

# A Pay-for-Performance Program for Diabetes Care in Taiwan: A Preliminary Assessment

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**P**ay for performance (P4P) is a healthcare management strategy that has been adopted in many countries to link the payment for services to desirable health outcomes.<sup>1,2</sup> Pay-for-performance programs may be outcome based or process based, and can be implemented at the clinician or hospital level.<sup>3</sup> To date, studies evaluating the effects of P4P programs have been inconclusive. Some have reported that P4P programs improved health outcomes,<sup>4,7</sup> but others have reported mixed results,<sup>1,8-10</sup> no significant changes,<sup>11,12</sup> or unintended consequences.<sup>13</sup> Experts continue to debate whether it is appropriate to provide financial incentives for high-quality healthcare services.<sup>14,15</sup>

Since 2001, Taiwan's universal health insurance system operated by the Bureau of National Health Insurance (NHI) has implemented P4P programs for 5 diseases: diabetes mellitus, tuberculosis, breast cancer, cervical cancer, and asthma. These programs primarily focus on encouraging healthcare providers to increase the monitoring and follow-up care of patients.

Established in 1995, NHI is the sole payer of healthcare services in Taiwan. More than 90% of all hospitals and community clinics contracted with NHI to provide ambulatory and inpatient care, rehabilitation, and prescription drugs to more than 99% of the 22.5 million residents of Taiwan. Under the NHI system, most healthcare services are reimbursed on a fee-for-service basis, excluding 53 procedures that are reimbursed according to fixed payment schedules. The average number of physician visits is approximately 15 per person per year. The high number of visits may be because of the lack of a formal referral system and because of easy access to physician services in Taiwan. A detailed description of the implementation of the NHI programs is available elsewhere.<sup>16</sup>

Diabetes mellitus is a common disease in Taiwan. It is the fourth leading cause of death in recent years, after cancer, cerebrovascular disease, and heart disease.<sup>17</sup> Previous studies have indicated that in Taiwan, patients with diabetes do not receive adequate care, especially with regard to regular checkups.<sup>18</sup> The NHI's P4P program for diabetes care provides financial incentives for healthcare providers to increase comprehensive follow-up visits including enhanced self-care education and annual diabetes-specific

physical examinations such as eye examinations and laboratory tests (eg, hemoglobin A1C[HbA1C]).

Hospitals and community clinics with physicians qualified in metabol-

**Objective:** To examine the effects of a pay-for-performance (P4P) program for diabetes care in Taiwan.

**Study Design:** A population-based natural experimental design with intervention and comparison groups.

**Methods:** Healthcare service and expense data were extracted from the Taiwanese Bureau of National Health Insurance claim files for 2005 and 2006. The number of essential diabetes-specific exams/tests, healthcare utilization, and pre- and post-intervention expenses were calculated for patients grouped according to P4P status. However, no clinical information was available for analysis. Difference-in-difference analysis was used in statistical regression models with proper distributions for these measures.

**Results:** Patients in the P4P program ( $n = 12,499$ ) received significantly more diabetes-specific exams and tests after enrollment (3.8 vs 6.4,  $P < .001$ ) than patients not enrolled in the program (3.5 vs 3.6,  $P < .001$ ). Patients in the intervention group had an average of 2 more physician visits for diabetes than those in the comparison group ( $P < .001$ ). Conversely, the intervention group had fewer diabetes-related hospitalizations ( $-0.027$ ,  $P = .003$ ). Patients in the intervention group incurred higher expenses due to physician visits but lower expenses due to inpatient services, with a net increase of \$104 per person per year ( $P < .001$ ).

**Conclusions:** This P4P program for diabetes was associated with a significant increase in regular follow-up visits and evidence-based services, and significantly lower hospitalization costs. The overall cost of care for those in the P4P program was significantly higher, although the total incremental expense was quite small.

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### Take-Away Points

A population-based natural experimental design with intervention and comparison groups was used to examine the effects of a pay-for-performance (P4P) program for diabetes care in Taiwan. Outcomes included the following:

- Patients enrolled in the P4P program received more essential exams/tests and incurred additional follow-up visits and higher expenses for diabetes-related physician visits.
- Conversely, patients in the P4P program had fewer hospital admissions and lower inpatient expenses due to diabetes-related conditions.
- The cost for physician visits and exams/tests because of the P4P program was significantly higher, although the incremental increase was small.

ic specialty can voluntarily apply to participate in the NHI P4P program. The participating physicians then can enroll individual patients in the program. In addition to regular reimbursement for healthcare services such as physician visits, medications, physical exams, and laboratory tests, the P4P program compensates participating clinicians' additional "enlarged physician fees" and "case management fees." The case management fees cover the following 3 types of services: initial enrollment visit, comprehensive follow-up visits, and an annual evaluation visit. Required and recommended services included in these initial and follow-up visits (eg, diabetes-specific eye examination, laboratory evaluation, self-care education) are clearly defined by the P4P program.<sup>19</sup>

## METHODS

Healthcare service and expense data were extracted from the NHI claims database. Subjects included patients diagnosed with diabetes (*International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] codes 250 or A181*) every year between 2004 and 2006 who filed claims for diabetes prescription drugs for at least 3 months in each year.

This study used a natural experimental design. All patients with diabetes who were enrolled in the P4P program in 2006 were included in the study as the intervention group (n = 12,499). To create a comparison group, we first identified all patients with diabetes who had never joined the P4P program since 2001. These patients then were randomly sampled to form the comparison group (n = 26,172; roughly twice the sample size of the intervention group).

The healthcare services received and healthcare costs incurred by patients in the intervention group were compared before and after enrollment in the program (ie, in 2005 vs 2006). Because of the lack of a detailed time record of enrollment, patients in the intervention group might have been enrolled in the P4P program at any time in 2006. The 2005 and 2006 data from the comparison group were extracted for comparison.

The indicators used in this study included the number of essential exams/tests conducted each year (including laboratory tests for blood glucose, HbA1C, lipid profile, serum creatinine, and alanine aminotransferase, urinalysis, and a dilated eyeground examination or ophthalmic photograph), the numbers of diabetes-related physician visits and hospital admissions, and health-care expenses for NHI. Only the number of exams/tests performed was accessible;

we were unable to obtain the laboratory results from the NHI claims database (eg, HbA1C, lipid profile). Diabetes-related healthcare services or expenses were identified when a diabetes ICD-9-CM code (250 or A181) appeared as the primary or secondary diagnosis in the claim data. Items in the healthcare expenses included physician fees, medication, exam/test fees for outpatient visits, and other fees such as nursing or rehabilitation fees for inpatient services. These expenses did not include home healthcare or nursing home services.

To control for the differences between the intervention and comparison groups, difference-in-difference (DID) regression models were used in the analysis. Based on the study variables' characteristics, a Poisson distribution was used to analyze the number of exams/tests, a negative binomial distribution was used for the number of physician visits and hospitalizations, and a normal distribution was used for healthcare expenses in the regression models. The generalized estimating equation method was used with the proper distribution, while taking into account the correlation between repeated measures for each patient.<sup>20</sup>

For clarity, the predicted values (rather than statistical parameters) from the regression models are presented to illustrate the pre- and post-P4P program results of the 2 groups. The standard errors of the differences and the DID of these predicted values were estimated using a bootstrap technique.<sup>21</sup> The estimates were obtained by conducting 100 replications with repeated samples of the same size as the original sample.

## RESULTS

The demographics of the patients with diabetes in the intervention and comparison groups are shown in **Table 1**. A total of 38,671 patients were included in the analyses, including 12,499 in the intervention group and 26,172 in the comparison group. There was a greater percentage of women in the intervention group (53.6%) than in the comparison group (51.0%). Intervention group patients were younger than comparison group patients (mean age: 61.5 years vs 63.4

## P4P Program for Diabetes Care

**Table 1.** Characteristics of Patients With Diabetes in Intervention and Comparison Groups in Taiwan in 2006

Characteristic	Total (n = 38,671)	Intervention Group (n = 12,499)	Comparison Group (n = 26,172)	P
<b>Sex, n (%)</b>				<.0001
Male	18,633 (48.2)	5799 (46.4)	12,834 (49.0)	
Female	20,038 (51.8)	6700 (53.6)	13,338 (51.0)	
<b>Age, y, n (%)</b>				<.0001
≤55	10,810 (28.0)	3788 (30.3)	7022 (26.8)	
56-70	16,698 (43.2)	5707 (45.7)	10,991 (42.0)	
≥71	11,163 (28.9)	3004 (24.0)	8159 (31.2)	
Mean	62.8	61.5	63.4	
<b>Charlson Comorbidity Index, n (%)</b>				<.0001
0	1066 (2.8)	290 (2.3)	776 (3.0)	
1	18,070 (46.7)	5454 (43.6)	12,616 (48.2)	
≥2	19,535 (50.5)	6755 (54.0)	12,780 (48.8)	

years). Patients in the intervention group were more likely to have a Charlson Comorbidity Index score greater than 2 (54.0% vs 48.8%,  $P < .001$ ), implying that the intervention group was not healthier than the comparison group.

Table 2 shows the changes in the indicators from 2005 to 2006 in the intervention group and comparison group. First, before the P4P program, the average number of essential exams/tests performed in a year was similar between the 2 groups. After the P4P program, the average number of exams/tests performed increased from 3.8 to 6.4 in the intervention group. The figures increased slightly from 3.5 to 3.6 in the comparison group. The net effect (DID) of the P4P program on the completion of all 7 essential exams/tests was 2.5.

Second, the average number of diabetes-related physician visits increased significantly from 15.0 to 17.5 per year in the intervention group. The visits increased slightly from 14.8 to 15.3 per year in the comparison group. In contrast, the average number of diabetes-related hospitalizations in the intervention group increased slightly from 0.23 to 0.25 per year ( $P = .076$ ). The comparison group had an increase in average hospitalization from 0.26 to 0.31 ( $P < .001$ ). The net effect of the P4P program was a lower increase of 2.7 admissions per 100 enrolled patients per year ( $P = .003$ ).

Third, the expenses due to physician visits increased by 8462 New Taiwan (NT) dollars (1 US dollar = 32 NT dollars in 2006) in the intervention group and by 1271 NT dollars in the comparison group, for a difference of 7191 NT dollars between the groups ( $P < .001$ ). The expense of diabetes-related inpatient services decreased in the intervention group and increased in the comparison group. The net decrease was 3878 NT dollars between the 2 groups ( $P < .001$ ). The to-

tal diabetes-related healthcare expenses in 2006 versus 2005 were higher in the intervention group by 3312 NT dollars, or \$104 per patient per year.

## DISCUSSION

The P4P program for diabetes care in Taiwan is designed to increase the quality of care. The major financial incentive of this program is to encourage regular follow-up visits and exams/tests for better monitoring and control of diabetes. This study examined the early impact of the P4P program and found that nearly all essential exams/tests were performed (6.38 of 7) over the course of a year for patients in the program, which is expected to improve patients' health outcomes.<sup>22,23</sup> We conclude that the P4P program has successfully improved the evidence-based service utilization of enrolled patients.

The number of diabetes-related physician visits among patients in the P4P program also grew, suggesting that this group received more attentive follow-up care. Because previous local studies have reported healthcare services for patients with diabetes to be insufficient,<sup>24,25</sup> an increase in physician visits and exams/tests is a desirable outcome. The lower likelihood of hospitalization may reflect better ambulatory care for the enrolled patients. However, the major differences resulted from the increased likelihood of hospitalization for the comparison group, the causes of which we were unable to explain in this study. This analysis shows that the P4P program attained its preliminary goal of improving the quality of care.

This P4P program was accompanied by a fee-for-service payment scheme under the NHI system in Taiwan. Only a

■ TRENDS FROM THE FIELD ■

■ **Table 2.** Changes in the Number of Essential Exams/Tests and Diabetes-Related Healthcare Utilization and Expenses (in New Taiwan Dollars) by Group

Indicator	Preprogram (2005)	Postprogram (2006)	Difference		P
			Post-Pre	SE	
<b>No. of essential exams/tests<sup>a</sup></b>					
Intervention group	3.796	6.377	2.581	0.016	<.001
Comparison group	3.496	3.626	0.131	0.011	<.001
Difference	0.300	2.751	2.450	0.019	<.001
<b>No. of diabetes-related physician visits<sup>b</sup></b>					
Intervention group	14.974	17.499	2.526	0.060	<.001
Comparison group	14.768	15.284	0.515	0.033	<.001
Difference	0.206	2.216	2.010	0.069	<.001
<b>No. of diabetes-related hospitalizations<sup>b</sup></b>					
Intervention group	0.234	0.248	0.014	0.008	.076
Comparison group	0.264	0.305	0.041	0.005	<.001
Difference	-0.030	-0.057	-0.027	0.009	.003
<b>Expense for diabetes-related physician visits<sup>c,d</sup></b>					
Intervention group	24,511	32,973	8462	152	<.001
Comparison group	25,589	26,860	1271	114	<.001
Difference	-1077	6113	7191	208	<.001
<b>Expense for diabetes-related inpatient services<sup>c</sup></b>					
Intervention group	11,025	10,773	-252	531	.603
Comparison group	13,848	17,475	3627	470	<.001
Difference	-2823	-6702	-3878	716	<.001
<b>Expense for all diabetes-related health services<sup>c,d</sup></b>					
Intervention group	35,537	43,747	8210	538	<.001
Comparison group	39,437	44,335	4898	504	<.001
Difference	-3901	-589	3312	764	<.001

<sup>a</sup>Predicted values obtained from generalized estimating equation models with Poisson distribution.  
<sup>b</sup>Predicted values obtained from generalized estimating equation models with negative binomial distribution.  
<sup>c</sup>Predicted values obtained from generalized estimating equation models with normal distribution.  
<sup>d</sup>The expenses included emergency department visits.

small portion (approximately 1270 NT dollars) of the estimated net increase of 7191 NT dollars for diabetes-related physician visits (Table 2) was due to the program's management fees for the initial enrollment visit, follow-up visits, and annual evaluation. The majority of the increase in healthcare expenses was attributed to the fees for additional physical exams, laboratory tests, medications, and physician visits under the regular NHI fee-for-service payment system. The insurance payment scheme plays a significant role in the P4P program.

In terms of healthcare expenses, the P4P program increased the cost of physician visits; however, after accounting for the

decreased hospitalization cost, the increase in total expenses for diabetes-related care was not much, only 104 US dollars or 3312 NT dollars per patient per year. However, more detailed analysis of the program's cost and effectiveness is needed.

This study has several important limitations. The nonrandom selection of physicians and patients enrolled in the P4P program may reduce the robustness of the findings. The lack of patient information on social and clinical characteristics such as HbA1C and lipid profile limits the comparability between the intervention and comparison groups. Due to the absence of information on the time of enrollment, patients in the intervention group were enrolled in the program at any

time in 2006 but were considered as postintervention for the entire year. This situation would bias the results toward the null, causing this study to underestimate the effect of the P4P program. The large number of physician visits per patient in Taiwan due to easy access to doctors also may limit the generalizability of our findings to other healthcare systems.

This study shows that the P4P program for diabetes care in Taiwan increased the number of physician visits and essential physical exams and laboratory tests. The program has achieved its preliminary goal of improving the quality of primary care at a reasonable cost. The study supports that a P4P program may result in desirable outcomes.

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