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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 Ethnics 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 generalizabilility 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.

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

Methods

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

Model development and validation

Target population: The general population residing in the province of Quebec, Canada. The province had a population of over 8.6 million people in 2021, and about 95% of the population reported being able to conduct a conversation in French. In Quebec, health services are planned and delivered through 18 health regions, 22 integrated health and social services centres, and 166 Centres locaux de santé Communautaire (CLSCs). Budgetary decisions are made at the levels of province and health regions/integrated .health and social services centres.

Data sources: We will develop the prediction tools by linking the suicide database, the Ministry of Health and Social Services (MSSS) public financial reports (Contour financier - Publications du ministère de la Santé et des Services sociaux (gouv.qc.ca), and the Canadian Urban Environmental Health Research (CANUE) data. The suicide database gathers individual-level data annually based on residents health insurance number from five administrative databases: the vital statistics death database, the physician claims database, the hospital discharge database, the Insured Person Registration File and the public drug plan. These databases cover up to 98% of the population in Quebec and contain data for over 20,000 suicides occurred since 1996. With the suicide database and other linkable Ministry financial databases, individual (e.g., sex, age), program (e.g., hospitalization, emergency department visits), and system (e.g., mental health and addiction budgets) level indicators can be identified, and the indicators at each level may be classified into the broad categories of input and process.(4)

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

Multilayer perceptron with an optimized model architecture. These 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. From that, we will make simulations of changes coming from policies by modifying the population composition for reflecting the effect of policies change (e.g., mental health diagnoses, socio-economic factors, health system resources allocation) and evaluate their effect on the suicide rates predicted, comparing these with rates obtained with the current population and population modified differently. Moreover, 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.(14,15) 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 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 fixed effect logistic regression to develop the sex-specific statistical models that accounted for clusterings at the health regions. Backward selection method will be used 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).(16) 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.(16) 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:(17)

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

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:

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

Qualitative study

The objective of the qualitative study is to investigate the end-users' views about predicting population risk of suicide, and the potential social, legal, ethical, and privacy issues and mitigation strategies for implementing such a predictive system. Using snowballing techniques, we have invited policy and decision makers at the federal and provincial levels, mental health professionals, individuals who have extensive experience in working with policy and decision makers and who have expertise in suicide prevention, social and health policy, as well as health administrative data, people with lived experience, and advocates for families bereaved by suicide. The qualitative study consists of two rounds of interviews. The first round of interviews were carried out after the general team meeting held in July 2021, at which the study design was finalized. The second round of interviews will be organized once the predictive models are developed. The first round interviews were held through zoom meetings, and follow a series of semi-structured interview questions related to the objectives. Qualitative data collected during the focus groups and qualitative interviews are audio recorded, transcribed, and analyzed with the support of QDA Miner (Provalis).(18) The second round of interviews will be conducted once the prototype models are developed and presented at the second general team meeting which is to be held in late 2022. We will perform an inductive thematic analysis of the focus

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

surveys and health administrative databases have been used to develop risk predictive models for diabetes,(19) heart disease,(20) and major depression.(21,22) These models may be used to identify high risk individuals in the community; they can also be used to forecast the population risk in the future. However, few models have integrated individual, healthcare system, and community level predictors in the same model. In this study, we proposed to include data from these different levels in model development, and convert the models into synthetic estimation models. There may be different approaches for integrating data from different levels for population risk prediction. Future studies are needed to explore the best method for data integration.

The performance of a risk predictive model is commonly assessed by indicators of model discrimination and calibration.(23) Whereas model discrimination is critical for individual risk predictive models, policy and decision makers' focus is on the whole population rather than individuals. Therefore, model calibration plays a more important role in the performance of a population risk model. We proposed four indicators for assessing model performance. However, it is not clear how much error (the difference between predicted and observed risks) policy and decision makers may tolerate for population risk prediction, how they perceive the importance of model discrimination, whether other indicators exist for assessing population risk prediction models. We will explore these aspects through our qualitative study, and also encourage others to consider these in future studies. Similarly, we welcome discussions and debates about the methods for validating population risk predictive models. An individual risk predictive model is often developed using longitudinal cohort/closed population data and validated in a different but related cohort/closed population. This poses challenges for population risk predictive models because the population in a community/health region is open and dynamic. Appropriate methods for model validation and acceptability need to be developed and agreed by the research community and policy and decision makers.

Despite the challenges for developing population risk predictive model for suicide, research is urgently needed to address this important population health issue. This study represents one of the early steps in building such risk predictive models and methodology development, as part of the collective efforts for moving the field forward.

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

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Competing interests: none

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APPENDIX I_1: CANDIDATE PREDICTORS

i. PSYCHIATRIC DISORDERS DIAGNOSIS[1]

- Substance use disorder[2]
  - Alcohol use disorder
  - 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 variables[5]	**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_pediatrician_3
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_6
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_12
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_24
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_36
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_48
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_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

# 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

neurological disease	physdx _neuro_12
neurological disease	physdx _neuro_24
neurological disease	physdx _neuro_36
neurological disease	physdx _neuro_48
neurological disease	physdx _neuro_60
endocrine system disorder	physdx _endo_3
endocrine system disorder	physdx _endo_6
endocrine system disorder	physdx _endo_12
endocrine system disorder	physdx _endo_24
endocrine system disorder	physdx _endo_36
endocrine system disorder	physdx _endo_48
endocrine system disorder	physdx _endo_60
trauma	physdx _trauma_3
trauma	physdx _trauma_6
trauma	physdx _trauma_12
trauma	physdx _trauma_24
trauma	physdx _trauma_36
trauma	physdx _trauma_48
trauma	physdx _trauma_60
respiratory disorder	physdx _resp_3
respiratory disorder	physdx _resp_6
respiratory disorder	physdx _resp_12
respiratory disorder	physdx _resp_24
respiratory disorder	physdx _resp_36
respiratory disorder	physdx _resp_48
respiratory disorder	physdx _resp_60
infectious disease	physdx _infec_3
infectious disease	physdx _infec_6
infectious disease	physdx _infec_12
infectious disease	physdx _infec_24
infectious disease	physdx _infec_36
infectious disease	physdx _infec_48
infectious disease	physdx _infec_60
digestive disorder	physdx _diges_3
digestive disorder	physdx _diges_6
digestive disorder	physdx _diges_12
digestive disorder	physdx _diges_24
digestive disorder	physdx _diges_36
digestive disorder	physdx _diges_48
digestive disorder	physdx _diges_60
cardiovascular disorder	physdx _cvd_3

cardiovascular disorder	physdx _cvd_6
cardiovascular disorder	physdx _cvd_12
cardiovascular disorder	physdx _cvd_24
cardiovascular disorder	physdx _cvd_36
cardiovascular disorder	physdx _cvd_48
cardiovascular disorder	physdx _cvd_60
cancer	physdx _cncr_3
cancer	physdx _cncr_6
cancer	physdx _cncr_12
cancer	physdx _cncr_24
cancer	physdx _cncr_36
cancer	physdx _cncr_48
cancer	physdx _cncr_60
other physical disorders	physdx _otr_3
other physical disorders	physdx _otr_6
other physical disorders	physdx _otr_12
other physical disorders	physdx _otr_24
other physical disorders	physdx _otr_36
other physical disorders	physdx _otr_48
other physical disorders	physdx _otr_60
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_3
charlson/elixhauser index with psy (conti)	physdx_comorbid_withpsy_6
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_12
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_24
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_36
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_48
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_60
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_3
charlson/elixhauser index without psy (conti)	physdx_comorbid_withoutpsy_6
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_12
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_24
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_36

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

rss 01 bas-saint-laurent	loc_rss_01_48
rss 01 bas-saint-laurent	loc_rss_01_60
rss 02 saguenay-lac-saint-jean	loc_rss_02_3
rss 02 saguenay-lac-saint-jean	loc_rss_02_6
rss 02 saguenay-lac-saint-jean	loc_rss_02_12
rss 02 saguenay-lac-saint-jean	loc_rss_02_24
rss 02 saguenay-lac-saint-jean	loc_rss_02_36
rss 02 saguenay-lac-saint-jean	loc_rss_02_48
rss 02 saguenay-lac-saint-jean	loc_rss_02_60
rss 03 capitale-nationale	loc_rss_03_3
rss 03 capitale-nationale	loc_rss_03_6
rss 03 capitale-nationale	loc_rss_03_12
rss 03 capitale-nationale	loc_rss_03_24
rss 03 capitale-nationale	loc_rss_03_36
rss 03 capitale-nationale	loc_rss_03_48
rss 03 capitale-nationale	loc_rss_03_60
rss 04 mauricie et centre-du-québec	loc_rss_04_3
rss 04 mauricie et centre-du-québec	loc_rss_04_6
rss 04 mauricie et centre-du-québec	loc_rss_04_12
rss 04 mauricie et centre-du-québec	loc_rss_04_24
rss 04 mauricie et centre-du-québec	loc_rss_04_36
rss 04 mauricie et centre-du-québec	loc_rss_04_48
rss 04 mauricie et centre-du-québec	loc_rss_04_60
rss 05 estrie	loc_rss_05_3
rss 05 estrie	loc_rss_05_6
rss 05 estrie	loc_rss_05_12
rss 05 estrie	loc_rss_05_24
rss 05 estrie	loc_rss_05_36
rss 05 estrie	loc_rss_05_48
rss 05 estrie	loc_rss_05_60
rss 06 montréal	loc_rss_06_3
rss 06 montréal	loc_rss_06_6
rss 06 montréal	loc_rss_06_12
rss 06 montréal	loc_rss_06_24
rss 06 montréal	loc_rss_06_36
rss 06 montréal	loc_rss_06_48
rss 06 montréal	loc_rss_06_60
rss 07 outaouais	loc_rss_07_3
rss 07 outaouais	loc_rss_07_6
rss 07 outaouais	loc_rss_07_12
rss 07 outaouais	loc_rss_07_24

rss 07 outaouais	loc_rss_07_36
rss 07 outaouais	loc_rss_07_48
rss 07 outaouais	loc_rss_07_60
08 abitibi-témiscamingue	loc_rss_08_3
rss 08 abitibi-témiscamingue	loc_rss_08_6
rss 08 abitibi-témiscamingue	loc_rss_08_12
rss 08 abitibi-témiscamingue	loc_rss_08_24
08 abitibi-témiscamingue	loc_rss_08_36
rss 08 abitibi-témiscamingue	loc_rss_08_48
rss 08 abitibi-témiscamingue	loc_rss_08_60
rss 09 côte-nord	loc_rss_09_3
rss 09 côte-nord	loc_rss_09_6
rss 09 côte-nord	loc_rss_09_12
rss 09 côte-nord	loc_rss_09_24
rss 09 côte-nord	loc_rss_09_36
rss 09 côte-nord	loc_rss_09_48
rss 09 côte-nord	loc_rss_09_60
rss 10 nord-du-québec	loc_rss_10_3
rss 10 nord-du-québec	loc_rss_10_6
rss 10 nord-du-québec	loc_rss_10_12
rss 10 nord-du-québec	loc_rss_10_24
rss 10 nord-du-québec	loc_rss_10_36
rss 10 nord-du-québec	loc_rss_10_48
rss 10 nord-du-québec	loc_rss_10_60
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_3
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_6
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_12
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_24
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_36
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_48
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_60
rss 12 chaudière-appalaches	loc_rss_12_3
rss 12 chaudière-appalaches	loc_rss_12_6
rss 12 chaudière-appalaches	loc_rss_12_12
rss 12 chaudière-appalaches	loc_rss_12_24
rss 12 chaudière-appalaches	loc_rss_12_36
rss 12 chaudière-appalaches	loc_rss_12_48
rss 12 chaudière-appalaches	loc_rss_12_60
rss 13 laval	loc_rss_13_3
rss 13 laval	loc_rss_13_6
rss 13 laval	loc_rss_13_12

rss 13 laval	loc_rss_13_24
rss 13 laval	loc_rss_13_36
rss 13 laval	loc_rss_13_48
rss 13 laval	loc_rss_13_60
rss 14 lanaudière	loc_rss_14_3
rss 14 lanaudière	loc_rss_14_6
rss 14 lanaudière	loc_rss_14_12
rss 14 lanaudière	loc_rss_14_24
rss 14 lanaudière	loc_rss_14_36
rss 14 lanaudière	loc_rss_14_48
rss 14 lanaudière	loc_rss_14_60
rss 15 laurentides	loc_rss_15_3
rss 15 laurentides	loc_rss_15_6
rss 15 laurentides	loc_rss_15_12
rss 15 laurentides	loc_rss_15_24
rss 15 laurentides	loc_rss_15_36
rss 15 laurentides	loc_rss_15_48
rss 15 laurentides	loc_rss_15_60
rss 16 montérégie	loc_rss_16_3
rss 16 montérégie	loc_rss_16_6
rss 16 montérégie	loc_rss_16_12
rss 16 montérégie	loc_rss_16_24
rss 16 montérégie	loc_rss_16_36
rss 16 montérégie	loc_rss_16_48
rss 16 montérégie	loc_rss_16_60
location nonrural	nonrural_3
location nonrural	nonrural_6
location nonrural	nonrural_12
location nonrural	nonrural_24
location nonrural	nonrural_36
location nonrural	nonrural_48
location nonrural	nonrural_60
location rural	rural_3
location rural	rural_6
location rural	rural_12
location rural	rural_24
location rural	rural_36
location rural	rural_48
location rural	rural_60
location missing data	loc_missing_3
location missing data	loc_missing_6

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 variables[7]	**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

rss 07 outaouais mental health budget	rss_07_mh_12
rss 07 outaouais mental health budget	rss_07_mh_24
rss 07 outaouais mental health budget	rss_07_mh_36
rss 07 outaouais mental health budget	rss_07_mh_48
rss 07 outaouais mental health budget	rss_07_mh_60
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_3
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_6
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_12
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_24
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_36
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_48
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_60
rss 09 côte-nord mental health budget	rss_09_mh_3
rss 09 côte-nord mental health budget	rss_09_mh_6
rss 09 côte-nord mental health budget	rss_09_mh_12
rss 09 côte-nord mental health budget	rss_09_mh_24
rss 09 côte-nord mental health budget	rss_09_mh_36
rss 09 côte-nord mental health budget	rss_09_mh_48
rss 09 côte-nord mental health budget	rss_09_mh_60
rss 10 nord-du-québec mental health budget	rss_10_mh_3
rss 10 nord-du-québec mental health budget	rss_10_mh_6
rss 10 nord-du-québec mental health budget	rss_10_mh_12
rss 10 nord-du-québec mental health budget	rss_10_mh_24
rss 10 nord-du-québec mental health budget	rss_10_mh_36
rss 10 nord-du-québec mental health budget	rss_10_mh_48
rss 10 nord-du-québec mental health budget	rss_10_mh_60
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_3
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_6
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_12
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_24
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_36
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_48
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_60
rss 12 chaudière-appalaches mental health budget	rss_12_mh_3
rss 12 chaudière-appalaches mental health budget	rss_12_mh_6
rss 12 chaudière-appalaches mental health budget	rss_12_mh_12
rss 12 chaudière-appalaches mental health budget	rss_12_mh_24
rss 12 chaudière-appalaches mental health budget	rss_12_mh_36
rss 12 chaudière-appalaches mental health budget	rss_12_mh_48
rss 12 chaudière-appalaches mental health budget	rss_12_mh_60
rss 13 laval mental health budget	rss_13_mh_3

rss 13 laval mental health budget	rss_13_mh_6
rss 13 laval mental health budget	rss_13_mh_12
rss 13 laval mental health budget	rss_13_mh_24
rss 13 laval mental health budget	rss_13_mh_36
rss 13 laval mental health budget	rss_13_mh_48
rss 13 laval mental health budget	rss_13_mh_60
rss 14 lanaudière mental health budget	rss_14_mh_3
rss 14 lanaudière mental health budget	rss_14_mh_6
rss 14 lanaudière mental health budget	rss_14_mh_12
rss 14 lanaudière mental health budget	rss_14_mh_24
rss 14 lanaudière mental health budget	rss_14_mh_36
rss 14 lanaudière mental health budget	rss_14_mh_48
rss 14 lanaudière mental health budget	rss_14_mh_60
rss 15 laurentides mental health budget	rss_15_mh_3
rss 15 laurentides mental health budget	rss_15_mh_6
rss 15 laurentides mental health budget	rss_15_mh_12
rss 15 laurentides mental health budget	rss_15_mh_24
rss 15 laurentides mental health budget	rss_15_mh_36
rss 15 laurentides mental health budget	rss_15_mh_48
rss 15 laurentides mental health budget	rss_15_mh_60
rss 16 montérégie mental health budget	rss_16_mh_3
rss 16 montérégie mental health budget	rss_16_mh_6
rss 16 montérégie mental health budget	rss_16_mh_12
rss 16 montérégie mental health budget	rss_16_mh_24
rss 16 montérégie mental health budget	rss_16_mh_36
rss 16 montérégie mental health budget	rss_16_mh_48
rss 16 montérégie mental health budget	rss_16_mh_60
rss 01 bas-saint-laurent addictions budget	rss_01_a_3
rss 01 bas-saint-laurent addictions budget	rss_01_a_6
rss 01 bas-saint-laurent addictions budget	rss_01_a_12
rss 01 bas-saint-laurent addictions budget	rss_01_a_24
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_60
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_12
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_48
rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60

rss 03 capitale-nationale addictions budget	rss_03_a_3
rss 03 capitale-nationale addictions budget	rss_03_a_6
rss 03 capitale-nationale addictions budget	rss_03_a_12
rss 03 capitale-nationale addictions budget	rss_03_a_24
rss 03 capitale-nationale addictions budget	rss_03_a_36
rss 03 capitale-nationale addictions budget	rss_03_a_48
rss 03 capitale-nationale addictions budget	rss_03_a_60
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_3
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_6
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_12
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_24
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_36
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_48
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
rss 05 estrie addictions budget	rss_05_a_3
rss 05 estrie addictions budget	rss_05_a_6
rss 05 estrie addictions budget	rss_05_a_12
rss 05 estrie addictions budget	rss_05_a_24
rss 05 estrie addictions budget	rss_05_a_36
rss 05 estrie addictions budget	rss_05_a_48
rss 05 estrie addictions budget	rss_05_a_60
rss 06 montréal addictions budget	rss_06_a_3
rss 06 montréal addictions budget	rss_06_a_6
rss 06 montréal addictions budget	rss_06_a_12
rss 06 montréal addictions budget	rss_06_a_24
rss 06 montréal addictions budget	rss_06_a_36
rss 06 montréal addictions budget	rss_06_a_48
rss 06 montréal addictions budget	rss_06_a_60
rss 07 outaouais addictions budget	rss_07_a_3
rss 07 outaouais addictions budget	rss_07_a_6
rss 07 outaouais addictions budget	rss_07_a_12
rss 07 outaouais addictions budget	rss_07_a_24
rss 07 outaouais addictions budget	rss_07_a_36
rss 07 outaouais addictions budget	rss_07_a_48
rss 07 outaouais addictions budget	rss_07_a_60
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_3
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_6
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_12
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_24
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_36
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48

rss 08 abitibi-témiscamingue addictions budget	rss_08_a_60
rss 09 côte-nord addictions budget	rss_09_a_3
rss 09 côte-nord addictions budget	rss_09_a_6
rss 09 côte-nord addictions budget	rss_09_a_12
rss 09 côte-nord addictions budget	rss_09_a_24
rss 09 côte-nord addictions budget	rss_09_a_36
rss 09 côte-nord addictions budget	rss_09_a_48
rss 09 côte-nord addictions budget	rss_09_a_60
rss 10 nord-du-québec addictions budget	rss_10_a_3
rss 10 nord-du-québec addictions budget	rss_10_a_6
rss 10 nord-du-québec addictions budget	rss_10_a_12
rss 10 nord-du-québec addictions budget	rss_10_a_24
rss 10 nord-du-québec addictions budget	rss_10_a_36
rss 10 nord-du-québec addictions budget	rss_10_a_48
rss 10 nord-du-québec addictions budget	rss_10_a_60
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_3
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_6
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_12
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_24
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_36
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_48
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
rss 12 chaudière-appalaches addictions budget	rss_12_a_3
rss 12 chaudière-appalaches addictions budget	rss_12_a_6
rss 12 chaudière-appalaches addictions budget	rss_12_a_12
rss 12 chaudière-appalaches addictions budget	rss_12_a_24
rss 12 chaudière-appalaches addictions budget	rss_12_a_36
rss 12 chaudière-appalaches addictions budget	rss_12_a_48
rss 12 chaudière-appalaches addictions budget	rss_12_a_60
rss 13 laval addictions budget	rss_13_a_3
rss 13 laval addictions budget	rss_13_a_6
rss 13 laval addictions budget	rss_13_a_12
rss 13 laval addictions budget	rss_13_a_24
rss 13 laval addictions budget	rss_13_a_36
rss 13 laval addictions budget	rss_13_a_48
rss 13 laval addictions budget	rss_13_a_60
rss 14 lanaudière addictions budget	rss_14_a_3
rss 14 lanaudière addictions budget	rss_14_a_6
rss 14 lanaudière addictions budget	rss_14_a_12
rss 14 lanaudière addictions budget	rss_14_a_24
rss 14 lanaudière addictions budget	rss_14_a_36

rss 14 lanaudière addictions budget	rss_14_a_48
rss 14 lanaudière 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
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_postsuicideattempt_3
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_6
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_12
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_24
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_36
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_48
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_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 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		
			Thioproperazine		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		

		Tranylcypromine		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, vasodilatators)				
		24:20	Alpha-blockers				
		24:24	Beta-blockers				
		24:28	Calcium chanel blockers				
		24:32	ACE inhibitors and ARBs				

		40:28	Diuretics				
	Antiarrythmic and cardiotonic	24:04	Cardiotropic (antiarythmics, cariotonics)				
	Hypolipemiants	24:06	Hypolipemiants (statins, fibrates, etc)				
	Vasodilatators	24:12	Nitrates and other vasodilatators				
Respiratory diseases (mediations used to treat COPD and asthma)							
		Medications		Code denomination commune			
		Aclidinium		47986			
		Glycopyrronium		47949			
		Tiotropium		46856			
		Uméclidinium		48109			
		Formotérol		47916			
		Indacatérol		47923			
		Salmétérol		46247			
				47112			
		Olodatérol					
		Glycopyrronium/indacatérol		48033			
		Uméclidinium/vilantérol		48224			
				48029			
		Aclinidium/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			
		Budénoside		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, opiods, etc)			SAUF
		Specific medicaitons		**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							

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.[46] 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.[46] 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[58] 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[a,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[a,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[a,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[a,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[a,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[a,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.

[a] 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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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 Ethnics 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.

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

Methods

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

Model development and validation

Target population: The general population residing in the province of Quebec, Canada. The province had a population of over 8.6 million people in 2021, and about 95% of the population reported being able to conduct a conversation in French. In Quebec, health services are planned and delivered through 18 health regions, 22 integrated health and social services centres, and 166 Centres locaux de santé Communautaire (CLSCs). Budgetary decisions are made at the levels of province and health regions/integrated health and social services centres.

Data sources: We will develop the prediction tools by linking the suicide database, the Ministry of Health and Social Services (MSSS) public financial reports (Contour financier - Publications du ministère de la Santé et des Services sociaux (gouv.qc.ca) which include the five health administrative databases below, and the Canadian Urban Environmental Health Research (CANUE) data. The suicide database gathers individual-level data annually based on residents health insurance number from five administrative databases: the vital statistics death database, the physician claims database, the hospital discharge database, the Insured Person Registration File and the public drug plan. The data of these databases (e.g., billing and service procedures codes, service dates) are routinely submitted by clinics and hospitals for billing and administration purposes; no self-reported data were collected from patients. These databases cover up to 98% of the population in Quebec and contain data for over 20,000 death by suicide cases occurred since 1996. Death by suicide cases were those ascertained by Quebec's Coroner office after investigation. The decision is registered in the Quebec vital statistics database. The latter is linked with other health administrative databases of the Quebec Integrated Chronic

Disease Surveillance System (QICDSS) managed by the Quebec's Public Health Agency.(16) With the suicide database and other linkable Ministry financial databases, individual (e.g., sex, age), program (e.g., hospitalization, emergency department visits), and system (e.g., mental health and addiction budgets) level indicators can be identified.(17)

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.

Because this study used existing de-identified health administrative data, informed consent from individual patients was waived. This study was approved by the Research Ethics Board of Dalhousie University.

Study design: Because the base rate of suicide in the population is low, we proposed to use a 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 death by suicide cases that occurred from January 1st 2002 to December 31st 2010.(18) 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) happened five years prior to the suicide events will be used as candidate predictors to develop the risk predictive algorithms. For example, we extracted the data about the diagnosis of major depression (an individual level factor) in the past 6, 12, 24, 48 and 60 months, as 5 separate candidate predictors. Similarly, we extracted mental health and addiction budget of each health region (a systemic level factor) in the past 5 years as candidate predictors. The QICDSS(16) provided all the variables drawn from health administrative databases. It covers 98% of the Quebec's population since 1996. The security and continuous quality and maintenance are the responsibility of the Quebec Public health Institute (INSPQ). Information is for administrative (i.e. age, hospital or outpatient contact dates) and clinician reporting (i.e. diagnoses) purposes. Validation of QICDSS physical diagnoses has been achieved by chart reviews(16) and by outcomes for QICDSS psychiatric diagnoses.(19,20) The QICDSS has been exploited over the past decade by a network of INSPQ officers and academic researchers, many are co-authors of publications on the characteristics of patients receiving rare psychiatric interventions,(21) and on personality disorders, schizophrenia and substance use disorders in relation to mortality, including suicide.(22,23) The quality of the data is also reflected by the minimal missing data

associated with the variables, which ranges from 0.87% and 4.12% of the variables in the databases.

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

For the objective of this study, we will use both statistical (e.g., logistic regression modeling) and machine learning (ML) approaches to develop the risk prediction models so that we may compare which approach performs better in predicting population suicide risk and is more feasible to implement. 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.(24,25) ML methods are divided into categories, i.e., supervised, semi-supervised, unsupervised, and reinforcement.

Imbalanced classes are a common problem in ML classification, where each class has a disproportionate ratio of observations. To predict the population risk of suicide, Dataset will be imbalanced because of rare cases of suicide as compared with a control group. To address the imbalanced Dataset, we will over-sample the minority class. We will "artificially" duplicate samples from the minority class to over-sample the minority class to correct imbalanced datasets, even though doing so does not provide the model with any new data. In the literature, this method was known as the Synthetic Minority Over-sampling Technique (SMOTE). Then, we will develop supervised learning models such as logistic regression, Random Forest, XGBoost, and Multilayer perceptron with an optimized model architecture. These 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.(26,27) 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 fixed effect logistic regression to develop the sex-specific statistical models that accounted for clustering at the health regions by including a variable of health region. After LASSO, there may still be a large number of candidate predictors. Backward selection method will be used to eliminate unpredictive 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).(28) 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.(28) 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:(29)

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

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:

For model validation, we will use the suicide data from January 1st, 2011 to December 31st, 2019. We will first calculate the yearly, 5-year and 10-year incidence of suicide death at the provincial and health regional levels in males and females (i.e., observed risk). We will apply the developed synthetic models in the validation data to estimate the yearly, 5-year and 10-year incidence of suicide death at the provincial and health regional levels in males and females (i.e.,

predicted risk). We will visually compare and calculate the differences between the predicted and observed risks; smaller differences indicate better calibration with the data and model accuracy. We will use four indicators for assessing model performance: mean average error (MAE), root mean square error (RMSE), Spearman's *r*, and proportion of correct identification of high risk regions.(14) The MAE is the average magnitude of the difference between the predicted and observed suicide death rate for each health region. The RMSE is the square root of the average magnitude of the difference squared, therefore is similar to MAE but penalises prediction errors with greater magnitude. More accurate predictions will result in smaller MAE and RMSE. Spearman's *r* compares the predicted ranking of health regions by suicide death rate compared with the actual observed rankings; results closer to 1 indicate that the model was more effective at rank-ordering regions based on suicide death rate. To assess the extent to which high risk regions are correctly identified, we will first disaggregate the predicted and observed suicide rates into quartile groups and categorised all health regions into their corresponding quartiles for both predicted and observed suicide rates. The proportion of health regions observed in the top quartile of observed suicide death rates that were rightly predicted to be in the top quartile will be calculated.

Qualitative study

The objective of the qualitative study is to investigate the end-users' views about predicting population risk of suicide, and the potential social, legal, ethical, and privacy issues and mitigation strategies for implementing such a predictive system. Using snowballing techniques, we have invited policy and decision makers at the federal and provincial levels, mental health professionals, individuals who have extensive experience in working with policy and decision makers and who have expertise in suicide prevention, social and health policy, as well as health administrative data, people with lived experience, and advocates for families bereaved by suicide. The qualitative study consists of two rounds of interviews. The first round of interviews were carried out after the general team meeting held in July 2021, at which the study design was finalized. The second round of interviews will be organized once the predictive models are developed. The first round interviews were held through zoom meetings, and follow a series of semi-structured interview questions related to the objectives (see supplementary file#1). Qualitative data collected during the focus groups and qualitative interviews are audio recorded, transcribed, and analyzed with the support of QDA Miner (Provalis).(30) The second round of interviews will be conducted once the prototype models are developed and presented at the second general team meeting which is to be held in late 2022. We will perform an inductive thematic analysis of the focus 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. For example, policy and decision makers may use the models to project the proportion and number of suicide deaths in specific health regions/communities over the next 5 years, and decide how resources and community level interventions may be mobilized to the high risk regions/communities. Furthermore, the models can inform policy and decision makers about the potential impacts of these community level intervention on suicide prevention. 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 surveys and health administrative databases have been used to develop risk predictive models for diabetes,(31) heart disease,(32) and major depression.(33,34) These models may be used to identify high risk individuals in the community; they can also be used to forecast the population risk in the future. However, few models have integrated individual, healthcare system, and community level predictors in the same model. In this study, we proposed to include data from

these different levels in model development, and convert the models into synthetic estimation models. There may be different approaches for integrating data from different levels for population risk prediction. Future studies are needed to explore the best method for data integration.

The performance of a risk predictive model is commonly assessed by indicators of model discrimination and calibration.(35) Whereas model discrimination is critical for individual risk predictive models, policy and decision makers' focus is on the whole population rather than individuals. Therefore, model calibration plays a more important role in the performance of a population risk model. We proposed four indicators for assessing model performance. However, it is not clear how much error (the difference between predicted and observed risks) policy and decision makers may tolerate for population risk prediction, how they perceive the importance of model discrimination, whether other indicators exist for assessing population risk prediction models. We will explore these aspects through our qualitative study, and also encourage others to consider these in future studies. Similarly, we welcome discussions and debates about the methods for validating population risk predictive models. An individual risk predictive model is often developed using longitudinal cohort/closed population data and validated in a different but related cohort/closed population. This poses challenges for population risk predictive models because the population in a community/health region is open and dynamic. Appropriate methods for model validation and acceptability need to be developed and agreed by the research community and policy and decision makers.

This study relied on routinely collected health administrative data for model development and validation, rather than collecting primary data. Therefore, we have a little information about suicide behaviors among the individuals in the control group, which are strongly associated with suicide deaths. In the model development, we included hospitalization and emergency department visits due to suicide attempt, which may reduce the bias related to the lack of information about suicide behaviors. Nevertheless, this is a limitation of routinely collected health administrative data.

Despite the challenges for developing population risk predictive model for suicide, research is urgently needed to address this important population health issue. This study represents one of the early steps in building such risk predictive models and methodology development, as part of the collective efforts for moving the field forward.

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.

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Competing interests: none

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Supplementary file #1:

Guiding questions for qualitative interviews.

1) What are the currently policies and practices for suicide prevention that you know?
2) What are the challenges you are facing in suicide prevention at population level?
3) What are your views on using risk predictive tools for facilitating suicide prevention in the population? The advantages and drawbacks?
4) what are your thoughts about using artificial intelligence and machine learning for suicide prevention? The potential pros and cons?
5) From your view, how an ideal risk prediction tool should look like, that assists in your decision making?
6) What visualization formats you have been using, and what are the limits of these visualization methods?
7) What do you think of the visualization model presented to you?

APPENDIX I_1: CANDIDATE PREDICTORS

i. PSYCHIATRIC DISORDERS DIAGNOSIS[1]

- Substance use disorder[2]
  - Alcohol use disorder
  - 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 variables[5]	**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_pediatrician_3
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_6
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_12
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_24
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_36
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_48
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_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

# 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

neurological disease	physdx _neuro_12
neurological disease	physdx _neuro_24
neurological disease	physdx _neuro_36
neurological disease	physdx _neuro_48
neurological disease	physdx _neuro_60
endocrine system disorder	physdx _endo_3
endocrine system disorder	physdx _endo_6
endocrine system disorder	physdx _endo_12
endocrine system disorder	physdx _endo_24
endocrine system disorder	physdx _endo_36
endocrine system disorder	physdx _endo_48
endocrine system disorder	physdx _endo_60
trauma	physdx _trauma_3
trauma	physdx _trauma_6
trauma	physdx _trauma_12
trauma	physdx _trauma_24
trauma	physdx _trauma_36
trauma	physdx _trauma_48
trauma	physdx _trauma_60
respiratory disorder	physdx _resp_3
respiratory disorder	physdx _resp_6
respiratory disorder	physdx _resp_12
respiratory disorder	physdx _resp_24
respiratory disorder	physdx _resp_36
respiratory disorder	physdx _resp_48
respiratory disorder	physdx _resp_60
infectious disease	physdx _infec_3
infectious disease	physdx _infec_6
infectious disease	physdx _infec_12
infectious disease	physdx _infec_24
infectious disease	physdx _infec_36
infectious disease	physdx _infec_48
infectious disease	physdx _infec_60
digestive disorder	physdx _diges_3
digestive disorder	physdx _diges_6
digestive disorder	physdx _diges_12
digestive disorder	physdx _diges_24
digestive disorder	physdx _diges_36
digestive disorder	physdx _diges_48
digestive disorder	physdx _diges_60
cardiovascular disorder	physdx _cvd_3

cardiovascular disorder	physdx _cvd_6
cardiovascular disorder	physdx _cvd_12
cardiovascular disorder	physdx _cvd_24
cardiovascular disorder	physdx _cvd_36
cardiovascular disorder	physdx _cvd_48
cardiovascular disorder	physdx _cvd_60
cancer	physdx _cncr_3
cancer	physdx _cncr_6
cancer	physdx _cncr_12
cancer	physdx _cncr_24
cancer	physdx _cncr_36
cancer	physdx _cncr_48
cancer	physdx _cncr_60
other physical disorders	physdx _otr_3
other physical disorders	physdx _otr_6
other physical disorders	physdx _otr_12
other physical disorders	physdx _otr_24
other physical disorders	physdx _otr_36
other physical disorders	physdx _otr_48
other physical disorders	physdx _otr_60
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_3
charlson/elixhauser index with psy (conti)	physdx_comorbid_withpsy_6
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_12
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_24
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_36
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_48
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_60
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_3
charlson/elixhauser index without psy (conti)	physdx_comorbid_withoutpsy_6
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_12
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_24
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_36

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

rss 01 bas-saint-laurent	loc_rss_01_48
rss 01 bas-saint-laurent	loc_rss_01_60
rss 02 saguenay-lac-saint-jean	loc_rss_02_3
rss 02 saguenay-lac-saint-jean	loc_rss_02_6
rss 02 saguenay-lac-saint-jean	loc_rss_02_12
rss 02 saguenay-lac-saint-jean	loc_rss_02_24
rss 02 saguenay-lac-saint-jean	loc_rss_02_36
rss 02 saguenay-lac-saint-jean	loc_rss_02_48
rss 02 saguenay-lac-saint-jean	loc_rss_02_60
rss 03 capitale-nationale	loc_rss_03_3
rss 03 capitale-nationale	loc_rss_03_6
rss 03 capitale-nationale	loc_rss_03_12
rss 03 capitale-nationale	loc_rss_03_24
rss 03 capitale-nationale	loc_rss_03_36
rss 03 capitale-nationale	loc_rss_03_48
rss 03 capitale-nationale	loc_rss_03_60
rss 04 mauricie et centre-du-québec	loc_rss_04_3
rss 04 mauricie et centre-du-québec	loc_rss_04_6
rss 04 mauricie et centre-du-québec	loc_rss_04_12
rss 04 mauricie et centre-du-québec	loc_rss_04_24
rss 04 mauricie et centre-du-québec	loc_rss_04_36
rss 04 mauricie et centre-du-québec	loc_rss_04_48
rss 04 mauricie et centre-du-québec	loc_rss_04_60
rss 05 estrie	loc_rss_05_3
rss 05 estrie	loc_rss_05_6
rss 05 estrie	loc_rss_05_12
rss 05 estrie	loc_rss_05_24
rss 05 estrie	loc_rss_05_36
rss 05 estrie	loc_rss_05_48
rss 05 estrie	loc_rss_05_60
rss 06 montréal	loc_rss_06_3
rss 06 montréal	loc_rss_06_6
rss 06 montréal	loc_rss_06_12
rss 06 montréal	loc_rss_06_24
rss 06 montréal	loc_rss_06_36
rss 06 montréal	loc_rss_06_48
rss 06 montréal	loc_rss_06_60
rss 07 outaouais	loc_rss_07_3
rss 07 outaouais	loc_rss_07_6
rss 07 outaouais	loc_rss_07_12
rss 07 outaouais	loc_rss_07_24

rss 07 outaouais	loc_rss_07_36
rss 07 outaouais	loc_rss_07_48
rss 07 outaouais	loc_rss_07_60
08 abitibi-témiscamingue	loc_rss_08_3
rss 08 abitibi-témiscamingue	loc_rss_08_6
rss 08 abitibi-témiscamingue	loc_rss_08_12
rss 08 abitibi-témiscamingue	loc_rss_08_24
08 abitibi-témiscamingue	loc_rss_08_36
rss 08 abitibi-témiscamingue	loc_rss_08_48
rss 08 abitibi-témiscamingue	loc_rss_08_60
rss 09 côte-nord	loc_rss_09_3
rss 09 côte-nord	loc_rss_09_6
rss 09 côte-nord	loc_rss_09_12
rss 09 côte-nord	loc_rss_09_24
rss 09 côte-nord	loc_rss_09_36
rss 09 côte-nord	loc_rss_09_48
rss 09 côte-nord	loc_rss_09_60
rss 10 nord-du-québec	loc_rss_10_3
rss 10 nord-du-québec	loc_rss_10_6
rss 10 nord-du-québec	loc_rss_10_12
rss 10 nord-du-québec	loc_rss_10_24
rss 10 nord-du-québec	loc_rss_10_36
rss 10 nord-du-québec	loc_rss_10_48
rss 10 nord-du-québec	loc_rss_10_60
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_3
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_6
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_12
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_24
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_36
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_48
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_60
rss 12 chaudière-appalaches	loc_rss_12_3
rss 12 chaudière-appalaches	loc_rss_12_6
rss 12 chaudière-appalaches	loc_rss_12_12
rss 12 chaudière-appalaches	loc_rss_12_24
rss 12 chaudière-appalaches	loc_rss_12_36
rss 12 chaudière-appalaches	loc_rss_12_48
rss 12 chaudière-appalaches	loc_rss_12_60
rss 13 laval	loc_rss_13_3
rss 13 laval	loc_rss_13_6
rss 13 laval	loc_rss_13_12

rss 13 laval	loc_rss_13_24
rss 13 laval	loc_rss_13_36
rss 13 laval	loc_rss_13_48
rss 13 laval	loc_rss_13_60
rss 14 lanaudière	loc_rss_14_3
rss 14 lanaudière	loc_rss_14_6
rss 14 lanaudière	loc_rss_14_12
rss 14 lanaudière	loc_rss_14_24
rss 14 lanaudière	loc_rss_14_36
rss 14 lanaudière	loc_rss_14_48
rss 14 lanaudière	loc_rss_14_60
rss 15 laurentides	loc_rss_15_3
rss 15 laurentides	loc_rss_15_6
rss 15 laurentides	loc_rss_15_12
rss 15 laurentides	loc_rss_15_24
rss 15 laurentides	loc_rss_15_36
rss 15 laurentides	loc_rss_15_48
rss 15 laurentides	loc_rss_15_60
rss 16 montérégie	loc_rss_16_3
rss 16 montérégie	loc_rss_16_6
rss 16 montérégie	loc_rss_16_12
rss 16 montérégie	loc_rss_16_24
rss 16 montérégie	loc_rss_16_36
rss 16 montérégie	loc_rss_16_48
rss 16 montérégie	loc_rss_16_60
location nonrural	nonrural_3
location nonrural	nonrural_6
location nonrural	nonrural_12
location nonrural	nonrural_24
location nonrural	nonrural_36
location nonrural	nonrural_48
location nonrural	nonrural_60
location rural	rural_3
location rural	rural_6
location rural	rural_12
location rural	rural_24
location rural	rural_36
location rural	rural_48
location rural	rural_60
location missing data	loc_missing_3
location missing data	loc_missing_6

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 variables[7]	**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

rss 07 outaouais mental health budget	rss_07_mh_12
rss 07 outaouais mental health budget	rss_07_mh_24
rss 07 outaouais mental health budget	rss_07_mh_36
rss 07 outaouais mental health budget	rss_07_mh_48
rss 07 outaouais mental health budget	rss_07_mh_60
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_3
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_6
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_12
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_24
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_36
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_48
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_60
rss 09 côte-nord mental health budget	rss_09_mh_3
rss 09 côte-nord mental health budget	rss_09_mh_6
rss 09 côte-nord mental health budget	rss_09_mh_12
rss 09 côte-nord mental health budget	rss_09_mh_24
rss 09 côte-nord mental health budget	rss_09_mh_36
rss 09 côte-nord mental health budget	rss_09_mh_48
rss 09 côte-nord mental health budget	rss_09_mh_60
rss 10 nord-du-québec mental health budget	rss_10_mh_3
rss 10 nord-du-québec mental health budget	rss_10_mh_6
rss 10 nord-du-québec mental health budget	rss_10_mh_12
rss 10 nord-du-québec mental health budget	rss_10_mh_24
rss 10 nord-du-québec mental health budget	rss_10_mh_36
rss 10 nord-du-québec mental health budget	rss_10_mh_48
rss 10 nord-du-québec mental health budget	rss_10_mh_60
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_3
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_6
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_12
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_24
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_36
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_48
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_60
rss 12 chaudière-appalaches mental health budget	rss_12_mh_3
rss 12 chaudière-appalaches mental health budget	rss_12_mh_6
rss 12 chaudière-appalaches mental health budget	rss_12_mh_12
rss 12 chaudière-appalaches mental health budget	rss_12_mh_24
rss 12 chaudière-appalaches mental health budget	rss_12_mh_36
rss 12 chaudière-appalaches mental health budget	rss_12_mh_48
rss 12 chaudière-appalaches mental health budget	rss_12_mh_60
rss 13 laval mental health budget	rss_13_mh_3

rss 13 laval mental health budget	rss_13_mh_6
rss 13 laval mental health budget	rss_13_mh_12
rss 13 laval mental health budget	rss_13_mh_24
rss 13 laval mental health budget	rss_13_mh_36
rss 13 laval mental health budget	rss_13_mh_48
rss 13 laval mental health budget	rss_13_mh_60
rss 14 lanaudière mental health budget	rss_14_mh_3
rss 14 lanaudière mental health budget	rss_14_mh_6
rss 14 lanaudière mental health budget	rss_14_mh_12
rss 14 lanaudière mental health budget	rss_14_mh_24
rss 14 lanaudière mental health budget	rss_14_mh_36
rss 14 lanaudière mental health budget	rss_14_mh_48
rss 14 lanaudière mental health budget	rss_14_mh_60
rss 15 laurentides mental health budget	rss_15_mh_3
rss 15 laurentides mental health budget	rss_15_mh_6
rss 15 laurentides mental health budget	rss_15_mh_12
rss 15 laurentides mental health budget	rss_15_mh_24
rss 15 laurentides mental health budget	rss_15_mh_36
rss 15 laurentides mental health budget	rss_15_mh_48
rss 15 laurentides mental health budget	rss_15_mh_60
rss 16 montérégie mental health budget	rss_16_mh_3
rss 16 montérégie mental health budget	rss_16_mh_6
rss 16 montérégie mental health budget	rss_16_mh_12
rss 16 montérégie mental health budget	rss_16_mh_24
rss 16 montérégie mental health budget	rss_16_mh_36
rss 16 montérégie mental health budget	rss_16_mh_48
rss 16 montérégie mental health budget	rss_16_mh_60
rss 01 bas-saint-laurent addictions budget	rss_01_a_3
rss 01 bas-saint-laurent addictions budget	rss_01_a_6
rss 01 bas-saint-laurent addictions budget	rss_01_a_12
rss 01 bas-saint-laurent addictions budget	rss_01_a_24
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_60
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_12
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_48
rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60

rss 03 capitale-nationale addictions budget	rss_03_a_3
rss 03 capitale-nationale addictions budget	rss_03_a_6
rss 03 capitale-nationale addictions budget	rss_03_a_12
rss 03 capitale-nationale addictions budget	rss_03_a_24
rss 03 capitale-nationale addictions budget	rss_03_a_36
rss 03 capitale-nationale addictions budget	rss_03_a_48
rss 03 capitale-nationale addictions budget	rss_03_a_60
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_3
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_6
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_12
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_24
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_36
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_48
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
rss 05 estrie addictions budget	rss_05_a_3
rss 05 estrie addictions budget	rss_05_a_6
rss 05 estrie addictions budget	rss_05_a_12
rss 05 estrie addictions budget	rss_05_a_24
rss 05 estrie addictions budget	rss_05_a_36
rss 05 estrie addictions budget	rss_05_a_48
rss 05 estrie addictions budget	rss_05_a_60
rss 06 montréal addictions budget	rss_06_a_3
rss 06 montréal addictions budget	rss_06_a_6
rss 06 montréal addictions budget	rss_06_a_12
rss 06 montréal addictions budget	rss_06_a_24
rss 06 montréal addictions budget	rss_06_a_36
rss 06 montréal addictions budget	rss_06_a_48
rss 06 montréal addictions budget	rss_06_a_60
rss 07 outaouais addictions budget	rss_07_a_3
rss 07 outaouais addictions budget	rss_07_a_6
rss 07 outaouais addictions budget	rss_07_a_12
rss 07 outaouais addictions budget	rss_07_a_24
rss 07 outaouais addictions budget	rss_07_a_36
rss 07 outaouais addictions budget	rss_07_a_48
rss 07 outaouais addictions budget	rss_07_a_60
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_3
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_6
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_12
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_24
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_36
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48

rss 08 abitibi-témiscamingue addictions budget	rss_08_a_60
rss 09 côte-nord addictions budget	rss_09_a_3
rss 09 côte-nord addictions budget	rss_09_a_6
rss 09 côte-nord addictions budget	rss_09_a_12
rss 09 côte-nord addictions budget	rss_09_a_24
rss 09 côte-nord addictions budget	rss_09_a_36
rss 09 côte-nord addictions budget	rss_09_a_48
rss 09 côte-nord addictions budget	rss_09_a_60
rss 10 nord-du-québec addictions budget	rss_10_a_3
rss 10 nord-du-québec addictions budget	rss_10_a_6
rss 10 nord-du-québec addictions budget	rss_10_a_12
rss 10 nord-du-québec addictions budget	rss_10_a_24
rss 10 nord-du-québec addictions budget	rss_10_a_36
rss 10 nord-du-québec addictions budget	rss_10_a_48
rss 10 nord-du-québec addictions budget	rss_10_a_60
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_3
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_6
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_12
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_24
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_36
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_48
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
rss 12 chaudière-appalaches addictions budget	rss_12_a_3
rss 12 chaudière-appalaches addictions budget	rss_12_a_6
rss 12 chaudière-appalaches addictions budget	rss_12_a_12
rss 12 chaudière-appalaches addictions budget	rss_12_a_24
rss 12 chaudière-appalaches addictions budget	rss_12_a_36
rss 12 chaudière-appalaches addictions budget	rss_12_a_48
rss 12 chaudière-appalaches addictions budget	rss_12_a_60
rss 13 laval addictions budget	rss_13_a_3
rss 13 laval addictions budget	rss_13_a_6
rss 13 laval addictions budget	rss_13_a_12
rss 13 laval addictions budget	rss_13_a_24
rss 13 laval addictions budget	rss_13_a_36
rss 13 laval addictions budget	rss_13_a_48
rss 13 laval addictions budget	rss_13_a_60
rss 14 lanaudière addictions budget	rss_14_a_3
rss 14 lanaudière addictions budget	rss_14_a_6
rss 14 lanaudière addictions budget	rss_14_a_12
rss 14 lanaudière addictions budget	rss_14_a_24
rss 14 lanaudière addictions budget	rss_14_a_36

rss 14 lanaudière addictions budget	rss_14_a_48
rss 14 lanaudière 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
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_postsuicideattempt_3
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_6
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_12
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_24
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_36
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_48
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_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 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		
			Thioproperazine		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		

		Tranylcypromine		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, vasodilatators)				
		24:20	Alpha-blockers				
		24:24	Beta-blockers				
		24:28	Calcium chanel blockers				
		24:32	ACE inhibitors and ARBs				

		40:28	Diuretics				
	Antiarrythmic and cardiotonic	24:04	Cardiotropic (antiarythmics, cariotonics)				
	Hypolipemiants	24:06	Hypolipemiants (statins, fibrates, etc)				
	Vasodilatators	24:12	Nitrates and other vasodilatators				
Respiratory diseases (mediations used to treat COPD and asthma)							
		Medications		Code denomination commune			
		Aclidinium		47986			
		Glycopyrronium		47949			
		Tiotropium		46856			
		Uméclidinium		48109			
		Formotérol		47916			
		Indacatérol		47923			
		Salmétérol		46247			
				47112			
		Olodatérol					
		Glycopyrronium/indacatérol		48033			
		Uméclidinium/vilantérol		48224			
				48029			
		Aclinidium/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			
		Budénoside		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, opiods, etc)			SAUF
		Specific medicaitons		**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							

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.[46] 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.[46] 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[58] 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[a,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[a,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[a,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[a,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[a,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[a,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.

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

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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 Ethnics 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.

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

Methods

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

Model development and validation

Target population: The general population residing in the province of Quebec, Canada. The province had a population of over 8.6 million people in 2021, and about 95% of the population reported being able to conduct a conversation in French. In Quebec, health services are planned and delivered through 18 health regions, 22 integrated health and social services centres, and 166 Centres locaux de santé Communautaire (CLSCs). Budgetary decisions are made at the levels of province and health regions/integrated health and social services centres.

Data sources: We will develop the prediction tools by linking the suicide database, the Ministry of Health and Social Services (MSSS) public financial reports (Contour financier - Publications du ministère de la Santé et des Services sociaux (gouv.qc.ca) which include the five health administrative databases below, and the Canadian Urban Environmental Health Research (CANUE) data. The suicide database gathers individual-level data annually based on residents health insurance number from five administrative databases: the vital statistics death database, the physician claims database, the hospital discharge database, the Insured Person Registration File and the public drug plan. The data of these databases (e.g., billing and service procedures codes, service dates) are routinely submitted by clinics and hospitals for billing and administration purposes; no self-reported data were collected from patients. These databases cover up to 98% of the population in Quebec and contain data for over 20,000 death by suicide cases occurred since 1996. Death by suicide cases were those ascertained by Quebec's Coroner office after investigation. The decision is registered in the Quebec vital statistics database. The latter is linked with other health administrative databases of the Quebec Integrated Chronic

Disease Surveillance System (QICDSS) managed by the Quebec's Public Health Agency.(16) With the suicide database and other linkable Ministry financial databases, individual (e.g., sex, age), program (e.g., hospitalization, emergency department visits), and system (e.g., mental health and addiction budgets) level indicators can be identified.(16)

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.

Because this study used existing de-identified health administrative data, informed consent from individual patients was waived. This study was approved by the Research Ethics Board of Dalhousie University.

Study design: Because the base rate of suicide in the population is low, we proposed to use a 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 death by suicide cases that occurred from January 1st 2002 to December 31st 2010.(17) The control group was a 1% random sample of living individuals in each year between January 1st, 2002 and December 31st, 2010 from the Quebec physician claim database. Controls are not allowed to be selected more than once across years. None of those in the control group died of suicide during this period. The cases and controls were not matched to allow for maximum variability in predictors.

Predictors: Individual, programmatic, systemic and community factors (see Appendix I) happened five years prior to the suicide events will be used as candidate predictors to develop the risk predictive algorithms. For example, we extracted the data about the diagnosis of major depression (an individual level factor) in the past 6, 12, 24, 48 and 60 months, as 5 separate candidate predictors. Similarly, we extracted mental health and addiction budget of each health region (a systemic level factor) in the past 5 years as candidate predictors. The QICDSS(18) provided all the variables drawn from health administrative databases. It covers 98% of the Quebec's population since 1996. The security and continuous quality and maintenance are the responsibility of the Quebec Public health Institute (INSPQ). Information is for administrative (i.e. age, hospital or outpatient contact dates) and clinician reporting (i.e. diagnoses) purposes. Validation of QICDSS physical diagnoses has been achieved by chart reviews(18) and by outcomes for QICDSS psychiatric diagnoses.(19,20) The QICDSS has been exploited over the past decade by a network of INSPQ officers and academic researchers, many are co-authors of publications on the characteristics of patients receiving rare psychiatric interventions,(21) and on personality disorders, schizophrenia and substance use disorders in relation to mortality,

including suicide.(22,23) The quality of the data is also reflected by the minimal missing data associated with the variables, which ranges from 0.87% and 4.12% of the variables in the databases.

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

For the objective of this study, we will use both statistical (e.g., logistic regression modeling) and machine learning (ML) approaches to develop the risk prediction models so that we may compare which approach performs better in predicting population suicide risk and is more feasible to implement. 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. This is a limitation of case-control study design which produces a biased sample because the proportion of cases in the sample is not the same as the population of interest.(24,25) One method for addressing this limitation when developing predictive models using case-control data is weighting.(25–28) Therefore, in logistic regression modeling, 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.(29,30) ML methods are divided into categories, i.e., supervised, semi-supervised, unsupervised, and reinforcement.

Imbalanced classes are a common problem in ML classification, where each class has a disproportionate ratio of observations. To predict the population risk of suicide, Dataset will be imbalanced because of rare cases of suicide as compared with a control group. To address the imbalanced Dataset, we will over-sample the minority class. We will "artificially" duplicate samples from the minority class to over-sample the minority class to correct imbalanced datasets, even though doing so does not provide the model with any new data. In the literature, this method was known as the Synthetic Minority Over-sampling Technique (SMOTE). Then, we will develop supervised learning models such as logistic regression, Random Forest, XGBoost, and Multilayer perceptron with an optimized model architecture. These

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 unpredictive 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)

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

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:

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

Qualitative study

The objective of the qualitative study is to investigate the end-users' views about predicting population risk of suicide, and the potential social, legal, ethical, and privacy issues and mitigation strategies for implementing such a predictive system. Using snowballing techniques, we have invited policy and decision makers at the federal and provincial levels, mental health professionals, individuals who have extensive experience in working with policy and decision makers and who have expertise in suicide prevention, social and health policy, as well as health administrative data, people with lived experience, and advocates for families bereaved by suicide. The qualitative study consists of two rounds of interviews. The first round of interviews were carried out after the general team meeting held in July 2021, at which the study design was finalized. The second round of interviews will be organized once the predictive models are developed. The first round interviews were held through zoom meetings, and follow a series of semi-structured interview questions related to the objectives (see supplementary file#1). Qualitative data collected during the focus groups and qualitative interviews are audio recorded, transcribed, and analyzed with the support of QDA Miner (Provalis).(34) The second round of interviews will be conducted once the prototype models are developed and presented at the second general team meeting which is to be held in late 2022. We will perform an inductive thematic analysis of the focus 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. For example, policy and decision makers may use the models to project the proportion and number of suicide deaths in specific health regions/communities over the next 5 years, and decide how resources and community level interventions may be mobilized to the high risk regions/communities. Furthermore, the models can inform policy and decision makers about the potential impacts of these community level intervention on suicide prevention. 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

surveys and health administrative databases have been used to develop risk predictive models for diabetes,(35) heart disease,(36) and major depression.(37,38) These models may be used to identify high risk individuals in the community; they can also be used to forecast the population risk in the future. However, few models have integrated individual, healthcare system, and community level predictors in the same model. In this study, we proposed to include data from these different levels in model development, and convert the models into synthetic estimation models. There may be different approaches for integrating data from different levels for population risk prediction. Future studies are needed to explore the best method for data integration.

The performance of a risk predictive model is commonly assessed by indicators of model discrimination and calibration.(39) Whereas model discrimination is critical for individual risk predictive models, policy and decision makers' focus is on the whole population rather than individuals. Therefore, model calibration plays a more important role in the performance of a population risk model. We proposed four indicators for assessing model performance. However, it is not clear how much error (the difference between predicted and observed risks) policy and decision makers may tolerate for population risk prediction, how they perceive the importance of model discrimination, whether other indicators exist for assessing population risk prediction models. We will explore these aspects through our qualitative study, and also encourage others to consider these in future studies. Similarly, we welcome discussions and debates about the methods for validating population risk predictive models. An individual risk predictive model is often developed using longitudinal cohort/closed population data and validated in a different but related cohort/closed population. This poses challenges for population risk predictive models because the population in a community/health region is open and dynamic. Appropriate methods for model validation and acceptability need to be developed and agreed by the research community and policy and decision makers.

This study relied on routinely collected health administrative data for model development and validation, rather than collecting primary data. Therefore, we have a little information about suicide behaviors among the individuals in the control group, which are strongly associated with suicide deaths. In the model development, we included hospitalization and emergency department visits due to suicide attempt, which may reduce the bias related to the lack of information about suicide behaviors. Nevertheless, this is a limitation of routinely collected health administrative data.

Despite the challenges for developing population risk predictive model for suicide, research is urgently needed to address this important population health issue. This study represents one of the early steps in building such risk predictive models and methodology development, as part of the collective efforts for moving the field forward.

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.

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Competing interests: none

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Supplementary file #1:

Guiding questions for qualitative interviews.

1) What are the currently policies and practices for suicide prevention that you know?
2) What are the challenges you are facing in suicide prevention at population level?
3) What are your views on using risk predictive tools for facilitating suicide prevention in the population? The advantages and drawbacks?
4) what are your thoughts about using artificial intelligence and machine learning for suicide prevention? The potential pros and cons?
5) From your view, how an ideal risk prediction tool should look like, that assists in your decision making?
6) What visualization formats you have been using, and what are the limits of these visualization methods?
7) What do you think of the visualization model presented to you?

APPENDIX I_1: CANDIDATE PREDICTORS

i. PSYCHIATRIC DISORDERS DIAGNOSIS[1]

- Substance use disorder[2]
  - Alcohol use disorder
  - 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 variables[5]	**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_pediatrician_3
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_6
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_12
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_24
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_36
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_48
# of outpatient paediatrician visits (continuous)	#_outpat_pediatrician_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

# 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

neurological disease	physdx _neuro_12
neurological disease	physdx _neuro_24
neurological disease	physdx _neuro_36
neurological disease	physdx _neuro_48
neurological disease	physdx _neuro_60
endocrine system disorder	physdx _endo_3
endocrine system disorder	physdx _endo_6
endocrine system disorder	physdx _endo_12
endocrine system disorder	physdx _endo_24
endocrine system disorder	physdx _endo_36
endocrine system disorder	physdx _endo_48
endocrine system disorder	physdx _endo_60
trauma	physdx _trauma_3
trauma	physdx _trauma_6
trauma	physdx _trauma_12
trauma	physdx _trauma_24
trauma	physdx _trauma_36
trauma	physdx _trauma_48
trauma	physdx _trauma_60
respiratory disorder	physdx _resp_3
respiratory disorder	physdx _resp_6
respiratory disorder	physdx _resp_12
respiratory disorder	physdx _resp_24
respiratory disorder	physdx _resp_36
respiratory disorder	physdx _resp_48
respiratory disorder	physdx _resp_60
infectious disease	physdx _infec_3
infectious disease	physdx _infec_6
infectious disease	physdx _infec_12
infectious disease	physdx _infec_24
infectious disease	physdx _infec_36
infectious disease	physdx _infec_48
infectious disease	physdx _infec_60
digestive disorder	physdx _diges_3
digestive disorder	physdx _diges_6
digestive disorder	physdx _diges_12
digestive disorder	physdx _diges_24
digestive disorder	physdx _diges_36
digestive disorder	physdx _diges_48
digestive disorder	physdx _diges_60
cardiovascular disorder	physdx _cvd_3

cardiovascular disorder	physdx _cvd_6
cardiovascular disorder	physdx _cvd_12
cardiovascular disorder	physdx _cvd_24
cardiovascular disorder	physdx _cvd_36
cardiovascular disorder	physdx _cvd_48
cardiovascular disorder	physdx _cvd_60
cancer	physdx _cncr_3
cancer	physdx _cncr_6
cancer	physdx _cncr_12
cancer	physdx _cncr_24
cancer	physdx _cncr_36
cancer	physdx _cncr_48
cancer	physdx _cncr_60
other physical disorders	physdx _otr_3
other physical disorders	physdx _otr_6
other physical disorders	physdx _otr_12
other physical disorders	physdx _otr_24
other physical disorders	physdx _otr_36
other physical disorders	physdx _otr_48
other physical disorders	physdx _otr_60
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_3
charlson/elixhauser index with psy (conti)	physdx_comorbid_withpsy_6
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_12
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_24
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_36
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_48
charlson/elixhauser index with psy (conti)	physdx_comorbidity_withpsy_60
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_3
charlson/elixhauser index without psy (conti)	physdx_comorbid_withoutpsy_6
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_12
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_24
charlson/elixhauser index without psy (conti)	physdx_comorbidity_withoutpsy_36

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

rss 01 bas-saint-laurent	loc_rss_01_48
rss 01 bas-saint-laurent	loc_rss_01_60
rss 02 saguenay-lac-saint-jean	loc_rss_02_3
rss 02 saguenay-lac-saint-jean	loc_rss_02_6
rss 02 saguenay-lac-saint-jean	loc_rss_02_12
rss 02 saguenay-lac-saint-jean	loc_rss_02_24
rss 02 saguenay-lac-saint-jean	loc_rss_02_36
rss 02 saguenay-lac-saint-jean	loc_rss_02_48
rss 02 saguenay-lac-saint-jean	loc_rss_02_60
rss 03 capitale-nationale	loc_rss_03_3
rss 03 capitale-nationale	loc_rss_03_6
rss 03 capitale-nationale	loc_rss_03_12
rss 03 capitale-nationale	loc_rss_03_24
rss 03 capitale-nationale	loc_rss_03_36
rss 03 capitale-nationale	loc_rss_03_48
rss 03 capitale-nationale	loc_rss_03_60
rss 04 mauricie et centre-du-québec	loc_rss_04_3
rss 04 mauricie et centre-du-québec	loc_rss_04_6
rss 04 mauricie et centre-du-québec	loc_rss_04_12
rss 04 mauricie et centre-du-québec	loc_rss_04_24
rss 04 mauricie et centre-du-québec	loc_rss_04_36
rss 04 mauricie et centre-du-québec	loc_rss_04_48
rss 04 mauricie et centre-du-québec	loc_rss_04_60
rss 05 estrie	loc_rss_05_3
rss 05 estrie	loc_rss_05_6
rss 05 estrie	loc_rss_05_12
rss 05 estrie	loc_rss_05_24
rss 05 estrie	loc_rss_05_36
rss 05 estrie	loc_rss_05_48
rss 05 estrie	loc_rss_05_60
rss 06 montréal	loc_rss_06_3
rss 06 montréal	loc_rss_06_6
rss 06 montréal	loc_rss_06_12
rss 06 montréal	loc_rss_06_24
rss 06 montréal	loc_rss_06_36
rss 06 montréal	loc_rss_06_48
rss 06 montréal	loc_rss_06_60
rss 07 outaouais	loc_rss_07_3
rss 07 outaouais	loc_rss_07_6
rss 07 outaouais	loc_rss_07_12
rss 07 outaouais	loc_rss_07_24

rss 07 outaouais	loc_rss_07_36
rss 07 outaouais	loc_rss_07_48
rss 07 outaouais	loc_rss_07_60
08 abitibi-témiscamingue	loc_rss_08_3
rss 08 abitibi-témiscamingue	loc_rss_08_6
rss 08 abitibi-témiscamingue	loc_rss_08_12
rss 08 abitibi-témiscamingue	loc_rss_08_24
08 abitibi-témiscamingue	loc_rss_08_36
rss 08 abitibi-témiscamingue	loc_rss_08_48
rss 08 abitibi-témiscamingue	loc_rss_08_60
rss 09 côte-nord	loc_rss_09_3
rss 09 côte-nord	loc_rss_09_6
rss 09 côte-nord	loc_rss_09_12
rss 09 côte-nord	loc_rss_09_24
rss 09 côte-nord	loc_rss_09_36
rss 09 côte-nord	loc_rss_09_48
rss 09 côte-nord	loc_rss_09_60
rss 10 nord-du-québec	loc_rss_10_3
rss 10 nord-du-québec	loc_rss_10_6
rss 10 nord-du-québec	loc_rss_10_12
rss 10 nord-du-québec	loc_rss_10_24
rss 10 nord-du-québec	loc_rss_10_36
rss 10 nord-du-québec	loc_rss_10_48
rss 10 nord-du-québec	loc_rss_10_60
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_3
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_6
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_12
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_24
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_36
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_48
rss 11 gaspésie-îles-de-la-madeleine	loc_rss_11_60
rss 12 chaudière-appalaches	loc_rss_12_3
rss 12 chaudière-appalaches	loc_rss_12_6
rss 12 chaudière-appalaches	loc_rss_12_12
rss 12 chaudière-appalaches	loc_rss_12_24
rss 12 chaudière-appalaches	loc_rss_12_36
rss 12 chaudière-appalaches	loc_rss_12_48
rss 12 chaudière-appalaches	loc_rss_12_60
rss 13 laval	loc_rss_13_3
rss 13 laval	loc_rss_13_6
rss 13 laval	loc_rss_13_12

rss 13 laval	loc_rss_13_24
rss 13 laval	loc_rss_13_36
rss 13 laval	loc_rss_13_48
rss 13 laval	loc_rss_13_60
rss 14 lanaudière	loc_rss_14_3
rss 14 lanaudière	loc_rss_14_6
rss 14 lanaudière	loc_rss_14_12
rss 14 lanaudière	loc_rss_14_24
rss 14 lanaudière	loc_rss_14_36
rss 14 lanaudière	loc_rss_14_48
rss 14 lanaudière	loc_rss_14_60
rss 15 laurentides	loc_rss_15_3
rss 15 laurentides	loc_rss_15_6
rss 15 laurentides	loc_rss_15_12
rss 15 laurentides	loc_rss_15_24
rss 15 laurentides	loc_rss_15_36
rss 15 laurentides	loc_rss_15_48
rss 15 laurentides	loc_rss_15_60
rss 16 montérégie	loc_rss_16_3
rss 16 montérégie	loc_rss_16_6
rss 16 montérégie	loc_rss_16_12
rss 16 montérégie	loc_rss_16_24
rss 16 montérégie	loc_rss_16_36
rss 16 montérégie	loc_rss_16_48
rss 16 montérégie	loc_rss_16_60
location nonrural	nonrural_3
location nonrural	nonrural_6
location nonrural	nonrural_12
location nonrural	nonrural_24
location nonrural	nonrural_36
location nonrural	nonrural_48
location nonrural	nonrural_60
location rural	rural_3
location rural	rural_6
location rural	rural_12
location rural	rural_24
location rural	rural_36
location rural	rural_48
location rural	rural_60
location missing data	loc_missing_3
location missing data	loc_missing_6

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 variables[7]	**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

rss 07 outaouais mental health budget	rss_07_mh_12
rss 07 outaouais mental health budget	rss_07_mh_24
rss 07 outaouais mental health budget	rss_07_mh_36
rss 07 outaouais mental health budget	rss_07_mh_48
rss 07 outaouais mental health budget	rss_07_mh_60
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_3
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_6
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_12
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_24
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_36
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_48
rss 08 abitibi-témiscamingue mental health budget	rss_08_mh_60
rss 09 côte-nord mental health budget	rss_09_mh_3
rss 09 côte-nord mental health budget	rss_09_mh_6
rss 09 côte-nord mental health budget	rss_09_mh_12
rss 09 côte-nord mental health budget	rss_09_mh_24
rss 09 côte-nord mental health budget	rss_09_mh_36
rss 09 côte-nord mental health budget	rss_09_mh_48
rss 09 côte-nord mental health budget	rss_09_mh_60
rss 10 nord-du-québec mental health budget	rss_10_mh_3
rss 10 nord-du-québec mental health budget	rss_10_mh_6
rss 10 nord-du-québec mental health budget	rss_10_mh_12
rss 10 nord-du-québec mental health budget	rss_10_mh_24
rss 10 nord-du-québec mental health budget	rss_10_mh_36
rss 10 nord-du-québec mental health budget	rss_10_mh_48
rss 10 nord-du-québec mental health budget	rss_10_mh_60
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_3
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_6
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_12
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_24
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_36
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_48
rss 11 gaspésie-îles-de-la-madeleine mental health budget	rss_11_mh_60
rss 12 chaudière-appalaches mental health budget	rss_12_mh_3
rss 12 chaudière-appalaches mental health budget	rss_12_mh_6
rss 12 chaudière-appalaches mental health budget	rss_12_mh_12
rss 12 chaudière-appalaches mental health budget	rss_12_mh_24
rss 12 chaudière-appalaches mental health budget	rss_12_mh_36
rss 12 chaudière-appalaches mental health budget	rss_12_mh_48
rss 12 chaudière-appalaches mental health budget	rss_12_mh_60
rss 13 laval mental health budget	rss_13_mh_3

rss 13 laval mental health budget	rss_13_mh_6
rss 13 laval mental health budget	rss_13_mh_12
rss 13 laval mental health budget	rss_13_mh_24
rss 13 laval mental health budget	rss_13_mh_36
rss 13 laval mental health budget	rss_13_mh_48
rss 13 laval mental health budget	rss_13_mh_60
rss 14 lanaudière mental health budget	rss_14_mh_3
rss 14 lanaudière mental health budget	rss_14_mh_6
rss 14 lanaudière mental health budget	rss_14_mh_12
rss 14 lanaudière mental health budget	rss_14_mh_24
rss 14 lanaudière mental health budget	rss_14_mh_36
rss 14 lanaudière mental health budget	rss_14_mh_48
rss 14 lanaudière mental health budget	rss_14_mh_60
rss 15 laurentides mental health budget	rss_15_mh_3
rss 15 laurentides mental health budget	rss_15_mh_6
rss 15 laurentides mental health budget	rss_15_mh_12
rss 15 laurentides mental health budget	rss_15_mh_24
rss 15 laurentides mental health budget	rss_15_mh_36
rss 15 laurentides mental health budget	rss_15_mh_48
rss 15 laurentides mental health budget	rss_15_mh_60
rss 16 montérégie mental health budget	rss_16_mh_3
rss 16 montérégie mental health budget	rss_16_mh_6
rss 16 montérégie mental health budget	rss_16_mh_12
rss 16 montérégie mental health budget	rss_16_mh_24
rss 16 montérégie mental health budget	rss_16_mh_36
rss 16 montérégie mental health budget	rss_16_mh_48
rss 16 montérégie mental health budget	rss_16_mh_60
rss 01 bas-saint-laurent addictions budget	rss_01_a_3
rss 01 bas-saint-laurent addictions budget	rss_01_a_6
rss 01 bas-saint-laurent addictions budget	rss_01_a_12
rss 01 bas-saint-laurent addictions budget	rss_01_a_24
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_60
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_12
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_48
rss 02 saguenay-lac-saint-jean addictions budget	rss_02_a_60

rss 03 capitale-nationale addictions budget	rss_03_a_3
rss 03 capitale-nationale addictions budget	rss_03_a_6
rss 03 capitale-nationale addictions budget	rss_03_a_12
rss 03 capitale-nationale addictions budget	rss_03_a_24
rss 03 capitale-nationale addictions budget	rss_03_a_36
rss 03 capitale-nationale addictions budget	rss_03_a_48
rss 03 capitale-nationale addictions budget	rss_03_a_60
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_3
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_6
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_12
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_24
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_36
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_48
rss 04 mauricie et centre-du-québec addictions budget	rss_04_a_60
rss 05 estrie addictions budget	rss_05_a_3
rss 05 estrie addictions budget	rss_05_a_6
rss 05 estrie addictions budget	rss_05_a_12
rss 05 estrie addictions budget	rss_05_a_24
rss 05 estrie addictions budget	rss_05_a_36
rss 05 estrie addictions budget	rss_05_a_48
rss 05 estrie addictions budget	rss_05_a_60
rss 06 montréal addictions budget	rss_06_a_3
rss 06 montréal addictions budget	rss_06_a_6
rss 06 montréal addictions budget	rss_06_a_12
rss 06 montréal addictions budget	rss_06_a_24
rss 06 montréal addictions budget	rss_06_a_36
rss 06 montréal addictions budget	rss_06_a_48
rss 06 montréal addictions budget	rss_06_a_60
rss 07 outaouais addictions budget	rss_07_a_3
rss 07 outaouais addictions budget	rss_07_a_6
rss 07 outaouais addictions budget	rss_07_a_12
rss 07 outaouais addictions budget	rss_07_a_24
rss 07 outaouais addictions budget	rss_07_a_36
rss 07 outaouais addictions budget	rss_07_a_48
rss 07 outaouais addictions budget	rss_07_a_60
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_3
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_6
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_12
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_24
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_36
rss 08 abitibi-témiscamingue addictions budget	rss_08_a_48

rss 08 abitibi-témiscamingue addictions budget	rss_08_a_60
rss 09 côte-nord addictions budget	rss_09_a_3
rss 09 côte-nord addictions budget	rss_09_a_6
rss 09 côte-nord addictions budget	rss_09_a_12
rss 09 côte-nord addictions budget	rss_09_a_24
rss 09 côte-nord addictions budget	rss_09_a_36
rss 09 côte-nord addictions budget	rss_09_a_48
rss 09 côte-nord addictions budget	rss_09_a_60
rss 10 nord-du-québec addictions budget	rss_10_a_3
rss 10 nord-du-québec addictions budget	rss_10_a_6
rss 10 nord-du-québec addictions budget	rss_10_a_12
rss 10 nord-du-québec addictions budget	rss_10_a_24
rss 10 nord-du-québec addictions budget	rss_10_a_36
rss 10 nord-du-québec addictions budget	rss_10_a_48
rss 10 nord-du-québec addictions budget	rss_10_a_60
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_3
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_6
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_12
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_24
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_36
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_48
rss 11 gaspésie--îles-de-la-madeleine addictions budget	rss_11_a_60
rss 12 chaudière-appalaches addictions budget	rss_12_a_3
rss 12 chaudière-appalaches addictions budget	rss_12_a_6
rss 12 chaudière-appalaches addictions budget	rss_12_a_12
rss 12 chaudière-appalaches addictions budget	rss_12_a_24
rss 12 chaudière-appalaches addictions budget	rss_12_a_36
rss 12 chaudière-appalaches addictions budget	rss_12_a_48
rss 12 chaudière-appalaches addictions budget	rss_12_a_60
rss 13 laval addictions budget	rss_13_a_3
rss 13 laval addictions budget	rss_13_a_6
rss 13 laval addictions budget	rss_13_a_12
rss 13 laval addictions budget	rss_13_a_24
rss 13 laval addictions budget	rss_13_a_36
rss 13 laval addictions budget	rss_13_a_48
rss 13 laval addictions budget	rss_13_a_60
rss 14 lanaudière addictions budget	rss_14_a_3
rss 14 lanaudière addictions budget	rss_14_a_6
rss 14 lanaudière addictions budget	rss_14_a_12
rss 14 lanaudière addictions budget	rss_14_a_24
rss 14 lanaudière addictions budget	rss_14_a_36

rss 14 lanaudière addictions budget	rss_14_a_48
rss 14 lanaudière 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
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_postsuicideattempt_3
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_6
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_12
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_24
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_36
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_48
quality of mental health services followup in primary care after suicide attempt (continuous)	qfu_primcare_postsuicideattempt_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 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		
			Thioproperazine		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		

		Tranylcypromine		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, vasodilatators)				
		24:20	Alpha-blockers				
		24:24	Beta-blockers				
		24:28	Calcium chanel blockers				
		24:32	ACE inhibitors and ARBs				

		40:28	Diuretics				
	Antiarrythmic and cardiotonic	24:04	Cardiotropic (antiarythmics, cariotonics)				
	Hypolipemiants	24:06	Hypolipemiants (statins, fibrates, etc)				
	Vasodilatators	24:12	Nitrates and other vasodilatators				
Respiratory diseases (mediations used to treat COPD and asthma)							
		Medications		Code denomination commune			
		Aclidinium		47986			
		Glycopyrronium		47949			
		Tiotropium		46856			
		Uméclidinium		48109			
		Formotérol		47916			
		Indacatérol		47923			
		Salmétérol		46247			
				47112			
		Olodatérol					
		Glycopyrronium/indacatérol		48033			
		Uméclidinium/vilantérol		48224			
				48029			
		Aclinidium/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			
		Budénoside		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, opiods, etc)			SAUF
		Specific medicaitons		**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							

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.[46] 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.[46] 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[58] 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[a,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[a,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[a,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[a,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[a,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[a,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.

[a] 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.