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Do prospective payment systems (PPS) lead to desirable providers incentives and patients outcomes? A systematic review of evidence from developing countries

Tan SY, Melendez-Torres GJ

Abstract

The reform of provider payment systems, from retrospective to prospective payment, has been heralded as the right move to contain costs in the light of rising health expenditures in many countries. However, there are concerns on quality trade-off. The heightened attention given to prospective payment system (PPS) reforms, and the rise of empirical evidence regarding PPS interventions among developing countries suggest that a systematic review is necessary to understand the effects of PPS reforms in developing countries. A systematic search of 14 databases and a hand search of health policy journals and grey literature from October to November 2016 were carried out, guided by a set of inclusion and exclusion criteria. Data were extracted based on the Consolidated Health Economics Evaluation Reporting Standards (CHEERS) checklist. Drummond's 10-item checklist for economic evaluation, Cochrane Collaboration's tool in assessing risk of bias for randomised trials, and Risk Of Bias In Non-randomised Studies of Interventions (ROBINS-I) were used to critically appraise the evidence. A total of 12 studies reported in China, Thailand and Vietnam were included in this review. Substantial heterogeneity was present in PPS policy design across different localities. PPS interventions were found to have reduced health expenditures on both the supply and demand side, as well as length of stay and readmission rates. In addition, PPS generally improved service quality outcomes by reducing the likelihood or percentage of physicians prescribing unnecessary drugs and diagnostic procedures. PPS is a promising policy tool for middle income countries to achieve reasonable health policy objectives in terms of cost containment without necessarily compromising the quality of care. More evaluations of PPS will need to be conducted in the future in order to broaden the evidence base beyond middle income countries.

Introduction

Provider payment is one of the most important policy tools in controlling ever-increasing health costs in many countries (Carrin & Hanvoravongchai 2003). Its critical role in shaping providers' incentives is gaining traction in health policy making vis-a-vis increased governmental efforts to expand health coverage to wider populations across the world while ensuring fiscal sustainability in the light of such expansion. Provider payment systems shape providers' decisions by creating incentives capable of influencing the actions of organizations and individuals in a health system. These actions have direct implications for both the quantity and quality of healthcare delivered (Roberts et al. 2008). From the users' perspective, the providers' behavioural responses to the incentive structures generated by different provider payment systems also have direct implications for their well-being. Provider payment systems can be categorised as retrospective or prospective. In retrospective systems, providers' costs are reimbursed ex-post; while a prospective payment system (PPS) refers to a system in which reimbursement rates are fixed and negotiated ex-ante (Jegers et al. 2002).

Three most common retrospective payment systems are fee-for-service (FFS), per diem and historical budgets (Jegers et al. 2002). The literature on provider payment mechanisms has long established that retrospective payment systems can lead to cost escalation that results in welfare loss to the patients by promoting the tendency to overprescribe treatment. Over-prescription of treatment causes healthcare inefficiency which often translates into skyrocketing premiums without necessarily improving the quality of care (Yip et al. 2010; Porter and Kaplan 2016).

Some of the most common PPS include capitation, case-based payment/diagnostic-related group (DRG) (DRG hereafter), salary and global budget. While capitation is largely fixed, case-

based payment can be either fixed or variable. PPS, in general, are deemed better at reducing costs and increasing efficiency of health delivery (Blomqvist & Busby 2012; Roberts et al. 2008; Jegers et al. 2002). Nevertheless, these systems are not insulated from criticism. Studies have alluded to the tendency for capitation payment to predispose providers to compromising quality of health care by providing less-than-clinically-needed care due to the incentive to reduce costs and to provide a large number of services (Blomqvist 2011; Blomqvist & Busby 2012; Mills et al. 2000). These practices often lead to risk-selection behaviours such as cream-skimming and dumping (Blomqvist & Busby 2012; Mills et al. 2000). Likewise, DRG has suffered from the same criticisms for creating perverse incentives among health providers. The more cases a health group delivers, the more it gets paid, predisposing the providers to shorten the length of stay, providing less care and admitting more patients (James & Poulsen 2016; Roberts et al. 2008). In some countries, administering a DRG payment system without robust monitoring and accountability controls has also been seen to encourage perverse behaviours such as up-coding of diagnoses so as to inflate the claims from the payers (Trisnantoro et al. 2016; Bystrov et al. 2015). Besides this, salary and global budget have also been described as prone to mediocrity, in so far as they do not incentivise providers to provide sufficiently high quality care, and may encourage them to spend less time and effort for patients (Blomqvist & Busby 2012). Furthermore, a review of global budget payment systems in developed countries has suggested that constraints of resources in the health systems – characterised by whether the payment is capitation or facility based, and soft or hard cap – greatly affect provider behaviours (Chen & Fan 2016). With calls for physicians to deliver value-based or quality-based treatment (Rosenthal et al. 2004; Conrad 2015), there has been increased attention given to the use of performance-based incentives, more commonly known as pay-for-performance (P4P), to remunerate providers. Performance incentives are usually not a standalone payment mechanism but a supplementary policy tool incorporated into other predominant provider payment systems (Friedberg et al. 2015). Hence, more often than not, it is designed to be a component within PPS to reward providers who manage to achieve certain performance targets, which is what this review will also be focusing on.

Many developed countries have increasingly moved away from implementing a pure retrospective FFS payment system in light of the excessive cost burden that it could foist upon on the health system without necessarily delivering high quality care (Carrin & Hanvoravongchai 2003). PPS such as capitation, DRG, and global budget have increasingly replaced the conventional FFS system in recent years across both developed and developing countries (Langenbrunner et al. 2009; Kwon 2003; Cheng et al. 2012; Moreno-Serra & Wagstaff 2010). While a review has shown that PPS in developed western countries tend to promote resource efficiency and are useful policy instruments to control rising health costs (Carrin & Hanvoravongchai 2003), some evidence on more disease-specific impacts have alluded to the perverse incentives that they could create (Bystrov et al. 2015; Lee & Lee 2007). While the theoretical ideal of PPS is to increase efficiency, the prevailing principal-agent problems in the healthcare triad (between providers, payers and patients) argue that robust monitoring and control mechanisms in the implementation of PPS are imperative in the face of widespread information asymmetries in health care. Studies have shown that without such audit system in place, providers tend to conceal their cost efficiencies while insurers tend to shirk their risk responsibilities, resulting health care market failure that have detrimental cost implications to payers and patients in the longer run (Cutler & Zeckhauser 2000; Culyer 1989; Bystrov et al. 2015; Lee & Lee 2007; Cheng et al. 2012; Sarma et al 2010).

Knowledge gaps

Several systematic reviews have investigated the financial and behavioural incentives created by various provider payment systems to various providers (Gosden et al. 2000; Brocklehurst et

al. 2013; Flodgren et al. 2011) and patients (Flodgren et al. 2011). While these studies are important early evidence synthesis efforts, they possessed several limitations. First, despite not having prior restrictions on geographical focus, these reviews ended up including only evidence from developed OECD countries (Gosden et al. 2000; Brocklehurst et al. 2013; Flodgren et al. 2011). This is likely due to the paucity of evidence from countries outside the OECD at the time when these reviews were conducted. Besides which, some of the primary evidence gathered suffered from low methodological quality due to the observational nature of the research design and implementation issues that prevented the reviewers from making strong causal inferences (Flodgren et al. 2011). Findings from these reviews pointed to a significant knowledge gap on provider payment mechanisms in the developing world - an area that was largely understudied until about a decade ago.

A more recently published systematic review that investigated methods of provider payment in community-based health insurance schemes in developing countries concluded that PPS such as capitation and salary plus performance bonus were able to achieve more efficiency gains and improved financial performance as compared to a FFS system (Robyn et al. 2013). This review is notable in its ability to shed light on the provider outcomes of community-based health insurance programmes in developing countries. However, participation in community-based health insurance programmes is voluntary and tends to target populations from the informal sector, suggesting a high probability of adverse selection presenting in these schemes.

Rationale and objectives of the review

Whilst evidence on the effects of provider payment systems on health costs, utilisation and treatment incentives in most developed countries with mature health systems is well-established (Christianson & Conrad 2011; Carrin & Hanvoravongchai 2003; Gosden et al. 2000; Flodgren et al. 2011), evidence in developing countries is relatively scarce due to the scant evidence. This is largely due to the fact that many health system reforms in developing countries were fairly recent. Empirical studies evaluating policy interventions comparing PPS to retrospective payment systems either in the form of policy pilots (Yip et al. 2014; Jian et al. 2015; Sun et al. 2016) or legislation reforms (Tangcharoensathien et al. 1999; Bryant & Prohmmo 2005; Yip et al. 2001; Hirunrassamee & Ratanawijitrasin 2009) are fast emerging in several developing countries. These recent evaluation efforts created an opportunity for consolidation of evidence at this juncture, to understand the impact of PPS reforms on providers' behaviours in maturing health systems, and the financial impacts on users. It is important to observe whether the incentive mechanisms created by PPS in mature health systems in developed countries manifested in similar patterns to those in developing nations that are mostly resource poor and embroiled in supply-side constraints. A synthesis of evidence from developing countries at this point would be a timely endeavour to understand the design components of a PPS that are optimal in creating desirable incentives for providers and users, which in turn will have important implications for policy makers configuring a provider payment system that will work in maturing health systems.

This study aims to synthesize empirical evidence on effects of PPS policy interventions or policy reforms in developing countries starting from the 1990s. This era marked the starting point for flourishing provider payment reforms in many developing countries - especially in Latin America and Asia (Bitran & Yip 1998). This study's review questions are: What are the effects of PPS interventions or reforms on users and providers in developing countries? Do these policy interventions or reforms lead to desirable outcomes as far as provider and patient incentives are concerned?

Methods

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Moher et al. 2009) was adopted in the reporting of this systematic review. The Consolidated Health Economics Evaluation Reporting Standards (CHEERS) guideline (Husereau et al. 2013) was used as a guiding tool in data extraction.

Inclusion and exclusion criteria

This review followed six inclusion criteria in selecting and gathering relevant evidence. First, the search process limited the timeline of evidence under consideration to studies published within the last 25 years (January 1991 to October 2016), as a vast majority of provider payment reforms in developing countries started in the 1990s (Bitran & Yip 1998) with an increase in intensity over the past decade (Langenbrunner et al. 2009). Second, only study locations and contexts reported at low and middle income countries classified by The World Bank based on country's gross domestic product (GDP) per capita (The World Bank 2016) were included. Third, only empirical studies with specific focuses on policy evaluation to examine the impact of PPS policy interventions (capitation, salary, DRG, global budget) or mixed financing policy interventions (a PPS with a performance incentive component such as P4P or performance bonus) were included. Fourth, all included studies must have a comparator or control group. Fifth, included studies must evaluate PPS from either health providers' or patients' perspectives or both. In this respect, only empirical studies evaluating either provider outcomes such as cost, quality and prescription patterns; and/or patient outcomes such as service utilisation/access and financial protections were included. Sixth, both primary studies conducted using experimental, quasi-experimental or observational design; and secondary studies using household survey data or administrative data adopting either a pooled cross section design or quasi-experimental design were included.

There were six exclusion criteria. First, studies that were published prior to 1991 were excluded. Second, studies reported on high income developed countries as classified by The World Bank based on GDP per capita (The World Bank 2016) were excluded. Third, empirical studies that evaluated the impacts of retrospective payment system such as FFS, or those evaluating P4P as a stand-alone intervention were excluded. Fourth, studies without a control or comparator group were excluded. Fifth, studies that examined system-wide aggregate impacts employing a cross-jurisdictional analysis approach were excluded as it did not allow the impact of PPS on individuals and facilities to be isolated. Sixth, sole descriptive study and qualitative case studies were excluded from the review.

Search strategy and information sources

'Provider incentive', 'provider payment' and 'physician reimbursement' were the three major keywords used for the literature search during the exploratory stage of this systematic review. From this preliminary screening exercise, three groups of precise keywords representing different types of PPS design and policies, levels of health facility and national economic stages were developed as search string to locate relevant evidence (see Supplementary Figure 1). In total, 12 academic databases (*Medline, PubMed, Embase, CINAHL, Science Direct, Web of Science, EconLIT, International Political Science Abstract, PsycINFO, Cochrane Central Register for Controlled Trials, HEA Economic Evaluation Database, ProQuest Dissertation & Theses*) and two working paper databases (*IDEAS and Social Science Research Network*) were searched using the search string, modified using wildcards and truncations based on the requirements specified in different databases. In addition, hand search was conducted on four prominent health policy journals (*Health Policy and Planning, Health Policy, Health Affairs and Health Services Research*), and grey literature such as policy documents from government and multilateral organisations' websites. The evidence search was conducted from October to November 2016.

Study selection

A preliminary systematic search of evidence using the above search strategy was conducted by the first author. Titles and abstracts of the shortlisted studies were reviewed by both authors. Besides this, full texts were reviewed by both authors based on the above pre-specified inclusion and exclusion criteria before relevant studies were shortlisted. Ongoing discussions were held between the authors until consensus was achieved.

Data extraction

Data extraction was conducted based on 26 questions covering six domains (title and abstract, introduction, design of policy intervention, methods, results and discussion), adopted and modified from the Consolidated Health Economics Evaluation Reporting Standards (CHEERS) (Husereau et al. 2013). CHEERS is an established tool used for reporting health economics evaluation studies and its checklist has been adopted by previous published studies in guiding the extraction, quality reporting and synthesis process (Bilvick Tai et al. 2016; Oosterhoff et al. 2016). In addition, tabulation of the key design components of PPS policy intervention examined in each study was conducted.

Critical appraisal and risk of bias assessment

All studies were critically appraised for their quality. Drummond's 10-item checklist for assessing economic evaluation (Drummond et al. 2015) was utilised as the primary appraisal tool. The above appraisals were supplemented using the Cochrane Collaboration's tool for assessing risk of bias in randomised trials (Higgins et al. 2011), and Risk Of Bias In Non-randomised Studies- of Interventions (ROBINS-I) tool for non-randomised and observational studies (Sterne et al. 2016).

Summary measures and synthesis of results

Due to substantial heterogeneities in research design, policy design components, study perspectives and outcome measures, a meta-analysis was not conducted. Instead, a narrative synthesis approach was adopted to explain the policy design and to synthesise the effects of various PPS pilots/reforms in developing countries. Narrative synthesis – centred on the use of textual descriptions to explain and analyse findings – has been established as an alternative approach to synthesise findings from multiple studies that are insufficiently similar to allow statistical meta-analysis to be conducted in deriving an aggregate effect size (Popay et al. 2006). In this review, a narrative synthesis approach was adopted to derive preliminary synthesis from all included studies, before the relationships of policy design and outcomes between studies were explored (Popay et al. 2006).

Results

Search results and study selection

A total of 5,466 records were identified from the 14 academic databases using the above search string. Three studies were identified from hand search. A total of 191 duplicates were removed. Titles and abstracts of the remaining 5,278 records were screened and 61 studies were shortlisted for more detailed evaluations. It is important to note that a vast majority of seemingly relevant studies that examined PPS reforms in many developing countries were excluded at this stage of screening as they comprised mainly descriptive studies, single group pre-post evaluation study, or qualitative case studies that addressed a different research question as compared to what this review is trying to answer. After retrieving the full texts of these 61 studies, a detailed assessment of the study objectives, research design and country contexts were conducted. 49 studies were excluded in this process. This was done for a variety of reasons:

either the studies reported on high income countries, examined policy interventions beyond the scopes of PPS, evaluated only the effects of P4P as a stand-alone intervention, were cross-country studies evaluating system wide aggregate impact, were descriptive in nature and lacked a control/comparator group, or were qualitative case studies providing context without an evaluation component. A total of 12 studies representing eight unique national or sub-national level policy experiments or policy contexts were included in the final synthesis (see Figure 1).

[Figure 1 about here]

Study contexts and characteristics

The twelve empirical studies included in this systematic review essentially represent eight unique policy experiments or policy contexts in three different countries – China, Thailand and Vietnam. Amongst them, seven studies representing six policy experiments were reported in China (Yip et al. 2014; Yip & Eggleston 2001; Yip & Eggleston 2004; Sun et al. 2016; Wang et al. 2011; Gao et al. 2014; Jian et al. 2015), one study was conducted in Vietnam (Nguyen et al. 2015), and four studies with similar policy contexts were conducted in Thailand (Yip et al. 2001; Hirunrassamee & Ratanawijitrasin 2009; Tangcharoensathien et al. 1999; Bryant & Prohmno 2005). In terms of study design, two studies adopted cluster-randomised experimental design with close collaborations with the local government (Yip et al. 2014; Sun et al. 2016), six studies exploited the advantage of natural experiments resulting from policy reforms or policy pilots introduced by the national/local government to evaluate the impacts of the PPS interventions introduced at county level (Nguyen et al. 2015; Yip & Eggleston 2001; Yip & Eggleston 2004; Wang et al. 2011; Gao et al. 2014; Jian et al. 2015), and four were observational studies examining the impacts of different payment systems applied to different social health insurance programmes at two different junctures (Hirunrassamee & Ratanawijitrasin 2009; Yip et al. 2001; Tangcharoensathien et al. 1999; Bryant & Prohmno 2005).

The prospective payment policy interventions or reforms introduced in these localities vary from capitation (Nguyen et al. 2015; Gao et al. 2014), capitated global budget (Yip & Eggleston 2001; Yip & Eggleston 2004), DRG (Jian et al. 2015), salary and performance bonus (Wang et al. 2011), to capitation and pay-for-performance (Yip et al. 2014; Sun et al. 2016). The four observational studies in Thailand compared the effects of both prospective and retrospective payment systems to different groups of patients covered under various social health insurance programmes that were reimbursed under different payment systems (Yip et al. 2001; Bryant & Prohmno 2005; Hirunrassamee & Ratanawijitrasin 2009; Tangcharoensathien et al. 1999).

All studies have clear comparator or control groups that were implementing FFS payment mechanisms at the time, except for one study which was unable to evaluate a PPS reform as compared to a FFS control group due to political interference of the local government during the implementation process (Sun et al. 2016). Consequent to this unexpected interruption of the original experimental protocol, this study compromised on its original plan by reducing its planned factorial design to a two group design examining different intervention components (capitated global budget plus pay-for-performance versus capitated global budget only). Most of the studies used a combination of administrative and household/health facility survey data sources (Yip et al. 2014; Nguyen et al. 2015; Yip & Eggleston 2001; Yip & Eggleston 2004; Hirunrassamee & Ratanawijitrasin 2009; Jian et al. 2015; Yip et al. 2001; Bryant & Prohmno 2005). Two experimental studies collected primary data from pre-post surveys for both intervention and control groups (Yip et al. 2014; Sun et al. 2016), one observational study collected primary data through a cross-sectional patients' satisfaction survey (Tangcharoensathien et al. 1999), while one quasi-experimental study depended solely on secondary survey data (Gao et al. 2014).

[Table 1 about here]

Critical appraisal of evidence quality and risk of bias assessment

All studies included in the synthesis were critically appraised for their quality. Drummond's 10-item checklist for assessing economic evaluations (Drummond et al. 2015) was adopted as the primary appraisal tool. Among 12 studies included in this systematic review, four were rated as high quality, six were rated as medium quality and the other two were rated as low quality based on the total number of 'yes' scores for each item.

All studies presented well-defined research questions and have explicit control or comparator groups. The effectiveness of the prospective payment policies was strongly established in five out of the 12 studies included. These studies either employed randomised experimental design (Yip et al. 2014) or a quasi-experimental design that capitalises on natural experiments as a result of policy pilots and policy reforms at the sub-national government level (Nguyen et al. 2015; Yip & Eggleston 2001; Yip & Eggleston 2004; Jian et al. 2015). For the other quasi-experimental studies, effectiveness was less conclusive due to the inability of the authors to address the ambiguities of the assumptions underlying the empirical strategies (Wang et al. 2011; Gao et al. 2014). Likewise, the nature of the observational study, which predisposes the estimates to various confounding factors, meant that causal inferences could not be made in four studies (Hirunrassamee & Ratanawijitrasin 2009; Bryant & Prohmmo 2005; Yip et al. 2001; Tangcharoensathien et al. 1999). In another study that attempted to employ experimental design, unexpected political interference by the local government disrupted the original treatment plan, forcing the researchers to adapt their objectives and study design accordingly in order to accommodate the change (Sun et al. 2016).

Most studies employed outcome measures from dual stakeholder viewpoints - providers and users - in evaluating the efficiency and quality of the PPS interventions (Yip et al. 2014; Nguyen et al. 2015; Yip & Eggleston 2001; Hirunrassamee & Ratanawijitrasin 2009; Wang et al. 2011; Jian et al. 2015; Bryant & Prohmmo 2005). Due to data limitations or pre-specified objectives, some studies gave only the providers' perspectives (Yip & Eggleston 2004; Yip et al. 2001) or only the patients' perspectives (Gao et al. 2014; Tangcharoensathien et al. 1999) in evaluating the outcomes.

In terms of the robustness of the empirical strategies, five out of 12 studies were able to account for uncertainty in the estimates by reporting ways to eliminate contamination and biases that could possibly arise. This was done either by reporting concrete measures taken to counteract the unforeseen circumstances that arose during random assignment (Yip et al. 2014), or ensuring that parallel trend assumptions underlying the difference-in-difference empirical strategies employed in quasi-experimental studies were tested (Nguyen et al. 2015; Yip & Eggleston 2001; Sun et al. 2016; Jian et al. 2015). Other studies either failed to test such model assumptions (Yip & Eggleston 2004; Wang et al. 2011), or were unable to deal with the omitted variable biases and unobserved heterogeneities that are inherent in observational studies (Yip et al. 2001; Tangcharoensathien et al. 1999; Hirunrassamee & Ratanawijitrasin 2009; Bryant & Prohmmo 2005). To further assess the risk of bias in each study, Cochrane Collaboration's tool for assessing risk of bias in randomised trials was employed to assess the two clustered-randomised studies in this review (Yip et al. 2014; Sun et al. 2016); while ROBINS-I tool was employed to assess the other six quasi-experimental studies (Nguyen et al. 2015; Yip & Eggleston 2004; Yip & Eggleston 2001; Wang et al. 2011; Gao et al. 2014; Jian et al. 2015) and four observational studies in this review (Hirunrassamee & Ratanawijitrasin 2009; Tangcharoensathien et al. 1999; Yip et al. 2001; Bryant & Prohmmo 2005).

Appraisal of the two clustered randomised studies indicated that random sequence generation was not a problem in one study (Yip et al. 2014) but was in the other due to interference by local governments in the original protocol assignment (Sun et al. 2016). Both studies also suffered from a high risk of bias for allocation concealment as township governments were not shielded from the knowledge of group assignment. Besides, it was not reported as to whether health facilities and health personnel involved in the interventions were blinded, and whether the outcome assessors had knowledge of group assignment, hence performance bias and detection bias could not be ruled out in these two studies. For the other six quasi-experimental studies and four observational studies, all except three (Nguyen et al. 2015; Yip & Eggleston 2001; Jian et al. 2015) were assessed as suffering from a high risk of bias due to confounding factors, as they were either not able to account for uncertainties underlying the model assumptions, or suffered from the policy endogeneity that is inherent in natural experiments implemented by the government, which are unlikely to be a random and thus an exogenous event (Rodrik 2012). In terms of the measurement of outcomes, two studies were assessed to be suffering from a high risk of bias due to the exclusion of uninsured patient data in the analysis (Yip & Eggleston 2004; Yip & Eggleston 2001), while two other studies were assessed to be suffering from an unknown risk of bias (Tangcharoensathien et al. 1999; Bryant & Prohmno 2005). As a patient survey was conducted in one study (Tangcharoensathien et al. 1999), and a community survey was conducted in another study, in which the responses were matched to coded medical records from the health facilities (Bryant & Prohmno 2005), it was unclear as to whether specific measures were taken to minimize recall or reporting bias during the survey, or whether relevant measures were taken to minimize medical report coding errors (See Supplementary Table 1, Supplementary Table 2 and Supplementary Table 3).

Synthesis of results

(i) PPS policy design

The PPS interventions examined in most studies were capitation payment or capitated global budget systems (Yip et al. 2014; Nguyen et al. 2015; Yip & Eggleston 2001; Yip & Eggleston 2004; Sun et al. 2016; Hirunrassamee & Ratanawijitrasin 2009; Gao et al. 2014; Yip et al. 2001; Tangcharoensathien et al. 1999; Bryant & Prohmno 2005), with the exception of the salary plus performance bonus system in one study (Wang et al 2011), and DRG in another study (Jian et al. 2015). Most of the PPS interventions were implemented at the hospital level covering inpatient services (Yip & Eggleston 2001; Yip & Eggleston 2004; Jian et al. 2015; Yip et al. 2001; Gao et al. 2014; Nguyen et al. 2015; Tangcharoensathien et al. 1999; Bryant & Prohmno 2005), three PPS interventions were implemented at the primary health levels covering outpatient services (Yip et al. 2014; Wang et al. 2011; Sun et al. 2016), and one at both hospital and primary health levels covering both inpatient and outpatient services (Hirunrassamee & Ratanawijitrasin 2009).

Though it was clear that the rules for these payments were negotiated between payers and the health providers in the treatment groups prior to the intervention, some of the design aspects of these policy interventions varied among different pilot programmes and localities. For instance, the capitation rate was calculated somewhat differently in different studies, with some payers benchmarked against historical budgets (Nguyen et al. 2015) or an historical average of per admission charges (Jian et al. 2015), and some payers using a per capita base rate determined by local government (Gao et al. 2014) or insurance payers (Sun et al. 2016; Hirunrassamee & Ratanawijitrasin 2009; Tangcharoensathien et al. 1999; Bryant & Prohmno 2005). It was not clear to what extent risk adjustment vis-a-vis of different health providers who were serving population with different risk factors was introduced in these provider payment policies, as only one study reported the introduction of a risk adjustment mechanism based on the number of

insured members registered in a facility (Nguyen et al. 2015). Another study incorporated complementary policy tools such as reservation funds to account for some common chronic diseases with a heavy disease burden, and equalisation funds to compensate certain unexpected losses in small facilities with a limited risk pool. The same study also reported adopting an open enrolment policy to introduce flexibility of choice among users and to encourage competition among the providers (Gao et al. 2014).

The frequency of payment for different PPS reforms varies in different countries and localities, with some paid on an annual basis (Yip & Eggleston 2001; 2004; Yip et al. 2014), quarterly basis (Sun et al. 2016), or monthly basis (Wang et al. 2011; Gao et al. 2014). Few studies did not report the frequency of payments (Tangcharoensathien et al 1999; Yip et al 2001; Bryant & Prohmmo 2005; Hirunrassamee & Ratanawijitrasin 2009; Jian et al. 2015; Nguyen et al. 2015). In some reforms, payments were not all given prospectively as a lump sum to the health providers. Normally, 20% to 30% of the payment was withheld from the providers until end of the financial month or financial year. Reimbursement of the remaining funds was subject to providers meeting certain conditions stipulated by the payers based on a quality assurance review (Yip & Eggleston 2001; Yip & Eggleston 2004) or performance assessment (Sun et al. 2016; Wang et al. 2011). The quality assurance review serves as a monitoring tool to ensure the accountability of providers in service delivery.

Performance incentives aiming to improve the quality of the services, were calibrated either as penalties (Sun et al. 2016) or bonuses (Yip et al. 2014; Sun et al. 2016). In three of the capitation payment system reforms reported on in three studies, providers were allowed to retain the surpluses. While two jurisdictions in China allowed providers to retain full surpluses (Gao et al. 2014; Jian et al. 2015), hospital providers that received capitation payments in Vietnam were only allowed to retain up to 20% of their capitated budget to invest in equipment or top up staff salary (Nguyen et al. 2015). Nevertheless, providers that were allowed to retain all surpluses in the above two jurisdictions in China would also have to bear the risks of budget overruns (Gao et al. 2014; Jian et al. 2015). Two jurisdictions reported using various mechanisms to reimburse providers' deficits in the event of cost overruns, with reimbursement caps applied in most cases (Nguyen et al. 2015; Yip & Eggleston 2001; Yip & Eggleston 2004). In Vietnam, hospital providers can appeal to have a minimum of 60% deficit reimbursement from the government regardless of the deficit amount (Nguyen et al. 2015). In China's Hainan province, providers can only appeal for partial deficit reimbursement if budget overruns remained under 20% of the capitated budget (Yip & Eggleston 2001; Yip & Eggleston 2004).

[Table 2 about here]

(ii) Effects of PPS on provider incentives

Expenditure outcomes

Ten studies reported the effects of PPS interventions on expenditure outcomes. Six out of eight studies reported significant reductions in total expenditure and/or expenditure per admission (Yip et al. 2014; Nguyen et al. 2015; Wang et al. 2011; Yip et al. 2001; Yip & Eggleston 2001; Jian et al. 2015), four out of seven studies reported reductions in drug expenditure (Nguyen et al. 2015; Yip & Eggleston 2004; Wang et al. 2011; Bryant & Prohmmo 2005), and one study reported reduction of programme spending (Yip & Eggleston 2001) among facilities that were piloted for prospective payment interventions or among patients whose insurance plans were paid under PPS. One study reported mixed findings on expenditure outcomes among patients with different medical conditions (Hirunrassamee & Ratanawijitrasin 2009), and another study reported reductions in total inpatient expenditure and in the ratio of drug to total expenditure but the results were statistically insignificant (Gao et al. 2014). An impact on expenditure

reduction was observed in different PPS reforms, including capitation or capitated budget systems (Yip et al. 2014; Nguyen et al. 2015; Yip & Eggleston 2001; Yip & Eggleston 2004; Yip et al. 2001; Bryant & Prohmmo 2005), DRG (Jian et al. 2015), and salary plus bonus systems (Wang et al. 2011). Two studies in China that examined expenditure outcomes for two types of health facilities were able to differentiate the impacts between those serving as the first line of health defense to the population (village health posts) and the higher level health facilities that accept more referrals from lower level facilities (township health centres). The results unanimously suggested evidence of cost-shifting from the lower level to the higher level health facilities, evident in the observation of expenditure reductions in primary health facilities but not in secondary or tertiary health facilities (Yip et al. 2014; Wang et al. 2011). PPS may have led patients who did not report poor health to receive less unnecessary care and patients who reported poor health to receive more optimal care, as two studies showed that PPS reforms led to higher health spending among patients who reported poor health, but no significant change in spending among patients who did not report poor health (Wang et al. 2011; Gao et al. 2014).

Service volume and intensities

Six studies documented the effects of PPS interventions on providers' service volumes and intensities. In terms of length of stay for inpatients, three out of four studies reported a significant reduction as a result of capitation and DRG payment reforms (Gao et al. 2014; Jian et al. 2015; Yip et al. 2001). One study reported a significant reduction in readmission rates as a result of a DRG payment reform among hospitals in Beijing (Jian et al. 2015). However, studies that examined the impact of capitation and capitated global budget systems on patient volume and patient contact did not show significant increase in either measure as a result of the reforms (Yip et al. 2014; Nguyen et al. 2015).

Quality outcomes

Six studies examined effects of PPS on quality outcomes. These studies used physician prescribing behaviours as proxies. The quality of the outcomes was generally positive, suggesting that PPS did not lead to over-prescription of unnecessary care. One study reported that capitation payment was able to reduce the percentage of antibiotic prescriptions delivered by the physicians in different level health facilities, with the reduction more pronounced among patients diagnosed with colds (Yip et al. 2014). Another study also documented a reduction in the percentage of expensive drugs prescribed for patients who were reimbursed under the capitation payment system as opposed to the FFS system (Bryant & Prohmmo 2005). Only one study suggested that hospitals that received capitated budgets were more likely to prescribe expensive drugs as opposed to hospitals that did not receive capitated budgets (Yip & Eggleston 2004). Besides, a study in China reported that DRG payment was able to streamline treatment plans into simpler and clearer clinical procedures as compared to FFS (Jian et al. 2015). In addition, adding a performance-based component to capitation payment was demonstrated to result in a reduced tendency to prescribe unnecessary drugs (Sun et al. 2016). Another study in Thailand suggested that the nature of the medical conditions involved play a role in influencing physician's prescribing behaviour. This study examined medical notes to analyse prescribing behaviours with regard to patients entitled to different payment structures (PPS versus retrospective payment systems) and concluded that patients with critical conditions such as upper gastrointestinal bleeding, regardless of their payment structures, had the same chance of receiving expensive diagnostic procedures such as gastroscopic imaging; whilst expensive diagnostic procedures such as magnetic resonance imaging (MRI) and computerized tomography (CT) scans, were more likely to be ordered for patients whose care were

reimbursed under a FFS payment system when the medical conditions were chronic and less critical (Hirunrassamee & Ratanawijitrasin 2009).

[Table 3 about here]

(iii) Effects of PPS on patient outcomes

The effects of PPS on patient outcomes were largely investigated as reflected by patient satisfaction, patient co-payment/out-of-pocket expenditure, and treatment and/or survival outcomes for patients with various medical conditions.

Patient satisfaction

The three studies that examined the effects of PPS interventions on patient satisfaction appeared to suggest that PPS either led to no change or a marginal reduction in patient satisfaction. Two studies concluded that there were no significant differences in patients satisfaction between those who sought treatment from health facilities that receive capitation as compared to those who sought treatment from health facilities that received FFS reimbursement (Yip et al. 2014; Gao et al. 2014). One study suggested that there was a reduction in patient satisfaction among those whose social health insurance schemes were paid prospectively as opposed to those whose social health insurance schemes were paid retrospectively (Tangcharoensathien et al. 1999). This study concluded that patients who belonged to social health insurance schemes paid by capitation, were more likely to report lower ratings for doctor's explanation on diagnoses and treatment, as well as less likely to provide good appraisals for their experiences in doctor's consultation, as compared to those in FFS systems. (Tangcharoensathien et al. 1999).

Co-payment/out-of-pocket expenditure

In terms of patient co-payment and out-of-pocket expenditure, the three studies that examined this outcome measure unanimously reported that PPS interventions, relative to retrospective payment system, resulted in lower patient co-payment (Yip & Eggleston 2001) and lower out-of-pocket expenditure for patients (Gao et al. 2014; Jian et al. 2015),.

Treatment/survival outcomes

The evidence of PPS interventions on patients' treatment and/or survival outcomes is rather limited in this review. Among the 12 studies, only two studies examined this. One study that examined the effect of capitation payment reform in China concluded that there was no treatment effect among patients enrolled in a social health insurance scheme reimbursed via capitation payment as compared to patients enrolled in another scheme that was reimbursed via FFS (Gao et al. 2014). Another study conducted in Thailand reported that there were no significant differences in terms of the percentage of cured cases among patients with upper gastrointestinal bleeding - a critical illness - across different social health insurance schemes. However, in epilepsy cases, patients covered under social health insurance schemes that were paid by FFS had a higher probability of being seizure free. Likewise, for lung cancer patients, those who belonged to social health insurance schemes reimbursed by a FFS system also had a higher chance of surviving through to their next birthday (Hirunrassamee & Ratanawijitrasin 2009). As this study is constrained by its observational design, which undermines the ability to make strong causal inference, the above associations are at most indicative and would require more empirical investigation in the future.

[Table 4 about here]

Discussion

Summary of the evidence

There are five key findings identified this review. First, PPS interventions were designed in a multitude of ways in different localities. However, the lack of sufficient documentation concerning the design components for some of the PPS interventions undermines the potential for us to tease out their critical ingredients. When performance-based components such as P4P were incorporated within PPS interventions, the constellation of incentive mechanisms resulted in positive provider outcomes. Nevertheless, the effects attributable solely to P4P could not be isolated due to limitations in the research designs (Yip et al. 2014; Wang et al. 2011; Sun et al. 2016).

Second, the prospective provider payment systems examined in this review – capitation, capitated budget, global budget with performance incentives, salary plus bonus, DRG – appear to have reduced administrative expenditures and health expenditures both on the supply-side (programme spending, total expenditure, drug expenditure, inpatient expenditure), and the demand-side (patient co-payment and out-of-pocket expenditure). There was preliminary evidence of cost-shifting from lower to higher level health facilities (Yip et al. 2014; Wang et al. 2011), and evidence of physician task shifting from patients who did not report poor health to patients who reported poor health (Wang et al. 2011; Gao et al. 2014). Such observations however, were limited to evidence from China.

Third, there were substantial heterogeneities in the way service volumes and intensities were measured, and findings are at most tentative. While there were no differences observed in terms of outpatient volumes and intensities (measured as patient volume and patient contact per capita), inpatient volumes and intensities (measured as length of stay and readmission rates) appeared to have reduced. The underlying reasons for the reductions in inpatient service volumes and intensities – whether it is due to a reduction in unnecessary care or physicians stinting on necessary care delivery – could not be established due to limitations in the data.

Fourth, the effects of PPS interventions on outcome quality - measured via the tendency on the part of the physicians to prescribe unnecessary or expensive care – appeared to be country-specific. While evidence from China suggested that PPS reforms resulted in the reduction of moral hazard behaviours, such as antibiotics over-prescription, among physicians, evidence from Thailand suggested that physicians' prescribing behaviours were likely mediated by the nature and severity of diagnoses.

Fifth, both subjective (patient's satisfaction) and objective patient outcomes (treatment/survival outcomes) may have been compromised as a result of PPS reforms, but a strong conclusion cannot be drawn due to the limited evidence included in this review.

Contribution of the review

This is the first systematic review to consolidate policy evaluation studies examining the effects of the PPS reforms/interventions that have increasingly emerged in developing countries in recent years. An earlier review examined the structures and effects of different forms of provider payment systems in developing countries, but this review focused only on community-based health insurance schemes that were mainly voluntary, non-governmental driven, and likely laden with strong selection bias in recipient recruitment and scheme implementation (Robyn et al. 2013). Our review builds on the findings of this earlier review, adding to the growing literature on provider payment reforms in developing countries by shedding light on the desired incentives achieved via PPS interventions in countries that have implemented these reforms, and analysing some of the unintended consequences of PPS interventions. While certain effects of PPS interventions remain ambiguous due to data limitations, our review makes an incremental contribution to the literature by providing preliminary insight into a health policy issue that remained largely understudied in developing countries until recently.

Strengths and limitations of the review

This review demonstrates that PPS can be employed as an effective cost containment tool in developing countries with a vast majority of the evidence indicating promising results. More than half of the studies employed either an experimental or a quasi-experimental design, with careful attention devoted to preserving experimental integrity and design rigour, making causal inference possible in this respect.

Besides which, this review incorporated both providers' and patients' outcomes and examined both the supply-side and demand-side impact of PPS interventions. While there were positive supply-side impacts – evident in positive provider outcomes in terms of expenditure, service volumes and quality of care, the demand-side impact were less established. This suggests the need for ongoing evaluation efforts that pay more attention to the evaluation of patient outcomes.

The importance of PPS policy design in effecting the various provider and patient outcomes cannot be overemphasised. This review suggests that there is a need to pay attention to the design components of PPS. This includes understanding the way in which the base rate is calculated, the extent of the benefit packages included, the timing and frequency of payment disbursed to the providers, a clear understanding of which parties will have to bear the ultimate responsibility in the event of budget overruns or deficits, whether there exists any risk-adjustment mechanisms, and the checks and balances to be built into a PPS. Unlike many large scale national level provider payment reforms that tend to adjust the payment rate based on variables such as age, gender and disease profiles of the local communities (Langenbrunner et al. 2009), this review found that risk adjustment mechanism was not present in most of the PPS reforms. Absence of such an important design component underlies the potential lack of capacity to effectively calculate health risks and map out population profiles among smaller jurisdictions in many developing countries.

One of the biggest limitations of this review is that it included only studies from three countries in the developing world – China, Vietnam and Thailand. These are all middle income countries in Asia that witnessed a heightened political commitment from the government to assume a more proactive role in health provision over the past two decades (Mills & Hsu 2014; Somanathan et al. 2014; Hanvoravongchai & Hsiao 2007; Eggleston 2012), hence the increased evaluation efforts that have emerged are not unprecedented. However, the findings from this review, as a result of its geographical limits, warrant careful interpretation. First, findings from this review are unlikely to be generalisable to low income countries that differ substantially from middle income countries in many of the health performance indicators. Low income countries tend to have lower total health expenditure per-capita, and are lagging far behind in terms of their human resources as compared to middle income countries (Mills & Hsu 2014). Second, even among middle income countries, the health performances and several basic health outcomes of those in Asia - especially those that were examined in this review - were reported to be far better than those in Sub-Saharan Africa, highlighting that within the same national income range, there are still heterogeneities in terms of capacity and endowment (Mills & Hsu 2014).

Besides geographical limitations, there are limitations with regard to the research design of some of the studies included in this review. The observational nature of the four cross-sectional studies from Thailand (Hirunrassamee & Ratanawijitrasin 2009; Yip et al. 2001; Tangcharoensathien et al. 1999; Bryant & Prohm 2005) meant that the relations between PPS interventions and the outcomes were merely associative. The cross-sectional nature of these studies also constrained their ability to establish causal relations between the different payment policies and their impacts. By the same token, some of the quasi-experimental studies

included in this review have lingering endogeneity problems such as selection bias (Hirunrassamee & Ratanawijitrasin 2009; Yip et al. 2001; Tangcharoensathien et al. 1999; Bryant & Prohmmo 2005; Gao et al. 2014) history (Yip & Eggleston 2004; Wang et al. 2011; Gao et al. 2014), and ambiguous temporal precedence (Hirunrassamee & Ratanawijitrasin 2009; Yip et al. 2001; Tangcharoensathien et al. 1999; Bryant & Prohmmo 2005; Yip & Eggleston 2004; Wang et al. 2011; Gao et al. 2014) that were left unaddressed.

With the exception of the prescription behaviour outcomes examined by several studies, the rest of the provider outcomes examined in this review were largely limited to the facility or organisational level rather than the individual health worker level. A recent qualitative study from the US suggests that many health workers remain insulated from the effects and understanding of the payment systems, and examining the professional satisfaction of health workers concerning the payment systems is important (Friedberg et al. 2015). None of the studies included in this review attempted to examine the providers' appraisals of the PPS interventions. In light of this, it would be useful for future research into health care payments in developing countries to include individual health worker behaviour and their professional appraisals of the payment systems as part of the focus on examining provider outcomes.

With the exception of one study in Vietnam (Nguyen et al. 2015), all other studies in this review examined short term impact, typically encompassing a time horizon of one to two years. The sustainability of the desired outcomes - for instance, reductions in health expenditure over a longer period of time - would require ongoing evaluation.

Conclusions: Policy implications and future research directions

The findings of this review suggest that PPS is a promising policy tool for middle income countries to achieve reasonable health policy objectives of cost containment without necessarily compromising the quality of care. This proposition, however, could not be extended to low income countries that are still struggling with severe supply-side constraints in terms of health spending, human resources, management capacities and political commitments to improve health deliveries. Findings from this review also highlighted the importance of PPS policy design, which has direct implications for the shaping of provider incentives and in determining the success or failure of its implementation. Strengthening agency relations between payers and providers through the incorporation of accountability mechanisms that entail monitoring of costs and service volumes – often via strong contractual agreements that are negotiated between payers and providers, with contractual obligations adhered to by both parties – are crucial in the design of payment system (Langenbrunner et al. 2009). In addition, the incorporation of performance-based incentives into PPS interventions, using performance monitoring tools that stipulate the minimum acceptable levels of service quality and encourage good clinical practices, have been demonstrated to be effective. They should be included as crucial components in payment design.

While studies that examined stand-alone performance-based incentives such as P4P were not included in this review, its incorporation into PPS interventions suggest that it is a complementary incentive that could improve the efficiency and quality of health delivery. However, the question of how these performance-based incentives should be designed – either as penalties that withhold the disbursement of payment to the providers, or as rewards in the form of performance bonuses for health workers who meet certain health performance targets, warrants more tinkering and evaluation.

This review developed initial answers to the questions of whether PPS interventions have worked in developing countries, and whether they have created the desired incentives among providers and users. While some of the outcome measures were promising, some others were

less conclusive, reflecting the fact that long term evaluation efforts of PPS interventions in developing countries remain a work-in-progress. Besides the need for ongoing evaluations of their impact, there are other important dimensions that require empirical investigations, one of which being the implementation processes associated with PPS interventions. Notably, a study of the components of PPS interventions that are contingent upon the various contexts and circumstances in developing countries would be a meaningful endeavour to undertake in future research.

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