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Original Research

Nationwide periodic health examinations promote early treatment of hypertension, diabetes and hyperlipidemia in adults: Experience from Taiwan

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SUMMARY

Objectives: To investigate the effectiveness of nationwide periodic health examinations in promoting early treatment of hypertension, diabetes and hyperlipidemia in adults aged ≥ 40 years.

Study design: Seven-year, retrospective, cohort study.

Methods: Based on a large and representative claims dataset in Taiwan, cohort analysis was undertaken among three disease-free cohorts for hypertension, diabetes and hyperlipidemia ($n = 26,661, 29,872$ and $30,712$ subjects, respectively) in 2000. Each cohort was observed from January 2001 to December 2007. Logistic regression, Cox proportional hazards analysis and the extended Cox model with counting process were employed in data analysis. Covariates such as age, gender, level of premium, beneficiary category, comorbidities and geographic factors were adjusted at baseline.

Results: For the hypertension, diabetes and hyperlipidemia cohorts, those who had ever used the preventive service between 1998 and 2000 had higher probabilities of being treated as new patients for these target diseases; the hazard ratios were 1.65, 1.32 and 1.57, respectively. Using the extended Cox model, associations for use of each service with treatment within a 1-year follow-up period between 2001 and 2007 were 1.68, 2.41 and 3.48.

Conclusions: In adults who were initially disease-free, those who used the preventive service had higher probabilities of early treatment of these target diseases. These findings indicate the effectiveness of nationwide periodic health examinations.

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Introduction

While current recommendations regarding preventive services are focused on disease-specific and individualized strategies, periodic health examination (PHE) remains popular in many health-related fields.¹ In general, PHE consists of several primary components, including risk assessment, laboratory testing and health counseling, and also serves as a link between the patient and the healthcare system.

In Taiwan, the Bureau of National Health Insurance (NHI) initiated the adult preventive care service in April 1996, also known as a health examination or check-up for adults. This service is free for people aged ≥ 40 years and uses a systematic approach, including taking a medical history, lifestyle review, gathering biometric information (e.g. weight, height, blood pressure, visual acuity), physical examination, laboratory tests (e.g. complete blood count; urine analysis; fasting plasma sugar; liver, renal and lipid profiles), psychological support, counseling on risky behavior, and education on morbidity. The Bureau of NHI provides reimbursement for this service every 3 years for adults aged 40–65 years and annually for those aged ≥ 65 years.

The preventive service is divided into two ambulatory visits. Biometric and laboratory data are obtained during the first visit, and during the second visit, physicians examine the subjects and provide advice, including referral to the healthcare system if necessary, based on the results of the check-up.

The 10 primary causes of death in Taiwan have changed from infectious diseases in 1952 to chronic diseases in recent years. In 2000, cerebrovascular diseases, heart disease, diabetes, nephrosis and hypertensive diseases represented 31.2% of the causes of death in Taiwan. Therefore, the preventive service was believed to address most of the major risk factors for death, not only through screening but also by contributing to disease control.

The US Preventive Services Task Force recommends screening for high blood pressure in all adults, and screening for diabetes in asymptomatic adults with sustained blood pressure greater than 135/80 mmHg. For hyperlipidemia, screening is recommended for men over 35 years of age and for those who are at increased risk of coronary heart disease. Benefits resulting from early detection and treatment of these diseases have been demonstrated.^{2–4}

Regarding the role of PHE in preventive medicine, the authors were interested not only in early detection of disease, but also in its effectiveness in promoting early intervention for manageable diseases. To assess the effectiveness of PHE, a previous systematic review developed a conceptual framework to investigate the potential goals and benefits of PHE, one of which was disease detection. However, this review only identified benefits related to delivering preventive services and decreasing patient concerns,⁵ which may have been due to the lack of large-scale and well-conducted trials.

The aim of this study was to investigate the effectiveness of nationwide PHE (adult preventive care service) in contributing to early treatment of hypertension, diabetes and hyperlipidemia among initially disease-free adults aged ≥ 40 years, using the administrative claims data from the Bureau of NHI.

Methods

Data sources

In Taiwan, the universal NHI programme was implemented in 1995, and population coverage reached 99% in 1996 for all citizens. Through the longitudinal health insurance database released by the National Health Research Institute, the authors obtained a 100,000-person cohort dataset sampled at random from the 23,753,407 beneficiaries of NHI between 1995 and 2000.

Three cohorts were established from the 100,000-person dataset, including subjects aged 40–100 years who were free of hypertension, diabetes or hyperlipidemia, respectively, in 2000. Claims data (including registration, inpatient and ambulatory care files) for 1998–2007 were retrieved for each cohort.

Definition of existing and newly treated hypertension, diabetes and hyperlipidemia

To identify patients with the target diseases at baseline (2000), based on the International Classification of Diseases, Ninth Revision, clinical modification (ICD-9-CM) codes, at least three ambulatory visits with a diagnosis of hypertension (401.xx–405.xx), diabetes (250.xx) or hyperlipidemia (272.xx) were required to avoid overdiagnosis and miscoding.

Occurrence of newly treated disease was established as the target event, and was identified through claims for ambulatory visits between 2001 and 2007. Definite diagnosis codes were required, along with corresponding prescriptions (e.g. antihypertensive, oral antidiabetic agent, insulin, lipid-lowering agent), and the length of prescription must have been longer than 7 days. Inpatient claims data were not included in baseline morbidity due to that discharge must accompany with ambulatory visit.

Use of adult preventive service and follow-up

Data for use of the preventive service were collected separately for 1998–2000 and 2001–2007. Each subject was reviewed from 1 January 2001 to the occurrence of the target event or until the data became censored (e.g. death, drop-out from NHI); the remaining subjects were followed until 31 December 2007. We used a dichotomous definition but not the frequency of use of the preventive service for two potential dilemmas, interpreting the contribution of use of each service and the phenomenon of confounding by indication.

Covariates

In Taiwan, some factors are related to utilization of the adult preventive service, including age, gender, living area, socio-economic status (SES) and morbidity status. Therefore, these factors were taken into consideration. Demographic and socio-economic information for the subjects, including age, gender, level of premium (based on individual or household monthly income: level 1, £0–468; level 2, £493–746; level 3, £785–1188) and beneficiary category (based on occupation type and employment status: category 1, civil servants and full-time or regularly paid personnel in governmental

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