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The Relationship Between Type 2 Diabetic Patients' Early Medical Care–Seeking Consistency to the Same Clinician and Health Care System and Their Clinical Outcomes

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Abstract: The literature has demonstrated that the continuity of diabetes care can lower medical service utilization and expenses. However, few studies have examined the effects of patients' medical care–seeking behaviors in the early stage after the diagnosis of diabetes on their long-term prognoses.

This study aimed to examine the association of medical care–seeking behavior in the first year following diabetes diagnosis on the occurrence of diabetes-related complications among patients in Taiwan. This is a retrospective data collection with follow-up analysis and a nationwide population-based dataset in Taiwan. A total of 89,428 newly diagnosed type 2 diabetes mellitus patients during the period from 2000 to 2006 were followed up until 2010. The patients' medical care–seeking behaviors were classified as follows: high consistency to a physician, high consistency to a medical setting, medium consistency to providers, and low consistency to providers. The occurrence of diabetes-related complications and all-cause mortality were the primary outcomes of this study. Chi-square tests, ANOVAs, and Cox proportional hazard models were applied to examine the relationships between the predictors and medical outcomes.

Compared to the patients with high medical care–seeking consistency to a physician, the multivariate-adjusted hazard ratios of diabetes-related complications occurrence among patients in the high consistency to a medical setting, medium consistency, and low consistency categories were 1.112 (95% CI 1.089–1.136, $P < 0.001$), 1.226 (95% CI 1.205–1.248, $P < 0.001$), and 1.536 (95% CI 1.504–1.567, $P < 0.001$) in outpatient visits and 1.032 (95% CI 0.992–1.074, $P = 0.121$), 1.056 (95% CI 1.022–1.092, $P = 0.001$), and 1.208 (95% CI 1.164–1.254, $P < 0.001$) in complication-incurred hospitalizations, respectively. The monotonic trend was sustained across different strata of age, gender, and disease complexity.

The findings of this study suggest that the incentives of continuity of care and physician–patient relationship management should be reinforced during the early stage of diabetes care in future medical care systems.

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Abbreviations: CVD = cardiovascular disease, DM = diabetes mellitus, HR = hazard ratios, NHI = National Health Insurance, P4P = pay for performance.

INTRODUCTION

Epidemiologic studies have demonstrated an increasing trend in the worldwide incidence of type 2 diabetes mellitus (DM). According to the statistics of the International Diabetes Federation, the incidence of diabetes increased from 4.6% in 2000 to 8.3% in 2013.[1,2] Type 2 DM accounts for 90% to 95% of all diabetes.[3] The numbers of type 2 DM patients are increasing in every country, and the disease causes a significant financial burden on global health care. Based on the literature, the average life-time cost of caring for a type 2 DM patient is approximately $85,200 and ranges from $55,000 to $130,000 depending on the demographic at diagnosis.[4] Specifically, heavy disease burdens occur when diabetes patients develop complications and require hospitalized care. Currently, many efforts are being made to defer the occurrence of complications.

There is general agreement that integrated continuity of care is beneficial to patient prognoses via reduction in hospitalizations, the occurrence of complications, and mortality.[5–7] Remaining with a particular physician or a specific medical setting is deemed to be a demonstration of patient consistency.[8] In contrast, some patients wander between different health care providers without professional referrals (a practice known as doctor shopping) along with the progression of their episodes.[9,10] The majority of type 2 DM patients suffer from disease complications that include cardiovascular disease (CVD), renal dysfunction, cancers, ophthalmic complications, peripheral neuropathies, and peripheral vascular diseases.[4,11,12] These complications can cause significant consequences such as hospitalizations, death, and elevated medical expenses.[4,13–15] Continuous and regular outpatient visits enhance health education and the monitoring of disease progression, and these factors are effective in deferring complications and maintaining a high quality of care.[16]

The literature has demonstrated that continuity of care can reduce overall emergency department visits, hospitalizations, inappropriate medication events, and medical costs.[16–19]

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However, few studies have examined the long-term effects of patients' medical care–seeking behaviors in the early stage following their diabetes diagnoses on the subsequent prognoses. For patients with newly diagnosed type 2 diabetes, earlier treatments with sulfonylurea, insulin, or metformin are associated with decreased risks of all-cause mortality, diabetes-related death, and diabetes-related complications, such as microvascular disease, myocardial infarction, heart failure, stroke, renal failure, and blindness.[20–22] Early intensive glucose control might affect biopathways, including those of the circulation, metabolism, and cell functionality, and prevent early physiological deteriorations that predispose patients to the occurrence of diabetes-related complications.[23,24] Accordingly, this study assumes that medical care–seeking behavior in the early stage of diabetes care is a predictor of long-term prognoses. The patients' consistency to a specific health care provider is deemed to be a demonstration of faithful medical care–seeking behaviors that benefit the early intensive control of diabetes. This study adds value to the currently available research in diabetes care by demonstrating the importance of early diabetes care behaviors to long-term prognoses with hard evidence from population-based inference findings. Therefore, this study aimed to examine the association between medical care–seeking behavior in the first year following diagnosis and the occurrence of diabetes-related complications in terms of outpatient and inpatient diagnoses.

METHODS

Data Source and Study Population

This is a retrospective data collection with follow-up analysis based on a nationwide health insurance claim database, which eliminated the potential of selection bias. The incidence of DM cases was abstracted from the national health insurance claim data from 2000 to 2006. All of the study subjects were followed up until December 31, 2010. Among 104,854 newly diagnosed type 2 DM cases abstracted from NHI database during 2000 to 2006, those who with principal diagnosis as ICD code 250.0x were included in the study. A final total of 89,428 newly diagnosed type 2 DM patients without DM associated complications or catastrophic diseases were eligible and were analyzed in this study (Appendix 1, http://links.lww.com/MD/A209).

Study Variables

Independent Variables

The study variables were classified into 3 dimensions that included patient characteristics, patient medical care–seeking behavior, and provider characteristics. The patient characteristics included age, gender, the date of the initial DM diagnosis, and the number of secondary diagnoses. The secondary diagnoses were classified into 3 categories with 0, 1, or $\geq$2 secondary diagnoses. In this study, the consistency of a patient to a provider was defined based on that patient's medical care–seeking behavior in the first year following the diabetes diagnosis. The patients were classified into the following 4 categories according to their medical care–seeking behavior: high consistency to a physician (100%), high consistency to a medical setting (100%), low consistency to both the physician and the medical setting ($<$70%), and medium consistency (other than high or low consistency). In this study, high consistency was defined as 100% of a patient's outpatient visits being to a specific provider during the first year following the DM diagnosis. The high medical care–seeking consistency to a provider was further classified into 2 groups including ''medical care–seeking consistency to a specific physician'' and ''medical care–seeking consistency to a specific medical setting.'' Those who always seek medical care to a specific physician regardless of whether the physician was in the same medical setting were grouped as ''high medical care–seeking consistency to a physician.'' Whoever seek medical assistance to at least 2 different physicians but always in the same medical setting were classified as ''high medical care–seeking consistency to a medical setting.'' Low consistency was defined by less than 70% of a patient's outpatient visits being to a specific provider in the first year following the DM diagnosis. The medium consistency group consisted of patients who were classified into neither high consistency nor low consistency group. With respect to provider variables, the physician characteristics included age, gender, and years of practice after receiving a specialty license. The medical setting is the institute provided care to the study patient who was collected from insurance claim data encoded each patient's medical visit or hospitalization during the study period. The characteristics of the medical setting included accreditation level, and location. The accreditation level of a medical setting includes medical center, regional hospital, district hospital, and primary care clinic. The locations of a medical setting include Taipei region, northern region, central region, southern region, Kao-Ping region, and eastern region in Taiwan. The primary department for outpatient visits was defined as the department that was most frequently used for outpatient visits during the first year following the DM diagnosis; these primary departments included metabolism and endocrine, family medicine, general internal medicine, and other departments.

Outcome Variables

The prognoses of the DM patients included the occurrence of complications upon outpatient visits, hospitalizations due to diabetes-related complications, and all-cause death. The diabetes-related complications included CVD (ICD-9-CM: 410–414, 428, 430–438), peripheral vascular diseases (ICD-9-CM: 250.7, 440, 443, 444, 447, 448, 451, 453, 454, 459.8, 459.9, 707, 785, 885–887, 891–897), renal diseases (ICD-9-CM: 250.4, 580–587, 590, 791.0), neural diseases (ICD-9-CM: 250.6, 337, 354, 355, 357.2, 358.1, 713.5, 729.2), cancers (ICD-9-CM:140–165, 170–176, 179–208), ophthalmic complications (ICD-9-CM: 250.5, 362, 364–366, 368, 369, 377), and other complications (ICD-9-CM: 681, 682, 250.8, 250.9).

Statistical Analysis

Numerical variables are displayed as the means $\pm$ the standard deviations, and categorical variables are displayed as frequencies and percentages. Univariate analyses included ANOVAs and χ^2 tests where appropriate. A Cox proportional hazard regression model was used to determine the multivariate-adjusted strength of the association of medical care–seeking behavior with the incidences of complications in both outpatient and inpatient departments and all-cause death. The results were expressed as multivariate-adjusted hazard ratios (HR) that were adjusted for patient characteristics and provider characteristics. Stratified analyses were performed to determine the sensitivities of the associations of medical care–seeking behaviors with the incidences of complications according to different patient and outpatient visit department characteristics. The SPSS 19.0 (IBM

Corporation, Amonk, NY) statistical software was used for all analyses. This study was approved and monitored by the Institutional Review Board of Chang Gung Medical Foundation (102–1130B).

RESULTS

The mean age of the 89,428 study subjects was 53.7 years, and the range was 31 to 99 years. There were more men (57.6%) than women (42.4%). The patients' secondary diagnoses were classified into 3 categories with 0, 1, or ≥ 2 secondary diagnoses; these groups composed 50.6%, 28.8%, and 20.6%, respectively, of the study population at the time of DM diagnosis. On average, 89.3%, 26.0%, and 7.2% of the total study population attended outpatient visits due to complications, hospitalizations due to complications, and all-cause death during the study follow-up, respectively. A dose-response relationship was found between the percentages of outpatient visits due to complications ($P < 0.001$), hospitalization due to complications ($P < 0.001$), and death ($P < 0.001$) and the high consistency, medium consistency, and low consistency groups. Approximately, 61.5% of the patients chose district hospitals or primary clinics as the sites of their primary outpatient visits during the first year following the diagnosis. Approximately 30.4% of the patients sought medical assistance in metabolism and endocrine departments followed by general internal medicine (24.4%), family medicine (24.0%), and other departments (21.2%). The average physician age and years of practice with a specialty license were 44.75 and 9.34, respectively. The majority of the physicians were men (88.1%). All of the variables in Table 1 were significantly different across the 4 medical care–seeking behavior groups (Table 1).

On average 85.56 follow-up months or 7.13 years of follow-up were completed in this study. The overall incidence densities of complications diagnosed during outpatient visits and complication incurred hospitalization during the follow-up period were 0.423 per year (0.383 per year among men and 0.489 per year among women; $P < 0.001$) and 0.041 per year (0.043 per year among men and 0.039 per year among women; $P < 0.001$), respectively. Medical care–seeking behaviors from the high consistency to the low consistency groups exhibited a dose-response relationship with the occurrence of complications ($P < 0.001$, test for monotonic trend). Compared to the patients with high medical care–seeking consistency to a physician, the multivariate-adjusted HR of diabetes-related complications occurrence among patients in the high consistency to a medical setting, medium consistency, and low consistency categories were 1.112 (95% CI 1.089–1.136, $P < 0.001$), 1.226 (95% CI 1.205–1.248, $P < 0.001$), and 1.536 (95% CI 1.504–1.567, $P < 0.001$) in outpatient visits and 1.032 (95% CI 0.992–1.074, $P = 0.121$), 1.056 (95% CI 1.022–1.092, $P = 0.001$), and 1.208 (95% CI 1.164–1.254, $P < 0.001$) in complication-incurred hospitalizations, respectively. Significant and positive dose-response relationships of age (HR 1.031, 95% CI 1.026–1.036, $P < 0.001$; HR 1.111, 95% CI 1.100–1.121, $P < 0.001$) or the number of secondary diagnoses (HR 1.063, 95% CI 1.054–1.073, $P < 0.001$; HR 1.083, 95% CI 1.065–1.101, $P < 0.001$) with the occurrence of complications diagnosed both outpatient visits and upon hospitalization were found, respectively. The metabolism and endocrine department (HR 1.120, 95% CI 1.088–1.153, $P < 0.001$) and other departments exhibited the greatest likelihoods of diagnosing patients with diabetes-related complications during outpatient visits and during hospitalization, respectively (Table 2).

Stratified analyses revealed a significantly elevated risk of developing outpatient complications among the low consistency to a provider group regardless of gender, age group, number of secondary diagnoses, or department of the outpatient visit (Table 3). All strata exhibited dose-response relationships between medical care–seeking behavior (from high consistency to low consistency) and the occurrence of outpatient complications (Table 3). The greatest likelihood of developing complication incurred hospitalization was also found among the patients with low consistency to a provider across all strata regardless of gender, age group, number of secondary diagnoses, and department of the outpatient visit (Table 4). Figure 1 illustrates the all-cause mortality survival curves during the study period for the 4 medical care–seeking behavior groups following adjustments for all of the other study variables. A monotonic trend was observed between decreasing consistency in medical care–seeking behavior (from high consistency to low consistency) and decreasing multivariate-adjusted survival ($P < 0.001$, test for monotonic trend) (Figure 1).

DISCUSSION

This national cohort analysis revealed that low consistency medical care–seeking behavior during the first year following type 2 DM diagnosis was associated with increases in the subsequent risks of diabetes-related complications and all-cause mortality. Our findings further evidence the associations between medical care–seeking behavior and the occurrence of complications in each stratum of patient's characteristics.

This study enriches diabetes care research from the perspective of patients' medical care–seeking behaviors. Previous studies have demonstrated that various types of interventions, such as health education, nutritional modification, and exercises, are associated with DM prognoses.[25–28] To date, only a few studies have reported on the long-term effects of medical care–seeking behaviors during the initial stage following disease diagnosis.[19,29] These studies have focused on examining the effects of pay-for-performance (P4P) programs on patient medical utilization and expenses. Diabetes patients who join P4P intervention programs spend more in the first year due to receiving greater numbers of diabetes-specific tests and exams, but these patients spend less on hospitalization costs in the subsequent years.[29,30] Our study further revealed that faithful medical care–seeking behavior during the early stages was a significant predictor of prognoses among a type 2 DM population.

In 1995, Taiwan implemented a compulsory National Health Insurance (NHI) program, and over 99% of the 23 million Taiwanese are currently enrolled in the NHI program. Under the NHI program, patients are unrestrained in their choice of health care providers. If patients are unsatisfied with their present disease conditions, they can consult other experts without referrals from physicians. Additionally, low copayment scheme of the NHI program encourages patients to utilize medical resources that include, on the one hand, use of continual medications and, on the other hand, doctor shopping. In 2009, the average number of annual physician visits per person in Taiwan was as high as 15, and this value was among the highest in the world.[18] Frequent doctor switching implies fragmentation of medication and increases the possibility of interruptions in intense disease monitoring and self-care skill cultivation. Despite the easy access to diverse medical resources, our cohort data revealed that a high proportion of type 2 DM patients

TABLE 1. Patient and Provider Characteristics According to the 4 Medical Care–Seeking Behavior Groups

Medical Care–Seeking Behavior	Mean ± SD or Frequency (%)					
Variables	Total (n = 89,428)	High Consistency to a Physician (n = 43,097)	High Consistency to a Medical Setting (n = 12,698)	Medium Consistency (n = 20,499)	Low Consistency to Both Physician and Medical Setting (n = 13,134)	*P* Value
Patient						
Age	53.70 ± 11.11	53.85 ± 11.06	53.35 ± 11.17	53.65 ± 11.14	53.65 ± 11.17	<0.001
≦40	10255 (11.5%)	4717 (10.9%)	1548 (12.2%)	2395 (11.7%)	1595 (12.1%)	<0.001
41–50	26973 (30.2%)	13019 (30.2%)	3937 (31.0%)	6172 (30.1%)	3845 (29.3%)	
51–60	28253 (31.6%)	13647 (31.7%)	3944 (31.1%)	6501 (31.7%)	4161 (31.7%)	
61–70	16620 (18.6%)	8153 (18.9%)	2237 (17.6%)	3740 (18.2%)	2490 (19.0%)	
≧71	7327 (8.2%)	3561 (8.3%)	1032 (8.1%)	1691 (8.2%)	1043 (7.9%)	
Gender						
Male	51521 (57.6%)	24963 (57.9%)	7655 (60.3%)	11866 (57.9%)	7037 (53.6%)	<0.001
Female	37907 (42.4%)	18134 (42.1%)	5043 (39.7%)	8633 (42.1%)	6097 (46.4%)	
Number of secondary diagnoses						
0	45239 (50.6%)	21938 (50.9%)	6154 (48.5%)	10313 (50.3%)	6834 (52.0%)	<0.001
1	25732 (28.8%)	12232 (28.4%)	3762 (29.6%)	5985 (29.2%)	3753 (28.6%)	
2+	18457 (20.6%)	8927 (20.7%)	2782 (21.9%)	4201 (20.5%)	2547 (19.4%)	
Average follow-up years	7.03 ± 2.03	7.00 ± 2.02	7.08 ± 2.03	7.04 ± 2.05	7.02 ± 2.04	0.001
Outpatient visit due to complications						
No	9548 (10.7%)	5449 (12.6%)	1370 (10.8%)	1907 (9.3%)	822 (6.3%)	<0.001
Yes	79880 (89.3%)	37648 (87.4%)	11328 (89.2%)	18592 (90.7%)	12312 (93.7%)	
Hospitalization due to complications						
No	66181 (74.0%)	32298 (74.9%)	9466 (74.5%)	15120 (73.8%)	9297 (70.8%)	<0.001
Yes	23247 (26.0%)	10799 (25.1%)	3232 (25.5%)	5379 (26.2%)	3837 (29.2%)	
Death during the follow-up period						
No	82998 (92.8%)	40140 (93.1%)	11836 (93.2%)	18947 (92.4%)	12075 (91.9%)	<0.001
Yes	6430 (7.2%)	2957 (6.9%)	862 (6.8%)	1552 (7.6%)	1059 (8.1%)	
Medical setting						
Primary outpatient visit department						
Family medicine	21495 (24.0%)	11221 (26.0%)	2701 (21.3%)	4740 (23.1%)	2833 (21.6%)	<0.001
General internal medicine	21850 (24.4%)	9168 (21.3%)	3398 (26.8%)	5772 (28.2%)	3512 (26.7%)	
Metabolism and endocrine	27147 (30.4%)	12247 (28.4%)	5017 (39.5%)	6077 (29.6%)	3806 (29.0%)	
Others	18936 (21.2%)	10461 (24.3%)	1582 (12.5%)	3910 (19.1%)	2983 (22.7%)	
Accreditation level of primary medical setting						
Medical center	15283 (17.1%)	6406 (14.9%)	2909 (22.9%)	3666 (17.9%)	2302 (17.5%)	<0.001
Regional hospitals	19128 (21.4%)	8856 (20.5%)	3443 (27.1%)	4250 (20.7%)	2579 (19.6%)	
District hospitals	16251 (18.2%)	5716 (13.3%)	2972 (23.4%)	4620 (22.5%)	2943 (22.4%)	
Primary care clinics	38766 (43.3%)	22119 (51.3%)	3374 (26.6%)	7963 (38.8%)	5310 (40.4%)	
Location						
Taipei region	26249 (29.4%)	12190 (28.3%)	4429 (34.9%)	6117 (29.8%)	3513 (26.7%)	<0.001
Northern region	11969 (13.4%)	5471 (12.7%)	1732 (13.6%)	2965 (14.5%)	1801 (13.7%)	
Central region	16213 (18.1%)	8087 (18.8%)	2088 (16.4%)	3531 (17.2%)	2507 (19.1%)	
Southern region	14623 (16.4%)	7593 (17.6%)	1771 (13.9%)	3092 (15.1%)	2167 (16.5%)	
Kao-Ping region	17877 (20.0%)	8527 (19.8%)	2415 (19.0%)	4238 (20.7%)	2697 (20.5%)	
Eastern region	2497 (2.8%)	1229 (2.9%)	263 (2.1%)	556 (2.7%)	449 (3.4%)	
Physician						
Age	44.75 ± 8.61	45.12 ± 8.38	44.06 ± 8.55	44.35 ± 8.89	44.79 ± 8.89	<0.001
Gender						
Male	78769 (88.1%)	38678 (89.7%)	10638 (83.8%)	17851 (87.1%)	11602 (88.3%)	<0.001
Female	10659 (11.9%)	4419 (10.3%)	2060 (16.2%)	2648 (12.9%)	1532 (11.7%)	
Specialty practice years	9.34 ± 4.75	9.54 ± 4.65	9.22 ± 4.74	9.05 ± 4.90	9.26 ± 4.84	<0.001

SD = standard deviation.

(62%) exhibited sustained preferences for visiting specific providers (48% were loyal to a physician, and another 14% were loyal to a medical setting) for ambulatory care, but 38% of the type 2 DM patients shopped around for different providers. The newly diagnosed type 2 DM patients who exhibited high levels of medical care–seeking consistency to health care providers during the first year following their diagnosis experienced fewer DM complications and DM complication incurred hospitalizations during the subsequent follow-up years (Table 1). Two primary factors might explain these effects. First, a well-planned treatment protocol during the first year of DM might benefit to the long-term prognosis via biophysiological mechanisms that prevent early hazards that ate predispositions to later adverse manifestations. Second, medical care–seeking behavior during the first year following DM diagnosis is a proxy indicator of later medical care–seeking behaviors, and such behaviors that result in a low continuity of care have been proven to be hazardous.

The characteristics of this DM patient cohort are in accordance with the features of other populations. Similar to previous reports, more men (57.6%) were newly diagnosed with DM during the data collection period.[31–33] The average age of onset (53.7 years) of type 2 DM in this study conformed to observations that the majority of people who are diagnosed with diabetes are between the ages of 45 and 64 in Asia-Pacific areas.[34] Thus, the generalizability of this finding is affirmed.

TABLE 2. Factors Associated With the Occurrence of Complications Diagnosed During Outpatient Visits or Hospitalizations Incurred due to Complications

Variables	Complications Diagnosed at Outpatient Visits				Complication-Incurred Hospitalizations			
	Number of Complications/Follow-Up Person-Years	Incidence Rate (y^{-1})	Hazard Ratio (95% CI)	*P* Value	Number of Complications/ Follow-Up Person-Years	Incidence Rate (y^{-1})	Hazard Ratio (95% CI)	*P* Value
Medical care–seeking behavior			1.138 (1.131, 1.145)*	<0.001			1.053 (1.042, 1.065)*	<0.001
High consistency to a physician	37648 / 103165	0.365	—		10799 / 271444	0.040	—	
High consistency to a medical setting	11328 / 26706	0.424	1.112 (1.089, 1.136)	<0.001	3232 / 80726	0.040	1.032 (0.992, 1.074)	0.121
Medium consistency	18592 / 39510	0.471	1.226 (1.205, 1.248)	<0.001	5379 / 128728	0.042	1.056 (1.022, 1.092)	0.001
Low consistency to provider	12312 / 19433	0.634	1.536 (1.504, 1.567)	<0.001	3837 / 81105	0.047	1.208 (1.164, 1.254)	<0.001
Patient's gender								
Male	45108 / 117695	0.383	0.877 (0.865, 0.890)	<0.001	13799 / 322694	0.043	1.225 (1.193, 1.258)	<0.001
Female	34772 / 71118	0.489	—		9448 / 239309	0.039	—	
Patient's age			1.031 (1.026, 1.036)*	<0.001			1.111 (1.100, 1.121)*	<0.001
≦40	8436 / 28387	0.297	—		1633 / 68959	0.024	—	
41–50	23126 / 67456	0.343	1.138 (1.110, 1.166)	<0.001	5295 / 178200	0.030	1.264 (1.196, 1.336)	<0.001
51–60	25445 / 58147	0.438	1.374 (1.341, 1.409)	<0.001	6894 / 177473	0.039	1.692 (1.603, 1.786)	<0.001
61–70	15797 / 25705	0.615	1.783 (1.736, 1.832)	<0.001	5717 / 99562	0.057	2.530 (2.394, 2.674)	<0.001
≧71	7076 / 9119	0.776	2.127 (2.059, 2.196)*	<0.001	3708 / 37809	0.098	4.485 (4.229, 4.756)*	<0.001
Number of secondary diagnoses			1.063 (1.054, 1.073)*	<0.001			1.083 (1.065, 1.101)*	<0.001
0	40038 / 101424	0.395	—		11359 / 101424	0.112	—	
1	23032 / 53003	0.435	1.050 (1.033, 1.068)	<0.001	6763 / 53003	0.128	1.089 (1.057, 1.123)	<0.001
2+	16810 / 34387	0.489	1.134 (1.114, 1.155)	<0.001	5125 / 34387	0.149	1.171 (1.132, 1.211)	<0.001
Medical setting								
Primary outpatient visit department of the first year								
Family medicine	19060 / 47129	0.404	1.002 (0.980, 1.025)	0.868	5520 / 133083	0.041	0.907 (0.871, 0.944)	<0.001
General internal medicine	19827 / 44116	0.449	1.040 (1.015, 1.066)	0.001	5936 / 138980	0.043	0.924 (0.884, 0.966)	<0.001
Metabolism and endocrine	24098 / 54292	0.444	1.120 (1.088, 1.153)	<0.001	6292 / 171976	0.037	0.897 (0.850, 0.947)	<0.001
Others	16895 / 43277	0.390	—		5499 / 117963	0.047	—	
Accreditation level of primary medical setting								
Medical center	13388 /34803	0.385	—		3752/ 100301	0.037	—	
Regional hospitals	17203 / 36073	0.477	1.206 (1.178, 1.234)	<0.001	4524 / 121346	0.037	1.010 (0.967, 1.056)	0.649
District hospitals	14856 / 29481	0.504	1.240 (1.206, 1.275)	<0.001	4467 / 100509	0.044	1.120 (1.063, 1.180)	<0.001
Primary care clinics	34433 / 88456	0.389	1.055 (1.026, 1.085)	<0.001	10504 / 239848	0.044	1.043 (0.990, 1.099)	0.113
Location								
Taipei region	23495 / 53752	0.437	—		6354 / 165920	0.038	—	
Northern region	10502 / 26456	0.397	0.903 (0.882, 0.924)	<0.001	2972 / 74914	0.040	1.008 (0.965, 1.054)	0.710
Central region	14567 / 32528	0.448	1.012 (0.990, 1.033)	0.284	3995 / 100699	0.040	1.006 (0.967, 1.048)	0.756
Southern region	13131 / 31630	0.415	0.960 (0.939, 0.981)	<0.001	4051 / 92582	0.044	1.096 (1.053, 1.141)	<0.001
Kao-Ping region	15904 / 39658	0.401	0.943 (0.924, 0.963)	<0.001	5069 / 112944	0.045	1.144 (1.101, 1.188)	<0.001
Eastern region	2281 / 4789	0.476	1.064 (1.019, 1.111)	0.005	806 / 14943	0.054	1.322 (1.227, 1.424)	<0.001
Physician								
Gender								
Male	70320 / 168426	0.418	0.964 (0.942, 0.985)	0.001	20674 / 496467	0.042	0.980 (0.938, 1.023)	0.347
Female	9560 / 20384	0.469	—		2573 / 65536	0.039	—	
Age			0.997 (0.996, 0.998)	<0.001			1.003 (1.002, 1.005)	<0.001
Specialty practice years			1.004 (1.002, 1.006)	<0.001			0.995 (0.991, 0.998)	0.002

— = reference group, CI = confidence interval.
* Test for monotonic trend by Cox proportional hazard model.

TABLE 3. The Association Between Patients' Medical Care–Seeking Behaviors and the Occurrence of Complications Diagnosed During Outpatient Visits Stratified by the Study Variables

Medical Care–Seeking Consistency	Hazard Ratio (95% CI)			
Stratified Variables	High Consistency to a Physician (n = 43,097)	High Consistency to a Medical Setting (n = 12,698)	Medium Consistency (n = 20,499)	Low Consistency to Both Physician and Medical Setting (n = 13,134)
Patient's gender				
Male	0.869 (0.851, 0.887)	0.968 (0.940, 0.996)	1.069 (1.043, 1.096)	1.365 (1.326, 1.405)
Female	—	1.111 (1.075, 1.148)	1.221 (1.189, 1.254)	1.495 (1.451, 1.541)
Patient's age				
≦40	—	1.111 (1.042, 1.184)	1.255 (1.189, 1.325)	1.613 (1.517, 1.714)
41–50	1.140 (1.098, 1.183)	1.299 (1.240, 1.360)	1.394 (1.337, 1.453)	1.854 (1.770, 1.941)
51–60	1.392 (1.342, 1.444)	1.549 (1.480, 1.622)	1.725 (1.655, 1.797)	2.112 (2.019, 2.210)
61–70	1.825 (1.755, 1.899)	2.027 (1.921, 2.138)	2.251 (2.150, 2.357)	2.618 (2.486, 2.756)
≧71	2.226 (2.125, 2.333)	2.300 (2.144, 2.467)	2.560 (2.415, 2.714)	3.267 (3.048, 3.502)
Number of secondary diagnoses				
0	—	1.151 (1.116, 1.186)	1.216 (1.186, 1.247)	1.547 (1.504, 1.592)
1	1.056 (1.031, 1.081)	1.160 (1.118, 1.204)	1.312 (1.272, 1.352)	1.594 (1.537, 1.653)
2+	1.147 (1.117, 1.178)	1.207 (1.157, 1.258)	1.410 (1.362, 1.460)	1.771 (1.698, 1.848)
Primary outpatient visit department of the first year				
Family medicine	0.998 (0.969, 1.028)	1.072 (1.022, 1.123)	1.216 (1.171, 1.263)	1.519 (1.454, 1.588)
General internal medicine	1.049 (1.016, 1.083)	1.124 (1.076, 1.175)	1.221 (1.176, 1.267)	1.600 (1.534, 1.669)
Metabolism and endocrine	1.074 (1.036, 1.113)	1.266 (1.214, 1.321)	1.409 (1.354, 1.467)	1.682 (1.609, 1.759)
Others	—	1.087 (1.028, 1.150)	1.199 (1.153, 1.247)	1.513 (1.450, 1.579)

Multivariate-adjusted hazard ratios were calculated based on a Cox proportional hazard model that was adjusted for variables that included the physician's gender, physician's age, physician's years of practice since acquiring a specialty license, accreditation level of the primary outpatient visit medical setting, area of the medical setting, patients' gender, patients' age, patients' number of diagnoses, primary outpatient visit department, and the medical care–seeking behavior, other than the stratified factor per se. — = reference group, CI = confidence interval.

Although the benefits of continuity in the site of care remain controversial, this study deemed site continuity as a second level of medical care–seeking consistency below physician continuity of care.[35,36] We believe that administrative integration contributes to the advantages of site consistency. Unified DM treatment guidelines and comprehensive medical records across different care givers within a hospital ensure treatment coherence and prevent some but not all adverse events are important factors for chronic disease control.[36]

In this study, the occurrences of DM complications and hospitalizations increased with decreasing medical care–seeking consistency to providers among newly diagnosed DM patients (HRs from 1.000 to 1.536) (Table 2). Medical care–seeking consistency behavior is indicative of a patient's willingness to adhere to a medication regimen, and such adherence

TABLE 4. The Association Between the Patients' Medical Care–Seeking Behavior and the Occurrence of Complication-Incurred Hospitalizations Stratified by the Study Variables

Medical Care–Seeking Consistency	Hazard Ratio (95% CI)			
Stratified Variables	High Consistency to a Physician (n = 43,097)	High Consistency to a Medical Setting (n = 12,698)	Medium Consistency (n = 20,499)	Low Consistency to Both Physician and Medical Setting (n = 13,134)
Patient's gender				
Male	1.208 (1.163, 1.256)	1.248 (1.183, 1.317)	1.268 (1.211, 1.328)	1.526 (1.449, 1.607)
Female	—	1.032 (0.968, 1.099)	1.067 (1.013, 1.123)	1.140 (1.077, 1.207)
Patient's age				
≦40	—	0.994 (0.856, 1.154)	1.107 (0.979, 1.252)	1.303 (1.139, 1.491)
41–50	1.273 (1.170, 1.385)	1.345 (1.214, 1.490)	1.342 (1.222, 1.473)	1.630 (1.476, 1.800)
51–60	1.729 (1.593, 1.876)	1.735 (1.573, 1.915)	1.836 (1.680, 2.007)	2.099 (1.910, 2.306)
61–70	2.610 (2.402, 2.837)	2.702 (2.438, 2.994)	2.709 (2.470, 2.971)	3.007 (2.725, 3.318)
≧71	4.595 (4.207, 5.019)	4.898 (4.374, 5.485)	4.849 (4.388, 5.358)	5.239 (4.686, 5.857)
Number of secondary diagnoses				
0	—	0.999 (0.942, 1.059)	1.063 (1.014, 1.114)	1.202 (1.141, 1.267)
1	1.081 (1.034, 1.131)	1.157 (1.081, 1.238)	1.135 (1.073, 1.201)	1.304 (1.222, 1.392)
2+	1.163 (1.107, 1.221)	1.222 (1.132, 1.319)	1.220 (1.145, 1.301)	1.423 (1.321, 1.532)
Primary outpatient visit department of the first year				
Family medicine	0.927 (0.879, 0.977)	0.877 (0.802, 0.959)	0.926 (0.863, 0.993)	1.159 (1.072, 1.254)
General internal medicine	0.905 (0.853, 0.960)	0.960 (0.887, 1.040)	1.014 (0.949, 1.084)	1.129 (1.047, 1.216)
Metabolism and endocrine	0.908 (0.850, 0.971)	0.946 (0.874, 1.024)	0.926 (0.859, 1.000)	1.060 (0.975, 1.152)
Others	—	1.083 (0.982, 1.194)	1.087 (1.015, 1.164)	1.181 (1.097, 1.271)

Multivariate-adjusted hazard ratios were calculated based on a Cox proportional hazard model that was adjusted for variables that included the physicians' gender, physicians' age, physicians' years of practice since acquiring a specialty license, accreditation level of the primary outpatient visit medical setting, area of the medical setting, patients' genders, patients' ages, patients' number of diagnoses, primary outpatient visit department, and medical care–seeking behavior, other than the stratified factor per se. — = reference group, CI = confidence interval.

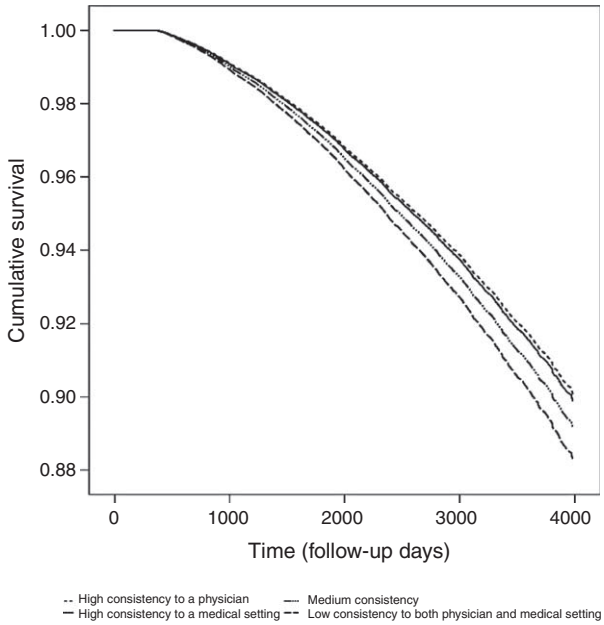

FIGURE 1. Multivariate-adjusted survivals among the 4 medical care–seeking behavior groups*. *$P < 0.001$, test for monotonic trend (from high medical care–seeking consistency to a physician to low medical care–seeking consistency) performed by Cox proportional hazard model that was adjusted for variables including the physicians' genders, physicians' ages, physicians' years of practice since acquiring a specialty license, accreditation level of the primary outpatient visit medical setting, area of the medical setting, patients' genders, patients' ages, patients' number of diagnoses, primary outpatient visit department, and whether complications occurred.

elicits advantageous conditions for glycemic control; in contrast, poor glycemic control is known to be one of the primary risk factors for diabetes complications.[37,38] While age, gender, and comorbidities are preexisting and minimally modifiable conditions that are related to the occurrence of complications, behavioral modification is critical to improve patient health. In each of the age, gender, and disease complexity strata, coherent trends were observed between increasing degrees of medical care–seeking consistency to providers and decreasing frequencies of DM complications. Based on the stratified analyses, we confirmed the universal effect of continuous health care–seeking behavior on patients' long-term prognoses regardless of the characteristics of the patient and provider. Three possible explanations for these results are as follows. First, changing providers may cause less continuity of care, which can be detrimental to patients in terms of their clinical outcomes. On the other hand, continual follow-up during ambulatory visits can also facilitate the physician's recognition of emergent health problems, which allows for timely adjustments of medications in response to the patient's needs. For instance, the effectiveness of glucose control can be evaluated with biophysiological indicators, such as HbA1C, during outpatient visits. Second, sicker patients are less satisfied with their care so they change clinicians more often. Patients may easily swift to other physicians or medical settings based on the information. Third, some clinicians may not want to treat sicker patients and they may refer these patients to other clinicians. Particularly, under P4P policy, the providers may have high likelihood of adverse selection practice due to financial incentives. In summary, regular medical consultations over time enhance the partnership between physicians and patients in combating diseases. In contrast, diabetes patients exhibiting low levels of medical care–seeking consistency behavior might have higher likelihoods of developing adverse events due to various causes. Therefore, the present findings provide guidance for the design of intervention programs; for example, the adoption of prospective payment systems and the introduction of incentives to promote patient consistency to a specific provider should be considered.

This study added value to the current literature. First, the conclusions derived from the nationwide claim database exclude the possibility of selection bias; thus, the validity of study results was affirmed. Second, the effects of medical care–seeking behavior during the first year following DM diagnosis were specifically verified and evidenced the importance of early intervention plans in disease progression. Finally, this study used diabetes-related complications as the primary endpoint, and this endpoint allows for more direct association about the relationship between glycemic control and manifestations.

Several policy implications can be derived from this research. First, we suggest that an integrated delivery system is for better care plans in terms of continuity and compliance. Second, P4P programs or capitation payments that motivate the medical care–seeking consistency behavior of patients with chronic diseases such as diabetes should be encouraged to improve care quality and medical outcomes. Third, doctors in primary care clinics must play the important roles of offering preventive medicine services and serving as a gatekeeper in terms of referring patients to appropriate care units. Fourth, we suggest the implementation of an early screening program for DM patients to deliver appropriate glycemic control and to defer the occurrence of related complications.

The limitations of this study necessitate caution in the future application of the results. First, the follow-up period was limited by data availability, and extended observations might result in different strength of association. Second, the number of secondary diagnoses was adopted to reflect the health conditions of newly diagnosed DM patients. However, some underlying diseases might act as major comorbidities to diabetes-related complications, and we were unable to differentiate such diseases in this study. Third, although informational, management, and relationship continuities are known as the 3 core dimensions that contribute to the continuity of care, it is unclear which component plays the dominant role in patient consistency behavior and thus the occurrence of DM complications.[39] Fourth, we did not further explore the mechanisms or reasons that caused the patients to switch doctors. The claim database did not contain measures of the patients' perceptions of continuity of care or related attributes. The variability in the providers' practices and levels of professionalism was not fully examined in this study. Fifth, the patient's self-management behavior and compliance to the orders, such as blood glucose tests, and oral medication compliance, were not available in the national insurance claim data. Future studies are warranted for clarifying the relationships.

In conclusion, this study addressed the effects of patient consistency to a provider during the early stage following DM diagnosis on the later medical outcomes. The mechanisms behind medical care–seeking behavior were discussed and are believed to be the critical factors behind the quality improvements mediated by P4P and prospective payment systems. The study suggests that the continuity of care and physician–patient relationship management should be reinforced in future medical care systems for chronic disease management.

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