DLSU Business & Economics Review 28(1) 2018, pp. 110-127

RESEARCH ARTICLE

Physician Quality and Payment Schemes: A Theoretical and Empirical Analysis

Renz Adrian T. Calub
De La Salle University, Manila, Philippines
renz.calub@dlsu.edu.ph

Abstract: Physicians are expected to provide the best healthcare to their patients; however, it cannot be discounted that their practice is driven primarily by incentives. In this paper, a physician utility maximization model that links physician quality of service to compensation schemes was constructed. Results showed that relative to fixed payment, fee-for-service and mixed payment yield higher quality. Multinomial treatment effects regression of vignette scores on payment schemes also support this hypothesis, indicating that physicians are still below the best level of quality and that incentives to improve are still present.

Keywords: Physician, quality of healthcare, incentives, compensation schemes

JEL Classifications: *I110, J440*

Equipped with the ability to produce health and prolong life, physicians bear a huge responsibility in practicing their profession. With the patient's life and future productivity on the line, the healthcare profession is considered an esteemed field, operating within a set of guidelines and entry barriers to ensure quality (Arrow, 1963). However, benevolence may not always be expected from physicians. Like any economic agent, health providers can alter their services given their financial incentives (Thorton & Eakin, 1997). Income is arguably an important factor in determining physician behavior, but the method of channeling such income to the physician should also be considered. For example, Barnum, Kutzin, and Saxenian (1995) argued that fixed payment tends to reduce services. Fee for service (FFS) tends to cause over-provision of services, while mixed payment appears to be a better alternative. Most studies have linked payment schemes with physician inputs such as work hours and services; however, using these inputs may not be sufficient to capture quality, an important dimension in the context of better health outcomes.

This paper attempts to construct a simple physician choice model that will allow us to compare the quality of care across different payment schemes. The physician chooses the optimal effort level that will determine the service quality given the income constraints which are then defined by each payment scheme. As empirical

support, the paper shall measure differences in scores derived from physician quality tests called the vignette across different payment schemes.

The results of this paper have shown plausible evidence that payment scheme policies can influence the quality of care, even accounting for incentives for self-selection into payment schemes. The results show that there is a stronger incentive in FFS to work harder and, therefore, provide services that input into quality.

In the Philippines, the Philippine Health Insurance Corporation (Philhealth) is the responsible agency in financing providers through the facilities, in support of the Department of Health's Universal Health Care program. Accredited facilities receive reimbursements for services given to members and their dependents. Philhealth data[1] show that as of December 31, 2013, 1,761 hospitals were accredited from 1,670 in December 2012. Clinics offering primary care benefit packages rose to 2,538 from 1,805 in end-December 2012; maternity care packages rose to 2,065 from 1,476; and TB-DOTS packages rose to 1,453 from 1,201. As more facilities become accredited, more physicians are likely to be entitled to receive FFS reimbursements. Along with the increasing Philhealth coverage across the country (through *Kalusugan Pangkalahatan*), demand for health care should also increase. Given the empirical results, providers in the public sector (i.e., fixed payment physicians) have the least incentive to provide quality care; nevertheless, providing them with opportunities to receive additional fees, for example, in the form of Philhealth reimbursements, moves them to a mixed system which will encourage them to provide quality services. With the growing number of accredited facilities and membership, Philhealth can be a potent mechanism to improve quality.

However, a system with working incentive mechanism and an effective quality monitoring mechanism should also be set in place. Along with Philhealth, the Professional Regulatory Commission and the Department of Health are the agencies in charge of monitoring entry in the profession and accreditation; however, they fall short of monitoring quality, with few and unreliable data and difficulty in assessing the use of practice guidelines in the private sector (World Health Organization & Department of Health, 2012). The existence of regular quality monitoring system such as the Physician Quality Measure Reporting[2] of the American Medical Association (AMA) could fill in gaps in quality data.

The findings have also strengthened the fact that children's diseases, TB, and maternal deaths have remained a significant health concern in the Philippines. Notwithstanding measurement issues, low vignette scores should not be taken lightly by policymakers, especially with the results on TB and pre-eclampsia vignettes. If taken as a signal, this poor performance in health service delivery raises questions and issues on sufficiency and quality of health care providers, especially in poor and far-flung regions.

Literature Review

In this section, I briefly discuss the physician as an agent who could take advantage of existing information asymmetries in the provision of care and mechanisms that could induce them to provide better quality output.

The Physician as an Agent

Provision of health care is typically riddled with information asymmetry and principal-agent problems, with health providers facing information advantage over patients in terms of verifiability of medical services and patients exhibiting moral hazard problems by not following through their doctor's orders and prescriptions (Schneider & Ulrich, 2008; Arrow, 1963).

Concerning information asymmetry, physicians can use their information advantage as leverage to influence patient preference, increase patient demand, and control quality of care (McGuire, 2000), breaking down the usual notion that doctors are supposed to be perfectly altruistic. To illustrate, in Demange and Geoffard (2006), a physician's output largely depends on the reward scheme, "talent," complexity of the medical case, and patient's observation of quality. The authors constructed a model that relaxes the assumption of altruism in providers, arguing that they condition their output on their own characteristics and the reward scheme that they face.

One widely-observed manifestation of agency is the so-called physician-induced demand which has been discussed extensively by McGuire (2000). The physician-induced demand argument is an answer to the observed peculiarities in the health care market such as increasing supply of services amid falling prices or increasing prices amid increasing supply of

health providers. It also stems from the hypothesis that doctors are likely to persuade patients to undergo services. Citing the theories of Evans (1974), McGuire and Pauly (1991), and Gruber and Owings (1996), McGuire (2000) summarized that physicians persuade patients to undergo services depending on the income, number of patients, and number of available providers. The model suggests that when the supply of providers increases, physicians tend to increase "inducement" behavior. The same occurs when the income they receive for each service falls. He also cited empirical studies such as Pauly (1980), showing that physician-induced demand is higher when information gap between patients and providers is higher or when services are easily accessible as in the case of physician families.

Inducing Physician Quality by Monitoring

To avoid the adverse effects of physician agency on quality of care, mechanisms are put in place to ensure that they operate towards the best outcomes. Institutions, for instance, are built to observe, reward, and punish providers based on their behavior. For instance, in Kessel (1958), medical associations such as the AMA ensure that providers are producing the best health outcomes and that hospitals hire only members of the association. Garcia-Prado (2005) and Leonard, Masatu, and Vialou (2007) have presented monitoring systems that could narrow the gap between actual service and a benchmark quality service. In the former, the authors suggested increased supervision and increased competition to deter shirking, while the latter proposed a stronger organizational framework to induce adherence to medical protocol.

Direct monitoring, however, has its pitfalls in terms of efficiency and defining quality standards. In the case of Garcia-Prado (2005), the implementation of non-pecuniary rewards to ensure quality assumes that the facility has infinite resources to push incentives; in reality, and most especially in public facilities, global budgets may not allow some legroom for additional financial incentives. Direct observation may not be feasible since actual health output cannot be measured by mere "visits" or hours devoted to each patient. McGuire (2000) went further by saying that quality is in fact not contractible. In addition, physicians may exercise some form of political power that can influence the effectiveness of direct observation (Demange & Geoffard, 2006).

Inducing Physician Quality by Payment Schemes

Payment schemes have been widely mentioned in the literature. Theoretical and empirical studies have identified payment schemes observed to increase or decrease motivation. In the health care sector, physicians can choose to work in any of the following payment arrangements (Barnum et al., 1995):

1. Budgetary transfers – these are fixed, global budgets provided to the facility. Doctors are paid fixed remuneration depending on the total hospital budget.
2. Capitation – this is a typical scheme under insurance or health management offices (HMOs). Under this setup, physicians are paid a fixed amount per insured person.
3. Fee-for-service – this is a common practice in the industrialized countries where providers charge according to the number of services provided.
4. Mixed payment scheme – this is a multi-dimensional payment scheme wherein providers can be paid in both fixed, budgetary transfers, and fee-for-service. For instance, a provider's fixed cost can be paid through transfers while variable costs may be reimbursed through fee-for-service payments.

The literature seems to agree that fixed payment modes such as budgetary transfers and capitation lead to weaker physician performance, despite the cost efficiency gains from implementing such policies. In Libby and Thurnston (2001), their estimates revealed that while participation in managed contracts has a small and statistically insignificant effect on work hours, the intensity of participation has a negative effect on work hours. That is, if a physician receives a large fraction of his income from managed-care contracts, the physician is likely to serve fewer hours. The data also revealed that the primary reason for participating in a managed-care contract is to reduce the variability in patient load. However, this might not always be the case. Kim et al. (2007) found a significant but small relationship between high compensation from salary and conduct of dilated eye

exam, foot exam, influenza vaccination, and advice to give aspirin. After adjusting for health plan, physician, and patient characteristics, no correlation was found between compensation scheme and treatment process.

The effectiveness of FFS as a motivator for quality care is always compared to fixed payments as a benchmark. It is also observed that FFS tend to increase services provided. Rice (1997) summarized pieces of behavioral evidence on FFS and capitation payments. In one of the studies she cited, physician payments still increased by 10–12% in the first phase of controls and 12–19% in the second despite payment controls by Medicare (the implementing body for FFS). This suggests increased quantity of services provided. Another set of studies she cited, in the context of the change in compensation schemes in Colorado during the 1970s, showed that physicians who received lower Medicare payment rates tended to provide greater quantity and intensity of services. Meanwhile, there is limited evidence on capitation scheme, which has become the global norm. One study in 1987 showed that compared to FFS, physicians receiving salary had 13% lower hospitalization rates and capitation lowered the rates by 8%. Visits per enrollee also fell by 10%. Another study she cited in Wisconsin HMO showed that the transition from FFS to capitation payment increased primary care visits by 18%, but reduced referrals to specialists by 45%. Hospital admissions and length of stay also fell by 16.3% and 12%, respectively.

Brennan and Shepard (2010) used specific medical protocols to compare impacts on quality between traditional FFS and private insurance Medicare Advantage (MA), which is analogous to capitation payments, using 11 measures from Healthcare Effectiveness Data and Information Sheet (HEDIS). The measures included specific procedures such as annual monitoring for persistent medications, antidepressant medication, breast cancer screening, persistence of beta-blockers, beta-blockers after a heart attack, LDL testing, and diabetics tests such as eye exam, A1C testing, LDL testing, and nephropathy. Quality measures are computed from the proportion of the population "who received the recommended care in accordance with the measure definition" (Brennan & Shepard, 2010, p. 842). Comparisons showed mixed results for FFS and MA for the administrative measures (persistent medications, among others) and hybrid measures (diabetics).

There is, however, a tendency of over-provision under FFS. Henning-Schmidt, Selten, and Wiesen (2009) conducted a controlled laboratory experiment to test the influence of FFS and capitation payments on the quantity of services that the physician will order. Results showed that FFS induces over-provision on patients whose optimal quantity of service is lower. Under capitation payment, patients whose optimal quantity of service is higher are likely to be underserved. Comparing the two schemes, more services are provided under FFS than in capitation payments. Another finding is that patients exert more influence on physician's behavior under capitation payment than under FFS.

It should be noted that, with the information advantage over patients, providers' can extend a level of influence in implementing a particular payment scheme. Demange and Geoffard (2006) constructed a model to show that shifting from any payment scheme to another can be obstructed by, say, the organizational power of physicians. This suggests that political power within the facility has an impact on the selection of payment schemes. In addition, physician characteristics, tastes, and practice environment can condition selection of payment schemes. Devlin and Sarma (2008) had established this when they compared the effect of FFS and non-FFS on patient visits and found out that those who engage more in non-clinical practice tend to select non-FFS payment schemes.

Several evaluation studies have also been done in the Philippines to gauge physician quality vis-à-vis financial incentives. Through the Quality Improvement Demonstration Survey (QIDS) lead by Shimkhada, Peabody, Quimbo, and Solon (2008), studies such as by Solon et al (2009) and Quimbo, Peabody, Shimkhada, Woo, and Solon (2008) were able to measure changes in quality of pediatric care across payment methods. This large-scale randomized controlled policy experiment was able to test payment incentive policies, such as the pay-for-performance (P4P) in Peabody et al. (2013), that can eventually improve child health outcomes. These series of studies were able to show the usefulness of the vignette as a measure of quality, which I will also utilize in this paper.

A Model of Physician Payment Scheme and Quality

Having discussed the payment scheme incentives on physician quality output, a relationship from a utility-maximization stance can be established. A typical physician facing income constraints that vary according to payment scheme will influence the choice of inputs, specifically work hours, which will have an impact on quality of care.

The Utility Function

Consider a physician whose overall utility depends on a set of sub-utility functions indexed by payment schemes *i*. From this set of sub-utility functions, the provider is expected to tend towards a particular payment scheme *i* such that the resulting sub-utility function strictly dominates all other sub-utility functions. In effect, this selected sub-utility function should maximize the overall utility function:

$$\arg\max \Upsilon := \{U^i \mid \forall\, i \neq w, \Upsilon(U^i) > \Upsilon(U^w)\} \quad (1)$$

For a given compensation scheme index, I define the sub-utility function in Equation (2). This will be the main model to establish my predictions on quality.

$$U^i = u(Y^i, l^i, v^i) \quad (2)$$

I define Y^i as income associated with the compensation scheme, l^i leisure, and v^i some measure of quality. The physician gains utility from both income and leisure, hence:

$$\frac{\partial U^i}{\partial Y^i} > 0, \frac{\partial U^i}{\partial l^i} > 0 \quad (3)$$

I assume that U^i increases in income and leisure at a decreasing rate, so that:

$$\frac{\partial^2 U^i}{\partial Y^{i2}} < 0, \frac{\partial^2 U^i}{\partial l^{i2}} < 0 \quad (4)$$

With the inclusion of a quality variable v^i in the utility function, the psychic benefits to the physician of providing quality services is being accounted. Specifically, I define *v* as a measure of deviation from a benchmark level of "quality." With the idea that a physician still gets some utility from providing the best quality, I assume that any positive deviation should result in a psychic disutility.[3]

$$\frac{\partial U^i}{\partial v^i} < 0, \frac{\partial^2 U^i}{\partial v^{i2}} < 0 \quad (5)$$

I decompose *v* (index omitted for simplicity) as the difference of the physician's actual score *V*, which I construct as a function of clinic hours *h*, and the best quality score $\bar{V}$. I define *V(h)* as a score function that maps clinic hours to a quality score.

$$v = \bar{V} - V(h) \quad (6)$$

The clinic hours *h* are cast as a sum of total time allocated to each particular procedure *j*, as shown below. I argue that each component of a typical health care service such as history-taking, physical exam, test ordering, diagnosis, and treatment would require a portion of a physician's total time.

$$h = \sum_{j=1}^{J} h_j \quad (7)$$

Therefore, the physician's allocation of time for all *J* procedures are then transformed into a score through *V (h)*, which will then measure the physician's quality. For $\bar{h}$, this would mean that the physician is allocating the best time possible for each procedure *j* that would give him the best score:

$$\bar{h} = \sum_{j=1}^{J} \bar{h}_j \quad (8)$$

For any given medical case, I assume that *V(h)* can increase with *h* (i.e., spending longer clinic time will allow him to do more procedures) up to a certain point—any additional unnecessary procedure will result in a score deduction. Hence, I define the behavior of *V* as follows:

$$\frac{\partial V}{\partial h} = \begin{cases} \geq 0, h < \bar{h} \\ < 0, h > \bar{h} \end{cases} \quad (9)$$

Equation (7) explains that each additional work hour increases the score function *V* if *h* is still below the level of work hours that corresponds to the best

quality score $\bar{V}$—that is, $V(\bar{h}) = \bar{V}$. In contrast, if the physician decides to unnecessarily go beyond $\bar{h}$, each additional work hour decreases the score function V. I also assume that V is U-shaped so that $\frac{\partial V}{\partial h}$ becomes smaller in absolute terms as approaches V the best level $\bar{V}$. Hence, a physician who values quality would ensure that the work is close to $\bar{V}$ to minimize the deviation v. This roughly follows Henning-Schmidt et al.'s (2009) specification.

As in standard labor-leisure models, I define leisure as the total available time less clinic hours.

$$l = T - h \tag{10}$$

I define a patient demand function which is essential in discussing the income functions. Denote $A(v)$ as a **patient demand** function of quality deviation v. Note that since any deviation implies low quality, A decreases with v. Importantly, I assume that the patient is fully insured to avail of the needed services without worrying about the cost.

$$\frac{\partial A}{\partial v} < 0 \tag{11}$$

Finally, I define the corresponding income equations for each payment scheme.

$$Y^m = Y_0 + M \tag{12.a}$$

$$Y^p = Y_0 + A(v)\sum_{j=1}^{J} p_j h_j \tag{12.b}$$

Letting $i = m$ represent fixed payment and $i = p$ represent FFS, **i** decompose income into a non-practice income component Y_0 and the practice income component. For the fixed payment scheme, practice income is represented by M, the fixed payment received by the physicians (Equation (12.a)). In the second equation, the term $\Sigma_{j=1}^{J} p_j h_j$ refers to the FFS revenue per case, with p_j as the FFS rate for procedure j. Since h_j is a portion of total time allocated to work h, I set $h_j = a_j h$, where $0 < a_j < 1$ owing to the definition in Equation (7). This entire revenue per case is multiplied by the patient load $A(v)$ and this total comprises the total practice income from FFS.

The Maximization Problem

I can then set the sub-utility maximization problem of the physician. Expanding the arguments of the sub-utility function in Equation (13), the physician chooses the optimal work hours that will maximize the sub-utility function.

$$\max_h U^i(T - h, \bar{V} - V(h), Y^i) \tag{13}$$

I then solve for the first-order conditions (FOC) under each payment scheme. Note that with the different forms of income Y^i, a different optimal work hours is expected. Hence, solving for the optimal work hours will also allow the determination of the corresponding score $V(h^*)$ and the conditions wherein the physician will under-provide (and get lower scores) so that $\frac{\partial V}{\partial h} > 0$ or over-provide so that $\frac{\partial V}{\partial h} < 0$.

$$\frac{\partial U^m}{\partial h} = -u_l - u_v \frac{\partial V}{\partial h} = 0 \tag{14.a}$$

$$\frac{\partial U^p}{\partial h} = -u_l - u_v \frac{\partial V}{\partial h} + u_Y \left[A(v)\sum_{j=1}^{J} p_j \frac{\partial h_j}{\partial h} - \left(\frac{\partial A}{\partial v}\frac{\partial V}{\partial h}\right)\sum_{j=1}^{J} p_j h_j \right] = 0 \tag{14.b}$$

Solving for h from Equations (14.a) and (14.b) will yield the optimal h^*; however, without a specific functional form for U^i I can only, at best, infer about how h will differ across payment schemes. Nonetheless, I can still determine the behavior of $\frac{\partial V}{\partial h}$ and draw hypotheses on which conditions a particular payment scheme will push the physician to either over-provide or under-provide.

Proposition 1: In fixed payment scheme, the physician will almost always under-provide.

From Equation (14.a), $\frac{\partial V}{\partial h}$ as seen in Equation (15) can be solved.

$$\frac{\partial V}{\partial h} = \frac{u_l}{-u_v} \tag{15}$$

By assumption, $u_l > 0$ and $u_v > 0$. Therefore, Equation (15) will always be positive, which means that in fixed payment schemes, the quality scores will always be below the best $\bar{V}$. It should be noted that the physicians can still be working close to the best quality. If the physicians value their quality so that u_v is large, then $\frac{\partial V}{\partial h}$ will also be small, which means that they are performing better but still below the best level. On the contrary, if they value leisure more so that u_l is large, then $\frac{\partial V}{\partial h}$ is also large, which means that they are performing way below the best and any additional

effort will have a huge impact on their quality score. Note that since all the RHS terms are positive, there is no way for the physician to over-provide in fixed payment.

Proposition 2: Under FFS, the physician's tendency to under-provide or over-provide depends on his valuation of leisure, income, quality, and patient demand sensitivity.

For FFS, $\frac{\partial V}{\partial h}$ is isolated on the left-hand side of Equation (14.b) to determine the conditions that will make the physician tend to under-provide or over-provide at the optimal level of work hours h^*.

$$\frac{\partial V}{\partial h} = \frac{u_l - u_Y \left[A(v) \sum_{j=1}^{J} p_j \frac{\partial h_j}{\partial h}\right]}{-u_v - u_Y \left[\frac{\partial A}{\partial v} \sum_{j=1}^{J} p_j h_j\right]} \quad (16)$$

Notice that Equation (16) is an augmented version of Equation (15) through the additional bracketed terms. These additional terms capture the income effect of FFS. The bracketed term in the numerator $\left[A(v) \sum_{j=1}^{J} p_j \frac{\partial h_j}{\partial h}\right]$ is always positive, since patient load *A(v)* is positive and $\frac{\partial h_j}{\partial h}$ is positive—any additional h will allow the physician to allocate more h_j for procedure *J*. This means that the entire numerator can be positive or negative depending on the magnitude of the physician's valuations of leisure u_l and income u_Y. The bracketed term in the denominator is always negative because of $\frac{\partial A}{\partial v}$, which means that the entire denominator is always positive. This shows that FFS has an ambiguous effect on quality, and this effect depends on the physician's valuation of leisure, income, quality, and patient demand sensitivity.

Suppose that u_Y is large but is still below u_l. Equation (16) will still be positive, but smaller than Equation (15), which means that the physician's quality score will be nearer the benchmark $\bar{V}$. Even when the physician values leisure highly so that u_l is large, the numerator will still be weighed down by the income effect u_Y, implying that there will always be an incentive to perform better and closer to $\bar{V}$ compared to fixed payment. The potential of FFS to induce quality is further magnified with the inclusion of patient demand sensitivity $\frac{\partial A}{\partial v}$. When patient demand is highly sensitive to quality, the provider will tend to perform better so that $\frac{\partial V}{\partial h}$ is smaller. With the inclusion of the income terms, it can also be inferred that the physician can perform better in FFS than in fixed.

While potentially useful to induce quality, FFS can also lead to over-provision, again conditional on the physician's behavior. If the physician values income so much that $u_Y > u_l$, the RHS of Equation (16) becomes negative. Consequentially, $\frac{\partial V}{\partial h} < 0$, which means that the physician is already over-providing. Such incentive to over-provide increases when the physician's valuation of quality u_v is very low or if the patient demand sensitivity $\frac{\partial A}{\partial v}$ is very low. This implies that in the case where the physician values income more relative to quality and if the patients are not aware of the physician's quality, there is a large tendency to over-provide.

Combining Fixed and FFS: The Mixed Payment Scheme

Pure payment schemes may lead to over- or under-provision of services. For example, in the fixed payment scheme, it is possible for the physician to work shorter hours and produce less quality services if the quality is not valued. On the other hand, there is the possibility that physicians will overprescribe in the FFS, again possibly to the extent that quality is compromised. With this, the literature proposed mixed payment scheme as an alternative to address these deficiencies. As described by Barnum et al. (1995), mixed payment scheme is an "ideal" choice given its benefits in terms of quality motivation and efficiency. In their words, the mixed system retains the desirable characteristics of pure payment systems (fixed payment and FFS) while preventing their adverse incentives. Ellis and McGuire (1986) supported this view mathematically, noting that this system rewards efficient level of services while deterring physician-induced demand for services.

Proposition 3: Mixed payment schemes temper the adverse incentives of FFS and fixed payment, with the impact of the fixed and FFS components on quality conditioned by the share of fixed payment and FFS in the physician's total income.

Its effect on quality can be predicted by reconstructing the income equation as the weighted average of fixed payment and FFS:

$$Y^{mp} = Y_0 + aM + b\left[A(v)\sum_{j=1}^{J} p_j h_j\right] \quad (17)$$

where $0 < a < 1$ and $0 < b < 1$ denote the weights of the fixed payment component and the FFS component, respectively. This equation establishes that the physician receives a fixed payment component after satisfying a minimum number of work hours; and FFS for working beyond the minimum. Given this, a and b can be constructed as endogenous functions of the physician's time allocation:

$$a = \frac{M}{M + \left[A(v)\sum_{j=1}^{J} p_j h_j\right]} \quad (18.a)$$

$$b = \frac{\left[A(v)\sum_{j=1}^{J} p_j h_j\right]}{M + \left[A(v)\sum_{j=1}^{J} p_j h_j\right]} \quad (18.b)$$

Equations (18.a) and (18.b) show the share of the fixed payment and the share of FFS with respect to the total practice revenue, respectively. These shares, in turn, can be linked to the physician's choice of work hours. Suppose that the time spent for FFS practice, h^p, is as follows:

$$h^p = h - h^{min} \quad (19)$$

where h is total work hours as before, and h^{min} minimum work hours required to receive the fixed payment. Thus, any additional work hours translate to one-to-one additional time spent for FFS practice; $\frac{\partial h^p}{\partial h} = 1$.

Since $a + b = 1$, any increase in income received from fixed payment will reduce the share of revenue from FFS and vice-versa, indicative of an implicit trade-off in work hours that the provider is willing to provide given the proportion of income received.

For simplicity of notation, define F as the bracketed term in Equation (14.b), which is just the partial derivative of Equation (12.b) with respect to h:

$$F = \frac{\partial Y^p}{\partial h} = \left[A(v)\sum_{j=1}^{J} p_j \frac{\partial h_j}{\partial h} - \left(\frac{\partial A}{\partial v}\frac{\partial V}{\partial h}\right)\sum_{j=1}^{J} p_j h_j\right] \quad (20)$$

Given this, the physician again chooses work hours to maximize utility. To get the optimal h, Equation (17) is plugged in Equation (13), but for a clearer presentation, the partial derivative of Y^{mp} with respect to h is derived first.

$$\frac{\partial Y^{mp}}{\partial h} = a'M + b'\left[A(v)\sum_{j=1}^{J} p_j h_j\right] + bF \quad (21)$$

where a' and b' are denoted as the derivatives of and with respect to h, respectively. Compute first for a' and b' then simplify:

$$a' = -\frac{M}{\left(M + \left[A(v)\sum_{j=1}^{J} p_j h_j\right]\right)^2} F \quad (22)$$

$$b' = \frac{M}{\left(M + \left[A(v)\sum_{j=1}^{J} p_j h_j\right]\right)^2} F \quad (23)$$

Equations (22) and (23) are then plugged back to Equation (21) and solve for the FOC of mixed payment, which gives Equation (24.a). Notice that with the inclusion of the bracketed term, the income incentive now depends on the relative weight of either fixed payment or FFS. If M = 0 and $p_j > 0$ for all j, the bracketed term cancels to one and Equation (24.a) becomes the FFS FOC; on the other hand, if $p_j = 0$ for all $j = 1,2, \ldots, J$ and $M > 0$, the entire second term disappears and Equation (24.a) reverts to the fixed payment FOC.

$$-u_l - u_v\frac{\partial V}{\partial h} + u_Y\left[\frac{\left[A(v)\sum_{j=1}^{J} p_j h_j\right]^2 - M\left(M - 2\left[A(v)\sum_{j=1}^{J} p_j h_j\right]\right)}{\left(M + \left[A(v)\sum_{j=1}^{J} p_j h_j\right]\right)^2}\right]F = 0 \quad (24.a)$$

Setting $\gamma = \left[\frac{\left[A(v)\sum_{j=1}^{J} p_j h_j\right]^2 - M\left(M - 2\left[A(v)\sum_{j=1}^{J} p_j h_j\right]\right)}{\left(M + \left[A(v)\sum_{j=1}^{J} p_j h_j\right]\right)^2}\right]$ for simplicity, $\frac{\partial V}{\partial h}$ can easily be isolated from F by rearranging the terms to get Equation (24.b):

$$\frac{\partial V}{\partial h} = \frac{u_l - u_Y\gamma\left[A(v)\sum_{j=1}^{J} p_j \frac{\partial h_j}{\partial h}\right]}{-u_v - u_Y\gamma\left[\frac{\partial A}{\partial v}\sum_{j=1}^{J} p_j h_j\right]} \quad (24.b)$$

Earlier it was shown that FFS can potentially increase scores assuming that the physician's income valuation is positive, with the effect magnified by the valuation of quality u_v and patient demand sensitivity $\frac{\partial A}{\partial v}$. With

the inclusion of $\gamma = \left[\frac{\left[A(v)\Sigma_{j=1}^{J} p_j h_j\right]^2 - M\left(M - 2\left[A(v)\Sigma_{j=1}^{J} p_j h_j\right]\right)}{\left(M + \left[A(v)\Sigma_{j=1}^{J} p_j h_j\right]\right)^2}\right]$, the incentive to increase quality is somehow tempered, especially when the fixed income portion M is high. If the fixed payment component becomes higher relative to the FFS component, then this weight decreases, which means that the FFS effect is also dampened. Practically, when the fraction of the fixed payment increases, the physician need not provide longer work hours since sufficient remuneration may already be received, which could otherwise be obtained through fee-for-service. On the other hand, if is small, Equation (24) moves closer to the FFS condition. In incentive terms, these suggest that the inclusion of a fixed term can potentially decrease labor supply and place the physician farther from the best quality level, since the physician may opt to have more leisure while earning M with less effort.

The benefits of mixed payment scheme on quality are better observed when the physician values income more than leisure so that $u_l < u_\gamma$. The reduction in $\frac{\partial V}{\partial h}$ due to high u_γ can be softened by a small γ, which is possible when M, the fixed payment share, is high. The higher fixed income component, therefore, induces the physician to reduce work hours, since the target amount has been received that could otherwise be earned by calling for unnecessary procedures.

The Case of Capitation Payments

In addition to fixed, FFS, and mixed payment, physicians can be paid by way of capitation payments. Usually adopted in health management organizations (HMOs), capitation payments involve paying the physician "periodic fixed amount per insured person to finance the costs of a defined package of services" (Barnum et al., 1995, p. 6). Income from capitation payments is shown in Equation (25):

$$Y^k = Y_0 + kA(v) \tag{25}$$

where k is per person fee or the capitation rate and $A(v)$ the patient load. Plugging this in Equation (13) and maximizing, the FOC becomes:

$$\frac{\partial U^k}{\partial h} = -u_l - u_v \frac{\partial V}{\partial h} - u_Y \left[k \cdot \frac{\partial A}{\partial v}\frac{\partial V}{\partial h}\right] = 0 \tag{26}$$

The marginal change can be isolated in scores to obtain Equation (27):

$$\frac{\partial V}{\partial h} = \frac{u_l}{-u_v - u_Y k\left[\frac{\partial A}{\partial v}\right]} \tag{27}$$

Equation (27) shows that at the optimal work hours h^*, the physician will tend to under-provide since the left-hand side becomes positive; however, the physician will be working at a higher quality than fixed payment because of $u_Y k\left[\frac{\partial A}{\partial v}\right]$, which represents the income incentive from capitation payments. Notice that with a higher income valuation u_γ or higher patient sensitivity $\left[\frac{\partial A}{\partial v}\right]$, the physician will tend to work with the best quality possible, making $\frac{\partial V}{\partial h}$ smaller and V closer to $\bar{V}$. This is intuitive since the patients are the physician's source of income. By ensuring that the quality is close to the best level, the physician's patient load will be higher, which means that the revenue received will also be higher. It is also important to note that there is no way for the physician to over-provide—there is no incentive to provide unnecessary services at the expense of the patient load and effectively the physician's revenue.

In the previous section, how payment schemes will affect quality given that the physicians choose their optimal work hours was discussed. By inspecting the first-order conditions, it can be seen that the optimal work hours h^* differ across payment schemes, which then results in different quality scores V. The presence (or absence) of income incentives explains the differences in quality. It was observed that fixed payment scheme yields the lowest level of quality compared to other payment schemes due to lack of income incentive and that the only way for the physician to perform closer to the best level is to value quality more. It was also observed that FFS could reward quality due to income incentive but posited that there is a possibility of over-providing especially when the sensitivity of patient demand is low and the valuation of income is very high relative to the valuation of quality. Furthermore, mixed payment scheme could temper the possibility of over-provision by inducing the incentive to cut down on unnecessary procedures by giving them a fixed amount without the need to increase procedures. Table 1 summarizes these predicted effects on scores.

Table 1. *Predicted Relationships*

Payment Scheme	Effect on quality
Fixed	Low
FFS	Ambiguous; depends on physician valuation of leisure, income, and quality; and patient demand sensitivity.
Mixed	Ambiguous, but a tempered case of FFS due to the income share term.

Solving for h in each compensation scheme allows the expression of h^* as a function of the exogenous variables. Each payment scheme, therefore, has an optimum h and corresponding V. Substituting in results to Equation (28).

$$V(h^*) = V\left[h\left(M, p_j, mp;\ Y_0, \bar{V}, T\right)\right] \tag{28}$$

In this equation, quality is now a function of payment schemes M, p_j, and mp for the mixed; non-practice income Y_0; benchmark score $\bar{V}$; and total available time T. This specification can then be used as a basis for the econometric model.

Empirical Analysis

With Equation (28) as the conceptual basis, I conducted an empirical analysis using the 2007 Operational Plan (OP) Baseline survey[4] commissioned by the UPecon Health Policy Development Program.[5] The physician survey portion was used to capture payment schemes and other confounding characteristics, while vignettes scores were used to measure quality. Several studies, such as those of Peabody, Luck, Glassman, Dresselhaus, and Lee (2000), Luck, Peabody, Dresselhaus, Lee, and Glassman (2000), Dresselhaus, Peabody, Lee, Glassman, and Luck (2000), and Dresselhaus, Peabody, Luck, and Bertenthal (2004) have validated the effectiveness of the vignette as a quality measure, while policy experimental studies such as that of Shimkhada et al. (2008), Solon et al. (2009), Quimbo et al. (2008) have exhibited practical applications of the vignette in measuring changes in quality with respect to changes in policy. The study implemented Deb and Trivedi's (2006) multinomial treatment effects regression to measure the differences in physician vignette scores across payment schemes while accounting for the endogeneity coming from the physician's selection of payment schemes. With vignette scores as the dependent variable, the empirical model is constructed as:

$$V = \boldsymbol{\beta X} + \boldsymbol{\varphi Y_0} + \boldsymbol{\delta \bar{V}} + \boldsymbol{\tau T} + \sum_{i=1}^{J} \lambda_i \omega_i + \varepsilon_0 \tag{29}$$

where V is the vignette score, X the vector of compensation schemes, T vector of time proxies, and ε_0 error term. Recall that this is anchored on the reduced form of procedures, which is derived by plugging in the optimal value of h in V as seen in Equation (28). The variables that represent the components in Equation (29) are presented in Table 2. Fixed income components embedded in Y_0 could determine the motivation to provide more work hours which, in turn, could affect V. Benchmark values of quality $\bar{V}$ define the necessary time to devote in a particular case. Meanwhile, T captures the preferences and tastes of the physician in spending total available time, which could influence actual h devoted to treatment and in turn affect quality V.

To account for the endogeneity, X is set up as a function of some factor z that can influence the selection of payment scheme without necessarily affecting the scores:

$$\Pr(X_i = i \mid Y_0, \bar{V}, T, \boldsymbol{z}, \omega) = g(\boldsymbol{\alpha z}; Y_0, \bar{V}, T, \omega_i) \tag{30}$$

Equations (29) and (30) are linked by the common unobserved factor w_i, which then captures the selection bias in the payment scheme equation. To estimate Equations (29) and (30), a maximum simulated likelihood regression of Equation (31) was run:

$$\begin{aligned} &\Pr(V, X_i | Y_0, \bar{V}, T, \omega) \\ &\quad = f\left(\alpha + \boldsymbol{\beta X} + \boldsymbol{\varphi Y_0} + \boldsymbol{\delta \bar{V}} + \boldsymbol{\tau T} + \sum_{i=1}^{J} \lambda_j \omega_j\right) \\ &\quad \cdot P(X_i = i | \boldsymbol{z}, Y_0, \bar{V}, T, \omega) \end{aligned} \tag{31}$$

Function $f(\cdot)$ refers to the distribution of the outcome variable, which is assumed to be normal[6], while $P(X_i = i|\boldsymbol{z}, Y_0, \bar{V}, T, \omega)$ is the distribution function of the treatment variable, which is assumed logit. Since ω is unknown, the simulation-based estimation will pick pseudo-random numbers based on Halton sequences (Deb & Trivedi, 2006) in lieu of ω. Deb and Trivedi (2006) recommended higher number of draws whenever computationally possible. Note that the coefficient λ_i also captures the selection bias; if $\lambda_i = 0$, then the treatment is exogenous to the outcome. A simple joint hypothesis test (likelihood ratio test) of all λ_i will be implemented to test for the exogeneity of the treatment.

To estimate Equation (31), the variables listed in Table 2 are used. Vignette scores are derived from the physician's performance in areas of history taking, physical exam, test ordering, diagnosis, and treatment, covering the cases of diarrhea, pediatric pneumonia, pulmonary tuberculosis, and pre-eclampsia (UPecon—Health Policy Development Program, 2011). The payment scheme variables are derived from the responses on the question "How are you [the physician] compensated?" of the physician survey. The responses are then reduced into three categories: fixed payment, fee-for-service, and mixed. Due to lack of appropriate response in the survey questionnaire, I was not able to include capitation payment as a category;

Table 2. *List of Explanatory Variables*

Explanatory variable	Interpretation	Represents	Mean	Std. Dev.
Vignette score	Vignette score in percent	$V(h)$	43.393	17.571
Fixed payment	= 1 if MD receives fixed payment, 0 otherwise (base variable)	M	0.276	0.447
FFS	= 1 if MD receives FFS, 0 otherwise	p_j	0.337	0.473
Mixed	= 1 if MD receives mixed payment, 0 otherwise	mp	0.387	0.487
Has other professional work	= 1 if the physician indicated that he holds other professional work/position, 0 otherwise	Y_0, T	0.212	0.409
Pneumonia	= 1 if MD answered pneumonia vignette, 0 otherwise (base variable)	$\bar{V}$	0.233	0.423
Diarrhea	= 1 if MD answered diarrhea vignette, 0 otherwise	$\bar{V}$	0.229	0.421
TB	= 1 if MD answered TB vignette, 0 otherwise	$\bar{V}$	0.283	0.451
Pre-eclampsia	= 1 if MD answered pre-eclampsia vignette, 0 otherwise	$\bar{V}$	0.255	0.436
Gender	= 1 if MD is female, 0 if male	T	0.667	0.472
Age	Physician's age	T	42.094	11.167
Age squared	Square of physician's age	T	1896.354	1072.19
Specialty society member	= 1 if MD has specialty society membership, 0 otherwise.	$\bar{V}$	0.519	0.5
Clinic	= 1 if MD is sampled at clinic, 0 otherwise.	T	0.269	0.444
Primary hospital	= 1 if MD is sampled at a primary hospital, 0 otherwise.	T	0.156	0.363
Secondary hospital	= 1 if MD is sampled at a secondary hospital, 0 otherwise.	T	0.198	0.399
Tertiary hospital	= 1 if MD is sampled at a tertiary hospital, 0 otherwise	T	0.377	0.485

Source: Author's calculation based on HPDP OP Baseline Physician Survey, UPecon-Health Policy Development Program

Table 3. *First-Stage Multinomial Logit Regression: Choice of Compensation Scheme (base = fixed payment)*

Explanatory variables	FFS	Mixed
Physician located in urban area	1.04**	0.92**
	(0.34)	(0.31)
Vignette type		
Diarrhea	-0.53	-0.10
	(0.42)	(0.36)
TB	0.23	0.08
	(0.36)	(0.36)
Pre-eclampsia	0.30	0.16
	(0.40)	(0.38)
Female	0.35	-0.12
	(0.32)	(0.30)
Holds other professional position	0.32	-0.33
	(0.33)	(0.33)
Age	0.38**	0.27**
	(0.07)	(0.08)
Age-squared	-0.003**	-0.002**
	(0.0007)	(0.0008)
Membership in specialty society	1.21**	0.24
	(0.28)	(0.27)
Facility fixed effects		
Primary hospital	-1.79**	0.03
	(0.46)	(0.43)
Secondary hospital	-2.34**	0.37
	(0.40)	(0.40)
Tertiary hospital	-1.53**	0.90**
	(0.36)	(0.37)
Constant	-10.75**	-7.56**
	(1.91)	(1.78)
N	576	
Halton quasi-random draws	1000	

***-Indicates significance at 5% or better; *-Indicates significance at 10% or better. Robust standard errors in parentheses.*
Source: Author's calculation based on HPDP OP Baseline Physician Survey, UPecon-Health Policy Development Program.

hence, it is excluded from the empirical analysis.[7] Physicians who are employed with salary; trainees; in retainer; contractual; or in stipend are all classified under the fixed payment category. Physicians who own the practice in the facility[8], receive FFS from owner or professional fee, are self-employed, or classified themselves as private consultants or receiving per-consultation fees are all classified under FFS. Finally, physicians who are paid the basic pay plus FFS or physicians who received a salary plus a reimbursement from Philhealth are considered under mixed payment. Note that only those physicians who do not own the practice in the facility were asked questions about their compensation schemes; hence, to fill up for the missing values, I assumed that those who own practice in the facility are paid through FFS.

It is notable that average score of physicians did not exceed even the 50% passing threshold. About four physicians even managed to score below 10%. Vignettes are roughly distributed equally across the sample, registering about 20% of physicians for each vignette type. About 70% of the sample is female doctors and about 20% of the physicians hold other positions.

I used an urban-rural dummy as a determinant of physician compensation selection. The urban-rural dummy tags whether the location of the physician is an urban area based on the classification of the National Statistical Coordination Board (NSCB). Aside from the heavily endogenous nature of the data[9] that limits the availability of suitable exogenous instruments to the selected, I can argue that urban status dummy can reflect the health care market faced by the provider, especially in relation to potential patient load and income. It can also determine what kind of facility would likely be predominant in the area (e.g., public hospitals vs. private hospitals; clinics vs. RHUs), which can either limit or expand the provider's payment scheme choices. Taking from Devlin and Sarma (2008), I can also argue that the physician's locality could have an influence on tastes and preferences, which in turn can affect the choice of payment scheme.

On a methodological note, Deb and Trivedi (2006) noted that the parameters of the model are still identified even if the regressors in the treatment (first-stage) equation are identical to the regressors in the outcome (second-stage) equation; therefore, the use of urban-rural dummy as an excluded variable should be sufficient. In terms of excludability, regressing vignette scores on urban-rural dummy yield statistically insignificant results, indicating it can be used as an instrument.

Results and Analysis

Results show a strong tendency to belong to payment schemes other than fixed payment in urban areas. The predominance of public facilities in rural areas may explain the lack of alternative payment scheme options for the physicians; hence, providers have no choice but fixed payment. Holding other professional position appears to have no selection effect on any of the payment schemes. Age also tends to have a positive effect on the choice of either FFS or mixed, although this effect diminishes as the physician gets older. Other than being a proxy of *T*, age can also indicate experience, which provides leverage for the physician to select a payment scheme deemed appropriate to his length of stay in the field. At least for FFS, physicians in specialty societies are likely to select this scheme. It is also interesting to note that physicians in hospitals are not likely to select pure FFS. One possible reason is that physicians in clinics, which is the base variable for facility type, may have the leverage to implement FFS and are not likely to receive fixed payment as those in hospitals. On the other hand, being in a hospital does not increase the probability of selecting mixed payment over fixed payment because this scheme may be a common practice, at least for tertiary hospitals. For example, if a hospital is Philhealth-accredited, the physicians can receive reimbursements for their services on top of their monthly fixed payment present, hence considered as a mixed payment scheme.

With payment scheme selection accounted for, the regression of vignette scores on payment schemes can be done. Table 4 shows the estimation results. Note that the estimation is run simultaneously and I separated the presentation for clarity. The lambdas indicate the necessity of multinomial treatment effects in estimating the effect of payment schemes on vignette scores. The significance[10] of these lambdas indicates that without accounting for the selection, coefficients of FFS and mixed will be biased.

Discussing the control variables, significant, negative coefficients for TB and pre-eclampsia vignettes can be seen, perhaps reflecting the difficulty of these cases relative to child pneumonia. Female physicians scored higher by four percentage points than males. Holding other professional positions appears to place a burden on the physician's total available time, resulting in lower scores. Age, however, slightly reduces quality score by 0.07 percentage points and appears to decrease quality continuously. At the mean age of 42, scores are lower by 0.24 percentage points, falling further as the physician ages. Notably, membership in specialty society is associated to lower scores of about 2.2 percentage points, and this appears to be a strong result even after controlling for vignette type. Combining the findings on physician vignette, age, and specialization, it appears that the younger, unspecialized physician performs better in the vignette test than the older, specialized ones. For the facility controls, providers in the primary hospitals scored 0.38 percentage points lower than those in clinics; secondary hospitals 0.7 percentage points higher; and tertiary hospitals 0.14 percentage points higher. The sizeable decline in scores of primary hospital physicians over clinicians may be indicative of the heavy patient load in these facilities. Meanwhile, the positive coefficient in secondary hospitals may indicate lighter patient load

Table 4. *Estimation Results: Vignette Score (in percent) (base = fixed payment)*

Explanatory variables	
Compensation scheme	
FFS	10.99**
	(0.04)
Mixed	3.30**
	(0.05)
Vignette type	
Diarrhea	1.37**
	(0.07)
TB	-25.57**
	(0.05)
Pre-eclampsia	-28.64
	(0.06)
Female	3.88**
	(0.04)
Holds other professional position	-1.36**
	(0.05)
Age	-0.07**
	(0.01)
Age-squared	-0.002**
	(0.00009)
Specialty society member	-2.20**
	(0.04)
Facility fixed effects	
Primary hospital	-0.38**
	(0.06)
Secondary hospital	0.70**
	(0.06)
Tertiary hospital	-0.14**
	(0.04)
Constant	58.57**
	(0.26)
Lambda	
Lnsigma	-2.25**
	(0.16)
Lambda FFS	-11.15**
	(0.01)
Lambda mixed	-1.03**
	(0.02)
Sigma	0.10
	(0.02)
N	576
Wald chi-squared statistic	**
Halton quasi-random draws	1000

***-Indicates significance at 5% or better; *-Indicates significance at 10% or better. Robust standard errors in parentheses.*
Source: Author's calculation based on HPDP OP Baseline Physician Survey, UPecon-Health Policy Development Program.

as cases may be referred to tertiary facilities whose coefficient is also negative but not as large in magnitude as in primary hospitals.

The coefficient estimates on vignette type, the local physicians' capacity to attend to complex cases is also concerning. The results have shown that even with specialization, TB and pre-eclampsia seem to be difficult cases to handle. While it can be argued that the test itself or the scoring rubrics may be too difficult or the administration of the test may have been inconvenient to the doctor, the low scores call for quality evaluation of providers specializing in those fields.

Controlling for the selection, FFS and mixed payment increase vignette scores by about 10.99 percentage points and 3.3 percentage points, respectively. This supports the theoretical predictions that as long as the physician remains below the best level and as long as the patient load is sufficiently high, FFS encourages quality compared to fixed payment. Mixed payment scheme also induces quality compared to fixed payment, albeit way lower than FFS. These positive coefficients indicate that there is still an incentive to improve quality. By looking at the cross-tabulation of payment schemes and facility types (see Table 5), it can be seen that while many physicians are already in either FFS or mixed, there are still a sizeable number of physicians who are operating in a fixed salary system, especially in public facilities (hospitals and RHUs). Hence, there could be a scope for introducing a mixed payment scheme to improve quality. From a policy perspective, Philhealth reimbursements may be a viable option.

While the coefficient results are promising, it appears that compensation schemes are not sufficient policy targets to improve quality. Using the margins function, I computed for the predicted scores, switching compensation scheme variables on or off while setting the other covariates at their actual levels. At a fixed payment baseline, the average predicted score is at 38.2%; if all physicians are allowed to choose FFS, the scores will only increase up to 49.2%, still below the passing benchmark of, for instance, 50%. The predicted scores in mixed are lower at 41.5%.

Scores can also be predicted by facility type (public or private) while assuming actual values for the other explanatory variables. At fixed payment (that is, FFS and mixed is set to zero), the average score in public facilities is 39.3% while the score in private facilities is 37.4%. Introducing FFS, the scores in public facilities improved to 50.2% while scores in private facilities increased only up to 48.4%. However, if mixed payment is introduced, public facility physicians will only improve up to 42.6% and private facility physicians up to 40.7%. It appears then that the improvement in scores is more pronounced in public facilities over private facilities, although scores barely reached the 50% benchmark (except for FFS in public facilities).

The same simulation can also be across vignette types. At the baseline, the scores are indeed lower for physicians answering the TB and pre-eclampsia vignettes at 25.6% and 24.4%, while the pneumonia and diarrhea physicians passed at 52.7% and 54.5%, respectively. When all physicians were to receive FFS, TB and pre-eclampsia vignette scores increased, but is still way below the passing mark at 36.6% and 35.4%, while pneumonia and diarrhea vignette scores improved. Scores did not increase as much under mixed payment. Again, this shows that while FFS and mixed payment schemes pose positive incentives to quality, they do not seem sufficient enough to increase scores up to or beyond the passing rate.

Table 5. *Cross-Tabulation of Compensation Scheme and Facility Type (N=576)*

Compensation scheme	Facility type					
	Public Hospital	**Private Hospital**	**RHU**	**Hospital-based clinic**	**Free-standing clinic**	**Total**
Fixed	78	55	18	7	1	159
FFS	10	84	2	67	31	194
Mixed	138	56	11	16	2	223
Total	**226**	**195**	**31**	**90**	**34**	**576**

Source: UPecon-Health Policy Development Program (2009). OP Baseline Physician Survey.

Conclusion

In this paper, I have examined how payment schemes influence the quality of care, measured by the vignettes. I constructed a simple model of physician quality, arguing that the different payment schemes yield different optimal work hours, which in turn affects total procedures and eventually quality scores. I predicted that, relative to fixed payment, FFS and mixed payment lead to higher quality. Using these predictions, I estimated the impact of payment schemes on quality by conducting multinomial treatment effects regression to account for endogeneity in the choice of payment scheme. I found evidence that relative to fixed payment, FFS and mixed payment yields higher vignette scores. On average, physicians under FFS score 11% higher than fixed payment while physicians under mixed score roughly 3% higher than mixed. I noted that notwithstanding these results, shifting all physicians to either FFS or mixed will barely lead to at least 50% in vignette scores. I accounted for the endogeneity of payment scheme with location (urban-rural) as the instrument. Selection of payment schemes is also highly affected by physician's age and, to some extent, specialization.

Notes

[*] This paper is a condensed and improved version of the author's Master's thesis entitled "A theoretical and empirical analysis on the relationship between payment schemes and physician quality" (May 2014), University of the Philippines School of Economics (UPSE), Diliman, Quezon City. The author would like to thank UPecon—Health Policy Development Program for graciously providing the data for the empirical analysis.

[1] The 2013 Philhealth stats and charts can be downloaded from http://www.philhealth.gov.ph/about_us/statsncharts/snc2013.pdf while the 2012 data can be found in http://www.philhealth.gov.ph/about_us/statsncharts/snc2012.pdf.

[2] See more at https://www.ama-assn.org/ama/pub/physician-resources/clinical-practice-improvement/clinical-quality/physician-quality-reporting-system.page

[3] See Feldstein (1999) and McGuire (2000) in their discussion of supplier-induced demand. In Feldstein's text, he went by saying that a physician's utility increases not only with additional income but also with the practice of quality medical care. McGuire (2000) also mentioned how quality clinical practice is motivated by the concern for the patient and overall social good, which could indicate that the physician does gain some utility from providing quality service.

[4] The Operational Plan (OP) Baseline survey is a data-collection project commissioned by the Health Policy Development Program (HPDP) in 2007 to obtain information on health facilities, provider, and patients which are otherwise unobtainable from regularly conducted national surveys (UPecon—Health Policy Development Program, 2011). This information is important in generating baseline monitoring and evaluation estimates to assess the impact of HPDP technical assistance given its focus on maternal, neonatal, and child health and nutrition (MNCHN). OP baseline covers a wider range of municipalities, facilities, and medical cases. The data covered facility information from October 2005–September 2006 while the physician survey covered information in the past five years.

[5] The Health Policy Development Program (HPDP) is a five-year project of the United States Agency for International Development (USAID) implemented by the UPecon Foundation, Inc. to provide support to the Department of Health in the formulation and implementation of policies relevant to family planning, maternal, neonatal, child health and nutrition (FP-MNCHN) and TB. For more information, see http://www.usaid.gov/philippines.

[6] Histogram chart of vignette score approximates the normal distribution.

[7] Professional fees and contractual as capitation were earlier used, but intuition suggests that professional fees may be better classified in FFS, while contractual (much like the retainer set-up) may be better classified under fixed payment.

[8] This is a key assumption in the study's data.

[9] From a theoretical standpoint, most questions are likely correlated with the physician's performance, such as years of practice, medical school, years of specialization, number of referrals, among others.

[10] Likelihood ratio test rejects exogeneity at 5% level of significance.

Acknowledgement

This paper is a condensed and improved version of the author's Master's thesis entitled "A theoretical and empirical analysis on the relationship between payment schemes and physician quality" (May 2014), University of the Philippines School of Economics (UPSE), Diliman, Quezon City. The author would like to thank UPecon—Health Policy Development Program for graciously providing the data for the empirical analysis.

References

Arrow, K. J. (1963). Uncertainty and the welfare economics of medical care. *The American Economic Review,* 53(5), 941–973. Retrieved 28 July 2011 from http://www.jstor.org/stable/1812044

Barnum, H., Kutzin, J., & Saxenian, H. (1995). Incentives and provider payment methods. *The International Journal of Health Planning and Management*, 10(1), 23–45. doi: 10.1002/hpm.4740100104

Brennan, N., & Shepard, M. (2010). Comparing quality of care in the Medicare program. *American Journal of Managed Care,* 16(11), 841–848. Retrieved 3 January 2013 from http://www.ajmc.com/publications/issue/2010/2010-11-vol16-n11/ajmc_10nov_brennan841to848/4

Deb, P., & Trivedi, P. K. (2006). Maximum simulated likelihood estimation of a negative binomial regression model with multinomial endogenous treatment. *The Stata Journal*, 6(2), 246–255. Retrieved 14 December 2013 from http://www.stata-journal.com/sjpdf.html?articlenum=st0105

Demange, G., & Geoffard, P. Y. (2006). Reforming incentive schemes under political constraints: The physician agency. *Annals of Economics and Statistics/ Annales d'Economie et de Statistique*, 83, 221–250. Retrieved 31 January 2012 from http://www.jstor.org/stable/20079169

Devlin, R. A., & Sarma, S. (2008). Do physician remuneration schemes matter? The case of Canadian family physicians. *Journal of Health Economics*, 27(5), 1168–1181. Retrieved 4 August 2013 from http://artsandscience.usask.ca/economics/research/pdf/SSarmaRemunerationPaper2.pdf

Dresselhaus, T. R., Peabody, J. W., Lee, M., Glassman, P., & Luck, J. (2000). Measuring compliance with preventive care guidelines: A comparison of standardized patients, clinical vignettes and the medical record. *Journal of General Internal Medicine*, 15(11), 782–788.

Dresselhaus, T. R., Peabody, J. W., Luck, J., & Bertenthal, D. (2004). An evaluation of vignettes for predicting variation in the quality of preventive care. *Journal of General Internal Medicine*, 19, 1013–1018.

Ellis, R. P., & McGuire, T. G. (1986). Provider behavior under prospective reimbursement: Cost sharing and supply. *Journal of Health Economics*, 5, 129–151. Accessed 12 December 2011 from http://www.ppge.ufrgs.br/giacomo/arquivos/eco02072/ellis-mcguire-1986.pdf

Feldstein, P. J. (1999). *Health economics* (5th ed.). Albany, NY: Delmar Publishers.

Garcia-Prado A (2005). *"Sweetening the Carrot: Motivating public physicians for better performance"*. World Bank Policy Research Working Paper 3772. doi: http://dx.doi.org/10.1596/1813-9450-3772.

Henning-Schmidt, H., Selten, R., & Wiesen, D. (2009). *How payment systems affect physician's provision behavior – An experimental investigation* (Discussion Paper 29/2009). Bonn Graduate School of Economics, University of Bonn. Retrieved 24 May 2012 from http://www.wiwi.uni-bonn.de/bgsepapers/bonedp/bgse03_2011.pdf

Kessel R (1958). "Price Discrimination in Medicine". *Journal of Law and Economics* 1: 20-53. Retrieved 13 Feb 2012 from: http://www.jstor.org/stable/724881.

Kim, C., Steers, W. N., Herman, W., Mangione, C., Narayan, K. M. V., & Ettner, S. (2007). Physician compensation from salary and quality of diabetes care. *Society of General Internal Medicine*, 22, 448–452. doi: 10.1007/s11606-007-0124-5

Leonard, K. L., Masatu, M. C., & Vialou, A. (2007). Getting doctors to do their best: The roles of ability and motivation in health care quality. *The Journal of Human Resources*, 42(3), 682–700. Retrieved 26 May 2011 from http://www.jstor.org/stable/40057323

Libby, A., & Thurston, N. K. (2001). Effects of managed care contracting on physician labor supply. *International Journal of Health Care Finance and Economics*, 1(2), 139–157. Retrieved 13 October 2011 from http://www.jstor.org/stable/3528869

Luck, J., Peabody, J.W., Dresselhaus, T. R., Lee, M., & Glassman, P. A. (2000). How well does chart abstraction measure quality? A prospective comparison of standardized patients with the medical record. *The American Journal of Medicine*, 108, 642–649.

McGuire, T. G. (2000). Physician agency. In Culyer, A.J. & Newhouse, J.P. (Eds.), *Handbook of Health Economics* (vol. 1, pp. 461-536. Oxford: Elsevier Science B.V.

Peabody, J. W., Luck, J., Glassman, P. A., Dresselhaus, T.R., & Lee, M. (2000). Comparison of vignettes, standardized patients, and chart abstraction: A prospective validation study of 3 methods for measuring quality. *Journal of the American Medical Association*, 283(13), 1715–1722.

Peabody, J. W., Shimkhada, R., Quimbo, S., Solon, O., Javier, X., & McCulloch, C. (2013). The impact of performance incentives on child health outcomes: Results from a cluster randomized controlled trial in the Philippines. *Health Policy and Planning*, 29(5): 615-621..

Quimbo, S., Peabody, J. W., Shimkhada, R., Woo, K., & Solon, O. (2008). Should we have confidence if a physician is accredited? A study of the relative impacts of accreditation and insurance payments on quality of care in the Philippines. *Social Science & Medicine*, 67, 505–510.

Rice, T. (1997). Physician payment policies: Impacts and implications. *Annual Review of Public Health*, 18, 549–565.

Schneider U and Ulrich V (2008). "The physician-patient relationship revisited: the patient's view". International

Journal of Health Care Finance and Economics 8, 279-300. Retrieved 27 July 2011. doi: http://dx.doi.org/10.1007/s10754-008-9041-3.

Shimkhada, R., Peabody, J. W., Quimbo, S., & Solon, O. (2008). The Quality Improvement Demonstration Study: An example of evidence-based policy-making in practice. *Health Research Policy and Systems*, 6(5).

Solon, O., Woo, K., Quimbo, S. A., Peabody, J. W., Florentino, J., & Shimkhada, R. (2009). A novel method for measuring health care system performance: Experience from QIDS in the Philippines. *Health Policy and Planning*, 24(3), 167–174.

Thorton, J., & Eakin, B. K. (1997). The utility-maximizing self-employed physician. *The Journal of Human Resources*, 32(1), 98–128. doi: 10.2307/146242

UPecon—Health Policy Development Program. (2011). *Documentation of the HPDP data library*. Unpublished manuscript.

World Health Organization & Department of Health Philippines. (2012). *Philippines health service delivery profile 2012*. Retrieved from http://www.wpro.who.int/health_services/service_delivery_profile_philippines.pdf