A Novel Population-Based Health Index for Mental Disorder

David Cawthorpe, MSc, PhD

Abstract

Introduction: A novel population-based health index was identified, in addition to calculation of the rates of psychiatric disorder in a random sample from a large urban center.

Methods: With use of the regional population as a sampling frame, 685,684 individuals (45.8% male) were selected randomly, with physician billing visit and cost data from 1994 to 2009 grouped on the basis of the presence or absence of a psychiatric disorder. The prevalence of psychiatric disorder was described and the groups were further analyzed in terms of somatic and biomedical disorders with the profile of depression highlighted.

Results: In the sample (45.8% male), the annual prevalence of psychiatric disorder from 1994 to 2009 was found to increase in 3 age strata (children, 5.3%; adults, 4.4%; and geriatric subjects, 6.2%). Depressive disorders as a group provided an example of the population profile. The cumulative rate of psychiatric disorder was 53% over 16 fiscal years. In comparison with the group without psychiatric disorder, the median cost of physical (biomedical/somatic) disorders was 2.9 times higher for the group with any International Classification of Diseases psychiatric disorder.

Discussion: The arithmetic ratio of median somatic and biomedical health costs, comparing groups with and without psychiatric disorders, was presented as a novel population profile. The cumulative rate of psychiatric disorder was 53% over 16 fiscal years. In comparison with a psychiatric disorder, divided by the total number of individuals for each year were based on counts of individuals having any psychiatric disorder from 1994 to 2009 using a representative random sample of the Alberta Health Services Calgary Zone population in Alberta, Canada. The average and median costs of biomedical and somatic disorders of patients with and without psychiatric disorders were calculated and combined in an arithmetic ratio to represent a novel health index. A population-based health index can be a useful tool to monitor the health of a community and to measure the effect of population-based promotion and prevention.

The objectives of this research were to calculate the cumulative and annual rates of mental disorder in the population-based sample and to explore whether health service utilization data are a viable and robust source of population health information. Additionally, depressive disorders are presented as an example of the population profile.

Methods

With the use of a population sampling frame, 685,684 individuals (45.8% male) were selected randomly on the basis of never having been treated in specialized, publicly funded psychiatric services (eg, no registration for treatment in regional ambulatory psychiatric clinics, nor psychiatric treatment in Emergency Departments or inpatient psychiatric units). All direct physician billings from 1994 through 2009 for treatment of any presenting concern were obtained under Calgary Research Ethics Board ID 21695. The anonymous data set included International Classification of Diseases (ICD) diagnoses, physician billing cost, visit date, age at index visit, and sex. Of 71,653,006 total unique billings, 9,918,619 (13.8%) were not included because the data were not complete (eg, diagnosis was missing). Each billing represented a visit where up to 3 diagnoses could be assigned. The 3 ICD diagnoses were used in this analysis.

The category of physical disorders (biomedical or somatic) could contain any of more than 13,000 ICD-Ninth Revision (ICD-9) diagnoses that were not psychiatric disorders. The category of psychiatric disorders was made up of 480 ICD diagnoses representing psychiatric disorders and related V codes. Within the data set, a psychiatric disorder is either present for any given visit, any given patient or it is not. Thus, the category of any psychiatric disorder was established, and there is, in fact, a clear line demarcating the difference between physical (somatic and biomedical) disorders and psychiatric disorders. The 16-year cumulative prevalence and the annual prevalence for each year were based on counts of individuals having any psychiatric disorder, divided by the total number of individuals.
visiting a physician over 16 years (cumulative prevalence) or in a given year (annual prevalence). Hence, for each year and for the 16-year cumulative rate, an individual was counted only once even if s/he had multiple ICD-9 physician-assigned psychiatric diagnoses.

The diagnosis and statistical manual of mental disorders (fourth edition, text revision, or DSM-IV-TR) has equivalent diagnoses, and crosswalks for ICD-9 are available. Typically, ICD-9 classifications of disease are used to code psychiatric disorder for the purpose of international comparison. The ICD-9 diagnostic codes of disorders are used in Alberta to code with diagnoses associated with physician visits and billings. In general, to be paid for a particular patient visit, the physician of record must submit at least one ICD-9 code. The physician-assigned ICD-9 diagnoses considered in this study arise predominantly from primary care physician billing.

The cumulative and annual rates of ICD diagnosis were summarized for those with any psychiatric disorder and expressed as a percentage of the cumulative (16-year) or annual number of individuals receiving any diagnoses. The average and median costs and number of visits to physicians per individual for ICD physical disorders among those with and without psychiatric disorders were also summarized. The arithmetic ratio of physical disorders between these 2 patient groups provides an index that integrates estimates of population-based key health and psychiatric health parameters.

Of note is that the random sample of 685,684 individuals represents approximately two-thirds of the catchment population of the Calgary health zone. This sample was selected on the basis of never having been registered in ambulatory, inpatient, or emergency psychiatric services. Hence, there is an inherent bias in this group against having a psychiatric disorder and toward being, according to social standards and norms, most representative of the normal population.

Results

Six percent of the total number of diagnoses (n = 84,213,781) were psychiatric disorders. The cumulative proportion of individuals in the sample with any ICD psychiatric disorder from 1994 to 2009 was 53.5%. The average cost of psychiatric disorder per patient was $515 for physician visits where a psychiatric disorder was assigned (all cost values are in Canadian dollars). Over the same period, patients with psychiatric disorders had a per-patient average cost of physical (biomedical/somatic) ICD disorders of $4,490 ($2.9 billion was spent on the somatic/biomedical healthcare of those with a mental disorder. Table 1 shows the number of unique patients with physician billings for ICD diagnoses and the number of unique patients with any psychiatric disorder for 3 age categories: those under 18 years of age, those between 18 and 69 years, and those 70 years and older.

Table 2 shows the proportion of individuals with physician billings having a psychiatric diagnosis by year across the 3 age categories. Notice the annual prevalence increased in each age category. Of particular note is that the rate doubled in the age group under 18 years. The percentage change in each group from 1994 to 2009 was 5.3% for those under 18 years, 4.4% for those between 18 and 69 years, and 6.2% for those 70 years or older.

Table 3 shows the rank order of different types of depression in the sample. The ICD diagnosis “Depression not elsewhere classified” had the highest cumulative 16-year rate, whereas “Other affective psychosis” was the lowest rate. Thirty-three percent of the population had a depressive disorder.

Discussion

Health care systems in the US and Canada are fundamentally different from one another. The Canadian health care system is typified at the provincial level by publicly funded health services and provincially managed physician fee-for-service billing based on a universal patient health care number. Private health care services, although available to some extent, are generally not used by the general population. The universality of the Canadian health care system permits population-based study, the results of which are perhaps most directly comparable to self-contained, all-inclusive health care systems in the US. The results of this study are of interest to any country that collects health care data.

The study follows an a priori hypothesis-driven study that employed the same health service utilization data, wherein the results were found to support the findings of the Adverse

<table>
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<th>&lt; 18 years</th>
<th>18-69 years</th>
<th>≥ 70 years</th>
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<td>5345</td>
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<td>2009</td>
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ICD = International Classification of Diseases.
Childhood Experiences (ACE) Study, which found a preponderance of adult physical disorders to be associated with early adverse experiences. The present study extends this original work, which was based on the principles of developmental psychopathology, which holds as a core assumption that early adversity is a principle risk factor for psychiatric disorder.

Psychiatric disorder was examined in a large, randomly selected sample from the Alberta Health Services Calgary Zone over 16 years for annual prevalence and cumulative average (median) of health costs (independent variable) given the presence or absence of any psychiatric disorder (dependent variable). The arithmetic ratio of health costs (minus the cost of psychiatric disorder), given the presence or absence of psychiatric disorder, is presented in this article as a novel population health index, which is justified given that 53.5% of the population had a psychiatric disorder over the 16-year period. Although the relationship between psychiatric and physical illness is well established, the fact that more than half of the population had a psychiatric disorder and almost 3 times the related health costs (in addition to the cost of psychiatric disorder) provides a basis for understanding the utility of the present novel population health index. Integration of the health costs directly related to psychiatric health into a universal population health index serves two ends. First, this index provides an empirical basis for directly measuring the effect of health and psychiatric health promotion and prevention programs. Second, the index may provide a mechanism for changing psychiatric disease-related social values within the health care system. Typically, low value is placed on the psychiatric health needs of populations. In Canada, the recent creation of yet another national mental health commission is evidence of the need to fundamentally change values related to psychiatric disorder and to reduce related stigma.

Considering psychiatric disorder as a subdomain of health may be ill advised. Although it is important to examine the impact of the burden of psychiatric disease independently, it is equally important to consider the relationship of health to psychiatric health in terms of an overall health index. The 9-year cumulative rate of ICD psychiatric disorders in an independent sample from the same population base was 46%. Compared with an independent population study of the 1-, 2-, and 3-year provincial rates of psychiatric disorder from physician billing data in Alberta, the 16-year rate of 53.5% observed in the present study sample indicates that the rate of psychiatric disturbance in the population is logistically stable and represents an epidemic proportion. Imagine if half the population had HIV (human immunodeficiency virus) or influenza. This finding places psychiatric medicine at the center of all medical concerns.

The observed cumulative 16-year rate draws attention to and opposes the story told by politicians and policymakers in relationship to psychiatric disorder. Even though depression is anticipated to become the second-largest contributor to the global burden of disease by 2020, our leaders’ stories, at least in Canada, often tend to focus on the homeless and criminality once the topic of psychiatric health is raised. Our present study indicates that the populist focus does not represent the mos maiorum. Although it is important for the provision of treatment to focus on the psychiatric condition of marginalized groups who are homeless or who occupy our jails, focusing on these populations in telling the public story of psychiatric illness may inadvertently have the effect of further marginalizing these groups, while stigmatizing and silencing the majority with psychiatric disorder.

Why is “Silent Epidemic” the public label for depression? Why do newsletters of the Mental Health Commission of Canada frontline homelessness while the silent epidemic proceeds unabated? Our study indicates that 53% of the general population experiences a psychiatric disorder over a 16-year period, with some form of depression diagnosed in 33%. The associated health costs are extraordinary. For every billion dollars spent on the health care of those without psychiatric disorder, the same health care system within the catchment spends about $2.9 billion (median) on the physical (biomedical/somatic) disorders of...
those with psychiatric disorder (exclusive of associated psychiatric disorder billing costs). Institutionalizing the segregation of psychiatric services and general health services is perhaps the strongest cornerstone of system-based stigma.

The present study findings stand in contrast to those of Labonte et al., who indicated that depression was stable, hovering between an annual prevalence in the range of 5% to 7%, between 1994 and 2009. The present study findings are more in line with the 2011 report by the Canadian Index of Wellbeing, in that the annual rate of psychiatric diagnosis doubled for children and increased in a similar linear fashion for both adult and geriatric populations. The use of population-based utilization data may in the future help to resolve and surmount issues related to survey-based data.

The reasons for the increased rates of psychiatric diagnosis are presently speculative. Further examination will be required to discern whether there are specific classes of disorder accounting for the observed increases in these age groups. Possibilities include but are not limited to the following: 1) a true increase in social psychiatric (and physical) disease related to increased social stress, 2) increased awareness of psychiatric disorder on the part of patients, 3) increased marketing of pharmaceutical products, and/or 4) improved education of physicians leading to an increase in the rate of diagnosis. However, the preponderance of the diagnosis of “Depression not elsewhere classified” argues against an improved ability to distinguish diagnostic subtypes, as least for depressive disorders. Further work will be required to unravel the influences underpinning the observed overall rate increase or rate changes within specific categories of diagnosis.

An algorithm is being designed to profile prodromal and prognostic patterns of associated disorders in time for any given index diagnosis or diagnostic cluster. Standard information from the algorithm will provide information relevant to planning health service clinical networks and pathways. In and of itself, the algorithm will serve as a window on the past from which to provide understanding about change or observed increases in bandwidths of the population. For each diagnosis or diagnostic cluster, standard information from utilization and physician diagnosis. This means that some degree of “casefulness” is associated with the assignment of each physician-assigned diagnostic code, whether or not the diagnosis is accurate (see limitations in the next paragraphs). Like all psychiatric disorders, depression-type disorders as a group are increasing in the population. When examined at the level of depression diagnosis types, some depression diagnosis types are increasing (eg, Depressive disorder not elsewhere classified), whereas others are decreasing or appear relatively stable in the population (eg, Other affective psychoses).

Depressive disorders were used as a point of illustration, as these diagnoses have also been examined using different epidemiologic methods in the Canadian population. For example, the Canadian Index of Wellbeing survey uses several questions related to depressive symptoms to measure the population-based rate of depression. In the present study, overall psychiatric disorder and ICD-9 depression disorders were measured in two-thirds of the regional population on the basis of service utilization and physician diagnosis. This means that some degree of “casefulness” is associated with the assignment of each physician-assigned diagnostic code, whether or not the diagnosis is accurate (see limitations in the next paragraphs). Like all psychiatric disorders, depression-type disorders as a group are increasing in the population. When examined at the level of depression diagnosis types, some depression diagnosis types are increasing (eg, Depression not elsewhere classified), whereas others are decreasing or appear relatively stable in the population (eg, Other affective psychoses).

Limitations include the validity and reliability of diagnoses. Regarding the validity and reliability of the diagnosis, we have 2 studies with 2 independently selected, random samples, sampled with replacement to represent about two-thirds of the urban population in the Calgary catchment area. The first of these samples spanned 9 years, and the second sample (described here) spanned 16 years. Compared with a provincial study examining the 1-, 2-, and 3-year prevalence of psychiatric disorder, the 9-year prevalence and 16-year prevalence create a perfect logistic function saturating at 53% of the population. A logistic growth curve may still represent a process that is flawed. There is no doubt exists some threat to the reliability and validity of every diagnosis made by every physician over the last 16 years. Misdiagnosed illnesses are...
possible with every diagnosis, and in some cases the likelihood of misdiagnosis is much greater than in others. Given that each diagnosis has the same liability to misdiagnosis within a given class of disorders, the measured variables (cost and prevalence) within the categories established given the presence or absence of any psychiatric disorder probabilistically suffer identical threats to reliability and validity. If one assumes that half or all of the psychiatric disorders are inaccurate, it stands to reason that half or all psychiatric disorders are not diagnosed. Given this assumption, how does one account for the group with any psychiatric diagnosis having a medial tripling of physical disorders (eg, heart disease, which presumably is more accurately diagnosed), if not on the variable that establishes the category that, in this case, is “any physician-assigned ICD psychiatric disorder”? In other words, if psychiatric disorder, as a diagnosis, is random (inaccurate and unreliable noise), then one would expect the same values represented within the measured independent variables (average or median costs of somatic and biomedical disorders) within each category (those with and those without psychiatric disorder).

Although there is a clear distinction between psychiatric and somatic disorders as assigned by physicians using ICD criteria, the results of this study indicate that the distinction blurs considerably when it comes to the relationship between psychiatric and somatic disorders in an individual. Within individuals, disorder appears to compound in a systematic manner. Elucidating this relationship is of first-order importance.

*Co-principal investigator, The Adverse Childhood Experiences Study.

Disclosure Statement

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References


Within the Fairy Circle

It is … to be lamented that regular physicians have indulged in a blind routine of inefficient treatment, and have allowed themselves to be confined within the fairy circle of antiphlogisticism, and by that means to be diverted from the more important consideration of the mind.

— Treatise on Insanity, Philippe Pinel, 1745-1826, French physician