Impact of Pay-for-performance Incentives for Contracted Family Doctor Service among Primary Healthcare Providers on Diabetes Care in China

Yinzi Jin  
Peking University

Wenya Tian  
Peking University

Yahang Yu  
Peking University

Wen Pan  
Peking University

Beibei Yuan (✉ beibeyuan@pku.edu.cn)  
Peking University

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Abstract

Background: As the first step towards building a gatekeeping system in China, the governments have introduced a contracted family doctor service (CFDS) policy in primary healthcare (PHC) facilities since 2016. The impact of performance-based salary (PBS) system incentive on performance remained unknown. This study was to examine the association between the PBS adding incentive for CFDS and the performance indicators of diabetes care.

Methods: We conducted a cross-sectional study in 72 PHC facilities in 6 cities that piloted the CFDS, extracting 827 PHC health workers and 420 diabetes patients. The PHC health workers’ performance on delivery of diabetes care focused on the continuity and coordination of care. The outcome performance of diabetes care was measured by patients’ utilization of diabetes care and control of blood glucose reported by patients.

Results: PHC health workers whose performance on contracted service was included in the overall performance assessment had 0.279 (95% CI 0.031-0.526) more score of the continuity of care, and had 92.6% (OR 1.926, 95% CI 1.160-3.197) higher likelihood of good coordination of care. PHC health workers whose performance linked with increased income were 168.1% (OR 2.681, 95% CI 1.502-4.788) and 78.0% (OR 1.780, 95% CI 1.220-2.597) more likely to have good continuity and coordination of care, respectively. The facility level analysis showed that additional one-point percentage of PHC health workers whose performance on contracted service was included in the overall performance assessment, and additional one-point percentage of whose performance assessment increased their income was associated with 7.192 (OR 8.192, 95% CI 1.903-35.266) times and 52.2% (OR 1.522, 95% CI 1.055-2.196) higher probability of having their patients with control of blood glucose. Additional one-point percentage of PHC health workers whose performance assessment increased their income was associated with 0.559 (95% CI 0.139-0.979) more score on patients’ utilization of diabetes care.

Conclusions: Inclusion of the requirements on CFDS into the assessment criteria, and adding the incentives rewarding better performance on contracted family doctors into PBS system for PHC health workers were associated with better delivery process and outcome performance on diabetes care.

Introduction

There were an estimated 422 million people suffering from diabetes, and up to 8.5% of the world’s population aged over 18 years in 2014. ¹ In China, the number of adult diabetes patients is as high as 114 million, ranking first globally, accounting for more than a quarter of the total number of the world’s diabetes. ² The prevalence of diabetes in China is increasing from 0.9% in 1990 to 11.2% in 2017. ³ However, a nationally representative survey in 2013 found that only about 30% of patients with type 2 diabetes were being treated, among which 40% achieved glycemic control. ⁴ The epidemic of diabetes is associated with high economic burden, impaired physical health, and reduced life quality, imposing a high burden on the adults. ⁵
The successful management of type 2 diabetes requires continuity and coordination of care, which are two key perspectives of quality of care. Continuity of care needs patient's 'continuous caring relationship' with an identified healthcare provider. Coordination of care refers to the delivery of a 'seamless services' through the sharing of information between different departments inside a health facility or among different level of healthcare providers. Doctors and other health workers in primary healthcare (PHC) facilities are in a central position to coordinate the diabetes patients’ care needs, from early detection to disease management. And the contractual arrangements between patients and primary healthcare doctors can be a facilitator for building stable relationship and continuous care. As the first step towards building a gatekeeping system in China, the governments have introduced a “contracted family doctor service” (CFDS) policy by which each resident would be registered with a team of PHC health workers including doctors, nurses and public health personals since 2016. National government of China set goals for this policy, including achieving a 30% rate of residents covered by contract services by 2017 and universal coverage to be achieved by 2020. However, this policy is still in an early stage, and the scaling up has been hindered by several factors, including the low motivation of health workers in PHC facilities because of the weakness in design of financial incentives for contract services.

In China, doctors and other health workers in PHC facilities are employees of PHC facilities, and they are paid by a performance-based salary system (PBS). In this payment system recommended by national policy guidance, total amount of salary included two parts: one basic salary (60–70% of the total income) and one performance-based bonus salary (30–40% of the total income). To further improve the incentives, later policies repeatedly mentioned “enlarge the variation of total income distribution among PHC facilities employees” and “appropriately increase the proportion of performance-based bonus salary in total salary”. Within allowed range of national policy documents, the specific design of PBS differed in different areas and different facilities in the same area, because current policies grant PHC facility the autonomy of setting proportion of performance-based part in total salary. It was reported that in practice, most of facilities used the quantity of services or the amount of workload as the major criteria of performance rather than the quality of care delivered.

A growing strand of literature has studied the aligning pay-for-performance incentive as an intervention for improving diabetes healthcare process and outcomes. Pay-for-performance is a payment policy that provides financial incentives to healthcare providers based on specific predetermined quality benchmarks, and PBS for health workers in PHC facilities in China is a kind of pay-for-performance targeting individual health workers. In 2009, China initiated basic public health services package and included diabetes patient management care in package, and in 2016 the “contracted family doctor service” policy was initiated and this policy prioritizes building the contracts with chronic disease patients. These two major policies implemented in PHC facilities resulted in that in many areas the PBS introduced the performance on management care and follow-up services as performance target linking to income to motivate PHC providers with the purpose to realize the quality of diabetes patient management. However, the impact of PBS incentive on performance remained unknown. Less is known
that whether the practices of health workers on diabetes patient management care have started to focus on continuity and coordination of diabetes care.

To fill this gap, this study aimed to explore the impact of the PBS adding incentive for CFDS on performance of diabetes management care in China.

**Methods**

**Study design and setting**

In this study, we used a multi-stage sampling in the cities of Tongren, Xining, Shenzhen, Xiamen, Fuyang and Suzhou, that piloted the CFDS in China. Study sites were selected based on the region, population size, and economic level. Two districts will be randomly selected in each of the six cities. In each district, 12 PHC facilities were randomly selected, including 6 community healthcare centers in urban areas and 6 township health centers in rural areas. All the health workers in PHC facilities on duty on the investigation day were included in the survey, including doctors, nurses, and public health workers. All the diabetes patients visiting PHC facilities for outpatient care on the investigation day were also interviewed. Finally, 72 PHC facilities, 827 PHC health workers and 420 diabetes patients were included in the analysis.

**Measurement**

**Dependent variables**

This study analyzed two levels of dependent variables on the process and outcome quality indicators of diabetes care, including the diabetes care delivery process of individual PHC health workers, diabetes patients’ outcomes in the utilization of services and self-reported blood glucose control at the level of patients.

The process quality of diabetes care focused on the continuity and coordination of care. The continuity of care was measured by “whether or not the health workers could follow the relevant information on the diabetes patients”, including “medical history” (1 = yes, 0 = no), “status of blood glucose control” (1 = yes, 0 = no), “lifestyle pattern” (1 = yes, 0 = no), “treatment plan at PHC facility” (1 = yes, 0 = no), and “treatment plan at other institutions” (1 = yes, 0 = no). Six items were summed to create the number of categories of patients’ information which were followed by the doctors or other health workers, and this summed variable ranged from 0 to 5. The coordination of care was measured by the extent of information sharing on diabetes care between departments within the facility (1 = good, and 0 = bad), and the sharing of patients’ information on diabetes management between the PHC facility and other institutions (1 = good, and 0 = bad).

The outcome performance of diabetes care was also measured by the diabetes patients’ utilization of services and self-reported health outcome. The utilization of services was assessed by the categories of services received by patients, including medicine consultation (1 = yes, 0 = no), physical examination (1 = yes, 0 = no), biochemical examination (1 = yes, 0 = no), blood glucose testing (1 = yes, 0 = no), formulating
a emergency treatment plan (1 = yes, 0 = no), making a lifestyle modification plan (1 = yes, 0 = no), health education (1 = yes, 0 = no), management of medical records (1 = yes, 0 = no), and making an appointment for follow-up (1 = yes, 0 = no). These nine variables were summed to create the number of service category received by patients, ranging from 0 to 9. The health outcome performance was measured by blood glucose control status reported by patients with the code of 1 indicating that patients achieved glycemic control, and the code of 0 indicating that patients had not achieved glycemic control.

**Independent variables**

The key independent variable analyzed in this study is related to the design of incentive in PBS for health workers in PHC facilities, which was measured by whether the performance of CFDS is added into the overall performance assessment system (yes or no), and whether the performance of CFDS was linked with the increase of personal income of PHC providers (yes or no).

The influence of PBS design on delivery process performance was analyzed at individual level, and the analysis on patients’ utilization and health outcomes was measured at facility level. We imputed the percentage of health workers whose performance on CFDS has been included in the overall performance assessment in a facility, and this imputed variable was divided into trisections (low-, middle-, or high-level). We also imputed the percentage of health workers who answered that their performance on CFDS increased their income, and this imputed variable was also divided into three equal parts (low-, middle-, or high-level).

**Control variables**

In the individual level analysis, control variables were sociodemographic characteristics of health workers, including sex (male or female), age (< 30, 30–40, 40–55, or > 55), educational background (high school and below, junior college, bachelor, or master and above), and employment status (permanent or temporary). In the facility level analysis, sociodemographic characteristics of diabetes patients were also added as other control variables, including sex (male or female), age (< 45, 45–60, 60–75, or > 75), educational background (illiteracy, primary school, junior high school, high school and technical secondary school, or junior college and above), health insurance (yes or no) and having other chronic diseases (yes or no).

**Statistical analysis**

We conducted descriptive analyses to examine the characteristics of PHC health workers and diabetes patients. Chi-square tests were used to test the differences in socio-demographic characteristics of health workers and patients with diabetes. Multivariate logistic regression models at the unit of individual health workers were used to investigate the association between the incentives on family doctor contract services and the continuity and coordination of diabetes management care. Multilevel multivariate regression models at the unit of health facility were used to investigate the association between PBS incentives for family doctor contract services and patients’ utilization of management care and blood glucose control. To account for unmeasured variations within each facility, we applied multilevel random intercept analyses to process the two-level structure of patient-level and institutional-level data. All the
models were adjusted for control variables reported by coefficients (Coef.) or odds ratios (ORs) with corresponding 95% confidence intervals (CI). All statistical analyses were conducted using Stata V.15.0.

Results

Descriptive Results

Table 1 presents the characteristics of PHC health workers. Among the 827 investigated health workers, the majority were female (77.0%), had education level of bachelor (64.6%), and had permanent employment status (63.2%). About 87.8% of investigated health workers reported that their performance on CFDS has been added into the overall performance assessment, and 57.9% reported that their income has ever been increased because their performance on CFDS. For PHC health workers whose performance on CFDS was added in assessment, they performed better on three performance indicators of diabetes management care than the health workers whose provision of contracted services were not assessed: the score of continuity of care (4.323 vs 3.969, p = 0.005), the percentage of good sharing information within facility (92.5% vs 86.4%, p = 0.050), the percentage of good sharing information between institutions (78.7% vs 68.9%, p = 0.036). PHC health workers whose performance on contracted services had linked to the increase of their income had higher score of continuity of care (4.362, 4.136 vs 4.168, p = 0.064), and had higher percentage of good sharing information within institution (95.1%, 85.0% vs 87.4%, p = 0.001), than whose performance on contracted services did not change their income.
|               | Total, n (%) | Mastery of patient’s information, mean (SD) | P     | Information sharing within institution, n (%) | P     | Information sharing with other institutions, n (%) | P     |
|---------------|--------------|---------------------------------------------|-------|-----------------------------------------------|-------|---------------------------------------------------|-------|
| **Sex**       |              |                                             |       |                                               |       |                                                   |       |
| Male          | 190 (23.0%)  | 4.335 (1.047)                               | 0.504 | 155 (87.1%)                                   | 0.010 | 127 (73.4%)                                       | 0.145 |
| Female        | 635 (77.0%)  | 4.269 (1.200)                               |       | 546 (93.2%)                                   |       | 454 (78.7%)                                       |       |
| **Age**       |              |                                             |       |                                               |       |                                                   |       |
| < 30          | 244 (29.5%)  | 4.170 (1.214)                               | 0.100 | 197 (90.0%)                                   | 0.128 | 175 (81.0%)                                       | 0.472 |
| 30–40         | 401 (48.5%)  | 4.379 (1.130)                               |       | 345 (92.3%)                                   |       | 278 (76.0%)                                       |       |
| 40–50         | 147 (17.8%)  | 4.172 (1.210)                               |       | 135 (95.1%)                                   |       | 105 (75.5%)                                       |       |
| > 50          | 35 (4.2%)    | 4.364 (1.055)                               |       | 26 (83.9%)                                    |       | 25 (80.7%)                                        |       |
| **Educational background** |              |                                             |       |                                               |       |                                                   |       |
| High school and below | 32 (3.9%)  | 4.063 (1.343)                               | < 0.001 | 28 (93.3%)                                   | 0.503 | 28 (90.3%)                                       | 0.029 |
| Junior college | 213 (25.8%)  | 4.043 (1.301)                               |       | 182 (91.5%)                                   |       | 160 (82.1%)                                       |       |
| Bachelor      | 534 (64.6%)  | 4.343 (1.118)                               |       | 450 (91.3%)                                   |       | 365 (75.9%)                                       |       |
| Master and above | 48 (5.8%)  | 4.783 (0.664)                               |       | 43 (97.7%)                                    |       | 30 (66.7%)                                        |       |
| **Employment status** |              |                                             |       |                                               |       |                                                   |       |
| Temporary     | 274 (33.1%)  | 4.170 (1.229)                               | 0.157 | 239 (92.3%)                                   | 0.483 | 206 (81.8%)                                       | 0.138 |
| Permanent     | 523 (63.2%)  | 4.331 (1.151)                               |       | 440 (91.9%)                                   |       | 356 (75.3%)                                       |       |
| NA            | 30 (3.6%)    | 4.413 (0.825)                               |       | 24 (85.7%)                                    |       | 21 (77.8%)                                        |       |
| Total, n (%) | Mastery of patient’s information, mean (SD) | Information sharing within institution, n (%) | Information sharing with other institutions, n (%) |
|-------------|---------------------------------------------|-----------------------------------------------|-----------------------------------------------|
| **Whether the performance of contracted service is included in the overall performance assessment** | | | |
| No | 101 (12.2%) | 3.969 (1.439) | 0.005 | 76 (86.4%) | 0.050 | 62 (68.9%) | 0.036 |
| Yes | 726 (87.8%) | 4.323 (1.121) | | 627 (92.5%) | | 521 (78.7%) | |
| **How the performance of contracted service influences the personal income** | | | | |
| None | 325 (39.3%) | 4.168 (1.205) | 0.064 | 264 (87.4%) | 0.001 | 223 (74.1%) | 0.163 |
| Decrease in income | 23 (2.8%) | 4.136 (1.246) | | 17 (85.0%) | | 16 (84.2%) | |
| Increase in income | 479 (57.9%) | 4.362 (1.136) | | 422 (95.1%) | | 344 (79.6%) | |

Table 2 presents the characteristics of diabetes patients. Among the 420 patients, 54.2% were female, 53.3% were between the ages of 60 and 75, 97.9% had health insurance, and 76.6% had other chronic diseases. Table 3 presents the patients’ utilization of diabetes care, the self-reported control of blood glucose, and the facility-level incentive design of PBS for motivating the contracted service. For PHC facilities with high percentage of health workers whose performance on contracted service has started to be assessed, the rate of patients with blood glucose under control was higher (82.6%) than the rate of patients covered by facilities with middle (77.4%) and low (67.2%) level percentages of health workers who has been assessed regarding the contracted services (p = 0.011). For PHC facilities with high percentage of health workers whose performance on CFDS was linked with increased income, the score of patients’ utilizations of diabetes treatment care were higher (Mean 6.72, SD 1.96) than those with middle (Mean 5.94, SD 1.96) and low (Mean 5.53, SD 2.16) level percentages of health workers whose income level was linked with the performance on CFDS (p < 0.001).
|                  | Total, n (% | Diabetic treatment, mean (SD) | P   | Blood sugar control, n (%) | P   |
|------------------|-------------|-------------------------------|-----|---------------------------|-----|
| **Sex**          |             |                               |     |                           |     |
| Male             | 192 (45.8%) | 6.200 (2.194)                 | 0.718 | 145 (78.4%)                | 0.266 |
| Female           | 227 (54.2%) | 6.121 (2.191)                 |      | 159 (73.6%)                |      |
| **Age**          |             |                               |     |                           |     |
| <45              | 21 (5.0%)   | 6.238 (2.234)                 | 0.371 | 15 (75.0%)                 | 0.998 |
| 45–60            | 113 (26.9%) | 5.963 (2.236)                 |      | 83 (76.2%)                 |      |
| 60–75            | 224 (53.3%) | 6.318 (2.162)                 |      | 162 (76.1%)                |      |
| >75              | 62 (14.8%)  | 5.864 (2.177)                 |      | 45 (75.0%)                 |      |
| **Educational background** |       |                               |     |                           |     |
| Illiteracy       | 95 (22.7%)  | 6.032 (2.113)                 | 0.945 | 66 (73.3%)                 | 0.731 |
| Primary school   | 104 (24.8%) | 6.097 (2.176)                 |      | 80 (80.0%)                 |      |
| Junior high school | 115 (27.5%) | 6.252 (2.226)                 |      | 81 (73.0%)                 |      |
| High school and technical secondary school | 70 (16.7%) | 6.212 (2.324) | 52 (77.6%) |
| Junior college and above | 35 (8.4%) | 6.286 (2.136) | 26 (78.8%) |
| **Health insurance** |       |                               |     |                           |     |
| No               | 9 (2.1%)    | 6.667 (1.732)                 | 0.478 | 7 (77.8%)                 | 0.892 |
| Yes              | 411 (97.9%) | 6.142 (2.198)                 |      | 298 (75.8%)                |      |
| **Having other chronic diseases** |       |                               |     |                           |     |
| No               | 98 (23.4%)  | 6.505 (2.123)                 | 0.075 | 78 (83.0%)                 | 0.062 |
Table 3
Facility-level incentive of performance-based salary system and patient-level diabetes services received and blood glucose control

| Percentage of whose performance of contracted service included in the overall performance assessment | Total, n (%) | Diabetic treatment, mean (SD) | P | Blood sugar control, n (%) | P |
|---|---|---|---|---|---|
| Low | 136 (32.4%) | 6.18 (2.21) | 0.387 | 88 (67.2%) | 0.011 |
| Middle | 140 (33.3%) | 5.96 (2.19) | | 103 (77.4%) | |
| High | 144 (34.3%) | 6.31 (2.17) | | 114 (82.6%) | |

| Percentage of whose performance of contracted service increases the personal income | Total, n (%) | Diabetic treatment, mean (SD) | P | Blood sugar control, n (%) | P |
|---|---|---|---|---|---|
| Low | 48 (11.4%) | 5.53 (2.16) | < 0.001 | 34 (72.3%) | 0.074 |
| Middle | 235 (55.9%) | 5.94 (2.26) | | 164 (72.6%) | |
| High | 137 (32.6%) | 6.72 (1.96) | | 107 (82.9%) | |

**Association between PBS incentive and performance on diabetes care**

Associations between the PBS incentive and the continuity and coordination of care at the individual level of health worker are shown in Table 4. PHC health workers with the performance on CFDS being assessed had 0.279 (Coef. 0.279, 95% CI 0.031–0.526, p = 0.028) higher score on the continuity of care, and had 92.6% (OR 1.926, 95% CI 1.160–3.197; p = 0.011) higher likelihood of sharing information on patients between institutions. PHC health workers whose income has been increased because of performance on contracted services were 168.1% (OR 2.681, 95% CI 1.502–4.788; p = 0.001) and 78.0%
(OR 1.780, 95% CI 1.220–2.597; p = 0.003) more likely to share information on patients within institution and between institutions, respectively.

Table 4

| Mastery of patients’ information | Information sharing within institution | Information sharing with other institutions |
|----------------------------------|----------------------------------------|--------------------------------------------|
| Coef. 95% CI  P   | OR 95% CI  P   | OR 95% CI  P   |
|----------------------------------|----------------------------------------|--------------------------------------------|
| Whether the performance of contracted service is included in the overall performance assessment (reference, no) |
| 0.279 [0.031, 0.526] 0.028 | 1.823 [0.909, 3.655] 0.091 | 1.926 [1.160, 3.197] 0.011 |
| How the performance of contracted service influences the personal income (reference, no change in income) |
| -0.035 [-0.539, 0.468] 0.890 | 0.740 [0.197, 2.781] 0.656 | 1.820 [0.490, 6.763] 0.371 |
| 0.093 [-0.080, 0.265] 0.293 | 2.681 [1.502, 4.788] 0.001 | 1.780 [1.220, 2.597] 0.003 |

Associations between PBS incentive and performance on diabetes care at facility level are shown in Table 5. Additional one-point percentage of health workers whose performance on CFDS has been assessed was associated with 7.192 (OR 8.192, 95% CI 1.903–35.266; p = 0.005) times of probability of more covered patients with blood glucose under control. Additional one-point percentage of health workers whose income has been increased because of performance on contracted services was associated with 52.2% (OR 1.522, 95% CI 1.055–2.196; p = 0.025) probability of more covered patients having blood glucose under control. Additional one-point percentage of PHC health workers whose income has ever been increased because of performance on contracted services was associated with 0.559 (Coef. 0.559, 95% CI 0.139–0.979; p = 0.009) more score on the covered patients’ utilization of management care.
Table 5
Associations between performance-based salary system incentive and performance on diabetes care at facility level

| Diabetic treatment                                      | Blood sugar control                                      |
|--------------------------------------------------------|----------------------------------------------------------|
| Coef. | 95% CI          | $P$ | OR | 95% CI          | $P$ |
|--------|-----------------|-----|----|-----------------|-----|
| Percentage of whose performance of contracted service included in the overall performance assessment | 0.272 | [-1.356, 1.900] | 0.743 | 8.192 | [1.903, 35.266] | 0.005 |
| Percentage of whose performance of contracted service increases the personal income | 0.559 | [0.139, 0.979] | 0.009 | 1.522 | [1.055, 2.196] | 0.025 |

Discussion

To the best of our knowledge, this study was the first to examine the impact of the adding incentive for CFDS into PBS for health workers in PHC facilities on their performance of diabetes care. In China, PHC facilities are not the point of first contact, and the residents, including the diabetes patients can choose to bypass PHC facilities to seek healthcare at high-level hospitals, which leads to escalating medical costs and low efficiency of whole health system. The implementation of CFDS is a critical way with the intention to change the traditional delivery pattern of China's PHC services. CFDS policy tries to build the multidisciplinary team, construct the stable relationship with patients, and improve the quality of PHC. As PHC facilities have autonomy in designing the detailed assessment criteria and PBS system of themselves, some facilities have started to use incentives to encourage the development of family doctor teams and quality of contracted services. Furthermore, in the pilots of contracted services, the first group of residents to be covered by contracted service all targeted the chronic disease patients, i.e. diabetes patients and high blood-pressure patients. So this study used the opportunity produced by different implementation status in different facilities, chose the outcomes in diabetes management care, and analyzed whether the incentives in PBS system had impacts on the performance of diabetes care, which was measured in the perspective of continuity and coordination of diabetes management care, patients' utilization of management care and self-reported control of blood glucose. The findings implied that the performance assessment and related incentive may significantly improve process and outcome quality of diabetes management care.

In this study, the key findings are the inclusion of performance of contracted service in the overall performance assessment was associated with the increasing the continuity and coordination of care. Health workers with experience of increasing income because of the performance on contracted service was associated with better coordination in the process of providing care.
Lack of financial incentive for PHC providers is one of the causes for the poor quality of PHC. First, the income level of health workers in PHC facilities was only about 30%-50% of their expected pay level. Second, regarding the payment method, i.e. PBS, the percentage of performance-based bonus on the total income is low, which has limited incentive power to guide the behavior of health worker. The CFDS policy tries to target these problems. The national policy guidance on the CFDS requires that PHC facilities include the contents of family doctor services into the performance assessment criteria of health workers, and increase the performance-related income to those with more contracted patients and better performance on contracted services. However, the implementation extent of different areas, different facilities, and different family doctor teams is different. In addition, the facility managers are in charge of design for the performance criteria and the performance target for their personnel. These varied situation in implementation process and among different facilities provided good opportunity for us to study the relationship between the addition incentives for contracted services and performance.

The contents of services contracted by family doctor team are designed by policy makers with the intention to solve some challenges for improving the quality of PHC. These challenges are mainly related to the continuity and coordination in PHC, and the coordination between PHC and hospital services.

Firstly, the services provided by PHC facilities inside are commonly fragmented. The medical services provided by physicians and nurses who are primarily paid by social health insurance and patients out-of-pocket payment; while public health services package provided by public health workers who are paid by the National Basic Public Health Service Program funds, with the aims to deliver essential public health services including diabetes management. There is limited coordination in monitoring, performance measurement, or management between the two programs, leading to little workflow interaction or information sharing between the programs. For instance, in diabetes management visits under the National Basic Public Health Service Program, patients can have blood glucose measurement and lifestyle consultations by public health workers, but cannot get prescriptions of hypoglycemic drugs from doctors. Furthermore, the electronic medical record system at PHC facilities is still commonly fragmented, of lack of integrating comprehensive information about individual patients. The resident health management document and medical records in outpatients and inpatients departments are kept by two separate information systems.

Secondly, the services provided by different levels of health providers are segmented. Because health system in China is featured by the fragmentation among different tiers of delivery institutions, PHC facilities are not the gatekeeper and patients have a strong preference to bypass the PHC facilities in favor of hospitals. As consequence, the lack of doctors being familiar with the patients and long-term follow-up by the same doctors is a barrier to improve the quality of chronic disease care.

National government policy guidance documents listed some minimum requirements on the package of contracted services, including a series of continuous services from common disease treatment, basic public health services, health management, health education and consultation, to referral to hospitals, etc. The package was mainly intended to solve the above fragmentation problems. The measurement
methods for the continuity and coordination of services in this study were designed based on the above service contents defined in these contract family doctor service documents. Continuity of care was measured by the awareness of health workers on the treatment and management experience of patients, which is the crucial function of family doctor team, i.e. the continuous caring and long-term relationship between patients and doctor. Coordination of care was measured by the level of information sharing inside the PHC facility and the level of information sharing between PHC facilities and hospitals. Care for chronic disease patients need coordination of screening, treatment, follow-up and management services, which are provided by different cadres in the same facility and different levels of health providers. As the major health manager for the contracted chronic disease patients, the family doctor team and its members have the responsibility in coordinating these services for their patients. Following the national suggestions, the contracted services were finally designed and were dependent on the design and capacity of different facility.

The finding on the positive relationship between incentive and better performance is consistent with the basic hypothesis that health workers seek to maximize the utility in the selection of work behaviors and the utility of health workers depends on their income and the health status of the contracted patients. The pay-for-performance incentive links quality of care by PHC health workers with their income, which guides PHC health workers seeking to increase their income through providing care of high quality to maximize their utility. Prior empirical studies also have the similar findings that the introduction of pay-for-performance incentive and linking remuneration for general practices to recorded quality of care for diabetes, can increase the provision performance of healthcare services.

In addition to the positive influence on provision behavior of PHC health workers, this study also find that the incentive is related to positive results on performance measured from the patients’ service utilization and health outcomes. The facility level analysis found that the facilities with higher percentage of health workers whose performance of contracted service had been assessed was associated with higher score on patients’ diabetes care utilization and blood glucose control, and facilities with higher percentage of health workers who had been rewarded because of better performance on contracted service was associated with better patients’ blood glucose control. The results of other studies showed that pay-for-performance incentive was not associated with patient outcomes of diabetes management. For instance, prior studies did not generate evidence supporting a beneficial effect of the pay-for-performance incentive on treatment (e.g., rate of HbA1c test, rate of lipid test, rate of dilated eye exam) and control. A synthesis result based on high-quality studies on effects of pay-for-performance incentives also found that the pay-for-performance incentive can only have impacts on service procedure outcomes which can totally controlled by health providers, but not on the patient outcome which can only partly controlled by health providers themselves. One possible reason is that our study used the self-reported service utilization and blood glucose control to measure the performance, which probably over-estimated the level of performance. Another possible reason is that the duration of incentives might be different in different studies, and the power of incentives is usually weakened over time, and in China the introduction of family doctor services and relevant incentives for PHC health workers just started.
Limitations

This study has several limitations. First, the observational nature of our study limited our ability to draw any causal inference from our findings. The results should not be interpreted as the effect of adding incentive into PBS system on diabetes care processes and outcomes. Rather, the association found in this study underscored the need for research to develop financial incentive policy to improve diabetes management. Second, this study could not consider the duration of the pay-for-performance incentive due to data limitation, which may modify the observed associations between the incentive and diabetes care in our study. Future studies should focus on more rigorous research, including randomized, controlled trials and observational studies with concurrent control groups, to assess the effectiveness of the incentive among the CFDS. And the longitudinal study and ongoing monitoring of the incentive program is critical to determine the effectiveness of incentives and the possible unintended effects on diabetes patients and health care providers. Third, the measurements of blood glucose control were performed by self-administrated method, which may lead to the self-administrated bias. However, the association between the incentive and performance on diabetes management care provide in-depth explanation and reliable support for policy importance to diabetes population in China.

Conclusions

The incentive linking income with performance on the CFDS in China PHC setting is probably positively associated with process and outcome performance on diabetes management care. Design and implementation of the incentive should be accompanied with the policy of CFDS, in order to increase the performance-related income of PHC providers with better performance, thereby improving the quality of diabetes management care and health status of diabetes patients.

Abbreviations

PBS: Performance-Based Salary; PHC: Primary Healthcare; CI: Confidence Interval; OR: Odds Ratios

Declarations

Ethics approval and consent to participate

The study has been approved by the Ethics Review Board of the School of Public Health, Peking University. Informed consent was obtained from all participants prior to questionnaire administration.

Consent for publication

Not applicable.

Availability of data and materials
The data used and/or analyzed during the study are available from the corresponding author on reasonable request.

**Competing interests**

All authors declare that they have no completing interests.

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**Authors’ contributions**

BY developed the study design. WT and YJ conducted data analysis and interpretation. YJ drafted the manuscript. BY reviewed the manuscript and provided revisions. All authors read and approved the final manuscript.

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