_36
rss 01 bas-saint-laurent mental health budget	rss_01_mh_48
rss 01 bas-saint-laurent mental health budget	rss_01_mh_60
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_3
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_6
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_12
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_24
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_36
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_48
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_60
rss 03 capitale-nationale mental health budget	rss_03_mh_3
rss 03 capitale-nationale mental health budget	rss_03_mh_6
rss 03 capitale-nationale mental health budget	rss_03_mh_12
rss 03 capitale-nationale mental health budget	rss_03_mh_14
rss 03 capitale-nationale mental health budget	rss_03_mh_36
rss 03 capitale-nationale mental health budget	rss_03_mh_48
rss 03 capitale-nationale mental health budget	rss_03_mh_60
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_3
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_6
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_12
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_24
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_36
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_48
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_60
rss 05 estrie mental health budget	rss_05_mh_3
rss 05 estrie mental health budget	rss_05_mh_6
rss 05 estrie mental health budget	rss_05_mh_12
rss 05 estrie mental health budget	rss_05_mh_24
rss 05 estrie mental health budget	rss_05_mh_36
rss 05 estrie mental health budget	rss_05_mh_48
rss 05 estrie mental health budget	rss_05_mh_60
rss 06 montréal mental health budget	rss_06_mh_3
rss 06 montréal mental health budget	rss_06_mh_6
rss 06 montréal mental health budget	rss_06_mh_12
rss 06 montréal mental health budget	rss_06_mh_24
rss 06 montréal mental health budget	rss_06_mh_36
rss 06 montréal mental health budget	rss_06_mh_48
rss 06 montréal mental health budget	rss_06_mh_60
rss 07 outaouais mental health budget	rss_07_mh_3
rss 07 outaouais mental health budget	rss_07_mh_6

1		
2		
3		
4	rss 07 outaouais mental health budget	rss_07_mh_12
5	rss 07 outaouais mental health budget	rss_07_mh_24
6	rss 07 outaouais mental health budget	rss_07_mh_36
7	rss 07 outaouais mental health budget	rss_07_mh_48
8	rss 07 outaouais mental health budget	rss_07_mh_60
9		
10	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_3
11	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_6
12	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_12
13	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_24
14	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_36
15	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_48
16	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_60
17		
18	rss 09 côte-nord mental health budget	rss_09_mh_3
19	rss 09 côte-nord mental health budget	rss_09_mh_6
20	rss 09 côte-nord mental health budget	rss_09_mh_12
21	rss 09 côte-nord mental health budget	rss_09_mh_24
22	rss 09 côte-nord mental health budget	rss_09_mh_36
23	rss 09 côte-nord mental health budget	rss_09_mh_48
24	rss 09 côte-nord mental health budget	rss_09_mh_60
25		
26	rss 10 nord-du-québec mental health budget	rss_10_mh_3
27	rss 10 nord-du-québec mental health budget	rss_10_mh_6
28	rss 10 nord-du-québec mental health budget	rss_10_mh_12
29	rss 10 nord-du-québec mental health budget	rss_10_mh_24
30	rss 10 nord-du-québec mental health budget	rss_10_mh_36
31	rss 10 nord-du-québec mental health budget	rss_10_mh_48
32	rss 10 nord-du-québec mental health budget	rss_10_mh_60
33		
34	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_3
35	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_6
36	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_12
37	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_24
38	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_36
39	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_48
40	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_60
41		
42	rss 12 chaudière-appalaches mental health budget	rss_12_mh_3
43	rss 12 chaudière-appalaches mental health budget	rss_12_mh_6
44	rss 12 chaudière-appalaches mental health budget	rss_12_mh_12
45	rss 12 chaudière-appalaches mental health budget	rss_12_mh_24
46	rss 12 chaudière-appalaches mental health budget	rss_12_mh_36
47	rss 12 chaudière-appalaches mental health budget	rss_12_mh_48
48	rss 12 chaudière-appalaches mental health budget	rss_12_mh_60
49		
50	rss 13 laval mental health budget	rss_13_mh_3
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1		
2		
3		
4	rss 13 laval mental health budget	rss_13_mh_6
5	rss 13 laval mental health budget	rss_13_mh_12
6	rss 13 laval mental health budget	rss_13_mh_24
7	rss 13 laval mental health budget	rss_13_mh_36
8	rss 13 laval mental health budget	rss_13_mh_48
9	rss 13 laval mental health budget	rss_13_mh_60
10	rss 13 laval mental health budget	rss_13_mh_60
11	rss 14 lanaudière mental health budget	rss_14_mh_3
12	rss 14 lanaudière mental health budget	rss_14_mh_6
13	rss 14 lanaudière mental health budget	rss_14_mh_12
14	rss 14 lanaudière mental health budget	rss_14_mh_12
15	rss 14 lanaudière mental health budget	rss_14_mh_24
16	rss 14 lanaudière mental health budget	rss_14_mh_24
17	rss 14 lanaudière mental health budget	rss_14_mh_36
18	rss 14 lanaudière mental health budget	rss_14_mh_36
19	rss 14 lanaudière mental health budget	rss_14_mh_48
20	rss 14 lanaudière mental health budget	rss_14_mh_48
21	rss 14 lanaudière mental health budget	rss_14_mh_60
22	rss 14 lanaudière mental health budget	rss_14_mh_60
23	rss 15 laurentides mental health budget	rss_15_mh_3
24	rss 15 laurentides mental health budget	rss_15_mh_3
25	rss 15 laurentides mental health budget	rss_15_mh_6
26	rss 15 laurentides mental health budget	rss_15_mh_6
27	rss 15 laurentides mental health budget	rss_15_mh_12
28	rss 15 laurentides mental health budget	rss_15_mh_12
29	rss 15 laurentides mental health budget	rss_15_mh_24
30	rss 15 laurentides mental health budget	rss_15_mh_24
31	rss 15 laurentides mental health budget	rss_15_mh_36
32	rss 15 laurentides mental health budget	rss_15_mh_36
33	rss 15 laurentides mental health budget	rss_15_mh_48
34	rss 15 laurentides mental health budget	rss_15_mh_48
35	rss 15 laurentides mental health budget	rss_15_mh_60
36	rss 15 laurentides mental health budget	rss_15_mh_60
37	rss 16 montérégie mental health budget	rss_16_mh_3
38	rss 16 montérégie mental health budget	rss_16_mh_3
39	rss 16 montérégie mental health budget	rss_16_mh_6
40	rss 16 montérégie mental health budget	rss_16_mh_6
41	rss 16 montérégie mental health budget	rss_16_mh_12
42	rss 16 montérégie mental health budget	rss_16_mh_12
43	rss 16 montérégie mental health budget	rss_16_mh_24
44	rss 16 montérégie mental health budget	rss_16_mh_24
45	rss 16 montérégie mental health budget	rss_16_mh_36
46	rss 16 montérégie mental health budget	rss_16_mh_36
47	rss 16 montérégie mental health budget	rss_16_mh_48
48	rss 16 montérégie mental health budget	rss_16_mh_48
49	rss 16 montérégie mental health budget	rss_16_mh_60
50	rss 16 montérégie mental health budget	rss_16_mh_60
51	rss 01 bas-saint-laurent addictions budget	rss_01_a_3
52	rss 01 bas-saint-laurent addictions budget	rss_01_a_3
53	rss 01 bas-saint-laurent addictions budget	rss_01_a_6
54	rss 01 bas-saint-laurent addictions budget	rss_01_a_6
55	rss 01 bas-saint-laurent addictions budget	rss_01_a_12
56	rss 01 bas-saint-laurent addictions budget	rss_01_a_12
57	rss 01 bas-saint-laurent addictions budget	rss_01_a_24
58	rss 01 bas-saint-laurent addictions budget	rss_01_a_24
59	rss 01 bas-saint-laurent addictions budget	rss_01_a_36
60	rss 01 bas-saint-laurent addictions budget	rss_01_a_36
	rss 01 bas-saint-laurent addictions budget	rss_01_a_48
	rss 01 bas-saint-laurent addictions budget	rss_01_a_48
	rss 01 bas-saint-laurent addictions budget	rss_01_a_60
	rss 01 bas-saint-laurent addictions budget	rss_01_a_60
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_3
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_3
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_6
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_6
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_12
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_12
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_24
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_24
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_36
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_36
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_48
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_48
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60

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4	rss 03 capitale-nationale addictions budget	rss_03_a_3
5	rss 03 capitale-nationale addictions budget	rss_03_a_6
6	rss 03 capitale-nationale addictions budget	rss_03_a_12
7	rss 03 capitale-nationale addictions budget	rss_03_a_24
8	rss 03 capitale-nationale addictions budget	rss_03_a_36
9	rss 03 capitale-nationale addictions budget	rss_03_a_48
10	rss 03 capitale-nationale addictions budget	rss_03_a_60
11	rss 03 capitale-nationale addictions budget	rss_03_a_60
12	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_3
13	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_6
14	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_12
15	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_24
16	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_36
17	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_48
18	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
19	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
20	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
21	rss 05 estrie addictions budget	rss_05_a_3
22	rss 05 estrie addictions budget	rss_05_a_6
23	rss 05 estrie addictions budget	rss_05_a_12
24	rss 05 estrie addictions budget	rss_05_a_24
25	rss 05 estrie addictions budget	rss_05_a_36
26	rss 05 estrie addictions budget	rss_05_a_48
27	rss 05 estrie addictions budget	rss_05_a_60
28	rss 05 estrie addictions budget	rss_05_a_60
29	rss 05 estrie addictions budget	rss_05_a_60
30	rss 06 montréal addictions budget	rss_06_a_3
31	rss 06 montréal addictions budget	rss_06_a_6
32	rss 06 montréal addictions budget	rss_06_a_12
33	rss 06 montréal addictions budget	rss_06_a_24
34	rss 06 montréal addictions budget	rss_06_a_36
35	rss 06 montréal addictions budget	rss_06_a_48
36	rss 06 montréal addictions budget	rss_06_a_60
37	rss 06 montréal addictions budget	rss_06_a_60
38	rss 06 montréal addictions budget	rss_06_a_60
39	rss 07 outaouais addictions budget	rss_07_a_3
40	rss 07 outaouais addictions budget	rss_07_a_6
41	rss 07 outaouais addictions budget	rss_07_a_12
42	rss 07 outaouais addictions budget	rss_07_a_24
43	rss 07 outaouais addictions budget	rss_07_a_36
44	rss 07 outaouais addictions budget	rss_07_a_48
45	rss 07 outaouais addictions budget	rss_07_a_60
46	rss 07 outaouais addictions budget	rss_07_a_60
47	rss 07 outaouais addictions budget	rss_07_a_60
48	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_3
49	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_6
50	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_12
51	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_24
52	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_36
53	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48
54	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48
55	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48
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4	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_60
5	rss 09 côte-nord addictions budget	rss_09_a_3
6	rss 09 côte-nord addictions budget	rss_09_a_6
7	rss 09 côte-nord addictions budget	rss_09_a_12
8	rss 09 côte-nord addictions budget	rss_09_a_24
9	rss 09 côte-nord addictions budget	rss_09_a_36
10	rss 09 côte-nord addictions budget	rss_09_a_48
11	rss 09 côte-nord addictions budget	rss_09_a_60
12	rss 09 côte-nord addictions budget	rss_09_a_60
13	rss 10 nord-du-québec addictions budget	rss_10_a_3
14	rss 10 nord-du-québec addictions budget	rss_10_a_6
15	rss 10 nord-du-québec addictions budget	rss_10_a_12
16	rss 10 nord-du-québec addictions budget	rss_10_a_24
17	rss 10 nord-du-québec addictions budget	rss_10_a_36
18	rss 10 nord-du-québec addictions budget	rss_10_a_48
19	rss 10 nord-du-québec addictions budget	rss_10_a_60
20	rss 10 nord-du-québec addictions budget	rss_10_a_60
21	rss 10 nord-du-québec addictions budget	rss_10_a_60
22	rss 10 nord-du-québec addictions budget	rss_10_a_60
23	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_3
24	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_6
25	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_12
26	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_24
27	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_24
28	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_36
29	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_48
30	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
31	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
32	rss 12 chaudière-appalaches addictions budget	rss_12_a_3
33	rss 12 chaudière-appalaches addictions budget	rss_12_a_6
34	rss 12 chaudière-appalaches addictions budget	rss_12_a_12
35	rss 12 chaudière-appalaches addictions budget	rss_12_a_24
36	rss 12 chaudière-appalaches addictions budget	rss_12_a_24
37	rss 12 chaudière-appalaches addictions budget	rss_12_a_36
38	rss 12 chaudière-appalaches addictions budget	rss_12_a_48
39	rss 12 chaudière-appalaches addictions budget	rss_12_a_60
40	rss 12 chaudière-appalaches addictions budget	rss_12_a_60
41	rss 13 laval addictions budget	rss_13_a_3
42	rss 13 laval addictions budget	rss_13_a_6
43	rss 13 laval addictions budget	rss_13_a_12
44	rss 13 laval addictions budget	rss_13_a_12
45	rss 13 laval addictions budget	rss_13_a_24
46	rss 13 laval addictions budget	rss_13_a_36
47	rss 13 laval addictions budget	rss_13_a_48
48	rss 13 laval addictions budget	rss_13_a_48
49	rss 13 laval addictions budget	rss_13_a_60
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51	rss 14 lanaudivère addictions budget	rss_14_a_6
52	rss 14 lanaudivère addictions budget	rss_14_a_12
53	rss 14 lanaudivère addictions budget	rss_14_a_12
54	rss 14 lanaudivère addictions budget	rss_14_a_24
55	rss 14 lanaudivère addictions budget	rss_14_a_36
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4	rss 14 lanauidière addictions budget	rss_14_a_48
5	rss 14 lanauidière addictions budget	rss_14_a_60
6	rss 15 laurentides addictions budget	rss_15_a_3
7	rss 15 laurentides addictions budget	rss_15_a_6
8	rss 15 laurentides addictions budget	rss_15_a_12
9	rss 15 laurentides addictions budget	rss_15_a_24
10	rss 15 laurentides addictions budget	rss_15_a_36
11	rss 15 laurentides addictions budget	rss_15_a_48
12	rss 15 laurentides addictions budget	rss_15_a_60
13	rss 16 montérégie addictions budget	rss_16_a_3
14	rss 16 montérégie addictions budget	rss_16_a_6
15	rss 16 montérégie addictions budget	rss_16_a_12
16	rss 16 montérégie addictions budget	rss_16_a_24
17	rss 16 montérégie addictions budget	rss_16_a_36
18	rss 16 montérégie addictions budget	rss_16_a_48
19	rss 16 montérégie addictions budget	rss_16_a_60
20	regional mental health budget (\$/capita)	region_mhbudget_2018-2019
21	regional mental health budget (\$/capita)	region_mhbudget_2017-2018
22	regional mental health budget (\$/capita)	region_mhbudget_2016-2017
23	regional mental health budget (\$/capita)	region_mhbudget_2015-2016
24	regional addictions budget (\$/capita)	region_abudget_2018-2019
25	regional addictions budget (\$/capita)	region_abudget_2017-2018
26	regional addictions budget (\$/capita)	region_abudget_2016-2017
27	regional addictions budget (\$/capita)	region_abudget_2015-2016
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ii. QUALITY OF CARE INDICATORS (QUALITYCARE)

- quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)
- quality of mental health services depression disorder mental health services follow-up in primary care (continuous)
- quality of substance use disorder mental health services follow-up in primary care (continuous)
- quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)
- quality of mental health services follow-up in primary care after suicide attempt (continuous)
- quality of community mental health services (continuous)
- quality of community mental health services of patients with severe mental illness (continuous)
- quality of community mental health services of patients with common mental disorders (continuous)
- quality of community mental health services of patients with personality disorders (continuous)
- adequate use of emergency room for mental health service (continuous)

derived variables	variable name
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_3
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_6
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_12
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_24
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_36
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_48
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_60
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_3
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_6
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_12
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_24
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_36
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_48
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_60
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_3
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_6
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_12

quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_24
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_36
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_48
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_60
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_3
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_6
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_12
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_24
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_36
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_48
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_60
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_3
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_6
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_12
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_24
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_36
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_48
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_60
quality of community mental health services (continuous)	qcomserv_3

quality of community mental health services (continuous)	qcomserv_6
quality of community mental health services (continuous)	qcomserv_12
quality of community mental health services (continuous)	qcomserv_24
quality of community mental health services (continuous)	qcomserv_36
quality of community mental health services (continuous)	qcomserv_48
quality of community mental health services (continuous)	qcomserv_60
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_3
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_6
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_12
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_24
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_36
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_48
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_60
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_3
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_6
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_12
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_24
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_36
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_48

quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_60
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_3
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_6
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_12
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_24
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_36
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_48
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_60
adequate use of emergency room for mental health service (continuous)	aduse_er_3
adequate use of emergency room for mental health service (continuous)	aduse_er_6
adequate use of emergency room for mental health service (continuous)	aduse_er_12
adequate use of emergency room for mental health service (continuous)	aduse_er_24
adequate use of emergency room for mental health service (continuous)	aduse_er_36
adequate use of emergency room for mental health service (continuous)	aduse_er_48
adequate use of emergency room for mental health service (continuous)	aduse_er_60

APPENDIX A: CLASSES_MEDICAMENTS_CAROLINE SIROIS 30

AVRIL.XLSX

Mental health medication

Psychotropic medications						
Group	Sub-group	Medications	Common denomination codes			

Antipsychotics				
	Typical			
		Chlopromazine	1924	
		Flupenthixol	41863	
			43202	
		Fluphenazine	4056	
			4069	
			34284	
		Haloperidol	4394	
			43540	
			43826	
			46292	
		Loxapine	34219	
			37612	
			40745	
		Methotrimeprazine	6045	
		Perphenazine	7176	
			46011	(In combination with amitryptiline)
		Pimozide	33465	
		Pipotiazine	41707	
		Prochlorperazine	45458	
			45528	
			8125	
		Thioridazine	9594	
		Thiopropazine	9568	
		Trifluoperazine	9802	
			34440	
			46108	(In combination with isopropamide)
		Zuclopenthixol	47136	
			47137	
			47138	
	Atypical	Asenapine	47921	
		Aripiprazole	47801	
		Brexpiprazole	48153	
		Clozapine	45580	
		Lurasidone	47939	

		Olanzapine	46318	
			47197	
		Paliperidone	47708	
			47861	
		Quetiapine	47267	
		Risperidone	46156	
			47052	
		Ziprasidone	47717	
Antidepressants - Those mostly used for depression and anxiety disorders				
	SSRIs	Citalopram	46543	
			47317	
		Escitalopram	47553	
			47971	
		Fluoxetine	45504	
		Fluvoxamine	45633	
		Paroxetine	47061	
		Sertraline	45630	
	SNRIs	Desvenlafaxine	47770	
		Duloxetine	47714	
		Levomilnacipran	48075	
		Venlafaxine	46244	
			47118	
	NDRIs	Bupropion	46435	(Also used for tobacco cessation)
			47285	
			48205	(In combination with naltrexone)
	NaSSAs	Mirtazapine	46744	(Also used in low doses for insomnia)
			47408	
	MAOI	Phenelzine	7280	

		Tranlycypromine	9698		
	IRMA	Moclobemide	46427		
			47005		
	SRI+ 5HT1a partial agonist	Vilazodone	48227		
	Serotonin modulator	Vortioxetine	48038		
Other antidepressants - Those mostly used for other indications than depression or anxiety disorders					
	Tricyclics	Amitryptiline	429		
			46011	(Combination with perphenazine)	
		Clomipramine	14781		
		Desipramine	2522		
		Doxepine	3198		
		Imipramine	4784		
		Nortriptyline	6578		
		Trimipramine	9906		
	Inh. S recap + antag 5-HT2	Trazodone	43137		
Mood stabilizers (other than antipsychotics and other medications included in other classes)					
		Carbamazepine	1404		
			10270		
		Gabapentin	46229		
			47100		
		Lamotrigine	47110		
			46248		
		Lithium	47071		
			47237		

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			47589		
			5330		
		Oxcarbazepine	46805		
			47430		
		Topiramate	46359		
			47229		
		Valproic acid	38951		
			39393		
			44073		
Anxiolytics					
	Benzodiazépines	Alprazolam	43501		
		Bromazepam	43488		
		Chlordiazépoxide	1807		
		Clobazam	45591		
		Clonazépam	37872		
		Clorazépate	14768		
		Diazépam	2717		
		Flurazépam	4095		
		Lorazépam	37950		
		Nitrazépam	42045		
		Oxazepam	6786		
		Temazepam	41590		
		Triazolam	39029		
	Buspirone	Buspirone	45609		
ADHD					
		Amphetamine	507		
			47601		
			48001		
		Amphetamine/dexamphetamine	47486		
		Atomoxetine	47547		
		Dexamphetamine	2626		
		Lisdexamfetamine	47818		
			48000		
		Methylphenidate	48003		

			39302	
		Guanfacine	47979	
Alzheimer's disease				
	Inh. Acetylcholinesterase	Donepezil	47352	
		Galantamine	47415	
			46767	
		Rivastigmine	47726	
			46673	
			47368	
	NMDA	Memantine	47542	

Medication classes – other

MAIN CLASSES	Sub-classes that may be studied	AHFS codes or Medications					
Diabetes		AHFS sub-class					
		68:20	Antidiabetes				
Cardiovascular diseases							
		AFHS sub-class					
	Antithrombotics	20:12	Antithrombotics (anticoagulants, antiplatelets)				et ajouter les CODES DÉNOMINATIONS COMMUNE ASPIRINE: 143 et 46353
	Antihypertensive agents	24:08	Antihypertensives (alpha-agonists, vasodilators)				
		24:20	Alpha-blockers				
		24:24	Beta-blockers				
		24:28	Calcium channel blockers				
		24:32	ACE inhibitors and ARBs				

		40:28	Diuretics			
	Antiarrhythmic and cardiotonic	24:04	Cardiotropic (antiarrhythmics, cardiotonics)			
	Hypolipemians	24:06	Hypolipemians (statins, fibrates, etc)			
	Vasodilators	24:12	Nitrates and other vasodilators			
Respiratory diseases (medications used to treat COPD and asthma)						
		Medications		Code denomination commune		
		Acidinium		47986		
		Glycopyrronium		47949		
		Tiotropium		46856		
		Uméclidinium		48109		
		Formotérol		47916		
		Indacatérol		47923		
		Salmétérol		46247		
				47112		
		Olodatérol				
		Glycopyrronium/indacatérol		48033		
		Uméclidinium/vilantérol		48224		
				48029		
		Acidinium/formotérol				
		Tiotropium/Olodatérol		48064		
		Budésonide/formotérol		47428		
				46800		
				47917		
				47925		
		Fluticasone/salmétérol		46597		
				47335		
		Fluticasone/vilantérol		48006		
		Salbutamol		10530		Exclure les codes de forme: 116, 203,435, 2262, 2088, 2117, 4147
				33634		
				46737		

		Terbutaline		34180			
		Ipratropium		43124			Exclure les codes de forme: 4321, 5582, 5583
				46640			
		Fénotérol/ipratropium		46288			
		Salbutamol/ipratropium		46302			
				47186			
		Roflumilast		47854			
		Théophylline		9464			
				9490			
				9503			
		Oxtriphylline		43475			
		Aminophylline		46428			
				364			
		Béclométhasone		780			
		Budénoside		45499			
		Ciclésone		47626			
		Fluticasone		47712			
				47050			
				46345			
		Fluticasone/azélastine		48092			
		Fluticasone/vilantérol/um éclidinium		48224			
		Fluticasone/salmétérol		47335			
				46597			
		Mométasone		47299			
		Mométasone/Formotérol		48115			
				47914			
				47884			
		Montélukast		47303			
				47302			
				46467			
		Zafirlukast		46401			
				47266			
	Gastro-intestinal disorders	AHFS class		(Example of sub-classes that are included in the 56. class)			
		56.xx		56:08	Antidiarrhea agents		

				56:14	Cholelitholytics	
				56:16	Digestives	
				56:22	Anti-emetics	
				56:28	Anti-acids	
				56:32	Pro-kinetics	
				56:36	Gastro-intestinal anti-inflammatory drugs	
				56:92	Miscellaneous	
Anti-infective agents		AHFS class		(Example of sub-classes that are included in the the 08. class)		
		08.xx		8:08	Anthelmintics	
				8:12	Antibacterials	
				8:14	Antifungals	
				8:16	Antimycobacterials	
				8:18	Antivirals	
				8:30	Antiprotozoals	
				8:36	Urinary Anti-infectives	
				9:32	Anti-Infectives, Miscellaneous	
Antineoplastic agents		AHFS class				
		10.xx				
Pain		AHFS subclass				
		28:08	Analgesic and antipyretics (NSAIDs, opioids, etc)			SAUF
		Specific medications		Codes denomination commune		
		Cyclobenzaprine		46516		
				38873		

		Baclofene		41447			
				46337			
		Orphenadrine		46094			
				46254			
				6734			
	Contraceptives	AHFS subclass	68:12	Anovulants			
	Not included: Glaucoma, Osteoporosis, ear/eyes/nose drugs, corticosteroids, skin medications, Parkinson disease						

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APPENDIX I_2: LIST OF THE CANDIDATE INDICATORS AT THE PROGRAMMATIC AND SYSTEM LEVELS SUPPORTED BY THE HEALTH SERVICES AND PUBLIC HEALTH LITERATURE OR PRACTICES

TABLE 2
List of the candidate indicators at the programmatic and system levels supported by the health services and public health literature or practices

Candidate indicators	Aim	Literature support	Description	Measure	Data sources
1. Quality of anxiety or depressive disorders mental health services follow-up in primary care	Determine adequate care for patient diagnosed with anxiety and depressive disorders in primary care	Based on number of physician visits by Wang, et al. ⁴⁴ and other studies ^{47,48}	Denominator: Individuals aged 15+ years with an anxiety or depressive disorder diagnosis by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received an anxiety or depressive disorder diagnosis with ≥ 4 visits for mental health	QICDSS
2. Quality of depression disorder mental health services follow-up in primary care	Determine adequate care for patient diagnosed with depression in primary care	Based on number of physician visits by Wang, et al. ⁴⁴ and other studies ^{47,48}	Denominator: Individuals aged 15+ years with a diagnosis of depression by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received a depression diagnosis with ≥ 4 visits for mental health	QICDSS
3. Quality of substance use disorder mental health services follow-up in primary care	Determine adequate care for patient diagnosed with substance use disorder in primary care	Based on 4 visits with a family physician for counseling as recommended by NICE ⁵⁶ and the guidelines for American primary care clinicians ⁵⁸	Denominator: Individuals aged 15+ years with a diagnosis of substance use disorder by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received a substance use disorder diagnosis with ≥ 4 visits for mental health	QICDSS
4. Quality of mental health care services follow-up after hospitalization: readmission within 30 days	Determine the quality of mental specialist health care and in-hospital care	Based on the work of the Canadian Institute for Health Information (CIHI) ^{45,47,48}	Denominator: Individuals aged 15+ years admitted in a hospital with a mental health diagnosis in a given year Numerator: Individual readmitted for mental health within 30 days of initial discharge	Prevalence of individuals 15+ years who were readmitted to a hospital for a mental health diagnosis within 30 days of initial discharge	QICDSS
5. Quality of mental health services follow-up in primary care after suicide attempt	Determine the quality of mental health care of readmission rates in the region compared to others	Based on the work of the Canadian Institute for Health Information (CIHI) ^{45,47,48}	Denominator: Individuals aged 15+ years admitted to a hospital for suicide attempt in a given year Numerator: Received ≥ 1 visit to a physician for mental health within 30 days of hospital discharge for suicide attempt	Prevalence of individuals 15+ years who received ≥ 1 visit from a physician within 30 days of initial discharge for suicide attempt	QICDSS (linked to MedEcho for suicide attempt) ^{40,41,50}
6. Quality of community mental health services	Determine the balance of the community-oriented mental health care system	Based on the typologies of primary and specialist (including in-hospital care) mental health care ^{45,46,54} used in the study of suicide attempts ⁵⁵	Denominator: Individuals aged 15+ years with a mental health diagnosis in a given year Numerator: Individuals with exclusively outpatient services – psychiatric or general practitioner (GP)	Prevalence of individuals 15+ years who received a mental health disorder diagnosis with exclusively outpatient services (psychiatric or GP)	QICDSS
7. Quality of community mental health services of patients with severe mental illness	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{45,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with exclusively a GP or a psychiatric outpatient visit for psychotic disorder Numerator: Number of individuals with exclusively a GP or psychiatrist outpatient visits	Prevalence of individuals 15+ years who received a severe mental illness disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
8. Quality of community mental health services of patients with common mental disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{45,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with a psychiatric or a GP outpatient visit for depression Numerator: Number of individuals with exclusively GP outpatient visits	Prevalence of individuals 15+ years who received a common mental disorder diagnosis and used exclusively outpatient services by a GP	QICDSS

Continued on the following page

TABLE 2 (continued)
List of the candidate indicators at the programmatic and system levels supported by the health services and public health literature or practices

Candidate indicators	Aim	Literature support	Description	Measure	Data sources
9. Quality of community mental health services of patients with substance use disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with a psychiatric or a GP outpatient visit for substance use disorder Numerator: Number of individuals with exclusively GP outpatient visits	Prevalence of individuals 15+ years who received a substance use disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
10. Quality of community mental health services of patients with personality disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with exclusively a GP or a psychiatric outpatient visit for personality disorder Numerator: Number of individuals with exclusively a GP or psychiatric outpatient visits	Prevalence of individuals 15+ years who received a personality disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
11. Adequate use of emergency room for mental health services	Determine the balance of utilization of emergency room (ER) for mental health reasons ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{46,60,61}	Denominator: Individuals aged 15+ years with a diagnosis of a mental health disorder Numerator: Number of individuals with ER visits without being admitted	Prevalence of individuals 15+ years who received a diagnosis of mental health disorder with exclusively ER visits without being admitted	QICDSS
12. Program expenditures for mental health services	Determine the strength of the relationship between changes in suicide rates and expenditures for mental health (regional and provincial)	Based on associations found between mental health budget and suicide rates ^{21,23}	Refer to the Gouvernement du Québec ⁴³	Dollars per capita spent on mental health programs (provincial and regional)	Annual financial reports from the Ministère de la santé et des services sociaux (MSSS) ⁴³
13. Program expenditures for addiction services	Determine the strength of the relationship between changes in suicide rates and expenditures for addiction services (regional and provincial)	Based on associations found between mental health budget and suicide rates ^{21,23}	Refer to the Gouvernement du Québec ⁴³	Dollars per capita spent on health programs for addiction services (provincial and regional)	Annual financial reports from the MSSS ⁴³

Abbreviations: CIHI, Canadian Institute for Health Information; ER, emergency room; GP, general practitioner; MSSS, Ministère de la santé et des services sociaux; QICDSS, Quebec Integrated Chronic Disease Surveillance System.

¹ Profile 1: psychiatric inpatient care; profile 2: hospital emergency room (ER); profile 3: psychiatric outpatient care; profile 4: general practitioner (GP) clinics; and profile 5: other medical specialist.

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BMJ Open

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Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2022-066423.R2
Article Type:	Protocol
Date Submitted by the Author:	27-Jan-2023
Complete List of Authors:	Wang, JianLi; Dalhousie University, Department of Community Health and Epidemiology Gholi Zadeh Kharrat, Fatemeh; Laval University, Department of Electrical Engineering and Computer Engineering Pelletier, Jean-François; University of Montreal, Department of Psychiatry Rochette, Louis ; Institut national de sante publique du Quebec Pelletier, Eric; INSPQ Lévesque, Pascale; Institut national de santé publique du Québec (INSPQ) Massamba, Victoria; Institut national de santé publique du Québec (INSPQ) Brousseau-Paradis, Camille; University of Montreal, Department of Psychiatry Mohammed, Mada; Dalhousie University, Department of Community Health and Epidemiology Gariépy, Geneviève; Public Health Agency of Canada; University of Montreal, Department of Social and Preventive Medicine Gagné, Christian; Laval University, Electrical Engineering Lesage, Alain ; Institut universitaire en sante mentale de Montreal
Primary Subject Heading:	Mental health
Secondary Subject Heading:	Public health
Keywords:	Suicide & self-harm < PSYCHIATRY, PUBLIC HEALTH, PSYCHIATRY, HEALTH SERVICES ADMINISTRATION & MANAGEMENT

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A case-control study on predicting population risk of suicide using health administrative data: A research protocol

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Abstract

Introduction: Suicide has a complex etiology and is a result of the interaction among the risk and protective factors at the individual, healthcare system, and population levels. Therefore, policy and decision makers and mental health service planners can play an important role in suicide prevention. Although a number of suicide risk predictive tools have been developed, these tools were designed to be used by clinicians for assessing individual risk of suicide. There have been no risk predictive models to be used by policy and decision makers for predicting population risk of suicide at the national, provincial and regional levels. This paper aimed to describe the rationale and methodology for developing risk predictive models for population risk of suicide.

Methods and analysis: A case-control study design will be used to develop sex-specific risk predictive models for population risk of suicide, using statistical regression and machine learning techniques. Routinely collected health administrative data in Quebec, Canada, and community level social deprivation and marginalization data will be used. The developed models will be transformed into the models that can be readily used by policy and decision makers. Two rounds of qualitative interviews with end-users and other stakeholders were proposed to understand their views about the developed models and potential systematic, social and ethical issues for implementation; the first round of qualitative interviews have been completed. We included 9440 suicide cases (7234 males and 2206 females) and 661,780 controls for model development. Three hundred and forty seven variables at individual, healthcare system and community levels have been identified and will be included LASSO regression for feature selection.

Ethics and dissemination: This study is approved by the Health Research Ethics Committee of Dalhousie University, Canada. This study takes an integrated knowledge translation approach, involving knowledge users from the beginning of the process.

Strengths and limitations of this study:

- This study will use routinely collected health administrative data, which are readily accessible to policy and decision makers.
- The candidate predictors include variables at individual, healthcare system and community levels, which reflect the complex etiology of suicide.
- The methodology of model development and validation needs to be improved.
- Some individuals in the control group might have suicide behaviors, which could not be ascertained by health administrative data.
- Important factors such as education, employment and income are not routinely collected by health administrative databases, which is a limitation of this study.

Introduction

Suicide is a major international public health problem. Each year, over 4,500 Canadians take their own life,⁽¹⁾ and more than 700,000 people die because of suicide worldwide,⁽²⁾ imposing enormous impacts on families, communities and societies. As such, suicide prevention has been a top priority of many countries.

Suicide has a complex etiology and is a result of the interaction among the risk and protective factors at the individual, healthcare system, and population levels.^(3–10) Therefore, policy and decision makers and mental health service planners can play an important role in suicide prevention. To facilitate suicide prevention planning, mechanisms should be in place that enable policy and decision makers to make informed decisions and mobilize resources to high-risk populations at the right places, before tragic events occur. This vision requires us to shift the paradigm from predicting individual risk to predicting population risk of suicide. However, the existing suicide risk assessment/predictive tools are not suitable for predicting population risk. Most of the existing risk assessment/risk predictive tools for suicide were designed to be used by clinicians; they were not designed for policy and decision makers.⁽¹¹⁾ Clinicians often use these tools to determine if individual patients are at high risk of suicide presently or in short term (e.g., next week). Whereas policy and decision makers are more concerned about the rate of suicide at the community level (e.g., health regions, provinces/states) in the medium or long term (e.g., in the next 5 or 10 years), driven partly by budgetary decisions that are often made on a yearly basis. Clinicians and policy/decision makers may have different emphases on risk predictive tools as well. For clinicians, an ideal suicide risk predictive tool should have high discriminative power (e.g., a large C statistics), high sensitivity, specificity and positive predictive value. For policy and decision makers, a tool with excellent calibration (i.e., how closely the predicted risk agrees with actual risk in the population) is more useful. To facilitate policy development in suicide prevention at the population level, risk predictive models specifically designed for policy and decision makers are needed.

Ideally, risk predictive models for population risk of suicide are based on large data from the target population. For example, Gradus and colleagues developed sex-specific machine learning algorithms for suicide using data from eight Danish national health and social registries which cover more than 90% of the Danish population.⁽¹²⁾ Kessler et al.'s machine learning (ML) algorithms targeted US Army soldiers who were hospitalized.⁽¹³⁾ Accordingly, these risk predictive algorithms may potentially be used for forecasting the risk of suicide in Danish general population and in the US Army population, respectively. Furthermore, predictive models for population risk may use not only individual data, but also health system level (e.g., quality of mental health care, mental health budget), and community level data (e.g., unemployment rate and social deprivation levels in the community). For instance, Marks and colleagues developed a predictive model for identifying counties at high risk of overdose mortality, which included county-level education, poverty rate, unemployment rate, overdose gravity, and other county-level indicators, among the 3106 counties in the United States.⁽¹⁴⁾ Given the complex etiology of suicide, predicting population risk of suicide may benefit greatly from the integration of data at the individual, health system and community levels.

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5 We undertook a project to develop and validate sex-specific risk predictive models to be used
6 by policy and decision makers to forecast population risk of suicide at the health region level,
7 using routinely collected health administrative data, and to identify the barriers and facilitators
8 to implementation and explore the ethical and privacy issues of the prediction program. In this
9 manuscript, we aimed to describe the methodology of the project, to inform methodological
10 discussions and suicide prevention strategies.
11

12 13 **Methods**

14
15 This project encompasses the components of quantitative and qualitative investigations and an
16 integrated knowledge translation (IKT). IKT is a model of research co-production, whereby
17 knowledge users are integrated throughout the research process and who can use the research
18 recommendations in practice or policy.⁽¹⁵⁾ IKT approaches are used to improve the relevance
19 and impact of research. The quantitative research involved developing and validating risk
20 prediction models for suicide using advanced ML and visualization methods. The qualitative
21 research is to understand the potential implementation, social, ethics and legal issues
22 associated with the risk prediction program. In line with IKT principles, we involved policy and
23 decision makers at the provincial and national levels, and people with lived experience of
24 suicidality from the beginning of the project. The methodology of each component is described
25 below.
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30 ***Model development and validation***

31 ***Target population:*** The general population residing in the province of Quebec, Canada. The
32 province had a population of over 8.6 million people in 2021, and about 95% of the population
33 reported being able to conduct a conversation in French. In Quebec, health services are
34 planned and delivered through 18 health regions, 22 integrated health and social services
35 centres, and 166 Centres locaux de santé Communautaire (CLSCs). Budgetary decisions are
36 made at the levels of province and health regions/integrated health and social services centres.
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40 ***Data sources:*** We will develop the prediction tools by linking the suicide database, the Ministry
41 of Health and Social Services (MSSS) public financial reports (Contour financier - Publications du
42 ministère de la Santé et des Services sociaux (gouv.qc.ca) which include the five health
43 administrative databases below, and the Canadian Urban Environmental Health Research
44 (CANUE) data. The suicide database gathers individual-level data annually based on residents
45 health insurance number from five administrative databases: the vital statistics death database,
46 the physician claims database, the hospital discharge database, the Insured Person Registration
47 File and the public drug plan. The data of these databases (e.g., billing and service procedures
48 codes, service dates) are routinely submitted by clinics and hospitals for billing and
49 administration purposes; no self-reported data were collected from patients. These databases
50 cover up to 98% of the population in Quebec and contain data for over 20,000 death by suicide
51 cases occurred since 1996. Death by suicide cases were those ascertained by Quebec's Coroner
52 office after investigation. The decision is registered in the Quebec vital statistics database. The
53 latter is linked with other health administrative databases of the Quebec Integrated Chronic
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3 Disease Surveillance System (QICDSS) managed by the Quebec's Public Health Agency.(16) With
4 the suicide database and other linkable Ministry financial databases, individual (e.g., sex, age),
5 program (e.g., hospitalization, emergency department visits), and system (e.g., mental health
6 and addiction budgets) level indicators can be identified.(16)
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8

9 CANUE is a Canadian consortium aiming to build a unique repository of standardized metrics of
10 urban, sub-urban, and rural characteristics, as well as the tools used to produce them
11 (www.canue.ca). The CANUE data contain indicators for unemployment, social deprivation,
12 access to health services and built environment at the community level, and can be linked with
13 health administrative data by postal codes. The CANUE is open and free for research projects.
14 The data linkage was performed at the Quebec Institute of Public Health (INSPQ) where the
15 suicide data are kept. Linking the databases provides an unprecedented sample size and the
16 capability of examining individual, neighborhood, programmatic and systemic indicators of
17 population suicide risk.
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21 Because this study used existing de-identified health administrative data, informed consent
22 from individual patients was waived. This study was approved by the Research Ethics Board of
23 Dalhousie University.
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26 *Study design:* Because the base rate of suicide in the population is low, we proposed to use a
27 case-control study design to develop sex-specific suicide risk predictive algorithms, using both
28 logistic regression modeling and machine learning (ML) techniques. We selected all death by
29 suicide cases that occurred from January 1st 2002 to December 31st 2010.(17) The control group
30 was a 1% random sample of living individuals in each year between January 1st, 2002 and
31 December 31st, 2010 from the Quebec physician claim database. Controls are not allowed to be
32 selected more than once across years. None of those in the control group died of suicide during
33 this period. The cases and controls were not matched to allow for maximum variability in
34 predictors.
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38 *Predictors:* Individual, programmatic, systemic and community factors (see Appendix I)
39 happened five years prior to the suicide events will be used as candidate predictors to develop
40 the risk predictive algorithms. For example, we extracted the data about the diagnosis of major
41 depression (an individual level factor) in the past 6, 12, 24, 48 and 60 months, as 5 separate
42 candidate predictors. Similarly, we extracted mental health and addiction budget of each health
43 region (a systemic level factor) in the past 5 years as candidate predictors. The QICDSS(18)
44 provided all the variables drawn from health administrative databases. It covers 98% of the
45 Quebec's population since 1996. The security and continuous quality and maintenance are the
46 responsibility of the Quebec Public health Institute (INSPQ). Information is for administrative
47 (i.e. age, hospital or outpatient contact dates) and clinician reporting (i.e. diagnoses) purposes.
48 Validation of QICDSS physical diagnoses has been achieved by chart reviews(18) and by
49 outcomes for QICDSS psychiatric diagnoses.(19,20) The QICDSS has been exploited over the
50 past decade by a network of INSPQ officers and academic researchers, many are co-authors of
51 publications on the characteristics of patients receiving rare psychiatric interventions,(21) and
52 on personality disorders, schizophrenia and substance use disorders in relation to mortality,
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3 including suicide.(22,23) The quality of the data is also reflected by the minimal missing data
4 associated with the variables, which ranges from 0.87% and 4.12% of the variables in the
5 databases.
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7 The initial selection of candidate predictors is determined by content knowledge (i.e.,
8 known relationships between suicide or suicide behaviors and individual and local area level
9 variables), feasibility of routine data collection, clinical utility and policy relevance through team
10 meetings. Therefore, the pre-determination of candidate predictors was a joint effort between
11 the team members, collaborators, health policy and decision makers and other stakeholders,
12 with the expertise of clinical psychiatry, psychiatric epidemiology, mental health services
13 research, health administrative data, computer science, and mental health policy.
14

15 For the objective of this study, we will use both statistical (e.g., logistic regression
16 modeling) and machine learning (ML) approaches to develop the risk prediction models so that
17 we may compare which approach performs better in predicting population suicide risk and is
18 more feasible to implement. ML can produce complex estimations by searching data for
19 relevant pieces of information and their complex interactions. Therefore, ML is best suited to
20 tackle the combined challenges of high dimensional data analysis associated with risk
21 prediction for suicide. Some predictors that may change over time (e.g., diagnoses,
22 medications, service use, etc.) will be dummy-coded to create time-varying predictors (i.e.,
23 intervals of 0-3,0-6, 0-12, 0-24, 0-36,0-48, and 0-60 months before the first day of the suicide
24 month). Because we included all suicide cases and a sample of controls, the proportion of
25 suicide in the sample is different from that in the general population. This is a limitation of case-
26 control study design which produces a biased sample because the proportion of cases in the
27 sample is not the same as the population of interest.(24,25) One method for addressing this
28 limitation when developing predictive models using case-control data is weighting.(25–28)
29 Therefore, in logistic regression modeling, sampling weights (inversed probability of being
30 selected) were assigned to the controls, while the weight of 1 was assigned to the cases, to
31 ensure the models are applicable to the whole population.
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37 *Model development – Machine learning (ML).*

38 ML is a part of Artificial intelligence (AI) that aims to construct systems that automatically
39 improve through experience using advanced statistical and probabilistic techniques. ML has
40 provided significant benefits to a range of fields. Recent research has shown a range of
41 advantages of ML that can assist in detecting, diagnosing, predicting suicide, and treating
42 mental health problems.(29,30) ML methods are divided into categories, i.e., supervised, semi-
43 supervised, unsupervised, and reinforcement.
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45

46 Imbalanced classes are a common problem in ML classification, where each class has a
47 disproportionate ratio of observations. To predict the population risk of suicide, Dataset will be
48 imbalanced because of rare cases of suicide as compared with a control group. To address the
49 imbalanced Dataset, we will over-sample the minority class. We will "artificially" duplicate
50 samples from the minority class to over-sample the minority class to correct imbalanced
51 datasets, even though doing so does not provide the model with any new data. In the
52 literature, this method – was known as the Synthetic Minority Over-sampling Technique
53 (SMOTE). Then, we will develop supervised learning models such as logistic regression, Random
54 Forest, XGBoost, and Multilayer perceptron with an optimized model architecture. These
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models' predictive capacity will be assessed by generating the receiver operating characteristic (ROC) curves calculating its AUC and various operating characteristics, including sensitivity, specificity, and positive predictive value for a variety of thresholds.

Interpretability is essential when we deal with healthcare data. It is significant because it is necessary to understand the casualty of learned representations for decision support also helps to assess whether the model is considering the right features while making a specific prediction. Feature-based model explainability technique, such as Shapley Additive Explanations (SHAP), was derived from game theory; each player decides to contribute to a coalition of players to produce a total value that will be superior to the sum of their individual values. SHAP relies on the Shapley value of both local and global explanations. Shapley's values are model-agnostic, and the marginal contribution of each feature can be calculated by using the input data and the predictions.(31,32) SHAP will use with the global explanation of how much the input features contribute to a model's output.

Model development – logistic regression.

As the first step of model development, we will include all pre-selected variables in penalized least absolute shrinkage and selection operator (LASSO) regression. The LASSO penalization factor selects important predictors by shrinking coefficients for weaker predictors toward zero, excluding predictors with estimated zero coefficients from the final sparse prediction model. We will perform a correlation analysis among variables selected by the LASSO regression, and identify variables that are strongly correlated (e.g., $\gamma \geq 0.60$). Correlated variables will be discussed by team members, and the variables that have better policy implication and clinical utility will be kept and become the candidate predictors for model development.

We will use logistic regression to develop the sex-specific statistical models. After LASSO, there may still be a large number of candidate predictors. Backward selection method will be used to eliminate unproductive variables and to identify the model with the best calibration and discrimination. The decisions of model selection will be initially based on the changes in the values of Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).(33) Since BIC penalizes for the complexity of the model more than AIC, selection with BIC will generally lead to smaller models than selection with AIC.(33) Once a model is developed, prediction accuracy will be assessed by the discrimination and calibration of the model. Discrimination is the ability of a prediction model to separate those who experienced the outcome events from those who did not. We will quantify this by calculating the C statistic, analogous to the area under a receiver operating characteristic curve. Calibration measures how closely predicted outcomes agree with actual outcomes. For this, we will use D'Agostino's version of the Hosmer-Lemeshow Chi square statistic. Discrimination and calibration compete with each other. Given that the program will be used to forecast population risk of suicide, we will prioritize calibration over discrimination. Stakeholders from different perspectives and scientific backgrounds will meet to determine the content and performance of the risk prediction models developed by statistical and ML techniques, the appropriate formats of data visualization that are acceptable to policy and decision makers, and the feasibility of implementation, which will in turn inform the revision of the models.

The second step of the model development is to estimate the synthetic rates, consisting of two stages. First, for each predictor, the proportions of individuals within each category of that predictor in the initial modeling will be computed, separately by regions. For instance, if hospitalization due to suicide attempt in the past 5 years is a predictor in the model, the proportion of individuals with this attribute in a specific health region is calculated. If age is a continuous variable in the model, the mean age of the population in a health region is estimated. A syntax program will then be prepared to apply the regression coefficients to the corresponding proportions and means in the data set, and to calculate the logit estimates for each of health regions. The resulting logit values for each of the health region will then be converted into probabilities, giving the estimated risk of suicide in the health region. The region's population counts from Statistics Canada Census data or the provincial health administrative database multiplied by the estimated risk will yield the estimated number of suicide in this health region.

The fitted logistic regression model described above estimates the proportion of suicide in the population at a given moment of time as a function of its risk factors in the past. This model is fundamentally etiologic, where the natural reference-point is the moment of the outcome's occurrence, corresponding to the zero time on the etiologic time scale. However, assessment of population risk of suicide over a particular span of time in the future involves a prognostic outlook, where the natural reference-point is the time of prognostication, corresponding to the zero time on the prognostic time scale. Predictive models for individual risk are often developed using a cohort/closed study-population and express the risk of future occurrence of the outcome as a function of current risk factors, and involves consideration of the values of the risk factors at issue at the prognostic time zero only. Whereas population risk models are applied in the context of a dynamic/open population and the estimated risk is a function of risk factors not only at the prognostic time-zero but also throughout the time span at issue. For example, the risk of suicide in the next 5 years in a health region may not only depend on the proportions of people with major depression and of hospitalization due to suicide attempt in the past, but also on whether there will be a reduction or increase in these parameters over the next 5 years, if so in which year. Thus, the population risk of suicide may be projected using the developed model to each future year over a pre-defined time interval. The cumulative incidence of suicide (CI_{0 to t}) from time T = 0 to T = t can be estimated as a function of time- and profile specific risk operating over that time interval:(28)

$$CI_{0 \text{ to } t} = 1 - \exp \left[- \int_0^t (ID_u) du \right]$$

The estimated cumulative risk represents the estimated risk of suicide of a health region over the time period at issue conditionally on the health region's risk profile.

Validation:

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3 For model validation, we will use the suicide data from January 1st, 2011 to December 31st,
4 2019. We will first calculate the yearly, 5-year and 10-year incidence of suicide death at the
5 provincial and health regional levels in males and females (i.e., observed risk). We will apply the
6 developed synthetic models in the validation data to estimate the yearly, 5-year and 10-year
7 incidence of suicide death at the provincial and health regional levels in males and females (i.e.,
8 predicted risk). We will visually compare and calculate the differences between the predicted
9 and observed risks; smaller differences indicate better calibration with the data and model
10 accuracy. We will use four indicators for assessing model performance: mean average error
11 (MAE), root mean square error (RMSE), Spearman's r , and proportion of correct identification
12 of high risk regions.(14) The MAE is the average magnitude of the difference between the
13 predicted and observed suicide death rate for each health region. The RMSE is the square root
14 of the average magnitude of the difference squared, therefore is similar to MAE but penalises
15 prediction errors with greater magnitude. More accurate predictions will result in smaller MAE
16 and RMSE. Spearman's r compares the predicted ranking of health regions by suicide death rate
17 compared with the actual observed rankings; results closer to 1 indicate that the model was
18 more effective at rank-ordering regions based on suicide death rate. To assess the extent to
19 which high risk regions are correctly identified, we will first disaggregate the predicted and
20 observed suicide rates into quartile groups and categorised all health regions into their
21 corresponding quartiles for both predicted and observed suicide rates. The proportion of health
22 regions observed in the top quartile of observed suicide death rates that were rightly predicted
23 to be in the top quartile will be calculated.

30 **Qualitative study**

31 The objective of the qualitative study is to investigate the end-users' views about predicting
32 population risk of suicide, and the potential social, legal, ethical, and privacy issues and
33 mitigation strategies for implementing such a predictive system. Using snowballing techniques,
34 we have invited policy and decision makers at the federal and provincial levels, mental health
35 professionals, individuals who have extensive experience in working with policy and decision
36 makers and who have expertise in suicide prevention, social and health policy, as well as health
37 administrative data, people with lived experience, and advocates for families bereaved by
38 suicide. The qualitative study consists of two rounds of interviews. The first round of interviews
39 were carried out after the general team meeting held in July 2021, at which the study design
40 was finalized. The second round of interviews will be organized once the predictive models are
41 developed. The first round interviews were held through zoom meetings, and follow a series of
42 semi-structured interview questions related to the objectives (see supplementary file#1).
43 Qualitative data collected during the focus groups and qualitative interviews are audio
44 recorded, transcribed, and analyzed with the support of QDA Miner (Provalis).(34) The second
45 round of interviews will be conducted once the prototype models are developed and presented
46 at the second general team meeting which is to be held in late 2022. We will perform an
47 inductive thematic analysis of the focus group and individual interview material, which will be
48 fed by answers to the open questions regarding potential (i) perceptions about the developed
49 prediction models, (ii) social issues, (iii) legal issues, (iv) ethical and privacy issues, and (v)
50 mitigation strategies for implementing such a system. Transcripts will be coded in order to
51 demarcate segments within each of them. We will look for words or short phrases that
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3 demonstrate how the associated data segments inform our research objectives. Detailed
4 results from the qualitative analysis of this material will be presented in a separate paper.
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7 **Patient and Public Involvement**

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9 Engagement with relevant stakeholders (e.g., policy/decision makers, and people with lived
10 experience) through IKT is critical for developing equitable risk predictive algorithms and for
11 maximizing the potential for future implementation. For this project, we have identified and
12 engaged policy/decision makers from the Public Health Agency of Canada and from the INSPQ,
13 as well as 8 people with lived experience. The representatives of INSPQ (EP, PL, VM, LR) were
14 involved in study conceptualization and grant application. PL has been facilitating data
15 extraction, participated in the bi-weekly team meetings. As described above, we have engaged
16 people with lived experience through the qualitative interviews. The next round of qualitative
17 interviews will be held after the prototype of the risk predictive models are developed to have a
18 better understanding about privacy, ethics and implementation issues.
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23 **Ethics and dissemination**

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25 This study will use routinely collected health administrative data. The analysis of secondary de-
26 identified data at the INSPQ where the data are kept will not incur physical and psychological
27 harms. The results of the study will be vetted by analysts at the INSPQ to ensure no privacy and
28 confidentiality will be breached. The data used for this study will be kept at INSPQ for 15 years.
29 The results will be presented in peer-reviewed journals, at academic conferences, and shared
30 with knowledge users who were engaged from the beginning.
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34 Through this study, we aimed to develop risk prediction models to be used by policy and
35 decision makers to forecast population risk of suicide at the provincial and health region levels,
36 using routinely collected health administrative data and other publicly available area-level data.
37 For example, policy and decision makers may use the models to project the proportion and
38 number of suicide deaths in specific health regions/communities over the next 5 years, and
39 decide how resources and community level interventions may be mobilized to the high risk
40 regions/communities. Furthermore, the models can inform policy and decision makers about
41 the potential impacts of these community level intervention on suicide prevention. The
42 potential utility of such predictive tools has been attested by the active involvement by the
43 policy and decision makers at the federal and provincial levels and people with lived
44 experience. Nevertheless, predicting population risk of suicide is new and has not been well
45 studied. There are a number of methodological and implementation challenges to be
46 addressed.
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51 Routinely collected health administrative data and population health survey data represent a
52 unique opportunity for population health projection because it covers a majority of the general
53 population in catchment areas, and the data can be readily accessed by policy and decision
54 makers. Many risk predictive models have been developed for physical and mental health
55 problems in the general population. For example, individual data from population health
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3 surveys and health administrative databases have been used to develop risk predictive models
4 for diabetes,(35) heart disease,(36) and major depression.(37,38) These models may be used to
5 identify high risk individuals in the community; they can also be used to forecast the population
6 risk in the future. However, few models have integrated individual, healthcare system, and
7 community level predictors in the same model. In this study, we proposed to include data from
8 these different levels in model development, and convert the models into synthetic estimation
9 models. There may be different approaches for integrating data from different levels for
10 population risk prediction. Future studies are needed to explore the best method for data
11 integration.
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16 The performance of a risk predictive model is commonly assessed by indicators of model
17 discrimination and calibration.(39) Whereas model discrimination is critical for individual risk
18 predictive models, policy and decision makers' focus is on the whole population rather than
19 individuals. Therefore, model calibration plays a more important role in the performance of a
20 population risk model. We proposed four indicators for assessing model performance.
21 However, it is not clear how much error (the difference between predicted and observed risks)
22 policy and decision makers may tolerate for population risk prediction, how they perceive the
23 importance of model discrimination, whether other indicators exist for assessing population
24 risk prediction models. We will explore these aspects through our qualitative study, and also
25 encourage others to consider these in future studies. Similarly, we welcome discussions and
26 debates about the methods for validating population risk predictive models. An individual risk
27 predictive model is often developed using longitudinal cohort/closed population data and
28 validated in a different but related cohort/closed population. This poses challenges for
29 population risk predictive models because the population in a community/health region is open
30 and dynamic. Appropriate methods for model validation and acceptability need to be
31 developed and agreed by the research community and policy and decision makers.
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37 This study relied on routinely collected health administrative data for model development and
38 validation, rather than collecting primary data. Therefore, we have a little information about
39 suicide behaviors among the individuals in the control group, which are strongly associated
40 with suicide deaths. In the model development, we included hospitalization and emergency
41 department visits due to suicide attempt, which may reduce the bias related to the lack of
42 information about suicide behaviors. Nevertheless, this is a limitation of routinely collected
43 health administrative data.
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47 Despite the challenges for developing population risk predictive model for suicide, research is
48 urgently needed to address this important population health issue. This study represents one of
49 the early steps in building such risk predictive models and methodology development, as part
50 of the collective efforts for moving the field forward.
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Authors' contribution:

JLW drafted the manuscript. JLW, FGZK, J-FP, LR, EP, PL, GG, CG, and AL were involved in study design, conceptualization and funding application. JLW, FGZK, J-FP, LR, EP, PL, VM, CB-P, MM, GG, CG, and AL were involved in manuscript review, discussion, revision, and final approval.

Funding statement:

This study is supported by a New Frontiers for Research Funds grant (2019-00471) from Tri-Agency Institutional Programs Secretariat, Government of Canada, and by a Tier I Canada Research Chair award to JLW. The funders play no role in design and operation of this study.

Competing interests: none

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3 Supplementary file #1:
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5
6 Guiding questions for qualitative interviews.
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- 8 1) What are the currently policies and practices for suicide prevention that you know?
- 9 2) What are the challenges you are facing in suicide prevention at population level?
- 10 3) What are your views on using risk predictive tools for facilitating suicide prevention in
11 the population? The advantages and drawbacks?
- 12 4) what are your thoughts about using artificial intelligence and machine learning for
13 suicide prevention? The potential pros and cons?
- 14 5) From your view, how an ideal risk prediction tool should look like, that assists in your
15 decision making?
- 16 6) What visualization formats you have been using, and what are the limits of these
17 visualization methods?
- 18 7) What do you think of the visualization model presented to you?
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APPENDIX I_1: CANDIDATE PREDICTORS

i. PSYCHIATRIC DISORDERS DIAGNOSIS¹

- Substance use disorder²
 - o Alcohol use disorder
 - o drug use disorder
- Mood disorder
 - Major depressive disorder
 - Bipolar disorder
- Anxiety disorder
- Schizophrenia
- Personality disorders
- ADHD
- Other diagnosis

derived variables ³⁴	variable name
Substance use disorder	psydx_subuse_3
Substance use disorder	psydx_subuse_6
Substance use disorder	psydx_subuse_12
Substance use disorder	psydx_subuse_24
Substance use disorder	psydx_subuse_36
Substance use disorder	psydx_subuse_48
Substance use disorder	psydx_subuse_60
Alcohol use disorder	Psydx_alcoholuse_3
Alcohol use disorder	Psydx_alcoholuse_6
Alcohol use disorder	Psydx_alcoholuse_12
Alcohol use disorder	Psydx_alcoholuse_24
Alcohol use disorder	Psydx_alcoholuse_36
Alcohol use disorder	Psydx_alcoholuse_48
Alcohol use disorder	Psydx_alcoholuse_60
Drug use disorder	Psydx_druguse_3
Drug use disorder	Psydx_druguse_6
Drug use disorder	Psydx_druguse_12
Drug use disorder	Psydx_druguse_24
Drug use disorder	Psydx_druguse_36
Drug use disorder	Psydx_druguse_48
Drug use disorder	Psydx_druguse_60

The candidate predictors were captured using timeframes of prior 3, 6, 12, 24, 36, 48, and/or 60 months, indicated by the last digits of the variable name. For instance, "psydx_subuse_3" and "psydx_subuse_6" refer to a diagnosis of substance use disorder in the prior 3 and 6 months, respectively

mood disorder	Psydx_mood_3
mood disorder	Psydx_mood_6
mood disorder	Psydx_mood_12
mood disorder	Psydx_mood_24
mood disorder	Psydx_mood_36
mood disorder	Psydx_mood_48
mood disorder	Psydx_mood_60
Anxiety disorder	psydx_anx_3
Anxiety disorder	psydx_anx_6
Anxiety disorder	psydx_anx_12
Anxiety disorder	psydx_anx_24
Anxiety disorder	psydx_anx_36
Anxiety disorder	psydx_anx_48
Anxiety disorder	psydx_anx_60
Major Depressive Disorder	Psydx_dep_3
Major Depressive Disorder	Psydx_dep_6
Major Depressive Disorder	Psydx_dep_12
Major Depressive Disorder	Psydx_dep_24
Major Depressive Disorder	Psydx_dep_36
Major Depressive Disorder	Psydx_dep_48
Major Depressive Disorder	Psydx_dep_60
Bipolar disorder	Psydx_bipolar_3
Bipolar disorder	Psydx_bipolar_6
Bipolar disorder	Psydx_bipolar_12
Bipolar disorder	Psydx_bipolar_24
Bipolar disorder	Psydx_bipolar_36
Bipolar disorder	Psydx_bipolar_48
Bipolar disorder	Psydx_bipolar_60
Schizophrenia	psydx_scz_3
Schizophrenia	psydx_scz_6
Schizophrenia	psydx_scz_12
Schizophrenia	psydx_scz_24
Schizophrenia	psydx_scz_36
Schizophrenia	psydx_scz_48
Schizophrenia	psydx_scz_60
Personality disorder	psydx_pd_3
Personality disorder	psydx_pd_6
Personality disorder	psydx_pd_12
Personality disorder	psydx_pd_24
Personality disorder	psydx_pd_36
Personality disorder	psydx_pd_48

Personality disorder	psydx_pd_60
ADHD	psydx_adhd_3
ADHD	psydx_adhd_6
ADHD	psydx_adhd_12
ADHD	psydx_adhd_24
ADHD	psydx_adhd_36
ADHD	psydx_adhd_48
ADHD	psydx_adhd_60
Other diagnosis	psydx_otr_3
Other diagnosis	psydx_otr_6
Other diagnosis	psydx_otr_12
Other diagnosis	psydx_otr_24
Other diagnosis	psydx_otr_36
Other diagnosis	psydx_otr_48
Other diagnosis	psydx_otr_60

ii. PHARMACOLOGICAL TREATMENTS FOR MENTAL HEALTH DISORDERS

- Typical antipsychotics
- Atypical antipsychotics
- Clozapine
- Antidepressant for anxiety or depression
- Antidepressants for other reasons
- Mood stabilizer
- Anxiolytic
- ADHD medication

derived variables⁵	variable name
Typical antipsychotics	rx_psy_antipsych_typ_3
Typical antipsychotics	rx_psy_antipsych_typ_6
Typical antipsychotics	rx_psy_antipsych_typ_12
Typical antipsychotics	rx_psy_antipsych_typ_24
Typical antipsychotics	rx_psy_antipsych_typ_36
Typical antipsychotics	rx_psy_antipsych_typ_48
Typical antipsychotics	rx_psy_antipsych_typ_60
Atypical antipsychotics	rx_psy_antipsych_atyp_3
Atypical antipsychotics	rx_psy_antipsych_atyp_6
Atypical antipsychotics	rx_psy_antipsych_atyp_12
Atypical antipsychotics	rx_psy_antipsych_atyp_24
Atypical antipsychotics	rx_psy_antipsych_atyp_36
Atypical antipsychotics	rx_psy_antipsych_atyp_48

Atypical antipsychotics	rx_psy_antipsych_atyp_60
Clozapine	rx_psy_clozapine_3
Clozapine	rx_psy_clozapine_6
Clozapine	rx_psy_clozapine_12
Clozapine	rx_psy_clozapine_24
Clozapine	rx_psy_clozapine_36
Clozapine	rx_psy_clozapine_48
Clozapine	rx_psy_clozapine_60
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_3
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_6
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_12
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_24
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_36
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_48
antidepressant for anxiety or depression	rx_psy_antidep_anxdep_60
antidepressant for other reasons	rx_psy_antidep_otr_3
Antidepressant for other reasons	rx_psy_antidep_otr_6
Antidepressant for other reasons	rx_psy_antidep_otr_12
Antidepressant for other reasons	rx_psy_antidep_otr_24
Antidepressant for other reasons	rx_psy_antidep_otr_36
Antidepressant for other reasons	rx_psy_antidep_otr_48
Antidepressant for other reasons	rx_psy_antidep_otr_60
mood stabilizer	rx_psy_mdestb_3
mood stabilizer	rx_psy_mdestb_6
mood stabilizer	rx_psy_mdestb_12
mood stabilizer	rx_psy_mdestb_24
mood stabilizer	rx_psy_mdestb_36
mood stabilizer	rx_psy_mdestb_48
mood stabilizer	rx_psy_mdestb_60
anxiolytics	rx_psy_anx_3
anxiolytics	rx_psy_anx_6
anxiolytics	rx_psy_anx_12
anxiolytics	rx_psy_anx_24
anxiolytics	rx_psy_anx_36
anxiolytics	rx_psy_anx_48
anxiolytics	rx_psy_anx_60
ADHD medication	rx_psy_adhd_3
ADHD medication	rx_psy_adhd_6
ADHD medication	rx_psy_adhd_12
ADHD medication	rx_psy_adhd_24
ADHD medication	rx_psy_adhd_36

ADHD medication	rx_psy_adhd_48
ADHD medication	rx_psy_adhd_60

iii. NON-PHARMACOLOGICAL TREATMENTS FOR MENTAL HEALTH DISORDERS

- duration of hospitalisations for mental health reasons (continuous, sum of days)
- number of hospitalisations for mental health reasons (continuous)
- duration of hospitalisations for suicide attempt (continuous, sum of days)
- number of hospitalisations for suicide attempt (continuous)
- Number of care center visits for mental health reasons (continuous)
- number of general practitioner visits for mental health reasons (continuous)
- number of emergency room visits for mental health reasons (continuous)
- number of outpatient psychiatrist visits (continuous)
- number of other specialist visits for mental health reasons (continuous)
- number of psychotherapy visits with a psychiatrist (continuous)
- number of psychotherapy visits with a general practitioner (continuous)
- number of psychotherapy visits with another specialist (continuous)
- Number of outpatient paediatrician visits (continuous)
- No mental health services
- number of ECT treatments received (continuous)
- Acute ECT received (dichotomous)
- Maintenance ECT received (dichotomous)

derived variables	variable name
Duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_3
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_6
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_12
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_24
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_36
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_48
duration of hospit for suicide attempt (conti, # days)	duration_hosp_suicide_60
# of hospit for suicide attempt (continuous)	#_hosp_suicide_3
# of hospit for suicide attempt (continuous)	#_hosp_suicide_6
# of hospit for suicide attempt (continuous)	#_hosp_suicide_12
# of hospit for suicide attempt (continuous)	#_hosp_suicide_24
# of hospit for suicide attempt (continuous)	#_hosp_suicide_36
# of hospit for suicide attempt (continuous)	#_hosp_suicide_48
# of hospit for suicide attempt (continuous)	#_hosp_suicide_60
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_3
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_6
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_12
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_24
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_36
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_48
Duration of hospit for mh reasons (conti, # of days)	Duration_hosp_mh_60

# of hospit for mh reasons (continuous)	#_hosp_mh_3
# of hospit for mh reasons (continuous)	#_hosp_mh_6
# of hospit for mh reasons (continuous)	#_hosp_mh_12
# of hospit for mh reasons (continuous)	#_hosp_mh_24
# of hospit for mh reasons (continuous)	#_hosp_mh_36
# of hospit for mh reasons (continuous)	#_hosp_mh_48
# of hospit for mh reasons (continuous)	#_hosp_mh_60
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_3
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_6
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_12
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_24
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_36
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_48
# of outpatient paediatrician visits (continuous)	#_outpat_pediatician_60
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_3
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_6
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_12
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_24
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_36
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_48
Number of Care center for mental health reasons (continuous)	#_Carectr_mh_60
# of emergency visits for mh reasons (continuous)	#_ER_mh_3
# of emergency visits for mh reasons (continuous)	#_ER_mh_6
# of emergency visits for mh reasons (continuous)	#_ER_mh_12
# of emergency visits for mh reasons (continuous)	#_ER_mh_24
# of emergency visits for mh reasons (continuous)	#_ER_mh_36
# of emergency visits for mh reasons (continuous)	#_ER_mh_48
# of emergency visits for mh reasons (continuous)	#_ER_mh_60
# of GP visits for mh reasons (continuous)	#_gp_mh_3
# of GP visits for mh reasons (continuous)	#_gp_mh_6
# of GP visits for mh reasons (continuous)	#_gp_mh_12
# of GP visits for mh reasons (continuous)	#_gp_mh_24
# of GP visits for mh reasons (continuous)	#_gp_mh_36
# of GP visits for mh reasons (continuous)	#_gp_mh_48
# of GP visits for mh reasons (continuous)	#_gp_mh_60
# of outpatient psychiatrist visits (continuous)	#_psy_mh_3
# of outpatient psychiatrist visits (continuous)	#_psy_mh_6
# of outpatient psychiatrist visits (continuous)	#_psy_mh_12
# of outpatient psychiatrist visits (continuous)	#_psy_mh_24
# of outpatient psychiatrist visits (continuous)	#_psy_mh_36
# of outpatient psychiatrist visits (continuous)	#_psy_mh_48

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2		
3		
4	# of outpatient psychiatrist visits (continuous)	#_psy_mh_60
5	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_3
6	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_6
7	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_12
8	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_24
9		
10	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_36
11	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_48
12	# of psychotherapy visits with a psychiatrist (conti)	#_psychotx_psy_60
13	# of other specialist visits for mh reasons (conti)	#_spc_mh_3
14	# of other specialist visits for mh reasons (conti)	#_spc_mh_6
15	# of other specialist visits for mh reasons (conti)	#_spc_mh_12
16	# of other specialist visits for mh reasons (conti)	#_spc_mh_24
17	# of other specialist visits for mh reasons (conti)	#_spc_mh_36
18	# of other specialist visits for mh reasons (conti)	#_spc_mh_48
19	# of other specialist visits for mh reasons (conti)	#_spc_mh_60
20	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_3
21	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_6
22	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_12
23	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_24
24	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_36
25	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_48
26	# of psychotherapy visits with a GP (conti)	#_psychotx_gp_60
27	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_3
28	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_6
29	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_12
30	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_24
31	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_36
32	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_48
33	# of psychotherapy visits with other specialist (conti)	#_psychotx_other_60
34	No mental health services	No_mh_services_3
35	No mental health services	No_mh_services_6
36	No mental health services	No_mh_services_12
37	No mental health services	No_mh_services_24
38	No mental health services	No_mh_services_36
39	No mental health services	No_mh_services_48
40	No mental health services	No_mh_services_60
41	number of ECT received (continuous)	ECT_#_3
42	number of ECT received (continuous)	ECT_#_6
43	number of ECT received (continuous)	ECT_#_12
44	number of ECT received (continuous)	ECT_#_24
45	number of ECT received (continuous)	ECT_#_36
46		
47		
48		
49		
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57		
58		
59		
60		

number of ECT received (continuous)	ECT_#_48
number of ECT received (continuous)	ECT_#_60
acute ECT (dichotomous)	ECT_acute_3
acute ECT (dichotomous)	ECT_acute_6
acute ECT (dichotomous)	ECT_acute_12
acute ECT (dichotomous)	ECT_acute_24
acute ECT (dichotomous)	ECT_acute_36
acute ECT (dichotomous)	ECT_acute_48
acute ECT (dichotomous)	ECT_acute_60
Maintenance ECT (dichotomous)	ECT_maintenance_3
Maintenance ECT (dichotomous)	ECT_maintenance_6
Maintenance ECT (dichotomous)	ECT_maintenance_12
Maintenance ECT (dichotomous)	ECT_maintenance_24
Maintenance ECT (dichotomous)	ECT_maintenance_36
Maintenance ECT (dichotomous)	ECT_maintenance_48
Maintenance ECT (dichotomous)	ECT_maintenance_60

iv. PHYSICAL DIAGNOSIS

- Dementia
- Neurological disease
- Endocrine system disorder
- Trauma
- Respiratory disorder
- Infectious disease
- Digestive disorder
- Cardiovascular disorder
- Cancer
- Other physical disorder
- Charlson/elixhauser index with psy (continuous)⁶
- Charlson/elixhauser index without psy (continuous)

derived variables	variable name
dementia	physdx_dem_3
dementia	physdx_dem_6
dementia	physdx_dem_12
dementia	physdx_dem_24
dementia	physdx_dem_36
dementia	physdx_dem_48
dementia	physdx_dem_60
neurological disease	physdx_neuro_3
neurological disease	physdx_neuro_6

1		
2		
3	neurological disease	physdx_neuro_12
4	neurological disease	physdx_neuro_24
5	neurological disease	physdx_neuro_36
6	neurological disease	physdx_neuro_48
7	neurological disease	physdx_neuro_60
8	neurological disease	physdx_neuro_60
9	endocrine system disorder	physdx_endo_3
10	endocrine system disorder	physdx_endo_6
11	endocrine system disorder	physdx_endo_12
12	endocrine system disorder	physdx_endo_24
13	endocrine system disorder	physdx_endo_36
14	endocrine system disorder	physdx_endo_48
15	endocrine system disorder	physdx_endo_60
16	endocrine system disorder	physdx_endo_60
17	trauma	physdx_trauma_3
18	trauma	physdx_trauma_6
19	trauma	physdx_trauma_12
20	trauma	physdx_trauma_24
21	trauma	physdx_trauma_36
22	trauma	physdx_trauma_48
23	trauma	physdx_trauma_60
24	trauma	physdx_trauma_60
25	respiratory disorder	physdx_resp_3
26	respiratory disorder	physdx_resp_6
27	respiratory disorder	physdx_resp_12
28	respiratory disorder	physdx_resp_24
29	respiratory disorder	physdx_resp_36
30	respiratory disorder	physdx_resp_48
31	respiratory disorder	physdx_resp_60
32	respiratory disorder	physdx_resp_60
33	infectious disease	physdx_infec_3
34	infectious disease	physdx_infec_6
35	infectious disease	physdx_infec_12
36	infectious disease	physdx_infec_24
37	infectious disease	physdx_infec_36
38	infectious disease	physdx_infec_48
39	infectious disease	physdx_infec_60
40	infectious disease	physdx_infec_60
41	digestive disorder	physdx_diges_3
42	digestive disorder	physdx_diges_6
43	digestive disorder	physdx_diges_12
44	digestive disorder	physdx_diges_24
45	digestive disorder	physdx_diges_36
46	digestive disorder	physdx_diges_48
47	digestive disorder	physdx_diges_60
48	digestive disorder	physdx_diges_60
49	cardiovascular disorder	physdx_cvd_3
50		
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1		
2		
3	cardiovascular disorder	physdx_cvd_6
4	cardiovascular disorder	physdx_cvd_12
5	cardiovascular disorder	physdx_cvd_24
6	cardiovascular disorder	physdx_cvd_36
7	cardiovascular disorder	physdx_cvd_48
8	cardiovascular disorder	physdx_cvd_60
9	cardiovascular disorder	physdx_cvd_60
10	cancer	physdx_cncr_3
11	cancer	physdx_cncr_6
12	cancer	physdx_cncr_12
13	cancer	physdx_cncr_24
14	cancer	physdx_cncr_36
15	cancer	physdx_cncr_48
16	cancer	physdx_cncr_60
17	other physical disorders	physdx_otr_3
18	other physical disorders	physdx_otr_6
19	other physical disorders	physdx_otr_12
20	other physical disorders	physdx_otr_24
21	other physical disorders	physdx_otr_36
22	other physical disorders	physdx_otr_48
23	other physical disorders	physdx_otr_60
24	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_3
25	charlson/elixhauser index with psy (conti)	physdx_comorbid_withpsy_6
26	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_12
27	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_24
28	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_36
29	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_48
30	charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_60
31	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_3
32	charlson/elixhauser index without psy (conti)	physdx_comorbid_withoutpsy_6
33	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_12
34	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_24
35	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_36
36	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_48
37	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
38	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
39	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
40	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
41	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
42	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
43	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
44	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
45	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
46	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
47	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
48	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
49	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
50	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
51	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
52	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
53	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
54	charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60
55		
56		
57		
58		
59		
60		

charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_48
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_60

V. PHARMACOLOGICAL TREATMENTS FOR PHYSICAL HEALTH DISORDERS

- Medication for diabetes
- Medication for cardiovascular disease
- Medication for respiratory diseases
- Medication for gastro-intestinal disorder
- Anti-infective agent
- Pain medication
- Contraceptive
- Other medication

derived variables	variable name
medication for diabetes	rx_phys_diabetes_3
medication for diabetes	rx_phys_diabetes_6
medication for diabetes	rx_phys_diabetes_12
medication for diabetes	rx_phys_diabetes_24
medication for diabetes	rx_phys_diabetes_36
medication for diabetes	rx_phys_diabetes_48
medication for diabetes	rx_phys_diabetes_60
medication for cardiovascular disease	rx_phys_cvd_3
medication for cardiovascular disease	rx_phys_cvd_6
medication for cardiovascular disease	rx_phys_cvd_12
medication for cardiovascular disease	rx_phys_cvd_24
medication for cardiovascular disease	rx_phys_cvd_36
medication for cardiovascular disease	rx_phys_cvd_48
medication for cardiovascular disease	rx_phys_cvd_60
medication for respiratory disease	rx_phys_resp_3
medication for respiratory disease	rx_phys_resp_6
medication for respiratory disease	rx_phys_resp_12
medication for respiratory disease	rx_phys_resp_24
medication for respiratory disease	rx_phys_resp_36
medication for respiratory disease	rx_phys_resp_48
medication for respiratory disease	rx_phys_resp_60
medication for gastro-intestinal disorder	rx_phys_gi_3
medication for gastro-intestinal disorder	rx_phys_gi_6
medication for gastro-intestinal disorder	rx_phys_gi_12
medication for gastro-intestinal disorder	rx_phys_gi_24
medication for gastro-intestinal disorder	rx_phys_gi_36
medication for gastro-intestinal disorder	rx_phys_gi_48

medication for gastro-intestinal disorder	rx_phys_gi_60
anti-infective agents	rx_phys_antiinfec_3
anti-infective agents	rx_phys_antiinfec_6
anti-infective agents	rx_phys_antiinfec_12
anti-infective agents	rx_phys_antiinfec_24
anti-infective agents	rx_phys_antiinfec_36
anti-infective agents	rx_phys_antiinfec_48
anti-infective agents	rx_phys_antiinfec_60
pain medication	rx_phys_pain_3
pain medication	rx_phys_pain_6
pain medication	rx_phys_pain_12
pain medication	rx_phys_pain_24
pain medication	rx_phys_pain_36
pain medication	rx_phys_pain_48
pain medication	rx_phys_pain_60
contraceptives	rx_phys_contracep_3
contraceptives	rx_phys_contracep_6
contraceptives	rx_phys_contracep_12
contraceptives	rx_phys_contracep_24
contraceptives	rx_phys_contracep_36
contraceptives	rx_phys_contracep_48
contraceptives	rx_phys_contracep_60
other medication	rx_phys_otr_3
other medication	rx_phys_otr_6
other medication	rx_phys_otr_12
other medication	rx_phys_otr_24
other medication	rx_phys_otr_36
other medication	rx_phys_otr_48
other medication	rx_phys_otr_60

vi. NON-PHARMACOLOGICAL TREATMENTS FOR PHYSICAL HEALTH DISORDERS

- duration of hospitalisations for physical health reasons (continuous, sum of days)
- number of hospitalisations for physical health reasons (continuous)
- care center visits/plays for physical health reasons*
- number of general practitioner visits for physical reasons (continuous)*
- number of emergency room visits for physical reasons (continuous)*
- number of outpatient specialist visits for physical health reasons (continuous)*
- number of outpatient paediatrician visits (continuous)*

derived variables	variable name
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_3
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_6
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_12

Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_24
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_36
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_48
Duration of hospit for phys reasons (conti, # of days)	Duration_hosp_phys_60
# of hospit for phys reasons (continuous)	#_hosp_phys_3
# of hospit for phys reasons (continuous)	#_hosp_phys_6
# of hospit for phys reasons (continuous)	#_hosp_phys_12
# of hospit for phys reasons (continuous)	#_hosp_phys_24
# of hospit for phys reasons (continuous)	#_hosp_phys_36
# of hospit for phys reasons (continuous)	#_hosp_phys_48
# of hospit for phys reasons (continuous)	#_hosp_phys_60
Care center for physical health reasons	Carectr_phys_3
Care center for physical health reasons	Carectr_phys_6
Care center for physical health reasons	Carectr_phys_12
Care center for physical health reasons	Carectr_phys_24
Care center for physical health reasons	Carectr_phys_36
Care center for physical health reasons	Carectr_phys_48
Care center for physical health reasons	Carectr_phys_60
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_3
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_6
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_12
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_24
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_36
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_48
# of outpatient specialist visit for phys reasons (cont)	#_spc_phys_60
# of GP visits for phys reasons (continuous)	#_gp_phys_3
# of GP visits for phys reasons (continuous)	#_gp_phys_6
# of GP visits for phys reasons (continuous)	#_gp_phys_12
# of GP visits for phys reasons (continuous)	#_gp_phys_24
# of GP visits for phys reasons (continuous)	#_gp_phys_36
# of GP visits for phys reasons (continuous)	#_gp_phys_48
# of GP visits for phys reasons (continuous)	#_gp_phys_60
# of emergency visits for phys reasons (continuous)	#_ER_phys_3
# of emergency visits for phys reasons (continuous)	#_ER_phys_6
# of emergency visits for phys reasons (continuous)	#_ER_phys_12
# of emergency visits for phys reasons (continuous)	#_ER_phys_24
# of emergency visits for phys reasons (continuous)	#_ER_phys_36
# of emergency visits for phys reasons (continuous)	#_ER_phys_48
# of emergency visits for phys reasons (continuous)	#_ER_phys_60

vii. INDIVIDUAL SOCIO-DEMOGRAPHIC VARIABLES

- Age (continuous)
- age group: 15-24
- age group: 25-34
- age group: 35-44
- age group: 45-54

- age group: 55-64
- age group: 65-74
- age group: 75-84
- age group: ≥85
- Sex
- Location – rural
- Location – non-rural
- Location – missing data
- rss 01 bas saint-laurent
- rss 02 saguenay-lac-saint-jean
- rss 03 capitale-nationale
- rss 04 mauricie et centre-du-québec
- rss 05 estrie
- rss 06 montréal
- rss 07 outaouais
- rss 08 abitibi-témiscamingue
- rss 09 côte-nord
- rss 10 nord-du-québec
- rss 11gaspésie-îles-de-la-madeleine
- rss 12 chaudière-appalaches
- rss 13 laval
- rss 14 lanaudière
- rss 15 laurentides
- rss 16 montérégie
- Adherence to the public drug plan (RAMQ) (dichotomous)

derived variables	variable name
Age (continuous)	Age_continuous
age group: 15-24	age_15-24
age group: 25-34	age_25-34
age group: 35-44	age_35-44
age group: 45-54	age_45-54
age group: 55-64	age_55-64
age group: 65-74	age_65-74
age group: 75-84	age_75-84
age group: ≥85	age_85+
sex male	sex_m
sex female	sex_f
rss 01 bas-saint-laurent	loc_rss_01_3
rss 01 bas-saint-laurent	loc_rss_01_6
rss 01 bas-saint-laurent	loc_rss_01_12
rss 01 bas-saint-laurent	loc_rss_01_24
rss 01 bas-saint-laurent	loc_rss_01_36

1		
2		
3		
4	rss 01 bas-saint-laurent	loc_rss_01_48
5	rss 01 bas-saint-laurent	loc_rss_01_60
6	rss 02 saguenay-lac-saint-jean	loc_rss_02_3
7	rss 02 saguenay-lac-saint-jean	loc_rss_02_6
8	rss 02 saguenay-lac-saint-jean	loc_rss_02_12
9	rss 02 saguenay-lac-saint-jean	loc_rss_02_24
10	rss 02 saguenay-lac-saint-jean	loc_rss_02_36
11	rss 02 saguenay-lac-saint-jean	loc_rss_02_48
12	rss 02 saguenay-lac-saint-jean	loc_rss_02_60
13	rss 03 capitale-nationale	loc_rss_03_3
14	rss 03 capitale-nationale	loc_rss_03_6
15	rss 03 capitale-nationale	loc_rss_03_12
16	rss 03 capitale-nationale	loc_rss_03_24
17	rss 03 capitale-nationale	loc_rss_03_36
18	rss 03 capitale-nationale	loc_rss_03_48
19	rss 03 capitale-nationale	loc_rss_03_60
20	rss 04 mauricie et centre-du-québec	loc_rss_04_3
21	rss 04 mauricie et centre-du-québec	loc_rss_04_6
22	rss 04 mauricie et centre-du-québec	loc_rss_04_12
23	rss 04 mauricie et centre-du-québec	loc_rss_04_24
24	rss 04 mauricie et centre-du-québec	loc_rss_04_36
25	rss 04 mauricie et centre-du-québec	loc_rss_04_48
26	rss 04 mauricie et centre-du-québec	loc_rss_04_60
27	rss 05 estrie	loc_rss_05_3
28	rss 05 estrie	loc_rss_05_6
29	rss 05 estrie	loc_rss_05_12
30	rss 05 estrie	loc_rss_05_24
31	rss 05 estrie	loc_rss_05_36
32	rss 05 estrie	loc_rss_05_48
33	rss 05 estrie	loc_rss_05_60
34	rss 06 montréal	loc_rss_06_3
35	rss 06 montréal	loc_rss_06_6
36	rss 06 montréal	loc_rss_06_12
37	rss 06 montréal	loc_rss_06_24
38	rss 06 montréal	loc_rss_06_36
39	rss 06 montréal	loc_rss_06_48
40	rss 06 montréal	loc_rss_06_60
41	rss 07 outaouais	loc_rss_07_3
42	rss 07 outaouais	loc_rss_07_6
43	rss 07 outaouais	loc_rss_07_12
44	rss 07 outaouais	loc_rss_07_24
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60		

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3		
4	rss 07 outaouais	loc_rss_07_36
5	rss 07 outaouais	loc_rss_07_48
6	rss 07 outaouais	loc_rss_07_60
7	08 abitibi-témiscamingue	loc_rss_08_3
8	rss 08 abitibi-témiscamingue	loc_rss_08_6
9	rss 08 abitibi-témiscamingue	loc_rss_08_12
10	rss 08 abitibi-témiscamingue	loc_rss_08_24
11	rss 08 abitibi-témiscamingue	loc_rss_08_36
12	08 abitibi-témiscamingue	loc_rss_08_48
13	rss 08 abitibi-témiscamingue	loc_rss_08_60
14	rss 08 abitibi-témiscamingue	loc_rss_08_60
15	rss 09 côte-nord	loc_rss_09_3
16	rss 09 côte-nord	loc_rss_09_6
17	rss 09 côte-nord	loc_rss_09_12
18	rss 09 côte-nord	loc_rss_09_24
19	rss 09 côte-nord	loc_rss_09_36
20	rss 09 côte-nord	loc_rss_09_48
21	rss 09 côte-nord	loc_rss_09_60
22	rss 10 nord-du-québec	loc_rss_10_3
23	rss 10 nord-du-québec	loc_rss_10_6
24	rss 10 nord-du-québec	loc_rss_10_12
25	rss 10 nord-du-québec	loc_rss_10_24
26	rss 10 nord-du-québec	loc_rss_10_36
27	rss 10 nord-du-québec	loc_rss_10_48
28	rss 10 nord-du-québec	loc_rss_10_60
29	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_3
30	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_6
31	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_12
32	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_24
33	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_36
34	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_48
35	rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_60
36	rss 12 chaudière-appalaches	loc_rss_12_3
37	rss 12 chaudière-appalaches	loc_rss_12_6
38	rss 12 chaudière-appalaches	loc_rss_12_12
39	rss 12 chaudière-appalaches	loc_rss_12_24
40	rss 12 chaudière-appalaches	loc_rss_12_36
41	rss 12 chaudière-appalaches	loc_rss_12_48
42	rss 12 chaudière-appalaches	loc_rss_12_60
43	rss 13 laval	loc_rss_13_3
44	rss 13 laval	loc_rss_13_6
45	rss 13 laval	loc_rss_13_12
46		
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59		
60		

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2		
3	rss 13 laval	loc_rss_13_24
4	rss 13 laval	loc_rss_13_36
5	rss 13 laval	loc_rss_13_48
6	rss 13 laval	loc_rss_13_60
7	rss 13 laval	loc_rss_13_60
8	rss 14 lanaudière	loc_rss_14_3
9	rss 14 lanaudière	loc_rss_14_6
10	rss 14 lanaudière	loc_rss_14_12
11	rss 14 lanaudière	loc_rss_14_12
12	rss 14 lanaudière	loc_rss_14_24
13	rss 14 lanaudière	loc_rss_14_36
14	rss 14 lanaudière	loc_rss_14_36
15	rss 14 lanaudière	loc_rss_14_48
16	rss 14 lanaudière	loc_rss_14_60
17	rss 14 lanaudière	loc_rss_14_60
18	rss 15 laurentides	loc_rss_15_3
19	rss 15 laurentides	loc_rss_15_6
20	rss 15 laurentides	loc_rss_15_12
21	rss 15 laurentides	loc_rss_15_12
22	rss 15 laurentides	loc_rss_15_24
23	rss 15 laurentides	loc_rss_15_36
24	rss 15 laurentides	loc_rss_15_48
25	rss 15 laurentides	loc_rss_15_60
26	rss 15 laurentides	loc_rss_15_60
27	rss 16 montérégie	loc_rss_16_3
28	rss 16 montérégie	loc_rss_16_6
29	rss 16 montérégie	loc_rss_16_12
30	rss 16 montérégie	loc_rss_16_24
31	rss 16 montérégie	loc_rss_16_24
32	rss 16 montérégie	loc_rss_16_36
33	rss 16 montérégie	loc_rss_16_48
34	rss 16 montérégie	loc_rss_16_60
35	location nonrural	nonrural_3
36	location nonrural	nonrural_6
37	location nonrural	nonrural_6
38	location nonrural	nonrural_12
39	location nonrural	nonrural_12
40	location nonrural	nonrural_24
41	location nonrural	nonrural_36
42	location nonrural	nonrural_48
43	location nonrural	nonrural_60
44	location nonrural	nonrural_60
45	location rural	rural_3
46	location rural	rural_6
47	location rural	rural_12
48	location rural	rural_12
49	location rural	rural_24
50	location rural	rural_36
51	location rural	rural_48
52	location rural	rural_60
53	location rural	rural_60
54	location missing data	loc_missing_3
55	location missing data	loc_missing_6
56		
57		
58		
59		
60		

location missing data	loc_missing_12
location missing data	loc_missing_24
location missing data	loc_missing_36
location missing data	loc_missing_48
location missing data	loc_missing_60
adherence to the public drug plan (RAMQ)	PublicRxPlan_3
adherence to the public drug plan (RAMQ)	PublicRxPlan_6
adherence to the public drug plan (RAMQ)	PublicRxPlan_12
adherence to the public drug plan (RAMQ)	PublicRxPlan_24
adherence to the public drug plan (RAMQ)	PublicRxPlan_36
adherence to the public drug plan (RAMQ)	PublicRxPlan_48
adherence to the public drug plan (RAMQ)	PublicRxPlan_60

ENVIRONMENTAL VARIABLES

i. DEPRIVATION INDEX

- Material deprivation (from 1, least deprived to 5, most deprived)
- Social deprivation (from 1, least deprived to 5, most deprived)

derived variables⁷	variable name
material deprivation (1-5)	matdep_3
material deprivation (1-5)	matdep_6
material deprivation (1-5)	matdep_12
material deprivation (1-5)	matdep_24
material deprivation (1-5)	matdep_36
material deprivation (1-5)	matdep_48
material deprivation (1-5)	matdep_60
social deprivation (1-5)	socdep_3
social deprivation (1-5)	socdep_6
social deprivation (1-5)	socdep_12
social deprivation (1-5)	socdep_24
social deprivation (1-5)	socdep_36
social deprivation (1-5)	socdep_48
social deprivation (1-5)	socdep_60

SYSTEM VARIABLES

i. HEALTH SYSTEM ENVIRONMENT (HEALTH SYSTEM)

- Mental health budget

- Bas-Saint-Laurent
- Saguenay-Lac-Saint-Jean
- Capitale-Nationale
- Mauricie et Centre-du-Québec
- Estrie
- Montréal
- Outaouais
- Abitibi-Témiscamingue
- Côte-Nord
- Nord-du-Québec
- Gaspésie-îles-de-la-Madeleine
- Chaudière-Appalaches
- Laval
- Lanaudière
- Laurentides
- Montérégie
- Addictions budget
 - Bas-Saint-Laurent
 - Saguenay-Lac-Saint-Jean
 - Capitale-Nationale
 - Mauricie et Centre-du-Québec
 - Estrie
 - Montréal
 - Outaouais
 - Abitibi-Témiscamingue
 - Côte-Nord
 - Nord-du-Québec
 - Gaspésie-îles-de-la-Madeleine
 - Chaudière-Appalaches
 - Laval
 - Lanaudière
 - Laurentides
 - Montérégie
- regional mental health budget (\$/capita)
 - 2018-2019
 - 2017-2018
 - 2016-2017
 - 2015-2016
- regional addictions health budget (\$/capita)
 - 2018-2019
 - 2017-2018
 - 2016-2017
 - 2015-2016

derived variables	variable name
rss 01 bas-saint-laurent mental health budget	rss_01_mh_3
rss 01 bas-saint-laurent mental health budget	rss_01_mh_6
rss 01 bas-saint-laurent mental health budget	rss_01_mh_12

rss 01 bas-saint-laurent mental health budget	rss_01_mh_24
rss 01 bas-saint-laurent mental health budget	rss_01_mh_36
rss 01 bas-saint-laurent mental health budget	rss_01_mh_48
rss 01 bas-saint-laurent mental health budget	rss_01_mh_60
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_3
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_6
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_12
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_24
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_36
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_48
rss 02 saguenay-lac-saint-jean mental health budget	rss_02_mh_60
rss 03 capitale-nationale mental health budget	rss_03_mh_3
rss 03 capitale-nationale mental health budget	rss_03_mh_6
rss 03 capitale-nationale mental health budget	rss_03_mh_12
rss 03 capitale-nationale mental health budget	rss_03_mh_14
rss 03 capitale-nationale mental health budget	rss_03_mh_36
rss 03 capitale-nationale mental health budget	rss_03_mh_48
rss 03 capitale-nationale mental health budget	rss_03_mh_60
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_3
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_6
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_12
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_24
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_36
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_48
rss 04 mauricie et centre-du-québec mental health budget	rss_04_mh_60
rss 05 estrie mental health budget	rss_05_mh_3
rss 05 estrie mental health budget	rss_05_mh_6
rss 05 estrie mental health budget	rss_05_mh_12
rss 05 estrie mental health budget	rss_05_mh_24
rss 05 estrie mental health budget	rss_05_mh_36
rss 05 estrie mental health budget	rss_05_mh_48
rss 05 estrie mental health budget	rss_05_mh_60
rss 06 montréal mental health budget	rss_06_mh_3
rss 06 montréal mental health budget	rss_06_mh_6
rss 06 montréal mental health budget	rss_06_mh_12
rss 06 montréal mental health budget	rss_06_mh_24
rss 06 montréal mental health budget	rss_06_mh_36
rss 06 montréal mental health budget	rss_06_mh_48
rss 06 montréal mental health budget	rss_06_mh_60
rss 07 outaouais mental health budget	rss_07_mh_3
rss 07 outaouais mental health budget	rss_07_mh_6

1		
2		
3		
4	rss 07 outaouais mental health budget	rss_07_mh_12
5	rss 07 outaouais mental health budget	rss_07_mh_24
6	rss 07 outaouais mental health budget	rss_07_mh_36
7	rss 07 outaouais mental health budget	rss_07_mh_48
8	rss 07 outaouais mental health budget	rss_07_mh_60
9		
10	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_3
11	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_6
12	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_12
13	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_24
14	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_36
15	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_48
16	rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_60
17		
18	rss 09 côte-nord mental health budget	rss_09_mh_3
19	rss 09 côte-nord mental health budget	rss_09_mh_6
20	rss 09 côte-nord mental health budget	rss_09_mh_12
21	rss 09 côte-nord mental health budget	rss_09_mh_24
22	rss 09 côte-nord mental health budget	rss_09_mh_36
23	rss 09 côte-nord mental health budget	rss_09_mh_48
24	rss 09 côte-nord mental health budget	rss_09_mh_60
25		
26	rss 10 nord-du-québec mental health budget	rss_10_mh_3
27	rss 10 nord-du-québec mental health budget	rss_10_mh_6
28	rss 10 nord-du-québec mental health budget	rss_10_mh_12
29	rss 10 nord-du-québec mental health budget	rss_10_mh_24
30	rss 10 nord-du-québec mental health budget	rss_10_mh_36
31	rss 10 nord-du-québec mental health budget	rss_10_mh_48
32	rss 10 nord-du-québec mental health budget	rss_10_mh_60
33		
34	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_3
35	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_6
36	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_12
37	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_24
38	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_36
39	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_48
40	rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_60
41		
42	rss 12 chaudière-appalaches mental health budget	rss_12_mh_3
43	rss 12 chaudière-appalaches mental health budget	rss_12_mh_6
44	rss 12 chaudière-appalaches mental health budget	rss_12_mh_12
45	rss 12 chaudière-appalaches mental health budget	rss_12_mh_24
46	rss 12 chaudière-appalaches mental health budget	rss_12_mh_36
47	rss 12 chaudière-appalaches mental health budget	rss_12_mh_48
48	rss 12 chaudière-appalaches mental health budget	rss_12_mh_60
49		
50	rss 13 laval mental health budget	rss_13_mh_3
51		
52		
53		
54		
55		
56		
57		
58		
59		
60		

1		
2		
3		
4	rss 13 laval mental health budget	rss_13_mh_6
5	rss 13 laval mental health budget	rss_13_mh_12
6	rss 13 laval mental health budget	rss_13_mh_24
7	rss 13 laval mental health budget	rss_13_mh_36
8	rss 13 laval mental health budget	rss_13_mh_48
9	rss 13 laval mental health budget	rss_13_mh_60
10	rss 13 laval mental health budget	rss_13_mh_60
11	rss 14 lanaudière mental health budget	rss_14_mh_3
12	rss 14 lanaudière mental health budget	rss_14_mh_6
13	rss 14 lanaudière mental health budget	rss_14_mh_12
14	rss 14 lanaudière mental health budget	rss_14_mh_12
15	rss 14 lanaudière mental health budget	rss_14_mh_24
16	rss 14 lanaudière mental health budget	rss_14_mh_24
17	rss 14 lanaudière mental health budget	rss_14_mh_36
18	rss 14 lanaudière mental health budget	rss_14_mh_36
19	rss 14 lanaudière mental health budget	rss_14_mh_48
20	rss 14 lanaudière mental health budget	rss_14_mh_48
21	rss 14 lanaudière mental health budget	rss_14_mh_60
22	rss 14 lanaudière mental health budget	rss_14_mh_60
23	rss 15 laurentides mental health budget	rss_15_mh_3
24	rss 15 laurentides mental health budget	rss_15_mh_3
25	rss 15 laurentides mental health budget	rss_15_mh_6
26	rss 15 laurentides mental health budget	rss_15_mh_6
27	rss 15 laurentides mental health budget	rss_15_mh_12
28	rss 15 laurentides mental health budget	rss_15_mh_12
29	rss 15 laurentides mental health budget	rss_15_mh_24
30	rss 15 laurentides mental health budget	rss_15_mh_24
31	rss 15 laurentides mental health budget	rss_15_mh_36
32	rss 15 laurentides mental health budget	rss_15_mh_36
33	rss 15 laurentides mental health budget	rss_15_mh_48
34	rss 15 laurentides mental health budget	rss_15_mh_48
35	rss 15 laurentides mental health budget	rss_15_mh_60
36	rss 15 laurentides mental health budget	rss_15_mh_60
37	rss 16 montérégie mental health budget	rss_16_mh_3
38	rss 16 montérégie mental health budget	rss_16_mh_3
39	rss 16 montérégie mental health budget	rss_16_mh_6
40	rss 16 montérégie mental health budget	rss_16_mh_6
41	rss 16 montérégie mental health budget	rss_16_mh_12
42	rss 16 montérégie mental health budget	rss_16_mh_12
43	rss 16 montérégie mental health budget	rss_16_mh_24
44	rss 16 montérégie mental health budget	rss_16_mh_24
45	rss 16 montérégie mental health budget	rss_16_mh_36
46	rss 16 montérégie mental health budget	rss_16_mh_36
47	rss 16 montérégie mental health budget	rss_16_mh_48
48	rss 16 montérégie mental health budget	rss_16_mh_48
49	rss 16 montérégie mental health budget	rss_16_mh_60
50	rss 16 montérégie mental health budget	rss_16_mh_60
51	rss 01 bas-saint-laurent addictions budget	rss_01_a_3
52	rss 01 bas-saint-laurent addictions budget	rss_01_a_3
53	rss 01 bas-saint-laurent addictions budget	rss_01_a_6
54	rss 01 bas-saint-laurent addictions budget	rss_01_a_6
55	rss 01 bas-saint-laurent addictions budget	rss_01_a_12
56	rss 01 bas-saint-laurent addictions budget	rss_01_a_12
57	rss 01 bas-saint-laurent addictions budget	rss_01_a_24
58	rss 01 bas-saint-laurent addictions budget	rss_01_a_24
59	rss 01 bas-saint-laurent addictions budget	rss_01_a_36
60	rss 01 bas-saint-laurent addictions budget	rss_01_a_36
	rss 01 bas-saint-laurent addictions budget	rss_01_a_48
	rss 01 bas-saint-laurent addictions budget	rss_01_a_48
	rss 01 bas-saint-laurent addictions budget	rss_01_a_60
	rss 01 bas-saint-laurent addictions budget	rss_01_a_60
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_3
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_3
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_6
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_6
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_12
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_12
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_24
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_24
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_36
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_36
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_48
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_48
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60
	rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60

1		
2		
3		
4	rss 03 capitale-nationale addictions budget	rss_03_a_3
5	rss 03 capitale-nationale addictions budget	rss_03_a_6
6	rss 03 capitale-nationale addictions budget	rss_03_a_12
7	rss 03 capitale-nationale addictions budget	rss_03_a_24
8	rss 03 capitale-nationale addictions budget	rss_03_a_36
9	rss 03 capitale-nationale addictions budget	rss_03_a_48
10	rss 03 capitale-nationale addictions budget	rss_03_a_60
11	rss 03 capitale-nationale addictions budget	rss_03_a_60
12	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_3
13	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_6
14	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_12
15	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_24
16	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_36
17	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_48
18	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
19	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
20	rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
21	rss 05 estrie addictions budget	rss_05_a_3
22	rss 05 estrie addictions budget	rss_05_a_6
23	rss 05 estrie addictions budget	rss_05_a_12
24	rss 05 estrie addictions budget	rss_05_a_24
25	rss 05 estrie addictions budget	rss_05_a_36
26	rss 05 estrie addictions budget	rss_05_a_48
27	rss 05 estrie addictions budget	rss_05_a_60
28	rss 05 estrie addictions budget	rss_05_a_60
29	rss 05 estrie addictions budget	rss_05_a_60
30	rss 06 montréal addictions budget	rss_06_a_3
31	rss 06 montréal addictions budget	rss_06_a_6
32	rss 06 montréal addictions budget	rss_06_a_12
33	rss 06 montréal addictions budget	rss_06_a_24
34	rss 06 montréal addictions budget	rss_06_a_36
35	rss 06 montréal addictions budget	rss_06_a_48
36	rss 06 montréal addictions budget	rss_06_a_60
37	rss 06 montréal addictions budget	rss_06_a_60
38	rss 06 montréal addictions budget	rss_06_a_60
39	rss 07 outaouais addictions budget	rss_07_a_3
40	rss 07 outaouais addictions budget	rss_07_a_6
41	rss 07 outaouais addictions budget	rss_07_a_12
42	rss 07 outaouais addictions budget	rss_07_a_24
43	rss 07 outaouais addictions budget	rss_07_a_36
44	rss 07 outaouais addictions budget	rss_07_a_48
45	rss 07 outaouais addictions budget	rss_07_a_60
46	rss 07 outaouais addictions budget	rss_07_a_60
47	rss 07 outaouais addictions budget	rss_07_a_60
48	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_3
49	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_6
50	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_12
51	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_24
52	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_36
53	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48
54	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48
55	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48
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4	rss 08 abitibi-témiscamingue addictions budget	rss_08_a_60
5	rss 09 côte-nord addictions budget	rss_09_a_3
6	rss 09 côte-nord addictions budget	rss_09_a_6
7	rss 09 côte-nord addictions budget	rss_09_a_12
8	rss 09 côte-nord addictions budget	rss_09_a_24
9	rss 09 côte-nord addictions budget	rss_09_a_36
10	rss 09 côte-nord addictions budget	rss_09_a_48
11	rss 09 côte-nord addictions budget	rss_09_a_60
12		
13	rss 10 nord-du-québec addictions budget	rss_10_a_3
14	rss 10 nord-du-québec addictions budget	rss_10_a_6
15	rss 10 nord-du-québec addictions budget	rss_10_a_12
16	rss 10 nord-du-québec addictions budget	rss_10_a_24
17	rss 10 nord-du-québec addictions budget	rss_10_a_36
18	rss 10 nord-du-québec addictions budget	rss_10_a_48
19	rss 10 nord-du-québec addictions budget	rss_10_a_60
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21	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_3
22	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_6
23	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_12
24	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_24
25	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_36
26	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_48
27	rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
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29	rss 12 chaudière-appalaches addictions budget	rss_12_a_3
30	rss 12 chaudière-appalaches addictions budget	rss_12_a_6
31	rss 12 chaudière-appalaches addictions budget	rss_12_a_12
32	rss 12 chaudière-appalaches addictions budget	rss_12_a_24
33	rss 12 chaudière-appalaches addictions budget	rss_12_a_36
34	rss 12 chaudière-appalaches addictions budget	rss_12_a_48
35	rss 12 chaudière-appalaches addictions budget	rss_12_a_60
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38	rss 13 laval addictions budget	rss_13_a_6
39	rss 13 laval addictions budget	rss_13_a_12
40	rss 13 laval addictions budget	rss_13_a_24
41	rss 13 laval addictions budget	rss_13_a_36
42	rss 13 laval addictions budget	rss_13_a_48
43	rss 13 laval addictions budget	rss_13_a_60
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48	rss 14 lanaudivère addictions budget	rss_14_a_24
49	rss 14 lanaudivère addictions budget	rss_14_a_36
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5	rss 14 lanauidière addictions budget	rss_14_a_60
6	rss 15 laurentides addictions budget	rss_15_a_3
7	rss 15 laurentides addictions budget	rss_15_a_6
8	rss 15 laurentides addictions budget	rss_15_a_12
9	rss 15 laurentides addictions budget	rss_15_a_24
10	rss 15 laurentides addictions budget	rss_15_a_36
11	rss 15 laurentides addictions budget	rss_15_a_48
12	rss 15 laurentides addictions budget	rss_15_a_60
13	rss 16 montérégie addictions budget	rss_16_a_3
14	rss 16 montérégie addictions budget	rss_16_a_6
15	rss 16 montérégie addictions budget	rss_16_a_12
16	rss 16 montérégie addictions budget	rss_16_a_24
17	rss 16 montérégie addictions budget	rss_16_a_36
18	rss 16 montérégie addictions budget	rss_16_a_48
19	rss 16 montérégie addictions budget	rss_16_a_60
20	regional mental health budget (\$/capita)	region_mhbudget_2018-2019
21	regional mental health budget (\$/capita)	region_mhbudget_2017-2018
22	regional mental health budget (\$/capita)	region_mhbudget_2016-2017
23	regional mental health budget (\$/capita)	region_mhbudget_2015-2016
24	regional addictions budget (\$/capita)	region_abudget_2018-2019
25	regional addictions budget (\$/capita)	region_abudget_2017-2018
26	regional addictions budget (\$/capita)	region_abudget_2016-2017
27	regional addictions budget (\$/capita)	region_abudget_2015-2016
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ii. QUALITY OF CARE INDICATORS (QUALITYCARE)

- quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)
- quality of mental health services depression disorder mental health services follow-up in primary care (continuous)
- quality of substance use disorder mental health services follow-up in primary care (continuous)
- quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)
- quality of mental health services follow-up in primary care after suicide attempt (continuous)
- quality of community mental health services (continuous)
- quality of community mental health services of patients with severe mental illness (continuous)
- quality of community mental health services of patients with common mental disorders (continuous)
- quality of community mental health services of patients with personality disorders (continuous)
- adequate use of emergency room for mental health service (continuous)

derived variables	variable name
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_3
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_6
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_12
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_24
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_36
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_48
quality of anxiety or depressive disorders mental health services follow-up in primary care (continuous)	qfu_primcare_anxdep_60
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_3
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_6
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_12
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_24
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_36
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_48
quality of depression disorder mental health services follow-up in primary care (continuous)	qfu_primcare_dep_60
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_3
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_6
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_12

quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_24
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_36
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_48
quality of substance use disorder mental health services follow-up in primary care (continuous)	qfu_primcare_sud_60
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_3
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_6
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_12
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_24
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_36
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_48
quality of mental health care services follow-up after hospitalization: readmission within 30 days (continuous)	qfu_posthosp_readmit30_60
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_3
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_6
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_12
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_24
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_36
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_48
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsucideattempt_60
quality of community mental health services (continuous)	qcomserv_3

quality of community mental health services (continuous)	qcomserv_6
quality of community mental health services (continuous)	qcomserv_12
quality of community mental health services (continuous)	qcomserv_24
quality of community mental health services (continuous)	qcomserv_36
quality of community mental health services (continuous)	qcomserv_48
quality of community mental health services (continuous)	qcomserv_60
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_3
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_6
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_12
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_24
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_36
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_48
quality of community mental health services of patients with severe mental illness (continuous)	qcomserv_severe_60
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_3
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_6
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_12
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_24
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_36
quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_48

quality of community mental health services of patients with common mental disorders (continuous)	qcomserv_cmd_60
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_3
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_6
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_12
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_24
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_36
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_48
quality of community mental health services of patients with personality disorders (continuous)	qcomserv_pd_60
adequate use of emergency room for mental health service (continuous)	aduse_er_3
adequate use of emergency room for mental health service (continuous)	aduse_er_6
adequate use of emergency room for mental health service (continuous)	aduse_er_12
adequate use of emergency room for mental health service (continuous)	aduse_er_24
adequate use of emergency room for mental health service (continuous)	aduse_er_36
adequate use of emergency room for mental health service (continuous)	aduse_er_48
adequate use of emergency room for mental health service (continuous)	aduse_er_60

APPENDIX A: CLASSES_MEDICAMENTS_CAROLINE SIROIS 30

AVRIL.XLSX

Mental health medication

Psychotropic medications						
Group	Sub-group	Medications	Common denomination codes			

Antipsychotics				
	Typical			
		Chlopromazine	1924	
		Flupenthixol	41863	
			43202	
		Fluphenazine	4056	
			4069	
			34284	
		Haloperidol	4394	
			43540	
			43826	
			46292	
		Loxapine	34219	
			37612	
			40745	
		Methotrimeprazine	6045	
		Perphenazine	7176	
			46011	(In combination with amitryptiline)
		Pimozide	33465	
		Pipotiazine	41707	
		Prochlorperazine	45458	
			45528	
			8125	
		Thioridazine	9594	
		Thiopropazine	9568	
		Trifluoperazine	9802	
			34440	
			46108	(In combination with isopropamide)
		Zuclopenthixol	47136	
			47137	
			47138	
	Atypical	Asenapine	47921	
		Aripiprazole	47801	
		Brexpiprazole	48153	
		Clozapine	45580	
		Lurasidone	47939	

		Tranlycypromine	9698		
	IRMA	Moclobemide	46427		
			47005		
	SRI+ 5HT1a partial agonist	Vilazodone	48227		
	Serotonin modulator	Vortioxetine	48038		
Other antidepressants - Those mostly used for other indications than depression or anxiety disorders					
	Tricyclics	Amitryptiline	429		
			46011	(Combination with perphenazine)	
		Clomipramine	14781		
		Desipramine	2522		
		Doxepine	3198		
		Imipramine	4784		
		Nortriptyline	6578		
		Trimipramine	9906		
	Inh. S recap + antag 5-HT2	Trazodone	43137		
Mood stabilizers (other than antipsychotics and other medications included in other classes)					
		Carbamazepine	1404		
			10270		
		Gabapentin	46229		
			47100		
		Lamotrigine	47110		
			46248		
		Lithium	47071		
			47237		

			39302	
		Guanfacine	47979	
Alzheimer's disease				
	Inh. Acetylcholinesterase	Donepezil	47352	
		Galantamine	47415	
			46767	
		Rivastigmine	47726	
			46673	
			47368	
	NMDA	Memantine	47542	

Medication classes – other

MAIN CLASSES	Sub-classes that may be studied	AHFS codes or Medications				
Diabetes		AHFS sub-class 68:20	Antidiabetes			
Cardiovascular diseases		AFHS sub-class				
	Antithrombotics	20:12	Antithrombotics (anticoagulants, antiplatelets)			et ajouter les CODES DÉNOMINATIONS COMMUNE ASPIRINE: 143 et 46353
	Antihypertensive agents	24:08	Antihypertensives (alpha-agonists, vasodilators)			
		24:20	Alpha-blockers			
		24:24	Beta-blockers			
		24:28	Calcium channel blockers			
		24:32	ACE inhibitors and ARBs			

		40:28	Diuretics			
	Antiarrhythmic and cardiotonic	24:04	Cardiotropic (antiarrhythmics, cardiotonics)			
	Hypolipemians	24:06	Hypolipemians (statins, fibrates, etc)			
	Vasodilators	24:12	Nitrates and other vasodilators			
Respiratory diseases (mediations used to treat COPD and asthma)						
		Medications		Code denomination commune		
		Acidinium		47986		
		Glycopyrronium		47949		
		Tiotropium		46856		
		Uméclidinium		48109		
		Formotérol		47916		
		Indacatérol		47923		
		Salmétérol		46247		
				47112		
		Olodatérol				
		Glycopyrronium/indacatérol		48033		
		Uméclidinium/vilantérol		48224		
				48029		
		Acidinium/formotérol				
		Tiotropium/Olodatérol		48064		
		Budésonide/formotérol		47428		
				46800		
				47917		
				47925		
		Fluticasone/salmétérol		46597		
				47335		
		Fluticasone/vilantérol		48006		
		Salbutamol		10530		Exclure les codes de forme: 116, 203,435, 2262, 2088, 2117, 4147
				33634		
				46737		

				56:14	Cholelitholytics	
				56:16	Digestives	
				56:22	Anti-emetics	
				56:28	Anti-acids	
				56:32	Pro-kinetics	
				56:36	Gastro-intestinal anti-inflammatory drugs	
				56:92	Miscellaneous	
Anti-infective agents		AHFS class		(Example of sub-classes that are included in the the 08. class)		
		08.xx		8:08	Anthelmintics	
				8:12	Antibacterials	
				8:14	Antifungals	
				8:16	Antimycobacterials	
				8:18	Antivirals	
				8:30	Antiprotozoals	
				8:36	Urinary Anti-infectives	
				9:32	Anti-Infectives, Miscellaneous	
Antineoplastic agents		AHFS class				
		10.xx				
Pain		AHFS subclass				
		28:08	Analgesic and antipyretics (NSAIDs, opioids, etc)			SAUF
		Specific medications		Codes denomination commune		
		Cyclobenzaprine		46516		
				38873		

		Baclofene		41447			
				46337			
		Orphenadrine		46094			
				46254			
				6734			
	Contraceptives	AHFS subclass	68:12	Anovulants			
	Not included: Glaucoma, Osteoporosis, ear/eyes/nose drugs, corticosteroids, skin medications, Parkinson disease						

For peer review only

APPENDIX I_2: LIST OF THE CANDIDATE INDICATORS AT THE PROGRAMMATIC AND SYSTEM LEVELS SUPPORTED BY THE HEALTH SERVICES AND PUBLIC HEALTH LITERATURE OR PRACTICES

TABLE 2
List of the candidate indicators at the programmatic and system levels supported by the health services and public health literature or practices

Candidate indicators	Aim	Literature support	Description	Measure	Data sources
1. Quality of anxiety or depressive disorders mental health services follow-up in primary care	Determine adequate care for patient diagnosed with anxiety and depressive disorders in primary care	Based on number of physician visits by Wang, et al. ⁴⁴ and other studies ^{47,48}	Denominator: Individuals aged 15+ years with an anxiety or depressive disorder diagnosis by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received an anxiety or depressive disorder diagnosis with ≥ 4 visits for mental health	QICDSS
2. Quality of depression disorder mental health services follow-up in primary care	Determine adequate care for patient diagnosed with depression in primary care	Based on number of physician visits by Wang, et al. ⁴⁴ and other studies ^{47,48}	Denominator: Individuals aged 15+ years with a diagnosis of depression by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received a depression diagnosis with ≥ 4 visits for mental health	QICDSS
3. Quality of substance use disorder mental health services follow-up in primary care	Determine adequate care for patient diagnosed with substance use disorder in primary care	Based on 4 visits with a family physician for counseling as recommended by NICE ⁵⁶ and the guidelines for American primary care clinicians ⁵⁸	Denominator: Individuals aged 15+ years with a diagnosis of substance use disorder by a General Practitioner (GP) in a given year Numerator: Received ≥ 4 visits for mental health in that year	Prevalence of individuals 15+ years who received a substance use disorder diagnosis with ≥ 4 visits for mental health	QICDSS
4. Quality of mental health care services follow-up after hospitalization: readmission within 30 days	Determine the quality of mental specialist health care and in-hospital care	Based on the work of the Canadian Institute for Health Information (CIHI) ^{45,47,48}	Denominator: Individuals aged 15+ years admitted in a hospital with a mental health diagnosis in a given year Numerator: Individual readmitted for mental health within 30 days of initial discharge	Prevalence of individuals 15+ years who were readmitted to a hospital for a mental health diagnosis within 30 days of initial discharge	QICDSS
5. Quality of mental health services follow-up in primary care after suicide attempt	Determine the quality of mental health care of readmission rates in the region compared to others	Based on the work of the Canadian Institute for Health Information (CIHI) ^{45,47,48}	Denominator: Individuals aged 15+ years admitted to a hospital for suicide attempt in a given year Numerator: Received ≥ 1 visit to a physician for mental health within 30 days of hospital discharge for suicide attempt	Prevalence of individuals 15+ years who received ≥ 1 visit from a physician within 30 days of initial discharge for suicide attempt	QICDSS (linked to MedEcho for suicide attempt) ^{40,41,50}
6. Quality of community mental health services	Determine the balance of the community-oriented mental health care system	Based on the typologies of primary and specialist (including in-hospital care) mental health care ^{45,46,54} used in the study of suicide attempts ⁵⁵	Denominator: Individuals aged 15+ years with a mental health diagnosis in a given year Numerator: Individuals with exclusively outpatient services – psychiatric or general practitioner (GP)	Prevalence of individuals 15+ years who received a mental health disorder diagnosis with exclusively outpatient services (psychiatric or GP)	QICDSS
7. Quality of community mental health services of patients with severe mental illness	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{45,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with exclusively a GP or a psychiatric outpatient visit for psychotic disorder Numerator: Number of individuals with exclusively a GP or psychiatrist outpatient visits	Prevalence of individuals 15+ years who received a severe mental illness disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
8. Quality of community mental health services of patients with common mental disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{45,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with a psychiatric or a GP outpatient visit for depression Numerator: Number of individuals with exclusively GP outpatient visits	Prevalence of individuals 15+ years who received a common mental disorder diagnosis and used exclusively outpatient services by a GP	QICDSS

Continued on the following page

TABLE 2 (continued)
List of the candidate indicators at the programmatic and system levels supported by the health services and public health literature or practices

Candidate indicators	Aim	Literature support	Description	Measure	Data sources
9. Quality of community mental health services of patients with substance use disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with a psychiatric or a GP outpatient visit for substance use disorder Numerator: Number of individuals with exclusively GP outpatient visits	Prevalence of individuals 15+ years who received a substance use disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
10. Quality of community mental health services of patients with personality disorders	Determine the balance of psychiatric outpatient and primary outpatient care depending on the profiles used ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{2,46,60,61}	Denominator: Individuals aged 15+ years with exclusively a GP or a psychiatric outpatient visit for personality disorder Numerator: Number of individuals with exclusively a GP or psychiatric outpatient visits	Prevalence of individuals 15+ years who received a personality disorder diagnosis and used exclusively outpatient services by a GP	QICDSS
11. Adequate use of emergency room for mental health services	Determine the balance of utilization of emergency room (ER) for mental health reasons ^{5,55}	Based on the associations found for the balance between primary and specialist mental health care and suicide rates ^{46,60,61}	Denominator: Individuals aged 15+ years with a diagnosis of a mental health disorder Numerator: Number of individuals with ER visits without being admitted	Prevalence of individuals 15+ years who received a diagnosis of mental health disorder with exclusively ER visits without being admitted	QICDSS
12. Program expenditures for mental health services	Determine the strength of the relationship between changes in suicide rates and expenditures for mental health (regional and provincial)	Based on associations found between mental health budget and suicide rates ^{21,23}	Refer to the Gouvernement du Québec ⁴³	Dollars per capita spent on mental health programs (provincial and regional)	Annual financial reports from the Ministère de la santé et des services sociaux (MSSS) ⁴³
13. Program expenditures for addiction services	Determine the strength of the relationship between changes in suicide rates and expenditures for addiction services (regional and provincial)	Based on associations found between mental health budget and suicide rates ^{21,23}	Refer to the Gouvernement du Québec ⁴³	Dollars per capita spent on health programs for addiction services (provincial and regional)	Annual financial reports from the MSSS ⁴³

Abbreviations: CIHI, Canadian Institute for Health Information; ER, emergency room; GP, general practitioner; MSSS, Ministère de la santé et des services sociaux; QICDSS, Quebec Integrated Chronic Disease Surveillance System.

¹ Profile 1: psychiatric inpatient care; profile 2: hospital emergency room (ER); profile 3: psychiatric outpatient care; profile 4: general practitioner (GP) clinics; and profile 5: other medical specialist.

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