

# Impacts of doctor-shopping behavior on diabetic patients' health

## A retrospective longitudinal study in Taiwan

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### Abstract

The aim of this study was to clarify the relationship between doctor-shopping behavior and clinical conditions, and to clearly outline the effects of both the number of clinic visits and the number of doctor changes on patients' health conditions. Data from January 1, 2000 to December 31, 2004 was collected from the National Health Insurance Research Database in Taiwan. After randomly selecting one million people, we extracted 5-year longitudinal data, about the number of clinic visits, number of doctor changes, and changes in self-health status for each patient with diabetes over the age of 18. We developed a relationship among the variables by using the generalized estimating equation. The results revealed that the number of clinic visits on the change of health status is a U curve, suggesting that health condition could be optimal with an appropriate number of clinic visits. The effect of the number of doctor changes is linearly correlated with health deterioration. The results suggest that disease conditions can only be controlled with an adequate number of clinic visits. Excessively frequent clinic visits are not only unfavorable to patients' health status but are also wasteful of limited medical resources. For diabetic mellitus patients, the more they change doctors, the worse their health status. All of these results are important for patients to stay healthy and to save medical resources.

**Abbreviation:** CCI= Charlson comorbidity index.

**Keywords:** doctor shopping, diabetes, National Health Insurance Research, database, generalized estimating equation

### 1. Introduction

Diabetes mellitus is a common chronic disease with increasing incidence. According to IDF diabetes atlas, there are expected 451 million people suffering from this disease worldwide in 2017.<sup>[1]</sup> It can result in micro-vascular and macro-vascular complications, causing multiple organ dysfunction. It also poses a huge impact on patients and society worldwide nowadays. In a retrospective study in Taiwan, the event cost of amputation was 7.0 times as much as that of patients without this complication, followed by fatal myocardial infarction (4.1 times), non-fatal

myocardial infarction (4.0 times), fatal stroke (3.5 times), and non-fatal stroke (3.4 times).<sup>[2]</sup>

Consequently, much attention has been paid to diabetes-related issues, especially from the medical care seeking behavior point of view. Doctor shopping behavior, one among the many heated issues, refers to the phenomenon of patients' excessive frequency of clinic visits or doctor change. Frequent clinic visits for the same illness episode has the potential to increase iatrogenic illnesses that causes mis-diagnosis and a delay management of clinical conditions.<sup>[3]</sup> Similarly, a frequent

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The authors have no conflicts of interest to disclose.

The data that support the findings of this study are available from a third party, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. Data are available from the authors upon reasonable request and with permission of the third party.

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change of doctors, though a right of patients for seeking a second opinion and best quality of health care to fulfill with their needs, can also impair medical continuity and may add excess costs of health care system.<sup>[3]</sup> However, the appropriate number of times a diabetic patient should see a doctor and the appropriate number of different doctors a patient should see still remain unanswered in the literature.

Many scholars have investigated issues concerning doctor shopping behavior. Some studies have shown that more-frequent medical care-seeking behavior has been observed in patients suffering from chronic diseases.<sup>[4–6]</sup> Furthermore, Agrawal et al<sup>[3]</sup> recommended that diabetic patients may have a wide range of health-care seeking behavior, such as irregular follow-up, seeking multiple physicians for treatment, and alternating with indigenous medicines and traditional systems. They also supposed the prevalence of doctor shopping behavior is 14% in urban Puducherry. Thus, doctor-shopping behavior is an important issue for diabetes patients.

However, doctor shopping behavior-related studies have seldom focused on the effects of the number of clinic visits or number of doctor changes on health status. In addition, due to the difficulty of data collection, there have been few studies that have performed a longitudinal study on the impact of doctor shopping on the patients' health status in different hospitals. In this study, we focused on the patients' doctor shopping behavior by exploring it from 2 perspectives: number of clinic visits and number of doctor changes. Furthermore, since the data collection of excessive clinic visits and number of doctor changes must span multiple time frames, logically it is difficult to collect an appropriate longitudinal data set. Therefore, this study aims to use Taiwan's National Health Insurance Research Database to explore the relationship among the variables to derive statistically defensible conclusions. The empirical results are of importance for patients with diabetes mellitus in understanding the optimal number of clinic visits and the appropriate number of doctor changes per year. The results can also provide solid evidence to government or relevant educational institutions to inform relevant regulations and aid the development of educational promotion for diabetes mellitus patients about how to effectively utilize medical resources.

## 2. Methods

### 2.1. Sample Selection

We collected longitudinal data from January 1, 2000 to December 31, 2004 from the National Health Insurance Research Database. From this data, data from one million people were randomly selected. Patients over the age of 18 who had diabetes were filtered as the research subjects. For each patient, all of the daily records for each clinic visit were summarized into 1 record for each year (each patient had 5 records within the study interval from 2000 to 2004). Since some fields of the daily record could be blank, the summarized yearly data could not be performed, resulting in missing information. After deleting data with missing information, a total of 13,204 patients with 66,020 records were included.

This study was conducted with the approval of the Institutional Review Board of the Buddhist Taichung Tzu Chi General Hospital, Taiwan (RC103-43). Due to the omission of an identification number, the personal information of the patients contained in the data sets collected from the secondary files of the

Taiwan National Health Insurance Research Database were safe from any unwanted disclosure. Written consent from patients was not required by the review board.

### 2.2. Doctor shopping behavior

Doctor shopping behavior is defined by some scholars as a phenomenon where patients seek medical services from other doctors without the original doctor's referral during the course of a disease.<sup>[7–10]</sup> Some other scholars define it as a phenomenon when patients seek medical treatments from multiple doctors only to get prescription drugs.<sup>[11–13]</sup> Demers<sup>[14]</sup> defines it as a phenomenon in which the number of clinic visits of patients is greater than that of 95% of the population. In our study, we define it according to Demers' definition and include the variable of doctor change to investigate impacts on health care.

### 2.3. Health status for diabetes patients

Charlson et al<sup>[15]</sup> developed the Charlson comorbidity index (CCI) to identify the relationship between comorbidities and death within 1 year by survival analysis after controlling for factors such as the main causes of patients' hospital admission and disease severity. The CCI is based on the summations that integrate weighted clinical conditions according to severe morbidity. In this paper, the CCI is used to measure the comorbidity summary due to its widespread use.

### 2.4. Tools of analysis

A general linear model is not suitable due to limitations of the model fitting, the dependent variables must be continuous when the situation to be analyzed is a categorical issue (eg, whether a company closes down or not; whether a patient passes away or not). However, Liang and Zeger<sup>[16]</sup> have proposed using generalized estimating equations to solve the issue of inaccurate standard deviation. Since the data collected in this paper is longitudinal with repeated measures for each patient, it is appropriate to use the generalized estimating equations to do the model fitting.

### 2.5. Model development

The model developed in this study mainly aims to investigate the effects of the number of clinic visits and number of doctor changes on health status. The independent variables are patients' number of clinic visits and number of doctor changes. The dependent variable, health status, is measured by the difference of comorbidity between 2 years, and the larger the delta comorbidity, the worse the health state:

$$\begin{aligned} \text{health}(t) &= \text{delta comorbidity}(t) \\ &= \text{comorbidity}(t) - \text{comorbidity}(t - 1) \end{aligned} \quad (1)$$

Because diabetes cannot be cured and can only be controlled without progression at most, the value of the comorbidity index subtraction only remains the same or increases, that is,

$$\text{delta comorbidity}(t) \geq 0 \quad (2)$$

In addition, in order to avoid the estimation bias due to the omission of important variables, the other relevant variables, the patients' age, gender, socioeconomic status, place of residence,

<b>Table 1</b>		
<b>Basic statistics of the sample.</b>		
<b>Variables</b>	<b>No. of patients</b>	<b>Percentage/average</b>
Male	6429	48.69%
Female	6775	51.31%
Age		62.13 (standard deviation 11.13)
Social economic status		
High	2588	19.60%
Low	10,616	80.40%
Residential area		
Northern Taiwan	5696	43.14%
Center Taiwan	2346	17.76%
Southern Taiwan	4756	36.02%
Eastern Taiwan	406	3.07%
Catastrophic illness	542	4.41%
Hospital Grade		
Grassroots clinic	4226	32.01%
District hospital	2437	18.46%
Regional hospital	3289	24.91%
Medical center	3252	24.63%
Urbanization (cities/township)		
High	3969	30.06%
Moderate	4961	37.57%
Emerging cities/townships	1264	9.57%
General cities/townships	1819	13.77%
Aging cities/townships	303	2.29%
Agricultural cities/townships	438	3.32%
Remote cities/townships	450	3.41%
CCI change	13,204	0.45 (standard deviation 0.94)

CCI=Charlson comorbidity index, No.=number.

existence of catastrophic illness, level of hospital, and level of urbanization of the area where the hospital is, are kept as the controlled variables.

Socioeconomic status is defined as high if a patient pays more than 120,000 New Taiwan Dollars yearly for his/her insurance,

otherwise it is defined as low. Hospitals are categorized into 4 classes according to its scale and tasks, medical center, regional hospital, district hospital, and grassroots clinic. Medical centers are hospitals with the most complete set of equipment and enough staff. Researches, teaching, and critically ill patients' treatment are their main tasks. Usually a patient goes to the nearby clinic seeking medical treatment first. After the doctor's professional treatment, if needed, then the patient is referred to other specialist clinics or hospitals for care. After referral treatment, the patient should be recommended by the physician to return to the original hospital or other appropriate hospital for follow-up treatment.

The level of urbanization is categorized into 7 classes according to the population density, High, Moderate, Emerging cities/township, General cities/township, Aging cities/township, Agricultural cities/township, and Remote cities/township.

### 3. Results

#### 3.1. Characteristics of sample data

The descriptive statistics of the sample data are shown in Table 1.

The average number of clinic visits per year was approximately 13 visits with a standard deviation of approximately 6 times. Figure 1 shows the distribution of the number of clinic visits. Figure 2 shows the distribution of number of doctor changes with mean equal to 1.47 and standard deviation equal to 1.62. In other words, the higher the number of doctor changes, the fewer the number of patients. The mean number, 1.47, shows most of the patients still would not concurrently seek diagnosis and treatment from different doctors.

#### 3.2. Empirical results

The empirical results of the effect of the number of clinic visits on the change in the comorbidity index are shown in Table 2. The

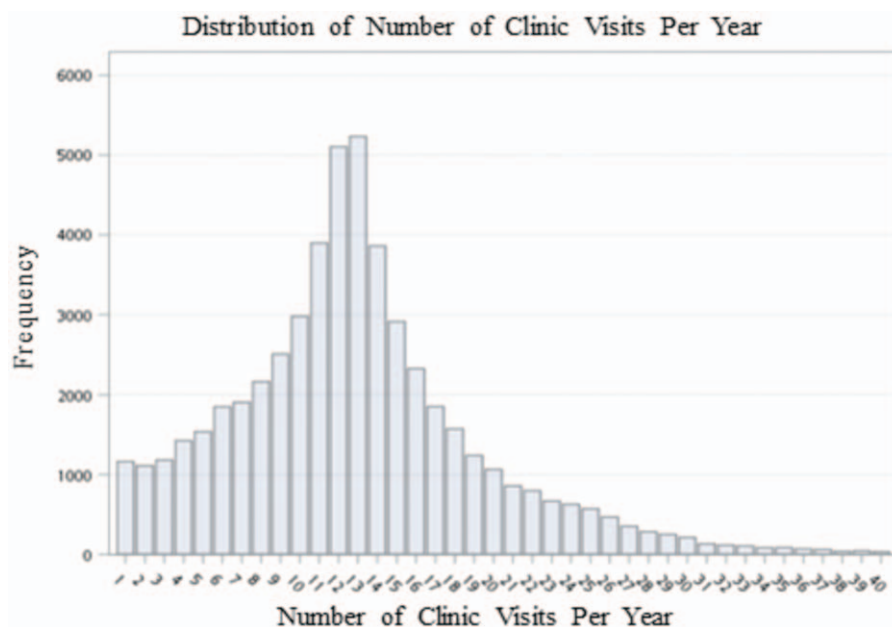
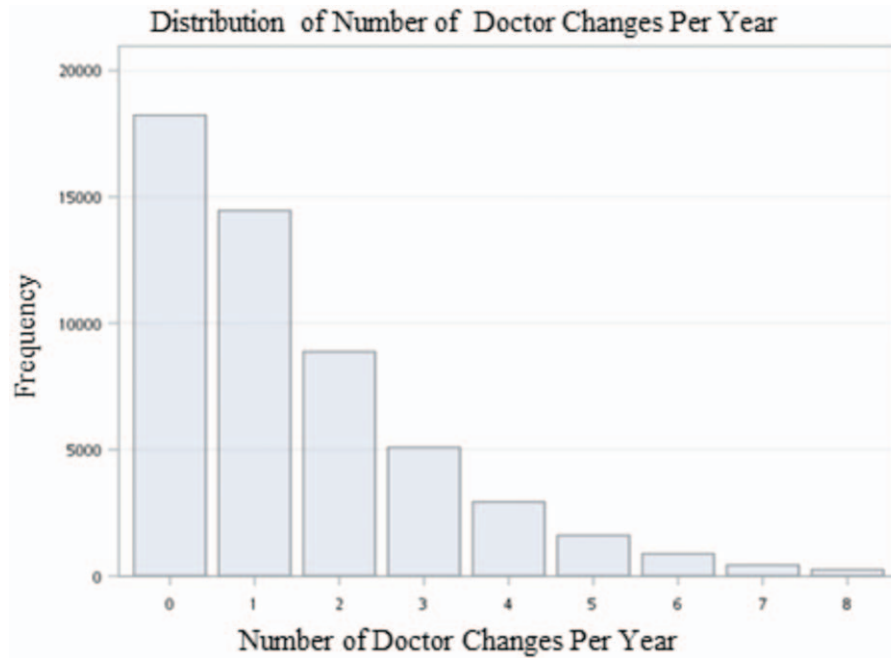


Figure 1. Distribution of number of clinic visits per year. The range is from once per year to 42 times per year and the peak is at 13 and 14 times per year.



**Figure 2.** Distribution of number of doctor changes per year. The range is from 0 to 8 times per year, and the peak is at 0 times per year. It is a monotonically decreasing distribution.

**Table 2**  
Analysis results of the effects of number of clinic visits on changes in comorbidity index.

Variables	Coefficient
Intercept	-0.0981 <sup>‡</sup>
Square of number of clinic visits	0.0006 <sup>‡</sup>
Number of clinic visits	0.0089 <sup>‡</sup>
Age	0.0030 <sup>‡</sup>
Gender	
Female	Reference group
Male	0.0183 <sup>*</sup>
Socioeconomic status	
Low	Reference group
High	-0.0632 <sup>‡</sup>
Catastrophic illness	
No	Reference group
Yes	0.1303 <sup>‡</sup>
Level of hospital	
Grassroots clinic	Reference group
District hospital	0.2058 <sup>‡</sup>
Regional hospital	0.1536 <sup>‡</sup>
Medical center	0.0222
Level of urbanization	
High	Reference group
Moderate	0.0442 <sup>‡</sup>
Emerging cities/townships	0.0823 <sup>‡</sup>
General cities/townships	0.0649 <sup>‡</sup>
Aging cities/townships	0.0342
Agricultural cities/townships	0.0385
Remote cities/townships	0.0554 <sup>*</sup>
Place of residence	
Northern Taiwan	Reference group
Central Taiwan	-0.0169
Southern Taiwan	0.0170
Eastern Taiwan	0.0350

<sup>\*</sup>  $P < .05$   
<sup>‡</sup>  $P < .001$ . (1-tailed tests).

effect of number of clinic visits on the change in the comorbidity index was a quadratic function that opened upwards, suggesting that the disease condition could be controlled with an adequate number of clinic visits. The optimal number of the medical visits was 7.42 ( $0.0089 / (-2 * 0.0006)$ ) yearly, and excessively small or large numbers of visits would lead to health status deterioration. The CCI index can increase at the rate of 0.003 as the age increases 1 year. The health status deterioration in male patients was 0.0183 higher than that in female patients. The health status deterioration in patients with high socioeconomic status was 0.0632 lower than that in those with low socioeconomic status. The health status deterioration in patients with a catastrophic illness was 0.1303 higher than that of those without it. Compared to grassroots, the health status deterioration of patients visiting district hospitals and regional hospitals were 0.2058 and 0.1536 worse, respectively. However, the average health status deterioration of patients in medical centers is as well as that of patients in grassroots clinics. These results indicate that the upper class hospitals do not promise better results in terms of health status. The health status deterioration of patients attending clinic visits in moderate urbanization, emerging cities/townships, general cities/townships, and remote cities/townships are all worse than that of patients attending clinic visits in areas of high urbanization. However, the health status deterioration of patients attending clinic visits in aging and agricultural cities/townships is as well as that of patients in high urbanization hospitals. It does not show a linear relationship between urbanization level of hospital location and health status deterioration. In other words, in terms of the health status maintenance, going to hospitals within a high urbanization area does not promise a better result.

The effects of doctor changes on the change in the comorbidity index are shown in Table 3. The impacts of these independent variables are similar to the results of the relationship between number of clinic visits and health status change except for 2

**Table 3****Analysis results of the effects of number of doctor changes on changes in comorbidity index.**

Variables		Coefficient
Intercept		-0.0878 <sup>‡</sup>
Square of number of doctor changes		0.0013
Number of doctor changes		0.1855 <sup>‡</sup>
Age		0.0032 <sup>‡</sup>
Gender	Female	Reference group
	Male	0.0179 <sup>*</sup>
Socioeconomic status	Low	Reference group
	High	-0.0438 <sup>‡</sup>
Catastrophic illness	No	Reference group
	Yes	0.1289 <sup>‡</sup>
Level of hospital	Grassroots clinic	Reference group
	District hospital	0.1021 <sup>‡</sup>
	Regional hospital	0.0975 <sup>‡</sup>
	Medical center	-0.0207
Level of urbanization	High	Reference group
	Moderate	0.0110
	Emerging cities/townships	0.0466 <sup>‡</sup>
	General cities/townships	0.0233
	Aging cities/townships	0.0102
	Agricultural cities/townships	0.0256
	Remote cities/townships	0.0378
Place of residence	Northern Taiwan	Reference group
	Central Taiwan	-0.0083
	Southern Taiwan	-0.0011
	Eastern Taiwan	-0.0139

\*  $P < .05$ .‡  $P < .001$ . (1-tailed tests).

variables that are different, square of the number of doctor change and the level of urbanization.

#### 4. Discussion

Diabetic patients with repeated visits to the clinic and constant doctor changes are common in Taiwan due to its specific medical environment. However, the impact of the number of clinic visits and the number of doctor changes on the patient's health has been discussed little before. Considering the disadvantages associated with questionnaires, such as fewer data points, restricted sample location, and memory oriented information, we downloaded a longitudinal data set from the National Health Insurance Research Database for our investigation. This data base includes patients with diabetes, and has repeatedly measured data for 5 years. Using this data, we were able to obtain answers by using the generalized estimating equations model, which is statistically reliable.

The empirical results show that the impacts on health status deterioration are significantly positive for binary variables such as age, gender, socioeconomic status, and catastrophic illness. They show that the health status of older patients is deteriorating more quickly than that of younger patients. The health status of male patients is deteriorating more quickly than that of female patients. The health status of patients with a low socioeconomic

status are deteriorating more quickly than that of those with a high socioeconomic status. In addition, health status deterioration is not the same for patients who visited different categories of hospitals, or for those who visited hospitals in areas with different urbanization levels.

The empirical results suggest that health condition can be controlled with an adequate number of clinic visits. However, excessively small or large numbers of clinic visits were not beneficial to health status, which might be associated with the fact that this study's subjects were exclusively patients with diabetes. The empirical research results of Polly<sup>[17]</sup> show that it is difficult to control the disease condition of diabetes, and that patients need to develop adequate medical behaviors. Therefore, if patients attend clinics periodically, and the number of clinic visits is properly controlled, their health status deterioration may be delayed. However, an excessively high or low number of clinic visits may cause health status deterioration due to overdoses or other reasons,<sup>[18]</sup> resulting in the phenomenon where the disease condition of patients keeps getting worse.

Moreover, the effects of the number of doctor changes on health status deterioration had a positive linear relationship, indicating that the disease condition of patients seeking medical services from more doctors would be poorer. This result was different from that in a past study, which found that "with an adequate number of doctor changes, patients seeking medical services from other doctors for confirmation of diagnosis and then choosing adequate treatments may be beneficial to their health status."<sup>[19]</sup> The reason may be that the treatment procedures and disease control of patients with diabetes usually requires long-term follow-up and further adjustments. Therefore, compared with doctors who have taken care of patients for a long period of time, new doctors from whom patients separately seek medical services may not necessarily administer adequate treatments according to the patient's health status and living habits. As a result, the disease condition of patients will get worse.

There are several limitations in the study. First, this study excludes patients with missing values from the research samples, which might have led to a loss of information. Subsequent studies may process missing values more adequately according to the research themes and sample characteristics. Second, if patients canceled their national health insurance or passed away before 2004, the database could not reflect such information. Third, in terms of the processing number of doctor changes, this study used the number of new doctors seen by a patient in the current year compared to that in the previous year. Subsequent studies may try different calculation methods to further verify the results obtained here. Finally, the time interval of this data set is from 2000 to 2004, so the conclusions derived from this study only directly apply to the medical environment of that time. In the future, studies can investigate the same relationship with a longer time interval or different time frame.

#### 5. Conclusions

This study shows that disease conditions are significantly affected by the number of clinic visits. Excessively frequent clinic visits and doctor changes are not only unfavorable to patients' health status but also wasteful of scarce medical resources. The results of this study could be provided to diabetic patients, the government, or relevant organizations for educational promotion in order to provide a foundation of knowledge about the optimal number of clinic visits and the appropriate number of doctor changes for

patients with diabetes, which can inform individual practice, health care policies, and education programs for patients.

### Author contributions

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**Writing – original draft:** Ruei-Yuan Chang, Wei-Chih Liao.

**Writing – review & editing:** Chin-Shien Lin, Ruei-Yuan Chang.

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