Methods

Study design and data sources

To complete this retrospective cohort study we accessed a total of eight administrative databases: The Ontario Mental Health Reporting System (OMHRS), the Discharge Abstract Database (DAD), the Same Say Surgery Database (SDS), the National Ambulatory Care Reporting System (NACRS), the Ontario Health Insurance Plan (OHIP) database, the Ontario Registered Persons Database (RPDB), the Canadian Census 2008 intercensal population estimates, and the Ontario Disability Support Program (ODSP) database. These contain health service, social support and demographic data and are maintained at the Institute for Clinical and Evaluative Sciences (ICES), in Toronto, Ontario. These datasets were linked using unique encoded identifiers and analyzed at ICES. ICES maintains longitudinal, population-based data on all Ontarians eligible for health services, representing all legal residents of Ontario.

Main independent variable

Included in the study were individuals between 19 and 65 years of age on April 1, 2010 who were eligible for provincial health insurance confirmed through the Registered Persons Database. The main independent variable was represented by the three mutually exclusive study subgroups: Those with IDD-only, those with IDD and a mental illness (IDD-MI), and those without IDD but with a mental illness (MI-only).

Our definition of IDD is consistent with the criteria used by the Ontario government to determine eligibility for support services. Included are conditions characterized by significant limitations in cognitive and adaptive functioning that are lifelong in nature and affect activities of daily living, with onset before age 18 (1). To identify records of persons with IDD, the health

(OMHRS, DAD, SDS, NACRS, OHIP) and social support (ODSP) datasets were searched for codes for intellectual disability and conditions associated with IDD such as Down syndrome, Fragile-X, and Autism Spectrum Disorder. The details of the datasets, methods and codes used to identify Ontarians with IDD are provided elsewhere (2).

The cohort of 66,484 adults created by our merged datasets were divided into two subgroups: IDD-only (n=36,496) and IDD-MI (n=29,988). The IDD-MI subgroup consisted of individuals with IDD with any health care contact between April 1, 2007 and March 31, 2009 associated with a diagnosis for mental illness in at least one of the health databases. Mental illness was defined as any ICD-10 F-code or the ICD-9 or DSM-IV equivalents, excluding the codes for IDD. This means that an individual with codes for Down syndrome and Autism Spectrum Disorder but no other mental illness would be categorized as IDD-only, not IDD-MI. The MI-only subgroup was created as a comparison group and was created by first drawing a 20% random sample from the population of Ontario without IDD. Within this sample, individuals with any mental illness health care contact (as defined for the IDD-MI subgroup) between April 1, 2007 and March 31, 2009 were considered MI-only.

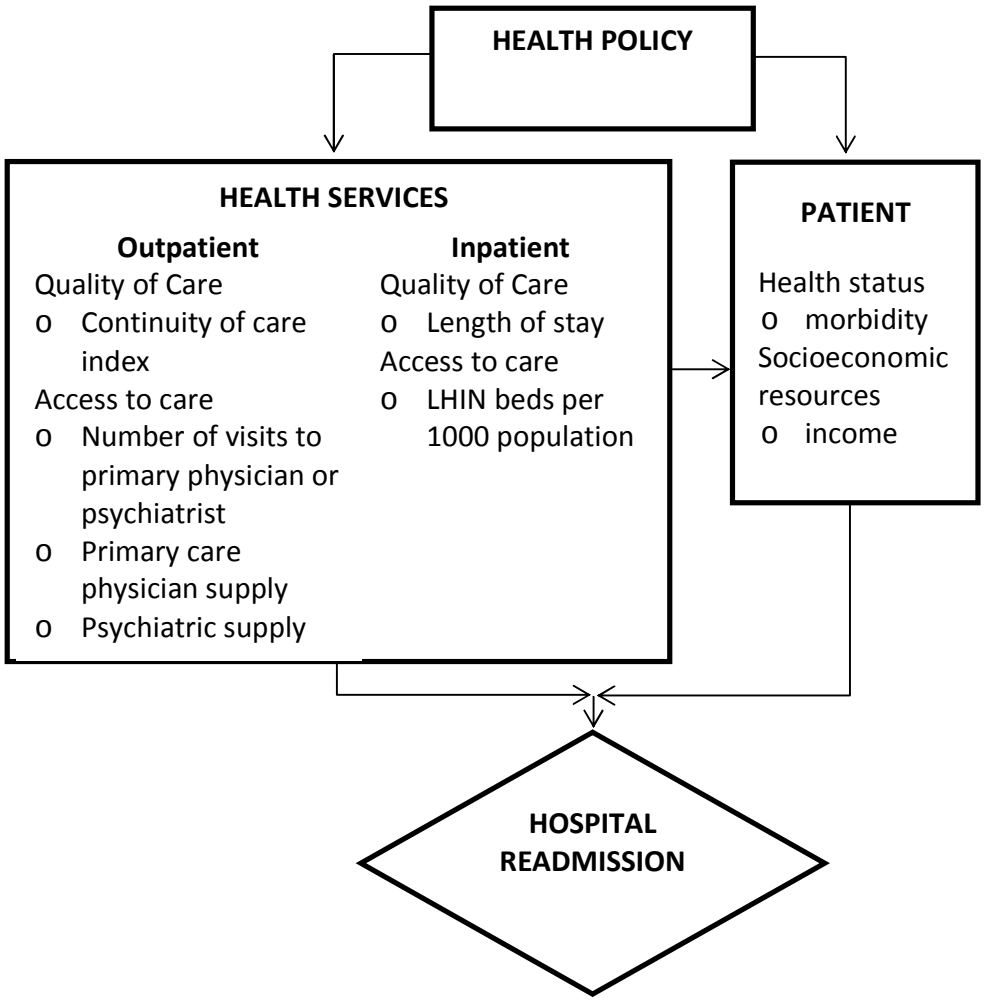
Other independent variables

Patient demographics: Demographic characteristics included in our study were sex, age, and rurality. Age was grouped into five categories (19-25, 26-35, 36-45, 46-55, 56-65) using age on April 1, 2010. Rurality was measured using the Canadian Census definition (i.e. rural was defined as living in a community with a population ≤ 10,000).

The remaining independent variables were categorized using the framework proposed by Kangovi (see figure 1) (3). The framework conceptualizes readmissions in terms of quality

and access within outpatient and inpatient care and acknowledges the influence of patient health and socio-economic factors.

Figure 1: Determinants of Hospital Readmission Framework as proposed by Kangovi & Grande (3): Revised to include variables in statistical models



Patient health status, socioeconomic resources: The Adjusted Clinical Groups (ACG) Case-Mix System developed by Johns Hopkins was used to account for differences in patient levels of morbidity (4). This system's algorithm has been validated for use in Canadian

populations (5) and uses data on age, sex and diagnoses obtained from administrative databases over a specified time period to provide a relative measure of an individual's health status. For our study, the ACG algorithm used data from the 2-year period before April 1, 2010, and produced 4 morbidity levels: low, moderate, high, very high morbidity. Neighborhood income quintile (poorest to wealthiest neighbourhoods) was used as a marker for socioeconomic resources and was determined using the Canadian Census.

Inpatient health services (quality and access): Based on research arguing that shorter lengths of stay can lead to higher rates of readmissions due to decreased opportunities to stabilize patients and provide discharge planning (6), we included length of index hospitalization as a measure of inpatient quality of care. Past research has also argued that increasing the availability of hospital beds can lead to increases in demand for hospitalizations without necessarily improving health (7, 8). As a measure of access we thus included the number of beds/1000 population for each of 14 health planning regions of the province (known as Local Health Integration Networks or (LHINs)).

Outpatient health services (quality and access): The Usual Provider Continuity (UPC) index, a commonly used measure of continuity of primary care (9), was used to measure quality of care in the two years preceding the index hospitalization. The measures of outpatient access were: the total number of visits made to a primary care physician or a psychiatrist (within 1 year of index hospitalization) and the number of full-time equivalent specialists (primary care physician and psychiatrist) per 10,000 population in each LHIN.

Analysis

For objective 1, adjusted odds of being readmitted for any reason within 30 days after discharge from an index hospitalization (dependent variable) were compared across the three study subgroups (main independent variable) using logistic regression. An index hospitalization was defined as the first hospitalization for an individual occurring between April 1, 2010 and March 31, 2011. To be counted, a readmission did not have to be for the same diagnosis as the index hospitalization. We found little difference in rates of readmission according to type of index hospitalization (i.e. psychiatric vs. all diagnoses). Multivariable regression was used to see if the association between the study subgroup variable and 30-day readmission was significant after controlling for other variables. Similarly, to address objective 2, we built three separate logistic regression models in order to identify significant predictors of all cause 30-day readmissions within each subgroup. A generalized estimating equation approach was used to account for clustering of individuals in LHIN level variables.

This study was approved by the institutional ethics review boards at Sunnybrook Health Sciences Centre (Toronto, Canada) the Centre for Addiction and Mental Health (Toronto, Canada), and the University of Ontario Institute of Technology (Oshawa, Canada).

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