

2020-09-24

A comparison between alternative primary care physician payment models: A systematic review and policy analysis

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Souri, S. (2020). A comparison between alternative primary care physician payment models: A systematic review and policy analysis (Master's thesis, University of Calgary, Calgary, Canada). Retrieved from <https://prism.ucalgary.ca>.

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A comparison between alternative primary care physician payment models: A systematic review and policy analysis

by

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE
DEGREE OF MASTER OF SCIENCE

GRADUATE PROGRAM IN COMMUNITY HEALTH SCIENCES

CALGARY, ALBERTA

SEPTEMBER, 2020

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Abstract

Objective:

Alternative models of primary care physician payment are being considered by policy makers as a potential way to contain healthcare expenditures. The purpose of this thesis was to synthesize the evidence for alternative primary care physician payment models on quality and economic outcomes worldwide and to make recommendations with respect to payment models that may improve chronic disease management in Canada.

Methods:

We first conducted a systematic review, searching selected databases from inception to October 2018, for studies that compared primary care physician payment models. There were no restrictions on language, country, or publication date, however studies were restricted to specific study designs (randomized controlled trial, controlled cohort and interrupted time series). A gray literature search was also conducted. The outcomes considered were quality and access to care, patient and physician satisfaction, clinical outcomes, healthcare utilization and costs. Thirteen studies were selected for synthesis, comparing fee-for-service, capitation, incentive payments, and mixed models. We then identified primary care payment methods currently used in Canada through an environmental scan. We applied evidence from the systematic review to evaluate the impact of the three most promising models on quality, utilization, cost, and implementation feasibility, and made a recommendation.

Conclusion:

Primary care payment models have moved toward incentive payments and mixed models in recent years, and mixed models have promising effects on cost and utilization overall and for managing chronic disease in primary care in Canada. Incentive payments show low sustainability in quality improvements,

and a gap in incentivized and non-incentivized aspects of care. Mixed models have been introduced in primary care in Canada. Based on current evidence, the recommended payment model for Canadian primary care physicians that is most likely to optimize chronic disease management is blended capitation. Future studies should focus on long-term quality improvements and improving the quality of non-incentivized activities in incentive models. Further study would help to elucidate the potential benefit of mixed models, in particular their effect on patient-oriented aspects of care: access, continuity, and quality. More studies are needed to understand how blended capitation payment models affect costs and utilization.

Preface

This thesis is original, unpublished work by the author, Sepideh Souri.

Acknowledgements

I could not have achieved success without a strong support group. First of all, my entire family, Hossein Souri, Mansoureh Khodabandehloo, Soheil Souri, and Nilofar Souri who supported me with love and understanding from the beginning of this journey. Secondly, my supervisor, Dr. Kerry McBrien, for going above and beyond her role to support me. And last but not least, my committee members, each of whom has provided patient advice, feedback, and guidance throughout the years. I would also like to thank Dr. Braden Manns for generously offering me the SVARE Chair Studentship. Thank you all for your unwavering support.

Dedication

I dedicate this thesis to my dear parents, Mansoureh and Hossein. Thank you for all that you have done, all these years, choosing to give up your dreams to help me reach mine.

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List of Abbreviations

ARP	Alternative Relationship Plan
CBA	Controlled Before and After study
CCM	Comprehensive Care Model
CCRCT	Cochrane Central Register of Controlled Trials
CDSR	Cochrane Database for Systematic Reviews
CHC	Community Health Center
CHF	Congestive Heart Failure
COPD	Chronic Obstructive Pulmonary Disease
DARE	Database of Abstracts of Reviews of Effects
EPOC	Cochrane Effective Practice and Organisation of Care Group
FFS	Fee-for-service
FHG	Family Health Group
FHN	Family Health Network
FHO	Family Health Organization
FMG	Family Medicine Groups
HSO	Health Service Organization
ITS	Interrupted Time Series
NHS EED	National Health Service Economic Evaluation Database
P4P	Pay for Performance
PCMH	Patient-Centered Medical Home
PCN	Primary Care Network
PCP	Primary Care Physician
PCR	Primary Care Reform

RCT

Randomized Controlled Trial

Chapter 1

1. Introduction

1.1 Problem

Primary health care in Canada has a dual function in the Canadian health care system (1). First, it includes the direct provision of first-contact services by primary care physicians, nurse practitioners, pharmacists, and telephone advice lines (1). Second, it ensures continuity and ease of movement in the system, so that care remains integrated when specialized services are required (1).

The fee-for-service (FFS) payment model compensates primary care physicians each time they deliver services to patients (2). FFS rewards physician productivity and in theory, matches effort with compensation. It also gives the physician more control over their practice and income, increasing physician autonomy. A disadvantage in this model is that it can lead to supplier induced demand, where the physician may encourage the patient to consume more care than necessary, stemming in part from a knowledge imbalance that exists between them (2). While FFS payments may increase quantity of care (2) and should in theory compensate for the time and complexity associated with physician tasks, this payment model has limitations. The complexity involved in assigning reimbursement levels associated with the multitude of physician services is vast and payments do not always take into account the indirect time associated with patient care. Given that health care resources are limited, payment models that may lead to a more efficient and cost-effective use of resources are being implemented and tested. A number of alternative physician payment models exist, the most common of which are capitation, salary, pay-for-performance (P4P; in addition to a base model), and mixed models of payment. In capitation, physicians have a set fee, paid annually or monthly, adjusted by age, sex, and sometimes other modifying factors, for each person on their roster (3). Capitation reduces the probability of supplier induced demand; however, it has the disadvantage of lower productivity compared to FFS and higher chances of taking on healthy patients. Salary provides a regular fixed instalment of wages per time period, independent of

other factors (3). Salary payments give the provider the advantage of a stable and predictable income, especially when working in a region with low demand for physician services. The downsides of this payment model are that quality of care may not be monitored, and this model can lead to low physician productivity. Pay-for-performance links physicians' income to the quality of the services they provide. Payment is made once the physician fulfills their tasks according to specified guidelines (4). An advantage of the pay-for-performance model is that quality of care can be monitored for incentivized activities. However, quality can deteriorate for non-incentivized activities, giving this model an important disadvantage.

Mixed models of payment combine two or more of the above models with the goal of combining their advantages and reducing the potential for negative behavioural incentives (5). Although mixed models are predicted to do well in theory as they combine the positive aspects of different payment models, they can be complex in nature. This means physicians will need more time to understand and adjust to them.

While there are theoretical arguments for alternative payment models being useful for improving the efficiency and quality of primary care delivery, the true effects can only be understood through studies in practice. A Cochrane systematic review (2000) by Godsen *et al.* assessed the impact of capitation, salary, FFS, and mixed systems of payment on the behaviour of primary care physicians (6). This review identified four studies by Davidson 1992, Krasnik 1990, Hickson 1987, and Hutchinson 1996 that met inclusion criteria.

The Davidson 1992 study (7) had two interventions. The first intervention was a capitation model and the second intervention was a higher paying FFS model. In the higher paying FFS intervention group, general physicians were paid a fee for comprehensive exams (including treatment), routine office visits, initial hospital visits and follow up hospital visits (7). The control group in this study was a lower paying FFS model, where physicians were paid a fee for the same services as the higher paying group, but the

fee was approximately half the size.

This study showed that after adjustment for underreporting and controlling for patient demographic characteristics and baseline differences in utilization, the number of primary care visits remained the same before and after the interventions (capitation and higher paying FFS) were introduced. This study also found that the number of non-primary care visits increased in all groups except for the capitation group.

In the Krasnik 1990 (8) study the intervention group was Copenhagen general physicians who changed from a capitation model to capitation/FFS payment model in 1987. The study's control group was general physicians in Copenhagen county who were already being paid through a capitation/FFS model. This study showed that physician activities (prescription renewals, number of examinations, and face-to-face consultations) increased, where they added services for existing patients rather than adding more patients.

In the Hickson 1987 (9) study, salaried primary care physicians carried out fewer scheduled and well child visits per enrolled patient on average compared with FFS physicians, differences that were statistically significant. The Hutchinson 1996 (10) study in Canada found that FFS primary care physicians, whose payment changed to a capitation/incentive payment system, did not have lower hospitalization rates. Overall, the Gosden *et al.* (2000) review concludes that payment systems influence physician behaviour, however, the evidence was not robust enough to make firm recommendations and further research was necessary.

Since the publication of the Gosden *et al.* (2000) review, there have been multiple reforms in physician payment in developed countries. In Canada several provinces have initiated reforms. In Alberta, there have been experiments with capitation (11) and alternative relationship plans, wherein physicians are contracted for services and remunerated based on time and scope of services provided

(i.e., not FFS) (12). Ontario experimented with all payment models, introducing mixed models (FFS mixed with incentives and capitation mixed with incentives), incentive-based payments, and salary-based payments (13). British Columbia and New Brunswick have experimented with incentive-based payments (14-17). Quebec introduced Family Medicine Groups, which are groups of physicians working as a team with nursing personnel that care for a registered group of patients in collaboration with other components of the health care system (18). Family Medicine Groups housed in private practices are mainly reimbursed through FFS, however, they receive a small amount per patient enrolled (18).

In the United Kingdom multiple quality improvement strategies have been implemented. In 1990, the UK introduced a modest pay-for-performance model in primary care settings to reach target levels of childhood immunization and cervical cancer screening (19). The positive result of this change was increased performance and reduction in socioeconomic inequalities. In 2004, given that this modest change was successful, a more ambitious form of pay-for-performance was introduced to primary care in the UK, where 20-25% of primary care physicians' income was based on a set of approximately 75 indicators for clinical care and 75 indicators for practice organization and patient experience (19). Although pay-for-performance has reduced socioeconomic disparities in care received, critics believe it has introduced a negative "tick box" culture into primary care (19).

Recently, the United States expanded the medical home concept, which is, according to the American College of Physicians, a care delivery model where patient care is coordinated through primary care physicians to ensure access to necessary and timely medical services for all patients (20). According to Berenson and Rich (2010), compensating physicians only using one of FFS, capitation, or salary models is not sufficient to facilitate the enhanced primary care services of patient-centered medical homes (21). They suggest that a more supported payment model would be bundling of services or performance-based payments, perhaps pay-for-performance on top of an existing model.

Given that alternative payment models are becoming increasingly popular in primary care across the world and in Canada, and in view of the pressures that governments are under to manage health care spending, it is important to synthesize evidence in the form of a systematic review and assess alternative primary care payment models with respect to health system related outcomes (e.g. utilization and costs) and patient related outcomes (e.g. quality of care).

To this end, this thesis includes a systematic review of the existing literature and summary of the impact of alternative models of payment for primary care physicians. The systematic review allowed us to comprehensively search and analyze existing literature, which is valuable to decision makers as it will provide them with an up-to-date comparative analysis of the evidence to base their decisions on. After completion of the systematic review, we critically analyzed the payment models in a policy analysis. We identified Canadian primary care payment models through an environmental scan and applied the results from the systematic review to assess each model's response to chronic disease management in Canada. Chronic disease management was chosen because, aside from it being one of the responsibilities of primary care physicians in Canada, more Canadians are being affected by chronic diseases in recent years, making this evaluation timely. Payment models were evaluated in terms of expected changes in quality of care, utilization, costs, and feasibility of implementation.

1.1.1 Research Questions

What is the impact of primary care physician payment models on quality and economic aspects of care, including quality of care, access to care, patient satisfaction, physician satisfaction, clinical outcomes, health service utilization, and health care costs? Which primary care physician payment model shows the most promise in managing chronic disease in Canada when evaluated on quality of care, utilization, costs and feasibility?

1.1.2 Defining quality of care

Defining quality of care is one of the challenging aspects of this study and is dependent on the

perspective taken. From a patient's perspective quality can be defined in terms of health outcomes, wait times, access to care, continuity of care, or satisfaction with care (5). A physician might define quality in terms of patient outcomes (survival or disease-free states), professional autonomy, or practice satisfaction. To the healthcare system, quality may be appropriateness of services provided and budget control (5). In this study, all these perspectives on defining quality were considered.

1.2 Significance and purpose

Alternative physician payment models have been implemented and studied in a number of jurisdictions since the completion of the 2000 Godsen *et al.* review. This thesis provides a comprehensive review of the literature including peer-reviewed and gray literature, updating the findings of the Godsen review, and a targeted policy analysis of primary care payment models in Canada. The findings and conclusions of this thesis will be useful to health care decision makers considering physician payment options that maximize quality of care and minimize health care costs, particularly for patients with chronic diseases. Taxpayers and citizens may also benefit if health systems adopt payment models that are more efficient and produce better quality care.

2. Literature Review

This literature review presents a detailed discussion of the main primary care payment models. Payments are either prospective or retrospective in nature. Prospective payments provide a fixed payment rate, whereas retrospective payments tend to be activity based. A summary of this information can be found in Table 1 at the end of this section.

2.1 Fee-for-service

The fee-for-service model compensates physicians each time they deliver services to patients (6). An advantage of this model is that physicians are rewarded for productivity. A disadvantage is that, according to some studies, it can lead to supplier induced demand (6). Physicians practicing in this model may provide frequent short visits. Some provinces and territories in Canada have implemented enhanced FFS models to offset some of the disadvantages of this model (22). Enhancements are bonuses for complex and chronic disease management, block funding to complement the FFS payments in rural settings, and funding to assist physician groups to collaborate in a multidisciplinary setting.

2.2 Capitation

In the capitation model, physicians have a set fee, paid annually or monthly, adjusted by age, sex, and sometimes other modifying factors, for each person on their roster (3). A study by Iversen and Luras (2000) found that since physicians in the study switched from a FFS remuneration model to a capitation model, the number of referrals they sent out for services that they, themselves, could provide increased (23). Robinson (2001) proposes that capitation improves efficiency of primary care practice by divorcing revenues from costs incurred (24). He further suggests that in the U.S. and the British National Health Services, primary care capitation was very successful in limiting medical service cost growth.

Proponents of the capitation model believe that some of the advantages of this model include reducing incentives for supplier-induced demand and increasing disease prevention and health promotion (5). Rudmik *et al.* (2014) also suggest that capitation reduces the quantity of care provided to patients, which can lead to lower health care expenditures; however, this may come at the cost of reduced productivity (5).

2.3 Salary

The salary payment model provides a regular fixed instalment of wages per time period, independent of other factors (3). According to Robinson (2001), although salary payments undermine productivity, the simplicity of this payment form is advantageous when considering the administrative costs of designing, negotiating, and implementing complex payment models (24). Rudmik *et al.* (2014) suggest that this method of physician payment is best in under-populated and under-supplied regions, providing an incentive to physicians who agree to work in areas with less predictable demand for physician services (5).

2.4 Incentive-based payments

Incentive-based payments are added to a base model, rewarding physicians based on various parameters. These parameters can be performance-based (as in P4P), or they can be non-performance-based, such as paying a fixed amount for providing after-hours care. A specific kind of incentive payment is pay-for-performance, which is linked to meeting a set of indicators that are thought to reflect the quality of the work provided by the physicians (4). A systematic review done by Lin *et al.* in 2015 proposed that applying the pay-for-performance program in primary health care settings improved clinical performance for most diseases studied, including diabetes, hypertension, asthma, epilepsy and cancer. This was, however, limited by the baseline quality of medical care and the scale of the medical institution (4).

Research done by Fleetcroft *et al.* in 2010 found no association between pay-for-performance indicators and physician behaviour and patient outcomes (26). Chen *et al.* (2011) found that lower quality primary care practices that had applied the pay-for-performance indicators excluded patients with severe conditions (27).

2.5 Mixed systems of payment

Mixed models of payment combine two or more models (FFS, capitation, salary, incentive-based) with the goal of maximizing their advantages and reducing the potential for negative behavioural incentives (5). Robinson (2001) (24), states that there are four key features of clinical practice, in terms of economic incentives. They are physician productivity and patient service; risk acceptance; efficiency and appropriate scope of practice; and cooperation and evidence-based medicine. Robinson states that two of the most important dimensions of physician performance (productivity and patient service, and risk acceptance) are well served by the FFS model. The other two most important dimensions of physician performance (efficiency and using appropriate scope of practice, and cooperation and using evidence-based medicine) are well served by the capitation model. Thus, he suggests that none of these two models in their pure forms are optimal forms of physician payment. Rather, a blend of elements of retrospective and prospective payment methods would work better.

2.5.1 Fee-for-service and capitation

Combining capitation with FFS allows physicians to receive a fixed payment for each enrolled patient on their roster for a fixed basket of commonly provided services plus FFS for out of basket services, and a smaller FFS payment for in-basket services (28). Theoretically, this payment system may lead to the provision of more appropriate levels of quantity and quality of medical services. However, little is known about how this model performs in comparison to the traditional FFS model, especially for primary care physicians (28).

2.5.2 Fee-for-service and salary

Through this model physicians receive a fixed payment, while still billing FFS, earning a percentage of the set fees (29). Because this model is based on a salary payment, it is beneficial for

recruiting physicians to low-populated regions (5). The FFS payments provide an incentive for physicians to maintain a standard level of productivity. According to Rudmik *et al.* (2014) knowledge related to mixed payment systems is very limited and future research needs to investigate the quality of care provided and health care costs in these models (5).

2.6 Knowledge Gap

According to Rosenthal (2008), although the faults in current physician payment systems are known, it is not clear which approach to physician payment will yield better results under given circumstances (30). The primary care profession is experiencing a challenging time in terms of compensation and professional satisfaction that has led to payment reforms specifically focused on primary care (30). While alternative models were introduced in Ontario in 2001 and 2003, some of these reforms have not been studied thoroughly. In order to gain a better understanding of physician payment models and which approach is appropriate under given circumstances, such as in chronic care management, a summary and critical analysis of existing studies is needed.

Table 1. Summary of payment models

Payment Type	Description
Fee-for-service (FFS)	Physicians reimbursed for each service delivered to patients (6). Payment is made retrospectively
Pay-for-Performance (P4P)	Physician compensation linked to quality of services provided, based on a set of indicators (4). Payment is made retrospectively
Capitation	A set fee paid per patient, paid annually or monthly, often adjusted by age, sex, and other patient characteristics (3). Payment is made prospectively
Salary	A regular fixed instalment of wages per time period, independent of other factors (3). Payment is made prospectively

Mixed systems of payment	Combine two or more models (FFS, capitation, salary, pay-for-performance) with the goal of maximizing their advantages (5)
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This thesis includes a systematic review in chapter two, a policy analysis in chapter three, followed by a concluding chapter.

References

1. About primary health care Canada: Government of Canada; 2012 [updated August 23, 2012]. Available from: <https://www.canada.ca/en/health-canada/services/primary-health-care/about-primary-health-care.html>.
2. Evans R. Supplier induced demand: some empirical evidence and implications. *The economics of health and medical care*. 1974.
3. Wranik D, Durier-Copp M. Framework for the design of physician remuneration methods in primary health care. *Social work in public health*. 2011;26(3):231-59.
4. Lin Y, Yin S, Huang J, Du L. Impact of Pay for performance on Behavior of Primary Care Physicians and Patient Outcomes. *Journal of evidence-based medicine*. 2015.
5. Rudmik L, Wranik D, Rudisill-Michaelsen C. Physician payment methods: A focus on quality and cost control. *Journal of Otolaryngology - Head and Neck Surgery*. 2014;43(34).
6. Gosden T, Forland F, Kristiansen I, Sutton M, Leese B, Giuffrida A, et al. Capitation, salary, fee-for-service and mixed systems of payment: effects on the behaviour of primary care physicians. *Cochrane Database Syst Rev*. 2000;(3):CD002215.
7. Davidson SM ML, Werner SM, Hohlen MM, Yudkowsky BK, Fleming GV. . Prepayment with office-based physicians in publicly funded programs: results from the Children's Medicaid Program. . *Pediatrics* 1992;89(4 Pt 2):761-7.
8. Krasnik A GP, Pedersen PA, von Scholten P, Mooney G, Gottschau A, et al. Changing remuneration systems: effects on activity in general practice. . *BMJ* 1990;300(6741):1698-701.
9. Hickson GB AW, Perrin JM. . Physician reimbursement by salary or fee-for-service: effect on physician practice behavior in a randomized prospective study. *Pediatrics* 1987;80(3):344-50.
10. Hutchison B BS, Hurley J, Lomas J, Stratford- Devai F. Do physician-payment mechanisms affect hospital utilisation? A study of Health Service Organisations in Ontario. *Canadian Medical Association Journal* 1996;154(5):653-61.
11. A case study evaluation of Crowfoot village family practice and the Taber clinic. Calgary, Alberta, Canada: Health Quality Council of Alberta; 2019 October 2019.
12. Yan CK-R, J.; Chuck, A. Financial Incentives to Physician Practices: A literature review of evaluations of physician remuneration models. Institute of Health Economics; 2009.
13. Primary Care Payment Models in Ontario Ontario, Canada: Ministry of Health - Ministry of Long-Term Care; 2020 [updated March 26, 2020]. Available from: <http://www.health.gov.on.ca/en/pro/programs/pcpm/>.
14. Lavergne MRL, M. R.; Peterson, S.; Garrison, S.; Hurley, J.; Cheng, L.; McGrail, K. A population-based analysis of incentive payments to primary care physicians for the care of patients with complex disease. *CAMJ*. 2016;188(15).
15. Hollander MJ, Kadlec H. Incentive-Based Primary Care: Cost and Utilization Analysis. *Perm J*. 2015;19(4):46-56.
16. Gupta N, Lavalley R, Ayles J. Effects of Pay-for-Performance for Primary Care Physicians on Preventable Diabetes-Related Hospitalization Costs Among Adults in New Brunswick, Canada: A Quasiexperimental Evaluation. *Can J Diabetes*. 2019;43(5):354-60 e1.
17. LeBlanc E, Belanger M, Thibault V, Babin L, Greene B, Halpine S, et al. Influence of a Pay-for-Performance Program on Glycemic Control in Patients Living with Diabetes by Family Physicians in a Canadian Province. *Can J Diabetes*. 2016;41(2):190-6.
18. Breton M, Lévesque JF, Pineault R, W H. Primary Care Reform: Can Quebec's Family Medicine Group Model Benefit from the Experience of Ontario's Family Health Teams? *Healthc Policy*. 2011;7(2):e122-2135.

19. Roland M, Guthrie B, Thomé DC. Primary Medical Care in the United Kingdom. *Journal of The American Board of Family Medicine*. 2012;25:S6-11.
20. What is the Patient-Centered Medical Home? : American College of Physicians; 2017 [
21. Berenson RA, Rich EC. US Approaches to Physician Payment: The Deconstruction of Primary Care. *Journal of General Internal Medicine*. 2010;25(6):613-8.
22. Faloon T. Module 8: Physician remuneration options. ON, Canada; 2012.
23. Iversen T, Luras H. The effect of capitation on GPs' referral decisions. *Health Economics*. 2000;9:199-210.
24. Robinson JC. Theory and Practice in the Design of Physician Payment Incentives. *The Milbank Quarterly*. 2001;79(2):149-77.
26. Fleetcroft R, Parekh-Bhurke S, Howe A, Cookson R, Swift L, N S. The UK pay-for-performance programme in primary care: estimation of population mortality reduction. . *British Journal of General Practice*. 2010;60(578):e345-52.
27. Chen TT, Chung KP, Lin IC, MS L. The unintended consequence of diabetes mellitus pay-for-performance (P4P) program in Taiwan: are patients with more comorbidities or more severe conditions likely to be excluded from the P4P program? *Health Services Research*. 2011;46(1 Pt 1):47-60.
28. Kralj B, Kantarevic J. Quality and quantity in primary care mixed-payment models: evidence from family health organizations in Ontario. *Canadian Journal of Economics*. 2013;46(1):208-38.
29. Wranik DW, Durier-Copp M. Physician remuneration methods for family physicians in Canada: expected outcomes and lessons learned. *Health care analysis : HCA : journal of health philosophy and policy*. 2010;18(1):35-59.
30. Rosenthal MB. Beyond Pay for Performance — Emerging Models of Provider-Payment Reform. *N Engl J Med*. 2008;359:1197-200.

Chapter 2

This chapter presents a systematic review of studies comparing various primary care physician payment models with respect to patient, physician and healthcare system related outcomes. These outcomes of interest were quality of and access to care, patient and physician satisfaction, clinical outcomes, healthcare utilization and costs. Thirteen studies were selected to be included in this review, comparing fee-for-service, capitation, salary, incentive payments, and mixed models. The following is a manuscript formatted for the Health Policy journal, summarizing this systematic review.

Impact of primary care physician payment models on quality and economic outcomes: a systematic review

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Competing interests

The authors declare that they have no competing interests.

Funding

SVARE Chair Research Studentship in Health Economics

Acknowledgements

The authors thank University of Calgary Health Sciences Library Director Diane Lorenzetti for assistance with the search strategy.

Abstract

Primary care physician payment models, through their effect on physician behaviour, may influence both the quality and efficiency of care. We conducted a systematic review to synthesize the current evidence on the impact of primary care payment models on quality and economic outcomes.

We searched eight databases from inception to October 2018. Eligible studies compared two primary care physician payment models using interrupted time series, controlled before after, and randomized controlled trials. Outcomes of interest included quality of and access to care, patient and physician satisfaction, clinical outcomes, healthcare utilization, and costs. Studies were grouped based on payment models and were synthesized narratively.

Thirteen studies met inclusion criteria. Two studies compared capitation and fee-for-service (FFS) and had conflicting results. Incentive payments led to improvements in targeted behaviours that were not sustained, and quality gaps between incentivized and non-incentivized aspects of care. Compared to FFS, mixed models using capitation or salary with incentives reduced utilization and expenditures, however, there were no studies examining their effect on patient related outcomes.

There is a paucity of robust studies comparing primary care physician payment models. The outcomes studied are limited. Most studies published in the recent years focus on incentive and mixed models. Based on the current body of evidence, mixed models appear best suited for achieving the combined goal of quality and efficiency, however further study would improve on our limited knowledge.

Introduction

Health policy makers are keen to implement physician payment models that maximize patient-related aspects of care while minimizing costs (1, 2). The fee-for-service (FFS) payment model pays physicians a fee for each service delivered (3, 4). While FFS payments may increase quantity of care (5) and should in theory compensate for the time and complexity associated with physician tasks, this payment model has limitations. The complexity involved in assigning reimbursement levels associated with the multitude of physician services is vast and payments do not always take into account the indirect time associated with patient care. Further, studies show that this payment model may lead to physician-induced demand for health services (3, 4).

Alternative models of physician payment are capitation (payment per patient on a physician's roster) (5) and time-based payments (fixed payment per time period- including sessional payments and salary arrangements) (5). Performance-based incentive payments (P4P) have also been introduced, where incentive payments are tied to achieving clinical targets based on a list of indicators aimed at improving quality of care (6, 7). Mixed models of payment combine two or more of these models with the goal of maximizing their advantages and reducing potential for negative behavioural incentives (7).

A systematic review of primary care physician payment models by Gosden *et. al.* (2000) (3) assessed the impact of capitation, salary, fee-for-service, and mixed systems of payment on the behaviour of primary care physicians (PCP) (3). This study sought to find evidence on five categories of outcomes: PCP job satisfaction, quantity and cost of secondary care referred services and primary care services, pattern and type of care, access to care (including in specific sub-populations), and changes in patient health status and clinical outcomes. Evidence was only found for the second outcome: quantity and cost of secondary care referred services and primary care services. Studies suggested that the quantity of primary care services provided by FFS physicians was higher compared to capitated and salaried physicians (2, 8). One study showed that costs were higher under capitation compared to FFS (2).

Many countries are using physician payment methods with the goal of aligning behavioural incentives with health care objectives, in the most cost-efficient manner (7). In Canada, Ontario has offered several novel primary care physician payment models. The Comprehensive Care Model (CCM) and Family Health Group (FHG) are FFS-based models with premiums (9). Family Health Network (FHN) and Family Health Organization (FHO) are capitation-based models with premiums and bonuses (10). Community Health Centers (CHC) offer salary-based compensation in rural and low-population areas, or urban centres, targeting low income or otherwise vulnerable populations (11).

In the United Kingdom, the National Health Service pays physicians financial incentives for improving the quality of care for chronic conditions under the Quality and Outcomes Framework, on top of a base payment model (6). These incentives are paid to target specific actions, such as, frequency of treatment initiation, monitoring, and incidence of adverse outcomes. The United States experimented with the pay-for-performance model to improve quality of care (12) before introducing the Patient-Centered Medical Home (PCMH). The medical home concept is patient centered with focus on coordinating care to increase access to and quality of care (13). Health care payers have been experimenting with different payment models with the goal of finding a model that best supports the activities and goals of a PCMH.

According to Rosenthal (2008), although the faults in current physician payment systems are known, it is not clear which approach to physician payment will yield better results under given circumstances (14). While there are theoretical arguments for alternative payment models being useful for improving the efficiency and quality of primary care delivery, the true effects can only be understood through studies in practice. To provide policy makers with an up to date synthesis of the evidence on primary care payment models, we performed a systematic review of the published studies that assessed the impact of primary care physician payment models on quality of care, access to care, patient satisfaction, physician satisfaction, clinical outcomes, health service utilization, and health care costs.

Materials and Methods

We conducted a systematic review of studies comparing different primary care physician payment models on predetermined outcomes. Ethics approval was not required as data were obtained from published literature.

Study outcomes

The outcomes considered in this study include quality of care indicators (e.g., appropriate prescribing), access to care, patient satisfaction, physician satisfaction, clinical outcomes (including morbidity and mortality), health service utilization (including consultation or visit rates, and diagnostic tests), and health care costs (including costs of care to the health care system, which takes into account use of emergency department and hospital services).

Data Sources and Search Strategy

Database search

We searched MEDLINE, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Database of Abstracts of Reviews of Effects, NHS Economic Evaluation Database, EconLit, Web of Science, and Embase from database inception to October 2018. There were no restrictions on language, country, or date of publication. We included all physicians in the initial database search and later separated primary care from specialist physicians. We also searched the bibliographies of included studies. We used comprehensive sets of keywords and MeSH terms to identify three themes in our search strategy:

1. Physicians
2. Study Design

3. Payment models

Synonymous terms such as “doctor” and “physician” were combined with the term “OR”. The three themes were then combined with the term “AND”. The full search strategy is included in Appendix A.

Gray literature search

We used the Google search engine, Canadian sources, such as Des Libris and CD Howe, and global sources of data such as ProQuest Global. The terms used in these searches were “payment model” AND “primary care physician*”. Sources of gray literature are included in Appendix B.

Study Selection

Two authors independently screened titles and abstracts for relevance. The full text of all citations deemed relevant were reviewed independently by two authors. Kappa was calculated after full text review to assess reviewer agreement before settling disagreements. Disagreements between reviewers regarding inclusion were resolved through discussion. If disagreements persisted, a third reviewer was consulted.

Studies were included if the intervention was an alternate model of primary care physician payment. Studies exploring payment models to all other health care professionals were excluded. Studies that only examined payment at the insurance plan or hospital level were excluded. We restricted studies to those with the following study designs: randomized controlled trials (RCTs), controlled before and after studies (CBAs), and interrupted time series analyses (ITS). All other study designs were excluded. These study designs are considered to be of highest quality by the Cochrane Effective Practice and Organisation of Care Group (EPOC) (15), increasing the quality and reliability of the studies that use them. However, by limiting our focus on these designs we may have omitted some studies on primary care physician payment that used a different study design. While RCTs are considered to provide the

most valid measure of the effect of an intervention, there are many instances where performing an RCT is not feasible or ethical (16), thus, non-randomized studies were also considered.

Data Extraction

A standardized data extraction form was used to extract publication date, first author, country, setting characteristics, physician and patient population characteristics, details of physician payment models being compared, outcomes assessed, and study results. All data were extracted by a single author and a second author verified the accuracy of the information.

Risk of Bias Assessment

Study quality was assessed using the Cochrane Effective Practice and Organisation of Care Group risk of bias assessment tool (15). This tool includes an assessment of bias in several domains, including reporting of outcomes. Two reviewers independently assessed risk of bias in each relevant domain as high, low, or unclear. Disagreements were resolved by discussion or with a third reviewer as needed.

Data Synthesis

Studies were grouped based on physician payment models and described in detail. Study heterogeneity precluded quantitative pooling of data; thus, a meta-analysis was not conducted, and instead study results were synthesized narratively.

Results

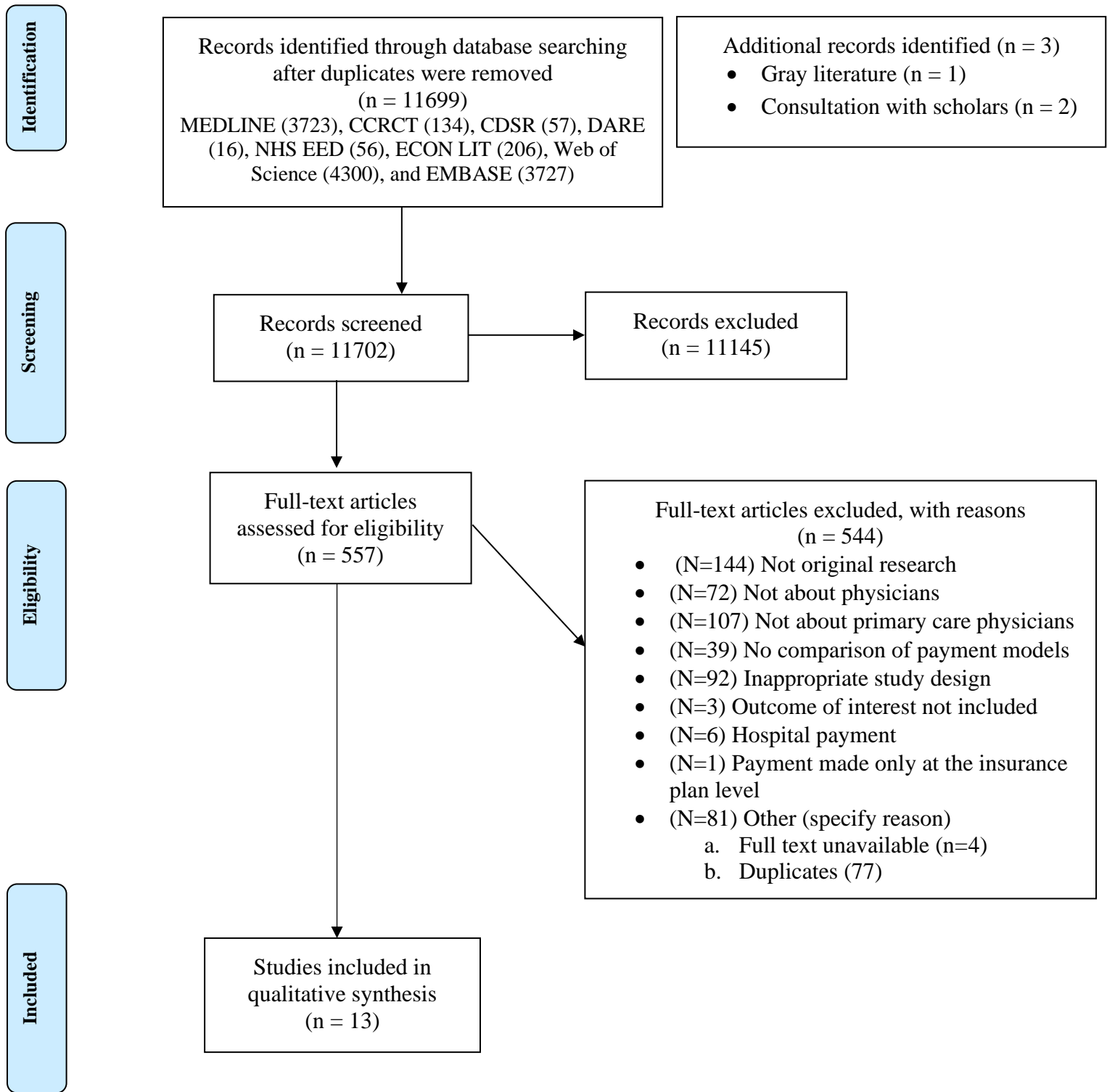
Study Identification

The database search identified 11,699 abstracts, from which 554 were reviewed in full text, and 10 were selected for inclusion. The most common reasons for exclusion were that the articles did not report an original research (144 studies) or they were not about primary care physicians (107 studies).

Our grey literature search found one study. Two additional studies were recommended after consultation with scholars for a total of 13 studies. There was moderate agreement between the reviewers at the full-text review stage with a kappa value of 0.47. A PRISMA flow diagram depicting the search results is presented in figure 1.

[Figure 1 about here]

Figure 1. PRISMA Flow Diagram



Study Characteristics

Study characteristics are summarized in Table 1. Studies were done in USA, Denmark, Canada, China and UK, and published between 1990 and 2018. Three studies were RCTs, five were CBA studies and five were ITS. The most studied outcome was health care utilization (9 out of 13 studies). The most studied payment model was incentive payments (pay-for-performance, P4P) (8 out of 13 studies). Two studies compared capitation and FFS. Three studies compared mixed models of P4P with salary or capitation with FFS.

Table 1. Study characteristics

First Author	Year	Country	Study Design	Patient / setting characteristics	Payment Models	Outcomes
Davidson (2)	1992	USA	RCT	Medicaid-eligible children in Suffolk County, NY	Capitation vs FFS	Health care utilization, Health care expenditure
Krasnik (17)	1990	Denmark	CBA	Physicians in Copenhagen city and Copenhagen county (control group)	Capitation vs FFS	Health care utilization
Lavergne (18)	2018	Canada	ITS	Primary care physicians in British Columbia	P4P	Access to care, Continuity of care, Health care utilization and cost of care
Hurley (19)	2011	Canada	CBA	Data collected from Ontario using administrative databases	P4P	Health care utilization
Serumaga (6)	2011	UK	ITS	Data collected from The Health Improvement Network in the UK, regardless of location	P4P	Quality of care in hypertension
Campbell (20)	2009	UK	ITS	Data collected through medical records from nationally representative family practices	P4P	Quality of care, access to care, continuity of care

Young (12)	2007	USA	ITS	Rochester, NY	P4P	Quality of care in diabetes
Beaulieu (21)	2005	USA	CBA	Primary care physicians in upstate NY	P4P	Quality of care, physician feedback
Kouides (22)	1998	USA	RCT	Rochester, NY and surrounding Monroe County	P4P	Health care utilization
Ritchie (23)	1992	UK	ITS	General practices in Grampian and a few in north Tayside	P4P	Health care utilization
Yip (24)	2014	China	RCT	Ningxia Province, China	Mixed Model: P4P with Capitation vs FFS	Health care utilization, expenditure, patient satisfaction
Wang (25)	2011	China	CBA	Rural setting: Fengsan Township, Guizhou Province (intervention), Machang Township (control)	Mixed Model: P4P with salary vs FFS	Health care utilization, Quality of care, Prescription behaviour changes
Hutchison (26)	1996	Canada	CBA	All capitation based and FFS based practices in Ontario.	Mixed Model: P4P with capitation vs FFS	Health care utilization




Study Quality Assessment

Table 2 presents the results of the risk of bias assessment. Studies were grouped and assessed based on study design: controlled before/after, randomized controlled trials, and interrupted time series. Only one study, Ritchie *et al.* (1992) (23), had low risk of bias in all categories. The weakest study in terms of risk of bias was Davidson *et al.* (1992), with only one category having a low risk of bias out of seven (2). The rest of the studies had high or unclear risk of bias in at least one category.

[Table 2 about here]

Table 2. Risk of bias by individual study

Controlled Before/After							
First Author (Year)	Reliable primary outcome	Group similarity at baseline	Blinding of outcome assessment	Protection against contamination	Follow-up of professionals	Follow-up of patients	Participants similar characteristics
Beaulieu (2005) (21)	Green	Red	Green	Green	Green	Red	Red
Hutchison (1996) (26)	Green	Green	Green	Green	Green	Yellow	Green
Wang (2011) (25)	Red	Yellow	Green	Green	Yellow	Red	Green
Krasnik (1990) (17)	Red	Green	Red	Green	Red	Yellow	Yellow
Hurley (2011) (19)	Red	Green	Red	Green	Yellow	Yellow	Green
Randomized Controlled Trials							
First Author (Year)	Reliable primary outcome measures	Group similarity at baseline	Blinding of outcome assessment	Protection against contamination	Follow-up of professionals	Follow-up of patients	Allocation concealment
Davidson (1992) (2)	Yellow	Green	Yellow	Yellow	Yellow	Yellow	Yellow
Yip (2014) (24)	Green	Green	Yellow	Green	Yellow	Yellow	Green
Kouides (1998) (22)	Red	Green	Green	Green	Green	Yellow	Yellow
Interrupted Time Series							
First Author (Year)	Reliable primary outcome measures	Protection against secular changes	Data analysed: time series regression models	Rationale for points pre/post intervention given	Intervention shape specified	Protection against detection bias	Completeness of data set
Lavergne (2018) (18)	Green	Green	Green	Red	Green	Green	Yellow
Serumaga (2011) (6)	Green	Yellow	Red	Red	Green	Green	Red
Campbell (2009) (20)	Green	Green	Green	Red	Green	Green	Red
Young (2007) (12)	Green	Yellow	Red	Green	Green	Green	Green
Ritchie (1992) (23)	Green	Green	Green	Green	Green	Green	Green

 Low risk of bias
 Unclear risk of bias
 High risk of bias

Summary of results

Capitation vs Fee for Service

Davidson *et al.* (1992) (2) performed an RCT in USA in 80 physician practices serving children in the Medicaid program. They compared an existing FFS payment model with two intervention payment models: capitation and a new FFS model. In the new FFS model physician payments for services provided were doubled. Study outcomes were healthcare utilization (visits) and expenditures. The capitation model consisted of fixed payments adjusted for patient age. The physicians in the capitation group were pre-paid and assumed financial risk for almost all services used by their patients: a \$2000 limit for primary care services and a \$25/patient/month set aside for non-PCP visits with a penalty for going over this limit. The FFS groups did not assume any financial risk. Non-PCP (specialist physician) visits increased in the FFS groups by 26.9 and 36.4% but decreased in the capitation group by 8.1%. The number of hospitalizations declined by 54.7% in the capitation group, by 30.6% in the new FFS group, and by 36.1% in the old FFS group. None of these values were statistically significant. Study findings regarding healthcare expenditures, i.e. healthcare costs, were inconclusive. This study had several limitations and was found to have high risk of bias: statistical tests were not fully performed; PCP characteristics were not reported; and it is unclear whether randomization was successful.

Krasnik *et al.* (1990) (17) completed their study in Denmark and used a controlled before after study design to compare Copenhagen city physicians that had recently switched from capitation to FFS (intervention) to Copenhagen county physicians who had already adopted the FFS payment system (control). Health care utilization in the form of prescription renewals, face-to-face contacts and phone consultations; curative services used; and referrals made were studied. The total contacts (telephone and face to face) rose in the city (intervention group) significantly between the first two data collection rounds, which is before and after the intervention. This increase was

significantly greater than in the county (control group) in the same period. In the FFS intervention group, significant increases were seen in the examination and curative services between first and second rounds and first and third rounds. This was significantly larger than the numbers seen in the county control group. Referrals to specialists and hospitals decreased significantly in the FFS intervention group. This decrease was significantly different from the county only in the third round. No p-values were reported for this study, but we can judge statistical significance by analyzing the confidence intervals. These intervals do not cross zero and so statistical significance exists.

Some of the limitations in this study include possibility of underreporting, since after the intervention there was greater cost to the physician to spend more time filling in study forms. Thus, intervention group results may have underestimated results. There was also an element of self-selection in recruiting doctors for the study, which may have introduced some bias.

Overall, these two studies that directly compared FFS with capitation had conflicting results. One study found that non-PCP services were higher under FFS while the other found the opposite. Further, in one study, PCP service volume was higher under capitation, while in the other, they were higher under FFS. Both studies had significant limitations.

Incentive payments alone

Eight studies looked at incentive payments made to primary care physicians.

Lavergne *et. al.* (2018) (18) conducted an interrupted time series study using linked administrative data for primary care physicians in British Columbia, Canada. Incentives were introduced three times, in September 2003, April 2006, and September 2009. Physicians were paid by FFS but received incentives for providing guideline concordant care to patients with diabetes (\$75, then changed to \$125), hypertension (\$50), and COPD (\$125). Access to and continuity of care were evaluated in this study, along with testing and pharmaceutical dispensing,

hospitalizations, and cost of care. The most significant changes were seen in the hypertension group. A decrease in primary care visits for patients with hypertension after the introduction of incentives was statistically significant, but not clinically important (from 77.6% to 75.3%). There were no other notable changes in visits or continuity of care. A small increase in testing trends following the intervention was observed in the diabetes patients, but it was not statistically significant. Testing in COPD increased right after introducing the incentives and declined after. This change was not statistically significant. In terms of prescribing, there was no change in prescribing for diabetes; prescribing for both hypertension and COPD increased, but only the changes for hypertension were statistically significant. Of note, visits to primary care doctors other than the usual care provider were not accounted for. Health care spending increased in patients with hypertension; the increased spending was mostly accounted for by laboratory testing and prescription medications.

Hurley *et. Al.* (2011) (19) conducted a controlled before after study with family physicians in the province of Ontario, Canada. Eligibility to participate was based on whether or not the physicians were in Ontario's Primary Care Reform (PCR) practices. Eligible family physicians received performance incentive payments in the study period (intervention), whereas ineligible physicians received no incentives and only received usual FFS payments (control). In the intervention group physicians were incentivized to increase the utilization of five preventive services: cervical cancer screening with Pap smear, colorectal cancer screening, mammograms, influenza immunization in seniors, and routine immunizations in toddlers. Preventive service utilization increased in four of the five services studied compared to the no incentive group. The relative percentage increase in services, compared to baseline, were: colorectal cancer screening (56.7%), Pap smear (7.0%), mammogram (2.8%), and influenza immunization in seniors (5.1%). Routine immunizations in toddlers did not change.

Serumaga *et al.* (2011) (6), Campbell *et al.* (2009) (20), Young *et al.* (2007) (12), and Beaulieu *et al.* (2005) (21) all studied incentive programs in chronic care where performance on quality indicators was measured and compared before and after the introduction of the incentive program.

Serumaga *et al.* (2011) (6) conducted a study in the UK and used an interrupted time series design to study five quality indicators for hypertension. They assessed blood pressure (BP) measurements, BP control, percentage of patients that had blood pressure measured every month, number of drugs used to treat hypertension, new drug treatment, adverse hypertension-related clinical outcomes, and all-cause mortality. Doctors were incentivized for reducing the blood pressure measurement below 150/90 mm Hg. None of these indicators were significantly changed after the introduction of the incentive program.

Campbell *et al.* (2009) (20) used an interrupted time series study in the UK to assess quality, access to and continuity of care in three chronic conditions: coronary heart disease, asthma, and diabetes. Quality of care increased in diabetes, but at the same rate measured in the pre-intervention period. Quality of care in asthma and heart disease improved over the first year but then plateaued. Quality scores increased for incentivized and decreased for non-incentivized aspects of care in asthma and coronary heart disease, creating a gap in quality of care. No significant change in access to care was identified post-intervention. Continuity of care decreased post-intervention.

Young *et al.* (2007) (12) used an interrupted time series to study five quality performance measures for diabetes before and after the introduction of incentive payments in USA. There was a statistically significant improvement in performance level, but the trends pre- and post- incentive introduction were similar, suggesting that the incentives were not responsible for the improvement in performance.

Beaulieu *et al.* (2005) (21) also looked at quality of care measures in diabetes in USA, measuring indicators such as HbA1c levels, lipid tests, retinal exam, nephropathy test, foot exam, and BP. Their controlled before after study showed statistically significant improvement in 5 out of 6 measures.

Kouides *et al.* (1998) (22) compared FFS with incentive payments with FFS payment alone in a randomized controlled trial conducted in the USA. Financial incentives were paid for an increase in immunization rates in the elderly. They found a statistically significant greater increase in immunization rates in the incentive group compared to the control group.

Ritchie (1992) (23) used ITS study design and assessed the effect of incentive payments for childhood immunizations in Scotland, where practitioners received additional payments for immunizing at least 90% of children. The trend in immunization rates remained the same before and after the introduction of the target payment.

Overall, results are mixed and indicate that incentive payments lead to improvements in targeted services (in 3 of 6 studies), but not in all cases and the effect may be short-lived and may have negative effects on non-incentivized services.

Mixed Model Studies

Three studies assessed mixed models of payment for primary care physicians. Two studies compared incentive payments with capitation to FFS, while one study compared incentive payments with salary to FFS.

Yip *et al.* (2014) (24) and Hutchison *et al.* (1996) (26) compared incentive payments with capitation to FFS. Yip *et al.* conducted a randomized controlled trial in China where intervention physicians were paid capitation as well as incentives for prescribing fewer antibiotics, while control physicians were maintained on a FFS model. Outcomes included antibiotic prescribing, health and

drug expenditures, patient consultations, and satisfaction (24). In the incentive/capitation group, there was a statistically significant decrease in antibiotic prescriptions and expenditures per visit. No evidence of an impact on patient satisfaction or patient volume was found. Hutchison *et al.* (1996) conducted a controlled before after study in Canada, where the intervention was capitation with incentive payments and control physicians remained in a FFS model. In their study incentives were paid for lower hospitalization rates (26). They did not find a significant change in health care utilization in the incentive/capitated group compared to the FFS group.

Wang *et al.* (2011) (25) conducted a CBA study in China where they compared salary plus incentive payments to FFS. Their primary outcomes were outpatient service utilization, cost of outpatient services, and quality of care. Their secondary outcome of interest was prescription behaviour changes. They found that when comparing pre- and post-intervention, health care utilization dropped due to fewer visits. Health spending and prescription of unnecessary drugs also decreased (statistically significant). Of note, tests for statistical significance were not reported for health care utilization.

Overall, one of two studies examining capitation/incentive models found that health care utilization, in the form of antibiotic prescriptions and per visit expenditures decreased compared to the FFS group. One study examining salary/FFS found that health care utilization, expenditures and prescription dispensing decreased compared to the FFS group.

The detailed summary of each included paper is presented in table 3.

[Table 3 about here]

Table 3. Summary of included studies

Author Year Country	Study Design	Participants and Setting	Intervention and Control	Outcome	Study findings	Conclusion
Capitation vs. FFS						
Davidson 1992 (2) USA	RCT	-80 primary care physicians -Children in the Medicaid program -Capitation: n=764 New FFS: n=1015 Control: n=1991	-Intervention groups: Capitation and new FFS -Control group: Old FFS -New FFS: Higher payment rates compared to old FFS -Capitation: Fixed monthly payment varied by patient's age. -Old FFS: Same services provided as the new FFS, but with half the fee payment -Physicians in the capitation group were at financial risk for the cost of most services. FFS group was not	-Primary outcome: PCP visits, non-PCP visits, clinic/ED visits, hospitalizations -Secondary outcome: Healthcare expenditure	-Visits to non-PCP increased (26.9-36.4% in all groups except capitation (decreased by 8.1%) -Number of hospitalizations decreased the most for capitation group (54.7%), and the least for old FFS (36.1%) -PCP service expenditures increased in both capitation and new FFS interventions -Specialist physician service expenditures decreased in capitation (p<0.05) -Total change in expenditures not significant in either intervention group	-Capitation resulted in a decrease in Non-PCP visits, but cost savings are uncertain.
Krasnik 1990 (17) Denmark	CBA	-FFS payment method introduced in October 1987 in Copenhagen city. FFS already in place in Copenhagen county before this date -Intervention: n=71 -Control: n=326	-Intervention group: PCPs in Copenhagen city (Capitation to FFS) -Control group: PCPs in Copenhagen county (FFS) -Data collected once before October 1987 and twice after	Health care utilization (per 1000 enlisted patients in one week): -Number of face-to-face or phone consultations -Prescription renewals -Diagnostic and curative services -Specialist and hospital referrals	-Rate of contact and face-to-face consultations rose significantly from the first to second data collection dates in the city compared to the county -Prescription renewal showed significant fall between first and second rounds, but not compared to the county -Rates of examinations and curative services were significantly larger in the city from the first to second rounds and first to third rounds, as compared to the county -Rate of referral to hospitals and to specialists decreased significantly	-Physician activities increased: added services to existing patients rather than adding patients -Referrals decreased -Target income higher than achieved before the payment change
Pay for Performance/Incentive payment						
Lavergne (2018) (18) Canada	ITS	-Used linked administrative data of all primary care physicians in British Columbia -Incentives introduced in September 2003. April 2006, September 2009	-Physicians are paid by fee-for-service and are eligible to bill for providing guideline informed care to patients with diabetes, hypertension, and COPD, payable once per year - Diabetes: \$75 (later increased to \$125) -Hypertension: \$50 -COPD: \$125	-Access to care (through primary care use): measured by tracking the number of visits -Continuity of care: Percent of primary care visits across the whole study population in each month -Also kept track of testing and pharmaceutical dispensing, hospitalization rates, and cost of care	- There was a statistically significant decline in primary care visits with the patients' usual provider of care from 77.6% to 75.3% among patients with hypertension (clinically unimportant change) -There were no other notable changes with primary care visits or continuity of care -No statistically significant changes in testing and prescribing -No change in total hospitalizations -Significant increase in spending was seen in hypertension (additional spending on GPs and pharmaceuticals) -Among diabetes patients there was an increase in GP spending that was offset by declining acute care spending -Increase in GP spending for COPD patients was not statistically significant	-No change observed in primary care visits or continuity -No statistically significant change in testing and prescribing -Health care spending increased significantly for hypertension patients
Hurley 2011 (19) Canada	CBA	-Family physicians in the province of Ontario with an annual billing of >/ \$30,000 per year -Covers fiscal years 1998-9 to 2007-8 -Physicians from four PCR practices participated: Family	-Intervention: Family physicians eligible for performance incentives in the study period -Control: Family physicians not eligible for the performance incentives in the study period. These physicians stayed in FFS payment	-Health care utilization (physicians contacting patients and billing: provision of services) - Services: Pap smears, colorectal cancer screening, senior flu shots, toddler immunization, mammogram	-Utilization: Rate of uptake was low: Proportion of eligible physicians who submitted at least one claim for contacting a patient to arrange an appointment. Less than 45% of eligible physicians submitted a claim	-Bonus payments increased the rate of service provision for four out of five services studied (all except toddler immunization)

		Health Networks (FHNs), Family Health Groups (FHGs), Comprehensive Care Models (CCMs) and Family Health Organizations (FHOs)			-Higher compliance rate in pap smears and colorectal cancer screening in the treatment group vs. control. Other 3 services showed no difference or were ambiguous. -Rate of service provision increased with bonus payments: Percentage of relative impact to baseline for colorectal cancer screening (56.7%), Pap smear (7.0%), senior flu shot (5.1%), and mammogram (2.8%)	
Serumaga 2011 (6) UK	ITS	-P4P in chronic care (hypertension) -358 general practices -470,725 patients -Two subgroups: Newly treated (n=103,009) and treatment experienced (n=104,754) -from January 2000 to July 2007	-P4P introduced in UK in April 2004 -Data collected 3 years before and up to four years after from The Health Improvement Network (THIN) -136 quality indicators (5 for hypertension)	-Quality of care in Hypertension: Blood Pressure (BP) measurements, BP control, percentage of patients that had blood pressure measured every month, number of drugs used to treat hypertension, new drug treatment, adverse hypertension-related clinical outcome, all-cause mortality	-No significant change in frequency of BP measurement -Rate of controlled BP did not change significantly -Percentage of patients with BP measured each month increased -P4P not associated with significant changes in drug prescribing trends -Study controlled for age, sex, smoking status, and diabetes, BMI. Discontinuities observed in the cumulative incidence of experiencing a hypertension related outcome after P4P was introduced were not clinically or statistically significant	-Quality of care and clinical outcomes did not significantly change after P4P introduced
Campbell 2009 (20) UK	ITS	-P4P in chronic care (asthma, diabetes, coronary heart disease) -42 nationally representative family practices -Data extracted from medical records	-Data collected pre- (1998, 2003) and post-intervention (2005, 2007) -Patient evaluation done using General Practice Assessment Questionnaire -Continuity and access to care assessed practitioners' tendency to neglect other aspects of care	-Quality of care -Continuity of care -Access to care	-Quality of care: <u>Coronary heart disease</u> (1998 and 2003: increased by 3.5% per annum on average. 2005 and 2007: rate of improvement dropped below the pre-intervention period). <u>Asthma</u> (1998 and 2003: increased by average of 2% per annum. 2005 and 2007: the trend did not differ significantly from before the intervention period; overall quality hardly changed). <u>Diabetes</u> (1998 and 2003: increased by average of 1.8% per annum. 2005 and 2007: the trend did not differ significantly from before the intervention period; overall quality hardly changed). -Both diabetes and asthma care showed significant quality improvement after the intervention but did not maintain it to 2005. -No significant change in access to care. Continuity of care dropped immediately after intervention and remained there.	-Although quality of care improvement was maintained in asthma and heart disease for a year, they reached a plateau -Diabetes quality of care improved but at the same rate as pre-intervention -Quality score for incentivized aspects of care increased, while it decreased for non-incentivized aspects of care creating a widening gap in quality. -No significant change seen in access to care. Continuity of care decreased,
Young 2007 (12) USA	ITS	-334 physicians in the Rochester Individual Practice Association who were available for the six years from 1999 to 2004	-Intervention: an incentive program comprised of five quality performance measures for diabetes	-Quality of care for diabetes patients	-For each performance measure there was a statistically significant increase in performance level -Pre- and post-intervention trends were not different. Suggesting pattern of performance did not change after the introduction of the incentive program	-All performance measures improved but pre- and post-intervention trends did not change -Only eye examination scores improvement was statistically significant, but short-lived (note: Eye examination scores at the start of the study were the lowest, having more room for improvement)
Beaulieu 2005 (21) USA	CBA	-21 physicians, 1076 patients -Intervention: n=476 -Control: n=600	-Intervention group: self-report by physicians on diabetic patient outcome	-Primary: Quality of care measures in HbA1c levels, lipids test, diabetic retinal	-Statistically significant improvement on 5/6 process measures.	-Improvements were seen in the process and outcome measures.

		-Study period: April 2001-January 2002	measures. Per member per month bonus for physicians who met target. -Control group: annual HEDIS data (Healthcare Effectiveness Data and Information Set)	exam, nephropathy test, foot exam, BP -Secondary: Physician feedback	-Improvements in performance also seen in outcome measures. -Only 8 physicians received 100% incentives based on their scores	-The program led physicians to take initiatives to improve the gap between best practice and actual clinical care delivered.
Kouides 1998 (22) USA	RCT	-54 practices -Intervention (usual care plus additional reimbursements):n=27 -Control (usual care-FFS): n=27 Patients intervention: (n=21,196) Control: (n=17,608) -September 1991to January 1992	-Financial incentives given to physicians for increasing immunization rates in the elderly -Attaining an immunization rate of 70%= 10% additional reimbursement -Attaining an immunization rate of 80%= 20% additional reimbursement	-Increasing immunization rate in the elderly (Quality of Care)	-Median change in immunization rates for the control group (3.5%) compared to the incentive group (10.3%) was statistically significant (p=0.03)	-The objective that a performance-based reimbursement payment model for primary care physicians increase influenza immunization rate to meet the national standard is supported here
Ritchie 1992 (23) UK (Scotland)	ITS	-January 1990 to September 1991 -All general practices in Grampian and some in north Tayside along with their registered patients (total 95 practices and 313 principal GPs) -Children aged 2yrs or 5yrs on the first day of the quarter analysed (avg. 6600 and 6400 children, respectively)	-Primary care practitioners receive incentive payments for immunising at least 90% of the intervention group	-Immunization rate in children in Grampian, Scotland (health care utilization)	-Immunization rate for 2- and 5-year olds followed a trend, which did not change after the introduction of the contract	-Improvements in immunization rates cannot be attributed to the 1991 contract
Mixed Model						
Yip 2014 (24) China	RCT	-Township health centres & village posts in Ningxia -Participants recruited through the EMR system -Assigned 28 towns to either intervention or control group -Intervention (n): 208,482 for township health centres, 338,185 for village posts -Control (n): 231,991 for township health centres, 376,476 for village posts	-Intervention: P4P with capitation -Control: FFS -The intervention group rewarded for fewer antibiotic injection and eliminated service fee of 5 Yuan/injection -Performance measured for antibiotics prescription. Indicators used: antibiotic prescription rates and measures of patient satisfaction -70% of the budget disbursed to township health centers but withheld until performance assessment -Assessments compared performance to the total average score in the county -Townships that scored above average received more than 30% of the budget withheld	-Antibiotic prescription practise (Health care utilization), total health expenditure/visit, drug expenditure/visit, number of patient consultations/day, patient satisfaction	-Antibiotic prescription dropped in both the township health centres and village posts (statistically significant) -Total expenditures per visit dropped in the village posts (statistically significant) -No change in patient volume and satisfaction	-Intervention led to lower primary care antibiotic prescribing practices (health care utilization and expenditure) - No impact on patient volume and satisfaction
Wang 2011 (25) China	CBA	-Intervention site: Fengsen township. The township has 25 village health posts and 37 village doctors -Control site: Machang township -Intervention: 2601 Control: 1879	-The intervention is Salary-plus-bonus: Basic salary: 120 Yuan/mo (15 USD) -Quantity bonus to ensure productivity: 0.5 Yuan/outpatient visit (0.06 USD) -Performance based bonus: up to 100 Yuan/mo (12.5 USD) -Control: FFS -Annual evaluation surveys of patients, provider prescription survey, village doctor's payroll data	-Primary outcome: Outpatient service utilization, cost of outpatient services, quality of care -Secondary outcome: Prescription behaviour changes	-payment model change was associated with 14% decrease in health spending at village posts, 5% increase in drug spending, 15% increase in cost of outpatient services in township health centers	-Health care utilization dropped (fewer visits) -The intervention reduced health spending and prescription of unnecessary medications -More village doctors referred patients to township facilities where the cost of care was higher, leading to

						rise of costs and overall spending
Hutchison 1996 (26) Canada	CBA	-116 primary care physicians that had transferred from FFS to capitation and had remained in the same community for 3 years -Intervention: 39 -Control: 77	-Intervention: capitation + incentives -Control: FFS -Incentive given for lower hospitalization rates (substituting ambulatory care for hospital care)	-Hospital utilization rates (hospital separations and hospital days per 1000 patients in each practice (health care utilization)	-Hospital utilization rates were not significantly different between capitation-based and FFS-based practices	-No support that capitation + incentives reduce hospital use

Discussion

Summary of Findings

This systematic review identified 13 studies that compared capitation, FFS, salary, incentive payments, and mixed payment models in the primary care setting. While we found significant heterogeneity in study design, setting, and interventions, some key findings may help direct future research in this field.

Several studies did not find any significant difference before and after the payment change. This could be due to a few reasons. First, some of these studies used small intervention and/or control groups. This makes reaching a plausible conclusion difficult. Second, short study periods were used in some of the studies. It takes time for physicians to adjust to the new payment model and modify their behaviours. Thus, no change may be seen in a short period of time.

We found only two studies that directly compared FFS to capitation, both published in the 1990s. There were no direct comparisons between salary and FFS or between salary and capitation. Both studies comparing FFS to capitation had limitations and results were conflicting.

Capitation has been compared to FFS in studies that did not meet inclusion criteria of this review. For instance, two primary care practices in Alberta implemented capitation-based payment models in 1999 (27). These practices employed a team-based, patient-centred, accessible, comprehensive, and collaborative approach. Primary care service costs were found to be higher than in rural and metropolitan counterparts that used FFS, however downstream service costs (emergency department and inpatient care) were lower (27).

Incentive payments lead to a wide range of results, and thus, drawing conclusions about their utility is difficult. Issues identified include variable effects, potentially relating to baseline performance, lack of sustained effect, and potentially negative effects on non-incentivized services.

Some of the studies on incentive payments evaluated a very limited set of targeted behaviours (e.g. immunization or antibiotic prescription).

A systematic review of incentive payment studies was done by Lin (2015), which was broader as they did not restrict by study design (28). They found similar results as this review. Practices with lower quality of care at baseline improved more compared to practices with higher baseline quality. They also reported improvements in disease management in terms of higher screening, vaccinations, blood pressure control in hypertension patients, and blood sugar control in diabetes patients. They do not, however, mention the gap in quality between incentivized and non-incentivized aspects of care even though it was reported in some of the papers they included.

Mixed payment models theoretically work better in a cost-conscious and competitive system. According to a report by Robinson (2001), which did not make it into the systematic review because it was not a primary research study, this specially works for mixing elements of FFS with capitation, which is a feature of blended capitation (29). Mixing the two payment models has been successful in constraining cost growth, while also improving primary care efficiency. Robinson (2001) points out that the success of the model declined over the years not because of the payment model or patient difference, but because of diversity in physician practice style. None of the payment models included in this review studied blended capitation (29).

None of the mixed model studies we have included thoroughly explore changes in quality, access to and continuity of care after introduction of the model.

Future studies should focus on patient related aspects of care, namely quality, access, and continuity of care, in mixed payment models, specifically blended capitation, studied under a robust yet feasible study design such as interrupted time series.

Limitations

Although this review was thorough in its methods there are some limitations. One of the limitations of this study is that most of the papers had high or unclear risk of bias. This limits our ability to draw conclusions based on study results. Second, we limited our search to only a few robust study designs, and even though this improved the quality of our evidence, we only found 13 studies, that did not address all potential comparisons. The papers selected were dependent on our search strategy. We attempted to balance the sensitivity and specificity of the search, but it is possible that we inadvertently excluded some studies. For example, the two studies recommended by the scholars were missed. This limitation stems from the diversity in payment model terminology used by different countries, and therefore it is possible that other studies were missed. Studies were heterogeneous in terms of setting, which limits their generalizability and our interpretation of them. Another limitation is that, like with other systematic reviews, reviewer bias exists. This bias was reduced to the best of our ability by using clear inclusion/exclusion criteria and having disagreements solved by a third reviewer if necessary.

Conclusion

Much work needs to be done in studying primary care physician payment models as there is limited evidence for or against specific payment models. While FFS is in theory fraught with issues, we need more studies to determine the impact of alternative models of care in practice. There is no clear evidence that capitation or salary leads to more efficient or higher quality care. Incentive payments appear to lead to improvements in targeted behaviours, but these may be short-lived and may be at the expense of non-incentivized behaviours. Mixed models of payment may allow for a balance of potential advantages and disadvantages of various models, but again, further study is needed because existing evidence is not conclusive.

References

1. Yan CK-R, J.; Chuck, A. Financial Incentives to Physician Practices: A literature review of evaluations of physician remuneration models. Institute of Health Economics; 2009.
2. Davidson S, Manheim, L., Werner, S., Hohlen, M., Yudkowsky, B., Fleming, G. Prepayment with Office-Based Physicians in Publicly Funded Programs: Results from the Children's Medicaid Program. *Pediatrics*. 1992;89(4).
3. Gosden T, Forland, F, Kristiansen, IS, Sutton, M, Leese, B, Giuffrida, A, Sergison, M, Pedersen, L. Capitation, salary, fee-for-service and mixed systems of payment: effects on the behaviour of primary care physicians. *Cochrane Database Syst Rev*. 2000(3):CD002215.
4. Evans R. Supplier induced demand: some empirical evidence and implications. *The economics of health and medical care*. 1974.
5. Wranik D, Durier-Copp, M. Framework for the design of physician remuneration methods in primary health care. *Social work in public health*. 2011;26(3):231-59.
6. Serumaga B, Ross-Degnan D, Avery AJ, Elliott RA, Majumdar SR, Zhang F, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. *BMJ*. 2011;342:d108.
7. Rudmik L, Wranik, D, Rudisill-Michaelsen, C. Physician payment methods: A focus on quality and cost control. *Journal of Otolaryngology - Head and Neck Surgery*. 2014;43(34).
8. Hickson GB AW PJ. Physician reimbursement by salary or fee-for-service: effect on physician practice behavior in a randomized prospective study. *Pediatrics*. 1987;80(3):344-50.
9. To T, Guan J, Zhu J, Loughheed MD, Kaplan A, Tamari I, et al. Quality of asthma care under different primary care models in Canada: a population-based study. *BMC Fam Pract*. 2015;16:19.
10. Primary Care Payment Models in Ontario Ontario, Canada: Ministry of Health - Ministry of Long-Term Care; 2020 [updated March 26, 2020. Available from: <http://www.health.gov.on.ca/en/pro/programs/pcpm/>.
11. Liddy CS, J.; Hogg, W.; Dahrouge, S.; Taljaard, M. Comparison of primary care models in the prevention of cardiovascular disease - a cross sectional study. *BMC Fam Pract*. 2011;12.
12. Young GJ, Meterko M, Beckman H, Baker E, White B, Sautter KM, et al. Effects of paying physicians based on their relative performance for quality. *J Gen Intern Med*. 2007;22(6):872-6.
13. What is the Patient-Centered Medical Home? American College of Physicians [Available from: <https://www.acponline.org/practice-resources/business-resources/payment/delivery-and-payment-models/patient-centered-medical-home/understanding-the-patient-centered-medical-home/what-is-the-patient-centered-medical-home>.
14. Rosenthal MB. Beyond pay for performance--emerging models of provider-payment reform. *N Engl J Med*. 2008;359(12):1197-200.
15. Cochrane Effective Practice and Organisation of Care Review Group (EPOC): Data Collection Checklist. 2002. p. 18-23.
16. Ryan R, Hill, S, Broclain, D, Horey, D, Oliver, S, Priclor, M. Cochrane Consumers and Communication Review Group 2013 [updated June 20,2013. Available from: <http://ccrg.cochrane.org/author-resources>.
17. Krasnik A, Groenewegen, P., Pedersen, P., Scholten, P., Mooney, G., Gottschau, A., Flierman, H., Damsgaard, M. Changing remuneration systems: effectson activity in general practice. *BMJ*. 1990;300:1698-701.

18. Lavergne MR, Law MR, Peterson S, Garrison S, Hurley J, Cheng L, et al. Effect of incentive payments on chronic disease management and health services use in British Columbia, Canada: Interrupted time series analysis. *Health Policy*. 2018;122(2):157-64.
19. Hurley J, DeCicca, P., Li, J., Buckley, G. The Response of Ontario Primary Care Physicians to Pay-for-Performance Incentives. Centre for Health Economics and Policy Analysis. 2011.
20. Campbell S, Reeves, D, Kontopantelis, E, Sibbald, B, Roland, M. Effects of Pay for Performance on the Quality of Primary Care in England. *N Engl J Med*. 2009;361(4).
21. Beaulieu ND, Horrigan DR. Putting smart money to work for quality improvement. *Health Serv Res*. 2005;40(5 Pt 1):1318-34.
22. Kouides RW, Bennett, N.M, Lewis, B., Cappuccio, J.D., Barker, W.H., LaForce, F.M. Performance-Based Physician Reimbursement and Influenza Immunization Rates in the Elderly. *American Journal of Preventive Medicine*. 1998;14(2).
23. Ritchie L, Bisset, A., Russell, D., Leslie, V., Thomson, I. Primary and preschool immunisation in Grampian: progress and the 1990 contract. *BMJ*. 1992;304:816-9.
24. Yip W, Powell-Jackson T, Chen W, Hu M, Fe E, Hu M, et al. Capitation combined with pay-for-performance improves antibiotic prescribing practices in rural China. *Health Aff (Millwood)*. 2014;33(3):502-10.
25. Wang H, Zhang L, Yip W, Hsiao W. An experiment in payment reform for doctors in rural China reduced some unnecessary care but did not lower total costs. *Health Aff (Millwood)*. 2011;30(12):2427-36.
26. Hutchison B, Birch, S., Hurley, J., Lomas, J., Stratford-Devai, F. DO PHYSICIAN-PAYMENT MECHANISMS AFFECT HOSPITAL UTILIZATION? A STUDY OF HEALTH SERVICE ORGANIZATIONS IN ONTARIO. *Can Med Assoc J*. 1996;154(5).
27. A case study evaluation of Crowfoot village family practice and the Taber clinic. Calgary, Alberta, Canada: Health Quality Council of Alberta; 2019 October 2019.
28. Lin Y, Yin, S, Huang, J, Du, L. Impact of Pay for performance on Behavior of Primary Care Physicians and Patient Outcomes. *Journal of evidence-based medicine*. 2015.
29. Robinson JC. Theory and Practice in the Design of Physician Payment Incentives. *The Milbank Quarterly*. 2001;79(2):149-77.

Chapter 3

The findings from the systematic review can be applied in a policy analysis to evaluate the different payment models with a narrower and directed focus. We chose to focus our attention on Canada and specifically looked at how primary care payment models affect chronic disease management. To evaluate the models, we consulted policy experts and chose the framework published by the National Collaborating Centre for Healthy Public Policy (1). This framework includes the criteria for evaluation and the ones most relevant to this study were selected. Evidence was searched and collected through an environmental scan of Canadian literature. The studies included in this policy analysis did not make it to the systematic review because they did not meet the study design criteria used in our review. The evaluation criteria were then applied to each included study. A recommendation was made in the final section of the analysis.

Paying for Chronic Disease Care in Canada: What is the best primary care payment model?

Executive Summary

Chronic disease management, along with other health promotion and management activities is one of the responsibilities of primary care physicians in Canada. There is an increase in prevalence of Canadians with chronic diseases in recent years (2). This trend calls for an evaluation of how primary care payment models affect chronic disease management in Canada. This policy analysis evaluates Canada's primary care physician payment models in their response to chronic disease management. The purpose is to inform policy makers about the most supported

payment model that may lead to quality improvement and cost containment in primary care when treating patients with chronic disease.

Our systematic review of primary care payment models provided evidence for the influence of some payment models on certain health care outcomes, predominantly utilization. We further identified primary care payment models across Canada that were implemented in part to support chronic disease management. Alberta, British Columbia, Ontario, Quebec, and New Brunswick have recently implemented primary care physician payment models meant to enable chronic care delivery. Alberta's Alternative Relationship Plans and capitation payment model are discussed. Then British Columbia's experiment with incentive payments are discussed. Many studies were found in Ontario that examined FFS-based mixed models, capitation-based mixed models, incentive payments, and salary-based models. The analysis then goes over the results from Quebec, which experimented with a FFS-based mixed model and finishes with New Brunswick's incentive-based model.

We evaluated and compared three mixed models, enhanced FFS, blended capitation, and salary with incentives or FFS. These payment models were evaluated based on four criteria: quality of care (including access to and continuity of care), utilization of healthcare services, costs to the healthcare system, and feasibility of implementation.

Of the three, blended capitation is the most supported payment model. This model does well in the quality of care parameter evaluated. Feasibility is high given the many demonstration projects, specifically in Ontario, that make potential implementation in other provinces easier as they can use Ontario's experience as a guide. Utilization of services is unchanged. In terms of costs, blended capitation shows an increase in primary care costs, but reports show a reduction in

general health care costs. More studies are needed to understand cost and utilization trends in blended capitation.

Section 1: Defining the issue

Primary care physicians in Canada act as a first point of contact between patients and the health care system. These physicians are responsible for general health promotion and management activities, making them accountable for management of chronic diseases. The prevalence of chronic diseases among Canadian adults is increasing. According to a report by the government of Canada (2019), 44% of adults in Canada have at least one chronic disease (2). Canada's health care system was set up to deal with acute, episodic care (3). The fee-for-service payment model is a good fit for this setup, but Canadian health care (and physician payment) may not be ideally designed for the care of patients with chronic diseases. Chronic disease patients need comprehensive care consisting of health promotion, disease management, lifestyle changes, educational resources, and community support (3). The kind of care needed by chronic disease patients goes beyond the physician and may require coordinated care between several health care providers. Adjustments in physician payment models to encourage better chronic disease care through more team-based collaborative care may positively influence the outcome of care for these patients.

According to the Public Health Agency of Canada, chronic diseases are persistent and slow in progression, and they can be treated but not cured (4). Common examples of chronic disease are asthma, cancer, diabetes, depression, hypertension, and chronic obstructive pulmonary disease (COPD).

Chronic disease patients are at risk of low continuity of care, which can be an indicator for low access to primary care and predisposes them to avoidable emergency department visits (5).

These patients often obtain care from multiple providers, making the care they receive complicated and confusing (6). According to Elliott *et al.* (2018) an effective primary care model is one where there is continuity of care for chronic disease patients, and a wider range of health care practitioners involved in providing care (6). Chowdhury (2014) suggests given the complexity of chronic diseases, care for patients needs to be continuous and coordinated in teams of providers (7).

Aside from fee-for-service, other payment models that are used in practice are capitation (fixed payments per patient enrolled), salary (fixed payment per time period), and pay-for-performance (incentive payments). Jurisdictions either use these models on their own or mix them for improved effect. Examples include blended capitation and enhanced fee-for-service that will be discussed in later sections. Capitation-based models may encourage continuity of, and collaborative care as patients are enrolled to receive services with the same physician.

The aim of this policy analysis is to synthesize available evidence and evaluate which model of primary care payment shows most promise for supporting high quality and efficient chronic disease management in primary care in Canada. This analysis will present an overview of models used across Canadian provinces. Only provinces with availability of related literature are presented. The most promising models are then evaluated based on how they improve quality of care and reduce health care system costs and utilization. Given the available literature points out that chronic disease patients receive poor continuity and access to care (5-7), quality of care will be measured based on access to care and continuity of care. Health care utilization is measured based on consultation and visit rates (physician services, emergency department, and hospitalizations). Each model is also evaluated on feasibility of implementation. In the final section a recommendation of a single payment model is made.

Section 2: Primary care payment—Theory and Evidence

This section defines primary care physician payment models and provides a brief overview of the results of the recently completed systematic review on the quality and economic outcomes of these models.

1. Existing payment models

a. Fee-for-service

In fee-for-service (FFS), primary care physicians receive a fee for each service provided (8). FFS incentivizes volume of care, which may lead to shorter visits and/or physician-induced demand (8). Critiques of this model argue that FFS also leads to fragmentation of care (9).

b. Capitation

In a capitation model, patients are assigned to a physician and they are paid per patient on the roster, adjusted for age and gender, and sometimes other factors (10). Chronic disease patients provide a risk to capitated physicians (10). Payments are fixed over a specified period, regardless of how many services are used. In some jurisdictions, this model includes a penalty for physicians if patients seek services from other primary care providers (11).

c. Salary

Salaried physicians are paid a fixed amount of income per given period of time (10), regardless of how many patients they provide services to. Patients visiting salaried physicians are at a risk of receiving fewer services since the physician does not receive incentives for providing more units of service.

d. Pay-for-performance (P4P)

This payment model gives physicians incentive payments for following a list of pre-determined performance indicators (12). Incentive payments are added on top of an existing model, usually FFS.

e. Mixed models of payment

In an attempt to increase positive behavioural incentives, mixed models attempt to mix two or more of the payment models mentioned above (13). Examples of this model include blended capitation, which is a mix of capitation with FFS billing.

2. Evidence from the systematic review

Our systematic review informed us about the effectiveness of existing payment models used in primary care settings worldwide. Of the thirteen studies included in the review, five of them included some focus on chronic disease management within primary care settings (14-18). All five of these studied incentive payments (P4P).

These studies revealed that incentive payments are not well supported in the literature as improving chronic disease care delivery. In most cases quality of care did not improve, or the improvement was short lived, or the promising trends were the same pre- and post-intervention. Only one study showed statistically significant improvements in quality, however, no more information is available regarding durability of the improvements. Other studies show that health care spending increased with incentive payments and continuity of care decreased.

Section 3: Examples of primary care payment models and how they support chronic disease care—Evidence from Alberta, British Columbia, Ontario, Quebec, New Brunswick

This section explores primary care payment methods implemented in Canadian provinces, and their impact on the care of patients with chronic diseases.

This evidence was found through an environmental scan of available literature and reports. The scan was done to find developments in primary care payment models in Canadian provinces. We looked for descriptive studies that address the impact of the models in each province, with a focus on chronic disease management. We also considered the results from our systematic review if they explored primary care payment models in Canada, with a focus on chronic diseases. The studies included in this policy analysis did not make it to the systematic review because none of them met the study design criteria used in our review.

The environmental scan was performed first by visiting the government of Canada website and searching for keywords ‘chronic disease’ and ‘primary care payment models’. The same keywords were used when searching each province’s individual government website. A broader search was done using google and PubMed, using the same keywords. Reports of studies regarding primary care payment models and chronic disease care were found for the provinces of Alberta, British Columbia, Ontario, Quebec, and New Brunswick. All studies and reports were considered, with no exclusions based on study design. While this allows a more fulsome understanding of how payment models have impacted care and outcomes in Canada, the reader should be aware that evidence from less robust study designs may be biased. Appendix C contains a list of the full sources of the environmental scan.

1. Alberta

More than 80% of primary care physicians in Alberta are reimbursed by FFS (19). Other primary care physicians are paid through Alternative Relationship Plans (ARP) or capitation. More recently, a new model of blended capitation has also been introduced.

a. Alternative Relationship Plans

One of the practice models established in Alberta is the Alternative Relationship Plans (ARP) which broadly includes any payment model except FFS (9, 19, 20). ARPs are meant to encourage clinical research, provide team-based care, patient satisfaction, better access and value for money (9). Two types of ARPs exist, academic and clinical. The academic model is meant for physicians that provide clinical and research services, along with teaching. The clinical model compensates physicians for a set of clinical services that are meant to target specific vulnerable or underserved populations (19).

Physicians in the ARP system can be reimbursed based on methods of their choice, choosing between salary, capitation, block funding, blended funding, or Alberta's sessional or contractual models (20). Block funding is a fixed amount paid to physician groups to provide medical services for a fixed period. Blended funding is a blend of FFS and ARP (20). Sessional model is an hourly or half-day payment, the payment amount differs between primary care and specialist care providers (20). The contractual model (placed under the same category as salary by the Canadian Institute for Health Information) is a fixed annual payment rate. Academic ARP is a form of contractual model where pooled funding is given to teaching and research institutions (20). These models are not widely studied.

b. Capitation

Two clinics in Alberta, Crowfoot village family practice and Taber clinic, started using capitation-based ARPs in 1999. Both clinics implemented a model that is team-based, patient-centred, accessible, comprehensive, collaborative, integrated, and efficient (9).

Both these practices were found to be more expensive than their rural and metropolitan counterparts but were also found to be cost-effective when considering downstream service costs (emergency department and inpatient care) (9). Overall, these clinics demonstrated that capitation-based ARP supports team-based care and is able to maximize benefits for patients and providers (9).

2. British Columbia

The majority of primary care physicians in British Columbia are paid by FFS (14). Patient rostering, team-based care, or coordinating care with non-physician primary care providers, such as nurse practitioners, are not currently supported in any payment models in British Columbia (14).

British Columbia introduced an incentive payment model in year 2005 in an attempt to improve chronic disease management and prevention (21). The incentive payments were paid on top of the traditional FFS model and were a flat rate per provider per patient.

a. Incentive payments

British Columbia's complex care initiative pays \$315 annually per patient, in addition to service fees (on a FFS basis), to compensate for the care of patients with complex care and to develop patient care plans.

Lavergne (2016) explored the impact of complex care incentives on primary care access and continuity, hospital admission and cost of care in British Columbia (22). Access was measured by the number of primary care contacts. Continuity was measured by the percentage of primary care contacts in a given month. Hospital admissions of interest were acute admissions, emergency department and admission for targeted chronic conditions. The targeted conditions were diabetes, chronic kidney disease, cerebrovascular disease, congestive heart failure, ischemic heart disease, chronic obstructive pulmonary disease and asthma. No improvements were seen in access to and continuity of care (measures of quality) after the implementation of the complex care initiative. No decline in costs were found after the start of British Columbia's complex care initiative (22).

Hollander (2015) examined the impact of activity-based incentive payments (payments received for providing after hours care and additional services) on top of FFS for providing chronic disease care on annual health costs and hospital utilization in British Columbia (23). The chronic conditions studied were COPD, hypertension, Congestive Heart Failure (CHF), and diabetes. Results showed that for all chronic diseases studied, patients who received incentive-based care had lower hospital utilization. The incentive program resulted in lower costs in the CHF, COPD and hypertension groups but not diabetes.

3. Ontario

Primary care physicians in Ontario receive payments that are either non-enrollment-based (one-third of physicians) or enrollment-based (two-thirds of physicians) (24, 25). These models are different based on whether patients are formally attached to their physician or not.

Enrollment-based models are further divided into harmonized or non-harmonized models. The non-harmonized model is retrospective in reimbursement. It is an enhanced FFS model that pays 10% premium for comprehensive services provided, and 20% premium for after-hours care. Examples of this model are Comprehensive Care Model (CCM) and Family Health Group (FHG).

The harmonized model is a prospective payment model. It has three parts to its reimbursement. The first is a fixed amount paid for each patient (capitation-based). The next part is a discounted value of FFS claims for services provided. Physicians are also eligible to receive bonus payments. Examples of this model are Family Health Network (FHN) and Family Health Organization (FHO). FHO is one of the most popular primary care payment models as it is the payment model for about one-third of all primary care physicians in Ontario (24).

Both harmonized and non-harmonized models provide incentives to physicians for caring for complex and vulnerable patients, which includes chronic disease patients.

Another model of primary care delivery in Canada is Community Health Centres (CHC) that have been around since the 1920's. Primary care physicians working within CHCs are paid by salary and benefits (26). CHCs are community governed and are made of interprofessional health care teams. CHCs are usually used in underserved, low-income areas (26).

a. Enhanced FFS

Several studies in Canada have looked at the combination of incentive payments and FFS in chronic care delivery. There are different types of mixed FFS models in Ontario. Enhanced FFS model is a remuneration model primarily consisting of FFS, but also includes incentives and premiums for services provided to enrolled patients (27). Two models of enhanced FFS in Ontario are the Comprehensive Care Model, for

solo physicians, and Family Health Group, for group practices. Physicians under both these models provide comprehensive and after-hours care to enrolled patients.

To (2015) *et al.* explored the quality of asthma care in Ontario, comparing different primary care payment models: FFS, enhanced FFS, blended capitation. They identified that the quality of asthma care has improved over time and that both enhanced FFS and blended capitation provided higher quality of asthma care compared to FFS (27).

Physician productivity in the FHG model in Ontario were studied by Kantarevic (2011) (28). A comparison was done between the enhanced FFS (FHG) and traditional FFS models. The results show that joining the FHG group had a positive impact on physician behaviour in increasing annual services, visits, and distinct patients.

Glazier (2009) evaluated practice characteristics in a capitation model compared to an enhanced FFS model in Ontario (29). The characteristics studied were comprehensiveness, continuity, after-hours care, inpatient and emergency department visits, and uptake of unattached patients. These are all measures of quality, except inpatient and emergency department visit which is a measure of health care utilization. This study did not show that capitation is better than enhanced FFS. Some of the trends were pre-existing and cannot be attributed to capitation. The capitation model was found to have more emergency department visits. However, these trends were found to exist before physicians were likely to switch their reimbursement model and cannot be attributed to capitation. More studies are needed.

b. Capitation Based Models

Two capitation-based models are being used in Ontario, Family Health Network and Family Health Organization. Physicians in these models, sometimes referred to as blended capitation, provide comprehensive care, preventative care, chronic disease management, and health promotion services (24). They are compensated by capitation, adjusted for patient age and sex, but also receive FFS payments, bonuses and premiums.

Jaakkimainen (2011) evaluated physician performance in chronic disease management in Ontario's FHN and FHG groups (30). Chronic disease management results showed that there were no significant differences between the FHN and the FHG groups in terms of providing asthma, heart failure and diabetes care.

Tu *et al.* (2009) looked at hypertension, an important modifiable risk factor and a leading risk factor for mortality around the world (31). They looked at practice patterns of primary care physicians in Ontario with respect to hypertension. A comparison of three payment models was done to see physicians' rate of screening, treatment and control of hypertension. These models were CHC (salary), primary care networks (PCN) (capitation), and FFS. They controlled for age, sex, socioeconomic status, place of residence (rural or urban), and presence of other comorbidities. None of these factors affected the comparative percentages.

All three remuneration models had high screening rates. Prevalence of hypertension was 34%. Of the patients with hypertension, 86% were treated with antihypertensive medications. The highest treatment rate (91%) belonged to the PCN

group and CHC had the lowest (81%). PCNs had the highest control rate of 55% compared to the mean control rate of 45%. Capitation showed better treatment and control results in hypertension than did salary or FFS. Screening was high among all three remuneration models.

No studies were identified that explored health care utilization in chronic care management in capitation plus incentives payment model across primary care in Canada.

A study by Laberge (2017) explored total health care and primary care costs in Ontario, comparing FFS, enhanced FFS, and blended capitation models (32). This study found that total health care costs were lowest in enhanced FFS model. Blended capitation was found to have higher primary care costs, but lower overall health care costs than FFS. More studies are required to build on the available knowledge of costs across these models.

c. Pay-for-Performance

In an attempt to study Ontario's diabetes incentive code, Kiran (2012) conducted a cross-sectional analysis (33). The incentive code is to ensure regular, comprehensive care for patients with diabetes. This research team assessed patient and physician characteristics associated with higher quality of care and quality of diabetes care. Quality of diabetes care was measured through evidence-based monitoring tests. This study found that a financial incentive code for diabetes had limited impact six years after implementation.

Kiran (2014) later conducted another study to see if introducing pay-for-performance in Ontario led to higher cancer screening rates (a measure of quality), while also checking for incentive costs. Cervical, colorectal, and breast cancer screenings were longitudinally evaluated. The results show little to no change in screening rates, even though there were large expenditures on primary care incentives.

The study by Kantarevic (2013) looked for the optimal design of P4P programs in Ontario's diabetes management incentive program (34). The outcomes of interest were physician response to the P4P incentives. Models here included FHG and FHO. They also received P4P incentives as part of the diabetes management incentive program. The FHO's effect was positive and statistically significant, showing that physicians in this blended capitation model were more responsive to the P4P model in the diabetes management incentive.

d. Salary Based Models

Liddy (2011) evaluated the quality of preventive cardiovascular disease care delivered by primary care physicians in Ontario operating in three organizational models, FFS, blended capitation, Community Health Centres (CHCs, which are salary-based) (26).

This study showed blended capitation provides superior care in smoking cessation and waist circumference management. CHCs showed the highest HbA1c (hemoglobin) monitoring. FFS had the greatest gaps in care here, mostly in diabetic care and waist circumference management. Quality of diabetic care was highest in CHCs while smoking cessation care and weight management were higher in the blended capitation model.

Russell (2009) (35) addressed two questions. Does chronic disease management differ between four models of primary health care delivery in Ontario? What practice-based organizational factors are associated with high quality chronic disease management? The payment models they looked at were FFS, CHC, FHN, and health service organization (HSO), which remunerates physicians by capitation and incentives. Most FFS practices later transitioned into the FHG model. In 2008, all HSO physicians were converted to the FHO model.

After adjusting for potential confounding factors, this study found that CHC had higher overall performance of chronic disease management by 10-15%. This improvement in performance came from their evidence-based processes associated with diabetes care, also through providing longer consultations and collaborating with a nurse practitioner. Diastolic blood pressure readings were significantly lower for HSO (FHO) patients.

In conclusion, high quality chronic disease care was most common in Ontario's CHC, a salary-based payment. This high quality was a result of longer consultation with patients, collaboration with nurse practitioners, and an organizational readiness for changes aimed at improving diabetic care, specifically in using diabetic education and care teams. HSO (FHO) shows good improvement in quality here. Of note, measures of efficiency were not examined.

4. Quebec

Quebec responded to challenges facing its health care system by creating the Family Medicine Groups (FMGs) (36). These challenges were the fact that 25% of Quebec residents did

not have a family physician. Also lack of after-hours care meant emergency departments were full, with long waiting times.

FMGs were designed to be a team-based primary care system. The team would typically include six to twelve physicians working with nurses to provide services to registered patients (36). The reimbursement method for FMGs was designed using elements from payment models used in Ontario, namely, FHN (blended capitation) and FHG (enhanced FFS). This model is mostly FFS, but also includes additional fixed payments for physicians in charge of the FMG system and for providing after-hours care. Physicians are also able to bill an additional fixed amount for each registered patient in the FMG system.

a. Incentive payments and FFS

A study done by Strumpf (2017) (36) evaluated the FMG model based on health care utilization and costs. The primary patient set for the group under study were elderly and/or chronically ill patients. This study showed a decrease in outpatient utilization by 9%, but no significant impact on hospital or emergency department utilization. Other aspects of utilization that were impacted were primary care and specialist visits. Both of these were decreased by 11% and 6%, respectively. Spending on primary care, specialist, and outpatient services decreased by 12%, 6%, and 8%, respectively, relative to baseline spending. However, there was no change in hospital utilization or costs.

Lower utilization is reflective of improvements in quality and continuity of care (36). The decrease in specialist visits may mean that chronic care management is improving in primary care, and there is reduced duplication of care. The lack of change in emergency department and hospital utilization and costs mean this model may not achieve all of its goals.

5. New Brunswick

Pay-for-Performance (P4P) was introduced in the New Brunswick primary care system in 2010 to enable chronic care prevention and management (21).

a. Incentive Payments

Gupta (2019) assessed excess health care costs of the P4P program in New Brunswick (21). They found that, other changes in the system being absent, the program did not lead to a decline in avoidable hospital costs.

The New Brunswick diabetes registry was used by LeBlanc (2016) to study the impact of a P4P model on primary care FFS physicians (37). The outcome evaluated was the glycemic control (A1C and glycemic control tests) of patients with diabetes, a measure of quality of care. They compared the probability of receiving at least two tests before (2005-2009) and after (2010-2014) the P4P model implementation.

The implementation of the P4P program in New Brunswick led to higher odds of receiving the recommended minimum of two A1C tests per year. This may suggest better follow up care and higher quality of care with this payment model. However, the incentive program did not appear to be associated with improvements in A1C levels in patients. This study also found literature that showed mixed results regarding the relationship between A1C levels and an incentive program. No changes were seen in the glycemic control of the population under study.

Section 4: Evaluating the most promising payment models for chronic disease management in primary care

Evidence from our systematic review and environmental scan point to the promise of mixed payment models to support chronic disease management in primary care.

Mixed models combine any of the known payment models, such as capitation, FFS, salary and incentivized payments, to achieve optimum results. There are three mixed models used in Canada: enhanced FFS, blended capitation and a mix of salary with another model (such as P4P and/or FFS). We use literature gathered from the environmental scan, the systematic review, and theoretical concepts to inform our analysis. Canadian studies were used preferentially to get evidence most relevant to Canada and the Canadian health care system, unless no Canadian studies exist for the particular outcome of interest.

Each of the Canadian provinces' efforts in improving chronic disease care has been evaluated in detail here, based on the chosen criteria, depending on the available information. The evaluation criteria are quality of care (including access and continuity), healthcare utilization, costs of care, and feasibility.

Access to care can be measured by the availability of extended hours and incentives for more patient enrollment. Continuity of care involves ongoing care with the same team of health care providers. Health care utilization is measured based on consultation and visit rates (physician services, emergency department, and hospitalizations). Health care costs include costs of care to the health care system, including emergency department and hospital services. Feasibility is measured based on ease of implementation of the named model. There are several ways to measure feasibility. One way is using evidence of effectiveness of the model, which can help convince

policy makers to implement the model. Another way to assess a payment model's feasibility is if there have been pilot programs to test its effects. This usually brings exposure to the model to physicians in a region, which then gives them experience and familiarity, increasing the chances of the model being accepted by that group.

1. Enhanced FFS

British Columbia and Ontario have experimented with enhanced FFS models (mix of FFS and incentive payments) and their outcomes in primary care chronic disease management. The models in Ontario are Comprehensive Care Model and Family Health Group.

a. Quality

It can be predicted that enhanced FFS would lead to higher quality of care because doctors now receive incentives for improving the quality of services provided.

However, there is mixed support in the Canadian literature for the enhanced FFS model. Studies either report no change or improvements in quality of care. These include improved quality in asthma care compared to FFS (27) and improved physician behaviour in providing more services to patients (access to care) (28). However, one study reported no change (29). Continuity of care was not measured in these studies and can be a good direction for future studies.

While in theory, enhanced FFS should improve the targeted behaviour, improvements were not always detected, which indicates that there are likely other factors influencing specific targeted behaviours, that are not directly linked to compensation.

b. Utilization

Utilization of primary care physician services should remain the same or increase in enhanced FFS. However, given the higher quality services provided through primary care physicians, emergency department and hospital utilization should decrease after introducing enhanced FFS.

When comparing enhanced FFS to blended capitation, studies report either no change in utilization or an increase. Kantarevic (2011) reported increased primary care physician visits (28). There is currently no solid evidence for a decrease in downstream utilization.

c. Costs

The literature supports the enhanced FFS model in terms of costs, either reporting no change (36) or decreased costs (32). Laberge (2017) studied total health care and primary care costs in Ontario, comparing FFS, enhanced FFS, and blended capitation models (32). This study reported both primary care costs and total health care costs, which include costs of institutional care, mostly hospital and physician costs, to be lowest in the enhanced FFS model compared to FFS and blended capitation (32). This trend can be explained by the incentives provided to enhanced FFS practices for providing preventive services and chronic disease management. These incentives support higher quality and continuity of care which then lead to lower downstream utilization and expenditures.

d. Feasibility

Provinces such as Ontario and Quebec have experimented with this model, other provinces can use these provinces' experiences as a guide for implementation.

Previous exposure increases the feasibility of this model. This model is also simple to implement and layers bonus payments on top of an existing payment scheme, so it is not a big leap for physicians. The only issue for physicians is reporting burden or if penalties were to be introduced for poor performance.

2. Blended Capitation

Ontario has extensively experimented with blended capitation (incentive and FFS payments and capitation model) in chronic care management in primary care. The models are Family Health Network and Family Health Organization.

a. Quality

Blended capitation is expected to lead to higher quality of care because of the presence of incentives, and the flexibility to provide more health promotion, and preventative and comprehensive care. This model was strongly supported in the literature in terms of improving quality of and access to care (26, 27, 31, 34, 35). Improvements were seen on these parameters compared to the control group (usually FFS). Continuity of care was not measured in blended capitation.

b. Utilization

Quantity of primary care services should remain the same or decrease as there are no financial rewards for providing more services. Emergency department and hospital visits should decrease as the health promotion, preventative, and

comprehensive care present in blended capitation is expected to positively impact quality and reduce the need for extra services.

Only one study reported on health care utilization (emergency department visits) in the blended capitation model and they reported no change in this parameter (29). The Alberta clinics, Crowfoot and Taber, that studied capitation found the programs to be expensive due to higher primary care costs, but decreasing downstream costs were lower (9).

c. Cost

Laberge (2017) reported blended capitation to have higher primary care costs compared to the other models, enhanced FFS and FFS (32). Their results, however, suggested that these higher primary care costs were offset by the lower general health care costs. The enhanced FFS model remains the lowest in health care costs among the models studied. More research is needed to confirm the costs that the blended capitation model imposes on the primary care system.

d. Feasibility

The provinces of Ontario and Alberta have implemented the blended capitation model. Demonstration projects give provinces a chance to test the effects of a payment model and the level of acceptability by physicians and patients. This exposure then leads to increasing the feasibility of the model under study.

3. Salary with Incentives or FFS

Given that mixed models of payment to primary care physicians showed the most promise in our systematic review and our previous discussions, it is worth looking at the mix of salary payments with another payment model. Salaried payments could be mixed with FFS or incentives. No Canadian studies were identified that explored the combination of salary and another payment model in primary care settings to manage chronic disease. We will, therefore, use our knowledge of the salary model to report on this section.

Salary payment may lead to lower physician productivity. Combining it with performance-based incentive payments provides a way to evaluate performance levels, giving physicians incentives for improving performance and raising productivity. Adding FFS to salary payments gives the physician some control over their income, again, leading to higher productivity.

Canadian studies by Russell (2009), Liddy (2011), and Tu (2009) reported on chronic disease management using a salary-focused model, Community Health Centers (CHCs). Another study that included an overview of the salary method of reimbursement was Yan (2009) in a literature review (20). One study from China in our systematic review looked at the combination of salary and pay-for-performance (38).

a. Quality

It is expected that a mixed model of salary with incentives would increase quality of care as previously there were no rewards for providing higher standard of quality. The literature shows mixed results for salary payments. Liddy (2011) and Russell (2009) both reported the most support, saying chronic disease management was

superior in CHCs with a high quality of care in diabetes (26, 35). This was in large part due to contributions by the diabetes nurses that helped in educating patients in their diabetes management (35). Tu (2009) reported quality of care to be the lowest in CHCs compared to capitation or FFS (lower treatment rates in hypertension) (31). Yan (2009) reported increased access to care (a measure of quality of care) in salaried primary care physicians compared to those reimbursed by capitation and FFS (20).

Interpreting these results is difficult due to unavoidable differences in setting and provider characteristics between intervention and control groups. Despite mixed literature, there is still support for salaried physicians, as provided in this analysis, the effects of which could be multiplied if this model were combined with another model to make a mixed reimbursement method. More studies are needed to confirm this.

b. Utilization

Raising the standards of quality by adding performance-based incentive payments would, in theory, lead to an increase in physician visits and a decrease in emergency department visits. Studies either reported no change in volume of physician services (20), or reported a decrease in utilization measured by the number of primary care visits and prescribing practices (38). In Wang (2011) lower primary care visits meant higher referral rates to specialist physicians that provide more expensive care. This resulted in higher utilization of specialty physician services.

c. Cost

Costs of a salaried plus incentives model decreased in primary care in a study by Wang (2011) in China (38). This was measured through general health care and

drug spending. This decrease in costs was more than offset by the increase in costs of visiting specialist physicians, making this model inefficient. Although it is difficult to generalize this finding to Canada, this is a good starting point for future research.

d. Feasibility

Russell (2009) reported clinicians had an easier time promoting higher quality of care by increasing the length of visits (35). This is a measure of physician satisfaction and means higher feasibility for this model.

This model shows higher feasibility in other areas as well. Salaried physicians are reported to spend less time on administrative work, which leads to having more time to dedicate to patient care. And although there is less physician autonomy here, this model provides physicians with a predictable income and removes some of the risk involved in managing a business under FFS payment.

Table 1. Summary of mixed payment models

Payment model	Quality	Utilization	Cost	Feasibility	Notes
Enhanced FFS	- Mixed results exist, either no change was seen or there were improvements - Continuity of care not studied -Increased access to care	- Mixed results exist - Either no change or an increase in utilization was seen	- Mixed results exist - either no change or decrease in costs was seen	- One study reports quality of care can be increased without changes in quantity of care. This increases feasibility.	- Studies are needed on continuity of care, utilization and costs.
Blended Capitation	- Strongly supported -All five studies reported higher quality of care.	- No change in utilization of health care services reported.	- Mixed results exist - Primary care costs were shown to increase, but	- Demonstration projects conducted in Ontario increase feasibility of this model.	- More studies are needed on costs and utilization.

			the general health care costs decreased.		
Mixed Salary	- Mixed results exist - Three studies report increased chronic care management, quality of, and access to care. One study reported lower quality.	- Mixed results exist -Decrease in primary care visits, increase in specialist visits.	- Mixed results exist -Decrease in costs of primary care visits, increase in costs of specialist visits.	- Less time spent in administrative work and more time for patient care mean higher feasibility.	- More studies are needed in quality of care, utilization, and costs. All the results on costs and utilization are from a study in China that are not easily generalizable to Canada.

Section 5: Conclusion and Recommendation

We reviewed primary care physician payment models for the management of chronic diseases across Canada. Mixed models of payment appear to be most promising. We evaluated three mixed models: Enhanced FFS, blended capitation, and a mix of salary payment with another model (P4P or FFS).

None of the mixed models evaluated were perfect. It should also be noted that the majority of the studies selected used a study design that was not robust (i.e., any design other than randomized controlled trials, controlled cohort, or interrupted time series), reducing the quality of the evidence.

The model with the most promise for improving quality, reducing costs, and higher feasibility of implementation was the blended capitation model. Enhanced FFS showed mixed results for quality and showed an increase in health care utilization in primary care physician visits. Blended capitation showed increased primary care costs, although the study by Laberge (2017)

did report that general health care costs were reduced (32). The literature strongly supported blended capitation in its ability to increase quality of care. More studies on blended capitation are needed to confirm that this model reduces downstream costs. The salary model showed mixed results in all sections.

With the available evidence the best potential is seen in the blended capitation model and is, therefore, recommended to policy makers. Ontario has already started using this model and has seen results, increasing the feasibility of the model. This payment model may be good for other provinces to try as well.

The heterogeneity of studies in terms of setting, study design, and payment model design limits their generalizability. This in turn affects the interpretation of the evidence and the application of it in a particular jurisdiction. While the results of studies can help to guide the implementation of payment models, it is critical that any alternative payment model that is implemented be carefully evaluated in its context, to ensure that the intended goals are being met.

Future studies should focus on gathering more evidence regarding costs and utilization of the model. The most current report on utilization was done by Glazier (2009), which shows no change in this parameter (29). But this study is older, and this model can benefit from a look at more recent data. Laberge (2017) reported higher primary care costs, but lower general health care costs (32). They also suggest gathering more evidence in this area.

References

1. Morestin F. A Framework for Analyzing Public Policies: Practical guide. National Collaborating Centre for Healthy Public Policy; 2012.
2. Prevalence of Chronic Diseases Among Canadian Adults: Government of Canada; 2019 [updated December 9, 2019. Available from: <https://www.canada.ca/en/public-health/services/chronic-diseases/prevalence-canadian-adults-infographic-2019.html>.
3. Tsisis PB, J. Chronic Disease: Shifting the Focus of Healthcare in Canada Healthcare Quarterly. 2009;12(2).
4. Chronic Diseases: Government of Canada; 2013 [updated October 21, 2013. Available from: <https://cbpp-pcpe.phac-aspc.gc.ca/chronic-diseases/>.
5. Lockhart EH, G.A.; Ivers, N.M.; O'Brien, T.; Mukerji, G.; Pariser, P.; Stanaitis, I.; Pus, L.; Baker, G.R. Engaging primary care physicians in care coordination for patients with complex medical conditions. Can Fam Physician. 2019;65(4).
6. Elliott JS, P.; Boscart, V.; Giangregorio, L.; Heckman, G. Coordinating care for older adults in primary care settings: understanding the current context. BMC Fam Pract. 2018.
7. Chowdhury T. Chronic Disease Management and Primary Care in Alberta. University of Alberta; 2014.
8. Evans R. Supplier induced demand: some empirical evidence and implications. The economics of health and medical care. 1974.
9. A case study evaluation of Crowfoot village family practice and the Taber clinic. Calgary, Alberta, Canada: Health Quality Council of Alberta; 2019 October 2019.
10. Wranik D, Durier-Copp, M. Framework for the design of physician remuneration methods in primary health care. Social work in public health. 2011;26(3):231-59.
11. Patient Rostering in Family Practice. The College of Family Physicians of Canada; 2012.
12. Lin Y, Yin, S, Huang, J, Du, L. Impact of Pay for performance on Behavior of Primary Care Physicians and Patient Outcomes. Journal of evidence-based medicine. 2015.
13. Rudmik L, Wranik, D, Rudisill-Michaelsen, C. Physician payment methods: A focus on quality and cost control. Journal of Otolaryngology - Head and Neck Surgery. 2014;43(34).
14. Lavergne MR, Law MR, Peterson S, Garrison S, Hurley J, Cheng L, et al. Effect of incentive payments on chronic disease management and health services use in British Columbia, Canada: Interrupted time series analysis. Health Policy. 2018;122(2):157-64.
15. Serumaga B, Ross-Degnan D, Avery AJ, Elliott RA, Majumdar SR, Zhang F, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. BMJ. 2011;342:d108.
16. Campbell S, Reeves, D, Kontopantelis, E, Sibbald, B, Roland, M. Effects of Pay for Performance on the Quality of Primary Care in England. N Engl J Med. 2009;361(4).
17. Young GJ, Meterko M, Beckman H, Baker E, White B, Sautter KM, et al. Effects of paying physicians based on their relative performance for quality. J Gen Intern Med. 2007;22(6):872-6.
18. Beaulieu ND, Horrigan DR. Putting smart money to work for quality improvement. Health Serv Res. 2005;40(5 Pt 1):1318-34.
19. Alberta Go. Primary Care Networks: Review. Alberta Health; 2016.
20. Yan CK-R, J.; Chuck, A. Financial Incentives to Physician Practices: A literature review of evaluations of physician remuneration models. Institute of Health Economics; 2009.

21. Gupta N, Lavalley R, Ayles J. Effects of Pay-for-Performance for Primary Care Physicians on Preventable Diabetes-Related Hospitalization Costs Among Adults in New Brunswick, Canada: A Quasiexperimental Evaluation. *Can J Diabetes*. 2019;43(5):354-60 e1.
22. Lavergne MRL, M. R.; Peterson, S.; Garrison, S.; Hurley, J.; Cheng, L.; McGrail, K. A population-based analysis of incentive payments to primary care physicians for the care of patients with complex disease. *CAMJ*. 2016;188(15).
23. Hollander MJ, Kadlec H. Incentive-Based Primary Care: Cost and Utilization Analysis. *Perm J*. 2015;19(4):46-56.
24. Primary Care Payment Models in Ontario Ontario, Canada: Ministry of Health - Ministry of Long-Term Care; 2020 [updated March 26, 2020. Available from: <http://www.health.gov.on.ca/en/pro/programs/pcpm/>.
25. Kantarevic J, Kralj B. Risk selection and cost shifting in a prospective physician payment system: evidence from Ontario. *Health Policy*. 2014;115(2-3):249-57.
26. Liddy CS, J.; Hogg, W.; Dahrouge, S.; Taljaard, M. Comparison of primary care models in the prevention of cardiovascular disease - a cross sectional study. *BMC Fam Pract*. 2011;12.
27. To T, Guan J, Zhu J, Lougheed MD, Kaplan A, Tamari I, et al. Quality of asthma care under different primary care models in Canada: a population-based study. *BMC Fam Pract*. 2015;16:19.
28. Kantarevic J, Kralj B, Weinkauff D. Enhanced fee-for-service model and physician productivity: evidence from Family Health Groups in Ontario. *J Health Econ*. 2011;30(1):99-111.
29. Glazier RH, Klein-Geltink J, Kopp A, Sibley LM. Capitation and enhanced fee-for-service models for primary care reform: a population-based evaluation. *CMAJ*. 2009;180(11):E72-81.
30. Jaakkimainen RLB, J.; Klein-Geltink, J.; Kopp, A.; Glazier, R. H. Did changing primary care delivery models change performance? A population based study using health administrative data. *BMC Fam Pract*. 2011;12.
31. Tu KC-D, K.; Chen, Z. Comparison of primary care physician payment models in the management of hypertension. *Canadian Family Physician*. 2009;55:719-27.
32. Laberge M, Wodchis WP, Barnsley J, Laporte A. Costs of health care across primary care models in Ontario. *BMC Health Serv Res*. 2017;17(1):511.
33. Kiran T, Victor JC, Kopp A, Shah BR, Glazier RH. The relationship between financial incentives and quality of diabetes care in Ontario, Canada. *Diabetes Care*. 2012;35(5):1038-46.
34. Kantarevic J, Kralj B. Link between pay for performance incentives and physician payment mechanisms: evidence from the diabetes management incentive in Ontario. *Health Econ*. 2013;22(12):1417-39.
35. Russell GM, Dahrouge S, Hogg W, Geneau R, Muldoon L, Tuna M. Managing chronic disease in ontario primary care: the impact of organizational factors. *Ann Fam Med*. 2009;7(4):309-18.
36. Strumpf E, Ammi M, Diop M, Fiset-Laniel J, Tousignant P. The impact of team-based primary care on health care services utilization and costs: Quebec's family medicine groups. *J Health Econ*. 2017;55:76-94.
37. LeBlanc E, Belanger M, Thibault V, Babin L, Greene B, Halpine S, et al. Influence of a Pay-for-Performance Program on Glycemic Control in Patients Living with Diabetes by Family Physicians in a Canadian Province. *Can J Diabetes*. 2016;41(2):190-6.

38. Wang H, Zhang L, Yip W, Hsiao W. An experiment in payment reform for doctors in rural China reduced some unnecessary care but did not lower total costs. *Health Aff (Millwood)*. 2011;30(12):2427-36.

Conclusion

This thesis systematically reviewed primary care physician payment models worldwide to assess their impact on quality and economic outcomes. The evidence was further synthesized by performing a policy analysis to evaluate the impact of payment models on chronic disease management in Canada.

The payment model that showed the most support in the literature was the mixed payment model, specifically the blended capitation. There are still gray areas in this model regarding costs, which sets the direction for future studies.

Most studies only considered the perspective of the health care system. It would be interesting to see what conclusion we would reach if the perspectives of physicians or patients were considered. If we exclusively took the perspective of physicians into account, then we would most likely reach a different conclusion. Given the autonomy and low risk in FFS, physicians would most likely have FFS as a main part of the payment model either on its own or in enhanced FFS.

Patients' perspective would most likely be similar to the health care system, although they are more concerned with quality rather than economic outcomes. Since compensation increases with volume of care in FFS, physicians are likely to take on more patients with no penalties/risks as seen in capitation. This can lower access for patients. There is also the issue of low continuity of care and no quality indicators in FFS. Therefore, if we exclusively took patient perspective, we would have likely reached the same conclusion as we did.

Strengths

The systematic review included a comprehensive search of the literature and was restricted to robust study designs. This is an important strength that increases reliability of the study results. Risk of bias in study selection was reduced by having two reviewers independently review the abstracts and the full texts.

The policy analysis allowed for the consideration of other, less robust but context-relevant evidence. Not limiting to specific study designs allowed us to gather more evidence that helped in comparisons.

Weakness

Physician payment models are complex, and outcomes measured in the included studies may not include all intended or unintended consequences. Exclusion of studies that do not meet study design criteria resulted in less bias in our study, however, this also resulted in fewer studies included in our systematic review. Studies brought together in our systematic review were heterogeneous in terms of intervention, setting, study design and outcomes. This heterogeneity made comparisons across studies challenging and precluded data pooling.

The policy analysis included evidence from less robust study designs, reducing the quality of evidence we found. A limited number of alternative payment models were studied, making it difficult to compare them. Most studies only considered the perspective of the health care system. The perspectives of physicians and patients also need to be considered.

Bibliography

1. A case study evaluation of Crowfoot village family practice and the Taber clinic. Calgary, Alberta, Canada: Health Quality Council of Alberta; 2019 October 2019.
2. About primary health care Canada: Government of Canada; 2012 [updated August 23, 2012. Available from: <https://www.canada.ca/en/health-canada/services/primary-health-care/about-primary-health-care.html>.
3. Alberta Go. Primary Care Networks: Review. Alberta Health; 2016.
4. Beaulieu ND, Horrigan DR. Putting smart money to work for quality improvement. *Health Serv Res.* 2005;40(5 Pt 1):1318-34.
5. Berenson RA, Rich EC. US Approaches to Physician Payment: The Deconstruction of Primary Care. *Journal of General Internal Medicine.* 2010;25(6):613-8.
6. Breton M, Lévesque JF, Pineault R, W H. Primary Care Reform: Can Quebec's Family Medicine Group Model Benefit from the Experience of Ontario's Family Health Teams? *Healthc Policy.* 2011;7(2):e122-2135.
7. Campbell S, Reeves, D, Kontopantelis, E, Sibbald, B, Roland, M. Effects of Pay for Performance on the Quality of Primary Care in England. *N Engl J Med.* 2009;361(4).
8. Chen TT, Chung KP, Lin IC, MS L. The unintended consequence of diabetes mellitus pay-for-performance (P4P) program in Taiwan: are patients with more comorbidities or more severe conditions likely to be excluded from the P4P program? *Health Services Research.* 2011;46(1 Pt 1):47-60.
9. Chowdhury T. Chronic Disease Management and Primary Care in Alberta. University of Alberta; 2014.
10. Chronic Diseases: Government of Canada; 2013 [updated October 21, 2013. Available from: <https://cbpp-pcpe.phac-aspc.gc.ca/chronic-diseases/>.
11. Cochrane Effective Practice and Organisation of Care Review Group (EPOC): Data Collection Checklist. 2002. p. 18-23.
12. Davidson S, Manheim, L., Werner, S., Hohlen, M., Yudkowsky, B., Fleming, G. Prepayment with Office-Based Physicians in Publicly Funded Programs: Results from the Children's Medicaid Program. *Pediatrics.* 1992;89(4).
13. Elliott JS, P.; Boscart, V.; Giangregorio, L.; Heckman, G. Coordinating care for older adults in primary care settings: understanding the current context. *BMC Fam Pract.* 2018.
14. Evans R. Supplier induced demand: some empirical evidence and implications. *The economics of health and medical care.* 1974.
15. Faloon T. Module 8: Physician remuneration options. ON, Canada; 2012.
16. Fleetcroft R, Parekh-Bhurke S, Howe A, Cookson R, Swift L, N S. The UK pay-for-performance programme in primary care: estimation of population mortality reduction. *British Journal of General Practice.* 2010;60(578):e345-52.
17. Glazier RH, Klein-Geltink J, Kopp A, Sibley LM. Capitation and enhanced fee-for-service models for primary care reform: a population-based evaluation. *CMAJ.* 2009;180(11):E72-81.
18. Gosden T, Forland F, Kristiansen I, Sutton M, Leese B, Giuffrida A, et al. Capitation, salary, fee-for-service and mixed systems of payment: effects on the behaviour of primary care physicians. *Cochrane Database Syst Rev.* 2000;(3):CD002215.

19. Gupta N, Lavalley R, Ayles J. Effects of Pay-for-Performance for Primary Care Physicians on Preventable Diabetes-Related Hospitalization Costs Among Adults in New Brunswick, Canada: A Quasiexperimental Evaluation. *Can J Diabetes*. 2019;43(5):354-60 e1.
20. Hickson GB AW, Perrin JM. . Physician reimbursement by salary or fee-for-service: effect on physician practice behavior in a randomized prospective study. *Pediatrics* 1987;80(3):344-50.
21. Hollander MJ, Kadlec H. Incentive-Based Primary Care: Cost and Utilization Analysis. *Perm J*. 2015;19(4):46-56.
22. Hurley J, DeCicca, P., Li, J., Buckley, G. The Response of Ontario Primary Care Physicians to Pay-for-Performance Incentives. Centre for Health Economics and Policy Analysis. 2011.
23. Hutchison B BS, Hurley J, Lomas J, Stratford- Devai F. Do physician-payment mechanisms affect hospital utilisation? A study of Health Service Organisations in Ontario. *Canadian Medical Association Journal* 1996;154(5):653-61.
24. Iversen T, Luras H. The effect of capitation on GPs' referral decisions. *Health Economics*. 2000;9:199-210.
25. Jaakkimainen RLB, J.; Klein-Geltink, J.; Kopp, A.; Glazier, R. H. Did changing primary care delivery models change performance? A population based study using health administrative data. *BMC Fam Pract*. 2011;12.
26. Kantarevic J, Kralj B. Risk selection and cost shifting in a prospective physician payment system: evidence from Ontario. *Health Policy*. 2014;115(2-3):249-57.
27. Kantarevic J, Kralj B. Link between pay for performance incentives and physician payment mechanisms: evidence from the diabetes management incentive in Ontario. *Health Econ*. 2013;22(12):1417-39.
28. Kantarevic J, Kralj B, Weinkauff D. Enhanced fee-for-service model and physician productivity: evidence from Family Health Groups in Ontario. *J Health Econ*. 2011;30(1):99-111.
29. Kiran T, Victor JC, Kopp A, Shah BR, Glazier RH. The relationship between financial incentives and quality of diabetes care in Ontario, Canada. *Diabetes Care*. 2012;35(5):1038-46.
30. Kouides RW, Bennett, N.M, Lewis, B., Cappuccio, J.D., Barker, W.H., LaForce, F.M. Performance-Based Physician Reimbursement and Influenza Immunization Rates in the Elderly. *American Journal of Preventive Medicine*. 1998;14(2).
31. Kralj B, Kantarevic J. Quality and quantity in primary care mixed-payment models: evidence from family health organizations in Ontario. *Canadian Journal of Economics*. 2013;46(1):208-38.
32. Krasnik A, Groenewegen, P., Pedersen, P., Scholten, P., Mooney, G., Gottschau, A., Flierman, H., Damsgaard, M. Changing remuneration systems: effectson activity in general practice. *BMJ*. 1990;300:1698-701.
33. Laberge M, Wodchis WP, Barnsley J, Laporte A. Costs of health care across primary care models in Ontario. *BMC Health Serv Res*. 2017;17(1):511.
34. Lavergne MR, Law MR, Peterson S, Garrison S, Hurley J, Cheng L, et al. Effect of incentive payments on chronic disease management and health services use in British Columbia, Canada: Interrupted time series analysis. *Health Policy*. 2018;122(2):157-64.

35. Lavergne MRL, M. R.; Peterson, S.; Garrison, S.; Hurley, J.; Cheng, L.; McGrail, K. A population-based analysis of incentive payments to primary care physicians for the care of patients with complex disease. *CAMJ*. 2016;188(15).
36. LeBlanc E, Belanger M, Thibault V, Babin L, Greene B, Halpine S, et al. Influence of a Pay-for-Performance Program on Glycemic Control in Patients Living with Diabetes by Family Physicians in a Canadian Province. *Can J Diabetes*. 2016;41(2):190-6.
37. Liddy CS, J.; Hogg, W.; Dahrouge, S.; Taljaard, M. Comparison of primary care models in the prevention of cardiovascular disease - a cross sectional study. *BMC Fam Pract*. 2011;12.
38. Lin Y, Yin S, Huang J, Du L. Impact of Pay for performance on Behavior of Primary Care Physicians and Patient Outcomes. *Journal of evidence-based medicine*. 2015.
39. Lockhart EH, G.A.; Ivers, N.M.; O'Brien, T.; Mukerji, G.; Pariser, P.; Stanaitis, I.; Pus, L.; Baker, G.R. Engaging primary care physicians in care coordination for patients with complex medical conditions. *Can Fam Physician*. 2019;65(4).
40. Morestin F. A Framework for Analyzing Public Policies: Practical guide. National Collaborating Centre for Healthy Public Policy; 2012.
41. Patient Rostering in Family Practice. The College of Family Physicians of Canada; 2012.
42. Prevalence of Chronic Diseases Among Canadian Adults: Government of Canada; 2019 [updated December 9, 2019. Available from: <https://www.canada.ca/en/public-health/services/chronic-diseases/prevalence-canadian-adults-infographic-2019.html>.
43. Primary Care Payment Models in Ontario Ontario, Canada: Ministry of Health - Ministry of Long-Term Care; 2020 [updated March 26, 2020. Available from: <http://www.health.gov.on.ca/en/pro/programs/pcpm/>.
44. Ritchie L, Bisset, A., Russell, D., Leslie, V., Thomson, I. Primary and preschool immunisation in Grampian: progress and the 1990 contract. *BMJ*. 1992;304:816-9.
45. Robinson JC. Theory and Practice in the Design of Physician Payment Incentives. *The Milbank Quarterly*. 2001;79(2):149-77.
46. Roland M, Guthrie B, Thomé DC. Primary Medical Care in the United Kingdom. *Journal of The American Board of Family Medicine*. 2012;25:S6-11.
47. Rosenthal MB. Beyond Pay for Performance — Emerging Models of Provider-Payment Reform. *N Engl J Med*. 2008;359:1197-200.
48. Rudmik L, Wranik D, Rudisill-Michaelsen C. Physician payment methods: A focus on quality and cost control. *Journal of Otolaryngology - Head and Neck Surgery*. 2014;43(34).
49. Russell GM, Dahrouge S, Hogg W, Geneau R, Muldoon L, Tuna M. Managing chronic disease in ontario primary care: the impact of organizational factors. *Ann Fam Med*. 2009;7(4):309-18.
50. Ryan R, Hill, S, Broclain, D, Horey, D, Oliver, S, Prictor, M. Cochrane Consumers and Communication Review Group 2013 [updated June 20,2013. Available from: <http://cccr.org/cochrane.org/author-resources>.
51. Serumaga B, Ross-Degnan D, Avery AJ, Elliott RA, Majumdar SR, Zhang F, et al. Effect of pay for performance on the management and outcomes of hypertension in the United Kingdom: interrupted time series study. *BMJ*. 2011;342:d108.
52. Strumpf E, Ammi M, Diop M, Fiset-Laniel J, Tousignant P. The impact of team-based primary care on health care services utilization and costs: Quebec's family medicine groups. *J Health Econ*. 2017;55:76-94.

53. To T, Guan J, Zhu J, Lougheed MD, Kaplan A, Tamari I, et al. Quality of asthma care under different primary care models in Canada: a population-based study. *BMC Fam Pract.* 2015;16:19.
54. Tsasis PB, J. Chronic Disease: Shifting the Focus of Healthcare in Canada *Healthcare Quarterly.* 2009;12(2).
55. Tu KC-D, K.; Chen, Z. Comparison of primary care physician payment models in the management of hypertension. *Canadian Family Physician.* 2009;55:719-27.
56. Wang H, Zhang L, Yip W, Hsiao W. An experiment in payment reform for doctors in rural China reduced some unnecessary care but did not lower total costs. *Health Aff (Millwood).* 2011;30(12):2427-36.
57. What is the Patient-Centered Medical Home: American College of Physicians; 2017. American College of Physicians [Available from: <https://www.acponline.org/practice-resources/business-resources/payment/delivery-and-payment-models/patient-centered-medical-home/understanding-the-patient-centered-medical-home/what-is-the-patient-centered-medical-home>].
58. Wranik D, Durier-Copp M. Framework for the design of physician remuneration methods in primary health care. *Social work in public health.* 2011;26(3):231-59.
59. Wranik DW, Durier-Copp M. Physician remuneration methods for family physicians in Canada: expected outcomes and lessons learned. *Health care analysis: HCA: journal of health philosophy and policy.* 2010;18(1):35-59.
60. Yan CK-R, J.; Chuck, A. Financial Incentives to Physician Practices: A literature review of evaluations of physician remuneration models. Institute of Health Economics; 2009.
61. Yip W, Powell-Jackson T, Chen W, Hu M, Fe E, Hu M, et al. Capitation combined with pay-for-performance improves antibiotic prescribing practices in rural China. *Health Aff (Millwood).* 2014;33(3):502-10.
62. Young GJ, Meterko M, Beckman H, Baker E, White B, Sautter KM, et al. Effects of paying physicians based on their relative performance for quality. *J Gen Intern Med.* 2007;22(6):872-6.

Appendices

Appendix A

MEDLINE (3723)

1. exp Physicians/
2. doctor*.mp.
3. physician*.mp.
4. exp Academic Medical Centers/
5. exp Family Practice/
6. exp primary health care/
7. general practitioner*.mp.
8. gp.mp.
9. specialist*.mp.
10. or/1-9
11. exp case-control studies/
12. exp cohort studies/
13. (controlled adj3 before adj3 after).tw.
14. time series.tw.
15. (random* or trial or trials or groups).tw.
16. randomized controlled trial.pt.
17. nonrandomized controlled trial.tw.
18. exp "Costs and Cost Analysis"/
19. (cost* or economic* or expenditures or price or fiscal or financial).ti.

20. (quality or versus or evaluation or analysis or impact* or effect* or change* or "before and after" or evidence or alternat* or compared or comparison).ti.

21. or/11-20

22. exp capitation fee/

23. capitat*.ti,ab.

24. prospective payment*.mp.

25. sessional.mp.

26. exp fee-for-service plans/ or fee-for-service.ti,ab.

27. exp fees, medical/ or exp fees, medical/sn [Statistics & Numerical Data]

28. alternat* funding.mp.

29. alternat* payment*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]

30. or/22-29

31. 10 and 21 and 30

32. limit 31 to (comment or editorial or letter or news or newspaper article or "review")

33. 31 not 32

Cochrane Central Register of Controlled Trials (134)

1. exp Physicians/

2. doctor*.mp.

3. physician*.mp.

4. exp Academic Medical Centers/

5. exp Family Practice/

6. exp primary health care/

7. general practitioner*.mp.
8. gp.mp.
9. specialist*.mp.
10. or/1-9
11. exp capitation fee/
12. capitat*.ti,ab.
13. prospective payment*.mp.
14. sessional.mp.
15. exp fee-for-service plans/ or fee-for-service.ti,ab.
16. exp fees, medical/ or exp fees, medical/sn [Statistics & Numerical Data]
17. alternat* funding.mp.
18. alternat* payment*.mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms]
19. or/11-18
20. 10 and 19
21. limit 20 to (comment or editorial or letter or news or newspaper article or "review")
22. 20 not 21

CDSR (57)

1. doctor*.mp.
2. physician*.mp.
3. practice.mp.
4. primary care physician.mp.

5. general practitioner*.mp.
6. gp.mp.
7. specialist*.mp.
8. or/1-7
9. capitat*.mp.
10. prospective payment*.mp.
11. sessional.mp.
12. fee-for-service.mp.
13. medical fee*.mp.
14. alternat* funding.mp.
15. alternat* payment*.mp. [mp=title, abstract, full text, keywords, caption text]
16. or/19-25
17. 8 and 16

DARE (16), NHS EED (56)

1. doctor*.mp.
2. physician*.mp.
3. practice.mp.
4. primary care physician.mp.
5. general practitioner*.mp.
6. gp.mp.
7. specialist*.mp.
8. or/1-7

9. case-control.mp.
10. cohort.mp.
11. (controlled adj3 before adj3 after).tw.
12. time series.tw.
13. (random* or trial or trials or groups).tw.
14. randomized controlled trial.tw
15. nonrandomized controlled trial.tw.
16. (cost* or economic* or expenditures or price or fiscal or financial).ti.
17. (quality or versus or evaluation or analysis or impact* or effect* or change* or "before and after" or evidence or alternat* or compared or comparison).ti.
18. or/9-17
19. capitat*.mp.
20. prospective payment*.mp.
21. sessional.mp.
22. fee-for-service.mp.
23. medical fee*.mp.
24. alternat* funding.mp.
25. alternat* payment*.mp. [mp=title, abstract, full text, keywords, caption text]
26. or/19-25
27. 8 and 18 and 26

ECON LIT (206), Web of Science (4300)

doctor* or physician* or practice* or primary care physician* or general practitioner* or gp or specialist*

AND

case-control or cohort or (controlled before and after) or time series or trial or random* or cost*

AND

capitat* or prospective payment* or sessional or fee-for-service or medical fee* or alternat* payment*

EMBASE (3727)

1. exp Physicians/
2. doctor*.mp.
3. physician*.mp.
4. exp primary health care/
5. general practitioner*.mp.
6. gp.mp.
7. specialist*.mp.
8. or/1-7
9. exp case-control studies/
10. exp cohort studies/
11. (controlled adj3 before adj3 after).tw.
12. time series.tw.
13. (random* or trial or trials or groups).tw.
14. randomized controlled trial.tw.
15. nonrandomized controlled trial.tw.
16. (cost* or economic* or expenditures or price or fiscal or financial).ti.

17. (quality or versus or evaluation or analysis or impact* or effect* or change* or "before and after" or evidence or alternat* or compared or comparison).ti.

18. exp economic evaluation/

19. or/9-18

20. exp medical fee/ or exp capitation fee/

21. capitat*.ti,ab.

22. sessional.mp.

23. fee-for-service.ti,ab.

24. alternat* funding.mp.

25. alternat* payment*.mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word]

26. exp prospective payment/

27. or/20-26

28. 8 and 19 and 27

29. limit 28 to (editorial or letter or "review")

30. 28 not 29

Appendix B

Sources of gray literature

- Google www.google.com
- Des Libris: Canadian electronic library <https://www.deslibris.ca>
- CD Howe Institute <https://www.cdhowe.org>
- ProQuest Global <https://search-proquest-com.ezproxy.lib.ucalgary.ca>

Appendix C

Sources of environmental scan

- www.Canada.ca
 - o Public Health Agency of Canada
- www.Alberta.ca
- www.ontario.ca
- www.gov.bc.ca
- www.saskatchewan.ca
- www.gov.mb.ca
- www.quebec.ca
- www2.gnb.ca
- www.novascotia.ca
- www.princeedwardisland.ca
- www.gov.nl.ca
- Keyword search in PubMed
- Google.ca