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Effects of long-term high continuity of care on avoidable hospitalizations of chronic obstructive pulmonary disease patients

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ABSTRACT

Objective: To examine the effects of high continuity of care (COC) maintained for a longer time on the risk of avoidable hospitalization of patients with chronic obstructive pulmonary disease (COPD).
Methods: A retrospective cohort study design was adopted. We used a claim data regarding health care utilization under a universal health insurance in Taiwan. We selected 2199 subjects who were newly diagnosed with COPD. We considered COPD-related avoidable hospitalizations as outcome variables. The continuity of care index (COCI) was used to evaluate COC as short- and long-term COC. A logistic regression model was used to control for sex, age, low-income status, disease severity, and health status.
Results: Long-term COC had stronger effect on health outcomes than short-term COC did. After controlling for covariables, the logistic regression results of short-term COC showed that the medium COCI group had a higher risk of avoidable hospitalizations (adjusted odds ratio [AOR]: 1.89, 95% CI: 1.07–3.33) than the high COCI group did. The results of long-term COC showed that both the medium (AOR: 1.98, 95% CI: 1.0–3.94) and low (AOR: 2.03, 95% CI: 1.05–3.94) COCI groups had higher risks of avoidable hospitalizations than did the high COCI group.
Conclusions: Maintaining long-term high COC effectively reduces the risk of avoidable hospitalizations. To encourage development of long-term patient–physician relationships could improve health outcomes.

1. Introduction

Avoidable hospitalizations are defined as conditions for which timely and appropriate ambulatory care can reduce the likelihood of future hospitalization [1]. These conditions, also called ambulatory care-sensitive conditions, have been used to assess the access, quality, and performance of ambulatory care [2]. Thus far, investigators and institutions have used several methods to identify avoidable hospitalizations [3–6]. The Agency of Healthcare Research and Quality (AHRQ) [6] and Billings et al. [4] have identified chronic obstructive pulmonary disease (COPD) as an ambulatory care-sensitive condition. In 2011, COPD was the fourth leading cause of death worldwide [7]. According to World Health Organization estimates, 65 million people worldwide have moderate to severe COPD. This condition is predicted to become the third leading cause of death worldwide in 2030 [8]. Although COPD cannot be cured completely, the Global Initiative for Chronic Obstructive Lung Disease recommends that regular and continuous medication and appropriate disease management can reduce the symptoms and frequency of exacerbations as well as improve the quality of life of COPD patients [9].

Continuity of care (COC) is considered a core element of primary care. For patients with chronic diseases, a long-term physician–patient relationship can improve communication and enhance the understanding of care providers regarding the medical histories of their patients, leading to effective chronic condition management and development of a long-term disease-monitoring mechanism [10]. Studies have revealed that diabetes patients with higher COC have fewer hospitalizations [11,12], fewer emergency department (ED) visits [11,12], a lower avoidable hospitalization risk, [13] and more efficient chronic disease control [14,15]. Asthma patients with higher COC have fewer hospitalizations [12,16] and ED visits [12,16]. Similarly, COPD patients with higher COC have not only fewer hospitalizations and ED visits [12] but also lower avoidable hospitalization risk [17]. However, further investigation is required to determine whether patients with higher COC for

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a longer time obtain greater control over chronic conditions and experience improved health outcomes.

Previous studies have used two methods to examine the relationship between COC and outcomes: (1) the concurrent method, where COC and outcome are measured for the same duration [13,16,18–20], and (2) the sequence method, where COC and outcome are measured for different durations. COC is examined before outcomes [12,17,21,22] to prevent the resulting time-dependent bias [23].

Gill and Mainous [24] have reported that COC was significantly associated with ED visits in the same year but not the subsequent year. Cheng et al. [25], have suggested that higher COC is associated with fewer hospital admissions and ED visits in the same year and the subsequent year. Moreover, Cheng et al. revealed that the association between COC and outcomes of the subsequent year was moderate.

Previous studies [12,17,21,22] have adopted the sequence method to measure the outcomes for 1 year; however, the duration of COC estimation remains undetermined. Regardless of the duration of COC (1, 2, or 3 years), higher COC was associated with fewer hospital admissions in all studies.

Gill and Mainous [21], adopted avoidable hospitalizations as dependent variables and measured COC for 1 year. The results showed that COC was significantly associated with overall avoidable hospitalizations (including chronic and acute diseases) and chronic avoidable hospitalizations, but not for acute avoidable hospitalization. Lin et al. [17] measured avoidable hospitalizations and COC in COPD patients for 1 and 2 years, respectively, and reported that higher COC reduced the risk of avoidable hospitalizations. This study examined whether maintaining higher COC for a longer time had a stronger effect on the risk of avoidable hospitalization among COPD patients.

2. Materials and methods

2.1. Study design and study population

We used a retrospective cohort design. We analyzed the health care utilization data of COPD patients from January 1, 2005, to December 31, 2009. We included subjects with newly confirmed diagnosis of COPD during January 1 to December 31, 2006. All patients with either one inpatient or at least two ambulatory claims of COPD [International Classification of Diseases, Ninth Revision, Clinical Modification code (ICD-9-CM) 491, 492, or 496] in the primary or secondary diagnosis position were identified. The date of confirmed diagnosis was defined as the date of the second ambulatory claim or the date of the first inpatient claim for COPD. Eligible subjects were required to be aged 40 years or older on the date of confirmed diagnosis [26–28]. Subjects with claims records for COPD treatment before the date of confirmed diagnosis were excluded.

According to previous studies [11,12,18,21,24,29], a reliable continuity of care index (COCI) becomes more robust as the number of visits increases; hence, we excluded subjects with fewer than three physician visits in the first year after the date of confirmed diagnosis. Furthermore, to ensure that avoidable hospitalizations were traced for every subject, we excluded subjects who died during the initial 2 years after the date of confirmed diagnosis.

2.2. Data

The Taiwan government has implemented a compulsory National Health Insurance (NHI) program that covers nearly the entire population of Taiwan. The main data source of this study was the Longitudinal Health Insurance Database 2005 from National Health Research Institutes, Taiwan. The database comprises 1 million beneficiaries randomly sampled from the entire NHI enrollee population in 2005 and the beneficiaries are traced from January 1, 2005, to December 31, 2009. The data comprise comprehensive inpatient and ambulatory care records, including unique patient and physician numbers as well as patient sex, date of birth, and ICD-9-CM codes for each encounter [30]. Because this study involved analysis of secondary data, institutional review was not required.

2.3. Measures of variables

2.3.1. Independent variables

We selected the COCI score as the primary independent variable. The COCI, proposed by Bice and Boxerman [31], is less sensitive to the number of physician visits than other indexes and is therefore considered a more stable form of measurement [19,29]. In Taiwan, only a small copayment of approximately US$1.6–US$12 is required for each physician visit. Moreover, patients can see specialists in community clinics or hospitals without a referral. Hence, some patients have a considerably higher number of physician visits in Taiwan.

The COCI score, in the range of 0–1, measures dispersion in the patient–physician contact. If a patient see the same physician for all visits, the COCI score is 1, whereas if the patient see a different physician for every visit, the COCI score is 0. The general formula is as follows:

$$\text{continuity of care index (COCI)} = \frac{\sum_{i-1}^{M} n_i^2 - N}{N(N-1)}$$

where N = total number of visits; n_i = number of visits to a given physician i; i = a given physician; M = number of physicians. N and n_i included COPD-related ambulatory claims (ICD-9-CM 491, 492 or 496 in the primary or secondary diagnosis position), consisting of both community clinic or hospital physician visits and filling the chronic illness refill prescription.

After the date of confirmed diagnosis, we assessed two COC types. We used the ambulatory records of the first year to calculate the COCI score; this was defined as short-term COC. We also used the ambulatory records of the initial 2 years to calculate the COCI score; this was defined as long-term COC. Moreover, in accordance with previous studies [11,12,18,19,25,29], we categorized the COCI in three equal tertiles (low, medium, and high).

2.3.2. Dependent variables

We used the Prevention Quality Indicator 05 (version 4.2) "Chronic Obstructive Pulmonary Disease (COPD) Admission Rate" from AHRQ to define the dependent variable. The subject was defined as having a COPD-related avoidable hospitalization when one of the following criteria were met: (1) inpatient claim with diagnosis of simple chronic bronchitis (ICD-9-CM 4910), mucopurulent chronic bronchitis (ICD-9-CM 4911), obstructive chronic bronchitis without acute exacerbation (ICD-9-CM 49120), obstructive chronic bronchitis with acute exacerbation (ICD-9-CM 49121), other chronic bronchitis (ICD-9-CM 4918), unspecified chronic bronchitis (ICD-9-CM 4919), emphysematous bleb (ICD-9-CM 4920), other emphysema (ICD-9-CM 4928), bronchiectasis (ICD-9-CM 494), bronchiectasis without acute exacerbation (ICD-9-CM 4940), bronchiectasis with acute exacerbation (ICD-9-CM 4941), or chronic airway obstruction, not classified elsewhere (ICD-9-CM 496), in the primary diagnosis position and (2) inpatient claims with diagnosis of acute bronchitis (ICD-9-CM 4660) or bronchitis, not specified as acute or chronic (ICD-9-CM 490), in the primary diagnosis position and diagnosis code of COPD in secondary diagnosis position [6]. The dependent variable of this study was dichotomous and indicated whether a COPD patient had COPD-related avoidable hospitalizations.