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The Effects of a Schizophrenia Pay-For-Performance Program on Patient Outcomes in Taiwan

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Objective: To examine the effects of a schizophrenia pay-for-performance (P4P) program on the health outcomes of patients in Taiwan.

Data sources: Seven years (2007~2013) of data from the National Health Insurance Administration (NHIA) databases were examined.

Study design: P4P patients included those who were treated at participating facilities and consecutively included in the regular group (classified by the NHIA). Non-P4P patients were treated at nonparticipating facilities and never included in the regular group. The caliper matching method and a generalized estimating equation were used to estimate difference-in-differences models (baseline year 2009) and examine the short- and long-term effects of the P4P program on adverse outcomes.

Principal findings: The schizophrenia P4P program was associated with decreases in unscheduled outpatient visits (OR 0.69, $P < 0.001$) and compulsory admissions (incidence rate ratio 0.33, $P < 0.05$). However, this program was not associated with decreases in other outcomes including emergency department visits for any disease, admissions to an acute psychiatric ward, and readmission within 6 months.

Conclusions: Although the disease management component of the P4P program can be beneficial for compulsory admissions, more sophisticated activities, such as health promotion targeting disadvantaged patients, could be implemented to reduce the occurrence of complicated adverse outcomes.

Keywords: schizophrenia, pay-for-performance, disease management program, readmission, compulsory admission

Objective

Scientific evidence examining the effects of pay-for-performance (P4P) in behavioral health care is scarce.[1] Taiwan introduced a schizophrenia P4P program in 2010 that has four components.[2] The first component was the establishment of a treatment plan and treatment goal, and the second component was the promotion of the use of care teams, including physicians, nurses, social workers, clinical psychologists, and occupational therapists, to provide patients with self-management education and consultation. The third component involved hiring a case manager to follow up with and remind patients to regularly visit the facility, and the fourth component involved incorporating financial incentives to reward facilities for improved performance.

Two prior studies have assessed the effectiveness of the schizophrenia P4P program. In one study, the program was judged to be ineffective in reducing emergency care for high-risk patients and readmission within 6 months for patients with schizophrenia who made regular visits.[3] In another study, the implementation of the schizophrenia P4P program reduced the yearly incidence of compulsory hospitalization, days of acute psychiatric hospitalization, and annual emergency department (ED) visits.[2]

These local studies had some limitations, however. For example, although the former study used a national database, it conducted only one-year evaluations and adopted only two outcome measures for evaluation,[3] and the evaluation was limited to regular-visit patients. The latter study conducted research at only one hospital site and did not include a comparison group.[2] In the present study, we examined the effects of the schizophrenia P4P program at a national level on several different outcomes over a multi-year period.

Methods

Background of the schizophrenia P4P program

The schizophrenia P4P program is a voluntary P4P program for facilities in Taiwan.[4] The first version of this program was initiated in January 2010, and facilities with

psychiatric services could apply to join. Once a facility had applied to participate in the program, a list of patients with schizophrenia who had ever been treated at that facility in the previous year was generated by the National Health Insurance Administration (NHIA) based on the claims database. The proposal for the schizophrenia P4P program developed by the NHIA classified patients with schizophrenia on the list into three groups based on their visits in the previous year: regular, low-frequency, or never visited.[4] According to the schizophrenia P4P proposal, the regular group was defined as including patients who 1) had received relevant medications at least 8 times in the previous year and 2) had visited a specific facility for more than 60% of their total visits in the previous year.[4] Under normal conditions, based on the first version of the P4P protocol, participating facilities were required to enroll all patients in the regular group without asking them to sign consent documents to voluntarily join the program.[4]

Three types of incentives were provided to the facilities: an incentive for disease management activities, an incentive for performance improvement (pay-for-improvement), and an incentive for enrolling patients in the low-frequency or never-visited groups. Appendix 1 provides a more detailed description.

Patient selection (P4P and non-P4P patients)

We utilized the NHIA's databases from 2007 to 2013. To be eligible as patients with schizophrenia, patients must have been diagnosed with schizophrenia (ICD-9-CM 295). Patients were excluded if they had two or more catastrophic disease cards (a card is issued to a patient by the NHIA for each catastrophic condition, such as schizophrenia, stroke, cancer, or dialysis), had died in the facility, or were admitted to a chronic ward. Among the patients who were eligible, the inclusion criteria for the P4P group were patients in the regular group who were treated at participating facilities in 2010 and were consecutively included in the regular group from 2011 to

2013.[3] The inclusion criteria for the non-P4P group were patients who were treated at nonparticipating facilities in 2010 and were never included in the regular group from 2011 to 2013 (see the details in Appendix 2, Figure 1). We used the plurality algorithm to attribute non-P4P patients to specific facilities from 2009 to 2013,[5] which assigned a patient to the physician who billed for the greatest number of care visits in a given year. Ties between physicians were resolved by favoring the physician with the greatest total charges for that patient.

Propensity score matching (PSM)

To meet the 'parallel trends' assumption necessary for the plausibility of difference-in-differences (DID) models, we traced back the P4P and non-P4P patients in 2010 to the years before the intervention from 2007 to 2009 and matched the P4P patients with the non-P4P patients (1:4) every year using propensity score matching (PSM).[6] We matched patients in the P4P group to patients in the control group based on preintervention levels of adverse outcomes and covariates (confounders).[7] However, to avoid a risk of regression to the mean (RTM) and the consideration of a covariate as an instrumental variable, we followed Daw and Hatfield's suggestions on selecting matching variables for DID analysis to test the preintervention differences between the P4P intervention and control group at the adverse outcome and covariate levels.[8] We further employed the DID analysis for each adverse outcome after PSM.

Adverse outcomes

We referenced and adapted P4P measures as proposed by the NHIA protocol (Table 2 in Appendix 1). In this study, we compared the P4P intervention and control groups and calculated these measures at the patient level on a yearly basis. This study included the following measures: 1) number of compulsory admissions, 2) number of emergency visits for any disease, 3) number of admissions to an acute psychiatric ward, 4) total length of stay (LOS) in an acute psychiatric ward, 5) percentage of

readmissions to an acute psychiatric ward within 6 months after a prior admission, and 6) percentage of patients with unscheduled psychiatric outpatient visits (interval ≥ 30 days).

Statistical modeling

This study used a short-term and long-term DID methodology to compare adverse outcomes between the 2 groups before and after implementation of the P4P program. For the number of compulsory admissions, number of emergency visits for any disease, and number of admissions to an acute psychiatric ward, we adopted a generalized estimating equation (GEE) or log-linear model for count data with the Poisson link. Because of the skewed nature of the LOS in an acute psychiatric ward, we used the same model but with the negative binomial link. Regarding percentages of readmissions to an acute psychiatric ward within 6 months and patients with unscheduled psychiatric outpatient visits, we used the logit link and binary distribution. The correlation structures for these models were exchangeable. We compared both the model-based (naive) and empirical (robust) covariance matrices to identify whether the model was adequate (if they were similar). For the one-year period (short-term period), we used the year 2009 as the baseline year, and we observed the DID results over the consecutive one year after the beginning of 2010. For the long-term period, we also used the year 2009 as the baseline year, and we observed the DID results over the consecutive four years after the beginning of 2010. The variables for the basic DID analysis included patient participation status, dummy variables for the intervention periods, and interaction terms for participation status and the intervention.

We controlled for two levels of confounders: patient-level factors, such as age, gender, income, comorbidity (Elixhauser index), severity (whether the patient was high risk), occupation, retirement (yes or no),[9] and trend, and facility-level factors,

such as level (tertiary, regional, district, clinic), ownership (public or private), teaching status (teaching hospital or not), and facility-level treatment volume. Regarding income, we used the premium category as a proxy to divide patients into four groups ($NT): no income, $1-$20,000, $20,001-$40,000 and ≥ $40,001.[10] The no income group consisted of patients who relied on their parents to pay premiums. We adopted the Elixhauser measure for the patient's comorbidity index.[11] The Elixhauser index (30 dichotomous variables) displayed statistical superiority to the Charlson index for comorbidity.[12] High-risk patients (severity) were defined based on more than 5 visits in the previous year due to 1) admission to an acute psychiatric ward with a primary ICD-9-CM diagnosis code of 295 or 2) injury/suicide and poisoning (ICD-9-CM 800-999), according to the P4P protocol.[4] The categories used for occupations in this study included public servants, employees, farmers, fishermen, veterans and their relatives, and no job or part-time job.[10] The index dates for the P4P and non-P4P groups were established as the last date the patient visited a specific facility each year to assess their complexities (comorbidities and high risk) and adverse outcomes.

We employed GEE models with patient- and hospital-level factors using backward elimination. The analysis was performed with SAS software version 9.4 (Statistical Analysis Systems, Inc., Cary, NC, U.S.). This study received ethics approval from the Institutional Review Board of Fu Jen Catholic University (IRB number C104144).

Results

After performing PSM for the data before 2010, there were a total of 746 subjects for the P4P group and 4,442 subjects for the non-P4P group in 2010. Table 1(main text) and Table 1(Appendix 3) show the characteristics of these subjects in 2010.
The final sample size of every group (adverse outcome) in 2010 is shown at the bottom of Appendix 2, Figure 1. For example, for the condition of compulsory admission, the final sample size was 719 for the P4P group and 4,024 for the non-P4P group in 2010.

In Table 2, the P4P participants were less likely than the non-P4P participants to make unscheduled psychiatric outpatient visits (i.e., interval ≥ 30 days) over the short term (1 year) (odds ratio [OR] = 0.63, $P < 0.001$) or the long term (4 years) (OR = 0.69, $P < 0.001$). In Table 3, patient participation in the schizophrenia P4P program was associated with reduced compulsory psychiatric admission visits over the long term (incidence rate ratio [IRR] = 0.33, $P < 0.05$). However, based on the results presented in Tables 3, 4 and 5, the P4P program was not significantly associated with reductions in any of the adverse outcomes over the long term, although reductions in ED visits for any disease, admissions to an acute psychiatric ward, LOS in an acute psychiatric ward, and readmission within 6 months were observed. Regarding other variables associated with the adverse outcomes over the long term, increased severity was the most powerful explanatory factor that accounted for these adverse outcomes,

such as increases in the number of ED visits for any disease, as presented in Table 3 (IRR = 2.57, $P < 0.001$). In addition to severity, patients with more diverse comorbidities were more likely to have higher numbers of adverse outcomes than other patients. In Table 4, patients with full-time jobs (public servants, employees or fisherman) displayed a lower number of admissions to an acute psychiatric ward and a shorter LOS in the acute ward than patients with no jobs or part-time jobs.

Discussion

To the best of our knowledge, this study is the first to evaluate a schizophrenia P4P program at a national level over a multi-year period. Patient participation in the schizophrenia P4P program was significantly associated with a shorter interval between outpatient visits over the short and long term and a reduction in compulsory admissions over the long term. However, this program was not significantly associated with reductions in the other complicated adverse outcomes, such as ED

visits for any disease, admissions to an acute psychiatric ward, and readmission within 6 months, over both the short and long term. Several schizophrenia P4P policy implications can be proposed based on the results from Taiwan.

Our research yielded results similar to the findings of previous studies showing that high-risk patients or patients with more diverse comorbidities present more adverse outcomes than other patients.[13-15] Regarding socioeconomic status, our study demonstrated that patients with a regular job had fewer adverse outcomes than those without a regular job, which is similar to previous research showing that high quality of life scores positively correlate with the employment status of patients with schizophrenia.[16]

The key component of the P4P program related to the reductions in compulsory admissions and unscheduled outpatient visits was disease management. Distinctive patient-centered care (PCC)-oriented activities in disease management were implemented, such as the enhancement of patient involvement and the encouragement of hopeful feelings, which can exert positive effects on the autonomy or satisfaction of patients with schizophrenia.[17,18] As shown in our previous study, patients with schizophrenia who participated in the P4P program reported greater satisfaction than non-P4P patients.[19] Patients with schizophrenia who have higher satisfaction may engage in less self-harm or fewer dangerous behaviors or have greater awareness of their illness, which may be associated with a lower likelihood of compulsory admissions. In addition, the disease management component of the schizophrenia P4P program could also help patients make scheduled visits to psychiatric services in an outpatient setting (leading to shorter intervals between outpatient visits), but perhaps nothing more can be gained.

Regarding the other complicated adverse outcomes, our study showed that the schizophrenia P4P program was not associated with a reduction in these outcomes;

instead, complexity and socioeconomic status were associated with these outcomes. For patient comorbidity, patients with serious mental health problems are at considerably higher risk of physical ill health than the general population.[20] Hence, to prevent increased patient comorbidity, holistic health promotion activities are essential. To provide sufficient health promotion advice, the U.K.'s Quality and Outcomes Framework (QOF) requires providers to conduct annual reviews, including alcohol/drug use, smoking, blood pressure, cholesterol checks, and BMI, for patients with schizophrenia.[20] However, according to the four components of the P4P program in Taiwan, holistic health promotion activities are not the main focus. In addition, the schizophrenia P4P program in Taiwan is not the same as programs for other chronic diseases, such as the diabetes P4P program,[21] and specific and simple outcomes for use as incentive targets are typically difficult to identify.[1] The NHIA has adopted proxy complicated adverse outcome measures, as mentioned above, which are difficult for facilities to control alone. For example, in our study, patients with low socioeconomic status, such as patients with part-time jobs or patients with more comorbidities, were more likely to experience these adverse outcomes, and this situation is difficult for a facility to improve alone. Finally, for schizophrenia P4P programs, although the amount of the incentive is not high, facilities in Taiwan are still willing to hire part-time case managers to execute the disease management program. However, for a part-time case manager, it is difficult to comprehensively handle high-risk patients (severity) in order to prevent the occurrence of these complicated adverse outcomes.[10] In summary, based on Taiwan's experience, more sophisticated activities, such as holistic health promotion and refined disease management targeting disadvantaged patients, including patients with highly complex conditions or low socioeconomic status, should be implemented to further reduce these complicated adverse outcomes. However, these activities require a greater

monetary investment in disease management or must be implemented outside the P4P program as another government-supported program.

In addition to the aforementioned reasons, the incentive structure of the schizophrenia P4P program, which was designed as a pay-for-improvement program, may also be ineffective in reducing complicated adverse outcomes. Pay-for-improvement theoretically increases the quality of a low-performing facility because some barriers, such as resource constraints or patients with disadvantaged characteristics, hinder performance improvement for these facilities compared to high-performing facilities.[22,23] However, empirical studies reported that pay-for-improvement alone does not enhance quality improvements.[24,25] Perhaps the pay-for-improvement design targeting complicated adverse outcomes in Taiwan may not drive low-performing facilities to overcome the aforementioned barriers.

Our study has some limitations. First, regarding confounders in the regression model, not all of the important patient-related data were available in the NHIA databases, such as the Clinical Global Impressions [CGI] for measuring symptom severity;[26] thus, we were unable to completely eliminate the possibility of an unobserved confounder bias in the experimental group. However, in this study, we included important patient characteristics, such as age, gender, income, employment, retirement, and comorbidity, and we defined a high-risk group as a proxy to control for patient severity in the regression model. We postulate that the confounder bias has been minimized. Second, regarding the exclusion of regularly-visiting patients from the P4P program, in normal situations, patients with schizophrenia in the regular group should all be enrolled in the P4P program.[4] However, in a very few cases, although patients were on the regular group list based on the inclusion criteria of the previous year, the facility may not have enrolled them in the program because they may have frequently visited another facility during this year. Actually, if

regularly-visiting patients were excluded from one facility in any year from 2010 to 2013, another facility had to enroll them in the P4P program; therefore, we believe that the exclusion of regularly-visiting patients in the P4P program resulted in minimal bias in our study.

Conclusions

Although the disease management component of the P4P program can be beneficial for compulsory admissions, more sophisticated activities, such as health promotion targeting disadvantaged patients, could be implemented to reduce the occurrence of more complicated adverse outcomes.

References

1. Stewart RE, Lareef I, Hadley TR, Mandell DS. Can We Pay for Performance in Behavioral Health Care? *Psychiatr Serv.* 2017;68:109-111.
2. Chen LH, Chang FC, Chien I, C., Day G, I. Effects of a pay-for-performance program for schizophrenia at a psychiatric hospital in northern Taiwan. *Taiwan J Public Health.* 2016;35:173-186.
3. Chen LN, Kung PT, Y. CH, Tsai WC. The impact of pay for performance on emergency department visits by and acute readmissions of patients with schizophrenia. *Taiwan J Public Health.* 2017;36:148-160.
4. National Health Insurance Association (NHIA). 2014. Schizophrenia pay-for-performance 3th version of proposal. [accessed on November 30, 2017]. Available at: http://sc-dr.tw/news/103/07/07160101.pdf (In Chinese).
5. Pham HH, Schrag D, O'Malley AS, Wu B, Bach PB. Care patterns in Medicare and their implications for pay for performance. *N Engl J Med.* 2007;356:1130-1139.
6. Rosenbaum PR, Rubin DB. The Central Role of the Propensity Score in

Observational Studies for Causal Effects. *Biometrika.* 1983;70:41-55.

7. Ryan AM, Krinsky S, Maurer KA, Dimick JB. Changes in Hospital Quality Associated with Hospital Value-Based Purchasing. *N Engl J Med.* 2017;376:2358-2366.
8. Daw JR, Hatfield LA. Matching and Regression to the Mean in Difference-in-Differences Analysis. *Health Serv Res.* 2018;53:4138-4156
9. Wu CH, Wang J, Lin WD. The Effect of Early Retirement on Health Care Expenditure. *Taiwan J Public Health.* 2014;33:51-62.
10. Chen TT, Hsueh YA, Ko CH, Shih LN, Yang SS. The effect of a hepatitis pay-for-performance program on outcomes of patients undergoing antiviral therapy. *Eur J Public Health.* 2017;27:955-960.
11. Elixhauser A, Steiner C, Harris DR, Coffey RM. Comorbidity measures for use with administrative data. *Med Care.* 1998;36:8-27.
12. Southern DA, Quan H, Ghali WA. Comparison of the Elixhauser and Charlson/Deyo methods of comorbidity measurement in administrative data. *Med Care.* 2004;42:355-360.
13. Protty MB, Lacey A, Smith D, Hannoodee S, Freeman P. Increased morbidity, mortality and length of in-hospital stay for patients with acute coronary syndrome with pre-morbid psychiatric diagnoses. *Int J Cardiol.* 2017;236:5-8.
14. Liu J, Brown J, Morton S, et al. Disparities in diabetes and hypertension care for individuals with serious mental illness. *Am J Manag Care.* 2017;23:304-308.
15. Kalseth J, Lassemo E, Wahlbeck K, Haaramo P, Magnussen J. Psychiatric readmissions and their association with environmental and health system characteristics: a systematic review of the literature. *BMC Psychiatry.* 2016;16:376.

16. Cai C, Yu L. Quality of Life in Patients With Schizophrenia in China: Relationships Among Demographic Characteristics, Psychosocial Variables, and Symptom Severity. *J Psychosoc Nurs Ment Health Serv.* 2017;55:48-54.
17. Chue P. The relationship between patient satisfaction and treatment outcomes in schizophrenia. *J Psychopharmacol.* 2006;20:38-56.
18. Oles SK, Fukui S, Rand KL, Salyers MP. The relationship between hope and patient activation in consumers with schizophrenia: Results from longitudinal analyses. *Psychiatry Res.* 2015;228:272-276.
19. Chen TT, Yang JJ, Huang CY, Tsai SL, Wang V, Huang HC. The Effect of a Schizophrenia Pay-for-Performance Program on Patient Satisfaction. 2019 (Submitted to journal).
20. Gutacker N, Mason AR, Kendrick T, et al. Does the quality and outcomes framework reduce psychiatric admissions in people with serious mental illness? A regression analysis. *BMJ Open.* 2015;5:e007342.
21. Kornelius E, Chiou JY, Yang YS, Lu YL, Peng CH, Huang CN. The Diabetes Shared Care Program and Risks of Cardiovascular Events in Type 2 Diabetes. *Am J Med.* 2015;128:977-985 e973.
22. Rosenthal MB, Landon BE, Normand SL, Frank RG, Epstein AM. Pay for performance in commercial HMOs. *N Engl J Med.* 2006;355:1895-1902.
23. Jha AK, Orav EJ, Epstein AM. The effect of financial incentives on hospitals that serve poor patients. *Ann Intern Med.* 2010;153:299-306.
24. Shih T, Nicholas LH, Thumma JR, Birkmeyer JD, Dimick JB. Does pay-for-performance improve surgical outcomes? An evaluation of phase 2 of the Premier Hospital Quality Incentive Demonstration. *Ann Surg.* 2014;259:677-681.
25. Ryan AM, Blustein J, Casalino LP. Medicare's flagship test of

pay-for-performance did not spur more rapid quality improvement among low-performing hospitals. *Health Aff (Millwood)*. 2012;31:797-805.

26. Busner J, Targum SD. The clinical global impressions scale: applying a research tool in clinical practice. *Psychiatry (Edgmont)*. 2007;4:28-37.

Table 1. Characteristics of patients with schizophrenia in 2010

	n (%)
Total n	5188 (100)
Age, y (SE*)	40 (0.2)
Gender	
Female	2666 (51.4)
Male	2522 (48.6)
Income	
≥ US$1,333	90 (1.7)
US$667-1,332	1323 (25.5)
US$1-666	2682 (51.7)
No income	1093 (21.1)
Job	
Public servant	87 (1.7)
Employee	1378 (26.6)
Farmer	269 (5.2)
Fisherman	102 (1.9)
Veterans and relatives	79 (1.5)
No job or part-time job	3273 (63.1)
High risk (severity)	
No	4970 (95.8)
Yes	218 (4.2)
Retired	
No	4367 (84.2)
Yes	821 (15.8)

Notes: SE*: standard error. No income: reliant on parents; US$1=NT$30

Table 2 ORs of unscheduled outpatient visits to psychiatric services (interval ≥ 30 days)

	2009 to 2010 (short term) OR (95% CI)	2009 to 2013 (long term) OR (95% CI)
P4P enrollee	0.32 (0.27, 0.38)***	0.33 (0.28, 0.39)***
After intervention (time)	1.31 (1.19, 1.43)***	1.22 (1.10, 1.35)***
P4P enrollee * time	0.63 (0.52, 0.77)***	0.69 (0.58, 0.81)***
Trend		1.04 (1.01, 1.07)**
Severity	2.19 (1.61, 2.97)***	2.12 (1.74, 2.59)***
Employee (Ref: no job or part-time job)	0.54 (0.51, 0.57)*	1.17 (1.07, 1.28)***
Paralysis		2.04 (1.14, 3.63)*
Facility level (Ref: clinics and other		

facilities)		
Tertiary	1.57 (1.32, 1.87)***	1.68 (1.46, 1.92)***
Regional	1.72 (1.46, 2.03)***	1.79 (1.57, 2.03)***
District	1.52 (1.27, 1.83)***	1.49 (1.29, 1.72)***

Note: Ref = reference; OR = odds ratio; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$. CI = confidence interval; P4P = pay for performance

Table 3. IRRs for compulsory admissions and ED visits of patients with schizophrenia

	2009 to 2010 (short term) Compulsory admission IRR (95% CI)	2009 to 2013 (long term) Compulsory admission IRR (95% CI)	2009 to 2010 (short term) ED visits IRR (95% CI)	2009 to 2013 (long term) ED visits IRR (95% CI)
P4P enrollee	2.02 (0.88, 4.61)*	1.87 (0.82, 4.28)	1.29 (1.00, 1.67)*	1.22 (0.96, 1.55)
After intervention (time)	0.57 (0.29, 1.10)*	0.70 (0.42, 1.17)	0.98 (0.88, 1.10)	0.99 (0.90, 1.08)
P4P enrollee * time	0.21 (0.02, 1.85)	0.33 (0.12, 0.92)*	0.85 (0.71, 1.02)	0.86 (0.72, 1.03)
Age			0.99 (0.98, 1.00)**	0.99 (0.98, 0.99)***
Gender			0.78 (0.68, 0.90)***	0.87 (0.77, 0.97)*
Severity	5.25 (2.57, 10.72)***	9.21 (5.29, 16.05)***	3.12 (2.37, 4.12)***	2.57 (2.16, 3.06)***
Employee (Ref: No job or part-time job)		0.57 (0.33, 0.99)*		
Cardiac arrhythmia			1.96 (1.28, 2.98)**	1.73 (1.37, 2.18)***
Neurological disorder			1.45 (1.77, 1.80)***	1.35 (1.14, 1.61)***
COPD			2.13 (1.63, 2.79)***	1.65 (1.42, 1.92)***
Peptic ulcer			1.92 (1.53, 2.41)***	1.68 (1.48, 1.91)***
Lymphoma			0.49 (0.33, 0.71)***	0.78 (0.62, 0.97)*
Weight loss			1.78 (1.13, 2.80)*	1.44 (1.12, 1.85)**
Fluid and electrolyte disorders			2.57 (1.77, 3.73)***	1.98 (1.56, 2.51)***

Alcoholic abuse	2.99 (1.94, 4.62)***	2.30 (1.74, 3.02)***
Drug abuse	1.46 (1.11, 1.92)**	1.43 (1.17, 1.75)***
Depression	1.88 (1.61, 2.19)***	1.80 (1.63, 1.99)***

Notes: Ref = reference; IRR = incidence rate ratio; ED = emergency department; No income = reliant on parents; CI = confidence interval;

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$

P4P = pay for performance; COPD = chronic obstructive pulmonary disease

Table 4. IRRs of admission to the acute ward and LOS in the acute ward for patients with schizophrenia

	2009 to 2010 (short term) Acute ward visits IRR (95% CI)	2009 to 2013 (long term) Acute ward visits IRR (95% CI)	2009 to 2010 (short term) LOS in acute ward IRR (95% CI)	2009 to 2013 (long term) LOS in acute ward IRR (95% CI)
P4P enrollee	0.96 (0.80, 1.15)	0.96 (0.81, 1.15)	1.00 (0.78, 1.28)	0.94 (0.74, 1.20)
After intervention (time)	0.89 (0.80, 0.98)*	0.92 (0.83, 1.03)	0.72 (0.62, 0.84)***	0.75 (0.67, 0.84)***
P4P enrollee * Time	0.78 (0.61, 1.00)	0.85 (0.70, 1.03)	1.03 (0.73, 1.46)	0.92 (0.70, 1.20)
Age	0.98 (0.98, 0.99)***	0.98 (0.98, 0.98)***	0.98 (0.97, 0.99)***	0.98 (0.97, 0.98)***
Trend		0.96 (0.93, 1.00)*		
Severity	4.72 (4.05, 5.50)***	4.55 (4.07, 50.8)***	5.31 (4.16, 6.76)***	4.84 (4.03, 5.81)***
Income				
(Ref: No income)				
US$667-1,332	1.32 (1.12, 1.56)***	1.29 (1.15, 1.45)***	1.39 (1.09, 1.77)**	1.39 (1.16, 1.67)***
Job				
(Ref: No job or part-time job)				
Public servant	0.44 (0.21, 0.93)*	0.49 (0.31, 0.78)**	0.21 (0.08, 0.55)**	0.22 (0.12, 0.39)***
Employee	0.67 (0.57, 0.80)***	0.71 (0.63, 0.80)***	0.58 (0.46, 0.74)***	0.56 (0.47, 0.66)***
Fisherman	0.25 (0.14, 0.47)***	0.36 (0.24, 0.53)***	0.21 (0.08, 0.56)**	0.35 (0.19, 0.63)***
Neurological disorder	1.43 (1.18, 1.74)***	1.39 (1.22, 1.59)***		

Fluid and electrolyte disorders	1.86 (1.36, 2.56)***	1.86 (1.53, 2.27)***	2.21 (1.37, 3.55)**	2.41 (1.91, 3.03)***
Deficiency anemia	1.90 (1.29, 2.80)**	1.68 (1.27, 2.21)***	2.29 (1.34, 3.92)**	1.60 (1.12, 2.29)**
Alcoholic abuse	1.57 (1.15, 2.14)**	1.62 (1.33, 1.98)***		1.82 (1.43, 2.33)***
Drug abuse	1.55 (1.15, 2.07)**	1.55 (1.26, 1.91)***	1.50 (1.06, 2.11)**	1.68 (1.30, 2.18)***
Depression	1.28 (1.13, 1.45)***	1.25 (1.14, 1.38)***	1.27 (1.06, 1.52)**	1.19 (1.03, 1.36)*
Facility level (Ref: clinics)				
Tertiary		1.51 (1.12, 2.02)**		
Regional		1.49 (1.11, 1.98)**		
District	1.42 (1.20, 1.69)***	1.73 (1.40, 2.14)***	1.87 (1.46, 2.41)***	1.40 (1.14, 1.71)**
Public hospital	1.45 (1.29, 1.64)***	1.39 (1.26, 1.54)***	1.59 (1.34, 1.88)***	1.65 (1.44, 1.90)***
Teaching status	1.79 (1.51, 2.12)***	1.34 (1.08, 1.69)**	2.26 (1.77, 2.88)***	1.83 (1.51, 2.21)***

Notes: Ref = reference; IRR = incidence rate ratio; CI = confidence interval; LOS = length of stay; No income = reliant on parents; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; P4P = pay for performance

Table 5. ORs for patients undergoing readmission to an acute psychiatric ward within 6 months of a prior admission

	2009 to 2010 (short term)	2009 to 2013 (long term)
	OR (95% CI)	OR (95% CI)
P4P enrollee	1.68 (0.99, 2.86)	1.71 (1.04, 2.79)*
After intervention (time)	0.85 (0.60, 1.21)	0.85 (0.65, 1.12)
P4P enrollee * time	0.71 (0.34, 1.50)	0.76 (0.44, 1.30)
Age		0.99 (0.98, 1.00)*
Severity	20.23 (15.41, 26.56)***	15.63 (12.98, 18.82)***
Employee (Ref: no job or part-time job)	0.47 (0.27, 0.81)**	0.62 (0.44, 0.88)**
Fluid and electrolyte disorders		1.89 (1.14, 3.11)*
Deficiency anemia		2.91 (1.55, 5.46)***

Notes: Ref = reference; OR = odds ratio; CI = confidence interval; *$P < 0.05$; **$P < 0.01$; ***$P < 0.001$; P4P = pay for performance