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Original Research

Prescription trends and the selection of initial oral antidiabetic agents for patients with newly diagnosed type 2 diabetes: a nationwide study

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ABSTRACT

Objectives: The aim of this study was to examine the characteristics of patients, physicians, and medical facilities, and their association with prescriptions that do not include metformin as the initial oral antidiabetic agent.

Study design: Observational, cross-sectional study.

Methods: Patients with incident type 2 diabetes between January 1, 2006, and December 31, 2010, were identified from the Taiwan National Insurance Research Database. We describe trends in the initial prescription of antidiabetic medications that do not contain metformin during the study period. A multivariable logistic model and a multilevel linear model were used in the analysis of factors at a range of levels (patient, physician, and medical facility), which may be associated with the selection of oral antidiabetic drugs.

Results: During the study period, the proportion of prescriptions that did not include metformin declined from 43.8% to 26.2%. Male patients were more likely to obtain non-metformin prescriptions (adjusted odds ratio [OR]: 1.15; 95% confidence interval [CI]: 1.08–1.23), and the likelihood that a patient would be prescribed a non-metformin prescription increased with age. Physicians aged ≥35 years and those with specialties other than endocrinology tended to prescribe non-metformin prescriptions. Metformin was less commonly prescribed in for-profit hospitals (adjusted OR: 1.34, 95% CI: 1.11–1.61) and hospitals in smaller cities (adjusted OR: 1.28, 95% CI: 1.05–1.57) and rural areas (adjusted OR: 1.83, 95% CI: 1.32–2.54).

Conclusions: Disparities continue to exist in clinical practice with regard to the treatment of diabetes. These inequalities appear to be linked to a variety of factors related to patients, physicians, and medical facilities. Further study will be required to understand the effects of continuing medical education in enhancing adherence to clinical guidelines.

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Introduction

Diabetes mellitus is a major public health issue, which affected 347 million people globally in 2008, and resulted in 1.3 million deaths in 2010.[1,2] The Pacific Rim region, including China, Japan, Australia, Korea, and Taiwan includes the largest number of individuals with diabetes, the economic burden of which was at least USD 88 billion in 2013.[3]

Developing cost-effective strategies to facilitate glycemic control in order to reduce the risk of diabetes-related complications is a matter of considerable clinical importance.[4,5] Practical guidelines for diabetic care have been developed and are constantly being updated by several organizations, including the American Diabetes Association (ADA),[6–8] the American Association of Clinical Endocrinologists (AACE)/the American College of Endocrinology (ACE),[9,10] and the National Institute of Health and Clinical Excellence.[11] These clinical guidelines list several classes of oral hypoglycemic agents deemed applicable for antidiabetic therapy. Nonetheless, these agents vary considerably with regard to cost, adverse effects, and evidence of benefits to the prevention of microvascular and macrovascular complications,[12] Based on evidence of effectiveness, safety, and cost, metformin is recommended as the first-line agent for patients with newly diagnosed type 2 diabetes and indications for oral antidiabetic monotherapy without contraindications.[6–11,13]

Adherence to clinical guidelines can be influenced by the clinical condition of the patient as well as socio-economic determinants, physician preferences, and the management structure of the medical facility.[14–19] A number of studies have reported that metformin is increasingly being prescribed as an initial antidiabetic monotherapy in accordance with updated clinical guidelines.[20,21] However, these studies did not investigate the factors that may be associated with a failure to prescribe metformin as a first-line oral antidiabetic agent, nor did they consider the clustering nature of the data from patients, physicians, and hospitals. This study sought to elucidate the reasons for the gap between existing clinical guideline and real-world practice. We examined, at the national level, the utilization of oral antidiabetic agents among patients with type 2 diabetes with the aim of identifying the factors most strongly associated with the selection of oral antidiabetic agents by clinicians.

Methods

Data source

A compulsory single-payer National Health Insurance program was launched in Taiwan in 1995, which had an enrollment rate of 98.4% in 2007. The National Health Insurance Research Database (NHIRD) is a research data set constructed by the National Health Research Institute that contains linked data from demographic and enrollment records, hospital admissions (up to a maximum of five diagnoses), and outpatient visits (up to a maximum of three diagnoses), as well as pharmacy dispensing claims from hospitals, outpatient clinics, and community pharmacies.[22] The Longitudinal Health Insurance Database 2005 (LHID 2005) comprises NHIRD data from a random sample of one million individuals in 2005 and is longitudinally linked for individuals from 1997 and annually updated.[23] The protocol of this study was approved by the National Taiwan University Hospital Research Ethics Committee.

Study population

We searched the outpatient pharmacy prescription database to identify adult patients (at least 20 years old) with type 2 diabetes who had initiated oral antidiabetic agents, including metformin, sulfonylurea, glinides, thiazolidinediones, alpha-glucosidase inhibitors, and dipeptidyl peptidase-4 inhibitors (anatomical therapeutic chemical classification system codes provided in Supplementary Table 1), between January 1, 2006, and December 31, 2010. New users were defined as free of any antidiabetic therapy in 2005. Subjects were excluded if they (1) were 100 years of age or older, (2) were not continuously covered by insurance during the 12 months leading up to the date that oral antidiabetic drugs were initiated (i.e. the index date), and (3) had been diagnosed with diabetic ketoacidosis prior to the initiation of treatment, (4) were suffering from chronic kidney disease in stage 4 or 5, as defined by the Kidney Disease Outcomes Quality Initiative 2004,[24] or (5) were missing data for gender or age.

Ascertainment of covariates

We used inpatient and outpatient diagnosis files from the 12-month period before the index date to ascertain patients' history of underlying disease. Specifically, we collected data pertaining to the duration that patients suffered from the following diseases: diabetes, ischemic heart disease, cerebrovascular and peripheral vascular disease, diabetic retinopathy, nephropathy and neuropathy, chronic kidney, liver, and lung disease, depression, hypertension, and dyslipidemia (International Classification of Diseases, Ninth Revision, Clinical Modification codes provided in Supplementary Table 2). We also determined Diabetes Complication Severity Index (DCSI) and Carlson index scores using health claims data of individual patients and collected demographic data, including patient age and sex. To account for the socio-economic status of patients, level of health insurance premiums were used as a proxy. Finally, we determined whether the patient was a healthcare professional or whether they had a family member who was a healthcare professional.

We also collected various data pertaining to physicians and medical facilities from administrative databases. Specifically, this data described characteristics of the prescribing physician, including age, sex, and specialty; the accreditation level of the medical facility (i.e. medical center, regional hospital, local hospital, or clinic); and medical facility ownership (i.e. public, for-profit, or not-for-profit). Furthermore, the city in which the medical facility was located was classified as highly urbanized, moderately urbanized, new, ordinary, aging, rural, or remote, based on statistics data provided by the Ministry of Interior, Taiwan.