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ORIGINAL RESEARCH

Association of Substance and Psychiatric Disorders with Health Care Utilization and Cost

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Abstract

Background: Few studies have directly examined the health care costs of those who suffer from mental disorders. The quality of administrative data has improved to the point where such study is currently possible.

Aims of the study: Prevalence and cost results for 16 years of physician billing data comparing the health costs of groups with and without substance and/or other psychiatric disorders are described.

Methods: A 16-year dataset containing 95846511 physician-assigned International Classification of Disease (ICD) diagnoses and billing costs (54% female) for 768460 unique individuals (64% female) was employed to develop three groups: Group 1 – Those without psychiatric disorders; Group 2 – Those without substance disorders but having other psychiatric diagnoses; Group 3 – Those with substance disorders. Associated ambulatory and inpatient/emergency admissions were also examined for each group. Total diagnoses, and costs per group, and descriptive statistics for unique individuals within groups were summarized.

Results: Only 8.4% of the total sample received a substance disorder diagnosis. The diagnosis frequency per unique individual for those with substance disorders was 3 times higher than those with no mental disorder and 1.4 times higher than those with a mental disorder but no substance disorder. In each category, health costs of substance disorder cases were greater. Associated ambulatory, and inpatient/emergency admissions were also 2.6 and 2.4 times higher than those with no mental disorder and 1.2 times higher for both ambulatory and inpatient/emergency admissions for those with a mental disorder.

Discussion: Having a substance disorder has a substantial impact on health-related expenditures. Taking into account substance disorder morbidity is central to planning treatment in respect to how mental disorder resources are constructed and rationed within the health care system.

Limitations: Four specific limitations are identified: Diagnostic precision, two-way effect of comorbidity, and inability to establish causality.

Implications: Other studies employing this dataset have begun to examine the clinical pathways in time illustrating the emergence of mental disorders and related physical diagnoses. These results have immediate relevance for general medical practice. Consideration of the temporal relationship of substance disorders together with mental disorders in association with biomedical disorders as a standard of care is central to a sustainable health system.

Background

Substance abuse and dependence are of paramount concern to society. Legal and illegal substance consumption are avoidable risk factors related to disease burden. The significant costs associated with alcohol abuse and dependence alone account for more than 1% of the gross national product in high-income and middle-income countries with a major proportion adding into health costs [1]. Alcohol also accounts for a major portion of mortality in some countries. For instance, alcohol-attributable mortality was a cause of more than half of all Russian deaths at ages 15-54 years [2]. Nevertheless, in relation to the level of the disease

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burden, alcohol-related research represents only one-sixth of that thought to be warranted [3].

Current societal patterns of alcohol use impose a huge health and economic burden on modern society [4,5], hence understanding the health and economic burden of substance disorders is important in respect to organizing services [6-8]. Primary and secondary service providers are a focus for capacity building and improvement of access to services [9,10]. In order to consider the cost-effectiveness of evidence-based interventions designed to reduce the burden of substance-related disease, comparative analysis is required [7], yet, comparative practice-related cost analysis is impeded by the considerable methodological heterogeneity in the published literature [6]. While the results of demographically-focused studies are useful in respect to the measured demographics [8], the results are not always generalizable in terms of utility to sector or system-wide policy formation [6]. Additionally, most studies restrict their research focus to dual diagnoses or comorbid mental and substance disorders or substance disorder specifically [7].

Further, national surveys are not consistently replicated and often fail to parse analysis of costs into unique categories that take into account complex morbidity [7]. Few, if any studies take into account the biomedical and biophysical disorders associated with mental or substance disorders, or both. The Adverse Childhood Experience study is one body of work that places biomedical and biophysical disorders at the centre of consideration related to substance disorder [11-15].

Analysis at the population-level is emerging as a viable approach that offers the potential to address sector and system-wide policy and practice issues related to substance disorders. Economic analysis forms a basis for policymakers to improve healthcare [16,17]. Further, the population-based study of multi-morbidity has provided insight to the fundamental relationship between mental disorders and associated biomedical and biophysical disorders [17-24].

Aims of the Study

This paper describes the 16-year biomedical and biophysical billing costs and associated ambulatory and inpatient/emergency admissions for those with or without substance disorders or other psychiatric disorders, or both, employing a case-comparison design.

Methods

Data for this paper was collected under ethics ID-REB15-1057. All physicians in Alberta must directly bill the provincial health plan for each patient visit for payment. Data analyzed for each billing record included an encrypted unique patient identifier, an International Classification of Diseases (ICD-9) diagnosis, a visit cost, age, and sex. The physician billing data and patient-associated ambulatory and inpatient admissions were comprised of records for all health services rendered to individuals from the Calgary Health Zone in Alberta Canada who sought health care for a specified problem on a specified date and subsequently were assigned an ICD diagnosis for the period of spring 1993 to fall 2010. More details on the data source, population, and provincial mental disorder prevalence rates for are available [23,24].

A 16-year dataset containing 95846511 physician-assigned International Classification of Disease Version 9 (ICD-9) diagnoses and billing costs (54% female) for 768460 unique individuals (64% female) was constructed from the respective Calgary Health Zone physician billing, ambulatory and emergency/inpatient datasets. These records included billing data related to biophysical, biomedical, and mental diagnoses, including substance disorders. Diagnoses over the billing period based on ICD-9 mental disorder diagnostic codes were employed to develop three groups. Groups were formed as a function of the presence or absence of a physician-assigned substance disorder or other psychiatric diagnosis. The data formed three natural groups (Table 1): Group 1 – those without physician-assigned psychiatric disorders (No SD/MD); Group 2 - those with only physician-assigned psychiatric disorders without substance disorders (MD only); Group 3 - Those both substance disorders and psychiatric diagnoses (SD & MD). Note that mental disorder and substance disorder billing costs were not included in cost calculations, rather the presence or absence of substance and psychiatric disorders were used as criteria for grouping so that biomedical and biophysical disorder costs were aggregated by unique individual within defined groups and thus were directly comparable to the base category without the added bias of the substance or mental disorder diagnosis frequency (Table 1 and Table 2) and costs (Table 3).

Health care costs were recorded in the dataset as the total amount paid by the provincial health plan to the physician for each visit. In calculating health costs, health costs were summed across each of the groups by sex for unique individuals Table 3). For comparison descriptive statistics: unique individuals per group,

Table 1: Female diagnosis frequency by group.

Group	Diagnosis Frequency	UID	Mean	Std. Dev.
No SD/MD	10,402,496	149618	69.53	78.38
MD Only	43,595,011	235994	184.73	155.90
SD & MD	7,595,487	30714	247.30	238.42

Table 2: Male diagnosis frequency by group.

Group	Diagnosis Frequency	UID	Mean	Std. Dev.
No SD/MD	9,018,315	173264	52.05	66.9
MD Only	19,568,115	145294	134.68	143.35
SD & MD	5,667,087	33576	168.78	205.34

Table 3: Total and mean cost by group by sex.

Group	Female		Male	
	Total Cost	Mean	Total Cost	Mean
No SD/MD	$430,075,903	$2,874	$355,529,079	$2,052
MD Only	$1,888,210,390	$8,001	$870,271,830	$5,990
SD & MD	$354,246,413	$11,534	$274,826,175	$8,185

Table 4: Unique Individuals and mean frequency of ambulatory visits and inpatient/emergency admissions by group by sex.

Ambulatory Visits				
Group	Female		Male	
	UID	Mean	UID	Mean
No SD/MD	87649	94.42	102812	69.91
MD Only	197960	202.11	118605	150.7
SD & MD	26783	263.79	28354	185.84
Inpatient/Emergency Admissions				
No SD/MD	40142	115.93	31688	99.35
MD Only	121711	235.3	52888	214.62
SD & MD	18392	308.16	16109	247.06

Table 5: Substance disorder morbidity.

ICD Code - Name	Frequency	% Total
311 - Depressive disorder NOS	572471	6.61
300 - Neurotic Disorders	384527	4.44
295 - Schizophrenic Psychoses	323909	3.74
780 - General symptoms (eg, Alterations in consciousness)	260787	3.01
296 - Affective Psychoses	250395	2.89
847 - Sprains and strains of other and unspecified parts of back	208416	2.41
724 - Other and unspecified disorders of the back	201183	2.32
304 - Drug dependence	196878	2.27
309 - Adjustment reaction	172026	1.99
303 - Alcohol dependence syndrome	155870	1.8
739 - Non-allopathic lesions, not elsewhere classified	141660	1.63
789 - Other symptoms involving abdomen and pelvis	125633	1.45
401 - Essential hypertension	115600	1.33
784 - Symptoms involving head and neck	97704	1.13
786 - Symptoms involving respiratory/chest system symptoms	92752	1.07
#519 distinct ICD Other Codes each< 1%: Total	4201153	48.61
#41 distinct ICD V Codes Total	425091	4.9
Visits without Diagnoses	678909	8.4
Total Multi-Morbid Disorders for those with Substance Disorder	8604964	100

total diagnoses, diagnoses per unique individual (mean, standard deviation; Tables 1 and Table 2) and cost (mean, standard deviation; Table 3) were represented by sex for each group. A separate calculation of the frequencies, means and standard deviations of admissions by group by sex is shown for both ambulatory and inpatient admissions in Table 4.

Table 5 presents a summary of where the frequency of diagnoses associated with Group 3 (both substance and mental disorder diagnoses) exceeded the sample size.

Results

Table 1 and Table 2 show the total diagnostic frequency, unique number of individuals and the descriptive statistics, mean, and standard deviation for each sex.

For both sexes (Table 1 and Table 2) mental disorder linked diagnoses make up the majority of the total number of diagnoses. The mean diagnoses for each individual is greatest for those with both substance and mental disorders. The mean values are greater for females in all groups.

Table 3 summarizes for males and females the total and mean cost per individual (Calculated from Table 1 and Table 2).

The mean cost in Table 3 is higher for those with mental disorders alone, and highest for those with both substance and mental disorder. The mean cost for females is higher in each group.

Similarly for ambulatory and inpatient admissions for both males and females, and higher for females in Table 4, the mean visits for all disorders per individual for those with both substance and mental disorder was greatest, followed by those with only mental disorder. Both groups were more than twice greater than the group without substance or mental disorder.

Table 5 shows the frequency count and percent total of the range of distinct ICD 9 diseases and disorders where the frequency of any diagnosis exceeded the sample size and accounted for more than 1% of the total diagnoses for individuals diagnosed with any substance disorder. The most frequent specific disorders and disease are associated mental disorders and substance disorders biomedical and biophysical diseases and disorders and exceed the unique individual sample size.

Other disorders (n = 519; each < 1%) and V Codes (n = 41; 4.9%) and visits without a diagnosis (8.9%) exceeded the total percentages of distinct ICD 9 disorders and diseases, the mass of the overall hyper-morbidity appears to be associated with mental disorders and about 10% associated with distinct biomedical and biophysical disorders.

Discussion

The results were consistent with the higher levels of physical disorder and morbidity associated with the report of adverse childhood experiences and early alcohol use [25,26]. In the present study psychiatric diagnosis is a proxy representing one endpoint of life stress and early adversity. Furthermore, psychiatric diagnosis in adulthood is often viewed as a sequelae of adversity in childhood [27]. Moreover, substance abuse and dependence are often a natural consequence of adversity, such as maltreatment [28].

While only a minority were treated for any form of substance disorder (e.g., 8.4% of the sample), the majority of individuals in the comparison group with a mental disorder (49.4% of the sample) had the most diagnoses during the 16-year period. This is consistent with an earlier three-year mental disorder prevalence study of Alberta billing data [9]. Noteworthy is that the total frequency of mental disorder diagnoses represented only 9% of the total number of physician diagnoses.

The health costs associated with substance disorders were higher than the health costs of those with other psychiatric disorders and those without any mental disorders. Of patients visiting physicans, 7% report heavy drinking and approximately 42% of the studied populations reported past-year cannabis use [28-30]. Physicians do not appear to be very involved in any integrated treatment model for those with substance disorders, even though this group has the highest health costs. It is likely that stigma, denial, and patients' failure to report substance abuse or dependence, if asked by their physicians, likely play a significant role in substance disorder identification and lack of integrated care.

The implications for policy are straightforward. Organizations delivering specialized services to treat substance disorder and psychiatric disorders would benefit by integrating with the delivery of health services given the exceptional amount of funding directed towards treating the somatic complaints of these two groups. Education is required for medical and allied professionals alike regarding mental disorder and addictions assessment as this is related to assessment of health status and in order to increase the capacity to identify and treat both mental disorder and substance problems together with their associated morbidities.

There are several limitations of this study. First, mental disorder diagnoses may be less accurate for the community mental disorder comparison sample (those with a mental disorder who did not receive any tertiary care), as these diagnoses were made by physicians who have less specialized psychiatric training. Second, there was no adjustment for the severity of medical illness when comparing the health care utilization and cost among the three groups. This remains an issue to address in future study in terms of the associations between disease severity, co-morbidity, and cost. Third, the observational data used in this study do not permit identification of a causal relationship between mental disorder and health care utilization and cost. This requires examination in age and time dependent cohorts of the emergence of mental disorder and substance disorders in relation to health problems and biomedical diseases. Fourth, data only include those

individuals with billing data and it did not include those who did not seek any mental or physical health care; such individuals may be deceased, may have moved or may be healthy. As a result, the association between mental disorder and health care utilization could be slightly overestimated.

Conclusions

The cost of substance disorder and its biomedical morbidity outweighs that of mental disorder. Further, the biomedical morbidity results indicate that an integrated medical and mental health approach to the treatment of both substance and mental disorders and their morbidities is required at the most fundamental levels of health service organization.

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