Health care utilization and expenditures of persons with diabetes comorbid with anxiety disorder: a national population-based cohort study

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ABSTRACT

Objective: The aim of this study was to investigate and compare health care utilization and expenditures between persons with diabetes comorbid with and without anxiety disorder in Taiwan.
Methods: Health care utilization and expenditures among persons with diabetes with and without comorbid anxiety disorder in the period 2000–2004 were examined using the Taiwan's National Health Insurance claims data. Health care utilization included outpatient visits and use of hospital inpatient services, while expenditures included outpatient, inpatient and total medical expenditures. General estimation equation (GEE) models were used to analyze the factors associated with outpatient visits and expenditures, and multiple logistic regression analysis was applied to identify factors associated with hospitalization.
Results: In the study period, the average number of annual outpatient visits was 43.11–50.37 and 29.82–31.42 for persons with diabetes comorbid with anxiety disorder and for those without anxiety disorder, respectively. The average annual total expenditure was NT$74,875–92,781 and NT$63,764–81,667, respectively. Controlling for covariates, the GEE models revealed that age and time were associated with outpatient visits. Income and time factor were associated with total expenditure.
Conclusions: Health care utilization and expenditures for persons with diabetes with comorbid anxiety disorder are significantly higher than those without anxiety disorder. The factors associated with health care utilization and expenditures are age, income and time.

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1. Introduction

Anxiety disorders are the most prevalent psychiatric disorders, with a 12-month prevalence rate of 18.1% in the general population [1]. Anxiety disorders are associated with substantial functional impairment and high rates of comorbid psychiatric and medical disorders. If untreated, overutilization of medical services and increased health care costs may bring sizable disease burden to society and the families, themselves [2]. Diabetes mellitus is a prevalent disease that causes significant morbidity and mortality and is associated with substantial care utilization and expenditure [2–4].

Comorbid mental and physical illnesses, often categorized as "chronic illness with complexity" (CIC), is a new and emerging area of research. Multiple chronic conditions often occur at the same time regardless of causal pathways and associations [5–7]. In identifying CIC, mental illnesses that co-occur with physical illnesses are often considered discordant [5,8] because of the special challenges involved with self-management and the varying treatment regimens of both diseases.

Many studies have discussed health care utilization and expenditures as regards persons with diabetes comorbid with physical complications [9–12]. However, few have focused on mental illnesses in persons with diabetes, even though patients with diabetes are more likely to suffer from anxiety and depression than the general population

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[13–16]. Most investigations are specifically related to depression among persons with diabetes [17–22], whereas health care utilization and expenditures of persons with diabetes comorbid with anxiety disorder are seldom discussed. More importantly, to date, few or none have provided information about the time factors associated with health care utilization and expenditures in persons with diabetes. In addition, there is scant research on Asia, particularly Chinese populations, even though analyses from other cultures (e.g.,. Taiwan) are a critical component of epidemiology.

The aim of this study was to investigate health care utilization and expenditures of persons with diabetes comorbid with anxiety disorder in an actual clinical setting and to identify the associated factors.

2. Methods

2.1. National Health Insurance Program and Health Research Database

Taiwan's National Health Insurance (NHI) Program is a compulsory and single-payer system established in 1995 under the NHI Administration. Approximately 98% of all residents are enrolled. Almost all medical care providers in Taiwan, from medical centers to primary care physicians, are contracted by the NHI to provide outpatient and inpatient services. Under a fee-for-service payment system, each health care provider is required to provide monthly service claims to the NHI to claim their fees. The claims cover inpatient, ambulatory, and home care, and contain information such as patient demographics (age, sex), clinical details [disease and procedure codes based on International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)] and health care utilization and expenditure (days in hospital, drug use, and charges).

Every year, the Bureau of NHI collects data from the NHI Program and sorts it into data files, including registration files and original claims data for reimbursement. These data files are de-identified by scrambling the identification codes of both patients and medical facilities, and then sent to the National Health Research Institutes (NHRI) to form the original files of the NHI Research Database (NHIRD). This database is maintained by the NHRI and is provided to scientists in Taiwan for research purposes. The database has been widely used by both scientists and clinicians [13–15,23–25].

2.2. Sample

This retrospective study derived its study cohort from a random sample of the entire NHI-enrolled population from 2000 to 2004. The NHI 2000 study cohort was randomly selected from the total NHI population enrolled in 2000 ($n = 23,735,407$), of which 1% was selected for this study. Excluding those from the uninsured population, a sample group of 200,432 was representative of 1% of the total NHI data. There were no statistically significant differences in age, sex or average insured payroll-related amount between the sample group and all of the enrollees.

Taiwan's NHI claims data include ICD-9-CM diagnosis codes, which provides a useful structure for identifying diabetes and mental illnesses. Taiwan also uses the same billing format as Medicare. Aside from the ICD-9-CM codes, the database contains patient demographic information such as income, residential area and charges for inpatient and outpatient services. Even though the administrative claims data have some limitations on the accuracy of diagnostic coding [26,27], it has been validated and research based on its data have been published in many journals [13–15,23–25]. After selection, 5685 persons with diabetes were identified, including 732 (12.88%) with anxiety disorder.

2.3. Definitions of diabetes and anxiety disorder

Subjects with at least two service claims for diabetes (ICD-9-CM: 250) for ambulatory care or one service claim for inpatient care from 2000 to 2004 were defined as having diabetes [13,14,23,28]. They were further classified into type 1 diabetes and type 2 diabetes according to the ICD-9-CM codes 250.x1 and 250.x3, and 250.x0 and 250.x2, respectively. Study subjects with at least one service claim from 2000 to 2004 for either ambulatory or inpatient care with a principal diagnosis of anxiety disorder ICD9-CM: 300.xx were included, but patients with diagnosis of de-personalization disorder (300.6), hyperchondriasis (300.7) or somatoform disorder (300.8) were excluded [14].

2.4. Health care utilization and expenditure

Health care utilization included outpatient visits per person per year. Outpatients included those who visited physician clinics and hospital outpatient departments. Hospital admission was defined as an admission to a general or psychiatric hospital. Health care expenditure included outpatient, inpatient and total medical expenditures per person per year. Outpatient expenditure included payments for office-based provider visits and hospital outpatient visits.

The items of payment included physician fee, medication, laboratory exams and others. Inpatient expenditures included 14 items, including medication, room, procedure, imaging and others [29]. To reflect the real monetary value, the Consumer Price Index was used to adjust the mean expenditures to reflect the value of the Taiwanese currency in 2004.

2.5. Age, income, time and covariates

Demographic data included age, sex, urbanization and income, while disease characteristics included types of complication and diabetes. Age was classified into <45, 45–64 and ≥65 years. Urbanization was defined as urban, suburban and rural [13–15,23,24]. Low-income has been identified as an important risk factor for depressive and anxiety symptom in existing studies [30–33] and for diabetes [34], and it has been associated with higher utilization and medical expenditures under the single-payer NHI system. Therefore, we included income level variables to investigate the association between income level and health utilization and expenditures. Income level was classified into dependent, <US$ 666 (NT$20,000), US$ 666–1332 (NT$20,000–39,999) and ≥US$1333 (≥NT$40,000). Patients' ages were calculated using year difference between midyear (June 30 each year) and patients' birthday, and patients' income level, urbanization and diabetes complications were identified within years. Time factors included each year from 2001 to 2004. We included individual complications (neurological, peripheral vascular, cardiovascular, renal, endocrine/metabolic, ophthalmic and others) to provide information for specific clinical characteristics among persons with diabetes with and without comorbid anxiety disorders. To reduce the possibility of coding or diagnostic errors, we specifically classified patients with type 1 diabetes (ICD-9-CM diagnosis code 250.x1 and 250.x3), and patients with type 2 diabetes (ICD-9-CM diagnosis codes 250.x0 and 250.x2) and others (for those whose diagnosis codes were not clear as to which types of diabetes they had or whether they had both type 1 and type 2 diabetes).

2.6. Statistical analysis

Differences in health care utilization and expenditures per person per year among persons with diabetes comorbid with and without anxiety disorder from 2000 to 2004 were tested by χ^2 test for categorical variables and by t test for continuous variables. We primarily identified the 2000 year cohort and then continuously follow-up those patients, also controlling for time effects to analyze which factors might be associated with health utilization/health expenditures among patients with anxiety disorders. General estimation equations (GEEs) were employed to study the factors associated with outpatient visits and total medical expenditure of persons with diabetes comorbid with anxiety disorder after controlling for the covariates. Multiple logistic regression analysis