Getting the incentives right

The design of value-based consumer and provider payments in health care

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Op weg naar betere prikkels

De vormgeving van waardegedreven betalingen door zorggebruikers
en beloning van zorgaanbieders

Thesis

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Ik heb het nog nooit gedaan, dus ik denk dat ik het wel kan
– Pippi Langkous –

CONTENTS

LIST OF PUBLICATIONS AND SUBMISSIONS

Chapters 2, 3, 4, 5, and 6 are based upon the following articles.

Chapter 2
Cattel, D., R.C. van Kleef & R.C.J.A. van Vliet. 2016. 'A method to simulate incentives for cost containment under various cost sharing designs: An application to a first-euro deductible and a doughnut hole.' *European Journal of Health Economics* 18: 987–1000.

Chapter 3
Cattel, D., F. Eijkenaar & F.T. Schut. 2020. 'Value-based provider payment: Towards a theoretically preferred design.' *Health Economics, Policy and Law* 15(1): 94-112.

Chapter 4
Cattel, D. & F. Eijkenaar. 2020. 'Value-based provider payment initiatives combining global payments with explicit quality incentives: A systematic review.' *Medical Care Research and Review* 77(6): 511-537.

Chapter 5
Cattel, D. & F. Eijkenaar. 2020. 'How to manage financial risk for capitated primary care providers? The impact of care package, risk adjustment, risk sharing, and patient panel size.' *Preparing for submission.*

Chapter 6
Cattel, D., F. Eijkenaar & R.C. van Kleef. 2021. 'Getting the incentives right: Simulating the effects of residual-based risk-sharing for primary care providers under global payment.' *Preparing for submission.*

Chapter 1

General introduction

1. BACKGROUND

Despite substantial contributions of healthcare systems to life expectancy and quality of life, in many countries it is widely recognized that there remains considerable room for improvements in the quality and efficiency of health care. In particular, across OECD countries, a significant share of spending on healthcare is wasteful (OECD 2017). In addition, adherence to clinical guidelines is often low, current healthcare systems are ill-equipped to provide well-coordinated, integrated care, and focus is on treating health problems instead of preventing them (Pronovost 2013; Tsiachristas 2015). Therefore, realizing more 'value' in health care has increasingly become a focal point in health policy in the last decade, with value being defined in many ways. In the past, value has been narrowly defined (see, for example, Porter 2010), while more recently, good attempts have been made to provide more comprehensive descriptions of value (see, for example, European Commission 2019). In this dissertation, value is considered a multifaceted concept, comprising not only quality of care at the lowest possible costs, but also efficient coordination of care, cost-effective innovation, and prevention (IOM 2001; Berwick et al. 2008; Porter 2009; Porter 2010; Conrad 2015; Eijkenaar & Schut 2015; European Commission 2019).

Improving value requires a thorough understanding of the main drivers of suboptimal value. A wide range of evidence suggests that suboptimal value is (at least partly) caused by perverse financial incentives in healthcare influencing behavior (McGuire 2000; McGuire 2011; Evans 1974; Newhouse 1993; Pauly 1968; Gaynor et al. 2004). Perverse incentives exist in all three healthcare markets: (1) the healthcare provision market where the consumer (here: the patient) interacts with the provider and care is delivered, (2) the health insurance market where the consumer (here: the insured) purchases health insurance from the payer (i.e., government or health insurer) in exchange for coverage, and (3) the healthcare purchasing market where the provider is contracted and paid for care delivery by the payer.[1] Figure 1.1 graphically displays these interactions between the consumer, provider, and payer in the three markets in health care. [2] In this dissertation the focus is on *incentives for consumers* who buy insurance coverage on the health insurance market and on *incentives for providers* who are reimbursed by the payer on the healthcare purchasing market for delivering care services on the healthcare provision market.

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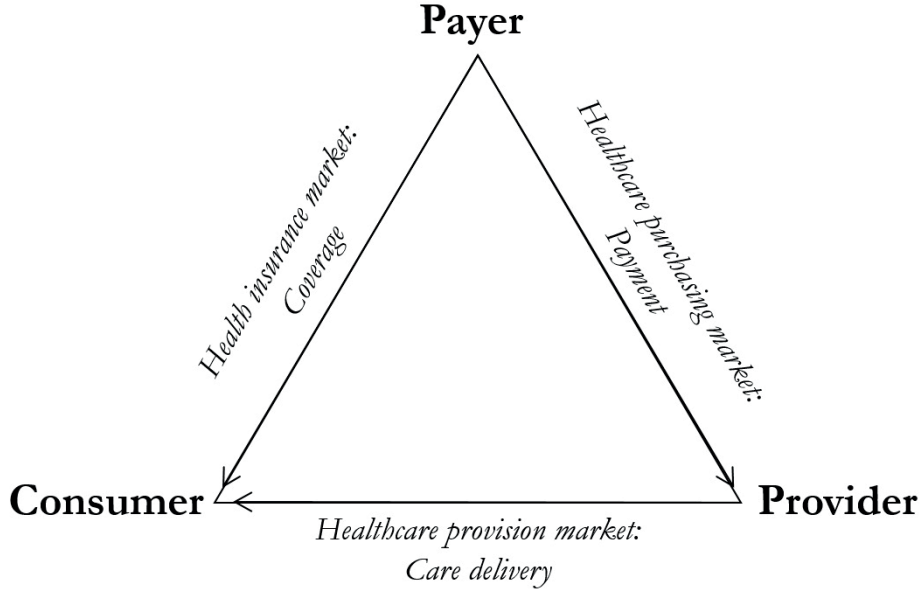
1 By provider we mean individual health practitioners as well as organizations, including hospitals, post-acute care providers, physicians, and other practitioners. By health professional we specifically mean individual health practitioners (typically physicians).

2 Note that the three markets are not present in each healthcare system. The healthcare purchasing market is only relevant for countries with social health insurance (i.e., a 'Bismarck system') and/or private health insurance (e.g., the United States of America; US), and does not exist in countries with a classical National Health Service (e.g., the United Kingdom; UK). In this dissertation, however, the focus is on a contract model in which providers and/or payers may or may not compete on price and in which the three markets can be distinguished (Van de Ven et al. 1994) although findings are also relevant for non-competitive healthcare systems.

Figure 1.1. Interactions between the consumer, provider, and payer in the three markets in health care



Health insurance is a popular instrument to establish universal access to otherwise unaffordable care and to realize welfare gains in risk-averse societies (Pauly 1968; Nyman 1999; Rosenthal 2004). An important drawback of health insurance, however, is that it may result in moral hazard, which means that individuals use more or more expensive medical services than they would without insurance because they do not bear the complete marginal costs of care (Arrow 1963; Pauly 1968; Zweifel & Manning 2000). This is a problem because of scarce resources and because it may impose a welfare loss on society in the case of excess utilization of health care (Pauly 1968; Feldstein 1973). Empirical research has shown that moral hazard is not merely a theoretical concern (see, for example, Newhouse 1993; Van Vliet 2004; Bakker 1997; Baicker et al. 2013).

In many countries' health insurance markets, out-of-pocket payments by consumers (often referred to as cost sharing) have been implemented to increase consumers' perceived price of health care and thereby reduce moral hazard (Qingyue et al. 2011). These direct payments by consumers ideally reduce inefficient use of health care without putting consumers at too much financial risk. Three types of payments where consumers pay part of the bill are co-insurance, co-payments, and deductibles. With co-insurance, consumers pay a percentage of total healthcare spending out-of-pocket, for example 10% of a €150 bill. With co-payments consumers are required to pay a certain amount per service out-of-pocket, for example €5 per specific prescription of medication. A deductible implies that, up to a certain amount, consumers pay 100% of their healthcare spending out-of-pocket after which the insurer covers additional expenses.

Each conventional cost-sharing method has its own disadvantages. With co-insurance and co-payments, for example, out-of-pocket spending for individuals with a relatively poor health

and high utilization of healthcare services accumulate and total out-of-pocket spending can be substantial. An important drawback of co-payments is that consumers are not sensitive for the price differences between providers and in case of a deductible, that consumers have no continuous incentive to act cost-consciously and reduce inefficient use of health care. Up to the deductible amount, consumers pay their healthcare spending out-of-pocket, stimulating consumers to behave as completely uninsured. However, after reaching the deductible amount, the insurer takes over and fully reimburses excess healthcare spending which stimulates consumers to behave as being completely insured. In sum, incentives for cost-conscious behavior for consumers emanating from the conventional cost-sharing methods are suboptimal.

Financial incentives for providers are stemming from the specific payment models through which they are reimbursed. Based on an extensive review of the literature, McGuire (2000; 2011) concludes that providers can influence quantity in practice and sometimes do so in their own interest. An important concern with predominant provider payment models is that these models are ill-aligned with value. In practice, payment is often positively related to the number of care services (known as fee-for-service (FFS)). FFS stimulates providers to increase the quantity of services because this results in higher income. Providing additional services can be in the best interest of the patient, for example when a physician persuades a non-compliant patient with diabetes to use specific medication for controlling the disease. By improving medication adherence, the provider reduces the health risk for the patient by shifting the demand curve outwards. In this case, the demand curve of a fully informed patient equals the demand curve induced by the provider. However, providing additional services might also harm patients, for example when a physician persuades the patient to demand extra (not cost-effective or unnecessary) tests. In this case, the provider's income rises, without any benefit for the patient and possibly even clinical risks for the patient. Here, the demand curve of the fully informed patient deviates from the demand curve constructed by the provider.

Two other provider payment models that are often used in practice are capitation (in which providers receive a periodical fixed amount per patient) and salary (in which providers receive a fixed amount irrespective of the number of patients). In contrast to FFS, these models have no link with the volume of care at all. Because there is no direct relation between effort and payment, capitation and salary might stimulate underprovision of care. In addition, providers might be inclined to select favorable (i.e., low-cost and 'easy' or low-effort) patients and might skimp on quality. An additional, important concern of predominant provider payment models in general is that none of the models reward well-coordinated, high-quality care. Although pursu-

ing integrated, high-quality care is in the best interest of patients, providers are financially not encouraged to 'walk the extra mile' required to significantly improve health care.[3]

2. CENTRAL AIM AND RESEARCH QUESTION

Financial incentives have been convincingly shown to influence consumer and provider behavior and predominant payment systems are ill-aligned with value (section 1). Therefore, stakeholders have been exploring alternative payment models for consumers and providers containing financial incentives facilitating value. These innovative payment models pursuing value will henceforth be referred to as value-based payment (VBP) incentives (Bazemore et al. 2018; Struijs et al. 2019; APMF FPT Work Group 2016; Chernew et al. 2020). To date, however, little is known about what VBP incentives for consumers and providers should look like and what this would entail in practice. The theoretical basis of VBP incentive design is fragmented and the relationship between what a healthcare system ideally pursues in terms of value and what is required in terms of VBP incentive design to achieve this remains poorly understood. In addition, little is known about the effectiveness of alternative payment incentives in improving value. Against this background, the central research question of this dissertation is:

How can financial incentives in consumer and provider payment be designed to facilitate value in health care?

This dissertation aims to provide insights into key issues in the design of VBP incentives for consumers and providers, and in associated tradeoffs and incentive effects. In doing so, we contribute to the body of knowledge concerning smarter choices in payment system design. Insights may help stakeholders with (re)designing existing and future consumer and provider payment models. Results are relevant for all countries seeking to increase value in health care by reforming financial incentives in consumer and provider payment systems.

In the next section of this general introduction, the problem of undesired consumer and provider behavior will be positioned within the theory of agency. In section 4 and 5 of this chapter a theoretical framework on financial incentives for consumers and providers, respectively, will

3 Note that the extent to which providers show behavior that does not stimulate value, depends on the utility function of a provider. If providers pursue an optimal combination of net income and patient health, the utility derived from a higher income is has to be balanced against the disutility of demand inducement and other perverse provider behavior that is not in the best interest of the patient (Evans 1974; McGuire & Pauly 1991). Social norms, medical ethics, altruistic preferences, and leisure time are examples of factors that are relevant for the doctor's utility function too (Robinson 2001a).

be provided and the specific research questions in this dissertation will be specified. In the last section, the structure of this dissertation will be presented.

3. AGENCY PROBLEMS IN HEALTH CARE

In health care, information is not equally spread among the consumer, payer and provider. In the relationship between the consumer and payer, the former generally is the relatively well-informed party and the latter the relatively ill-informed party, when it comes to the consumer's health status, risk, and behavior (Harris & Raviv 1978; Arrow 1986). In the relationship between the provider and the payer and the provider and the patient, the provider as the clinical professional is the relatively well-informed party (Vermaas 2006). Agency theory, as part of contract theory, helps to understand how information asymmetry may result in agency problems and provides tools for dealing with those problems.

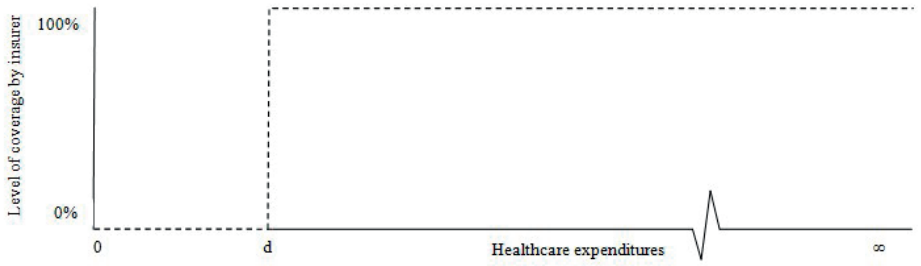
Agency theory studies the contractual relationship between two parties: the agent and the principal. The agent is the relatively well-informed party and the principal the relatively ill-informed party. According to this theory, information asymmetry between agents and principals is not a problem if interests are aligned (Laffont & Martimort 2002). In case of conflicting interests, however, agents might exploit their information surplus for their own (financial) benefit (Jensen & Meckling 1976; Richardson 1981). Two main types of problems may evolve (Arrow 1986). The first problem is called the adverse selection problem and may occur before the contract is concluded (Eisenhardt 1989). Here, the actions of agents are observable, but the information used by agents to take these actions is not. As a result, principals do not know whether the agents' actions suit the principals' interests best. Adverse selection is beyond the scope of this dissertation. The second problem is called the moral hazard problem and may appear after the contract is concluded. In this case, principals cannot monitor the agents' actions and only have some information about the outcomes of the actions. As a result, the principals do not know whether these outcomes are optimal given the agents' knowledge. Supplier-induced moral hazard is an example of the moral hazard problem and implies that a provider induces demand in the knowledge that the patient has insurance and resulting costs are covered by the insurance policy (Vermaas 2006). An example of supplier-induced moral hazard is that of a physician prescribing expensive drugs covered by insurance instead of inexpensive drugs not covered by insurance. To address moral hazard, an important strategy offered by agency theory entails 'controlling' agents by means of contracts – including financial incentives – to align agents' interests with those of principals' (Vermaas 2006). In this dissertation we focus on a specific type of the contractual agreement, namely the design of VBP incentives for consumers and providers.

4. VALUE-BASED PAYMENT INCENTIVES FOR CONSUMERS

This dissertation focuses on a specific type of consumer cost sharing: the mandatory deductible. The reason is that mandatory deductibles are widespread, administrative costs are relatively low, and that different choices in the deductible design have different consequences for consumers. In this dissertation the impact on incentives for cost-conscious behavior of three specific designs for the mandatory deductible is studied: (1) a first-euro deductible, (2) a shifted deductible (also known as a 'doughnut hole' deductible) with a uniform starting point, and (3) a shifted deductible with a risk-adjusted starting point.

A *first-euro deductible* (Figure 1.2) is the most commonly applied deductible and means that consumers pay the first €d out-of-pocket before the payer takes over and reimburses all excess medical spending covered by the benefit package. In Figure 1.2 spending in the interval [0, d] is the responsibility of the consumer while spending in interval [d, ∞] is the responsibility of the payer. An example of a first-euro deductible can be found in the Dutch basic health insurance system where individuals have a mandatory deductible of €385 per person in 2021.

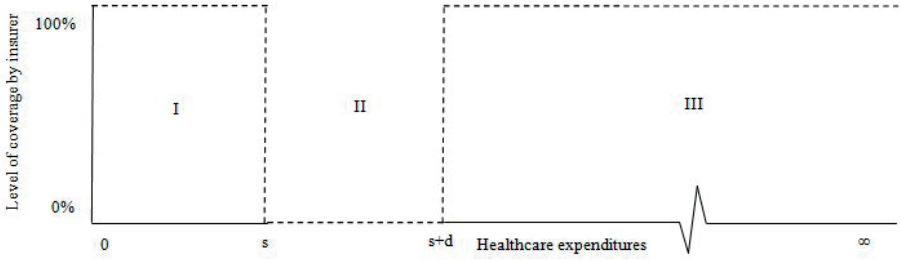
Figure 1.2. Insurance under a first-euro deductible with range [0, d]



A first-euro deductible has several drawbacks in terms of efficiency and equity (Van Kleef et al. 2009; Van Kleef et al. 2010; Van Kleef et al. 2011). First, for the high-risk individuals, for instance the chronically ill or elderly, the first-euro deductible is not effective in reducing moral hazard. These individuals know ex ante that their annual healthcare spending will exceed the deductible range. As a result, they are not price sensitive and lack any incentive to contain costs because cost-conscious behavior will not prevent them from having to pay the maximum out-ot-pocket payment at the end of the contract period. In addition, high-risk individuals do not have any incentive to opt for a voluntary deductible on top of the mandatory deductible since they are not likely to benefit financially from this (Van de Ven & Schut 2010). Finally, under a first-euro deductible, high-risk individuals on average pay more out-of-pocket than low-risk individuals. If high-risk individuals do not receive sufficient compensation, this can be seen as a decrease in risk solidarity compared to a situation without consumer cost sharing.

A possible remedy to reduce the drawbacks of a first-euro deductible in terms of efficiency and equity is a shifted deductible (Van Kleef et al. 2009). A shifted deductible is a deductible that starts at a higher level of healthcare spending than €0. Thus, the consumer experiences a coverage gap that begins at a predefined level of healthcare spending. Figure 1.3 shows that full coverage is provided for spending ranging from €0 to €s (interval I [0, s]). Then, consumers experience a gap in coverage – also labeled as the doughnut hole – as healthcare spending from €s until €s+d must be paid out-of-pocket (interval II [s, s+d]). Full coverage is again provided by the payer if healthcare spending exceeds point s+d (interval III [s+d, ∞]). Under a shifted deductible, the probability of having maximum out-of-pocket spending may reduce, which in turn may lead to increased price sensitivity (Van Kleef et al. 2009).

Figure 1.3. Insurance under a shifted deductible with range [s, s+d]



An interesting question is where to locate starting point *s*. One possibility is to use a uniform shifted starting point (i.e., *a shifted deductible with a uniform starting point*). The doughnut hole is fixed for all individuals and set, for example, at the mean actual spending in the population in the previous year. An example of such a deductible design can be found in the Medicare Part D coverage system that was implemented in 2006 in the US. In theory, however, a shifted deductible with a uniform starting point does not provide optimal incentives either, as incentives for cost-conscious behavior are weak for low-risk individuals with low expected spending. The reason is that for these individuals, the probability of reaching the starting point of the doughnut hole and paying the full deductible amount concentrates near 0. Because there is little uncertainty about their out-of-pocket spending, incentives for cost-conscious behavior are weak (Van Kleef et al. 2009).

To overcome the problems of both a first-euro deductible and a shifted deductible with a uniform starting point, *a shifted deductible with a risk-adjusted starting point* has been proposed (Van Kleef et al. 2009). Under this specific design, the starting point is dependent on individuals' risk of spending, providing everyone with appropriate financial incentives by correcting for heterogeneity in terms of individuals' ex-ante health status (Zhang et al. 2009; Roblin & Maciejewski 2011). Specific individual-level risk characteristics such as demographics, chronic conditions, and prior healthcare utilization can be used to predict healthcare spending and determining the

starting point (Van Kleef et al. 2009). Under a shifted deductible with a risk-adjusted starting point, high-risk and low-risk individuals have, on average, the same out-of-pocket spending. A shifted deductible with a risk-adjusted starting point has not (yet) been implemented in practice.

In theory, a shifted deductible with a risk-adjusted starting point results in more value than a first-euro deductible and a shifted deductible with a uniform starting point because this design of the deductible provides (1) stronger incentives for cost-conscious behavior and thus less risk of moral hazard since the perceived price of health care in the population is higher, (2) a higher probability that high-risk insured opt for a voluntary deductible and (3) more risk solidarity between high-risk and low-risk individuals. On the other hand, transaction costs may be high due to, for example, higher information costs or administration costs and transparency may decrease as everyone has an individualized starting point according to their risk-characteristics, making it more difficult for consumers to compare insurance policies.

The theoretical basis of the first-euro deductible and shifted deductible in general is quite well established in the literature. However, the relative effects of a first-euro deductible, a shifted deductible with a uniform starting point, and a shifted deductible with a risk-adjusted starting point on incentives for cost-conscious behavior will mostly be absent. This dissertation aims to reduce this knowledge gap. Against this background the first research question of this dissertation is:

Q1: How can incentives for cost-conscious behavior under various deductible designs be compared?

A simulation model is developed to approximate the relative effects of different deductible designs on consumers' incentives for cost-consciousness and compare these incentives under various deductible designs. In addition, we empirically illustrate this simulation model for a first-euro deductible and a shifted deductible with various starting points. Results are presented for the total population and separately for low-risk and high-risk individuals and can be used by stakeholders to underpin decisions on the design of effective consumer cost sharing in health insurance.

5. VALUE-BASED PAYMENT INCENTIVES FOR PROVIDERS

As briefly discussed in section 1, predominant provider payment models discourage the provision of efficient and well-coordinated care that is of high quality. Below, the incentives for providers generated by five payment models that are commonly used in practice are discussed in more depth (Miller 2009).

5.1 Payment per item-of-service (FFS)

A widespread provider payment model in healthcare systems worldwide is payment per-item-of-service. Under this model, which is frequently referred to as fee-for-service (FFS), individual providers are paid a predetermined amount for each discrete service, like an office visit or diagnostic test. The most important drawback of this payment model is that volume is rewarded, which provides incentives for overprovision. In addition, FFS may trigger providers to incorrectly classify patients in treatment categories with higher fees (i.e., upcoding). Furthermore, because the focus is on remunerating individual providers delivering single care activities, no incentives for coordination and collaboration among providers exist, resulting in fragmented care. This is particularly problematic for the increasing number of patients with multiple health problems, who would especially benefit from an integrated care approach. Finally, as preventing health problems will lead to less demand and a decrease in provider's income, incentives for health promotion and prevention are weak. On the other hand, under the assumption that marginal fees exceed marginal costs, providers have no incentives to withhold patients from necessary and good quality care and high productivity is rewarded. In addition, there is an incentive to pursue high levels of patient satisfaction, because satisfied patients are more likely to return.

5.2 Payment per case (case rate)

Under this payment model providers receive a single payment for all the services needed by a patient during an episode of care, such as pregnancy and delivery or a heart attack. No matter if the patient has a hospital stay of one or ten days or has five of fifty tests, one set price is paid. This single payment is commonly referred to as a case rate. A payment per case is broader than a payment per item-of-service. In case of a payment per case, providers are financially accountable for the difference between the payment and actual spending during the episode of care. As a result, the provision of unnecessary (expensive) care services per episode of care is discouraged. To contain costs, providers might, however, also be inclined to behave strategically and select financially attractive patients, shift costs to other providers, or skimp on quality. If the services of multiple providers are covered by payment per case, coordination of multiple providers is encouraged. There is, however, no incentive for providers to orchestrate the whole care process because multiple payments for episodes of care and conditions might apply. Another disadvantage of a payment per case is that it still is a volume-based payment model that might stimulate a 'more-is-better culture' and discourages primary prevention (i.e., the preventing episodes of care or conditions from occurring).

5.3 Payment per condition (DRG)

Under this payment model providers receive a single payment for a coherent set of care activities (usually hospital services) associated with a specific condition. A payment per condition is broader than a payment per case. A well-known example of a payment per condition is the diagnosis-related group (DRG) payment system in which payments to the hospital (excluding physician-fees) are bundled. The Dutch equivalent of the DRG system is the diagnosis-treatment combination (in Dutch abbreviated as DBC). Like under a payment per case, providers are financially accountable for the difference between the payment and actual spending. On the one hand, this discourages the provision of unnecessary (expensive) care services per condition and provides incentives to control the number of unnecessary episodes of care per condition. On the other hand, incentives for perverse provider behavior such as risk selection and quality skimping might evolve. Incentives for well-coordinated care and cooperation between providers are strong for those services covered by the payment. However, care still is fragmented for patients with multimorbidity since multiple payments for conditions might apply. Finally, there is no incentive to prevent conditions from occurring.

5.4 Payment per person (global payment, capitation, or population-based payment)

Another widespread payment model, especially in primary care sectors in many European countries, is a periodic payment per person. Under this payment model, a provider receives a prospectively determined, fixed amount for the provision of a specified care package for each person enrolled with the healthcare provider during the relevant period. A payment per person is broader than a payment per condition. Under a payment per person, the provider receives the payment, irrespective of whether the individual uses healthcare services. Again, the provider is financially responsible for the difference between the payment and actual spending, providing incentives for cost control but also for strategic provider behavior. Unlike a payment per item-of-service, case, or condition, a payment per person stimulates primary prevention and health maintenance because a healthier population is financially rewarding. Assuming the payment per person applies to one provider type (as generally is the case in practice), this payment does not stimulate well-coordinated care across the continuum of care.

5.5 Payment per period (salary or budget)

Under a payment per period, providers receive a fixed, periodical lump sum (salary or budget) for providing a set of predefined care services. In contrast with a payment per person, the provider is not accountable for a specific population. In general, this payment model discourages high productivity and may result in waiting lists. In addition, efforts to increase quality of care or boost innovation are not rewarded. An advantage is that administrative costs can be relatively low.

An important conclusion of the above analysis is that despite several advantages, all common payment models have significant drawbacks. None of the payment models are optimally aligned

with value. Therefore, worldwide, stakeholders are exploring alternative payment strategies to help steering healthcare systems towards value. Over the past decade, there has been much experimentation with various types of VBP, especially in the US. A prominent example of an alternative payment model is pay-for-performance (P4P). Under this model, providers receive explicit financial incentives for performing well on specific, measurable aspects of value, often related to quality. Examples of P4P-initiatives from practice are the Hospital Value-Based Purchasing Program in the US and the Quality and Outcomes Framework in the UK. Another type of VBP is bundled payment. Bundled payments are a predetermined reimbursement for services related to a condition or procedure over a defined period (CMS 2020). Payments per condition (e.g., DRGs) are essentially bundled payments for hospital services categorized by diagnosis, but under recent bundled payments a more comprehensive care package is covered by the payment (IBM 2017). In case of a patient suffering from severe arthritis requiring a hip replacement, for example, all charges associated with an inpatient stay related to the hip replacement from the time of admission to discharge are covered under a payment per condition, whereas under a bundled payment, also physicians fees, the costs of rehabilitation care, and of treatment of possible complications would be included in the bundle and covered by the payment. Bundled payment rewards multidisciplinary cooperation among multidisciplinary providers, sometimes even from different organizations and settings. Examples from practice are the Bundled Payment for Care Improvement Initiative and the Acute Care Episode Demonstration, both implemented in US Medicare. The various payment options in the public and private Accountable Care Organizations (ACOs) in the US are a final type of an alternative VBP model. ACOs are multidisciplinary groups or networks of providers that have voluntarily agreed to be held accountable for the cost and quality of care for a patient population assigned to them. Multiple payment options exist, but a frequently used model is a global payment with risk sharing. Under this model, ACOs share in realized savings (and potentially losses too) with the payer, conditional on reaching certain quality targets. In contrast to traditional capitation, under this payment model high-quality care is rewarded and risk-mitigating measures such as reinsurance provisions are included.

In the Netherlands, VBP reform is also high on the (political) agenda. In 2018 the Dutch Ministry of Health, Welfare, and Sport introduced a program to stimulate value in health care by – amongst other things – investing in alternative payment models (in Dutch: 'Programma uitkomstgerichte zorg 2018-2022'). In addition, in their advice on the future of provider payments in secondary care, the Dutch Healthcare Authority recommends stakeholders to invest in alternative payment contracts and reward high-value care (in Dutch: 'Advies bekostiging medisch-specialistische zorg: Belonen van zorg die waarde toevoegt'). Furthermore, in 2018 a working group composed of stakeholders in the field of provider payment reform (i.e., providers, patients, insurers, regulators, and scientists) was formed in the context of the national Linnean Initiative, with the goal of accelerating the uptake of VBP in the Netherlands (in Dutch: 'Werkgroep bekostiging). Another example is the 2015 reform of the payment system for primary care, which since then includes the option to negotiate with insurers a bundled payment for diabetes,

chronic obstructive pulmonary disease, vascular risk management, and asthma (in Dutch: 'keten-DBC's'), and the option to explicitly reward innovation and improving outcomes (i.e., P4P).[4] Also in the hospital sector, several bundled payment initiatives were recently started (Cattel et al. 2021). Finally, in 2013 several experiments with regional population health management were initiated (in Dutch: 'regionale proeftuinen'). Although the ambition of many of these initiatives was to introduce alternative (population-based) payment models, an evaluation of nine different initiatives showed that this ambition has not been realized yet in practice (Drewes et al. 2018).

In sum, VBP for providers is 'hot and happening'. However, despite substantial literature on the theory and implementation of provider payment incentives (e.g., McGuire 2000; McGuire 2011; Conrad et al. 2014; Conrad 2015; Conrad et al. 2016), little is known about what VBP models for providers should look like. Specifically, the relationship between what a healthcare system ideally pursues in terms of value and what is required in terms of VBP design to stimulate the desired provider behavior, has not been explicated. Therefore, the second research question of this dissertation is:

Q2: What are the key design elements of a theoretically preferred value-based payment model?

Based on key theoretical and empirical studies on provider behavior and payment incentives, we describe how an 'optimal' provider payment system in theory looks like given our five-dimensional definition of value in health care (section 1). The insights from this paper are of practical relevance for stakeholders who are responsible for (re)designing existing and future VBP initiatives.

After constructing a conceptual framework of a theoretically preferred VBP, an interesting question is whether initiatives that come close to this theoretically 'optimal' design have been implemented in practice and if so, how the payment models are designed in these initiatives and to which extent they are effective in improving value. Therefore, the third research question of this dissertation is:

Q3: Which initiatives exist in practice that come close to a theoretically 'optimal' VBP model, how are they designed, and what is their impact on value?

To provide an answer to this question, a systematic review of the literature is conducted. By systematically identifying and describing initiatives from practice that match the definition of a theoretically 'optimal' VBP model, a comprehensive overview of the design and effects of these initiatives is provided. In doing so, we aim to provide stakeholders with insight in promising and

4 Bundled payments for these conditions were already broadly introduced in 2010 on an experimental basis (De Bakker et al. 2012).

practically feasible modalities of VBP reform. This could support innovation and facilitate future provider payment model comparison.

A growing number of provider payment reform initiatives rely on global payments applied in primary care settings. Under these reforms, primary care providers (PCPs) receive a prospectively determined fixed amount for each registered or assigned individual in their patient panel, covering a specified care package for a defined period. In contrast to a traditional payment per person to PCPs, the payment does not only pertain to primary care services but also to other types of care, such as prescription medication and medical specialist care. A key characteristic of these type of payments is that – because of their prospective nature and the care package stretching beyond single services, diseases or treatments in primary care – PCPs are exposed to greater amounts of financial risk for medical spending than under conventional payment models in primary care. As providers become to some extent accountable for discrepancies between spending and payments, incentives for cost control increase. A potential disadvantage, however, is that without ancillary measures providers may be exposed to excessive financial risk, which might result in low rates of provider participation in the payment program, unwanted bankruptcies, and/or strategic provider behavior such as risk selection. Thus, an important question is how financial risk can be kept manageable for PCPs under global payments, while maintaining incentives for cost control. Answering this question requires insight in the key determinants of financial risk and the interplay between these determinants. Therefore, the fourth research question of this dissertation is:

Q4: Which determinants of financial risk related to global payment design can be distinguished and what is their relative impact on the financial risk of primary care providers subjected to global payments?

To answer research question 4, we empirically simulate prospective global payments for PCPs using rich administrative data on medical spending and risk characteristics of over 4.2 million individuals enrolled with a large Dutch health insurer. We examine the relative impact on PCPs' financial risk of key determinants of that risk related to the design of the global base payment. This research contributes to the body of knowledge concerning smarter choices in provider payment design and could help those involved in primary care payment reform in making better-informed decisions regarding payment design and appropriate levels of financial risk for providers.

Risk adjustment and risk sharing are important measures to reap the benefits of global provider payments while mitigating adverse effects related to risk selection and excessive financial risk. With risk adjustment, provider payments are based on predicted spending of a population given a predefined set of population characteristics (such as age, gender and morbidity). With risk sharing, provider payments are (partly) based on observed spending. Unfortunately, these two measures are not without drawbacks. Risk adjustment based on prior utilization and diagnoses might confront providers with incentives for upcoding (i.e., incentives to overstate measured pa-

tient risk in order to increase payments), while risk sharing creates a direct link between payments and spending and thereby reduces incentives for cost control. Designing risk adjustment and risk sharing for (global) provider payment thus involves a tradeoff between incentives for cost control, incentives for risk selection, incentives for upcoding, and excessive financial risk. In the light of this tradeoff, the developing field of provider payment might benefit from insights from the field of health plan payment. Specifically, an innovative form of risk sharing that was recently proposed in that field – risk sharing based on residual spending after risk adjustment – may well be an interesting option in the context of provider payment. Under this approach, providers receive extra payments for those individuals most heavily underpaid by the risk-adjustment model and must make repayments for heavily overpaid individuals. At least in theory, residual-based risk sharing substantially reduces incentives for risk selection, incentives for upcoding, and excessive losses/profits for providers, while the reduction in incentives for cost control is limited. Despite its potential, this form of risk sharing has not been studied in the context of provider payment and insight into the incentive effects and tradeoffs associated with the design of residual-based risk sharing is lacking. Therefore, the last research question of this dissertation is:

Q5: What is the effect of residual-based risk sharing for providers on (1) incentives for cost control, (2) incentives for risk selection, (3) incentives for upcoding, and (4) excessive losses/profits for providers.

Using rich administrative data on medical spending and risk characteristics of over 4.4 million individuals enrolled with a large Dutch health insurer, we simulate risk-adjusted global payments for primary care providers (PCPs) for a comprehensive care package, and apply various residual-based risk-sharing modalities that differ in the funds devoted to risk sharing and in whether only residual-based payments or both payments and repayments are used. We simulate the effects on cost-control incentives, risk selection incentives, upcoding incentives, and excessive provider-level losses/profits and provide an answer to research question 5. The resulting insights in incentive effects and associated tradeoffs are expected to be of substantial value for providers, purchasers, and policymakers in designing better provider payment models.

6. STRUCTURE OF THIS DISSERTATION

This dissertation is structured as follows. In part I (VBP incentives for consumers), chapter 2 compares cost-containment incentives for consumers under three different deductible designs (Q1). Part II focuses on VBP incentives for providers. In chapter 3 a conceptual framework of a theoretically 'optimal' VBP design is presented (Q2). Chapter 4 summarizes the results of an extensive systematic review of the literature on 'optimal VBP' in practice (Q3). Chapters 5 and 6 contain the results of two empirical simulation studies on key determinants of financial risk for

PCPs subjected to global payments (Q4 and Q5). Finally, in chapter 7 the main findings of the preceding chapters are summarized and discussed. In addition, the implications for policy and practice of the findings are discussed as well as important topics for further research.

Part I

Value-based payment incentives for consumers

Chapter 2

A method to simulate incentives for cost containment under various cost sharing designs: An application to a first-euro deductible and a doughnut hole

With Richard van Kleef and René van Vliet

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ABSTRACT

Many health insurance schemes include deductibles to provide consumers with cost containment incentives (CCI) and to counteract moral hazard. Policymakers are faced with choices on the implementation of a specific cost sharing design. One of the guiding principles in this decision process could be which design leads to the strongest CCI. Despite the vast amount of literature on the effects of cost sharing, the relative effects of specific cost sharing designs—e.g., a traditional deductible versus a doughnut hole—will mostly be absent for a certain context. This paper aims at developing a simulation model to approximate the relative effects of different deductible modalities on the CCI. We argue that the CCI depends on the probability that healthcare expenses end up in the deductible range and the expected healthcare expenses given that they end up in the deductible range. Our empirical application shows that different deductible modalities result in different CCI and that the CCI under a certain modality differs across risk-groups.

1. INTRODUCTION

There is a vast amount of literature on the effects of consumer cost sharing on moral hazard (Arrow 1963; Pauly 1968; Zweifel & Manning 2000). The RAND experiment, for example, has shown that a higher level of cost sharing generally results in less moral hazard (Newhouse 1993). It is therefore not surprising that most health insurance schemes include cost sharing arrangements to provide consumers with incentives for cost containment and counteract moral hazard (Baicker & Goldman 2011; Hartman et al. 2015; Qingyue et al. 2011; Stabile et al. 2013; Zare & Anderson 2013). Policymakers are faced with choices on the implementation of a specific cost sharing design. Should, for example, a first-euro deductible[5] (i.e., up to the deductible amount, insured are obliged to pay 100% of their healthcare expenses out-of-pocket in the contract period, generally a calendar year) be favored rather than a 'doughnut hole' (i.e., insured experience a gap in coverage starting after they have incurred a fixed amount of healthcare expenses)? In this case, policymakers decide on the timing of onset of a deductible during the contract period. Under a first-euro deductible, the timing is initial, while under a 'doughnut hole' the timing of onset is delayed, since individual healthcare expenses are required before this modality comes into effect. One of the guiding principles in this decision process on the cost sharing design could be which specific cost sharing design is expected to lead to the strongest incentives for cost containment.

Despite the vast amount of literature on the effects of cost sharing, the relative effects of specific cost sharing designs will mostly be absent. In these situations, methods to simulate incentives for cost containment under various cost sharing designs may be helpful for policymakers to underpin decisions on the design of effective consumer cost sharing in health insurance. To the best of our knowledge, such a method is not yet described in the literature. This paper focuses on the deductible as a cost sharing mechanism and aims at developing a simulation model to approximate the relative effects of different deductible modalities on incentives for cost containment. We simulate the individual's cost containment incentives (henceforth referred to as the CCI) as expected at the start of the contract period, given the individual's expected healthcare expenses. We focus solely on the CCI at the start of the insurance contract—rather than on the evolution of the CCI during the contract period—since benefit design decisions are usually made prior to the start of the insurance contract. In addition to developing a simulation method, we empirically illustrate this method for a first-euro deductible and a doughnut hole.[6] In this illustration we will simulate average CCIs for the total population and, separately, CCIs for groups of low-risk individuals and high-risk individuals.

5 Or a first-dollar deductible.

6 In this paper we do not pursue optimization of the deductible design. We use designs from practice to illustrate the methodology to simulate the CCI. Nevertheless, the framework can be used as a tool to gain insight in the properties of other deductible modalities and compare deductible designs in terms of the CCI.

Our method is based on the classical economic theory that consumers act like a homo economicus and possess traits such as perfect self-interest, rationality, and information. For the homo economicus the CCI is affected by the marginal out-of-pocket expenses given the individual's expected spending in the contract period. We will argue that these marginal out-of-pocket expenses depend on two parameters. The first parameter is the probability that individual healthcare expenses end up in the deductible range. Ceteris paribus, the CCI is expected to decrease with this probability. The explanation is that individuals will hardly experience any incentives for cost-conscious behavior when they expect their expenses to (far) exceed the deductible range; any savings will reduce the insurance claim, but not their out-of-pocket expenses (Keeler et al. 1977; Newhouse 1993). Given that expenses of an individual end up in the deductible range (hypothetically speaking), there is a second parameter of concern: the total expected expenses in the deductible range.[7] The higher the total expected expenses—given that they end up in the deductible range—the higher the savings potential is, and the stronger the CCI will be.

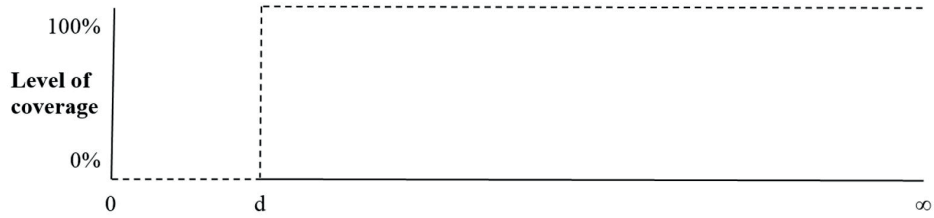
The structure of this paper is as follows. In the next section, the two deductible modalities under study are introduced followed by a section in which the relevant parameters for approximating the CCI are specified. Section 4 briefs about the conceptual framework to simulate the CCI. Data and methods are described in sections 5 and 6. Results are presented before the concluding section. Finally, in section 8 conclusion and discussion are summarized.

2. DEDUCTIBLE MODALITIES

In our conceptual model and empirical illustration, we study two deductible modalities applied in practice: (1) a first-euro deductible and (2) a doughnut hole. A first-euro deductible is the most commonly applied deductible modality and implies that patients pay the first €d of healthcare expenses out of their own pocket, before the insurer takes over and reimburses all excess healthcare expenses covered by the benefit package. The timing of onset of this deductible is initial. In Figure 2.1 expenses in the interval [0, d] are borne by the insured, while expenses in the interval [d, ∞] are borne by the insurer. First-euro deductibles can be, for example, found in the US, the Netherlands and Switzerland.

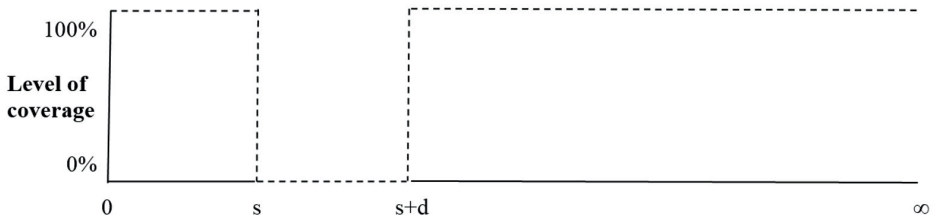
7 Expected expenses are considered to be the total expected healthcare expenses that fall under the basic benefit package.

Figure 2.1. Insurance under a first-euro deductible with range [0, d]



A doughnut hole is a deductible that starts at a higher level of healthcare expenses than €0. In contrast to a first-euro deductible, the timing of onset of this deductible modality is delayed, since individual healthcare expenses are required before this modality comes into effect. A 'doughnut hole' can be seen as a 'shifted' deductible with a uniform starting point. The latter means that the starting point of the doughnut hole is fixed for all individuals and set, for example, at the mean of actual healthcare expenses in the population in the previous year. Figure 2.2 shows that full coverage is provided for those expenses ranging from 0 to the starting point of the doughnut hole (interval [0, s]). Then, insured enter the doughnut hole and experience a gap in coverage. Healthcare expenses from the starting point of the deductible s until the endpoint s + d must be paid out-of- pocket (interval [s, s+d]). Full coverage is again provided by the insurer if healthcare expenses exceed the doughnut hole (interval [s+d, ∞]). An example of this modality can be found in the Medicare drug coverage system that was implemented in 2006 in the US (part D).

Figure 2.2. Insurance under a doughnut hole with range [s, s+d]



3. INCENTIVES FOR COST CONTAINMENT: WHAT ARE THE RELEVANT PARAMETERS?

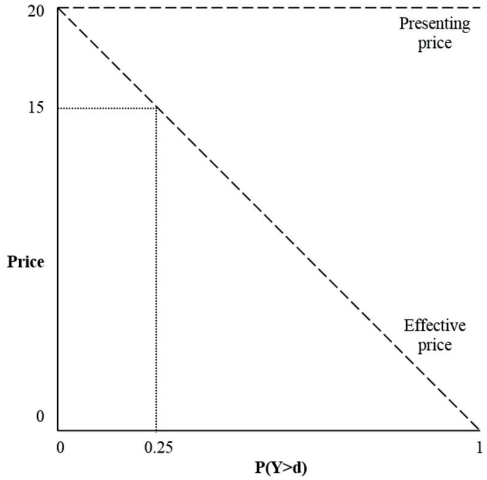
Our framework starts from the idea that consumers behave rationally. Though this assumption is probably unrealistic and oversimplistic, it provides a theoretical starting point for the development of our framework. As we will discuss in the end of this paper, we believe it is possible to extend the framework with other assumptions on consumer behavior that may follow from (future) empirical studies. The central point of our framework is that for a perfectly rational consumer

the CCI in a deductible plan depends on the marginal out-of-pocket expenses given the expected spending in the contract period. More specifically, we will argue that the CCI depends on (1) the probability that individual healthcare expenses end up in the relevant deductible range and (2) the total expected expenses given that they end up in the relevant deductible range. The relevant deductible range represents the interval where the individual, instead of the insurer, bears the costs. In sections 3.1 and 3.2 we discuss these two parameters in more depth.

3.1 The probability that individual healthcare expenses end up in the relevant deductible range

Theory predicts that, in case of a first-euro deductible, the price sensitivity of an individual is negatively correlated with the probability that healthcare expenses exceed the deductible amount, ceteris paribus (Keeler et al. 1977; Newhouse 1993). For a doughnut hole, the price sensitivity of an individual is expected to be negatively correlated with the probability that healthcare expenses do not fall in the deductible range, keeping other things equal. This principle can be illustrated by the following anecdotal example from Newhouse [1993:81]: "Consider a consumer on the Experiment plan with a 50% coinsurance plan and a $1000 maximum dollar expenditure (MDE). In any year, this person will have free care after spending $2000 on healthcare services. Suppose the person knows in advance that she will spend at least $2000; then any additional care she decides to purchase today is, in effect, free. Alternatively, suppose the person knows that she will not spend as much as $2000; then any additional care she decides to purchase today will cost 50 cents on the dollar because she will not anticipate free care later in the year." This example implies that a utility-maximizing consumer uses the presenting price of a visit (i.e., the real price) minus the product of the probability to exceed the MDE and the presenting price to determine whether a visit is worth its costs. This can be defined as the effective price (Newhouse 1993). For example, if the probability of exceeding the deductible amount is 0.25, the effective price for healthcare to the insured of a €20 visit is €15 (€20 minus the product of 0.25 and €20). The principle of varying effective prices with the probability of having 'free' healthcare is shown in Figure 2.3.

Figure 2.3. Presenting price versus effective price under a deductible



Note. P = probability; Y = healthcare expenses; d = deductible amount.

The theory of effective prices suggests that, in some cases, an individual perceives himself as completely insured or completely uninsured and thus experiences a weak or strong CCI. For example, if for a first-euro deductible the probability that healthcare expenses exceed the deductible amount approximates 0, the individual perceives himself as completely uninsured and the effective price equals the presenting price, which suggests a relatively strong CCI. In contrast, if for a first-euro deductible the probability that healthcare expenses exceed deductible amount is close to 1, the individual perceives himself as completely insured and the effective price is €0 which implies a relatively weak CCI. In the latter case, cost-conscious behavior will not prevent the individual from reaching the maximum on out-of-pocket expenses (Newhouse 1993; Van Kleef et al. 2009; Van Kleef et al. 2011). Under a first-euro deductible, an individual thus perceives himself as completely uninsured if he knows for sure—hypothetically speaking—that total healthcare expenses end up in the interval [0, d]. Under a doughnut hole, this is the case if an individual knows for sure that total healthcare expenses end up in the doughnut hole (interval [s, s+d]). In contrast, an individual perceives himself as completely insured under a first-euro deductible, if he knows for sure that total healthcare expenses will end up in the interval [d, ∞]. Under a doughnut hole, this is the case if the individual knows for sure that total expenses end up in the intervals [0, s] or [s+d, ∞]. Though it is unrealistic to assume that individuals know for sure whether or not healthcare expenses end up in a specific deductible interval, the aforementioned examples illustrate how the CCI depends on the probability to end up in the deductible range.

Theoretically, the probability that an individual's healthcare expenses end up in the deductible range depends on three parameters: (1) the amount of healthcare that is already used in the contract period, (2) the number of days remaining in the contract period, and (3) the expected healthcare expenses for the remainder of the contract period (Keeler et al. 1977). Since we focus

on the CCI at the start of the contract period (and not on how the CCI evolves through the contract) the first two parameters are not relevant here.[8] This implies we will solely focus on the link between expected spending and the CCI. In general, higher expected spending at the start of the contract period implies a higher probability to exceed the deductible.

3.2 The total expected expenses given that they end up in the relevant deductible range

As discussed in the previous section, the probability that healthcare expenses end up in the deductible range is an important determinant in approximating the CCI. Nevertheless, we argue it is not the only relevant parameter. Consider the following hypothetical situation where two individuals are subject to a first-euro deductible of €500. Both individuals know with certainty that healthcare expenses remain below this deductible amount.[9] Assume that person A has expected expenses in the deductible range of €100 and person B has expected expenses in the deductible range of €400. In this case, it would be inaccurate to conclude that the CCIs for these individuals are equal. In this specific case, B has a stronger CCI than A, since the expected expenses for which the individual is price sensitive due to the probability of not exceeding the deductible are higher for B than for A. In other words, B has a higher savings potential than A. Building on this example, we state that the expected healthcare expenses given that they end up in the deductible range is a relevant parameter for the CCI too.

4. A METHOD TO SIMULATE INCENTIVES FOR COST CONTAINMENT

In this section we build a conceptual framework to simulate the CCI under different deductible modalities at the start of the contract period. We describe our method for a first-euro deductible and a doughnut hole.

4.1 First-euro deductible

Under a first-euro deductible, the deductible range where the individual bears the costs equals [0, d]. Accordingly, the CCI under a first-euro deductible can be simulated by combining the probability P that individual healthcare expenses Y remain below the deductible amount d and the expected expenses E(Y) given that expenses Y remain below the deductible amount d:

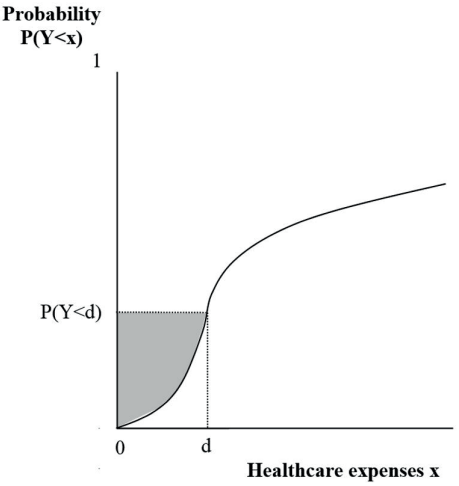
$$CCI_{\text{first-euro deductible}} = P(Y < d) * E(Y|Y < d) \quad (1)$$

8 Nevertheless, the conceptual framework can be refined to facilitate simulation of the CCI during the contract period. By determining the CCI on multiple moments (i.e., by repeating the procedure that is described in this paper), the other two parameters can be taken into account.

9 Or: both individuals have an equal probability that healthcare expenses exceed the deductible amount [i.e., P(Y<d)<1].

The essence of the CCI can be graphically illustrated with Figure 2.4. Consider the curve in Figure 2.4 to represent the probability of an individual's healthcare expenses to remain below amount x. For an infinite value of x, this probability equals 1, which means that all expenses are in the interval [0, x]. In this extreme case E(Y|Y<x) equals E(Y) and the outcome of equation (1) exactly represents the total area above the curve. This is no longer true, however, when P(Y<x) is smaller than 1, which is the case for x = d. Since P(Y<d) is smaller than 1 and E(Y|Y<d) is smaller than E(Y), the outcome of equation (1) no longer represents the total area above the curve, but shrinks to the shaded area. Here we come to the essence of our method: when the shaded area of deductible modality A is larger than that of deductible modality B, the CCI is expected to be stronger under modality A than under modality B.

Figure 2.4. CCI under a first-euro deductible



4.2 Doughnut hole

Under a doughnut hole, the endpoint of the deductible range is marked by s+d. P(Y<s+d) and E(Y|Y<s+d) are higher compared to P(Y<d) and E(Y|Y<d) under a first-euro deductible with deductible amount d. Consequently, the CCI for the interval [0, s+d] will be stronger than the CCI for the interval [0, d]. It is incorrect, however, to assume that the CCI under a doughnut hole equals the CCI for the complete interval [0, s+d]. This can be illustrated with an infinite value for s: here both P(Y<s+d) and P(Y<s) equal 1. In this case it would be inaccurate to conclude that the CCI equals P(Y<s+d) * E(Y|Y<s+d), since all expenses are in the interval [0, s] and are fully reimbursed by the insurer. In other words, no expenses appear in the interval [s, s+d] where the individual bears the costs. So, we argue that, in this specific example, the CCI should equal 0 and, in general, the negative effect of interval [0, s] on the CCI should be incorporated in the calculation of the CCI. The latter implies that when determining the CCI under a doughnut hole, the

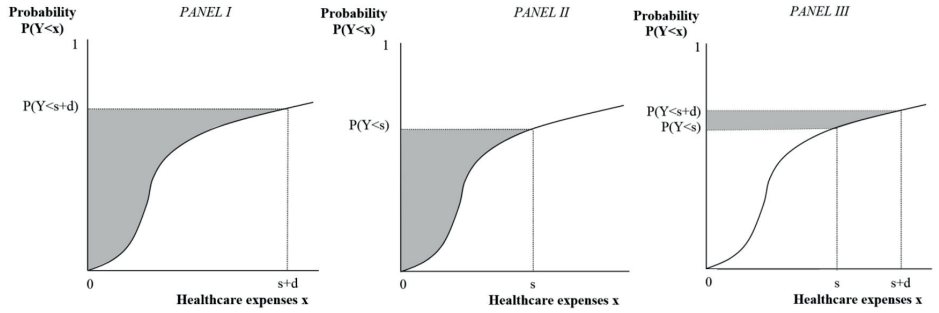
focus should be on the expenses where the insured are price sensitive due to the probability of entering the doughnut hole but not reaching the endpoint of the doughnut hole.

This reasoning implies that the CCI under a doughnut hole can be approximated by the product of P(Y<s+d) and E(Y|Y<s<d) minus the product of P(Y<s) and E(Y|Y<s). Accordingly, the CCI under a doughnut hole can be calculated by equation (2).

$$CCI_{\text{doughnut hole}} = [P(Y < s+ d) * E(Y|Y < s+ d)] - [P(Y < s) * E(Y|Y < s)] \quad (2)$$

This procedure is graphically illustrated in Figure 2.5 where the shaded area in panel I represents P(Y<s+d) * E(Y|Y<s+d), the shaded area in panel II represents P(Y<s) * E(Y|Y<s), and the shaded area in panel III represents the outcome of equation (2).

Figure 2.5. The CCI under a doughnut hole



5. DATA

For the empirical application of our method, we used administrative data from Dutch insurers operating under the Health Insurance Act. We used a sample of 500,000 individuals who were randomly selected from the total Dutch population of 18 years and older and enrolled in the basic health insurance for a complete calendar year (2011). The sample is similar to the total Dutch population regarding mean, standard deviation, minimum, and maximum.

The dataset includes individual-level risk-information on healthcare expenses and risk-characteristics. The risk characteristics are age-gender classes, diagnoses cost groups (DCGs), pharmacy-based cost groups (PCGs), high-cost groups (HCGs) and multiple prior years high costs (MHCs). In the Netherlands this information is used in the Dutch risk-equalization system. Further information on these risk characteristics can be found in previous work (see, for example, Van Veen et al. 2015a). In addition to information on risk characteristics, the dataset includes information on total healthcare expenses in 2011 that are covered by the Dutch basic health insurance (e.g., costs for general practitioner care, hospital care, pharmaceutical care and mental care). Based on visual inspection, we excluded 10 insured with extremely high healthcare

expenses ranging from €223,184 till €467,722 from the full sample of 500,000 insured, because they appeared to negatively affect our expenditure model. On average in the selected sample of 499,990 individuals, the actual healthcare expenses were €2257 with a standard deviation of €6124, a minimum of €1, a median of €593 and a maximum of €217,566.

6. METHODS

To empirically illustrate our method for simulating the CCI under different deductible modalities we follow a four-step procedure:

1. Estimate an expenditure model;
2. Approximate the probability that healthcare expenses end up in the deductible range;
3. Approximate the expected expenses given that they end up in the deductible range;
4. Simulate the CCI.

In this paper we are interested in the CCI under a specific deductible modality relative to others; absolute figures of the CCI are of little significance. Empirical results are intended as an illustration of the method developed. First, we derive the CCI under a first-euro deductible of €500, €1000, €2000, €3000, €4000, €5000 and €10,000 in order to examine the effects of the deductible amount. After that, we examine the CCI under a doughnut hole of €1000 with a uniform starting point at €500, €1000, €2000, €2257 (i.e., the mean of actual healthcare expenses in the selected sample of 499,990 individuals), €3000, €4000 and €5000 in order to compare the CCI between a first-euro deductible and a doughnut hole. Average CCIs under the two deductible modalities are simulated for the full sample, and separately, for a group of high-risk individuals and the complementary group of low-risk individuals. Morbidity information is used to determine to which risk-group an individual belongs: those individuals with (without) a DCG, PCG, HCG and/or MHC are considered as a high-risk individual (low-risk individual). In this sample 72% is considered as a low-risk individual and 28% as a high-risk individual.

It is important to mention that – next to the assumption on rational behavior – our concept is based on some other (implicit) assumptions. For example, we assume a linear relationship between the probability that healthcare expenses end up in the deductible range and the CCI. Furthermore, we focus on the CCI regarding total healthcare utilization that is subject to the deductible and neglect the composition of the care that is used. The implications of these and other assumptions, will be discussed in section 8.

6.1 Estimate an expenditure model

First, to predict expected healthcare expenses E(Y) for each individual, an expenditure model is estimated with actual expenses in 2011 as dependent variable and age-gender classes, DCGs, PCGs, HCGs and MHCs as explanatory variables. We opted for a Generalized Linear Model

(GLM) with a gamma distribution and a log-link function, which is considered to be an appropriate statistical method for modelling healthcare expenses in many studies (e.g., Beeuwkes-Buntin 2004; Blough et al. 1999; Duan et al. 1983; Manning & Mullahy 2001; Van Kleef et al. 2009). Basically, all risk characteristics are statistically significant at the conventional level (given the large sample size). On average the expected healthcare expenses were €2537 with a standard deviation of €7762, and the R^2 of the model is 0.39. In the subsequent tables we show that our estimation approach provides an acceptable fit between the actual and predicted parameters of the CCI.[10]

6.2 Approximate the probabilities that healthcare expenses end up in the deductible range

After estimating an expenditure model, the probability P that healthcare expenses Y remain below deductible amount d, starting point s and endpoint s+d is approximated. We follow the procedure as described by van Kleef and colleagues (2009), who have identified the relevant parameters given the use of a gamma distribution with a log-link. The probabilities that we are interested in can be derived by equations (3) to (5).

$$P(Y < d) = \Gamma(c_d,k) \quad (3)$$

$$P(Y < s) = \Gamma(c_s,k) \quad (4)$$

$$P(Y < s+d) = \Gamma(c_{s+d},k) \quad (5)$$

where c(.) is the cumulative density function of the gamma distribution, the scale parameter k is 0.4969, and:

$$\lambda = k/E(Y) \quad (6)$$

$$c_d = d^*\lambda \quad (7)$$

$$c_s = s^*\lambda \quad (8)$$

$$c_{s+d} = (s+d)^*\lambda \quad (9)$$

Given the assumptions made and given our dataset, we check whether the results based on equations (3) to (9) are in line with the actual figures in the sample; the proportion ϱ and probability P that healthcare expenses Y remain the deductible amount d under a first-euro deductible are compared. Table 2.1 shows that ϱ (Y<d) and P(Y<d) follow the same pattern, specifically in case of a relatively high deductible amount.

10 We also took into consideration other specifications of the model varying in terms of distribution and link-function. We opted for a GLM with a gamma distribution and a log-link function based on a comparison of mean, standard deviation, minimum, maximum and mean absolute predicted error of actual and expected expenses in the sample and per expenditure quintile.

Table 2.1. Proportions ϱ and probabilities P in the sample that healthcare expenses Y remain below various deductible amounts d

d	ϱ (Y<d)	P(Y<d)
500	0.47	0.43
1,000	0.61	0.57
2,000	0.75	0.73
3,000	0.82	0.81

6.3 Approximate the expected expenses given that they end up in the deductible range

Given expected expenses E(Y) and the parameters calculated in the previous step, expected expenses given that expenses end up in the interval [0, d], [0, s], respectively [0, s+d] can be calculated by equations (10), (11), and (12) (Van Kleef et al. 2019).

$$E(Y|Y < d) = E(Y) * \Gamma(c_d,k + 1) / \Gamma(c_d,k) \quad (10)$$

$$E(Y|Y < s) = E(Y) * \Gamma(c_s,k + 1) / \Gamma(c_s,k) \quad (11)$$

$$E(Y|Y < s+d) = E(Y) * \Gamma(c_{s+d},k + 1) / \Gamma(c_{s+d},k) \quad (12)$$

Table 2.2 shows the actual expenses and expected expenses given that expenses remain below first-euro deductible amount d. Our approach somewhat underestimates these expenses for the relatively small first-euro deductibles and somewhat overestimates them for the higher ones, but these deviations do not seem important.

Table 2.2. Mean of actual expenses Y and expected expenses E(Y) in the sample given that expenses Y remain below various deductible amounts d

d	Y|Y<d	E(Y|Y<d)
500	186	158
1,000	314	302
2,000	517	551
3,000	688	755

Based on the results presented in Tables 2.1 and 2.2, there seems to be no reason to believe that the overestimations of the mean and the standard deviation of expected healthcare expenses compared to the actual healthcare expenses have unacceptable effects on the key parameters of interest in this paper.

6.4 Simulate the CCI

As discussed in section 4, the CCI is conceptualized as a product of the probability that individual healthcare expenses end up in the deductible range and the expected expenses given that they end up in the deductible range. Therefore, parameters obtained in step 2 and step 3 are combined

in order to determine the CCI for each individual. The CCI under a first-euro deductible with deductible amount d is calculated by equation (1) The CCI under a doughnut hole with starting point s and deductible amount d is approximated by equation (2). The CCI is presented in Euros and can be interpreted as the marginal amount of healthcare expenses for which a consumer is fully price sensitive. Hypothetically speaking, the CCI will be zero for a consumer who knows for sure his spending will exceed the deductible amount. For a consumer who knows for sure his spending will not exceed the deductible amount, the CCI will equal his expected spending.

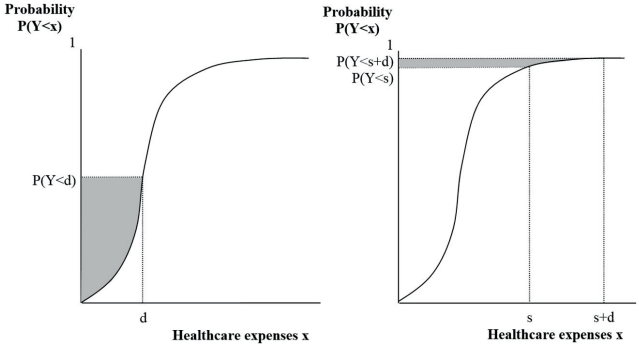
6.5 Implications

At least three implications arise from the conceptual framework as described in section 4. These hypotheses are to be addressed in section 7 where the simulation results are presented. First, the CCIs under a deductible increase when the deductible amount increases. If, ceteris paribus, the deductible amount increases (i.e., point d and, accordingly, point s+d is shifted to the right), the deductible range is broadened. As a result, both the probability that expenses end up in the deductible range and the expected expenses in the deductible range once they ended up in the deductible interval are expected to increase. This will result in a stronger CCI.

Second, we expect that different deductible modalities lead to different CCIs. Shifting the deductible influences the CCI. The direction of the effect is an interesting empirical question. On the one hand, a shift of the deductible to higher expenditure levels reduces the probability to reach the deductible range, which negatively affects the CCI. On the other hand, such a shift increases the expected expenses given that they end up in this range, which positively affects the CCI.

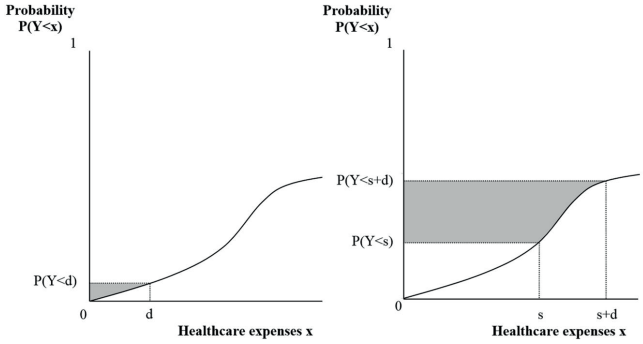
Third, we hypothesize that the CCI under a first-euro deductible and a doughnut hole will differ across risk groups. Figure 2.6 shows P(Y<x) of a relatively low-risk individual under a first-euro deductible (left panel) and under a doughnut hole with a starting point at the mean of actual healthcare expenses in the population (right panel). E(Y) for this healthy individual are relatively low, but there is always a certain level of uncertainty whether this individual needs care. This implies that, under a first-euro deductible, there is a low probability that healthcare expenses exceed the deductible amount. In contrast, under a doughnut hole with a starting point at the mean of healthcare expenses, it is not very likely that this low-risk individual ends up in the doughnut hole. P(Y<s) and P(Y<s+d) both approximate 1. As a result of the relatively high P(Y<d) under a first-euro deductible compared to P(s<Y<s+d) under a doughnut hole, the CCI for this low-risk individual is relatively strong in case of a first-euro deductible in comparison to a doughnut hole.

Figure 2.6. The CCI for a relatively low-risk individual under a first-euro deductible (left panel) and under a doughnut hole with a starting point at the mean of actual healthcare expenses in the population (right panel)



Now consider a relatively high-risk individual, such as a chronically ill patient. P(Y<x) is depicted in Figure 2.7. E(Y) for this relatively unhealthy individual are above average. Accordingly, under a first-euro deductible, P(Y<d) is low (Figure 2.7, left panel). In contrast, P(s<Y<s+d) is relatively high when the starting point of the doughnut hole is set at the mean of actual healthcare expenses (Figure 2.7, right panel). Consequently, for this high-risk individual the CCI is relatively strong in case of a doughnut hole in comparison to a first-euro deductible.

Figure 2.7. The CCI for a relatively high-risk individual under a first-euro deductible (left panel) and under a doughnut hole with a starting point at the mean of actual healthcare expenses (right panel)



The previous consideration implies that, at the population level, it is not obvious whether a first-euro deductible leads to a stronger or weaker CCI than a doughnut hole. On the one hand, a shift of the starting point of the deductible to a higher expenditure level than €0 may increase the CCI for the high-risk individuals (a relatively small group with relatively high savings potential). On the other hand, such a shift may decrease the CCI for the low-risk individuals (a relatively large group with relatively low savings potential). In our empirical illustration we aim to simulate the net outcome of these two effects.

7. RESULTS

As an illustration of the method developed, this section presents the empirical results for a first-euro deductible and a doughnut hole. Results are shown for the full sample and also separately for a group of high-risk individuals and the complementary group of low-risk individuals.

7.1 Full sample

In Table 2.3 the results are presented for a first-euro deductible of various deductible amounts for the total sample. The mean probability that healthcare expenses remain below the deductible amount, the expected expenses given that they remain below the deductible amount, and the product of these two parameters are shown. As hypothesized in section 6.5, Table 2.3 reveals that an increase in the deductible amount indeed leads to a higher P(Y<d) and higher E(Y|Y<d). Thus, the higher the deductible amount is, the stronger the CCI will be. Note that this conclusion also holds for a doughnut hole, as P(s<Y<s+d) and E(Y|s<Y<s+d) increase with a higher deductible amount.

Table 2.3. The CCI under a first-euro deductible of various deductible amounts d for the full sample

d	P(Y<d) [a]	E(Y|Y<d) [b]	CCI
500	0.43	158	68
1,000	0.57	302	171
2,000	0.73	551	393
3,000	0.81	755	598
4,000	0.86	921	773
5,000	0.89	1,059	920
10,000	0.96	1,475	1,371

[a] The probability that healthcare expenses remain below the deductible amount.
[b] The expected expenses given that they remain below the deductible amount.

Table 2.4 shows (the relevant parameters for determining) the CCI under a doughnut hole of €1000 with various starting points (the CCI under a doughnut hole assuming other deductible amounts is shown in the Appendix). The mean probability that healthcare expenses remain below the starting point, respectively the endpoint of the deductible, the expected expenses given that they end up in the interval [0, s], respectively [0, s+d] and the CCI are shown. Table 2.4 shows that P(Y<s) is lower compared to P(Y<s+d). Similarly, E(Y|Y<s) are lower compared to E(Y|Y<s+d). Second, results suggest that the CCI under a doughnut hole with deductible amount €1000 increases when the starting point of the doughnut hole is shifted to the right until a starting point of €1000 is used. On average, a stronger CCI is realized under a doughnut hole with a starting point at €1000 compared to a starting point at the mean of actual healthcare expenses in the sample (i.e., €2257). These results imply that, given the dataset and the assumptions made, the 'sweet spot' of the starting point is located somewhere around €1000. This finding might

suggest that the starting point of the doughnut hole should be located below the overall mean of actual healthcare expenses, implying that the starting point of the doughnut hole in the Medicare drug coverage system should be lowered, since it is currently set at the overall mean of actual healthcare expenses.

Table 2.4. The CCI under a doughnut hole with deductible amount d €1,000 with various starting points s for the full sample

s	P(Y<s) [a]	P(Y<s+d) [b]	E(Y|Y<s) [c]	E(Y|Y<s+d) [d]	CCI
0 [e]	0	0.57	0	302	171
500	0.43	0.66	158	433	215
1,000	0.57	0.73	302	551	222
2,000	0.73	0.81	551	755	204
2,257	0.75	0.82	607	801	197
3,000	0.81	0.86	755	921	175
4,000	0.86	0.89	921	1,059	147
5,000	0.89	0.92	1,058	1,173	123

[a] The probability that healthcare expenses remain below the starting point of the deductible.
[b] The probability that healthcare expenses remain below the endpoint of the deductible.
[c] The expected expenses given that they end up in the interval [0, s].
[d] The expected expenses given that they end up in the interval [0, s+d].
[e] A doughnut hole with a starting point of €0 is effectively a first-euro deductible; the CCI and related probabilities and expected expenses are identical (see Table 3).

A comparison of the results under a first-euro deductible with those under a doughnut hole suggests that different deductible modalities lead to differences in CCIs. Assuming a deductible amount of €1000, a doughnut hole with a relatively low starting point leads on average to a stronger CCI compared to a first-euro deductible. For example, a first-euro deductible of €1000 leads to a CCI of €171 while a doughnut hole of €1000 with a starting point at €1000, respectively at the mean of actual healthcare expenses leads to a CCI of €222, respectively €197. Results suggest that this pattern in favor of a doughnut hole reverses (and the CCI will be stronger in case of a first-euro deductible) when the starting point of the doughnut hole is located somewhere between €3000 and €4000.

7.2 Low-risk individuals and high-risk individuals

Table 2.5 provides the CCI under a first-euro deductible specifically for the low-risk individuals and the high-risk individuals. For the high-risk individuals P(Y<d) is lower while E(Y|Y<d) are higher in comparison to the low-risk individuals. Under a first-euro deductible, the CCI is strongest for the low-risk individuals compared to the high-risk individuals, as long as the deductible amount is relatively low; when the deductible amount is set somewhere between €4000 and €5000, this pattern is reversed.

Table 2.5. The CCI under a first-euro deductible of various deductible amounts d for the low-risk individuals and the high-risk individuals

	d	P(Y<d) [a]	E(Y|Y<d) [b]	CCI
Low-risk individuals	500	0.48	157	75
	1,000	0.63	296	187
	2,000	0.79	529	418
	3,000	0.88	709	617
	4,000	0.92	846	776
	5,000	0.95	952	899
	10,000	0.99	1,199	1,188
High-risk individuals	500	0.30	162	48
	1,000	0.41	318	130
	2,000	0.55	609	329
	3,000	0.64	875	547
	4,000	0.70	1,119	765
	5,000	0.75	1,341	976
	10,000	0.87	2,203	1,853

[a] The probability that healthcare expenses remain below the deductible amount.

[b] The expected expenses given that they remain below the deductible amount.

The CCI under a doughnut hole of €1000 with various starting points is shown in Table 2.6 for the two risk-groups. The CCI under a doughnut hole is stronger for the high-risk individuals than for the low-risk individuals, as long as the starting point of the deductible is shifted to the right considerably. If the starting point is set at a relatively low point (i.e., at €500 or at €1000), the CCI under a doughnut hole is stronger for the low-risk individuals. For the low-risk individuals, the 'sweet spot' of the starting point seems to be located somewhere around €1000 while for the high-risk individuals this is somewhere around the overall mean of actual healthcare expenses.

Table 2.6. The CCI under a doughnut hole with deductible amount d €1,000 with various starting points s for the low-risk individuals and the high-risk individuals

	s	P(Y<s) [a]	P(Y<s+d) [b]	E(Y|Y<s) [c]	E(Y|Y<s+d) [d]	CCI
Low-risk individuals	0 [e]	0	0.63	0	296	187
	500	0.48	0.73	157	420	230
	1,000	0.63	0.79	296	529	231
	2,000	0.79	0.88	529	709	199
	2,257	0.82	0.89	580	748	189
	3,000	0.88	0.92	709	846	159
	4,000	0.92	0.95	846	952	123
	5,000	0.95	0.97	952	1,031	94
High-risk individuals	0 [e]	0	0.41	0	318	130
	500	0.30	0.49	162	467	177
	1,000	0.41	0.55	318	609	200
	2,000	0.55	0.64	609	875	218
	2,257	0.57	0.65	680	940	219
	3,000	0.64	0.70	875	1,119	218
	4,000	0.70	0.75	1,119	1,341	211
	5,000	0.75	0.78	1,341	1,545	200

[a] The probability that healthcare expenses remain below the starting point of the deductible.

[b] The probability that healthcare expenses remain below the endpoint of the deductible.

[c] The expected expenses given that they end up in the interval [0, s].

[d] The expected expenses given that they end up in the interval [0, s+d].

[e] A doughnut hole with a starting point of €0 is effectively a first-euro deductible; the CCI and related probabilities and expected expenses are identical (see Table 5).

A comparison of the CCI under the two deductible modalities shows that, given our dataset and under the assumptions made in this research, for the low-risk individuals, a doughnut hole on average leads to a stronger CCI compared to a first-euro deductible until a starting point of €3000 or more is chosen. For example, the CCI under a doughnut hole with a starting point at €1000 is €231 compared to the CCI of €187 under a first-euro deductible. Nevertheless, only small differences exist when comparing a first-euro deductible to a doughnut hole with a starting point at the mean of actual healthcare expenses; the CCI equals €187 compared to €189. For the high-risk individuals the CCI is noticeably stronger under a doughnut hole compared to a first-euro deductible, even if the starting point is shifted to the right only moderately. The CCI is, for instance, €177 under a doughnut hole with a starting point at €500 compared to €130 under a first-euro deductible. Results suggest that for the high-risk individuals, a doughnut hole with a starting point at the mean of actual expenditures leads to a stronger CCI compared to a first-euro deductible (€219 compared to €130).

8. CONCLUSION AND DISCUSSION

Starting from the traditional economic theory that consumers act like a homo economicus, this paper has developed a method to simulate Cost Containment Incentives (CCI) under different deductible modalities. For a homo economicus the CCI depends on two parameters: (1) the probability that individual healthcare expenses end up in the deductible range and (2) the total expected healthcare expenses given that they end up in the deductible range. We have empirically illustrated the method for two modalities applied in practice, i.e., a first-euro deductible and a doughnut hole. Given our dataset and under the assumptions made, our findings lead to four conclusions.

First, not surprisingly, the CCI increases with the deductible amount, ceteris paribus. The developed method can be used to simulate the impact of a higher deductible on the CCI. Second, the CCI differs between deductible modalities. Which deductible modality is opted for by policymakers seems to have consequences in terms of the CCI and it can thus be valuable to take the CCI into consideration when comparing the effectiveness of these different deductible designs. In our sample, a doughnut hole with a well-chosen starting point (i.e., below €4000) on average provides a stronger CCI than a first-euro deductible. This would imply that, to realize a strong CCI, the starting point of the deductible should be higher than zero for all insured. This finding is in line with the conclusion of van Kleef and coauthors (2009). Third, the CCI differs across risk-groups. We have found that under a first-euro deductible the CCI is strongest for the low-risk individuals, as long as the deductible amount is relatively low (i.e., until the deductible amount is set somewhere between €4000 and €5000). Under a doughnut hole, the CCI is strongest for the high-risk individuals, as long as the starting point is higher than €1000. Our findings suggest that the CCI is stronger under a doughnut hole than under a first-euro deductible for both the low-risk individuals – at least when a starting point below €3000 is chosen – and for the high-risk individuals. Fourth, our results suggest that, in order to provide a stronger CCI, the starting point of the doughnut hole should not be located at the mean of actual healthcare expenses in the sample, but somewhere below that mean. This finding suggests that the CCI under the doughnut hole in the Medicare drug coverage system could be increased by lowering the starting point.

It is important to note that our empirical findings depend on several assumptions which deserve further elaboration. In addition, many important topics remain for future research. Six of these issues are discussed below. First, a note of caution should be raised against the assumption of individuals behaving completely rationally, since in practice, insured might actually act differently than the classical theory suggests. There is empirical evidence that individuals tend to overestimate small probabilities and underestimate large probabilities (Kahneman & Tversky 1979:279; Van Winssen et al. 2015). This may have consequences for the first parameter in our framework (i.e., the probability that healthcare expenses fall in the deductible range). For example, if a low-risk individual under a first-euro deductible would overestimate the probability of becoming ill, this individual's perceived probability that healthcare expenses remain below

the deductible amount decreases, leading to a weaker CCI. In addition, Brot-Goldberg et al. (2015) show that, in practice, consumer behavior departures from fully rational behavior in that sense that individuals seem to act in a myopic way. In particular, they show that in the decision of using healthcare, individuals are not responsive to the expected marginal end-of-year price but often respond to easier to understand prices such as spot prices or their prior end-of- year marginal price. This evidence suggests that the second parameter of our framework (i.e., the total expected expenses in the deductible range)might be influenced. Although there is growing empirical evidence on alternative assumptions concerning consumer behavior, there is limited research on how these 'new' assumptions should be incorporated in economic simulation studies. It is yet unclear how these insights exactly translate into our simulation framework. For instance, it would be interesting to study how our framework could be extended with weights or additional parameters to incorporate new insights.

Second, in this paper a linear relation between the probability of exceeding the deductible and the CCI is assumed. If there are reasons to believe that an alternative relationship is more realistic, it is possible to interchange the assumption of linearity and plug-in any other relationship in the conceptual framework.

Third, the expected healthcare expenses are an important parameter in the approximation of the CCI. The expenditure model based on age-gender classes, DCGs, PCGs, HCGs and MHCs probably predicts expenses less than perfectly. Therefore, obtained results cannot expected to be perfect either. Overestimated expected expenses might explain why—in contrast to what we hypothesized—a doughnut hole instead of a first-euro deductible leads to the strongest CCI for the low-risk individuals. Further research is needed to simulate the CCI with better prediction models. Significantly better predictions can be expected if expenses in previous years are added to the model, since previous expenses proved to be a strong predictor for future expenses, even when the abovementioned predictors are already included (Bertsimas et al. 2008; Van Veen et al. 2015a). A better prediction model will likely lead to a larger variance in expected expenses and larger differences in the CCI across risk groups.

Fourth, for reasons of simplicity we did not incorporate a correction for the moral hazard effect. In our empirical illustration we apply a substantially higher deductible amount (i.e., €1000) than the amount originally applied in our data (i.e., €170). If the higher deductible amount was implemented in practice this would have led to less moral hazard and thus lower healthcare expenses. An interesting question is whether or not consumers include the 'moral hazard effect' in their expectations about future healthcare expenses. If they do (e.g., by expecting lower healthcare expenses in case of a higher deductible amount) this effect should ideally be incorporated in the type of simulations applied in this paper. This would be possible by modifying the healthcare expenses on which the expenditure model is based.

Fifth, different cost sharing designs are expected to have different implications in terms of solidarity. For example, for the high-risk individuals, a first-euro deductible can be considered as socially inequitable (assuming insufficient financial compensation), because these individuals

incur, on average, higher out-of-pocket expenses than their healthy counterparts. In addition, for these high-risk individuals, a first-euro deductible can be considered as ineffective in reducing moral hazard, because these individuals know ex-ante that their yearly healthcare expenses will exceed the deductible amount. The relation between different cost sharing designs and solidarity and to what extent a stronger CCI has an effect on moral hazard reduction might benefit from future research.

Sixth, in this paper only two deductible modalities are empirically illustrated. The method developed allows approximation of the CCI under other deductible modalities as well. Examples of other modalities are a doughnut hole with a risk-adjusted starting point and an income-related deductible. Under a doughnut hole with a risk-adjusted starting point (as proposed in the literature by van Kleef et al. 2009), the location of the doughnut hole depends on specific individual risk characteristics of the insured, such as demographics, diagnostics or prior healthcare utilization. The starting point could be, for example, based on maximized uncertainty in out-of-pocket expenses or on a maximized CCI. It is expected that a doughnut hole with a risk-adjusted starting point leads to a stronger CCI than a first-euro deductible and a uniform doughnut hole. In addition to the possibility to simulate the CCI under other deductible modalities, the method provides the opportunity to determine the CCI under other forms of cost sharing than deductibles, such as co-insurance (i.e., insured are obliged to pay a percentage of the healthcare expenses per service out-of-pocket) or co-payments (i.e., insured are required to pay a predefined amount per service out-of-pocket). This might be an interesting topic for future research.

Last, we acknowledge that the CCI may be regarded as one of the multiple criteria that can be taken into consideration by policymakers when deciding on the design of effective consumer cost sharing in health insurance. Other criteria, such as the practical and political-ideological aspects of different deductible modalities could be relevant as well. For example, an important aspect in the deductible design decision would be the trade-off between a stronger CCI versus transparency and simplicity. Specifically, in a system with a doughnut hole where the starting point of the deductible depends on individual risk-characteristics, the average CCI might be higher compared to a first-euro deductible, but transparency may be worse when the majority of insured does not understand how and why certain starting points are assigned to them. Consequently, acceptance of the deductible system might be in danger. Another issue would be how policymakers will try to level the government's cash flow. Switching to a deductible system where a relatively strong CCI can be realized, might lead to a reduction in revenues from deductibles due to more cost-conscious behavior. An option to overcome this reduction in revenues would be to increase the deductible amount (Rosenthal 2004).

Though the results of our empirical illustration should be interpreted with caution, we believe the method developed in this paper to simulate the CCI can be useful to researchers, insurers and policymakers who want to indicate the relative effects of different cost sharing designs on the incentives for cost-conscious behavior.

APPENDIX

Table A.2.1. The CCI under a doughnut hole with various deductible amounts d and various starting points s for the full sample

d	s	P(Y<s) [a]	P(Y<s+d) [b]	E(Y|Y<s) [c]	E(Y|Y<s+d) [d]	CCI
	0	0	0.43	0	158	68
	500	0.43	0.57	158	302	104
500	1,000	0.57	0.66	302	433	112
	2,257	0.75	0.79	607	709	102
	5,000	0.89	0.91	1059	1118	64
	0	0	0.73	0	551	393
	500	0.43	0.77	158	658	431
2000	1,000	0.57	0.81	302	755	426
	2,257	0.75	0.87	607	959	365
	5,000	0.89	0.93	1059	1269	226
	0	0	0.81	0	755	598
	500	0.43	0.84	158	842	621
3000	1,000	0.57	0.86	302	921	602
	2,257	0.75	0.90	607	1090	505
	5,000	0.89	0.94	1059	1348	313
	0	0	0.89	0	1059	920
	500	0.43	0.91	158	1118	917
5000	1,000	0.57	0.92	302	1173	872
	2,257	0.75	0.93	607	1290	722
	5,000	0.89	0.96	1059	1475	451

[a] The probability that healthcare expenses remain below the starting point of the deductible.

[b] The probability that healthcare expenses remain below the endpoint of the deductible.

[c] The expected expenses given that they end up in the interval [0, s].

[d] The expected expenses given that they end up in the interval [0, s+d].

Part II

Value-based payment incentives for providers

Chapter 3

Value-based provider payment: Towards a theoretically preferred design

With Frank Eijkenaar and Erik Schut

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ABSTRACT

Worldwide, policymakers and purchasers are exploring innovative provider payment strategies promoting value in health care, known as value-based payments (VBP). What is meant by 'value', however, is often unclear and the relationship between value and the payment design is not explicated. This paper aims at: (1) identifying value dimensions that are ideally stimulated by VBP and (2) constructing a framework of a theoretically preferred VBP design. Based on a synthesis of both theoretical and empirical studies on payment incentives, we conclude that VBP should consist of two components: a relatively large base payment that implicitly stimulates value and a relatively small payment that explicitly rewards measurable aspects of value (pay-for-performance). Being the largest component, the base payment design is essential, but often neglected when it comes to VBP reform. We explain that this base payment ideally (1) is paid to a multidisciplinary provider group (2) for a cohesive set of care activities for a predefined population, (3) is fixed, (4) is adjusted for the population's risk profile and (5) includes risk-mitigating measures. Finally, some important trade-offs in the practical operationalization of VBP are discussed.

1. INTRODUCTION

Worldwide, there is dissatisfaction with current, input-oriented, and supply-led health care systems. These systems are characterized by monodisciplinary and segmented care and result in fragmented care processes, suboptimal quality and waste of resources (Porter & Teisberg 2006; Berwick 2011; De Bakker et al. 2012; Mechanic & Tompkins 2012; Pronovost 2013; Tsiachristas 2015). There is consensus that flawed provider payment methods contribute to this problem (McGuire 2000; Porter & Teisberg 2006; McGuire 2011). In particular, predominant payment methods generate perverse incentives for health care providers regarding the delivery of services. For example, fee-for-service (FFS) – in which providers are paid retrospectively for each service delivered – is still a very common payment method in health care (especially in the United States) because it is relatively easy to administer and encourages productivity (Jegers et al. 2002; Marmor et al. 2011). However, this payment method may generate a 'more-is-better culture' and therefore tends to overprovision. In addition, providers who promote population health and successfully prevent treatment are financially penalized for that (Jegers et al. 2002; Ellis & Miller 2008). Another widespread payment method (especially in Europe) is capitation, in which providers receive a fixed amount per person per period. This payment method also has important drawbacks, such as encouraging underprovision and risk selection (Porter & Kaplan 2016). Furthermore, both FFS and capitation (as well as other predominant payment methods) do not reward the provision of high-quality care and innovation. Finally, because these methods traditionally remunerate single, monodisciplinary providers instead of multidisciplinary groups of providers, they preserve fragmentation and thwart cooperation and coordination across the continuum of care (Epping-Jordan et al. 2004; Van Exel et al. 2005). In short, predominant payment methods are not fully aligned with 'value'.

In order to tackle the problems related to current payment methods, worldwide, policymakers and purchasers of care are exploring alternative payment strategies to help steering health care systems towards value (Conrad et al. 2014; Burwell 2015). A well-known endeavor in this regard is pay-for-performance (P4P), in which providers are explicitly rewarded for 'doing a better job'. Although P4P is an appealing idea, explicit financial incentives for value should in principle be used only modestly in provider payment methods because of the multitasking problem (Holmstrom & Milgrom 1991; section 3.2).

Therefore, it is not surprising that in practice, the majority of provider revenues (typically referred to as the base payment) is not explicitly linked to value. This base payment, however, does create implicit (dis)incentives for value, because each payment method influences providers' behavior through incentives (Jensen & Meckling 1976; Enthoven 1988; Prendergast 1999; McGuire 2000; Gaynor et al. 2004; Berenson 2010; Christianson & Conrad 2011; McGuire 2011). In this paper, we underline the importance of carefully considering the design of particularly these implicit financial incentives, in such a manner that desired behavior is fostered and value is incentivized. We discuss a theoretically preferred design of a payment method that both

implicitly and explicitly stimulates value in a broad sense, henceforth referred to as value-based payment (VBP).

There is substantial literature on the theory and implementation of payment incentives (for an overview, see McGuire 2000; McGuire 2011; Conrad et al. 2014; Conrad 2015; Conrad et al. 2016). However, the theoretical basis of VBP design is fragmented and in the available work, the ters 'value' and 'VBP' are often implicitly used for different dimensions of value. In addition, the relationship between what a health care system ideally pursues in terms of value and what is required in terms of the VBP design to achieve this has not been explicated. Therefore, this paper aims at: (1) identifying key-value dimensions that are ideally stimulated by VBP and (2) constructing a conceptual framework of a theoretically preferred VBP design according to these dimensions. We achieve these goals based on a synthesis of findings of key theoretical and empirical studies conducted in the field of health services research, health economics, contract theory and the general economic theory on incentive design. Throughout, we relate our findings to VBP initiatives from practice, and end with illustrating some important trade-offs in the practical operationalization of VBP. The insights from this paper are of practical relevance for policymakers and purchasers who are responsible for (re)designing existing and future VBP initiatives.

The structure of this paper is as follows. In the next section, key-value dimensions are discussed, followed by a section containing a concise theoretical background on payment methods. The fourth section focusses on a theoretically preferred VBP design. Section 5 illustrates several important trade-offs in the practical operationalization of VBP, followed by some concluding remarks.

2. KEY-VALUE DIMENSIONS IN HEALTH CARE

In previous work, the term 'value' in health care has been defined in different ways. According to the Institute of Medicine (IOM 2001), health care needs to be safe, effective, patient-centered, timely, efficient, and equitable. Berwick et al. (2008) state that a health care system should pursue a Triple Aim of limiting per capita cost of care, improving individual patient experience, and improving population health. Porter (2009; 2010) provides a more global description of health care system goals, namely maximal value, defined as the best health outcomes achieved per dollar spent. Value encompasses efficiency and the central focus is on multidimensional outcomes, rather than inputs and processes. Conrad (2015) defines value as maximum health benefit (i.e., health outcomes, processes of care and patient experience) at minimum cost.

Based on these descriptions as well as arguments derived from the societal debate on what stakeholders in health care should ideally aim for (Eijkenaar & Schut 2015), five key-value dimensions can be distinguished:

1. High-quality care. Care is safe, effective, patient-centered, and timely. High quality comprises 'technical' or clinical quality as well as patient-reported measures regarding individual care

paths and outcomes (e.g., PROMs). Technical quality can be operationalized in structures (e.g., having an up-to-date patient registry for diabetes patients affiliated with the primary care practice), processes (e.g., regularly checking the blood glucose levels of diabetes patients) and (intermediate) outcomes (e.g., acceptable blood sugar levels for diabetes patients or absence of diabetes-related complications) (Donabedian 1988).

2. Cost-conscious behavior. Scarce resources are efficiently used, so there is no misuse or overuse.
3. Well-coordinated care. Multidisciplinary providers communicate and cooperate well in order to realize integrated, well-orchestrated care across the continuum of care. This dimension mainly regards coordination between providers of different disciplines and sites. A team-based approach in which multidisciplinary providers work side-by-side is of great importance, particularly given the increase in the number of individuals with multiple (chronic) diseases.
4. Cost-effective innovation. Cost-saving services result in equal or better health and health-promoting innovations are worth the additional costs.
5. Cost-effective prevention. Deteriorations of health problems are prevented in a cost-effective way. This dimension entails primary, secondary and tertiary prevention.

In this paper, a payment method is considered 'value-based' if it simultaneously provides incentives for all dimensions. Clearly, these dimensions are interrelated. For instance, well-coordinated care can be considered an element of high-quality care. However, for the purpose of describing a theoretically preferred VBP design, it is necessary to explicitly distinguish the different dimensions of value. Note, however, that it is not the goal of this paper to develop indicators for measuring value. As we will argue below (section 3.2), the measurement of all aspects of value and calculating payments only based on indicator scores is neither feasible nor desirable.

3. THEORETICAL BACKGROUND ON PROVIDER PAYMENT METHODS

3.1 Financial incentives to counterbalance agency problems

Agency theory, as part of contract theory, studies the relation between two contracting parties: the principal and the agent (Spence & Zeckhauser 1971; Ross 1973). In this paper, the focus is on the health care provider acting as a double agent, interacting with both the patient and the purchaser (Blomqvist 1991). Information asymmetry between providers as the relatively well informed party relative to patients and purchasers is not a problem, as long as the interests of all involved parties are aligned (Laffont & Martimort 2002). However, in case of conflicting interests, agency problems may evolve and providers may exploit their information surplus for their own (financial) benefit (Jensen & Meckling 1976; Richardson 1981).

An important strategy to counterbalance agency problems entails 'controlling' the agent by means of (financial) incentives (Vermaas 2006). The goal of controlling is to align providers' interests with those of patients' and 'purchasers' and is based on the assumption that providers

are in the position to improve value if they are motivated to do so. Providers' responsiveness to financial incentives has been well documented in the literature, implying that the (design of the) payment method is an important factor influencing providers' behavior and can thus be used to help steering health care systems towards value (Jensen & Meckling 1976; Enthoven 1988; Prendergast 1999; McGuire 2000; Gaynor et al. 2004; Berenson 2010; McGuire 2011).

3.2 The need for a base payment

Ideally, providers who are 'doing a good job' in terms of key-value dimensions are explicitly rewarded for this. A prerequisite of a payment method based fully on providers' performance with respect to value is that all aspects of value can be captured in the payment contract (i.e., for each aspect an indicator is available on which providers can be 'scored'). Complete contracts are, however, unfeasible in health care since the outcomes of some of the multiple tasks that providers perform, are more difficult (or even impossible) to measure objectively than others. For instance, for some medical interventions reliable and valid outcome indicators are available, whereas for other care activities – e.g., good communication and coordination of care – the added value is difficult to measure and appropriate registries are lacking. This problem has been referred to as the multitasking problem (Holmstrom and Milgrom 1991; Eggleston 2005; Frølich et al. 2007) and is defined as the challenge of designing incentives to motivate appropriate effort across multiple tasks when the desired outcomes for some tasks are more difficult to measure than others (Eggleston 2005). An important potential consequence of this challenge is that explicitly rewarding providers for some specific aspects of value may result in undesired behavior. Specifically, providers may focus disproportionately on those tasks that are measured and rewarded and neglect unincentivized tasks. This phenomenon has been referred to as 'teaching to the test' (Holmstrom & Milgrom 1991) and has actually been observed in practice (Steel et al. 2007; Glickman et al. 2007; Campbell et al. 2009; Mullen et al. 2010).

Due to the multitasking problem and the associated risk of teaching to the test, explicit financial incentives for value can and should be used only modestly in provider payment methods. As a consequence, the majority of providers' revenues can and should not be explicitly related to value. This part of providers' revenue is commonly referred to as the base payment. This base payment will typically comprise the largest part of total provider payment, whereas the payment component explicitly related to performance indicators (P4P) is likely to be relatively small. Indeed in practice, base payments currently comprise at least 90% of total provider payment (Eijkenaar 2013a; Ryan et al. 2015; Milstein & Schreyögg 2016). So far, papers investigating VBP reform have focused mainly on the design of the relatively small P4P component. Being the largest payment component, however, the design of the base payment is at least equally and arguably more important.

3.3 Shortcomings of predominant and alternative base payment methods

The four most frequently applied base payment methods in practice are payment per item-of service (FFS), payment per case (e.g., DRG's), payment per person (capitation) and payment per period (salary for individual providers and fixed budget for organizations). In Table 3.1, the incentives generated by these methods in relation to the key-value dimensions are summarized, based on Jegers et al. (2002), Ellis & Miller (2008) and Christianson & Conrad (2011). This table shows that, although each payment method to some extent stimulates at least one key-value dimension, other dimensions are not incentivized or even discouraged.

As none of the predominant base payment methods adequately promotes all key-value dimensions, alternative base payment methods have been developed. One example is combining predominant methods with opposing incentives in order to sustain the favorable elements of each method, while neutralizing the drawbacks (Ellis & McGuire 1986; Robinson 2001a; Christianson & Conrad 2011; McGuire 2011). Unfortunately, it is still unlikely that all value dimensions are stimulated under these mixtures (see Table 3.1, for a mixed payment method of 50% FFS and 50% capitation). Another recent example of an alternative base payment method is bundled or episode-based payment (De Brantes et al. 2009; Mechanic & Altman 2009; De Bakker et al. 2012; Ridgely et al. 2014). Although bundling stimulates cost-conscious behavior and well-coordinated care, value is only stimulated to some extent and only for those services inside the bundle (Wilensky 2014; Table 3.1).

Table 3.1. Base payment methods and their incentives for key value dimensions [a]

	High-quality care	Cost-conscious behavior	Well-coordinated care [b]	Cost-effective innovation	Cost-effective prevention
Payment per item-of-service	+/-	-	-	-	-
Payment per case	+/-	+/-	-	+/-	-
Payment per person	-	+	-	-	+
Payment per period	-	+/-	-	-	+/-
Mixed payment method of 50% FFS and 50% capitation	+/-	+	- [b]	-	+/-
Bundled or episode-based payment	+/-	+/-	+/-	+/-	-

[a] Authors' own analysis.

[b] By definition, no incentives for well-coordinated care exist because in these examples the payment is assumed to apply to a single, monodisciplinary provider.

4. A THEORETICALLY PREFERRED VBP DESIGN

4.1 Core components of a theoretically preferred VBP

Building on the theory as discussed in section 3, a theoretically preferred VBP should consist of two core components: (1) a substantial base payment that implicitly stimulates key-value dimensions and (2) a relatively small variable payment that explicitly rewards some measurable aspects of value dimensions (P4P). A base payment is a vital component of a theoretically preferred VBP because of the multitasking problem and the risk of teaching to the test when using high-powered explicit incentives (section 3.2). Nevertheless, relatively small explicit rewards are a crucial component of a theoretically preferred VBP. This payment component is required to ensure that value aspects that are not or cannot be implicitly incentivized by the base payment, are given sufficient attention by providers. The variable payment is particularly suitable for stimulating aspects of value that can be relatively easily and objectively measured and that are difficult to incentivize implicitly (Vlaanderen et al. 2019). Typically, these aspects are related to the value dimension 'high-quality care' since a broad spectrum of indicators has already been developed and is increasingly becoming available as a result of an increasing number of P4Pexperiments and initiatives employed by the International Consortium for Health Outcomes Measurement (ICHOM). Other measurable aspects of other value dimensions, however, can be part of the variable payment as well (e.g., smoking cessation counselling as an element of cost-effective prevention; Lindenauer et al. 2007; Mendelson et al. 2017).

The two components should be well tailored to ensure every value dimensions is implicitly and/or explicitly incentivized by VBP. The variable payment can be either designed as an 'add-on' to the base payment or as an integral part. The first modality is similar to most current P4P-programs, while in the latter modality receiving (part of) the base payment is conditional on meeting specific value targets. Note that the relative shares of the two components may vary over time and may depend heavily on the specific context (section 5). For instance, if better performance indicators become available, the share of the variable component that explicitly rewards high quality may increase relative to the base component.

In practice, there are several payment methods that come close to the theoretically preferred VBP design as described above. Box 1 provides a description of three prominent examples. In the remainder of this paper, we relate our findings to these examples.

Box 1. VBP practice initiatives

Medicare Accountable Care Organisations (ACOs)
ACOs are networks of healthcare providers that are jointly accountable for a share of the financial and clinical outcomes of a defined population during a predetermined period. Examples of public sector ACO models are the Medicare Pioneer ACO model and the Medicare Shared Savings Program (MSSP). Under the MSSP, a global budget based on the historical expenses of an assigned population of Medicare FFS beneficiaries is calculated. This 'benchmark' is corrected for national growth and is adjusted for population risk. Shared savings (and losses) are determined by comparing the benchmark to the ACO's actual expenditures and are conditional on meeting a minimum savings rate and quality standard. Assignment of the population to ACOs is mainly done retrospectively (Rose et al. 2016; Song 2014; Pham et al. 2010; McWilliams et al. 2015; Lewis et al. 2013).

The Alternative Quality Contract (AQC)
The Alternative Quality Contract is a five year ACO agreement in the private sector introduced by Blue Cross Blue Shield of Massachusetts (BCBS). Under the AQC, an annual fixed payment is provided, based on a per member per month amount. Providers are responsible for the total continuum of care for a defined population of enrolees that is prospectively attributed to a provider group by means of the affiliation of their designated primary care physician. The base payment is set using historical expenses and is adjusted periodically for (changes in) health risk. The base payment and future increases thereof (i.e., annual growth rates) are negotiated between provider groups and BCBS. Providers share both financial savings and losses. In addition to the global budget, providers who meet quality benchmarks are explicitly rewarded via the P4P-program (a bonus of maximal 10 per cent of the global budget). Shared savings and losses directly depend on the quality score as well; as quality improves (declines), the share of providers' deficit decreases (increases) while the share of providers' surplus increases (decreases). The base payment and the variable payment are thus highly integrated (Chernew et al. 2011; Song et al. 2012; Song 2014; Mechanic & Altman 2009).

Gesundes Kinzigtal
Gesundes Kinzigtal is a population-based integrated care approach in the Kinzigtal region, Germany. Providers are (financially) accountable for care across all health service sectors and indications (e.g., active health promotion for the elderly, disease management programs for chronic conditions, and patient university programs). The target population consists of all individuals who are insured by one of the two sickness funds in the region. Key to this initiative is the shared health gain approach by means of a shared savings contract (i.e., financial goals are realised if actual costs in the region increase at a lower rate than the German norm costs). The base payment is a global budget and equals the costs of the German risk-adjusted standard (i.e., the norm costs within the context of the risk-equalisation system). Quality is stimulated by means of a P4P-program (Hildebrandt et al. 2010; Hildebrandt et al. 2012; Busse & Stahl 2014).

Henceforth, we focus on the first component of a theoretically preferred VBP – the base payment – for two reasons. First, the design of the second component – the variable payment – has already been extensively discussed in the literature (for an overview, see Eijkenaar 2013a; Milstein & Schreyögg 2016). Second, as argued above, the base payment typically comprises the majority of providers' revenues, underlining the importance of carefully designing the implicit incentives generated by this component.

4.2 Five key features of a theoretically preferred base payment

Below, we explain which key features of a theoretically preferred base payment are required to stimulate value in a broad sense. Based on a synthesis of the findings of key studies conducted in the field of health services research, health economics, contract theory and the general economic theory on incentive design, we conclude that the base payment should preferably be paid (1) to a

multidisciplinary provider group for delivering (2) a cohesive set of care activities to a predefined population. In addition, the base payment should (3) be fixed, (4) be adjusted for the population's risk profile and (5) include risk-mitigating measures. We acknowledge that these five key features are interrelated (e.g., for the provision of a comprehensive set of care activities a multidisciplinary provider group is required).

4.2.1 Multidisciplinary provider group

To encourage well-coordinated care, the base payment should jointly remunerate multidisciplinary groups of providers who have agreed to work together as an 'accountable group' for the delivery of a cohesive set of care activities. Depending on the exact nature of the care activities, these groups may consist of different types of physicians (e.g., primary care physicians or medical specialists), other health care professionals (e.g., nurses or physiotherapists) and various care facilities (e.g., specialty hospitals or rehabilitation centers).

Financial barriers between separately paid providers are removed once a single, integrated payment for a provider group is introduced. Such an integrated payment to a provider team is expected to encourage multidisciplinary cooperation and collaboration, fostering greater (cross-specialty) coordination and increasing active provider engagement in improvements across the whole care path (Anderson & Weller 1999; Berenson 2010; Burwell 2015; Mehrotra & Hussey 2015). This is of relevance particularly for the increasing number of individuals with multiple coexisting (chronic) health problems who will likely benefit from well-coordinated, integrated care (DeGruy & Etz 2010; Pollack et al. 2012; Leijten et al. 2017). In addition, paying a provider group instead of individual providers is likely to result in more flexibility in the use of resources (Mechanic & Altman 2009; Miller 2009; Cutler & Ghosh 2012; Tsiachristas et al. 2013). Another advantage is that the financial risk that is associated with VBP is pooled. This may prevent individual providers from being confronted with excessive financial risk and may reduce incentives for undesired behavior (Anderson & Weller 1999; Gaynor et al. 2004; Vermaas 2006; Frakt & Mayes 2012).

Group-based incentives require a certain entity that contracts with the purchaser and receives the payment on behalf of the provider group. This 'main contracting entity' administers the payment and is responsible for the organization, coordination and (possibly) the delivery of care activities and employs or subcontracts other providers (Anderson & Weller 1999). The main contractor thus initially bears the financial risk and has to divide the pain and gain among the group members. Entities such as ACOs, health maintenance organizations (HMOs) and hospitals might qualify for this role because of their size and level of professionalism. To pass the incentives along from the group to the individual providers, a transparent payment distribution mechanism needs to be developed; it has to be decided 'who is getting paid, how much, for doing what' (Frølich et al. 2007). For instance, distribution can be in proportion to the provider's share of the target population or the provider's contribution to the group's performance (Olson 1965; Gaynor et al. 2004; Conrad 2015).

4.2.2 Cohesive set of care activities for a predefined population

To encourage cost-effective prevention, the base payment should remunerate a provider group for the provision of a cohesive set of (preventive) care activities to a predefined population of individuals. From a theoretical perspective, VBP ideally involves 'whole-person accountability'. Key to such an approach is that the payment is not disease-specific but person-centered and holistic. The payment covers all relevant health services given a person's needs. An evident set of care activities that is covered by the payment is (virtually) the full continuum of services included in the relevant benefit package in place. For instance, if a provider group accepts whole-person accountability for a target population of diabetics, the provider group is not only responsible for all diabetes-related care but for all care services that the diabetics in the target population might need, within limitations of the relevant benefit package covered by the health plan or other third party payer. The target population may consist of any defined set of individuals, including those not currently in need of care (Kindig 2007).

Whole-person accountability triggers incentives for health promotion and prevention because prevention is often more effective and cheaper than cure. The more a provider group improves the health of the population, the greater the financial gain (Sharfstein 2016). Stimulating preventive efforts is of great importance, since the causes of many health problems lie in individual behavior (e.g., smoking and unhealthy diet) and the current system does not effectively promote healthy behavior (Berwick et al. 2008; Casalino et al. 2015). Another advantage of a whole person accountability approach is that effective long-term management of chronic diseases (e.g., delaying the progression of diseases and preventing exacerbations) is stimulated (Berenson 2010; McClellan et al. 2013; Conrad 2015). In addition, cost-shifting becomes more difficult once the payment applies to a broad set of care activities and is even impossible if the payment applies to all care services (Sood 2011; Busse & Stahl 2014). The provision of unnecessary services is expected to gradually be phased out (Gaynor et al. 2004; McClellan et al. 2013). Finally, the risk of double payment for the same services decreases. Double payment is plausible in particular for patients with comorbidity and if services are paid for through different systems (Hussey et al. 2011; EIB 2012; Ridgely et al. 2014).

Four characteristics can be used to delineate the target population: (1) individual characteristics (e.g., age or diagnoses), (2) geographical catchment areas (e.g., region or ZIP-codes), (3) provider affiliation (e.g., enrolment in a GP practice or retrospective assignment to a provider based on actual utilization) and (4) purchaser affiliation (e.g., having an insurance policy with a specific insurer). The characteristics are not mutually exclusive. Under the AQC (Box 1), the target population consists of individuals who are below 65 years of age, live in Massachusetts, are registered with a primary health care provider, and have an HMO or preferred provider organization (PPO) insurance policy from BCBS (Mechanic & Altman 2009; Chernew et al. 2011; Song et al. 2012; Song 2014). Assignment of the target population to the provider group for the coming year can be done prospectively (e.g., based on enrolment with affiliated primary care physicians, or on health care utilization in the prior year) or retrospectively (e.g., based on the plurality of utiliza-

tion in the completed year). In case of prospective assignment, provider groups know beforehand for whom they are responsible in the coming year, enabling providers to proactively reach out to and improve care for their target population (Lewis et al. 2013). A potential advantage of retrospective assignment is that it stimulates providers to manage costs and quality for all of their patients, instead of just the assigned population. However, professional ethics may effectively prevent that – under prospective assignment – providers will actually distinguish between assigned and unassigned patients in terms of (the quality of) provided services. Under the AQC, assignment is done prospectively, while under the MSSP a retrospective form is used (Box 1).

4.2.3 Fixed payment for a defined period of time

To encourage cost-conscious behavior and cost-effective innovation, the base payment should be fixed for a defined period of time, implying that there is no link with actual costs (Anderson & Weller 1999; Jegers et al. 2002). Such a method implies that (some of) the financial risk is transferred from the purchaser to the provider. The financial result is retrospectively determined by the difference between actual expenses and the prospectively defined, fixed payment ('reconciliation').

A fixed payment for a defined period of time is theoretically preferred over a variable payment because of the high potential for cost-conscious behavior and cost-effective innovation. Because marginal benefits are zero, providers are stimulated to reduce costs and to reconsider the full care process (Jegers et al. 2002; Miller 2009; Cutler & Gosh 2012; Conrad et al. 2014; Conrad 2015). Critically assessing care processes might also uncover room for substitution of relatively expensive for relatively inexpensive services or providers (Casalino 2001). In addition, because the payment can be flexibly deployed, more attention can be paid to cost-effective, creative management of care (Anderson & Weller 1999; McConnell et al. 2014). Note, however, that a fixed payment for a defined period of time also is a main feature of traditional capitation that was heavily criticized in the past for, amongst other things, triggering care rationing and threatening patient choice (Porter & Kaplan 2016). These drawbacks from traditional capitation can be addressed by adding a variable payment component guaranteeing high-quality care (section 4.1), by adopting adequate risk adjustment (section 4.2.4.) and by including arrangements to mitigate excessive financial risk (section 4.2.5).

Below, three design issues of a fixed payment for a defined period of time are discussed: setting the payment level, multiyear contracts and risk transfer.

Setting the payment level

In general, three methods for setting the fixed payment level can be discerned. A first method is based on historical expenses (Douven et al. 2015; Rose et al. 2016). An advantage of this approach is that calculation is relatively straightforward. However, because the payment level is based on prior expenses, past inefficiencies are 'buried' in the payment (Newhouse et al. 1997; Berenson 2010). Moreover, providers have a perverse incentive to increase expenses in the years

prior to the onset of the contract, in order to build up the historical expenses that lie at the basis of the payment level (Berenson 2010; Chernew et al. 2011; Douven et al. 2015). A second approach is basing the payment on average expenses, for instance per relevant peer group or region (Newhouse et al. 1997; Ellis & McGuire 1988). An advantage is that the payment is relatively easy to calculate and providers with higher than average expenses due to inefficiency are stimulated to reassess their delivery processes. However, providers with higher than average expenses as a result of a disproportionate amount of high-risk individuals in the target population are disadvantaged (Rose et al. 2016). In this case, the payment level can be considered as unfair and inaccurate, calling for appropriate risk adjustment (section 4.2.4). A third option is to base the payment on acceptable expenses (Newhouse et al. 1997). In this case, the payment is set at a level that is sufficient to cover only those expenses generated in delivering medically necessary, cost-effective care (Van de Ven & Ellis 2000). Although this approach seems theoretically preferred, it is difficult to implement in practice, since selecting the 'right' care activities and putting a price upon each service is disputable or likely to be unfeasible. Regardless of the chosen method for setting the payment level, the absolute price is clearly of relevance too. The payment should at least be sufficient to cover (potential) resource costs and to make the provision of high-value care worthwhile for providers.

Multiyear contracts

Contracts in which the fixed payment level is specified can be expected to be incomplete on a range of variables due to the multitasking problem (Maskin & Tirole 1999; Hart 2003). In the case of incomplete contracts, a certain level of mutual trust between the purchaser and the provider group is vital. Multiyear contracts are a sign of mutual trust and prevent costly effort on 'overwriting' complex, short-term contracts (Marques & Berg 2011). Microeconomic theory suggests that long-term contracts produce more favorable effects as compared to short-term contracts. A multiyear contract is likely to stimulate innovation and prevention because, over the longer term, providers are more likely to reap the financial benefits of their investments (Silberberg 1990; Christianson & Conrad 2011; Shortell 2013). On the other hand, providers and purchasers may also be hesitant to conclude multiyear payment contracts because of the concern about being locked into the contract. This calls for a certain level of flexibility in the contract to be able to adjust for inflation and unforeseen events (Chernew et al. 2011; Rose et al. 2016). In practice, multiyear VBP contracts have evolved, such as the five-year AQC contracts (Box 1).

Risk transfer

An important consequence of a fixed base payment for a defined period of time is that (some of) the financial risk is transferred from the purchaser to the accountable provider group. Two types of risk may be transferred: insurance risk and performance risk. Insurance risk is the risk that is typically borne by the purchaser and concerns the random variation around the mean health care expenses. Performance risk is the systematic variation around the mean expected health care

expenses due to providers acting as imperfect agents. This risk can be influenced by providers, as it directly relates to the clinical skills and the choices made by the provider (Vermaas 2006; De Brantes & Rastogi 2008; Miller 2009; Berenson 2010).

Ideally, only performance risk is transferred to the provider group, whereas insurance risk remains with the purchaser (Porter & Kaplan 2016). After all, it is the typical function of a purchaser to deal with random variation by pooling risks, and transforming providers into insurers is not the goal of VBP. Because the target population of a provider group is likely to be smaller than the total number of individuals the purchaser is responsible for, the conditions of the law of the large numbers for effective risk pooling might not be sufficiently fulfilled. Therefore, the provider group might face substantial financial risk due to large random variation from the statistically expected result (Christianson & Conrad 2011; Van de Ven 2014). In comparison to purchasers, providers have limited financial means at their disposal to compensate for this random variation. Transferring insurance risk to providers could encourage risk selection (section 4.2.4) and, in extremis, providers might go bankrupt (Anderson & Weller 1999; Vermaas 2006).

Unfortunately, it is practically unfeasible to split insurance risk and performance risk (Vermaas 2006). Often, unravelling the extent to which health outcomes are the result of chance or of providers acting as (im)perfect agents is virtually impossible. For instance, a lower incidence of diabetes-related health problems in the target population could be the result of a decrease of the number of individuals with obesity due to a successful government campaign to improve lifestyle but could also stem from a provider's successful effort in monitoring blood glucose levels. The first explanation is not necessarily linked to the provider's performance, while the second cause refers to the provider acting as a good agent. While risk-splitting is thus not possible, distributing the financial risk among providers and the purchaser in such a way that providers bear some, but not all, of the risk may be a viable option (Frakt & Mayes 2012).

4.2.4 Risk adjustment

To prevent undesired behavior that may thwart key-value dimensions, the base payment should be risk adjusted. If the payment is not corrected for systematic variation in expenses due to differences in risk characteristics of the target population, incentives for risk selection evolve because then the financial result is partly determined by the risk composition of the population, rather than a mark of achievement. Providers would be unfairly penalized financially if they are responsible for a disproportionate amount of high-risk individuals rather than low-risk individuals. In this case, providers have a financial incentive for risk selection which is the practice of attracting low-risk individuals for which the payment exceeds expected expenses and/or avoiding high-risk individuals for which the opposite holds (Iezzoni 2003; Sood 2011; Rose et al. 2016). Risk selection is undesired because it may jeopardize quality, equal access and efficiency (Welch 1999; Jegers et al. 2002; Barros 2003). Several empirical studies provide evidence of risk selection by capitated provider groups (Newhouse & Byrne 1988; Frank & Lave 1989; Newhouse 1989;

Cutler & Zeckhauser 1998; Altman et al. 2000; Dranove et al. 2003; Chang et al. 2012; Hsieh et al. 2016).

In case of fixed payments, provider groups may experience incentives for risk selection. Because of the relatively small size of target populations a small number of high-risk individuals may have a large impact on the global budget. Providers are in the position to be successful in risk selection. First, providers are particularly well equipped to effectively identify low-risk and high-risk individuals because they have information about the health status of their target population, and they are professionally trained to assess this type of information. Second, providers have subtle tools for risk selection. For instance, a provider might advise a high-risk patient to switch to a different provider by suggesting that he or she would be better served elsewhere (Folland et al. 2013). Non-financial restraints, such as peer review and professional ethics, may however counteract incentives for providers to engage in risk selection (Eggleston 2000). With risk adjustment predictable, systematic variation in expenses as a result of differences in risk characteristics of the population is recognized and accounted for. In this way, risk adjustment contributes to a fair allocation of payments and ensures that providers are willing to accept and serve high-risk individuals. Ideally, risk adjustment creates a level playing field for providers (Anderson & Weller 1999; Iezzoni 2003; McGuire 2011; Ash & Ellis 2012; Omachi et al. 2013; Brilleman et al. 2014; Rose et al. 2016). In Gesundes Kinzigtal, the base payment equals the normative cost-level calculated using the German risk-adjustment model for health insurers, and ACO and AQC models use population risk-score software to adjust for differences in risk characteristics of the target population (Box 1). It is an interesting question to what extent existing risk-adjustment models – most of which were originally developed to adjust capitation payments for insurers – can be (adequately) used to adjust provider payments, taking account of differences between provider and insurer payment regarding incentives and tools for risk selection.

4.2.5 Arrangements to limit excessive financial risk

To prevent undesired behavior that may thwart key-value dimensions, the base payment should include arrangements that effectively mitigate excessive financial risk for providers. As discussed before, providers accepting VBP share financial risk with the purchaser. Risk adjustment accounts for systematic, predictable variation in expenses. However, the majority of between-person variance is random and unpredictable (Van Vliet 1992; Newhouse 1996; Ellis & McGuire 2007). This implies that, even in the unlikely case of perfect risk adjustment, providers still face significant residual financial risk. To protect providers against excessive financial risk, additional approaches to mitigate this risk are likely to be required. In principle, these arrangements are focused on protecting providers against large, unpredictable, random losses (i.e., insurance risk). However, such arrangements could also include protection against predictable and systematic risk that is, for whatever reason, not corrected for by a risk-adjustment model. Note that risk-mitigating arrangements could be used not only to limit but also to (gradually) expand the financial risk a

provider runs. Below, we elaborate on two main parameters that can be simultaneously used to bring the financial risk to appropriate levels.

Type of risk sharing

Two main types of risk contracts can be distinguished. Under a one-sided risk contract, providers that keep expenses below the global payment share in the savings with the purchaser. An advantage is that providers can get familiar to accepting financial 'risk' without sharing in the losses and, keeping all else constant, have less incentives for undesired behavior such as risk selection (Berwick 2011). Under a two-sided risk contract, providers share in the savings, but also in the losses if expenses exceed the global budget. Providers accepting two-sided risk qualify for higher shared savings rates (Berwick 2011; Rose et al. 2016). Theoretical and empirical evidence from the field of behavioral economics has shown that individuals tend to prefer avoiding losses to achieving equivalent gains (Kahneman & Tversky 1979; McNeil et al. 1982), suggesting that a two-sided risk contract provides stronger incentives for value than a contract that includes rewards only (Berenson 2010). However, incentives for undesired behavior increase under a two-sided risk contract (assuming imperfect risk adjustment). In the MSSP, ACOs can opt for a one-sided or a two-sided risk contract while they are in their first two contract periods. After this period, they can only accept a two-sided risk contract (Berwick 2011; Rose et al. 2016). In addition to one- and two-sided risk contracts, risk corridors and reinsurance can be used to bring financial risk to the appropriate level. Risk corridors protect against cumulative losses, because losses and gains are limited beyond a predefined acceptable range (Layton et al. 2016). Reinsurance can be defined as "the insurance of contractual liabilities incurred under contracts of direct insurance or reinsurance" (Carter 1983:4). In the case of VBP, reinsurance would imply that providers are retrospectively reimbursed by the purchaser for some or all of the expenses of specific individuals from their population, based on prospectively determined conditions. Under the AQC, for example providers can buy reinsurance from BCBS or an external entity (Chernew et al. 2011). A variety of non-mutually exclusive reinsurance techniques exist, such as stop-loss contracts, proportional risk sharing and outlier risk sharing (e.g., Carter 1983; Von Eije 1989; Bovbjerg 1992; Van Barneveld et al. 1998; Anderson & Weller 1999; Vermaas 2006; Miller 2009).

Extent of risk sharing

Under VBP, the main contractor (i.e., provider group) shares the financial risk with the purchaser. Thus, the provider group is typically liable for less than 100% of the financial result (Vermaas 2006; Frakt & Mayes 2012). The risk rate (i.e., the share of savings/ losses the provider group is accountable for) should not be set too high in order to keep the risk manageable for the provider group and to prevent (strong) incentives for risk selection in the case of imperfect risk adjustment. However, this rate should not be set too low either, because then the incentives lack power to actually affect provider's behavior (Laffont & Tirole 1993; Gaynor et al. 2004).

The risk rate ideally depends on several variables. A first factor concerns the size of the target population. Ceteris paribus, if the size of the population increases, the payment is expected to gain in stability due to the law of the large numbers, allowing higher risk rates. Second, it seems natural to increase the risk rate for primary relative to secondary care if a primary care group acts as main contractor, while the opposite may be preferred if a hospital accepts this role. Third, the diminishing marginal utility of income might be taken into account (Conrad & Perry 2009). Under the AQC, the risk borne by the different groups of providers ranges from 50% to 100% and is periodically (re)negotiated between the provider group and BCBS (Chernew et al. 2011).

In addition to the risk rate, carve-outs can be used to influence the extent of risk sharing. Carve-outs mitigate the financial risk for providers by placing a portion of the risk outside the payment and contracting separately for this risk (Frank & McGuire 1998). For VBP, this would imply that certain services, medical conditions, or populations are excluded from the contract and are paid for on a separate basis, such as FFS. Consequently, providers are protected against the associated high expenses of these services, conditions or populations and the high costs that are associated with acquiring the needed expertise (Frank & McGuire 1998). Examples of possible carve-outs are intensive care, organ transplantation, mental health or cancer care. Carve-outs may also be required if whole-person accountability is not (instantly) feasible from a practical point of view or for those care services for which risk adjustment is not or insufficiently attainable; carve-outs can be used as an interim measure to (temporarily) exclude certain care types from the payment.

5. TRADE-OFFS IN THE OPERATIONALIZATION OF THE BASE PAYMENT

In section 4, a theoretically preferred VBP design was discussed. We explained how the largest component of VBP – the base payment – should preferably be designed to incentivize value. When it comes to the practical operationalization of the base payment, several inherent trade-offs arise, implying that no 'one size fits all' design exists that can optimally incentivize all key-value dimensions simultaneously. The practical operationalization of the base payment and the extent to which the different value dimensions are incentivized, depend on three determinants: (1) compatibility of incentives, (2) preferences and (3) context. Below, these determinants are briefly discussed and illustrated.

5.1 Compatibility of incentives

Theory predicts that several key features of the base payment are likely to conflict to a certain extent. For instance, regarding the optimal composition and size of the provider group, stronger incentives for well-coordinated care must be traded-off against weaker incentives for cost-conscious behavior. In order to be able to deliver (virtually) the full continuum of care and realize well-coordinated care, the provider group will have to be composed of many different types of providers. But, as the composition becomes more diverse, the size of the provider group is likely

to increase as well. Consequently, the financial risk that is associated with VBP is necessarily spread over more providers within the group, reducing the financial incentives for individual providers and increasing incentives for free-rider behavior (Gaynor & Gertler 1995; Gaynor et al. 2004; Town et al. 2004; Conrad 2015).

Another example of a practical decision involving trade-offs is about the comprehensiveness of the set of activities a provider group is responsible for. If the payment covers a broader set of care activities, the payment moves towards 'whole-person accountability' and incentives for health promotion and (primary) prevention become stronger. However, given that perfect risk adjustment is practically unfeasible, a more comprehensive set of activities will also increase the incentives for risk selection. Hence, stronger incentives for cost-effective prevention should be weighed against stronger incentives for risk selection.

5.2 Preferences

In trading-off the different value dimensions, decision-makers should carefully weigh preferences for each dimension, taking full account of relevant (societal) interests. For instance, if in a country health care expenses are considered to be at an acceptable level, while quality is considered to be suboptimal, decision-makers may attach greater importance to incentives for high-quality care and compromise on the incentives for cost-conscious behavior (under the assumption that higher quality is associated with higher expenses). In this case, the share of the variable payment may be expanded, whereas the financial risk for providers may be reduced. Alternatively, a country with escalating health care expenses and an inefficient health care system may choose to intensify incentives for cost-conscious behavior by expanding the financial risk for providers, while accepting the possible negative consequences in terms of stronger incentives for risk selection.

5.3 Context

The context of implementation can have a major impact on the practical operationalization of the base payment, implying that VBP should be structured in relation to the circumstances of time and place (Conrad et al. 2016). The following four examples illustrate this. First, if limited individual-level data on population risk characteristics are routinely available, a base payment that requires sophisticated risk adjustment is unlikely to be practically feasible. Second, in a setting where providers still predominantly work in monodisciplinary 'silos', it might be problematic to find provider groups that are willing and able to accept whole-person accountability. Third, in a setting in which the IT-infrastructure is underdeveloped, it is unlikely that a multidisciplinary provider group is effectively able to share the information required to realize well-orchestrated, integrated care for the target population (Miller 2009; Berwick 2011). Fourth, expanding the size and scope of providers groups covered by VBP may also affect market concentration and therefore may reduce consumer choice and workable competition. Therefore, in countries with a competitive health care system, the optimal size and scope of provider groups covered by VBP may be smaller than in countries with a more centralized health care system.

6. CONCLUDING REMARKS

This paper has provided a conceptual framework of key components and design features of a theoretically preferred VBP method. We consider a provider payment method 'value-based' if it stimulates value in a broad sense, that is if it offers incentives for: (1) high-quality care, (2) cost-conscious behavior, (3) well-coordinated care, (4) cost-effective innovation and (5) cost-effective prevention.

To our knowledge, this is the first paper in the provider payment literature with a prime focus on the design of such a VBP method, and in particular of arguably the most important component thereof: the base payment. Based on a synthesis of existing literature from a variety of fields, this paper provides insight in the contours of a theoretically preferred VBP method.

The main contribution of this paper is twofold. Inspired by the societal debate on what stakeholders in health care should ideally strive for, as well as by existing definitions of value, we first described and further specified the concept of value, facilitating the specification of requirements in the design of VBP. We conclude that, in this respect, value is ideally conceptualized as a multifaceted concept, comprising not only high quality of care at the lowest possible costs but also efficient cooperation, innovation and health promotion. Second, starting from these value dimensions, we derived various design features of a theoretically preferred VBP model. We conclude that in order to stimulate value in a broad sense, the payment should consist of two main components that must be carefully designed. The first component is a risk-adjusted global base payment with risk-sharing elements paid to a multidisciplinary provider group for the provision of (virtually) the full continuum of care to a certain population. The second component is a relatively low-powered variable payment that explicitly rewards aspects of value that can be adequately measured.

Although a well-designed VBP is clearly a necessary condition for realizing value-based health care, we acknowledge that it is unlikely to be a sufficient condition. Non-financial mechanisms as well as organizational structures may be at least as important (Robinson 2001a; Christianson & Conrad 2011; Phipps-Taylor & Shortell 2016). Furthermore, as explained above, the practical operationalization and implementation of a well-designed VBP model should not be underestimated and be well tailored to the specific context. Nevertheless, several innovative payment initiatives in practice already come quite close to the theoretically preferred VBP-design described in this paper, indicating that this design can actually be implemented in various contexts. An interesting direction for future research would be gaining more insight in how a two-component model as described in this paper can be practically operationalized and successfully implemented given the relevant context, as well as in the short- and long-term effects of introducing such a model on different value dimensions.

Chapter 4

Value-based provider payment initiatives combining global payments with explicit quality incentives: A systematic review

With Frank Eijkenaar

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ABSTRACT

An essential element in the pursuit of value-based health care is provider payment reform. This article aims to identify and analyze payment initiatives comprising a specific manifestation of value-based payment reform that can be expected to contribute to value in a broad sense: (a) global base payments combined with (b) explicit quality incentives. We conducted a systematic review of the literature, consulting four scientific bibliographic databases, reference lists, the Internet, and experts. We included and compared 18 initiatives described in 111 articles/documents on key design features and impact on value. The initiatives are heterogeneous regarding the operationalization of the two payment components and associated design features. Main commonalities between initiatives are a strong emphasis on primary care, the use of 'virtual' spending targets, and the application of risk adjustment and other risk-mitigating measures. Evaluated initiatives generally show promising results in terms of lower spending growth with equal or improved quality.

1. INTRODUCTION

1.1 Background

Worldwide, the interest in value-based health care (VBHC) is growing rapidly. In many developed countries there is public recognition that waste and inefficiency can be reduced, while quality and health outcomes can be improved (Berwick & Hackbarth 2012). Encouraging health care providers to deliver high-value care is thus a focal point in health policy.

An essential element in the pursuit of VBHC is provider payment reform. The reason for this is twofold. First, financial incentives in general, convincingly show to substantially influence provider behavior (Gaynor et al. 2004; McGuire 2000 and 2011; Robinson 2001a). For example, physicians paid on a fee-for-service (FFS) basis, tend to provide more care compared with capitated and salaried physicians (Gosden et al. 2000). Second, predominant payment methods – in particular FFS – are not well aligned with value (Christianson & Conrad 2011; Ellis & Miller 2008; Jegers et al. 2002; Robinson 2001a). Specifically, paying providers separately and per activity encourages overprovision, maintains fragmentation, discourages prevention, and does not stimulate high-quality care. Since working toward VBHC, while leaving financial incentives for low-value care intact would clearly be counterproductive, there is consensus that VBHC and payment reform should go hand-in-hand.

Over the past decade, there has been much experimentation with various types of value-based payment (VBP) models. In this regard, both 'value' and 'VBP' are defined and operationalized in different ways. According to Berwick et al. (2008), high-value care requires pursuit of the 'triple aim': limiting per capita cost of care, improving individual patient experience, and improving population health. Porter (2009 and 2010) provides a more general description of value, namely, the best health outcomes achieved per dollar spent. Conrad (2015) defines value as maximum health benefit (operationalized as health outcomes, processes of care, and patient experience) at minimum cost. A commonality in these definitions is that value is considered a multidimensional concept, comprising not only high quality and integration of care but also cost consciousness and good health outcomes, which in turn require prevention.

Regarding VBP reform, emphasis is primarily on developing and implementing bundled-payment models for specific conditions or treatments as well as pay-for-performance (P4P) models that explicitly reward specific, measurable aspects of value (Chee et al. 2016; Roland & Campbell 2014; Ryan et al. 2017). Examples of the former are the Bundled Payment for Care Improvement Initiative and the Acute Care Episode Demonstration, both implemented in U.S. Medicare. Examples of the latter are the Hospital Value-Based Purchasing Program in U.S. acute care hospitals and the Quality and Outcomes Framework in the U.K. primary care sector. Although bundled payment and P4P could contribute to improvement of specific value dimensions, other important dimensions are unlikely to be strongly affected. Bundled payment mainly stimulates cost-conscious behavior and coordination, regarding the services pertaining to the condition or treatment in question (Stokes et al. 2018). P4P, by design, only focuses on

aspects of value that can be explicitly measured using indicators, which are typically aspects of clinical quality. In other words, both types of VBP adopt a relatively narrow definition of value and are not well-suited for simultaneously incentivizing the multiple value dimensions as defined in the literature.

If payment reform is to substantially contribute to value in a broad sense, more profound reform of current payment models is likely to be required. Indeed, there is growing recognition in the literature as well as in practice that VBP models be designed in such a manner that incentives for high-value care stretch beyond the level of conditions or treatments. In addition, these models should not only stimulate measurable aspects of high-quality care but also cost-conscious behavior, well-coordinated care, and prevention (Peikes et al. 2018; Quentin et al. 2018; Scott et al. 2018). Arguably, this can be realized by combining two payment components: (a) global base payments and (b) explicit quality incentives (Cattel et al. 2020a; see section 2.1 for a justification). Over the past years, payment reform initiatives adopting these two components have been gaining ground, for example, in the shape of accountable care organizations (ACOs). To date, however, these initiatives have not been systematically identified and described.

1.2 New contribution

Prior literature reviews investigating VBP reform mainly focused on bundled payment and P4P initiatives, which adopt a relatively narrow definition of value (Conrad et al. 2014; Mendelson et al. 2017; Milstein & Schreyögg 2016; Scott et al. 2018). A comprehensive overview of VBP initiatives aiming at improving value in a broad sense via global base payments combined with explicit quality incentives is lacking. Currently, it is unclear how these initiatives are being designed and to what extent they are effective in improving value. In this article, we aim to fill this gap by systematically identifying and analyzing VBP initiatives comprising these two payment components. Specifically, we (a) describe the design features of these initiatives and (b) assess the extent to which initiatives have been successful in improving value. In doing so, we aim to provide policy makers, payers, and health care providers insight in promising and practically feasible modalities of VBP reform. In turn, this could support additional innovation, facilitate future model comparison, and ultimately contribute to VBHC. The integration of non-U.S. initiatives is especially valuable to stimulate international comparisons and shared learning.

This article proceeds as follows. The next section presents a framework of a VBP model comprising global base payments and explicit quality incentives, which will be used to systematically describe and compare identified initiatives. Section 3 elaborates on the strategy followed while conducting this systematic literature review, and section 4 presents the results. The last section reflects on the main findings and provides an overall conclusion.

2. CONCEPTUAL FRAMEWORK

Recent papers have attempted to explicate the relationship between what a health care system ideally pursues in terms of value and what is required in terms of the design of provider payment systems (e.g., Cattel et al. 2020a; Eijkenaar 2013a; Scott et al. 2018). After reviewing existing descriptions of value and arguments used in the societal debate on what stakeholders in health care ideally aim for, we conclude that value is a multidimensional concept. The commonality in all descriptions is that value encompasses not only high-quality care, but also multidisciplinary coordination, cost-conscious behavior, and prevention (Berwick et al. 2008; Conrad 2015; Donabedian 1988; Eijkenaar & Schut 2015; IOM 2001; Porter 2009 and 2010; Stokes et al. 2018). Based on a comprehensive synthesis of the payment incentive literature, Cattel et al. (2020a) conclude that a combination of global base payments with explicit quality incentives seems well-suited to stimulate all these value dimensions simultaneously. The next section briefly elaborates on the rationale of such a two-component model.

2.1 The rationale of global base payments in combination with explicit quality incentives

The first component of a VBP model that stimulates value in a broad sense is a substantial global base payment. In essence, global payments are a form of bundled payment, with the bundle being constructed at a higher level than at the level of conditions or treatments. This addresses the shortcomings of lower level forms of bundled payment mentioned in the Introduction. The second component is a relatively low-powered P4P payment that explicitly rewards some measurable aspects of value.

Any provider payment system will at least consist of a base component that is not directly linked to providers' measured performance. The reason is that many aspects of value, such as well-coordinated care and many health outcomes, are difficult or impossible to measure and attribute. While important, these aspects can thus not 'explicitly' be accounted for in the payment contract (Eggleston 2005; Holmstrom & Milgrom 1991). The base payment can be designed in such a manner that it 'implicitly' incentivizes aspects of value that cannot be adequately measured and thus not stimulated through explicit incentives (section 2.2). Designing the base payment as a global payment facilitates cost-consciousness and well-coordinated care across the full continuum of care, with a focus on whole persons instead of on separate conditions or treatments.

Global base payments transfer financial risk from payer to provider. A possible danger is that providers become exposed to too much financial risk. As a result, they may be inclined to skimp on quality or act too aggressively in attempts to reduce spending by underproviding necessary but expensive services. These concerns, which are not just theoretical (Frakt & Mayes 2012; Robinson 2001a), can be mitigated by supplementing the global base payment with risk-sharing arrangements and explicit quality incentives. Risk sharing results in a situation in which providers are being held accountable for only a share of savings/losses realized under the global base

payment. Explicit quality incentives may trigger providers to give sufficient attention to value aspects that are unlikely to be incentivized by the global base payment but may be prone to quality skimping or underprovision (Eijkenaar 2013b). These incentives should be relatively low-powered to prevent a disproportionate focus on rewarded tasks (Campbell et al. 2009; Mullen et al. 2010; Steel et al. 2007). In addition, high-powered explicit incentives may have a negative effect on physicians' intrinsic motivation (Eijkenaar 2013b; Wynia 2009).

Empirical work supports the theoretical rationale of a two-component VBP model. Vlaanderen et al. (2019), for example, conclude that using explicit incentives for (outcome) quality paired with global base payments seems preferred over using explicit quality incentives alone.

2.2 Design of global base payments and explicit quality incentives

In this review, we analyze VBP initiatives combining global base payments with explicit quality incentives in terms of design and impact on value. For this purpose, we use two existing conceptual frameworks: one for the global base payment (Cattel et al. 2020a) and one for the explicit quality incentives (Eijkenaar 2013a). Although other frameworks made important contributions to the VBP literature, they are not suited for thoroughly describing and comparing key design features of payment models adopting the two-component structure described above. Shortell et al. (2014), for example, established a taxonomy to classify and understand early ACOs using eight general attributes that are not all related to payment design. In another article, Stokes et al. (2018) proposed a typology of payment models for integrated care. Since the focus of that article is specifically on incentives and facilitators for integrated care, it is also not suitable for the purpose of our review.

Table 4.1 summarizes design features and issues regarding both payment components, which we briefly discuss below. First, providing the global base payment to a multidisciplinary provider group fosters coordination across the continuum of care (Anderson & Weller 1999; Berenson 2010; Burwell 2015; Mehrotra & Hussey 2015). Financial barriers between providers and sites are removed, resulting in more flexibility in the resource deployment (Cutler & Ghosh 2012; Mechanic & Altman 2009; Miller 2009). Generally, a main contractor is responsible for administering and distributing the payment and employing and/or subcontracting individual providers (Anderson & Weller 1999).

Table 4.1. Core components and associated design features of a value-based payment model combining global base payments with explicit quality incentives

Core component 1: Global base payment	
To a multidisciplinary group	Which provider type included? Who is main contractor? Group members employed or subcontracted?
For a cohesive set of care activities to a predefined population	What care services to include? How to delineate the population? How to attribute patients to provider group?
Fixed for a defined period of time	Is payment real of virtual? How to set the payment/target? What is the contract duration?
Risk adjusted	Is risk adjustment applied? Which risk adjustors to use?
Risk-mitigating measures	One-sided or two-sided risk? What is the risk-sharing rate? Include reinsurance provisions? What care to carve-out?
Core component 2: Explicit quality incentives	
Method of linking the payment to quality	Shared savings/losses conditional on quality? Add-on for quality?
Quality measurement	Which indicators to use? What measurement level (individual/group)?
Quality incentive structure	Rewards and/or penalties? Maximum payment size relative to total payment? Absolute, relative and/or improvement targets? Payment frequency?

Note. Based on Cattel et al. (2020a) and Eijkenaar (2013a).

Second, a global base payment pertains to a comprehensive set of care services for a predefined population of individuals. By adopting a person-based rather than a condition-based approach, incentives for prevention and cost-conscious behavior are strengthened. Another advantage is that cost-shifting becomes more difficult and is even impossible if the payment applies to the full continuum of care (Busse & Stahl 2014; Hussey et al. 2011; Ridgely et al. 2014). The population can be delineated in various ways, for example, based on provider and/ or payer affiliation. Attribution of this population to the provider group can be done prospectively or retrospectively.

Third, providing a payment that is fixed for a defined period of time stimulates cost-conscious behavior because it transfers financial risk to providers (Conrad 2015; Frakt & Mayes 2012; Jegers et al. 2002; Miller 2009; Robinson 2001a). The payment can be determined in various ways, including based on historical spending and on average per capita spending in the region. The payment can be implemented as a 'real' payment that actually replaces existing payment systems or as a 'virtual' spending target with end-of-period reconciliation with claims. Regarding the contract period, in principle multiyear contracts seem preferable over short-term contracts because they provide room for earning back investments in value improvement. In addition,

multiyear contracts signal mutual trust and prevent costly effort on 'overwriting' complex, short-term contracts (Christianson & Conrad 2011; Marques & Berg 2011; Shortell 2013; Silberberg 1990). In practice, however, multiyear contracting could be difficult, especially in settings with high rates of beneficiary 'churn'.

Finally, to realize better effects on the different value dimensions, theory recommends risk adjusting the base payment and applying risk-mitigating measures. Risk adjustment prevents providers from being unfairly penalized for caring for a disproportionate share of high-risk individuals and from being incentivized to select favorable risks (Iezzoni 2003; Rose et al. 2016). Adopting risk-mitigating measures protects providers against excessive financial risk due to large random shocks in spending. Several options are available to bring financial risk to appropriate levels, including using one- or two-sided risk contracts (i.e., sharing upside risk only or also downside risk), varying the risk-sharing rate, adding reinsurance provisions, and carving out specific high-cost services from the contract.

The second component of a two-component VBP model is a payment explicitly linked to quality. Three main design features are of relevance: the method used to link payment to quality, quality measurement, and the quality incentive structure (Eijkenaar 2013a). Regarding the method for linking payment to quality, the payment can either be applied as 'add-on' to the global base payment or the provider share of realized savings/losses can be made conditional on aggregated quality scores. Regarding quality measurement, indicators could reflect 'technical' quality (structures, processes, and outcomes) and/or patient-reported quality. Finally, the incentive structure concerns choices with regard to rewards versus penalties, incentive size relative to the total payment, type of quality targets, and payment frequency. Although each choice has advantages and disadvantages, prior literature suggests that using relatively low-powered rewards (Deci et al. 1999; Eijkenaar 2013a; Holmstrom & Milgrom 1991; Moscucci et al. 2005; Shen 2003), limiting the time lag between care delivery and payment (Conrad & Perry 2009; Frederick et al. 2002; Thaler 1981), and using absolute quality targets (Conrad & Perry 2009; Rosenthal & Dudley 2007; Young et al. 2007) is most likely to be effective in stimulating desired behavior.[11]

11 The VBP model as described in this section shows similarities with the global capitation payment model traditionally used by Health Maintenance Organizations (HMOs). In both models, provider groups receive a fixed payment for the provision of a comprehensive set of care activities for a predefined population, with the goal to increase efficiency by shifting financial risk to providers (Frakt & Mayes 2012). However, both models differ in two important respects, specifically meant to address the concerns that were often raised against HMOs and global capitation: underprovision and quality skimping (section 'The rationale of global base payments in combination with explicit quality incentives'; Frakt & Mayes 2012). First, under VBP, providers and payer share financial risk, while HMOs typically use full capitation models that involve much more financial risk for providers. Second, under VBP, total compensation is partly dependent on quality performance, while in HMOs this was often not the case or only to a relatively limited extent (Frakt & Mayes 2012). Thus, the VBP model takes advantage of the benefits of traditional capitation, while trying to avert its main disadvantages.

3. METHOD

3.1 Search strategy and selection procedure

Complying with the Cochrane Handbook for systematic reviews (Higgins & Green 2011), we conducted a systematic review of the literature on VBP initiatives written in English or Dutch and published between January 2000 and April 2017. We included articles/documents describing VBP initiatives that

1. have been implemented in developed countries;
2. combine global base payments with explicit quality incentives;
3. involve payments to multidisciplinary provider groups; and
4. involve payment for the provision of cohesive sets of care activities to predefined populations.

Consequently, we excluded initiatives that have not been implemented as well as initiatives that have adopted payment models without clearly discernable global base payments and/or explicit quality incentives, that are targeted at individual providers, and/or that are organized around specific conditions or treatments.

We mainly focused on articles published in peer-reviewed scientific journals. However, we did not exclude unpublished studies, reports, or policy briefs beforehand, because they may still describe initiatives meeting our inclusion criteria. Our main focus was on articles/documents *describing* VBP initiatives; the absence of a quantitative evaluation was not an exclusion criterion. Insofar available, however, we included studies describing quantitative effects on value, but only if published in peer-reviewed scientific journals and if the research approach corresponds to a difference-in-differences, interrupted-time series, randomized controlled trial, or systematic review design.

In identifying eligible VBP initiatives, we consulted four sources: (a) scientific bibliographic databases, (b) reference lists, (c) the Internet, and (d) experts publishing in the field of VBHC and/or VBP. We started our review by searching four bibliographic databases on April 12, 2017: Embase, Medline, Web of Science, and Cochrane Central. We used the same search terms for each database, while taking into account database-specific requirements (see Appendix A). In consultation with an information specialist of the library of the Erasmus Medical Center in Rotterdam, we developed the search strings using a combination of the terms *value-based payment* and *care provider*. After removal of duplicates, we independently screened the titles and abstracts of all articles yielded by the search and assessed their potential eligibility for inclusion. We compared initially included articles and resolved discrepancies by discussion. In a second round of screening, the first author retrieved full texts and assessed each article on eligibility.

Next, we examined reference lists of included articles/documents resulting from the database search and used forward citation tracking to identify additional VBP initiatives. Together with the database search, this resulted in a preliminary list of initiatives. To gather additional information on these initiatives and identify potentially relevant other initiatives, we searched Google

and websites of relevant organizations, including the Centers for Medicare and Medicaid Services (CMS) and health insurers. Last, we consulted experts (see Appendix B) to validate our preliminary list of initiatives and to suggest additional initiatives, if any. Importantly, we consulted the four sources in an iterative process. For example, if we encountered an initiative via reference screening that was not identified based on the database search using the original search string, we used initiative-specific key words to search the databases again and obtain additional articles/documents.

3.2 Analysis and synthesis

For each identified VBP initiative, we extracted data on (a) general characteristics, (b) key design features with regard to the global base payment and the explicit quality incentives, and (c) effects on value. Regarding the general characteristics, we recorded the name of the initiative, setting, year of implementation, main contracting entities, and availability of a quantitative evaluation. We analyzed the results concerning the two payment components according to the design features shown in Table 4.1. Finally, for initiatives that were evaluated, we recorded the design of quantitative studies, the effects on the applicable value dimensions, and information on the magnitude and statistical significance of effects. Because of heterogeneity in study design and outcome measures used, formal meta-analysis was not possible. Therefore, we present the results narratively.

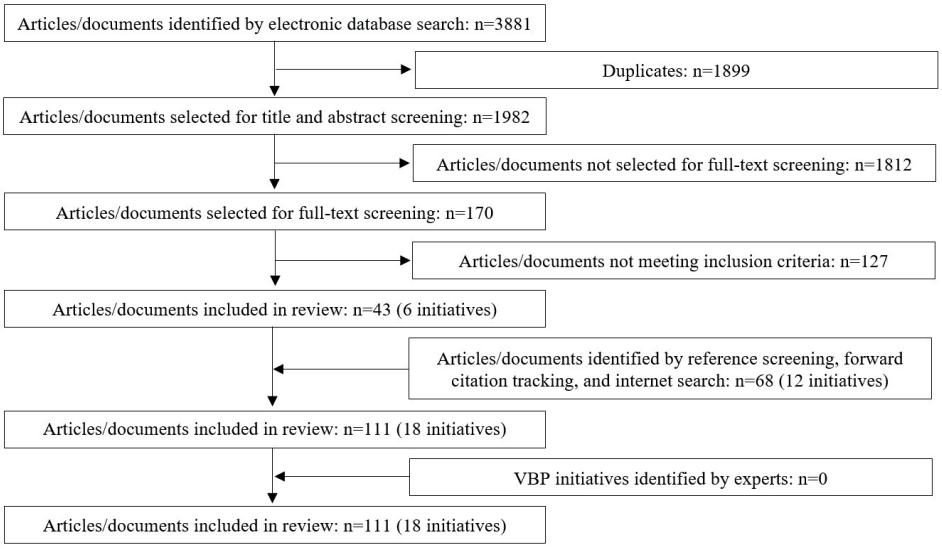
We extracted relevant information using three standardized extraction forms. In case of inconsistencies among articles/documents describing the same initiative, we used information from the article/document with the most recent publication date. After completion of the extraction forms, we summarized the information in three compressed tables with key results only.

4. RESULTS

4.1 Search results

Applying our search string in the four databases resulted in 3,881 hits (Embase = 1,215; Medline Ovid = 1,403; Web of Science = 1,160; Cochrane Central = 103). After removing duplicates and examining titles and abstracts, we retrieved full texts of 170 potentially relevant articles/documents, which were screened in detail by the first author. Of these, we included 43 articles/documents describing six VBP initiatives. Based on reference screening, forward citation tracking, and searching the Internet, we added 68 articles/documents describing another 12 VBP initiatives. Since expert consultation did not result additional initiatives or articles/documents, we included a total of 111 articles/documents in the review (see Appendix C), representing 18 VBP initiatives (Figure 4.1).

Figure 4.1. Flow diagram of steps taken in the systematic review



The 18 included initiatives represent approximately 15% of all payment reform initiatives that we identified in our search ($N = 126$). More than 40% of all identified initiatives pertain to payment models comprising only one of the two components. Generally, these models are 'traditional' P4P initiatives without global base payments. Examples are the hospital Value-Based Purchasing Program and the Programs for All-inclusive Care for the Elderly. In almost 25% of the cases, we excluded initiatives because they use alternative payment models that do not fit our inclusion criteria. Examples are models where providers receive a case rate for an episode of care related to a specific condition or treatment or separate fees for coordinating patient care (e.g., the Acute Care Episode Demonstration and the Cigna Collaborative Accountable Care Model).

Despite fitting our inclusion criteria, we excluded two initiatives—the Physician Group Practice Demonstration and the Pioneer ACO Model—because they are precursors of current models that are included (#14, 15). Experiences and lessons learned in these 'early versions' were used to (re)design current models and in that sense, we still indirectly incorporated these two initiatives in our review (CMS 2018). For the remaining excluded cases, insufficient information was available to determine whether the payment model consisted of the two payment components and/or to describe the design of these components. Examples are the Medica Patient Choice Model, the Rhode Island Health System Transformation Model, and the Medicaid ACO Learning Collaborative in New York, Vermont, and Washington, respectively.

4.2 Description of general characteristics

Table 4.2 summarizes the general characteristics of the 18 identified VBP initiatives. The initiatives were implemented in four different countries: 15 in the United States, 1 in Spain, 1 in Germany,

and 1 in the Netherlands. Most VBP models are regional initiatives, with four initiatives having been implemented nationally (#3, 14, 15, 18). Seven initiatives were initiated by public payers, nine by private payers, and two by public–private partnerships. Of the seven public initiatives, three are U.S. Medicare programs (#14, 15, 18), and four are U.S. Medicaid programs (#1, 8, 12, 16). Five initiatives have been formally evaluated on their impact on spending and/or quality.

Table 4.2. General characteristics of identified VBP initiatives

Name initiative	Country	Setting	Year of implementation	Contracting entities	Evaluated on impact on value
Accountable Care Collaborative Program	US, Colorado	Public (Medicaid)	2011	CMS + the State of Colorado + Regional Accountable Entities	No
Advocate Care	US, Greater Chicago area	Private	2011	Private health insurer + private group of physicians	No
Aetna's Shared Savings Model	US, nationwide	Private	2011	Private health insurer + integrated health systems	No
Alternative Quality Contract	US, Massachusetts	Private	2009	Private health insurer + ACOs	Yes, spending and quality
Alzira Model	Spain, Valencia	Public-private partnership	2003	The regional Health Ministry + private contractor that owns a hospital	No
Anthem WellPoint ACO Arrangement	US, California	Private	2011	Private health insurer + health care delivery systems	No
CalPERS Sacramento ACO Program	US, California	Public-private partnership	2010	Private health insurer + public pension fund + large, independent physician association + hospital system	No
Coordinated Care Organizations	US, Oregon	Public (Medicaid)	2012	CMS + the State of Oregon + Coordinated Care Organizations	No
Dutch Shared Savings Program	The Netherlands, Twente region	Private	2014	Private health insurer + multispecialty primary care provider groups	No
Gesundes Kinzigtal	Germany, Kinzigtal region	Private	2005	Two statutory private health insurers + physician network that concluded a contract with health management company	Yes, only quality
Horizon BCBS New Jersey ACO Pilot	US, North of Atlantic City, New Jersey	Private	2010	Private health insurer + large, multispecialty medical group	No
Integrated Health Partnership Demonstration Project	US, Minnesota	Public (Medicaid)	2013	CMS + the State of Minnesota + health care delivery systems	No
Medica Shared Savings Model	US, Minnesota	Private	2009	Private health insurer + integrated health systems and physician clinics	No

Table 4.2. General characteristics of identified VBP initiatives (continued)

Name initiative	Country	Setting	Year of implementation	Contracting entities	Evaluated on impact on value
Medicare Shared Savings Program	US, nationwide	Public (Medicare)	2012	CMS + ACOs	Yes, spending and quality
Next Generation ACO Model	US, nationwide	Public (Medicare)	2016	CMS + ACOs	No
Partners for Kids Program	US, Ohio	Public (Medicaid)	2012	CMS + five Medicaid Managed Care Plans + large pediatric ACO	Yes, spending and quality
ProvenHealth Navigator	US, Pennsylvania	Private	2006	Private health insurer + Patient-Centered Medical Homes	Yes, only spending
Independence at Home	US, nationwide	Public (Medicare)	2012	CMS + primary care practices	No

Note. ACO = accountable care organization; BCBS = Blue Cross Blue Shield; CalPERS = The California Public Employees' Retirement System; CMS = Centers for Medicare and Medicaid Services; US = United States.

4.3 Key design features of identified VBP initiatives

Table 4.3 summarizes the initiatives' key design features. In sections 4.3.1 and 4.3.2 these findings are discussed and synthesized for the global base payment and the explicit quality incentives, respectively. The structure of these sections mirror Table 4.1.

4.3.1 Key design features of the global base payment

Multidisciplinary provider group

In most initiatives, large, multispecialty provider groups act as main contractor. Typically, these groups comprise different types of physicians, other health care professionals (e.g., nurses, nurse practitioners, physician assistants, case managers, and social workers), and facilities such as hospitals, labs, and outpatient clinics. Although generally a broad range of provider types is involved, all initiatives have a particularly strong focus on substitution to primary care, which becomes evident from the explicit and central role of primary care physicians (PCPs) in all initiatives. We were unable to determine whether individual providers are being employed or subcontracted by the main contractor.

Within each group, providers are jointly accountable for the care for the attributed population with regard to quality and spending. Often, the groups are referred to as ACOs (#4, 10, 14, 15, 16), although terminology varies. Across the 18 initiatives, different types of provider groups take on the role of main contractor. Examples are groups of independent practices that have united themselves into organized networks (e.g., #9), multispecialty group practices that usually have a strong link with hospitals (e.g., #7), and integrated delivery systems including hospitals and a range of other care services like home health care, skilled nursing care, and physician services (e.g., #8). Note that within the same initiative, multiple group types may take on the role of main contractor (e.g., #6).

Cohesive set of care activities to a predefined population

Typically, the payment covers virtually the full continuum of primary and specialized medical services and prescription drugs, covered by the relevant benefit package. Information was lacking for #17. In some initiatives (e.g., #1, 8), the payment even covers a broader scope than medical care services only, including behavioral health care and long-term care. In case of the Medicare Shared Savings Program (#14), the Next Generation ACO Model (#15), and the Independence at Home Demonstration (#18), the payment covers the full set of services furnished under Medicare Parts A and B, including, among other services, inpatient care, physician care, outpatient care, skilled nursing facility care, home health agency care, hospice care, and durable medical equipment. Prescription drugs covered under Medicare Part D are not included in the payment of these initiatives.

Commercial initiatives (#2, 3, 4, 6, 9, 10, 11, 13, 17) often use payer affiliation, geographical catchment areas, or a combination of both as a ground for delineating the population. For example, the Alternative Quality Contract (AQC) (#4) only includes Blue Cross Blue Shield of

Massachusetts' members with a health maintenance organization (HMO) or point-of-service policy. The four Medicaid initiatives (#1, 8, 12, 16), automatically enroll all Medicaid beneficiaries in the region in the program. For the three Medicare initiatives (#14, 15, 18) the population consists of Medicare FFS beneficiaries (i.e., age 65 years and older), with the Independence at Home Demonstration (#18) focusing on the most expensive and frailest elders. One initiative (#16) delineates the population based on age, since the focus is on children only. Six of the 18 initiatives (#4, 5, 12, 13, 14, 18), impose a minimum population size per provider group to reduce the influence of stochastic variation (e.g., 5,000 in #4).

Information on the method used to attribute the population to provider groups was not available for five initiatives (#7, 8, 10, 16, 17). Of the other 13 initiatives, 6 use prospective attribution based on prior utilization (#1, 2, 6), affiliation with a provider group or PCP practice (#4, #9, #18), or region (#5). In contrast, three initiatives (#11, 12, 13) retrospectively attribute populations based on the plurality of utilization in the completed year. The three remaining initiatives (#3, 14, 15) use a mixture of assignment methods, depending on, for example, the specific financial risk 'tracks' provider groups may opt for.

Fixed payment for a defined period of time

Fourteen initiatives incorporate 'virtual' spending targets by building risk-sharing arrangements on the existing payment modality, most often a FFS-chassis. Three initiatives (#5, 8, 12) actually replaced existing payment systems with 'real' global base payments in the shape of per-member-per-month (PMPM) payments. The remaining initiative (#15) uses both modalities; depending on the 'track' chosen, providers are confronted with a 'virtual' spending target or a 'real' PMPM payment.

Information on the method for setting the payment/target was unavailable for eight initiatives (#1, 3, 5, 6, 7, 8, 11, 16). In 6 of the 10 other initiatives, historical spending in the prior year(s) is the basis for the payment/target. Advocate Care (#2) and the Medica Shared Savings Model (#13) use relative cost benchmarks as targets, that is, the average medical cost trend in the relevant market and the total cost of care of a peer group, respectively. The Independence at Home Demonstration (#18) uses Medicare FS Part A and B expenditures that would have been incurred by beneficiaries in the absence of the initiative as the spending target. Gesundes Kinzigtal (#10) uses a combination of the German 'standardized norm cost' (i.e., the average cost across all insurers, risk adjusted using the German risk-equalization formula) for the specific provider group and spending during a reference period prior to the start of the initiative as a spending target. In nine initiatives, spending targets are trended forward using annual growth rates (#4, 5, 8, 9, 12, 14, 15, 16, 18).

Most initiatives rely on multiyear contracts, although information was missing for six initiatives. One initiative (#7) assumes a multiyear contract but does not specify the exact duration. Nine initiatives apply a contract of 2 to 5 years (#1, 2, 4, 6, 11, 12, 14, 15, 18), one initiative

administers a 15-year contract that is extendable to 20 years (#5), and one initiative even applies an unlimited contract (#10), although the precise content of this contract is unclear.

Risk adjustment

In 14 initiatives, the payment/target is adjusted to the risk profile of the attributed population. For the other four initiatives (#1, 3, 5, 6), it was unclear whether or not risk adjustment is being applied. Among the initiatives using risk adjustment, information on the specific variables used is available for 11 initiatives. In one of these (#16), the risk-adjustment model includes only demographic information, while 10 other initiatives (#2, 4, 7, 9, 10, 12, 13, 14, 15, 18) use rather sophisticated models including demographic, socioeconomic, and diagnoses-based morbidity information. Typically, initiatives adopt existing 'off-the-shelf' algorithms, originally developed in the context of risk adjustment for health plan payment. For example, the Medicare Shared Savings Program (#14) uses the CMS Hierarchical Condition Category (HCC) risk-adjustment model (Pope et al. 2004). This model funnels diagnostic codes into diagnoses and ranks them into condition categories, representing conditions with similar cost patterns.

Risk-mitigating measures

In eight initiatives providers accept upside risk only (#1, 3, 6, 9, 10, 13, 17, 18), while in eight other initiatives providers also assume downside risk (#2, 4, 5, 7, 8, 11, 15, 16). In the remaining two initiatives, provider groups are free to choose either a one-sided or two-sided contract (#14), or groups are accountable for upside risk only in the first year, and downside risk as well from the second year onward (#12). In initiatives in which providers also assume downside risk, the provider share of savings is larger compared with initiatives in which providers assume upside risk only. For example, in the Medicare Shared Savings Program (#14), providers assuming only upside risk receive 50% of accrued savings, while providers assuming both upside and downside risk receive 60% of savings.

With regard to the risk-sharing rate, information is available for 14 initiatives; for the other 4 initiatives, rates are not available/confidential (#1, 9, 10, 11). Risk-sharing rates for providers exceed 50% in six initiatives (#4, 8, 14, 15, 16, 18), while all other initiatives use a rate of maximally 50%. For example, in the Alzira Model (#5) the risk rate is maximally 7.5%, whereas this rate is 50% in the Anthem WellPoint ACO Arrangement (#6). One initiative (#7) adjusts the risk-sharing rate according to provider groups' ability to influence cost in a particular category. For example, if a provider group is considered not to have any influence over mental health care utilization, the financial risk for this group in this particular domain is zero. For initiatives #12, 14, and 15, the risk-sharing rate increases over time. Typically, in two-sided contracts, the sharing rates for savings are higher than for losses.

The majority of identified VBP contracts include reinsurance provisions, although information is lacking for seven initiatives (#1, 2, 3, 5, 10, 16, 17). The AQC (#4), for example, applies overall cost trend corridors to protect provider groups against significant trends that affect the complete

market. Another example is the Dutch Shared Savings Program (#9), in which providers are protected against high-cost cases by means of a cap of €22.500 (about $25.500) per patient per year. Finally, in all but one (#1) of the 10 initiatives for which information is available, some specific high-cost services are carved-out from the payment contract. Examples are dental care services (#9, 10, 12, 13), transplants (#2, 6, 12), behavioral health services and drugs (#4, 8, 12, 13), and long-term care (#8, 12). The Medicare initiatives (#14, 15, 18) exclude prescription drugs furnished under Medicare Part D from the payment.

4.3.2 Key design features of the explicit quality incentives

Method of linking payment to quality

Across the 18 initiatives, we observe three main modalities of linking payment to quality. The most common modality (#1, 2, 4, 7, 8, 10, 11, 13, 15, 17) applies quality incentives as add-on payment in combination with a system in which the provider share of realized savings/losses depends on quality. In the AQC (#4), for example, providers passing higher 'quality gates' receive both a higher bonus and a larger share of savings (or a smaller share of losses). In the second modality, savings/losses also depend on quality but there is no direct add-on payment for high quality scores (#3, 6, 9, 12, 14, 18). The last modality only involves add-on payments (#5, 16).

Quality measurement

The initiatives use a broad range of indicators. Clinical quality indicators are adopted most frequently (e.g., #16), although many initiatives incorporate other domains such as patient experience (e.g., #14), patient safety (e.g., #12), and avoidable hospital admissions (e.g., #3). Most initiatives predominantly use measures of process quality, with few initiatives also using outcome measures (e.g., #2). Often, the indicator set is based on a selection of nationally accepted measures (e.g., HEDIS [Healthcare Effectiveness Data and Information Set] measures in #11). For 10 initiatives (#2, 3, 5, 6, 7, 11, 12, 13, 14, 15), we were unable to determine the level of measurement or payment. The remaining initiatives measure quality at the level of individual providers (#10) or provider groups (#1, 4, 8, 9, 16, 18). One initiative splits the savings between individual providers and the relevant group practice (#17).

Quality incentive structure

Among the 12 initiatives that implemented add-on payments for quality, eight initiatives only use rewards (#1, 4, 5, 7, 8, 11, 16, 17), while three also use penalties (#2, 13, 15). Information for #10 is missing. The maximum size of the add-on payment relative to the total payment is 10% (#2, 4, 10), but typically lower (e.g., 2% to 3% for #8 and 2% to 8% for #13). An exception is the Alzira Model in Spain (#5) in which the maximum payment size is 20%, although this percentage also includes on-call payments for providers. For initiatives #7, 11, and 16, information on payment size is lacking.

Across the 15 initiatives for which information is available, providers are typically rewarded for both achieving absolute targets and improving over time or relative to other providers. For example, in the Medicare Shared Savings Program (#14), providers share in realized savings only if they attain certain quality levels and show improvement relative to national Medicare FFS and Medicare Advantage. With regard to payment frequency, five initiatives pay on an annual basis (#4, 12, 13, 14, 17) and two on a quarterly basis (#1, 2). Information is lacking for other initiatives.

Table 4.3. Key design features of identified VBP initiatives

Name initiative	**Multidisciplinary provider group** a) Main contractor b) Providers in the group c) Employed or subcontracted	**Cohesive set of care activities for a predefined population** a) Healthcare services b) Population c) Attribution method
1. Accountable Care Collaborative Program	a) Regional accountable care entity (e.g., community partnerships and insurers), responsible for developing provider networks. b) Formal networks of PCPs and informal networks of specialists, hospitals, and social services. c) N/A.	a) Regular Health First Colorado benefit package: medical care, long-term care, and behavioral health. b) All Medicaid beneficiaries in the region are automatically enrolled. c) Attribution to PCP and corresponding regional accountable care entity based on prior utilization. If a patient did not use care, they are to select a PCP.
2. Advocate Care	a) Private physician group that partners with not-for-profit multi-hospital integrated health system. b) Numerous care sites, including integrated children's hospitals, acute care hospitals, and home care providers. Provider groups consists of solo, group, single- and multi-specialty practices. c) Both (employed and independent).	a) Full continuum of care. b) Fully insured and self-insured commercial PPO members receiving care from the provider group at least 2 times during 2 years. No minimum size. c) Prospective attribution based on prior utilization (claims from previous 2 years).
3. Aetna's Shared Savings Model	a) Variety of health systems (e.g., independent physician associations, multispecialty physician groups, and multispecialty physician groups with contracted hospitals). b) N/A. c) N/A.	a) Full continuum of care. b) Varies by health system. c) In some cases prospective attribution based on enrolment with an ACO. In other cases retrospective attribution based on the plurality of utilization in the completed year.

	Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
	a) Virtual, FFS and PMPM payment for coordination and case management. b) N/A. c) One-year contract, with possibility to renew contract annually for up to 4 years.	a) N/A. b) One-sided risk. c) N/A. d) N/A. e) No carve-outs.	a) P4P and savings conditional on achieving quality thresholds. b) Eight key performance indicators: total cost of care, emergency department visits for conditions that could be prevented with primary care, wellness visits, members receiving behavioral health services/prenatal care/dental care services, rates of overweight/obesity, use of electronic consultations, and agreements with specialists. c) Payments to regional accountable care entity and PCPs. d) Rewards. e) 5% of behavioral health capitation. f) Improvement and meeting criteria. g) Quarterly.
	a) Virtual, FFS. b) Benchmark is the projected average medical cost trend in the market (i.e. BCBS Illinois' PPO network) c) Three-year contract.	a) Yes, using DxCG software. b) Two-sided risk. c) Up to 50%. d) N/A. Cost are not truncated. e) Some high-cost services such as transplantation.	a) P4P and savings conditional on achieving quality thresholds. b) 116 measures of clinical quality (i.e. preventive care, acute care processes, and outcomes), patient safety, and patient satisfaction. c) N/A. d) Rewards and penalties (i.e. lower unit price in next year if quality has declined). e) 10%. f) Maintain quality baseline during year 1; thereafter negotiated improvements. g) Quarterly, with annual reconciliation.
	a) Virtual, payment system varies by health systems. b) N/A. c) N/A.	a) N/A. b) One-sided risk. c) Up to 50%. d) N/A. e) N/A.	a) Savings conditional on meeting efficiency thresholds and set of clinical quality measures. Whether P4P as add-on is used, is unclear. b) Clinical quality measures and thresholds related to other domains (e.g., avoidable inpatient admissions and ER visits). c) N/A. d) N/A. e) N/A. f) N/A.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	**Multidisciplinary provider group** a) Main contractor b) Providers in the group c) Employed or subcontracted	**Cohesive set of care activities for a predefined population** a) Healthcare services b) Population c) Attribution method
4. Alternative Quality Contract	a) ACOs. b) Variety of primary and specialty providers (e.g., physicians, hospitals, post-acute care facilities). Each ACO is required to include a PCP. c) Physicians are either employed or independent; for other providers information N/A.	a) All medical services BCBS pays for; full continuum of care. b) BCBS members with a HMO/POS policy. Minimum population size of 5,000. c) Prospective attribution based on affiliation with PCP whom enrollees designate each year.
5. Alzira Model	a) Private contractor that owns a hospital, consisting of health insurer, 3 regional savings banks, and 2 construction companies. b) Numerous care sites (e.g., health centers, outpatient clinics, and a hospital). c) Hospital physicians and about half of the PCPs are employed and paid salary. Others are public employees or civil servants.	a) Primary and specialty care. b) Health zones of Alzira. c) Prospective attribution to primary health center based on geographical catchment area.
6. Anthem WellPoint ACO Arrangement	a) Health care delivery systems (e.g., integrated health systems and independent practice associations in private practice). b) Multiple care sites for a broad spectrum of care services (e.g., primary and specialty care, laboratory, physical therapy, radiology, pharmacy, and urgent care). c) N/A.	a) The full continuum of medical services. b) Minimum population size of 15,000. c) Attribution is prospective and based on prior utilization in the past 2 years. To be attributed to a provider group, a patient should have received at least 50 per cent of their care with this group.

	Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
	a) Virtual, FFS. b) Spending target is negotiable. Historical PMPM spending in the population of the group's PCP serves as a starting point and spending is trended forward using a negotiated annual growth rate. c) Five-year contract.	a) Yes, using DxCG software. Health status is measured concurrently. b) Two-sided risk. c) Negotiated, 50-100%. d) Mandatory reinsurance, unit cost corridor, and in some cases overall cost trend corridor. e) Behavioral health services.	a) P4P and risk-sharing rates depend on passing quality gates. b) 64 measures: 32 in ambulatory setting (i.e. HEDIS clinical process and intermediate outcome measures, and patient experience measures) and 32 in hospital setting (i.e. process measures for specific diseases/treatments, patient safety indicators, and patient experience measures). In total, 47 process, 5 outcomes for diabetes, hypertension, and cardiovascular disease, and 12 patient experience measures. c) Payment to ACO. d) Rewards. e) 10%. f) Passing predefined 'gates' and year-to-year performance. g) Annually.
	a) Real, annual capitation paid to main contractor. b) N/A, updated according to the yearly growth rate in the Valencian health budget. c) 15-year contract, extendable to 20 years.	a) N/A. b) Two-sided risk. c) Up to 7.5%. d) N/A. e) N/A.	a) P4P, no link between quality and savings. b) Quality and safety targets, including indicators for processes, clinical outcomes, and patient experience. c) N/A. d) Rewards. e) Negotiated, up to 20% between €6.000 and €24.000 per year. Percentage and amount also include on-call payments. f) N/A. g) N/A.
	a) Virtual, FFS and care management fee. b) N/A. c) Five-year contract.	a) N/A. b) One-sided risk. c) 50%. d) Caps on high-cost cases and stop-loss reinsurance. e) Transplants.	a) Savings conditional on meeting quality thresholds and efficiency criteria. b) Clinical quality measures and measures related to other domains (e.g., avoidable ER visits or all-cause readmissions), specific to physician care and hospital care. c) N/A. d) Not applicable. e) Not applicable. f) Improvement and attainment. g) N/A.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	**Multidisciplinary provider group** a) Main contractor b) Providers in the group c) Employed or subcontracted	**Cohesive set of care activities for a predefined population** a) Healthcare services b) Population c) Attribution method
7. CalPERS Sacramento ACO Program	a) Large, independent physician association for primary and specialized care and a not-for-profit hospital system. b) Multiple care sites for primary and specialty care. c) N/A.	a) The full continuum of care. b) Blue Shield HMO members in the Sacramento area. c) N/A.
8. Coordinated Care Organizations	a) CCOs i.e. networks of physical, mental, and dental care providers linked to publicly funded health programs. b) A broad range of primary and specialty providers. c) N/A. Each CCO must decide how to contract providers. PCPs usually paid capitation; specialty care providers receive less frequently capitated budget.	a) Full continuum of care, including services for physical health, behavioral health, oral health, mental health, and addiction. b) All Medicaid beneficiaries in the region are automatically enrolled. c) N/A.
9. Dutch Shared Savings Program	a) A multidisciplinary primary care provider group. b) Provider group is led by primary care physicians and comprises nurse practitioners, physician assist, pharmacists, and physiotherapists. c) N/A.	a) All medical services for which health insurer provides coverage under both mandatory and supplementary benefits packages. b) Individuals who take up health insurance from the pilot insurer. c) Attribution based on enrolment with PCP.

Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
a) Virtual, hospital receives FFS payment and physician group receives capitation budget and pays individual providers FFS. b) PMPM cost target for specific cost categories. Information on how targets are set N/A. c) Multi-year contract, information on exact duration N/A.	a) Yes, based on 'case complexity'. b) Two-sided risk. c) Depends on partner's ability to influence particular costs category. Hospital system: up to 50%. Independent physician association: up to 33.3%. d) Stop-loss reinsurance. e) N/A.	a) P4P and savings conditional on maintaining or improving quality. b) Quality, utilization, and patient satisfaction measures. c) N/A. d) Rewards. e) Unclear, but top-performing physicians have earning potential of 150% of Medicare rates. f) N/A. g) N/A.
a) Real, CCOs receive PMPM payment. b) Unclear, adjusted according to historical growth rate. c) N/A.	a) Yes, information on which variables are used N/A b) Two-sided risk. c) Full financial risk: 100%. d) Mandatory reinsurance. e) Mental health drugs, long-term care, case management, and public health.	a) P4P and savings conditional on quality metrics. b) 17 measures on preventive care, access, patient satisfaction, chronic illness management, behavioral health, maternal care, overuse, and electronic health record adoption and use. c) Payment to CCOs. d) Rewards. e) Approximately 2-3%. f) Achievement of benchmark metric or improving performance relative to the State's benchmark. g) N/A.
a) Virtual, PCPs are paid salary or combination of capitation, FFS, bundled payment, and P4P. b) Historical spending in the past 3 years (with larger weights attached to more recent years), updated using a growth rate based on spending in a control group of randomly sampled nonparticipating providers in the region, and adjusted for periodic effects (e.g., inflation). c) N/A.	a) Yes, adjusted for demographics and socioeconomic status (concurrently) and morbidity (prospectively). b) One-sided risk. c) Confidential risk rate. d) Cost cap at €22.500 ($25.376) per patient per year. e) Dental care services.	a) Savings conditional on overall quality score. In case performance has declined more than 5% during the year, the overall quality score is insufficient to be eligible for sharing any savings. b) 41 measures in 4 domains: patient satisfaction, chronic care, drug prescription behavior, and practice management. c) Measurement at provider group level. d) Not applicable. e) Not applicable. f) Absolute performance and improvement relative to prior year. g) N/A.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	Multidisciplinary provider group a) Main contractor b) Providers in the group c) Employed or subcontracted	Cohesive set of care activities for a predefined population a) Healthcare services b) Population c) Attribution method
10. Gesundes Kinzigtal	a) Physician network (including local independent primary care physicians, specialists, and hospitalists) that concluded a contract with a health management company specialized in the management of integrated care. b) Multidisciplinary teams including PCPs, specialists, hospitals, nursing homes, ambulatory agencies, psychotherapists, physiotherapists, and social workers. c) N/A.	a) Care across all health service sectors and indications. Noticeable focus on preventive programs and health promotion. b) Individuals living in the Kinzigtal region who have an insurance policy with 1 of the 2 insurers. c) N/A.
11. Horizon BCBS New Jersey ACO Pilot	a) Multispecialty medical group. b) Primary care, specialty care, ancillary services, and some ambulatory and surgery services. c) N/A.	a) Full continuum of care. b) Patients with a commercial self-insured PPO policy. c) Retrospective attribution based on percentage of total visits.

	Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
	a) Virtual, FFS. b) Spending target determined by combining the German 'standardized norm costs' and spending during a reference period prior to the start of the initiative. c) Unlimited contract.	a) Yes, age, sex, and morbidity, based on German risk-equalization model. b) One-sided risk. c) N/A. d) N/A. e) Dental care services.	a) Payment similar to P4P and savings depending on quality. b) Information on specific measures N/A, but clinical outcome measures and patient satisfaction included. c) Measurement at individual provider level. d) Variable performance-related rewards (i.e. an add-on payment to encourage coordination, rewards for activities such as participating in the electronic health record, and hourly rates for participating in certain project groups). e) 10%. f) N/A. g) N/A.
	a) Virtual, FFS. b) N/A. c) Two-year contract.	a) Yes, information on which variables are used N/A. b) Two-sided risk. c) Negotiated, but specific percentages N/A. d) Outliers are eliminated. e) N/A.	a) P4P and savings conditional on meeting quality threshold. b) Variety of HEDIS measures regarding quality of care, diabetes, cardiovascular disease, oncology, and (over)weight assessment. c) N/A. d) Rewards. e) N/A. f) Reward if provider is in top-10% of best performers. g) N/A.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	Multidisciplinary provider group a) Main contractor b) Providers in the group c) Employed or subcontracted	Cohesive set of care activities for a predefined population a) Healthcare services b) Population c) Attribution method
12. Integrated Health Partnership Demonstration Project	a) Integrated delivery systems (e.g., multispecialty provider network or not-for-profit medical practice group). b) Provider groups deliver full scope of primary care services, coordinate with specialty providers and hospitals, and partner with community organizations and social service agencies. c) N/A.	a) All Medicaid services. b) Medicaid enrollees in Minnesota (children and adults). Minimum population size applies to Track 2 participants (i.e. 2,000 patients). c) Retrospective attribution based on plurality of utilization (>1 visit with provider affiliated with the program), using a 24-month look-back period.
13. Medica Shared Savings Model	a) Integrated health systems and physician clinics. b) A broad range of primary and specialty care (e.g., primary care clinics, inpatient care providers, and home care providers). c) N/A.	a) Full continuum of care. b) Medica's members enrolled in fully insured and self-insured PPOs and some members enrolled in commercially insured HMOs. Minimum population size of 15,000 to 20,000 member-months or 1,250 to 1,667 patients. c) Retrospective attribution based on claims (attribution in case of receiving >50% of primary care services from the group) with 1 year look-back.

Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
a) Real, population-based payment. b) Negotiable. Prior year's spending is starting point and trended forward using an expected trend rate. c) One-year contract that renews annually during 3 years.	a) Yes, age, sex, and diagnostic information using Johns Hopkins Adjusted Clinical Groups tool. b) One-sided risk in year 1, thereafter two-sided risk. c) 25% in year 1 and 2, thereafter 50%. Up to an agreed maximum savings/losses threshold. d) Cost cap at $200.000 per patient per year. e) Dental care services, transportation, personal care services in home care, long-term care, and residential mental health.	a) Savings conditional on total quality score; losses do not depend on quality. b) Measures of care quality (nationally accepted indicators for e.g., screening and patient safety; weight 70%), health information technology (weight 20%), and pilot measures (based on populations served; weight 10%). c) N/A. d) Not applicable. e) Not applicable. f) In year 1 only reporting. Thereafter, relative thresholds (i.e. being at least in 30th percentile for State or Medicaid average rates) and improvement during the years. g) Annually.
a) Virtual, FFS with withholds or prospective adjustments for the risk and reward pool. b) Spending target in comparison to a peer group. c) N/A.	a) Yes, age, sex, and diagnostic information using Johns Hopkins Adjusted Clinical Groups tool. b) One-sided risk. c) Up to 50%. d) Cost cap at $250.000 or $500.000 per patient per year. e) Behavioral health and dental care services.	a) P4P and savings conditional on quality. b) Measures of quality, patient experience, provider collaboration, and utilization among practices, according to Minnesota Community Measurement Program focusing on prevention, chronic care, and utilization. c) N/A. d) Rewards and penalties. e) 2-8%. f) Attainment and improvement. g) Annually.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	Multidisciplinary provider group a) Main contractor b) Providers in the group c) Employed or subcontracted	Cohesive set of care activities for a predefined population a) Healthcare services b) Population c) Attribution method
14. Medicare Shared Savings Program	a) Medicare ACOs. b) ACO professionals (i.e. physicians and certain non-physician practitioners). Involvement of PCP is mandatory. c) N/A.	a) The full set of services furnished under Medicare Parts A and B. b) Medicare FFS beneficiaries. Minimum population size of 5,000. c) Attribution is based on where patients have received the plurality of primary care services in that year. Track 1 and 2: prospective attribution, with retrospective reconciliation. Track 3: prospective attribution.
15. Next Generation ACO Model	a) ACOs that are experienced in coordination care for defined populations. b) Participants (i.e. PCPs aligned with ACO), preferred providers (e.g., specialists, hospitals, home health facilities), and all other Medicare providers (no formal link between these providers and the model). c) N/A.	a) All services covered by Medicare Part A or Part B. b) Medicare FFS beneficiaries. c) Prospective attribution based on claims using provider lists, supplemented with possibility for beneficiaries to confirm a care relationship with an ACO.

Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
a) Virtual, FFS. b) Historical spending in the past 3 years (with larger weights attached to more recent years), trended forward by the national growth rate. c) At least three-year contract.	a) Yes, using the CMS-HCC model. Initially prospectively, but retrospectively adjusted. b) ACOs can choose to accept one-sided risk (track 1) or two-sided risk (track 2 and 3). c) Track 1 (50% of savings), track 2 (60% of savings and 40-60% of losses), track 3 (70% of savings and 40-75% of losses). Maximum share of savings payment capped at 10% (track 1), 15% (track 2), and 20% (track 3) of spending target. d) Expenditures capped at 99th percentile of expenditure distribution. e) N/A.	a) Savings depend on overall quality score. Minimum savings rate and minimum losses rate that must at least be met to qualify for shared savings or repay shared losses. b) Four quality domains: Patient/caregiver experience, care coordination/patient safety, preventive health, and at risk population c) N/A. d) Not applicable. e) Not applicable. f) Attainment and improvement, relative to national Medicare FFS and Medicare Advantage percentiles. g) Annually.
a) Both possible. Virtual, FFS or FFS and PMPM payment. Real, PMPM payment equal to percentage FFS reduction or capitation. b) Historical spending trended forward by the national growth rate and Medicare geographic pricing factors. c) Three-year contract, extendable to five-year contract.	a) Yes, using the CMS-HCC model. Initially prospectively, but retrospectively adjusted. b) Two-sided risk. c) Type A: performance year 1-3 80% and performance year 4 and 5 85%. Type B: 100%. Maximum share of savings payment is capped at 15% of spending target. d) Expenditures capped at 99th percentile of expenditure distribution. e) N/A.	a) Share of savings is conditional on quality; losses are independent. In addition, the quality score is used in determining the discount applied to the spending target. b) 31 measures on 4 domains with equal weights: patient/caregiver experience, care coordination/patient safety, preventive health, and population at-risk of chronic diseases. c) N/A. d) Not applicable. e) Not applicable. f) Attainment and improvement, relative to national Medicare FFS and Medicare Advantage percentiles. g) N/A.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	Multidisciplinary provider group a) Main contractor b) Providers in the group c) Employed or subcontracted	Cohesive set of care activities for a predefined population a) Healthcare services b) Population c) Attribution method
16. Partners for Kids Program	a) Pediatric ACO. b) Academic medical center with multiple facilities (NCH), primary and specialty physician practice groups and advanced practice professionals. c) N/A.	a) All Medicaid care. b) All Medicaid beneficiaries aged 0-18 years in central and southeastern Ohio. c) N/A.
17. ProvenHealth Navigator	a) Patient-centered medical homes (i.e. reengineered primary care practices) owned by private health insurer or private independent physician practices. b) Medical home teams composed of PCPs, teams of specialists, physician's assistants, nurses, case managers, pharmacists, social workers, and community health assistants. c) N/A.	a) N/A. b) Adult commercial population. c) N/A.

Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
a) Virtual. Three payment mechanisms: (1) FFS + P4P for independent providers contracted as member, (2) FFS for community providers not contracted as member, and (3) capitation for the academic personal from NCH. b) N/A. c) N/A.	a) Yes, age and sex. b) Two-sided risk. c) Full financial risk: 100%. d) N/A. e) N/A.	a) P4P, no link between quality and savings. P4P for contracted providers, not for non-members and hospital physicians. b) Selection of HEDIS measures (n=14), number of Medicaid members accepted per physician, completion of Maintenance of Certification program, and being recognized as PCMH. c) Payment at provider group level. d) Rewards. e) N/A. f) N/A. g) N/A.
a) Virtual, FFS. b) Spending in the past 2 years, adjusted for medical cost inflation. c) N/A.	a) Yes, information on which variables are used N/A. b) One-sided risk. c) 50%. d) N/A. e) N/A.	a) P4P and savings conditional on meeting quality targets. b) Shared savings conditional on 10 measures regarding chronic illnesses, preventive care, care transition, patient/professional experience, and continuous improvement. For P4P, a more comprehensive set of HEDIS-measures is used. c) Measurement at primary care practices level. Payments split between providers and practice. d) Rewards. e) 9%. f) Improve and maintain quality. g) Annually.

Table 4.3. Key design features of identified VBP initiatives (continued)

Name initiative	Multidisciplinary provider group a) Main contractor b) Providers in the group c) Employed or subcontracted	Cohesive set of care activities for a predefined population a) Healthcare services b) Population c) Attribution method
18. Independence at Home	a) Single primary care practices, other multidisciplinary teams or consortia (multiple primary care within a region) that are led by physicians or nurse practitioners (in total 14). b) Physicians, nurses, physician assistants, pharmacists, social workers, and other staff required to deliver complete range of primary care services in home setting. c) N/A.	a) Care across all settings. b) High-cost, frail Medicare beneficiaries with multiple chronic conditions and functional dependencies (e.g., feeding and walking). Minimum population size of 200. c) Attribution based on enrolment with PCP.

Note. ACO = accountable care organization; BCBS = Blue Cross Blue Shield; CCO = coordinated care organization; CMS-HCC = Centers for Medicare and Medicaid Services' hierarchical condition category risk-adjustment model; ER = emergency room; FFS = fee-for-service; HEDIS = healthcare effectiveness data and information set; HMO = health maintenance organization; N/A = not available; NCH = Nationwide Children's Hospital; PCP = primary care provider/physician; PMPM = per member per month; POS = point-of-service; PPO = preferred provider organization; P4P = pay-for-performance.

Fixed payment for a defined period of time a) Virtual or real, current main payment system b) Setting the payment or target c) Contract duration	**Risk adjustment & risk-mitigating measures** a) Risk adjustment b) One-sided or two-sided risk c) Risk-sharing rate d) Reinsurance provisions e) Carve-outs	**Explicit quality incentives** a) Link payment and quality b) Quality measures c) Level of measurement/payment d) Rewards or penalties e) Maximum payment size relative to total payment/target. f) Absolute or relative targets g) Payment frequency
a) Virtual, FFS. b) Medicare FFS Part A and B expenditures that would have been incurred by beneficiaries in the absence of the initiative, trended forward using set annual growth rate. c) Five-year contract.	a) Yes, using the CMS-HCC and CMS ESRD model. To reflect functional impairment, frailty factors are used. b) One-sided risk. c) Ranging from 50 to 80%, with higher shares with higher quality. d) Expenditures capped at 99th percentile of expenditure distribution. e) Claims associated with hurricane Sandy were not included. Indirect and graduate medical education and disproportionate share hospital payments excluded.	a) Savings conditional on meeting at least 3 of the 6 quality targets and surpassing savings threshold of 5%. b) Shared savings depending upon proportion of 6 quality measures met: rates of emergency department and inpatient admissions for ambulatory care–sensitive conditions, 30-day readmission rate, contact with and visits to beneficiaries within 48 hours of hospital admission and discharge, completed medication reconciliation, and documentation of patient preferences. c) Practice / consortium level. d) Not applicable. e) Not applicable. f) N/A. g) N/A.

4.4 Effects on value

Table 4.4 presents information on the effects on value of the five VBP initiatives that have been evaluated. For these initiatives, only effects on quality and spending are available (yet). In total, we included 24 studies, 20 of which pertain to either the AQC (#4) or the Medicare Shared Savings Program (#14). Partners for Kids (#16) was evaluated in two studies, while both Gesundes Kinzigtal (#10) and ProvenHealth Navigator (#17) were each evaluated in one study.

Typically, studies adopted a difference-in-differences design investigating the effects of the initiative on both spending/resource use and quality of care. Initiative #10 has only been evaluated on its impact on quality and #17 only on its impact on spending. Usually, studies compared enrollees attributed to providers participating in the initiative with comparable enrollees attributed to providers not participating in the initiative, using pre- and post-intervention longitudinal data. Below, we summarize the main findings of the evaluation studies separately for the AQC, the Medicare Shared Savings Program, and the three other initiatives.

4.4.1 Alternative Quality Contract

Using 3 years of pre-intervention data and 4 years of postintervention data, Song et al. (2014) investigated the impact of the AQC on medical spending growth and quality of care for the general population of Massachusetts AQC enrollees. The authors found that spending growth was significantly lower in the first 4 years of the contract for the four cohorts under study (2009-2012) compared with control states. For the 2009 cohort, for example, 6.8% savings were realized over the 4-year period ($p < .001$), mainly as a result of lower prices and volumes in the outpatient facility setting. Similar results were found for the other three cohorts. For the 2009 cohort, savings first exceeded quality incentive payments and investments in, for example, information technology in 2012. Regarding quality, Song et al. compared scores on 18 measures of ambulatory care processes and five outcome measures for chronic diseases to New England and national HEDIS averages. Quality improvements were generally significantly larger for the AQC cohorts. Two earlier studies conducted by largely the same researchers (Song et al. 2011; Song et al. 2012) found similar results regarding both spending and quality.

Nine other studies explored the effects on spending on and utilization of specific services and the effects in specific populations. McWilliams et al. (2013) found significant reductions in spending for FFS Medicare beneficiaries served by provider organizations in the AQC compared with beneficiaries served by providers not in the contract, suggesting a positive spillover effect. Uptake of tobacco cessation treatment slightly increased in the AQC population (Huskamp et al. 2016). Song, Fendrick et al. (2013) provide evidence that providers participating in the contract used lower priced facilities and services more often than providers outside the contract. Barry et al. (2015), however, show that mental health care delivery was not meaningfully affected in the first years of the AQC. In addition, other studies did not find significant differences in pharmaceutical spending and utilization, pediatric health care spending or utilization, emergency department use, and substance use disorder treatment between intervention and control groups

(Afendulis et al. 2014; Chien et al. 2014; Sharp et al. 2013; Stuart et al. 2017). Finally, Song et al. (2017) found no significant changes in spending between enrollees in the AQC in areas with lower and higher socioeconomic status.

With regard to quality, one study (Chien et al. 2014) found small but significant positive effects on pediatric preventive care measures, but no effects for diabetes, cardiovascular disease, and HEDIS measures related to substance use (Barry et al. 2015; Stuart et al 2017). Two other studies (McWilliams et al. 2013; Song et al. 2017) observed a positive change for some measures—such as annual rates of low-density lipoprotein cholesterol and adult preventive care—but not for others.

4.4.2 Medicare Shared Savings Program

Eight studies evaluated the effect of the Medicare Shared Savings Program on spending/utilization and/or quality. Of the four studies evaluating the impact on spending/utilization, three found significant reductions relative to the control groups. Specifically, McWilliams et al. (2016) and Colla et al. (2016) found reductions in total spending of approximately 1% compared with beneficiaries served by providers not participating in the program. McWilliams et al. (2017) show a 9% reduction in post-acute spending and Colla et al. (2016) found a decrease of hospitalizations and emergency department visits of 1.3 and 3 events per 1,000 beneficiaries per quarter, respectively. One study (Busch et al. 2016) found no significant changes in spending and utilization of mental health care.

Of the six studies reporting on the impact on quality, three studies found insignificant effects (Busch et al. 2016; McWilliams et al. 2016; Winblad et al. 2017). The three remaining studies found small but significant reductions of hospital readmissions after common surgical procedures (Borza et al. 2019) and significant improvements of some patient experience measures (McWilliams et al. 2014). Finally, Winblad et al. (2017) demonstrate a significant reduction of 1% in rehospitalization rates from skilled nursing facilities compared with the control group.

4.4.3 Other initiatives

Four different studies evaluated Gesundes Kinzigtal, Partners for Kids Program, and ProvenHealth Navigator. Kelleher et al. (2015) demonstrate lower PMPM spending in the Partners for Kids Program compared with Ohio Medicaid FFS ($p < .001$) and Ohio Managed Care ($p = .121$) populations. A study investigating the effects of the ProvenHealth Navigator (Gilfillan et al. 2010) found that the number of hospital admissions and readmissions reduced by 18% ($p < .01$) and 36% ($p = .02$), respectively, although total cost of care did not change.

Regarding quality, three studies mainly found positive or null effects as a result of participation in the particular program relative to the control group. For example, Pimperl et al. (2017) show improvements for Gesundes Kinzigtal enrollees in potential years of life lost and estimated survival time, but found no significant effect in average age at time of death. In contrast, one study (Kelleher et al. 2015) provides evidence of significant declines in quality for 2 of the 15 measures used in the Partners for Kids Program: diabetes short-term admission rates and perioperative hemorrhage or hematoma rates.

Table 4.4. Effects of five identified VBP initiatives that have been formally evaluated

Name initiative	References	Study design
Alternative Quality Contract	(1) Afendulis et al. 2014 (2) Barry et al. 2015 (3) Chien et al. 2014 (4) Huskamp et al. 2016 (5) McWilliams et al. 2013 (6) Sharp et al. 2013 (7) Song et al. 2011 (8) Song et al. 2012 (9) Song et al. 2013 (10) Song et al. 2014 (11) Song et al. 2017 (12) Stuart et al. 2017	(1) DiD analyses of drug spending and utilization between 2006 and 2010. (2) DiD analyses of probability of mental health service use, spending, HEDIS metrics for diabetes and cardiovascular conditions using 2006-2011 data. (3) DiD analyses of quality and spending between 2006 and 2010 for children aged 0 to 21 years, including children with special health care needs (CSHCN). (4) DiD analyses of tobacco cessation service use using 2006-2011 data. (5) DiD analyses of spending and quality between 2007 and 2010 for elderly FFS Medicare beneficiaries in Massachusetts served by 11 provider organizations entering the AQC in 2009 or 2010 versus beneficiaries served by other providers. (6) DiD analyses of emergency department (ED) visits using 2006-2009 data. (7) DiD analyses of spending and quality using 2006-2009 data. (8) DiD analyses of spending using 2006-2010 data for the 2009 and 2010 intervention cohort. (9) DiD analyses of spending and utilization of several categories of medical technologies and quality using 2006-2010 data. (10) DiD analyses of spending and unadjusted DiD analyses for ambulatory process quality and outcome measures during the first 4 years (2009-2012) of the initiative for the 2009, 2010, 2011, and 2012 cohorts using 2006-2012 data. (11) DiD analyses of spending and quality using 2006-2012 data for enrollees in areas with lower and higher socioeconomic status. Outcome measures were measured only after the intervention. (12) DiD analyses of substance use disorder service use, spending, and three HEDIS-based performance measures related to substance use disorder using 2006-2011 data.
Gesundes Kinzigtal	Pimperl et al. 2017	(1) Quasi-experimental design using propensity score matched control to evaluate the effect on population health using 2005-2013 data. Control group is a random sample of all members of the two insurers in the region Baden-Wurttemberg of 18 years and older.

Effects on resource use/spending	Effects on quality
(1) No significant effect on drugs utilization. (2) Intervention group is slightly less likely (–1.41%; P<0.05) to use mental health services. No significant change in mental health spending, but a 1% annual decline in total health care spending for mental health services users. (3) No significant effect on spending trends. (4) Significant increases rates of tobacco cessation treatment use for the overall population (+0.13%; P<0.0001). (5) Significant reductions in spending for Medicare beneficiaries in intervention (change of -$99 or -3.4% relative to an expected quarterly mean of $2,895; P=0.02). (6) No significant effect on ED use. (7) Smaller spending increase for intervention group, i.e., $15.51 less per quarter (-1.9%; P = 0.007). (8) Savings of $22.58 over 2 years (-2.8%; P=0.04). (9) Higher use of colonoscopies for the intervention group in the first 2 years of the contract (+5.2%; P=0.04). Decreases in spending on cardiovascular services in the first 2 years (-7.4%; P=0.02), and on imaging services (-6.1%; P<0.001). No effect in orthopedics. (10) Over the 4-year period lower spending growth for the intervention group (6.8% for the 2009 cohort; P<0.001). The 2010/2011/2012 cohorts had savings of 8.8% (P<0.001), 9.1% (P<0.001), and 5.8% (P=0.04). (11) No significant differences in spending between areas with lower versus higher socioeconomic status. (12) No sizeable changes.	(2) No significant improvements for diabetes or cardiovascular disease among enrollees with co-occurring mental healthcare use. For two measures (nephropathy monitoring and retinal exams) non-mental health users appear to have benefited more than mental health care users (annual change in probability of –2.90%; P<0.01 and –2.57%; P<0.05). (3) Significant, positive effect on pediatric preventive care quality measures tied to P4P (+1,8% for CSHCN and +1.2% for non-CSHCN; P<0.001). No significant changes for measures not tied to P4P. (5) Significant improvements of some measures (e.g., 3.1% for low-density lipoprotein cholesterol testing [P<0.001] and 2.5% for cardiovascular disease [P<0.001]), but no differential change for others. (7) Improved quality for chronic conditions in adults (P<0.001) and pediatric care (P=0.001) after 1 year, but not for adult preventive care. (8) Improvements in measures for chronic care management (+3.7%; P<0.001), adult preventive care (+0.3%; P=0.008), and pediatric care (+0.3%; P<0.001). (10) Measures of chronic disease management increased by 3.9%, and unadjusted performance in adult preventive care and pediatric care increased by 2.7% and 2.4% (P-values are unavailable) compared to the HEDIS national average. The five outcome measures for patients with diabetes, patients with coronary artery disease, and patients with hypertension improved compared to the national and regional HEDIS scores (size of the effect and P-values unavailable). (11) Process measures improved +1.2% per year more among individuals living in areas with lower versus higher socioeconomic status (P<0.001). No significant differences in outcome measures. (12) No sizeable changes.
Not available.	(1) For the ACO intervention group age at time of death is on average 1.4 years higher compared to the control group but not significant, 639 fewer years of potential life were lost compared to the control group (P<0.05), and the estimated survival time is approximately 7 days higher for beneficiaries participating in the program (significant; p-value unavailable).

Table 4.4. Effects of five identified VBP initiatives that have been formally evaluated (continued)

Name initiative	References	Study design
14. Medicare Shared Savings Program	(1) Borza et al. 2019 (2) Busch et al. 2016 (3) Colla et al. 2016 (4) Herrel et al. 2016 (5) McWilliams et al. 2014 (6) McWilliams et al. 2016 (7) McWilliams et al. 2017 (8) Winblad et al. 2017	(1) DiD analyses of hospital readmission after common surgical procedures using 2010-2014 data. (2) DiD analyses of mental health care spending, utilization, and quality using 2008-2013 data. (3) DiD analyses of spending and high-cost institutional use using 2009-2013 data. (4) DiD analyses of 30-day mortality, complications, readmissions, and length of stay for patients undergoing a major surgical resection for various types of cancer using 2011-2013 data. (5) DiD analyses of patient experience using 2010-2013 data. (6) DiD analyses of spending and quality using 2009-2013 data. (7) DiD analyses of post-acute spending and utilization using 2009-2014 data. (8) DiD analyses of all-cause rehospitalizations from skilled nursing facilities using 2007-2013 data.
16. Partners for Kids Program	(1) Gleeson et al. 2016 (2) Kelleher et al. 2015	(1) DiD analyses of pediatric performance of primary care physicians using 2010-2013 data. (2) Observational study of spending, growth rates, and quality using 2008-2013 data. Results for the PFK group is compared to Ohio Medicaid FFS and Ohio managed care (MC).
17. ProvenHealth Navigator	(1) Gilfillan et al. 2010	(1) DiD analyses of hospital admissions, readmission rates, and the total cost of care using 2005-2008 data for Medicare Advantage patients at 11 intervention sites and 75 control groups.

Effects on resource use/spending	Effects on quality
(2) No significant changes in mental health care spending and utilization. (3) Modest reductions in total spending (-1.3%; P<0.001). Hospital and ED use reduced significantly by 1.3 (P<0.05) and 3.0 (P<0.01) events per 1000 beneficiaries per quarter. (6) Significant reductions in spending for the 2012 cohort (-1.4%; P=0.02), but not for the 2013 cohort. (7) Significant reductions in post-acute spending (-9.0%; P=0.003 for 2012 ACO cohort and smaller for the 2013 and 2014 cohort).	(1) Significant reduction in readmissions for hospitals in the program (-0.52%; P=0.021). (2) No significant changes in quality metrics. (4) No significant effect on perioperative outcome measures. (5) Improvements in some patients experience measures (e.g., effect size for reports of timely access to care is 2.1 standard deviation of the ACO-level distribution, adjusted for trends; P=0.02), but not (significantly) in others (e.g., overall ratings of care and physicians). (6) No significant differences in quality or use of low-value services for the majority of measures. (8) Significant reduction in re-hospitalization rate (-0.994%; P<0.01).
(2) Compared to both control groups, PMPM spending was significantly lower in 2008, and grew at a rate of $2.40 per year compared to $16.15 per year in the FFS group (P<0.001) and $6.47 per year (P<0.121) in the MC group.	(1) Significant improvements in 8 of the 14 HEDIS measures for preventive care, chronic care, and acute care primary care services for the group of Nationwide Children Hospital physicians compared to incentivized physicians ('traditional' P4P). ORs favoured the intervention group mainly in the immunization measures (range of OR of 0.34 with CI of 0.31-0.37 for hepatitis vaccine to 0.86 with CI of 0.78-0.95 for meningococcal vaccine). (2) Significant improvement for gastroenteritis admission rate (-0.05 events/1000; P=0.000), pediatric quality acute composite (-0.03 events/1,000; P=0.018), and pediatric quality overall composite (-0.05 events/1,000; P=0.046). Significant declines in quality regarding diabetes short-term admission rates (+0.02 events/1,000; P=0.027) and perioperative haemorrhage or hematoma rates (+3.99 events/1,000; P=0.048). No significant differences on 10 other measures.
(1) Significant reduction in hospital admissions (-18%; P<0.01) and readmissions (-36%; P=0.02). Total cost of care decreased 7% (not significant).	Not available.

5. DISCUSSION

5.1 Summary and discussion of main findings

In this article, we systematically identified and analyzed 18 VBP initiatives aiming at improving value in a broad sense. Specifically, our focus was on initiatives combining global base payments with payments explicitly linked to quality. Our analysis has resulted in a comprehensive overview of the possibilities in terms of operationalization of the two payment components and associated design features. Six main findings merit further discussion.

First, although all identified initiatives share the same two payment components, they differ considerably in the exact operationalization thereof. Specifically, we observed heterogeneity in the degree of risk sharing, the method of attributing populations to provider groups, the sophistication of the risk-adjustment methodology, and the way in which payment is linked to quality. Reasonable explanations for this heterogeneity are local preferences and contextual differences among settings. For example, in a setting in which providers lack experience with bearing downside risk, payers may choose to start with transferring upside risk only, allowing providers to gain this experience. After an adaption period, incentives for cost-conscious behavior can be intensified by transferring some downside risk as well.

Second, 15 of the 18 initiatives have been implemented in the United States. In part, this may be due to the adopted language restriction in this review. Another potential explanation can be found in the specific structure and history of the U.S. health care system. Specifically, it is likely that essential preconditions for a successful introduction of VBP are better fulfilled in the United States than in other countries, enabling a jump-start of VBP in the United States. Collaborative networks of multidisciplinary providers that are able and willing to take on the role of risk-bearing accountable group are historically embedded in the U.S. health care system (Enthoven 2009). This might be partly the result of the integrated delivery systems that gained traction in the 1980s.

A third noteworthy finding is the strong reliance on primary care in all initiatives, which is evident from the explicit and central role of PCPs. In the Dutch Shared Savings Model, for example, groups of PCPs are accountable for the full continuum of primary and specialized care services. As gatekeepers, Dutch PCPs have at least some control over both primary and specialist care, legitimating their role as main contractor. The central focus on primary care across all initiatives is consistent with the global trend toward primary care–oriented systems. This trend is understandable given the many studies showing that areas with higher ratios of PCPs to population are associated with better health outcomes and lower total cost of health services compared with other areas (Starfield et al. 2005).

Fourth, the majority of identified initiatives adopt spending targets with risk-sharing arrangements built on existing (FFS) payment systems. This finding is consistent with the recommendation derived from a major VBP initiative in California to start with 'virtual' targets and shift to 'real' prospective payments at a later stage (Williams & Yegian 2014). Virtual payments can

potentially realize the same goal as real payments, without the regulatory and administrative burdens of replacing current payment and billing systems that could disrupt momentum. In addition, initially testing the model using virtual payments offers the possibility of developing a reliable benchmark from which the fixed payment level can be reasonably negotiated (Williams & Yegian 2014). However, the incentives emanating from virtual payments may be perceived as weaker than those from real prospective payments (Struijs et al. 2018). Thus, although virtual payments can be a practical first step, moving away from FFS should remain a priority (De Bakker et al. 2012; Williams & Yegian 2014).

Fifth, most initiatives apply some form of risk adjustment and incorporate risk-mitigating measures in their payment contracts. This contributes to fairness in payment, reduced incentives for risk selection, and protection against excessive random variation in spending. Apparently, the importance of these two VBP design features is not only recognized in theory (Ash & Ellis 2012; Cattel et al. 2020a) but also in practice. Regarding risk adjustment, initiatives typically use existing diagnoses-based algorithms that were originally developed in the context of health plan payment. Although this may be an efficient and pragmatic approach that could serve its purpose in the short run, in the longer run it seems preferable to customize the risk-adjustment algorithm to the specific purpose of paying providers (Ash & Ellis 2012). This may be particularly relevant to prevent the introduction of new perverse incentives such as for manipulating the diagnoses-based morbidity information used in the risk-adjustment formula to maximize payment (Geruso & Layton 2015; Landon & Mechanic 2017; Markovitz et al. 2019).

Finally, our results indicate that VBP models as defined here have the potential to improve value and contribute to the provision of VBHC. Regarding the five initiatives that have been evaluated, studies generally demonstrate similar or reduced spending growth and equal or improved quality. In this respect, it is noteworthy that the Medicare Shared Savings Program excludes prescription drugs from the VBP contract. Since prescription drugs account for a substantial proportion of total health care spending, it is possible that this initiative did not fully reach its potential for value improvement.

Our findings are consistent with results found for ACOs in the United States that indicate no association between ACO implementation and worsened health outcomes (Kaufman et al. 2019). In addition. Our findings correspond well with the results of a recent review of outcome-based P4P initiatives, which found favorable effects only when P4P was combined with global base payments (Vlaanderen et al. 2019). Conversely, our findings are in contrast with results from prior reviews on the effects of P4P, which did not find convincing evidence for P4P being (cost-) effective in improving value when the underlying, flawed base payment system is left intact (e.g., Eijkenaar et al. 2013; Mendelson et al. 2017; Vlaanderen et al. 2019). A possible explanation for the latter is that P4P typically concerns a relatively small part of the total provider payment, whereas initiatives included in this article focus on reform of the total payment system. Finally, our finding that quality does at least not seem to have deteriorated, suggests that quality—as operationalized by the chosen indicators—did not suffer from the adopted global base payments

in VBP. This is in contrast with the widespread concern about the use of capitation payments in the context of HMOs (Dudley & Luft 2001; Miller & Luft 1997).

5.2 Limitations and implications

Our findings should be interpreted in the light of several limitations. First, as any systematic review, this study suffers from publication bias. Second, it is possible that we missed relevant VBP initiatives as a consequence of our search strategy, specifically the restriction to articles/documents written in English or Dutch. In addition, we excluded multiple potentially relevant initiatives due to insufficient information. For example, we expect that long-standing integrated delivery systems such as Kaiser Permanente and Cleveland Clinic also adopt relevant VBP models, but since specific information on the payment structure is lacking, we could not include them. Overall, maximally twice as much VBP initiatives could have been included in this review, had sufficient information been available. Third, we were not always able to describe all relevant design features of each included initiative. In particular, information was often unavailable on the attribution methods, methods of setting the payment/target, internal payment contracts, contract duration, risk-mitigating measures, and quality incentive structure. Fourth, the overrepresentation of U.S. initiatives limits the generalizability of our findings to other settings. Finally, our findings regarding the effects on value are based studies evaluating only 5 of the 18 initiatives, with 20 of the 24 included evaluation studies pertaining to 2 initiatives: The Alternative Quality Contract and the Medicare Shared Savings Program. Moreover, the effects found in these studies are unlikely to reflect the impact of payment reform exclusively. This is because VBP is typically part of a broader approach to value improvement including other interventions that are implemented simultaneously, like structured performance feedback and public reporting.

In addition to the implications mentioned in the section 5.1, the results of this review have two other implications for research and policy. First, from both a research and a policy perspective, the design of VBP models are ideally documented more carefully in the future. Furthermore, it is important that VBP implementation goes hand-in-hand with rigorous evaluation. This is expected to result in important insights with regard to VBP design and the link with effectiveness, enabling others to learn from prior experiences. As this review shows, few initiatives have been subject to rigorous evaluation. Hence, little is still known about the effects in general, let alone about the impact of specific design choices on value. Moreover, the long-term impact of VBP is often not assessed, even though the gains from specific interventions such as investments in prevention are expected to emerge only after a longer period of time. The only two initiatives for which effects in the longer run are available confirm this statement. For example, net savings were generated only after 4 years in the AQC (Song et al. 2014).

Second, policy makers pursuing VBHC should keep in mind that although payment reform is an invaluable element in this process, it is not the only relevant factor. Other financial and nonfinancial interventions on both the supply- and demand-side of the market are likely to be important for the success of VBHC as well. Examples are a joint IT-infrastructure, physician

leadership, performance monitoring with structured feedback, and public reporting (McClellan et al. 2010; Phipps-Taylor & Shortell 2016; Robinson 2001a; Shortell & Casalino 2010). Consistent with the recommendation by Roland and Campbell (2014) that P4P needs to be combined with other improvement strategies to produce sustained improvements, implementing VBP while disregarding other relevant factors is unlikely to materially affect value. The successful AQC, for example, embraced a multifaceted improvement strategy by offering technical support for participating provider groups parallel to the intervention of payment reform (Chernew et al. 2011). The role of other value-adding aspects and the interplay with VBP is an interesting avenue for future research.

5.3 Conclusion

In the coming years, VBP models stimulating value in a broad sense will likely continue to gain ground, as the quest toward VBHC proceeds. This article demonstrates that VBP models consisting of global base payments combined with explicit quality incentives are operationalized in practice in various ways. In addition, our results show that this particular VBP model has the potential to improve value and contribute to VBHC. Going forward, this article may serve as inspirational material for those interested in developing new or improving on existing VBP models.

APPENDIX

Appendix A: Search strings

Embase.com: 1215

((((Value* OR variable OR performance OR explicit OR outcome OR quality OR readmission OR mortality OR complication OR coordination OR efficien* OR effectiveness* OR efficac* OR cost-conscious* OR well-coordinat* OR innovat* OR prevent*) NEAR/6 (based OR program* OR evaluat* OR assess* OR model* OR initiative* OR connect*) NEAR/6 (Payment* OR incentive* OR remuner* OR fee OR fees OR reward* OR reimburs* OR financing OR funding OR budget OR capitat* OR bonus OR contract OR contracts OR contracting OR contracted OR spending))):ab,ti) AND ('physician'/exp OR 'medical specialist'/exp OR 'hospital'/de OR 'general hospital'/de OR 'community hospital'/de OR 'geriatric hospital'/de OR 'mental hospital'/exp OR 'pediatric hospital'/de OR 'private hospital'/de OR 'public hospital'/de OR (physician* OR practitioner* OR doctor* OR ((health-care OR healthcare) NEAR/3 provider*) OR hospital* OR clinic OR clinics):ab,ti) NOT ([Conference Abstract]/lim OR [Letter]/lim OR [Note]/lim OR [Editorial]/lim) AND ([english]/lim OR [dutch]/lim) AND [2000-2017]/py

Medline Ovid: 1403

("Value-Based Purchasing"/ OR "Value-Based Insurance"/ OR (((Value* OR variable OR performance OR explicit OR outcome OR quality OR readmission OR mortality OR complication OR coordination OR efficien* OR effectiveness* OR efficac* OR cost-conscious* OR well-coordinat* OR innovat* OR prevent*) ADJ6 (based OR program* OR evaluat* OR assess* OR model* OR initiative* OR connect*) ADJ6 (Payment* OR incentive* OR remuner* OR fee OR fees OR reward* OR reimburs* OR financing OR funding OR budget OR capitat* OR bonus OR contract OR contracts OR contracting OR contracted OR spending))).ab,ti,kf.) AND (exp "Physicians"/ OR "Specialization"/ OR "hospitals"/ OR "Hospitals, General"/ OR "Hospitals, Community"/ OR "Hospitals, Psychiatric"/ OR "Hospitals, Pediatric"/ OR "Hospitals, Private"/ OR "Hospitals, Public"/ OR (physician* OR practitioner* OR doctor* OR ((health-care OR healthcare) ADJ3 provider*) OR hospital* OR clinic OR clinics).ab,ti,kf.) NOT ((letter OR news OR comment OR editorial OR congresses OR abstracts).pt.) AND (english.la. OR dutch.la.) AND (2000 OR 2001 OR 2002 OR 2003 OR 2004 OR 2005 OR 2006 OR 2007 OR 2008 OR 2009 OR 2010 OR 2011 OR 2012 OR 2013 OR 2014 OR 2015 OR 2016 OR 2017).yr

Cochrane central: 103

((((Value* OR variable OR performance OR explicit OR outcome OR quality OR readmission OR mortality OR complication OR coordination OR efficien* OR effectiveness* OR efficac* OR cost-conscious* OR well-coordinat* OR innovat* OR prevent*) NEAR/6 (based OR program* OR evaluat* OR assess* OR model* OR initiative* OR connect*) NEAR/6 (Payment* OR incentive* OR remuner* OR fee OR fees OR reward* OR reimburs* OR financing OR funding

OR budget OR capitat* OR bonus OR contract OR contracts OR contracting OR contracted OR spending))):ab,ti) AND ((physician* OR practitioner* OR doctor* OR ((health-care OR healthcare) NEAR/3 provider*) OR hospital* OR clinic OR clinics):ab,ti)

Web of science: 1160

TS=(((((Value* OR variable OR performance OR explicit OR outcome OR quality OR readmission OR mortality OR complication OR coordination OR efficien* OR effectiveness* OR efficac* OR cost-conscious* OR well-coordinat* OR innovat* OR prevent*) NEAR/5 (based OR program* OR evaluat* OR assess* OR model* OR initiative* OR connect*) NEAR/5 (Payment* OR incentive* OR remuner* OR fee OR fees OR reward* OR reimburs* OR financing OR funding OR budget OR capitat* OR bonus OR contract OR contracts OR contracting OR contracted OR spending))))) AND ((physician* OR practitioner* OR doctor* OR ((health-care OR healthcare) NEAR/2 provider*) OR hospital* OR clinic OR clinics))) AND DT=(article) AND LA=(english)

Appendix B: List of consulted experts

- Erik Schut (the Netherlands)
- Richard Heijink (the Netherlands)
- Lieven Annemans (Belgium)
- Maria Trottmann (Switzerland)
- Thomas McGuire (US)
- Noaki Ikegami (Japan)

Appendix C: Overview of included articles and documents

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Chapter 7

Conclusions and discussion

1. INTRODUCTION

In this dissertation, focus has been on key conceptual and practical issues in the design of financial incentives for consumers and providers to facilitate value in health care. We synthesized evidence on the financial incentives embedded in payment systems, and conceptually and empirically analyzed important choices and tradeoffs in the design of payment systems. Findings may help stakeholders who are responsible for (re)designing existing and future cost-sharing methods for consumers and VBP models for providers in making smarter choices in payment system design. This chapter first summarizes the main conclusions of chapters 2 to 6 by answering the five research questions formulated in the introduction. Next, several implications and recommendations for policy and practice are discussed. The last section of this chapter provides some suggestions for future research.

2. MAIN FINDINGS

In part I of this dissertation (chapter 2) we have sought to contribute to a better understanding of VBP incentives for consumers and provided an answer to research question 1.

Q1: How can incentives for cost-conscious behavior under various deductible designs be compared?

In chapter 2 a simulation model to approximate the relative effects of different deductible modalities on the cost-containment incentives (CCIs) is developed. Our model started from the idea that for a perfectly rational consumer the CCIs in a deductible plan depend on the marginal out-of-pocket spending given the expected spending in the contract period. We argued that the CCIs depend on (1) the probability that individual healthcare spending ends up in the relevant deductible range and (2) total expected spending given that spending ends up in the relevant deductible range. The relevant deductible range is the interval where the consumer, not the insurer, bears the costs. Ceteris paribus, CCIs are expected to reduce with the probability that spending ends up in the deductible range and higher savings potential (i.e., higher expected spending) is likely to lead to stronger CCIs. An important finding is that a deductible with an adjustable starting point based on individual's predicted healthcare spending not only results in stronger CCIs than a first-euro deductible and a doughnut hole with a uniform starting point, but also to a more equal distribution of out-of-pocket payments across consumers with low and high expected healthcare costs.

In the second part of chapter 2, our simulation model is empirically illustrated for a first-euro deductible as well as a doughnut hole with various but uniform starting points. CCIs are presented for the total population and for groups of low-risk individuals and high-risk individuals

assuming a deductible amount of €1,000. We showed that different designs result in different CCIs and incentives may differ across risk-groups. Given the data and under the assumptions made, for the total population, a doughnut hole with a uniform starting point above €0 but below €4,000 on average provides stronger CCIs than a first-euro deductible. For the low-risk individuals, this conclusion holds as long if a starting point below €3,000 is chosen. For the high-risk individuals, CCIs are (considerably) stronger under a doughnut hole with a uniform starting point compared to a first-euro deductible, even if the starting point is shifted to the right only modestly (i.e., to €500).

In part II of this dissertation we focused on VBP incentives for providers. In chapter 3 we turned to the question what the 'optimal' provider payment system in theory looks like given a five-dimensional definition of value in health care: high quality of care, cost-consciousness, well-coordinated care, cost-effective innovation, and prevention. We provided an answer to research question 2.

Q2: What are the key design elements of a theoretically preferred value-based payment model?

Based on a synthesis of findings of key theoretical and empirical studies on provider behavior and payment incentives, we concluded that a provider payment model that stimulates each of the five value dimensions preferably consists of two core components that must be carefully designed. The first component is a relatively large global base payment with implicit incentives for value. The second component is a relatively small variable payment with explicit incentives for value (typically: quality). Being the largest component, the base payment design is crucial but has long been largely neglected when it comes to VBP reform. The focus of chapter 3 was therefore on this component.

Our analysis revealed that the global base payment ideally consists of five key design features. In order to stimulate well-coordinated care, this payment component should be a single payment to a multidisciplinary group of healthcare providers (key design feature 1). Paying a group instead of individuals removes financial barriers between disciplines and sites, encouraging communication and cooperation across the care continuum. In addition, the global payment ideally pertains to a comprehensive set of care activities for a predefined population (key design feature 2). A global payment ideally covers all the primary and secondary care services individuals might need. Such a person-centered, holistic approach reduces fragmentation and stimulates health promotion and cost-effective prevention. Furthermore, in order to strengthen incentives for cost control and cost-effective innovation, the base payment should be fixed for a defined period (key design feature 3). Because there is no link between payment and delivered care services, providers are stimulated to contain costs.

An important consequence of the design of the base payment as described above is that providers are confronted with more financial risk than under conventional payment models. This

provides incentives for cost control but might also stimulate strategic provider behavior that may thwart value. Specifically, in order to reduce healthcare spending, providers might engage in actions to select favorable risks or skimp on quality. Therefore, the global base payment should be adjusted according to the risk profile of the population (key design feature 4) and the payment contract should include arrangements to protect providers against excessive financial risk (key design feature 5).

Under a global base payment, providers might be inclined to act too aggressively in attempts to control costs by skimping on quality or underproving necessary but expensive services. Therefore, the global base payment should be complemented with a small variable payment with explicit rewards for 'doing a good job'. This payment should trigger providers to give sufficient attention to value aspects that are unlikely to be incentivized by the global base payment but may be prone to quality skimping or underprovision. Explicit incentives should be relatively low powered to prevent a disproportionate focus on rewarded tasks. The variable payment is particularly suitable for stimulating aspects of value that can be relatively easily and objectively measured and that are difficult to incentivize implicitly. Typically, these aspects are related to high-quality care and patient-reported outcomes.

In chapter 4 we turned our attention from theory to practice. Results of a systematic review of the literature that aimed to identify and describe payment reform initiatives from practice that match the definition of a theoretically 'optimal' VBP model (i.e., a global base payment combined with explicit quality incentives) are presented. We described how these payment reform initiatives are operationalized, and their effects on spending and quality. The research question of this chapter was:

Q3: Which initiatives exist in practice that come close to a theoretically 'optimal' value-based payment model, how are they designed, and what is their impact on value?

We identified 18 initiatives implemented in four different countries: 15 in the US, 1 in Germany, 1 in Spain, and 1 in the Netherlands. Our analysis provides a comprehensive overview of the possibilities in terms of operationalization of the two payment components and associated design features. In most initiatives the payment is given to a large, multidisciplinary provider group consisting of various types of physicians, other healthcare providers, and facilities. Within each group, providers are jointly accountable for the provision of a comprehensive set of care activities to a delineated population. Often, these provider groups are referred to as Accountable Care Organizations (ACOs). Generally, a main contractor such as an integrated delivery system or multispecialty group practice receives the payment on behalf of the provider group and is responsible for distributing the payment and hiring individual providers. Typically, the payment covers virtually all primary and specialized medical services and prescription drugs, covered by the relevant benefit package. Sometimes, the package includes types of care beyond medical care

services only, e.g., long-term care and behavioral health care. All initiatives have a strong focus on substitution to primary care. The population can be attributed to the provider group prospectively based on prior utilization, affiliation with a provider, or region, or retrospectively based on the plurality of utilization in the completed year. A third of the 18 initiatives impose a minimum population size per provider group to reduce the effect of stochastic spending variation.

Most initiatives adopt virtual spending targets with risk-sharing arrangements built on existing (often fee-for-service like) payment and billing systems instead of actually replacing these systems with real global base payments. Most initiatives adopt multiyear contracts and apply some form of risk adjustment. Typically, initiatives adopt existing morbidity-based algorithms, originally developed in the context of risk adjustment for health plan payment. In addition to risk adjustment, a variety of risk-mitigating measures is implemented to bring financial risk for providers to acceptable levels. In about half of the initiatives, providers assume upside risk (i.e., profits) only while in the other half, providers accept downside risk (i.e., losses) as well. The risk-sharing rate varies between 50 and 100%. Most identified contracts include reinsurance provisions and carve-out some specific high-cost services from the payment contract.

We observed three main modalities of explicitly rewarding quality: add-on payments for quality (pay-for-performance), shared savings or losses dependent on quality, or a combination of these two modalities. The latter is most common in practice. A broad range of indicators is used, with clinical quality indicators being adopted most frequently. Some initiatives incorporate clinical outcome measures, patient-reported outcome measures (PROMS), or patient-reported experience measures (PREMS). The variable payment is typically low-powered (usually much lower than 10% of total payment).

Only five of the 18 initiatives have been evaluated on their impact on quality and spending. Available evaluation studies indicate that global payments in combination with variable payments for quality have the potential to improve value. Studies generally show promising results in terms of spending and quality. Importantly, these results are not the effect of payment reform only, but of a broader, multifaceted approach to value improvement that includes financial and non-financial improvement strategies.

A key question in de the design of global payments is how financial risk can be kept manageable for providers and unintended consequences can be prevented as much as possible. Answering this question requires insight in the determinants of financial risk and the interplay between these determinants. Therefore, in chapter 5 the relative impact of four key determinants related to the design of global payments on providers' financial risk was examined. The research question of this chapter was:

Q4: Which determinants of financial risk related to global payment design can be distinguished and what is their relative impact on the financial risk of primary care providers subjected to global payments?

We simulated prospective global payments for primary care providers (PCPs) and assessed how PCPs' financial risk depends on the scope of the care package covered by the payment, the sophistication of risk adjustment, the presence or absence of high-cost risk sharing, and patient panel size. Our primary measure of financial risk was the standard deviation of residual spending at the PCP level, with residual spending being defined as observed spending less risk-adjusted payment. In addition, we calculated PCPs' risk of ruin, defined as the probability of a PCP suffering a loss which exceeds the payment by at least 5%. To provide an answer to the research question, we relied on two large administrative datasets. The first dataset includes individual-level data on medical spending and health characteristics. The second dataset includes individual-level data obtained from a large Dutch health insurer and contains information on the PCPs that individuals were registered with.

Our simulations showed that the scope of the care package had the greatest impact on financial risk. For the narrower packages covering primary care, physiotherapy, and durable medical equipment, financial risk is relatively limited. However, irrespective of the sophistication of the risk adjustment, the use of risk sharing, and the size of the patient panel, adding prescription medication and particularly hospital care to the care package increases financial risk drastically. Our analyses further showed that morbidity-based risk adjustment is an effective measure to reduce financial risk, especially for broad care packages. Without sophisticated risk adjustment, financial accountability for comprehensive care packages would expose PCPs to excessive amounts of systematic risk. To a lesser extent than risk adjustment, full risk sharing for the 1% most costly cases can also be effective in mitigating risk, particularly when patient panels are small and the care package includes hospital care. Importantly, however, combining morbidity-based risk adjustment and high-cost risk sharing did not guarantee low levels of financial risk in absolute terms. For the care package including hospital care, more than a quarter of all PCPs in our data could be expected to suffer a loss which exceeds the payment by at least 5%. Finally, the negative impact of patient panel size on financial risk was most prominent for broad care packages in combination with morbidity-based risk adjustment but no risk sharing. We concluded that to bring financial risk for providers to appropriate levels, sufficiently large patient populations should be required.

Chapters 3, 4 and 5 have shown that both in theory and in practice, risk adjustment and risk sharing are important measures to reap the benefits of financial risk for providers under global payments while mitigating adverse effects. In chapter 6 we examined an innovative form of risk sharing, namely residual-based risk sharing. Despite its potential, this form of risk sharing has not been studied in the context of provider payment yet. Therefore, we provided insight into the incentive effects and tradeoffs associated with the design of residual-based risk sharing. We provided an answer to research question 5.

Q5: What is the effect of residual-based risk sharing for providers on (1) incentives for cost control, (2) incentives for risk selection, (3) incentives for upcoding, and (4) excessive losses/profits for providers.

Using the same datasets as in chapter 5, we simulated risk-adjusted global payments for PCPs for a comprehensive care package including primary care, physiotherapy, durable medical equipment, prescription medication, and hospital care. We complemented morbidity-based risk adjustment with various residual-based risk-sharing modalities that differ in the funds devoted to risk sharing and in whether only residual-based payments or both payments and repayments are used. Under this type of risk sharing, providers receive extra payments for those individuals most heavily underpaid by the risk-adjustment model and must make repayments for heavily overpaid individuals. Furthermore, in an iterative procedure we optimized the risk-adjustment payment weights for the presence of (re)payments.

Our simulation showed a substantial impact of residual-based risk sharing on cost-control incentives, risk selection incentives, upcoding incentives, and excessive provider-level losses/profits. Devoting just a very small share of total payments to residual-based payments substantially reduces incentives for risk selection as measured by Payment System Fit (PSF). The effect of adding repayments to the payment model on PSF is less prominent. Residual-based payments lead to improvements of our second measure of incentives for risk selection (i.e., Cumming's Prediction Measure; CPM) as well, but only for a relatively high degree of risk sharing. With regard to incentives for risk selection operationalized as the mean undercompensation for the group individuals belonging to the top-10-% of spenders in each of the three prior years, we observed that residual-based risk sharing only has a noticeable impact in our data if risk-sharing percentages are high. Importantly, we detected no clear pattern in the three measures for risk selection, emphasizing the importance of considering multiple measures for this outcome, given a specific context.

Incentives for upcoding are measured by the mean incremental payment for the morbidity indicators in the risk-adjustment model, i.e., pharmacy-based cost groups (PCGs) and diagnosis-based cost groups (DCGs). Our results showed that residual-based payments alone already lead to reductions in upcoding incentives, although the impact of repayments is much stronger, particularly for DCGs. Finally, we found that residual-based risk sharing can be an effective measure to reduce the share of PCPs with an excessive loss and – to a lesser extent – excessive profit, although for a substantial impact relatively high risk-sharing percentages are needed.

We concluded that less incentives for risk selection, less incentives for upcoding and less excessive losses/profits for providers, however, do come with a price. To substantially reduce the risk of unwanted effects through residual-based risk sharing, a sacrifice in incentives for cost control is required. Though small levels of risk sharing can achieve much in terms of less risk on unwanted effects, an acceptable reduction of that risk still requires a sizeable sacrifice of cost control incentives. It is up to the relevant decision makers to weigh the pros and cons of various shares of funds

devoted to residual-based payments (and potentially to repayments) in terms of incentive effects, given context-specific preferences.

3. IMPLICATIONS FOR POLICY AND PRACTICE

Part I of this dissertation (chapter 2) focused on the design of consumer out-of-pocket payments. A simulation model was developed and empirically illustrated to approximate the relative effects of different deductible designs on cost-containment incentives (CCIs). At least two implications can be derived. First, a deductible with an adjustable starting point based on individual's predicted healthcare spending not only results in stronger CCIs than a first-euro deductible and a doughnut hole with a uniform starting point, but also to a more equal distribution of out-of-pocket payments across consumers with low and high expected healthcare costs, confirming that such a design is an interesting design option to be (re)considered by stakeholders. Second, a doughnut hole design with a (uniform) starting point above €0 but below €4,000 on average provides stronger CCIs than a first-euro deductible implying that the starting point of the deductible should be higher than zero.

In part II of this dissertation (chapters 3 to 6) a specific manifestation of value-based provider payment reform was studied: a global base payment combined with explicit quality incentives. Such a payment model has been implemented in various settings and provides incentives for high-quality of care, cost-conscious behavior, well-coordinated care, cost-effective innovation, and prevention. Although effect studies generally show promising results we are, however, only at the beginning of the alternative payment model journey. Going forward, the insights obtained in chapters 3 to 6 may prove helpful in providing a foundation for future improvements of provider payment models. Based on our findings, at least three key implications for policy and practice can be formulated.

A first implication is that it is important to pay sufficient attention to the design of the global base payment because for several reasons the base payment constitutes the largest payment component with the strongest financial (dis)incentives for value. The scope of the care package covered by that payment component is a particularly important design aspect that designers of global payments should carefully decide on. Especially when the package covers spending on hospital care, designers should consider risk-mitigating measures to bring financial risk for providers to appropriate levels. In this regard, morbidity-based risk adjustment, (residual-based) risk sharing, and requiring sufficiently large patient populations can be highly effective measures. The latter could also imply that implementing global payments in competitive healthcare markets is most realistic in populated areas.

A second implication is that in designing VBP, decision makers should carefully consider the extent to which necessary preconditions are met, while accounting for local economic and societal preferences. This dissertation has shown that no 'one size fits all VBP design' exist that

can successfully be implemented in each setting. Adjusting the design to the specific context is a process fraught with complex tradeoffs, and it is up to decision makers to weigh the pros and cons associated with various design choices. This dissertation has provided a useful start in gaining insight in these tradeoffs. We provide three examples. First, in a setting in which providers still predominantly work in monodisciplinary 'silos', a shift from fee-for-service to global payments for multidisciplinary provider groups might be desirable but simply unfeasible, at least in the short term. Important preconditions, such as the presence of provider organizations that are able and willing to accept financial and clinical accountability for the provision of a comprehensive care package to a predefined patient population, may not be fulfilled. In that case, it seems preferable to start with adopting a less far-reaching alternative payment model than global payments, like bundled payments for specific conditions or a hybrid payment model in which part of the payment model remains fee-for-service. Second, to strengthen incentives for cost control, the global payment ideally applies to a comprehensive care package including spending on hospital care. To mitigate incentives for risk selection, morbidity-based risk adjustment is required. If, however, individual-level data on relevant population risk characteristics are not routinely available, adequate risk adjustment is unfeasible. Decision makers should then strongly consider a sacrifice in incentives for cost control by carving-out hospital care spending. Third, a tradeoff related to the local economic and societal preferences is the decision on the relative share of the global base payment and the variable quality payment. In a setting where quality of care is considered to be at an acceptable level while healthcare costs keep rising, decision makers may attach greater importance to strengthening incentives for cost control and expand the size of the global base payment. To prevent providers from acting too aggressively in attempts to control costs by skimping on quality or underproving necessary but expensive services, it is of crucial importance to carefully monitor quality of care in this context.

A third implication is that the implementation of VBP is complex and will likely require a step-by-step approach and long-term vision. It requires far-reaching changes in structures, processes, relationships, and mindsets. Building trust-based relationships and reaching consensus on, for example, the definition the care package, an appropriate form of cooperation, and the terms of the payment contract will take much of stakeholders' time and energy. In this respect, multiyear contracts with standardized contract elements can prevent stakeholders from reinventing the wheel, signal trust and a shared long-term ambition, and provide time and (financial) room to get used to bearing financial risk and invest in improvements in the care process. A related relevant finding is that it has proven possible to experiment with alternative payment models (including global payments) without replacing current payment and billing systems. Implementing a spending target with end-of-period reconciliation with fee-for-service claims can be a practical first step in moving away from volume-based payment, without the regulatory and administrative burdens of replacing current systems.

4. SUGGESTIONS FOR FUTURE RESEARCH

In addition to the directions for future research suggested in chapters 2 to 6, we highlight three major avenues for further study. First, only a few of the VBP initiatives included in our systematic review have been rigorously evaluated. Although available results are promising, evidence about the effects of VBP on quality and spending is scarce. Moreover, evidence is lacking on other relevant outcomes such as changes in work processes and the impact of financial incentives on the intrinsic motivation of providers. An important but understudied question in this regard is how to pass the financial incentives for value along from the provider entity receiving the payment, to the affiliated providers and individual professionals on the work floor. Furthermore, most evaluations focus on the short-term effects of payment models, while the benefits of VBP are likely to emerge after a long period of time (e.g., benefits from investments in prevention). Finally, there is still a lot to learn about barriers and facilitators to successful implementation of VBP models in various contexts. Implementation of VBP should therefore be accompanied with rigorous evaluation comprising both quantitative and qualitative methods and with careful documentation of design choices and tradeoffs made.

Second, risk adjustment and risk sharing are crucial measures to mitigate unintended effects of confronting providers with financial risk. An important direction for further research is how risk adjustment can be tailored to the specific purpose of provider payment. We have shown that risk-adjustment models used in VBP programs in practice typically make use of algorithms that were originally developed for the purpose of health plan payment. Arguably, the risk characteristics in these models may not be appropriate for risk adjusting provider payments because providers may have other incentives and tools for risk selection and other undesired behaviors. On the other hand, ethical constraints tempering such behaviors may be stronger for providers than for health plans. Design of risk adjustment for provider payment requires a better understanding of the differences in incentives, tools, and possible mitigating factors between providers and health plans. In addition, in this research only two forms of risk-sharing were studied. Many other forms are possible, including risk corridors. The design and effects of these other forms in the context of provider payment is an interesting avenue for further research.

Finally, more insight is required in the practical consequences of shifting financial risk to providers. For example, when providers bear substantial financial risk, relevant regulatory bodies might consider them as insurers and confront them with similar solvency requirements. This is an important but understudied issue. The same holds for the possible practical consequences in terms of (violation of) competition and antitrust regulations when larger provider entities with larger patient panels are developed for risk-bearing purposes.

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Summary

Despite substantial contributions of healthcare systems to life expectancy and quality of life, in many countries it is widely recognized that there remains considerable room for improvements in the efficiency, quality, and outcomes of health care. In the context of ever-increasing healthcare expenditures, realizing more 'value' in health care has therefore increasingly become a focal point in health policy. An essential element in the transition towards more value is restructuring the financial incentives embedded in consumer and provider payment systems. There are at least two reasons for this. First, financial incentives have been convincingly shown to influence behavior. Second, predominant payment systems are ill-aligned with value. What alternative systems should look like and what this would entail in practice, however, remains poorly understood. Therefore, the main aim of this dissertation is to provide insights into key issues in the design of alternative, value-based payment incentives for consumers and providers, and in associated tradeoffs and incentive effects. In doing so, we contribute to the body of knowledge concerning smarter choices in payment system design.

Chapter 1 introduces the topic of this dissertation and describes the relevance of focusing on the design of value-based payment incentives for consumers and providers. Incentives for (un)desired consumer and provider behavior are positioned within the theory of agency and an overview of common consumer cost sharing and provider payment models is presented. This chapter also introduces the objectives and research questions that are addressed in this dissertation.

In **chapter 2** we present our research on consumer cost-sharing methods to counteract moral hazard in health insurance markets. In many countries, policymakers are faced with choices on the specific design of cost sharing. An important factor in this decision-making process is which design is expected to lead to the strongest incentives for cost-conscious behavior. This chapter focuses on the design of one of the most popular methods of cost sharing: the deductible. As explained in this chapter, the common deductible design does not provide effective incentives for cost-conscious behavior to consumers with high expected healthcare expenses. Using rich administrative individual-level data, a simulation model is developed to compare the incentives for cost-conscious behavior for different groups of consumers under various deductible designs. We show that different designs result in different incentives for cost-conscious behavior and that these incentives may differ across risk-groups. An important finding is that a deductible with an adjustable starting point based on people's expected healthcare costs not only results in more effective incentives for cost-conscious behavior, but also to a more equal distribution of out-of-pocket payments across consumers with low and high expected healthcare costs.

In **chapter 3** we turn to the question what the 'optimal' provider payment system in theory looks like given a five-dimensional definition of value in health care: high quality of care, cost-consciousness, well-coordinated care, cost-effective innovation, and prevention. Based on synthesis of theoretical and empirical studies on provider behavior and payment incentives, we conclude that given this definition of value, a payment model ideally consists of two components: (1) a relatively large base payment that implicitly stimulates value and (2) a relatively small payment that explicitly rewards quality. Being the largest component, the base payment and its design is

crucial. We explain why this base payment ideally (1) is a single payment to a multidisciplinary group of providers, (2) pertains to a comprehensive set of care activities for a predefined population, (3) is fixed for a defined period, (4) is adjusted according to the risk profile of the population, and (5) is accompanied by risk-mitigating measures.

In **chapter 4** we turn our attention from theory to practice. Based on a systematic literature review we identify 18 provider payment reform initiatives from practice that come close to the theoretically 'optimal' design (i.e., a global base payment combined with explicit quality incentives). We describe how these payment reform initiatives are operationalized, and their effects on spending and quality. The initiatives are quite heterogenous regarding the operationalization of the two payment components and associated design features. Main commonalities between initiatives are a strong emphasis on primary care, the use of virtual spending targets with risk-sharing arrangements built on existing (often fee-for-service like) payment systems, and the application of risk adjustment and other risk-mitigating measures. Evaluated initiatives generally show promising results in terms of spending and quality, although in general methodologically sound research is scarce.

In **chapter 5** we focus on the question how a global payment can be designed such that financial risk is kept manageable for providers and unintended consequences are prevented as much as possible. In a simulation study using rich administrative data, we examine the relative impact on primary care providers' financial risk of four key determinants of that risk related to the design of the global base payment: the scope of the care package covered by the payment, the sophistication of risk adjustment, the presence or absence of risk sharing for high-cost cases, and patient panel size. We show that in our data the scope of the care package is the most important determinant of financial risk. In addition, irrespective of panel size, more sophisticated risk adjustment and applying full risk sharing for the 1% most costly cases sharply decreases risk, particularly for more comprehensive care packages. Finally, to bring financial risk for providers to appropriate levels, sufficiently large patient populations are required.

In **chapter 6** we examine an innovative form of risk sharing: residual-based risk sharing. Despite its potential, this form of risk sharing has not been studied in the context of provider payment. In this chapter we provide insight into the incentive effects and tradeoffs associated with the design of residual-based risk sharing in the presence of morbidity-based risk adjustment. Using rich administrative data, we simulate the effects of various modalities of residual-based risk sharing for primary care providers under global payment on cost-control incentives, risk selection incentives, upcoding incentives, and excessive provider-level losses/profits. We show that to substantially reduce the risk of unwanted effects through residual-based risk sharing, a sacrifice of incentives for cost control is required. Though small levels of risk sharing can achieve much in terms of less risk on unwanted effects, an acceptable reduction of that risk still requires a sizeable sacrifice of cost-control incentives. We conclude that residual-based risk sharing is a promising design feature of global provider payment models and that it is up to decision makers to make the unescapable incentive tradeoffs, given context-specific preferences.

In **chapter 7** the main findings of this dissertation are discussed and implications for policy and practice and suggestions for future research are presented. We emphasize the importance of paying sufficient attention to the design of the global base payment. Stakeholders should adjust the payment design to the specific context, while accounting for local economic and societal preferences. This is a process fraught with complex tradeoffs that should not be underestimated and requires a step-by-step approach and long-term vision. The most important suggestion for further research is to accompany implementation of VBP with rigorous evaluation comprising both quantitative and qualitative methods.

Samenvatting

Hoewel de gezondheidszorg substantieel heeft bijgedragen aan een hogere levensverwachting en betere kwaliteit van leven, is duidelijk dat er veel ruimte voor verbetering is op het gebied van doelmatigheid, kwaliteit en uitkomsten van zorg. Het realiseren van meer 'waarde' in de zorg is de afgelopen jaren dan ook een belangrijk speerpunt geworden in gezondheidszorgbeleid. Een essentieel onderdeel hierbij is het hervormen van de financiële prikkels voor zorgconsumenten en zorgaanbieders, vanwege twee redenen. Ten eerste beïnvloeden financiële prikkels gedrag, ook in de zorg. Ten tweede wordt 'waarde' door de huidige vormgeving van financiële prikkels niet gestimuleerd, integendeel. Er is echter weinig bekend over hoe alternatieve financiële prikkels er idealiter uit zouden moeten zien. Daarom beoogt dit proefschrift inzicht te geven in belangrijke kwesties in de vormgeving van alternatieve, 'waardegedreven' financiële prikkels voor consumenten en zorgaanbieders en in de bijbehorende afwegingen en prikkelwerking. Zodoende dragen we bij aan de kennis over slimmere keuzes in de wijze van betaling voor de zorg.

Hoofdstuk 1 biedt achtergrondinformatie over de vormgeving van waardegedreven financiële prikkels voor consumenten en zorgaanbieders. Het probleem van ongewenst consument- en zorgaanbiedergedrag wordt gepositioneerd binnen de principaal-agenttheorie. Daarnaast wordt een overzicht gegeven van de meest gangbare wijzen waarop de financiële prikkels voor consumenten en zorgaanbieders zijn vormgegeven. Ten slotte introduceert dit hoofdstuk de doelstellingen en onderzoeksvragen die in dit proefschrift aan de orde komen.

In **hoofdstuk 2** presenteren we ons onderzoek naar financiële prikkels voor consumenten in de vorm van eigen betalingen om moreel risico op zorgverzekeringsmarkten tegen te gaan. In veel landen staan beleidsmakers voor de keuze hoe eigen betalingen specifiek vorm te geven. Een van de overwegingen in dit besluitvormingsproces is welke vormgeving naar verwachting zal leiden tot de sterkste prikkels voor kostenbewust gedrag. In dit hoofdstuk staat de vormgeving van een populaire vorm van eigen betalingen centraal: het eigen risico. Uiteengezet wordt dat de huidige vormgeving van het eigen risico geen effectieve prikkels voor kostenbewust gedrag geeft aan consumenten met hoge verwachte zorgkosten. Op basis van administratieve data ontwikkelen en illustreren we een simulatiemodel waarmee prikkels voor kostenbewust gedrag kunnen worden vergeleken bij een verschillende vormgeving van het eigen risico. We laten zien dat verschillende manieren waarop het eigen risico kan worden vormgegeven resulteert in verschillende prikkels voor kostenbewust gedrag voor verschillende groepen consumenten. Een belangrijke conclusie is dat een eigen risico met een variabel startpunt dat afhankelijk is van de verwachte zorgkosten van de consument, niet alleen leidt tot effectievere prikkels voor kostenbewust gedrag, maar ook tot een meer solidaire verdeling van eigen betalingen tussen consumenten met lage en hoge verwachte zorgkosten.

In **hoofdstuk 3** gaan we in op de vraag hoe een theoretisch 'optimale' bekostiging van zorgaanbieders er uit zou zien, gegeven een vijf-dimensionale definitie van 'waarde' in de zorg: goede kwaliteit van zorg, kostenbewust gedrag, goed afgestemde zorg, kosteneffectieve innovatie en preventie. Op basis van de bevindingen van eerdere theoretische en empirische studies op het gebied van het zorgaanbiedersgedrag en financiële prikkels concluderen we dat – gegeven deze definitie

van waarde – een bekostigingsmodel idealiter bestaat uit (1) een relatief grote basiscomponent met impliciete prikkels voor waarde en (2) een relatief kleine aanvullende component met expliciete prikkels voor kwaliteit. Gezien de omvang van de basiscomponent, is juist de vormgeving van deze component cruciaal. Wij laten zien dat de basisbekostiging idealiter (1) één bedrag omvat voor een multidisciplinaire groep van zorgverleners dat (2) vast is voor een bepaalde periode, (3) betrekking heeft op een uitgebreid zorgpakket voor een bepaalde patiëntenpopulatie, (4) wordt aangepast aan het specifieke risicoprofiel van de populatie en (5) risicobeperkende maatregelen bevat. Een zodanig vormgegeven basiscomponent wordt ook wel populatiebekostiging genoemd.

In **hoofdstuk 4** verleggen we de focus van theorie naar praktijk. Op basis van een systematische review van de literatuur identificeren we 18 initiatieven met alternatieve bekostiging die overeenkomen met de theoretisch optimale vormgeving (dat wil zeggen populatiebekostiging gecombineerd met expliciete financiële prikkels voor kwaliteit). We beschrijven hoe de bekostigingsmodellen in deze initiatieven worden geoperationaliseerd en wat het effect is op kosten en kwaliteit. De initiatieven verschillen sterk in de uitwerking van de twee bekostigingscomponenten en in de specifieke kenmerken van het ontwerp. De belangrijkste overeenkomsten tussen de initiatieven zijn een sterke nadruk op eerstelijnszorg, het gebruik van normatieve prestatiedoelen met verrekening achteraf op basis van gedeclareerde kosten, een correctie voor verschillen in ziekterisico tussen patiënten of verzekerden en de toepassing van andere risicobeperkende maatregelen. Geëvalueerde initiatieven laten over het algemeen veelbelovende resultaten zien in termen van kosten en kwaliteit van zorg, hoewel het aantal beschikbare evaluatiestudies van hoge kwaliteit beperkt is.

In **hoofdstuk 5** richten we ons op de vraag hoe populatiebekostiging zodanig kan worden ontworpen dat het financiële risico voor zorgaanbieders behapbaar blijft en de kans op ongewenste neveneffecten beperkt is. In een simulatiestudie op basis van administratieve data onderzoeken we de relatieve invloed van vier determinanten van financieel risico in relatie tot de vormgeving van het populatiebekostigingsmodel op het financiële risico van eerstelijnszorgaanbieders: de omvang van het zorgpakket waarop de bekostiging betrekking heeft, de verfijndheid van het model voor risicocorrectie, volledige risicodeling voor patiënten met zeer hoge kosten, en de omvang van de patiëntenpopulatie. We laten zien dat in onze data de omvang van het zorgpakket de grootste impact heeft op het financiële risico. Daarnaast constateren we dat, ongeacht de omvang van de patiëntenpopulatie, het verbeteren van de risicocorrectie en het toepassen van hoge kosten compensatie dit risico aanzienlijk verlaagt, met name in geval van omvangrijke zorgpakketten. Ten slotte laten we zien dat omvangrijke patiëntenpopulaties nodig zijn om het financiële risico voor zorgaanbieders op een acceptabel niveau te brengen.

In **hoofdstuk 6** richten we ons op een innovatieve vorm van risicodeling in de aanwezigheid van geavanceerde risicocorrectie, te weten risicodeling op basis van residuele kosten. Ondanks de potentiële voordelen is de impact van deze specifieke vorm van risicodeling nog niet onderzocht in de context van bekostiging van zorgaanbieders. In dit hoofdstuk geven we inzicht in de (uitruil in termen van) prikkelwerking in relatie tot de vormgeving van deze specifieke vorm van risicode-

ling. Op basis van administratieve data simuleren we het effect van diverse varianten van risicodeling op basis van residuele kosten op doelmatigheidsprikkels, selectieprikkels, prikkels voor 'upcoding' en het risico op excessieve verliezen/winsten voor eerstelijnszorgaanbieders. We laten zien dat een opoffering in termen van doelmatigheidsprikkels nodig is om de kans op ongewenste neveneffecten te verminderen. Hoewel beperkte risicodeling de kans op deze ongewenste effecten al sterk doet verminderen, is een aanzienlijke opoffering van doelmatigheidsprikkels nodig om de kans te reduceren tot een acceptabel niveau. We concluderen dat risicodeling op basis van residuele kosten een veelbelovende optie is bij de vormgeving van het populatiebekostigingsmodel en dat het aan relevante beleidsmakers is om de onontkoombare voor- en nadelen in termen van prikkelwerking af te wegen, gegeven de context-specifieke voorkeuren.

In **hoofdstuk 7** worden de belangrijkste bevindingen van dit proefschrift bediscussieerd en worden de implicaties voor beleid en praktijk en suggesties voor vervolgonderzoek gepresenteerd. We benadrukken het belang van een zorgvuldige vormgeving van de basisbekostigingscomponent in plaats van enkel te focussen op de kwaliteitsbeloning. Beleidsmakers zouden bij de vormgeving van de financiële prikkels rekening moeten houden met de specifieke context, gegeven de lokale economische en maatschappelijke voorkeuren. Dit complexe proces moet niet onderschat worden en vraagt om een stapsgewijze aanpak en een langetermijnvisie. De belangrijkste suggestie voor vervolgonderzoek is om de implementatie van waardegedreven bekostiging gepaard te laten gaan met diepgaande kwantitatieve en kwalitatieve evaluatiestudies.

PhD portfolio

Name D. (Daniëlle) Cattel
Department: Erasmus School of Health Policy and Management (ESHPM)
PhD period: November 2014 – March 2021
Promotor: Prof.dr. F.T. Schut
Copromotor: dr. F. Eijkenaar

Education	Year
Bachelor of Science (cum laude) in 'Beleid en Management voor de Gezondheidszorg', Erasmus University Rotterdam, the Netherlands	2013
Master of Science in 'Health Economics, Policy and Law', specialization in 'Health Economics', Erasmus University Rotterdam, the Netherlands	2014
University Teaching Qualification (in Dutch: Basis Kwalificatie Onderwijs), Risbo, the Netherlands (2018)	2018

International peer-reviewed publications (published or preparing for submission)	Year
Cattel, D., R.C. van Kleef & R.C.J.A. van Vliet. 2016. 'A method to simulate incentives for cost containment under various cost sharing designs: An application to a first-euro deductible and a doughnut hole.' *European Journal of Health Economics* 18: 987–1000	2016
Cattel, D., F. Eijkenaar & F.T. Schut. 2020. 'Value-based provider payment: Towards a theoretically preferred design.' *Health Economics, Policy and Law* 15(1): 94-112.	2020
Cattel, D. & F. Eijkenaar. 2020. 'Value-based provider payment initiatives combining global payments with explicit quality incentives: A systematic review.' *Medical Care Research and Review* 77(6): 511-537.	2020
Cattel, D. & F. Eijkenaar. 2020. 'How to manage financial risk for capitated primary care providers? The impact of care package, risk adjustment, risk sharing, and patient panel size.' *Preparing for submission.*	2020
Cattel, D., F. Eijkenaar & R.C. van Kleef. 2021. 'Getting the incentives right: Simulating the effects of residual-based risk-sharing for primary care providers under global payment.' *Preparing for submission.*	2021

Dutch publications	Year
Cattel, D., F. Eijkenaar & F.T. Schut. 2019. 'Betalen voor waarde in de zorg.' *We are finance* 3:32-34.	2019
Cattel, D., F. Eijkenaar, K. Ahaus & M. Van der Laar. 2021. 'Bundelbekostiging in de zorg mogelijk, ondanks belemmeringen.' *ESB* 106(4794):86-89.	2021
Qruxx. 2021. 'Interview Daniëlle Cattel over bundelbekostiging.' Publication *Qruxx.nl* in April.	2021

Contributions to Dutch policy research projects	Year
Cattel, D., F. Eijkenaar, R.C. van Kleef, en R.C.J.A. van Vliet (2016). "Onderzoek risicoverevening 2017: Berekening normbedragen" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2016
Cattel, D., F. Eijkenaar, R.C. van Kleef, en R.C.J.A. van Vliet (2016). "Onderzoek risicoverevening 2017 Overall Toets" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2016
Cattel, D., F. Eijkenaar, R.C. van Kleef, en R.C.J.A. van Vliet (2016). "Onderzoek risicoverevening 2017: Gegevensfase" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2016
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2017). "Onderzoek risicoverevening 2018: Berekening Normbedragen" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2017

Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2017). "Onderzoek risicoverevening 2018: Overall Toets" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2017
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2017). "Onderzoek risicoverevening 2018: Gegevensfase" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2017
Cattel, D., Eijkenaar F, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2017). "Onderzoek risicoverevening 2018: Pre-Overall Toets" Rapport iBMG, Rotterdam: Erasmus Universiteit.	2017
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2018). "Onderzoek risicoverevening 2019: Berekening Normbedragen" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2018
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2018). "Onderzoek risicoverevening 2019: Overall Toets" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2018
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2018). "Onderzoek risicoverevening 2019: Gegevensfase" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2018
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2019). "Onderzoek risicoverevening 2020: Berekening Normbedragen" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2019
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2019). "Onderzoek risicoverevening 2020: Overall Toets" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2019
Cattel, D., F. Eijkenaar, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2019). "Onderzoek risicoverevening 2020: Gegevensfase" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2019
Cattel, D., F. Eijkenaar, M. Oskam, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2020). "Onderzoek risicoverevening 2020: Berekening Normbedragen" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2020
Cattel, D., F. Eijkenaar, M. Oskam, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2020). "Onderzoek risicoverevening 2020: Overall Toets" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2020
Cattel, D., F. Eijkenaar, M. Oskam, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2020). "Onderzoek risicoverevening 2020: Gegevensfase" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2020
Cattel, D., F. Eijkenaar, M. Oskam, R.C. van Kleef, R.C.J.A. van Vliet en A.A. Withagen-Koster (2020). "Onderzoek risicoverevening 2021: pre Overall Toets" Rapport ESHPM, Rotterdam: Erasmus Universiteit.	2020

PhD training	**Year**
'Ready within four years', Erasmus University Rotterdam	2015
'Academic writing in English', Erasmus University Rotterdam	2015
'Innovative teaching in health economics', international Health Economics Association	2015
'Modelling healthcare costs and counts', international Health Economics Association	2015
'Teaching plenary sessions', Erasmus University Rotterdam	2015
'Keeping students' attention', Erasmus University Rotterdam	2015
'Presenting and networking', Erasmus University Rotterdam	2016
'SAS base programming', SAS institute Huizen	2016
'Personal branding and networking', Erasmus University Rotterdam	2016
'Presentation skills', Erasmus University Rotterdam	2016
'Effective communication', Erasmus University Rotterdam	2017

'Active blended learning', Erasmus University Rotterdam	2017
'A new digital learning environment: Canvas', Erasmus University Rotterdam	2018
'Online interactive tool experience', Erasmus University Rotterdam	2020

Conferences and seminars	**Year**
International Health Economics Association, Milan	2015
Risk Adjustment Network, Solothurn	2015
Risk Adjustment Network, Berlin	2016
Annual conference of the Dutch Association for Health Economics, Utrecht	2016, 2020
ESHPM/EUR research seminars, Rotterdam	2016-2020
International Health Policy Conference, London	2017
Seminar on 'Population-based payments' by the Dutch Ministry of Health, Welfare and Sport, Den Haag	2017
LoLa Health Economics Study Group, Rotterdam	2017
Conference on 'Purchasing health care' by Zorgvisie, Utrecht	2018
Bi-annual national meetings Linnean Initiative, the Netherlands	2018-2020
Conference on 'Affordable networks and population-based payments' by the Rijksacademie, Den Haag	2019
Conference 'Smarter Choices for Better Health' by the Erasmus Initiative, Rotterdam	2019
Risk Adjustment Network, digital meeting	2020

Invited conference and seminar presentations	**Year**
ESHPM, Rotterdam	2015
International Health Economics Association, Milan	2015
ESHPM, Rotterdam	2016
Risk Adjustment Network, Berlin	2017
Dutch Ministry of Health, Welfare and Sport, The Hague	2017
ESHPM, Rotterdam	2017
International Health Policy Conference, London	2017
Dag van de zorginkoop, Utrecht	2018
Dutch Ministry of Health, The Hague	2018
ESHPM, Rotterdam	2019
Symposium 'Betaalbare netwerken en populatiebekostiging', Den Haag	2019
ESHPM, Rotterdam	2019
Smarter Choices for Better Health, Rotterdam	2019
Vereniging voor Gezondheidseconomie, Utrecht	2020

Projects and committees	**Year**
Member of 'jongBMG', ESHPM's PhD association	2015-2017
Co-organizer of the post-academic course 'Risk equalization: what, why, and where do we stand?' at ESHPM, Rotterdam	2016, 2018

Member of the project team that calculates the risk equalization payments for health insurers in the Netherlands	2016-present
Co-organizer of a multi-day in-house training for data-analysts working for a Dutch health insurer on statistics and the use of quality data	2017
Member of the external sounding board of the Dutch Health Authority on their long-term vision on the remuneration of hospital care	2017
Member of the steering committee 'Quality in education'	2017
Principal teacher quantitative research during the reform of the bachelor's program	2017-2020
Member of the Linnean Initiative workgroup 'Provider payments'	2018-2021
Member of the strategic workgroup 'Future-oriented education'	2019

Supervising and teaching experience	**Year**
Mentor of first-year bachelor students	2015
Tutor and supervisor in the bachelor course 'Stage: werken in de zorg'	2015
Supervisor in the premaster course 'Kwantitatief Leeronderzoek'	2015-2016
Tutor in the bachelor course 'Algemene Economie van de Gezondheidszorg'	2015-2017
Coordinator and tutor in the bachelor course 'Multivariate analyse'	2015-2019
Lecturer in the master course 'Economics and Financing of Healthcare Systems'	2017-present
Coordinator, lecturer, and tutor in the bachelor course 'Marktordening in de zorg'	2019-present
Bachelor thesis supervisor	2020-present

About the author

Daniëlle Cattel (1990) completed a BSc. in Health Sciences in 2013 (with distinction) and obtained her master's degree in Health Economics, Policy and Law in 2014 at the Erasmus University Rotterdam. She then became a PhD student at Erasmus School of Health Policy and Management (ESHPM). Her research focusses on the design of innovative payments models for consumers and providers to enhance value in health care. The results of her research are published in several peer-reviewed scientific as well as professional journals. In addition, she presented her work to a wide range of audiences, including fellow researchers, policymakers, and students. While working on her dissertation, Daniëlle was a member of the project team that calculates the risk equalization payments for health insurers in the Netherlands and of the Linnean Initiative workgroup on value-based provider payments. As a teacher and coordinator, Daniëlle was involved in nine different courses of the bachelor's, pre-master's, and master's program of ESHPM.

Hoewel de gezondheidszorg substantieel heeft bijgedragen aan een hogere levensverwachting en betere kwaliteit van leven, is duidelijk dat er veel ruimte voor verbetering is op het gebied van doelmatigheid, kwaliteit en uitkomsten van zorg. Het realiseren van meer 'waarde' in de zorg is de afgelopen jaren dan ook een belangrijk speerpunt geworden in gezondheidszorgbeleid. Een essentieel onderdeel hierbij is het hervormen van de financiële prikkels voor zorgconsumenten en zorgaanbieders. Er is echter weinig bekend over hoe alternatieve financiële prikkels er idealiter uit zouden moeten zien. Dit proefschrift beoogt inzicht te geven in belangrijke kwesties in de vormgeving van innovatieve, 'waardegedreven' financiële prikkels voor consumenten en zorgaanbieders en in de bijbehorende afwegingen en prikkelwerking.