The Development and Evaluation of Hospital Pay-for-Performance in Lebanon: Casemix, Readmissions and Patient Perspectives.

Khalife, Jade

2023

Document Version:
Publisher's PDF, also known as Version of record

The Development and Evaluation of Hospital Pay-for-Performance in Lebanon

Casemix, Readmissions and Patient Perspectives

JADE KHALIFE
DEPARTMENT OF CLINICAL SCIENCES | FACULTY OF MEDICINE | LUND UNIVERSITY

The Development and Evaluation of Hospital Pay-for-Performance in Lebanon: Casemix, Readmissions and Patient Perspectives

The Development and Evaluation of Hospital Pay-for-Performance in Lebanon

Casemix, Readmissions and Patient Perspectives

Jade Khalife

LUND
UNIVERSITY

Doctoral Dissertation
by due permission of the Faculty of Medicine, Lund University, Sweden.
To be publicly defended on 27th September at 13.00 in Agardh Hall,
Clinical Research Center, Malmö, Sweden.

Faculty opponent
Josephine Borghi, Professor,
Department of Global Health and Development,
London School of Hygiene & Tropical Medicine

Organization: Lund University

Document name: Doctoral Dissertation **Date of issue** 2023-09-27

Author(s): Jade Khalife **Sponsoring organization:**

Title and subtitle: The Development and Evaluation of Hospital Pay-for-Performance in Lebanon: Casemix, Readmissions and Patient Perspectives.

Abstract:

Background: Pay-for-performance (P4P) has been widely used in healthcare, but there are few experiences of hospital-based P4P at scale. The evidence of impact from these has been mixed, and there has been increased recognition of the importance of different contexts, designs, incentives and other factors. In 2014, the Lebanese Ministry of Public Health integrated a P4P model for determining hospital reimbursement tiers. In 2018, this model was updated to include a readmissions component, in addition to the preexisting components such as casemix and patient satisfaction. The impact of these interventions was previously undetermined. This also provided an opportunity to contribute to some of the known knowledge gaps regarding hospital P4P. The purpose of this thesis was to describe the development and evaluate the impact of hospital P4P in Lebanon, and ultimately to contribute more broadly to improved design and implementation of value-based healthcare, particularly in limited resource settings.

Methods: This thesis uses a mixed methods approach, combining quantitative and qualitative study designs, to conduct four research investigations. The first paper uses descriptive analysis to address how and why hospital P4P was developed in Lebanon. The second and third papers both use an interrupted time series design on data collected from the Ministry hospitalization database. The former uses Newey-OLS regression, and the latter uses Autoregressive Integrated Moving Average models. The second paper analyzes the impact of the 2014 P4P integration on casemix index, and the third paper analyzes the impact of the 2018 model update on readmissions. The fourth paper uses qualitative content analysis on data collected from eight focus groups discussions with patient participants.

Results: The Ministry developed hospital P4P after recognizing the limitations of the previous model that had been solely based on accreditation status. Casemix index was included in the P4P model, to improve the appropriateness and fairness of the Ministry-hospitals relation. The analysis of P4P integration impact on casemix included 1,353,025 hospitalizations between 2011 and 2016. This revealed an abrupt increase in casemix among short-stay cases, and a gradual increase in medium-stay cases. Code-level analysis suggested this was attributable to a decrease in unnecessary hospitalizations and improved coding practices. The analysis of P4P impact on readmissions included 1,333,691 hospitalizations across 2011-2019. An abrupt decrease of cholecystectomy and stroke readmissions was found, but not of general and pneumonia readmissions. Our qualitative investigation allowed us to identify six patient perspectives, including satisfaction, health status, perceptions on each of quality, access and health system, and valuing of health, all of central relevance to health systems performance.

Conclusion: Hospital P4P in Lebanon led to several positive impacts, including improving the relation between hospitals and the Ministry of Public Health, and providing a tool for continuous development of the health system. The 2014 and 2018 P4P interventions improved system effectiveness and related patient outcomes, by decreasing unnecessary hospitalizations and decreasing some types of readmissions. The Ministry should develop its P4P model to capture the entire spectrum of hospital visits. Using appropriate interrupted time series analysis on readily available data is a useful way to evaluate the effects of health system interventions in contexts with limited resources. Patients in Lebanon highly valued health and supported improving public hospitals and measures to counter the influence of personal connections and money. Health systems can more widely engage people for their perspectives, and patients can have a fundamental role in shaping the values and functions of a health system.

Key words: health system, hospital performance, pay-for-performance, evaluation, patient perspectives, casemix, readmissions, Lebanon.

Classification system and/or index terms (if any) Supplementary bibliographical information

Language: English **ISSN and key title**: 1652-8220

ISBN: 978-91-8021-446-9

Recipient's notes **Number of pages**: 140

Price Security classification

Signature Date 2023-08-15

The Development and Evaluation of Hospital Pay-for-Performance in Lebanon

Casemix, Readmissions and Patient Perspectives

Jade Khalife

LUND
UNIVERSITY

Coverphoto: “Accompanying the patient on their journey”, by Ramzi Semrani.

Faculty of Medicine

Department of Clinical Sciences

Lund University, Faculty of Medicine Doctoral Dissertation Series 2023:105

ISBN 978-91-8021-446-9

ISSN 1652-8220

Printed in Sweden by Media-Tryck, Lund University

Lund 2023

Media-Tryck is a Nordic Swan Ecolabel certified provider of printed material. Read more about our environmental work at www.mediatryck.lu.se

MADE IN SWEDEN

To Oliver & Nadine

From those before us, through us, and for those that follow.

Table of Contents

Abstract

Background: Pay-for-performance (P4P) has been widely used in healthcare, but there are few experiences of hospital-based P4P at scale. The evidence of impact from these has been mixed, and there has been increased recognition of the importance of different contexts, designs, incentives and other factors. In 2014, the Lebanese Ministry of Public Health integrated a P4P model for determining hospital reimbursement tiers. In 2018, this model was updated to include a readmissions component, in addition to the preexisting components such as casemix and patient satisfaction. The impact of these interventions was previously undetermined. This also provided an opportunity to contribute to some of the known knowledge gaps regarding hospital P4P. The purpose of this thesis was to describe the development and evaluate the impact of hospital P4P in Lebanon, and ultimately to contribute more broadly to improved design and implementation of value-based healthcare, particularly in limited resource settings.

Methods: This thesis uses a mixed methods approach, combining quantitative and qualitative study designs, to conduct four research investigations. The first paper uses descriptive analysis to address how and why hospital P4P was developed in Lebanon. The second and third papers both use an interrupted time series design on data collected from the Ministry hospitalization database. The former uses Newey-OLS regression, and the latter uses Autoregressive Integrated Moving Average models. The second paper analyzes the impact of the 2014 P4P integration on casemix index, and the third paper analyzes the impact of the 2018 model update on readmissions. The fourth paper uses qualitative content analysis on data collected from eight focus groups discussions with patient participants.

Results: The Ministry developed hospital P4P after recognizing the limitations of the previous model that had been solely based on accreditation status. Casemix index was included in the P4P model, to improve the appropriateness and fairness of the Ministry-hospitals relation. The analysis of P4P integration impact on casemix included 1,353,025 hospitalizations between 2011 and 2016. This revealed an abrupt increase in casemix among short-stay cases, and a gradual increase in medium-stay cases. Code-level analysis suggested this was attributable to a decrease in unnecessary hospitalizations and improved coding practices. The analysis of P4P impact on readmissions included 1,333,691 hospitalizations across 2011-2019. An abrupt decrease of cholecystectomy and stroke readmissions was found, but not of general and pneumonia readmissions. Our qualitative investigation allowed us to identify six patient perspectives, including satisfaction, health status, perceptions on each of quality, access and health system, and valuing of health, all of central relevance to health systems performance.

Conclusion: Hospital P4P in Lebanon led to several positive impacts, including improving the relation between hospitals and the Ministry of Public Health, and providing a tool for continuous development of the health system. The 2014 and 2018 P4P interventions improved system effectiveness and related patient outcomes, by decreasing unnecessary hospitalizations and decreasing some types of readmissions. The Ministry should develop its P4P model to capture the entire spectrum of hospital visits. Using appropriate interrupted time series analysis on readily available data is a useful way to evaluate the effects of health system interventions in contexts with limited resources. Patients in Lebanon highly valued health and supported improving public hospitals and measures to counter the influence of personal connections and money. Health systems can more widely engage people for their perspectives, and patients can have a fundamental role in shaping the values and functions of a health system.

Preface

This thesis came about through a mix of factors, including my personal interests, the people I met, and chance. I have had an interest in population health since childhood, and specifically in how a country can improve its population's health. My perspective included a recognition of the limited scalability of private initiative, the wide differences in national health systems, and the role of historic circumstances. I was partly influenced through reflections on my grandparents' social initiatives in their towns, particularly my maternal grandfather, Ishak Sejaan. I was also influenced by the impact of the 1975-1990 war in Lebanon, and other conflicts elsewhere. I considered private initiatives to be important, but they could not replace the need for a strong public health system.

During my medical studies I became curious about healthcare design, and the gap between the medical and public health fields. My interests in public health impact took me towards non-communicable diseases (NCDs) and tobacco control. In 2008, I had the opportunity to observe a few people working at the Ministry of Public Health (MoPH). That so much was dependent on the dedication of so few was rather inspiring. The following year I got involved in some independent projects at the MoPH. I had initially turned down the opportunity to work on the health system reforms planned by the MoPH, as I had wanted to focus on NCDs, in Lebanon and elsewhere. I was encouraged to 'try it for a few months and see' by Walid Ammar, the then-Director-General, whose vision guided the reforms (out of which hospital pay-for-performance evolved). Months turned to years, as my interest in health systems grew. It was during this time that I met Björn Ekman, then senior health economist at the World Bank, who would later become my thesis supervisor at Lund University (LU).

During my time at the MoPH, I became more aware of a second interesting gap. Aristotle introduced three key terms in his works, particularly in "Nicomachean Ethics" and "Politics". These were *episteme*, *techne*, and *phronesis* [1]. The first referred to theoretical knowledge, which was predominant during my university studies, and is generally the focus in academia. The second term referred to practical knowledge or technical expertise, which I came to witness more in the operational setting of the MoPH. The different focus of university and health authority was an issue that interested me. And it was particularly relevant in the joint collaborations I was involved in, which are described in the thesis Paper 1. The third term, *phronesis*, referred to practical wisdom, the type one could only gain with experience, and of which I saw much in the technical (but not political) leadership of the MoPH.

Some years later, I had partially relocated to Denmark to join my family there, but was regularly in Lebanon as well. I had not specifically intended to pursue a PhD,

but it seemed a logical path to interact with other health professionals, develop myself further and have a local network. At Björn's suggestion, I enrolled part-time with the PhD program at LU, to investigate the development and impact of the MoPH hospital pay-for-performance (P4P) of 2014. A year later, we had a team across Lebanon and Sweden successfully apply for funding from the UK Joint Health Systems Research Initiative (HSRI), to continue developing the MoPH work on P4P, specifically through an implementation-based research project. This involved the American University of Beirut, LU and the MoPH.

Between 2016-2019 much of the work was focused on the operational details of this project, while the later research outputs would include articles for inclusion in my thesis. I was able to devote most of my efforts towards the operational details, while also developing a solid base for subsequent research investigations. A substantial part of this involved algorithmic thinking and statistical review for developing the required data and methods. Of course, having been involved in both the development and evaluation of hospital P4P in Lebanon may place particular demands on my conduct and scientific approach. My perspective is that all researchers and practitioners have some form of bias or another, to various extents, and perhaps influenced by past experiences, current dependencies, career paths and other factors. Many system-determined incentives seem unhealthy. The best we can do to address this is to be transparent, adopt rigorous investigative approaches, and involve other professionals or stakeholders where relevant. In the research included in this thesis, my colleagues and I strove to meet all three of these actions. One of the strengths of this thesis, and the preceding development of P4P, was the involvement of both researchers and practitioners. In essence, this brought *episteme* and *techne* together, at the individual and group level.

The P4P initiative in Lebanon also had some setbacks, which affected the implementation of the thesis studies. Similar to many projects dealing with health policies, we had to contend with the changing political environment in Lebanon, and specifically for the then-health ministers to sign the approval for the modified P4P model. Despite a delay of over a year, the updated model was officially approved in 2019.

Two broader setbacks were the political-economic crisis in Lebanon in late 2019, and subsequently the COVID-19 pandemic. The first had major implications in limiting the future development and use of the P4P model, at least in the near-term. It has been four years since the last application of P4P was used to determine hospital reimbursement tiers. Much of the know-how can still be used, but the challenges of the current context require wider reforms, and even health system redesign, if population health is our priority. I think most of the participants in the focus group discussions documented in Paper 4 of this thesis would agree. From my perspective, this can only be achieved with the creation of a single Lebanese

National Health System. At the current time, the political priorities are unfortunately elsewhere.

The COVID-19 pandemic had major implications for humanity, but also on my professional and personal life. From my perspective, the pandemic revealed that most health systems are far from being patient or people-centered. This issue also happens to be a focus of Paper 4 of this thesis. There are several examples of declarations and agreements at various levels regarding patient-centeredness. A notable one is the Framework on Integrated People-centered Health Services, adopted by member states at the 69th World Health Assembly (2016). Despite this, when faced by COVID-19, most countries had approaches centered on hospital burdens, not their population's well-being (and ignoring long-term sequelae, including Long Covid). Maintaining hospital capacity was the priority, while limiting infection was only relevant in the context of hospital capacity. From my perspective, this represented a monumental failure of public health and ethics, and more broadly technical incompetence and political indifference, albeit with some important exceptions. 'To err is human' is a universal truth, but it was also highlighted in the US Institute of Medicine 2000 report on building a safer health system. As individuals, we will make mistakes. However, it is distinctly more grave to have systems that do not self-correct based on scientific evidence. Although not directly relevant to my thesis, the response to the pandemic was highly informational. I increasingly recognize the limitations of our systems, and the importance of putting people first, and developing self-correction mechanisms based on logic and evidence. Multi-disciplinary collaboration and engagement of the public are essential ingredients in this.

During my work on this thesis I learned much from the past work of others. Most of this has been through reading, engaging with others, and much reflection in between. This went across different contexts and disciplines. Many scientific articles have been useful in this process, but on some topics I think select books provide a considerably greater depth of understanding. One example that has been very relevant to this thesis is interrupted time series analysis. Although I had been rather critical of the use and miss-use of statistical approaches before this PhD, this increased after I had the opportunity to read some select books regarding time series and related issues. This enabled me to more easily identify limitations of different articles, and attempt to improve my own. I have encountered much material on P4P of variable validity, particularly regarding construct and statistical conclusion validities using time series design (see chapter 5). Given that one can never have expertise in all relevant disciplines (myself included, of course), collaboration is indispensable to ensure the validity and meaningful conclusions of our scientific investigations. That, coupled with the spirit expressed by the likes of Ibn al-Haytham and Richard Feynman (see Chapter 8).

This thesis was written with health practitioners and researchers in mind, but also in a manner to be more widely accessible to the public. An unavoidable trade-off is involved regarding readability and detail. Some of the theoretical and historical aspects may be skipped by those more familiar with this. Throughout this thesis, the pronoun 'we' refers to my contributions and perspective, unless otherwise specified.

I have been fortunate to work with various practitioners and researchers in Lebanon, Sweden and elsewhere. I am also very grateful to have engaged with patients before and during my thesis work, and to be surrounded by family and friends that have made all the difference in life. I acknowledge many of these in the last section of the thesis, although a more appropriate place would be the front cover.

If one were to sum up this thesis into a single question, it would be along the lines of "Does hospital pay-for-performance work?". However, it is rather obvious that the wide diversity of contexts, designs, incentives, measures, and other features does not provide a useful answer to a question framed in this simple manner. From my perspective, I think that there are instances where P4P may be beneficial. Perhaps what is most relevant is to increase our understanding of the factors that make success more likely, and in parallel ensure that we avoid or decrease unintended consequences. We should have a reasonable chance to succeed, without risking someone's health or well-being. More specifically, for my research I developed P4P as the common thread linking specific components such as casemix index, readmissions and patient perspectives, while also considering aspects of health systems, complexity, sustainability, robustness, and integration.

Overall, I think this thesis' findings reveal some positive effects of hospital P4P in Lebanon, and some areas that should be further developed in the future, in Lebanon and beyond. In light of the ongoing economic crisis, P4P can continue to have an important role in the health system. But more useful than P4P itself may be some of the tools and findings developed in this process, particularly towards the recovery and redesign of the health system.

More widely, health systems should carefully design P4P initiatives using multi-disciplinary collaboration and principles of participatory governance, and more rigorously evaluate their impact. They also should improve engagement of patients and the public, both for P4P and for health system development.

Health systems are increasingly challenged in this new age of pandemics, climate catastrophe and political-economic upheavals. People highly value health, and we should strengthen our systems to reflect this.

List of Papers

Paper 1

Khalife J., Rafeh N., Makouk J., El-Jardali F., Ekman B., Kronfol N., Hamadeh G., Ammar W. (2017). Hospital Contracting Reforms: The Lebanese Ministry of Public Health Experience. Health Systems & Reform. 3(1):34–41.

Paper 2

Khalife J., Ammar W., Emmelin M., El-Jardali F., Ekman B. (2020). Hospital performance and payment: impact of integrating pay-for-performance on healthcare effectiveness in Lebanon. Wellcome Open Research. 5:95.

Paper 3

Khalife J., Ammar W., El-Jardali F., Emmelin M., Ekman B. Impact of pay-for-performance on hospital readmissions in Lebanon: An ARIMA-based intervention analysis using routine data. *In manuscript.*

Paper 4

Khalife J., Ekman B., Ammar W., El-Jardali F., Al Halabi A., Barakat E., Emmelin M. (2023). Exploring patient perspectives: A qualitative inquiry into healthcare perceptions, experiences and satisfaction in Lebanon. PLOS ONE. 18(8):e0280665.

Abbreviations

ARIMA	Autoregressive Integrated Moving Average
BPT	Best Practice Tariff (UK)
CMI	Casemix index
CMS	Centers for Medicare & Medicaid Services (US)
CPT	Common Procedural Terminology
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
DRGs	Diagnosis related groups
ESPISP-2	2nd Emergency Social Protection Implementation Support Project
HACRP	Hospital-Acquired Condition Reduction Program (CMS)
HICs	High income countries
HRRP	Hospital Readmissions Reduction Program (CMS)
HSRI	Health Systems Research Initiative
ICD-10	International Classification of Diseases, 10th Revision
ITS	Interrupted time-series
LMICs	Low- and middle-income countries
MI	Myocardial infarction
MoPH	Ministry of Public Health
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least squares
P4P	Pay-for-performance
WHA	World Health Assembly
WHO	World Health Organization
VBP	Value-based purchasing

1 Purpose, Goals and Overview

"All men can see these tactics whereby I conquer, but what none can see is the strategy out of which victory is evolved"
– Sun Tzu (544-496 BCE)

This thesis has similar elements to a strategy: a purpose, goals and means. This chapter presents the purpose of the thesis, and the goals which serve as intermediate steps. The means are elaborated in subsequent chapters. We further provide an overview of the linkage between the thesis goals and the research studies, and depict the main building blocks of each paper.

1.1 Purpose

The purpose of this thesis is to describe the development and evaluate the impact of hospital pay-for-performance (P4P) in Lebanon, and ultimately to contribute to improved design and implementation of value-based healthcare, particularly in limited resource settings

1.2 Goals

The goals of the thesis are to:

a. Describe how and why hospital P4P was developed in Lebanon. *(Paper 1)*
b. Analyze the impact of P4P integration on healthcare effectiveness. *(Paper 2)*
c. Describe how routine data and casemix index may be used for hospital performance. *(Paper 2)*
d. Analyze the impact of P4P on hospital readmissions in Lebanon. *(Paper 3)*
e. Explore patient perspectives on hospital care in Lebanon, and contribute insights that may improve P4P design and effectiveness. *(Paper 4)*

1.3 Overview

The linkage between the thesis goals and the four research studies is depicted in figure 1. The goals are connected with the particular problems tackled in each paper. The figure also highlights the conclusions of each paper.

A research canvas approach is then used to depict each of the four studies, using a framework consisting of nine specific cells, developed by John Latham [2]. These provide a concise summary of the main building blocks of each paper, and help to clarify their alignment and coherence.

Each canvas is organized into two groups: the 'T' that depicts the foundation of the paper (problem, purpose, conceptual framework and research questions), and the 'U' for the methods (overall approach, literature review, data collection, analysis and conclusions). The conceptual framework for each paper notes its relation to the cross-cutting topic of pay-for-performance. The problem component notes the potential contribution of the paper to the context of Lebanon and LMICs, as well as to the broader field of P4P.

Conclusion

This chapter provided the thesis purpose and goals; the linkage between the goals and research studies; and the main building blocks of each paper.

In the next chapter we will provide an introduction to pay-for-performance, and the three concentration areas this thesis deals with: casemix, readmissions and patient perspectives.

The Development and Evaluation of Hospital Pay-for-Performance in Lebanon

Casemix, Readmissions and Patient Perspectives

The purpose of this thesis is to describe the development and evaluate the impact of hospital pay-for-performance in Lebanon.

The ultimate purpose is to contribute to the improved design and implementation of value-based healthcare, particularly in limited resource settings.

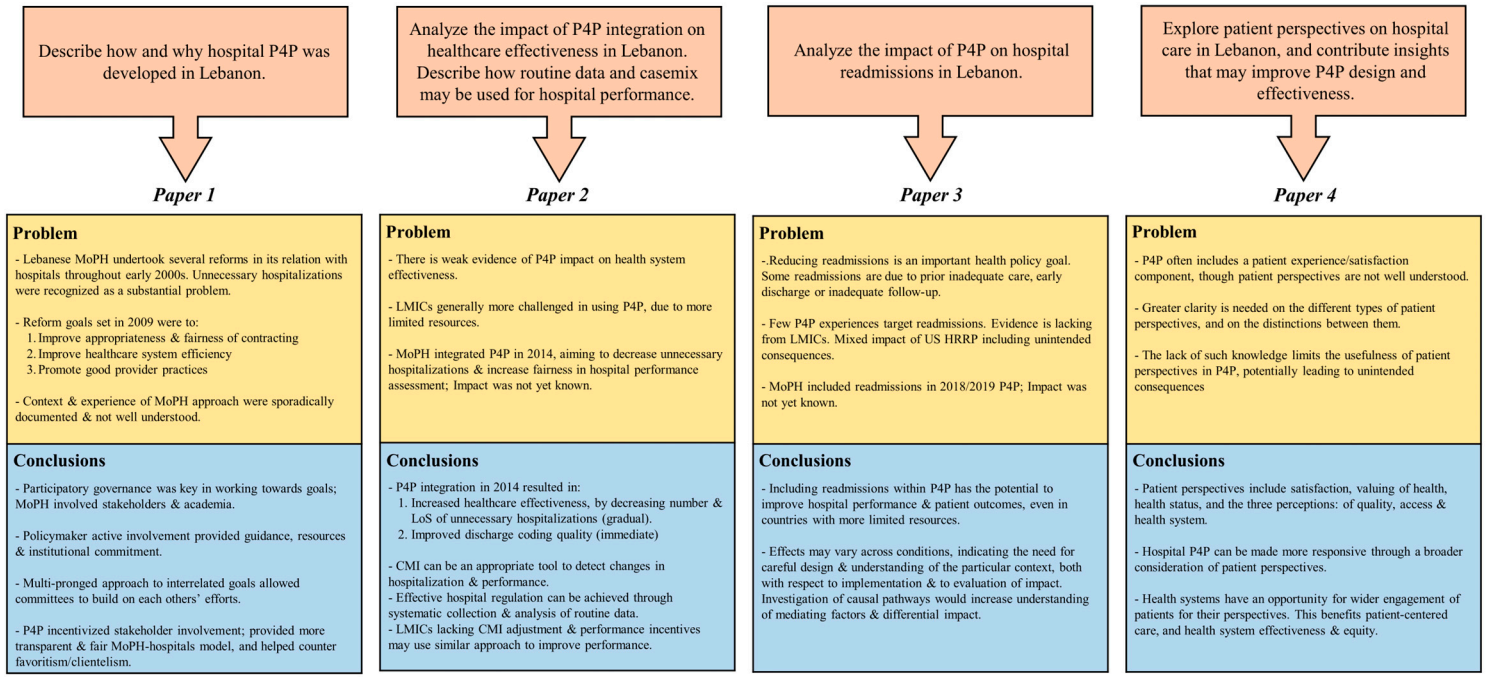


Figure 1: The linkage between the thesis goals and the four research studies.

Hospital Contracting Reforms:
The Lebanese Ministry of Public Health Experience

Paper 1

Problem

- Lebanese MoPH undertook several reforms in its relation with hospitals throughout early 2000s. Unnecessary hospitalizations were recognized as a substantial problem.

- Reform goals set in 2009 were to:
  1. Improve appropriateness & fairness of contracting
  2. Improve healthcare system efficiency
  3. Promote good provider practices

- Context & experience of MoPH approach were sporadically documented & not well understood.

Purpose

- To detail the experience of the MoPH 2009-2014 reforms, specifically the context & approach used to improve governance & regulation of hospitals, and counter favoritism & clientelism.

- To investigate how & why the MoPH moved towards hospital pay-for-performance (P4P).

Research Questions

1. What was the MoPH experience in pursuing the three goals set in 2009?

2. Why did the MoPH implement hospital P4P?

Conclusions

- Participatory governance was key in working towards goals; MoPH involved stakeholders & academia.

- Policymaker active involvement provided guidance, resources & institutional commitment.

- Multi-pronged approach to interrelated goals allowed committees to build on each others' efforts.

- P4P incentivized stakeholder involvement; provided more transparent & fair MoPH-hospitals model, and helped counter favoritism/clientelism.

Conceptual Framework

- Health reforms are influenced by various factors, including approach, stakeholder interests, and political & socioeconomic factors.
- Alignment of interests provides a tool for the principal (payer) to incentivize the provider to improve outputs & outcomes.
- A health system intervention linking measures to payment creates a financial incentive for hospitals to improve their performance vis-à-vis these measures.
- Seen through the lens of principal-agent theory, P4P seeks to address recognized information problems within healthcare, particularly information asymmetry.

Literature Review

- The Lebanese health system is highly diverse, including a mix of public and private payers and providers.
- Private hospitals dominate service provision, while the public sector is the major payer of hospital care.
- In 2014 the MoPH contracted with 131 hospitals (105 private).
- Hospital accreditation was linked to reimbursement tier in 2001.
- Its inappropriateness as a sole determinant for reimbursement was soon apparent.
- Stakeholders required a fairer contracting model, and the MoPH sought to incentivize performance.

Data Analysis

Descriptive analysis

Data Collection

- Review of reports & materials related to each of the Utilization Review, Performance Contracting & Admission Criteria committees.

- Hospitalization database of the Ministry of Public Health.

- Hospital performance scores & reimbursement tiers

Overall Approach

Descriptive qualitative approach using project documentation materials, discussions with key personnel involved, and limited descriptive statistics.

Figure 2: Summary of the main building blocks of Paper 1.

Hospital performance and payment: impact of integrating pay-for-performance on healthcare effectiveness in Lebanon

Paper 2

Problem

- There is weak evidence of P4P impact on health system effectiveness.

- LMICs generally more challenged in using P4P, due to more limited resources.

- MoPH integrated P4P in 2014, aiming to decrease unnecessary hospitalizations & increase fairness in hospital performance assessment; Impact was not yet known.

Purpose

- To assess if P4P had an impact on healthcare effectiveness.

More specifically:
- To analyze if P4P affected the complexity of the average case hospitalized (CMI).
- To quantify & offer plausible explanations for changes, at the level of diagnoses & procedures.

Research Questions

1. What was P4P impact on CMI level & trend, across public & private hospitals, by:
   a. Case type: medical, surgical & mixed
   b. LoS: short, medium & long-stays (medical)

2. What changes occurred in diagnoses & procedures by:
   a. Contribution to CMI changes
   b. Hospitalized cases

Conclusions

- P4P integration in 2014 resulted in:
  1. Increased healthcare effectiveness, by decreasing number & LoS of unnecessary hospitalizations (gradual).
  2. Improved discharge coding quality (immediate)

- CMI can be an appropriate tool to detect changes in hospitalization & performance.
- Effective hospital regulation can be achieved through systematic collection & analysis of routine data.
- LMICs lacking CMI adjustment & performance incentives may use similar approach to improve performance.

Conceptual Framework

- Alignment of interests provides a tool for the principal (payer) to incentivize the provider to improve outputs & outcomes.

- A health system intervention linking measures to payment creates a financial incentive for hospitals to improve their performance vis-à-vis these measures.

- Seen through the lens of principal-agent theory, P4P seeks to address recognized information problems within healthcare, particularly information asymmetry.

Literature Review

- P4P has been increasingly used in healthcare, but evidence on P4P impact is mixed.

- P4P potential impact may be larger in LMICs, given relatively lower provider resources & more dynamic health reform context.

- P4P usually used in distinct projects & not integrated within health system towards broad system goals;
'not seeing the forest for the trees'.

Data Analysis

- Main impact measure was national CMI, calculated across 2011-2016, using medical & surgical procedure codes.

- Single-group interrupted time series analysis model with Newey OLS regression was estimated.

- Adjustment for seasonality & stratification by case type.

- Code-level analysis used to attribute & explain CMI changes due to specific diagnoses/procedures.

Data Collection

- Hospitalization data of 1,353,025 cases under MoPH coverage, between January 2011 and December 2016.

- Patient identifiers were anonymized. Fields included record number, case identifier, hospital code, admission date, discharge date, length of stay, total charge, medical code on discharge & surgical procedure code.

- Algorithms developed to calculate monthly CMI, for medical, surgical & mixed cases; and for code-level analysis.

Overall Approach

- Intervention impact evaluation, using an interrupted time-series design.

- Evaluates the impact of the 2014 Lebanese MoPH integration of hospital P4P on casemix (as a proxy indicator of unnecessary hospitalizations).

Figure 3: Summary of the main building blocks of Paper 2.

Impact of pay-for-performance on hospital readmissions in Lebanon: An ARIMA-based intervention analysis using routine data

Paper 3

Problem	Purpose	Research Questions
- Reducing readmissions is an important health policy goal. Some readmissions are due to prior inadequate care, early discharge or inadequate follow-up. - Few P4P experiences target readmissions. Evidence is lacking from LMICs. Mixed impact of US HRRP including unintended consequences. - MoPH included readmissions in 2018/2019 P4P; Impact was not yet known.	- To estimate the impact of P4P on readmissions of general, pneumonia, stroke and cholecystectomy cases. More specifically: - To compare readmission rates before & after the announcement of P4P component on readmissions. - To analyze for heterogeneous changes across hospital sizes.	1. What was the impact of the P4P components announcement on hospital readmissions? 2. Did impact vary across hospitals of different sizes?
Conclusions	**Conceptual Framework**	**Literature Review**
- The addition of a readmissions component to P4P resulted in a decrease in cholecystectomy and stroke readmissions. - No impact was found on general and pneumonia readmissions, also among small, medium and large hospitals. - Including readmissions within P4P has the potential to improve hospital performance and patient outcomes, but requires careful design and comprehensive understanding of context.	- Alignment of interests provides a tool for the principal (payer) to incentivize the provider to improve outputs & outcomes. - A health system intervention linking measures to payment creates a financial incentive for hospitals to improve their performance vis-à-vis these measures. - Seen through the lens of principal-agent theory, P4P seeks to address recognized information problems within healthcare, particularly information asymmetry.	- US HRRP had mixed impact & unintended consequences. Included MI, heart failure, pneumonia, then COPD, CABG, hip & knee replacement. - Heart failure readmissions: up to 80% may be due to increased ER/observation visits. Readmissions decreased, but mortality increased. - England BPT decreased hip fracture readmissions & mortality. - Challenges due to contextual changes, spill-over, measurement limitations & overall design. - P4P anticipatory/short-term behaviors may differ from long-term behavior.
Data Analysis	**Data Collection**	**Overall Approach**
- Autoregressive Integrated Moving Average (ARIMA) models, with seasonality adjustment. - Stable medium-length time-series data. - Outcome measure was age-adjusted all-cause 30-day readmission rates, calculated at national level for each condition, and across hospital sizes for two conditions.	- Data extracted from MoPH hospitalization database, for 1,333,691 cases, between January 2011 and December 2019. - Case definitions developed for four conditions using literature, and algorithms developed for readmission identification & calculation using Stata v16. - Readmission definition: patient readmitted within 30 days of previous discharge. - 99 monthly data points were available (80 pre-intervention, 19 post-intervention).	- Intervention impact evaluation, using an interrupted time-series design. - Evaluates impact of the 2018 MoPH announcement on the inclusion of a readmissions component to the ongoing P4P model.

Figure 4: Summary of the main building blocks of Paper 3.

Exploring patient perspectives: A qualitative inquiry into healthcare perceptions, experiences and satisfaction in Lebanon

Paper 4

Problem

- P4P often includes a patient experience/satisfaction component, though patient perspectives are not well understood.

- Greater clarity is needed on the different types of patient perspectives, and on the distinctions between them.

- The lack of such knowledge limits the usefulness of patient perspectives in P4P, potentially leading to unintended consequences.

Purpose

- To explore how people with experience of being hospitalized perceive the healthcare, focusing on health perceptions, access to care, experiences of hospitalization & satisfaction of care.

- To contribute insights that may improve MoPH P4P design & effectiveness.

- To contribute to the knowledge on engaging patients towards person-centered health systems.

Research Questions

1. What does health mean to people who have been hospitalized in Lebanon?
2. How do they perceive certain aspects of the health system?
3. How do they characterize their accessibility to healthcare?
4. How do they experience their hospital care?
5. Which factors do they identify as relevant to their satisfaction of hospital care?

Conclusions

- Patient perspectives include satisfaction, valuing of health, health status, and the three perceptions: of quality, access & health system.

- Hospital P4P can be made more responsive through a broader consideration of patient perspectives.

- Health systems have an opportunity for wider engagement of patients for their perspectives. This benefits patient-centered care, and health system effectiveness & equity.

Conceptual Framework

- Explored what satisfaction meant for patients & what their experience & perceptions of care were. This was refined as the review & research unfolded into 'patient perspectives'.

- Health system interventions such as P4P often claim to capture patient perspectives & intend to align provider interests through incentives.

- Seen through the lens of principal-agent theory, P4P seeks to address recognized information problems within healthcare, particularly information asymmetry.

Literature Review

- Perspective of patients within health systems highlighted by WHA, US Institute of Medicine, OECD & others.
- Patient-centeredness as "the doorway to all qualities".
- Personal value pillar in value-based healthcare.
- A return to Hippocratic medicine: accompanying the patient & meeting their individual goals.
- Patient perspectives in P4P, e.g. Brazil, UK & US.
- Patient experience & satisfaction recognized as multi-dimensional, but also ambiguous & under-theorized .

Data Analysis

Five overall themes were identified, which reflected the underlying meaning of the discussions:
1. Health is everything
2. Being turned into second class citizens
3. Money & connections make all the difference
4. Wanting to be treated with dignity & respect
5. Tolerating letdown for the sake of right treatment

These themes were supported by 17 categories at manifest level of interpretation.

Data Collection

- Pilot, 8 FGDs & pile sorting exercise.
- Random sample from hospitalization database, of persons discharged from hospital in preceding 3 months.
- 42 participants (20 women, 22 men).
- During July to September 2017.
- Content analysis based on Graneheim & Lundman (2004).

Overall Approach

- A qualitative approach was used, since it allows gathering information directly from participants, on a topic that is not well understood.

- Focus group discussions were used, with persons who had been hospitalized under MoPH coverage. This was chosen due to our interest in a wide range of views & experiences, and to encourage discussion & explanation of issues.

Figure 5: Summary of the main building blocks of Paper 4.

2 Introduction

"Property which comes to a man from Zeus, both justly and cleanly, remains always steadfast. But if a man obtains it unjustly, improperly and with a profit-loving heart, or takes it contrary to justice through an oath, he seems at first to make some profit, but in the end he becomes poor again, and the design of the gods overpowers him"
– Theognidea 197-202 (6th century BCE)[3p.57]

This chapter begins with a definition of health system 'performance', and the theoretical underpinnings for pay-for-performance. Having a shared understanding of this is necessary before proceeding with evaluating P4P. This is followed by the evidence on hospital-based pay-for-performance, with a focus on large-scale programs. We then move on to introduce three important areas addressed by this thesis: the casemix index as a measure of complexity, hospital readmissions, and patient perspectives. The last section presents a concise list of recognized knowledge gaps on pay-for-performance.

2.1 Pay-for-performance

2.1.1 What is 'performance'?

Performance implies an action or achievement. In health systems policy development, performance is used broadly for a range of goals or expectations that health service providers (usually) are supposed to fulfill or achieve. Whereas quality of care is definable, albeit variably, performance is more subjective and less generalizable. Essentially, performance entails progress according to a set of measures. The linkage between these measures and improved healthcare is a necessary but secondary argument. Nevertheless, frameworks for health system performance are available, and it is useful to utilize or adapt these where relevant. Health systems share many similar features, but also important differences, for example across disease burdens, resources and scale.

Kruk and Freedman developed a framework based on performance indicators used in actual practice in LMICs, and adapted Donabedian's system of structures-processes-outcomes [4] [5]. This categorizes indicators under dimensions of effectiveness, equity and efficiency (see figure 6).

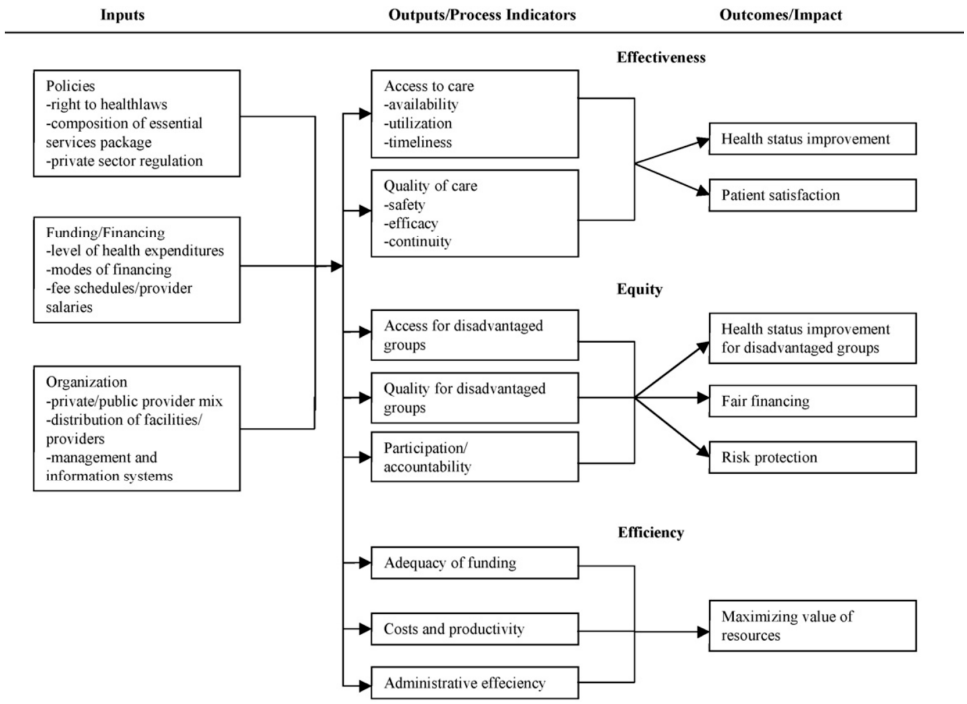


Figure 6: Kruk & Freedman framework for health systems performance measures [4].

Structural measures have commonly been targeted in LMICs, as well as to a more limited extent process measures [6]. There has been increased attention towards outcome measures, although these are more challenging to target and track, particularly in countries with more limited resources [7]. Besides the necessary capabilities to calculate and monitor outcomes, the pathways, mediating factors and complexities of health present a formidable barrier to P4P in healthcare, relative to other fields such as engineering or other industry.

From a practical perspective, any P4P intervention requires a clear depiction of the measures used. Within hospital P4P, typical outcome measures have included the patient experience, readmissions and mortality, with 'performance' entailing changes across these measures.

2.1.2 Theoretical underpinnings

Contract theory provides a framework for understanding how different actors enter a formal (or binding) agreement, considering incentives and motivation. Unlike general equilibrium theory, which uses detailed contracts to reach efficient outcomes under ideal conditions, contract theory considers incomplete contracts and informational problems, such as information asymmetry. One type of contract is a principal-agent relation, whereby one actor (principal) delegates decisions or actions to a second actor (agent) to act on its (or some third party's) behalf.

Information asymmetry refers to an imbalance in the information available between actors. Such asymmetry may lead to problems such as moral hazard and adverse selection. Moral hazard refers to situations when an actor (agent) has an incentive to act contrary to the interests of a second actor (principal). Adverse selection occurs when one actor (principal) is less informed about another actor (agent), prior to entering into a contracting arrangement. In moral hazard, the relevant information is available before the contract is agreed, but not after. In adverse selection, the information is unavailable before the contract is signed.

Seen through a principal-agent lens, pay-for-performance is a tool to address the recognized information problems within healthcare, particularly information asymmetry [8]. This entails linking measures to payment, creating a financial incentive for an agent to perform vis-à-vis these measures. Within healthcare, an example of this would be an insurer or payer (e.g. health agency, ministry) contracting with a provider to deliver certain services. Thus, the first acts as principal, and the second as agent. The alignment of interests allows the principal to improve healthcare outputs and outcomes [9]. Within the context of this thesis, the principal is the Ministry of Public Health, and the agents are the hospitals with which it is contracted.

The recognition of informational asymmetry in healthcare was originally noted by Kenneth Arrow in 1963 [10]. This included the roles of moral hazard, adverse selection, and more narrowly the roles of trust and qualifications within the doctor-patient relation. This emphasizes the significance of regulation both within the health profession and beyond.

It is relevant to recognize the several market failures that exist within the field of healthcare, which differentiate it from other markets [10 11]. Besides the prominent role of information asymmetry, this includes health as a public good, the roles of externalities, market power and equity. Health is also distinguishable due to its impact on catastrophic payments and human dignity. These further highlight the role of regulation, which also aligns with the free market of classical economists: a market that is free of land rent, bank usury and monopolies in private hands. The question is not whether to regulate, but what to regulate, by how much, by whom, through which means, and at which scale.

2.1.3 Hospital pay-for-performance

In its simplest sense, pay-for-performance may be thought of as a linkage of payment to performance. In practice, such alignment of interests between actors has occurred in various forms throughout history. The early 20th century included some large-scale applications within engineering and industry, such as automobile manufacturing. The use of P4P in healthcare, and more broadly performance-based financing, has spread over the past three decades, including a wide variety of programs and targets across various countries.

Many initiatives have focused on increasing finances directly towards service delivery and administration. More recently, there has been increasing emphasis towards a health system approach focusing on P4P integration and on health outcomes, although structure and process measures are predominant [7 12 13]. Mixed findings have characterized P4P impact in healthcare, across high and low or middle-income countries [14-17]. Numerous lessons have been drawn from successes and failures of linking financial incentives to performance. The variation in results in generally attributed to factors such as different contexts, designs, implementation mechanisms and evaluation approaches [18]. Considering the complexity surrounding P4P, it may be more beneficial to engage in a realist approach examining how P4P affects outcomes and in what contexts [14].

The experience of *hospital*-based P4P is more modest, with few large-scale experiences. One of the earliest examples was the sub-national P4P in the state of São Paulo, Brazil, which in 1998 included a performance component within a model used to set hospital budgets [19]. The component used patient satisfaction results and service volume targets to determine performance. At national level, the most prominent examples of hospital P4P were in the United States and the United Kingdom.

Advancing Quality Program, northwest England

This program targeted 30-day in-hospital mortality for pneumonia, heart failure and myocardial infarction, across 24 hospitals. Initial analysis of the program's first 18 months found a 6% mortality decrease among pneumonia patients only [20]. However, subsequent analysis of the following 24 months found a greater decrease in mortality among hospitals not participating in the program [21]. Early improvements were therefore not sustained, and there was no difference among participating and control hospitals across the 42-month period. However, some findings were suggestive of a spill-over effect on non-targeted conditions at participating hospitals.

Premier Hospital Quality Incentive Demonstration (HQID), US

Launched in 2003 by Premier Inc. and the Centers for Medicare & Medicaid Services (CMS), the HQID program was the earliest large-scale hospital P4P,

including about 260 hospitals across 36 US states. This program targeted pneumonia, heart failure (HF), myocardial infarction (MI), coronary artery bypass graft (CABG), and hip and knee replacement. It included a mix of 34 process and outcome measures. Investigations into the program's impact at three years or later found no change in 30-day mortality for MI, HF, CABG and pneumonia, whether implicitly or explicitly linked to incentives [22] [23]. Similarly, no impact found on serious complications following CABG or replacement surgery [24]. There was also no change among hospitals who were poorer performers at baseline, and weak evidence that receiving a bonus was associated with subsequent performance improvement [25] [26].

Value-Based Purchasing, US

As a result of the 2010 Patient Protection and Affordable Care Act in the US, three programs were developed under CMS, dealing with value-based purchasing (VBP), the reduction of readmissions (HRRP), and the reduction of hospital acquired conditions (HACRP). The Value-Based Purchasing program was developed in 2012, using the infrastructure built since 2003 through the Hospital Inpatient Quality Reporting Program (which rewarded hospital reporting) [7].

The VBP program initially used measures of clinical care processes measures and patient experience, to develop hospital total performance scores. A combination of achievement targets and improvement were used, with poor performance resulting in payments being withheld. The program later expanded to include measures on patient safety, efficiency and outcomes [7].

By the first year of the program no improvement had been found, although some clinical processes improved just prior to VBP implementation [27]. Mortality for both targeted (MI, HF, pneumonia) and non-targeted conditions was similar across 2,671 participating and 385 non-participating hospitals [28]. Similar results were found for hospitals with a high share of Medicare patients (i.e. degree of exposure to program) compared with hospitals with a low share [29]. The program was also found to disadvantage safety-net hospitals, which were more likely to be penalized by the program (scoring less on patient experience and process measures), as well as hospitals in socioeconomically disadvantaged areas [30] [31].

A systematic review of six years of the VBP concluded that there were no meaningful changes in quality of care or patient outcomes [32]. The performance trajectory of hospitals across this period was also variable: a third of hospitals had mixed performance across six years, 24% improved, 14% maintained a good performance, 11% maintained a poor performance, and 18% declined [33]. Other findings suggest that some hospitals may have been disadvantaged by metric changes during VBP's timeframe or methodological biases, had limited managerial influence on targeted conditions, or were not sufficiently incentivized [33-36]. A

comparison of hospital total performance scores found a large gap between the top 5% performing hospitals and others, with suggestions that the VBP rankings be redesigned to resemble the HRRP more, by rewarding improvement and incentivizing lower performing hospitals [36].

A comparison including 1189 US hospitals across P4P program early adopters (HQID) and late adopters (VBP) found no difference in process scores or mortality for non-targeted and targeted outcomes (pneumonia, HF and MI) [37]. The complexity of the HQID and VBP programs (in contrast to HRRP, below) was suggested to have limited the meaningful engagement of hospitals, in addition to incentive design aspects [37].

Hospital Readmissions Reduction Program, US

The HRRP program initially targeted readmissions following myocardial infarction, heart failure and pneumonia. This was later expanded to include Chronic Obstructive Pulmonary Disease (COPD), hip and knee replacement surgery, and then coronary artery bypass graft surgery (CABG), Penalties were applied on hospitals with greater than average readmission rates, initially set at 1% of hospital reimbursement costs (in 2012), and subsequently up to 3%.

Early studies of the HRRP had encouraging findings, unlike those of the VBP. Following the announcement of the program (2010; prior to penalties), readmissions rates changed from having been stable throughout 2008-2010, to decreasing for all three targeted conditions, as well as for non-targeted conditions [38]. Among hospitals that were subsequently penalized, the rates decreased more among targeted than non-targeted conditions, suggesting they acted to address their known performance (public reporting began in 2009) [38]. The same was not found among non-penalized hospitals, suggesting less focused and wider system-approaches to decreasing readmissions [38].

Subsequent studies have suggested there may have been unintended consequences of the program. One concern had been the potential shifting of patients away from hospital admission and towards observation or emergency rooms (i.e. not hospitalized). Initially, no association was found between hospital visits and readmission rates, but later findings showed decreased readmissions were accompanied by increased emergency and observation room stays [39 40]. Among heart failure cases, potentially up to 80% of the readmissions decrease may be accounted for by such shifting [41].

Another concern was whether HRRP impacted the mortality rate of targeted conditions. No increased mortality was found among MI patients, however, studies arrived at opposite conclusions regarding patients with heart failure [41-47]. Important methodological limitations of several studies, in addition to changes in HF epidemiology, precluded them from identifying a causal relation between HRRP

and mortality [41 48]. This has led to considerable professional debate, and the impact remains uncertain [41 49]. It has been suggested that HF patients tend to be older and more medically complex that other patients, and may therefore be more sensitive to outpatient longer-term care rather than inpatient care [42].

Several recommendations for an improved HRRP have been proposed by professional societies, such as having a combined metric of readmission and mortality, and the inclusion of the entire spectrum of hospital interactions across observation, emergency and hospitalization [41]. Changes to incentive structure have also been suggested, noting that for heart failure the incentive for hospitals to reduce readmissions (through HRRP) was several times stronger than that to reduce mortality (through VBP) [49 50]. This motivated the recommendation for combining the HRRP and VBP into a single comprehensive program [41].

Hospital-Acquired Condition Reduction Program (HACRP), US

This program aimed to decrease hospital infection and increase patient safety across about 3,300 hospitals (in 2015). Three components formed the hospital HACRP score. Specific measures were used for central line–associated bloodstream infection and catheter-associated urinary tract infection. The third component was a composite patient safety score, initially including 8 measures (10 in 2021), such as rates of pressure ulcers, iatrogenic pneumothorax, in-hospital fall with hip fracture, and post-operative sepsis [51 52]. A wider range of conditions was targeted through this program, compared to VBP and HRRP.

Considerable limitations of the composite score had been noted at the start of HACRP implementation, including issues with weighting, risk adjustment, surveillance bias and areas targeted [53]. There is an overlap of measures used between HACRP and VBP, which is due to legal requirements, alignment efforts and the lack of alternative appropriate measures [51]. Unlike other programs, the HACRP penalized only the worst-performing quartile, with 1% of their total payment [51]. Thus, the incentive to improve primarily applied to hospitals within this lowest category.

Evaluations of the HACRP impact found weak or no change in hospital acquired conditions, both compared to historical trends as well as to non-targeted measures [54-56]. This highlighted concerns regarding the composite score, but also the ability to impact change on major harm or mortality [56]. Hospitals serving more medically complex or socioeconomically deprived populations were more likely to be penalized [57-59]. Such hospitals were more likely to move from penalized to non-penalized status than others, however, when considering all hospitals, penalization did not result in improved patient safety [55 60].

A repeated finding regarding ‘Magnet’ hospitals, known for high nursing standards and quality improvement focus, had worse or similar performance in HACRP

measures [61-63]. Hospitals with more quality accreditations (e.g. Joint Commission, Commission on Cancer) or having better performance on non-HACRP processes/outcomes were also more likely to be penalized by the program [64]. This suggested the need not only for improvement of both HACRP and other non-CMS programs, but also for broader quality initiatives that are not limited to individual domains (e.g. nursing alone) [61-63].

Altogether, these findings suggested important opportunities for improved program design and fairness, though several of these had been previously noted [53]. Foremost among these were for stratified hospital comparisons, and improvements to risk adjustment, monitoring systems, and measure selection and validity [53 65-67].

While the findings from the VBP, HRRP and HACRP programs may be somewhat disappointing, given their limited successes, it is especially important to highlight the valuable lessons learned. Replicating their same course would be neither advisable nor ethical. However, the evidence that resulted from evaluations of these programs provides important opportunities for developing effective P4P initiatives.

Financial Incentive for Quality Improvement, France

The program 'Incitation Financière à la Qualité' (IFAQ) has been gradually developed since 2012, by several institutions and including hospital stakeholders [68]. Hospitals are brought together in comparison groups, and quality assessed using a set of indicators, with results used to rank hospitals. The comparison groups include acute care, rehabilitation care, home care and dialysis units. Groups are further subdivided based on volume and casemix. Several indicators are used, such as certification, patient-reported experience measures, pain assessment and quality of hospital discharge summary [69]. To improve ease of understanding, no more than 10 indicators are used within each comparison group, and an average success rate used to determine overall performance. Thresholds are set for remuneration, and the financial compensation is allocated based on their economic volume and success rate.

There is limited documented research regarding the impact of the IFAQ P4P in France. An evaluation of the 2012-2014 pilot phase of the program comparing 185 case hospitals and 192 control hospitals did not find a difference across nine process quality indicators [70].

2.2 Casemix

2.2.1 Why casemix?

If two hospitals differed by cost-per-case or by outcomes such as mortality, one's initial thought would likely be that one receives sicker patients than the other, on average. Therefore, if we intend to be fair in comparing hospitals, we would have to measure and adjust for the severity of illness. While adjustment is a rather straightforward mathematical exercise, measurement is not; how do we compare the severity across thousands of medical conditions? The most widely used approach has been through resource consumption acting as a proxy for severity of illness. The 'casemix index' of a hospital is calculated based on this and reflects the aggregate risk of all persons hospitalized at that institution [71 72]. The same can be applied at population levels, such as across regions or nationally by time.

Since the 1980s dozens of countries have developed their casemix systems, beginning in the US, then in some European countries and other regions. The applications of casemix are varied, and can be broadly categorized into three areas: policy, management and research [73]. Within policy, casemix can be used for payment or reimbursement, planning of healthcare resources and program evaluation. Some uses within management include quality control and performance comparisons, planning and budgeting. The most important research application is for casemix as a risk adjustor when comparing utilization and outcomes.

In the context of performance, casemix is not typically a target in and of itself. A hospital's casemix is what it is; we cannot prescribe what it should be. However, being a proxy for illness severity, changes in casemix provide information on changes in hospital behavior. For example, this may include increased unnecessary or low-risk hospitalizations, or selective admission of specific diagnoses. A hospital's casemix may also strongly impact its performance across different measures. For example, readmissions are more frequent in hospitals receiving more severely ill patients (higher casemix index) [74 75]. Similarly, hospitals with increased technical capability tend to have a higher casemix index, which is at least in part due to greater patient severity [76]. Hospital ownership status has a more mixed relation with casemix, as it is always secondary to other factors (e.g. patient severity). In different contexts, a higher casemix may be found in public or private hospitals, which may vary by diagnostic category, and sometimes being a consequence of some private hospitals pursuing more profitable and less complex hospitalizations (sometimes referred to as 'cream-skimming') [77-79].

2.2.2 Casemix approaches and calculation

The calculation of casemix is essentially the reduction of information from hundreds, thousands or more hospitalizations, into a single number. Such a process involves several parameters that can affect the casemix result. Sound statistical skills and knowledge of the local healthcare system are essential precursors for developing a fair and accurate measure of a hospital's casemix.

Diagnosis Related Groups (DRGs) are usually used to derive the casemix index. DRGs were developed at Yale University in the 1960s as a tool to facilitate hospital comparisons and evaluation, using administrative data [80]. Similar to the concept of the casemix index, the function of DRGs is to reduce information into smaller blocks, which allow uses for various purposes, such as comparing performance or prospective payment. This typically involves grouping hospitalizations based on clinical data (diagnosis and procedures), age, sex, resource utilization (cost, length of stay) and severity. DRGs were first adopted by the US CMS in 1983, primarily as a cost-containment tool [81]. This supported the shift from a system based on fee-for-service reimbursement, to one using prospective payment based on DRGs [82]. Generally, the cost-containment goal was not successful, due to various provider responses [82]. Contrary to the US, the primary purpose in early European adopters was for increased fairness and efficiency, given their systems having per-diem payment and global budgets [81]. It is for such reasons that a DRG approach may be advantageous, although it also brings with it new risks and challenges that necessitate strong monitoring and information systems [83].

Many countries lack DRGs, which require considerable investment and maintenance by national health systems. In such contexts, casemix index can be calculated using diagnosis and procedures codes directly. Such an approach has been shown to be valid and feasible [84]. The approach remains one of information reduction, and what differs is a question of the type and volume of grouping involved for the 'averaging' process. The strength of a well-designed DRG approach would allow a more accurate reflection of average patient risk, whereas the strength of a well-designed code-based approach would require fewer assumptions.

The standard generic formula for casemix index calculation as used by the US CMS is presented in equation 1 [85] [86]. While variations exist, the underlying concept involves using a standard weight for each code defined based on the population average; a numerator and denominator of hospital and population cases, respectively; and a summation across all available codes.

$$\mathrm{CMI}_h = \frac{\frac{\sum W_g N_{gh}}{\sum N_{gh}}}{\frac{\sum W_g N_{gn}}{\sum N_{gn}}}$$

Equation 1

Here, $_h$ is the hospital; W_g is the weight calculated for each ICD/CPT code; N_{gh} is the number of cases within each code in hospital $_h$; and N_{gn} is the number of cases within each code in the total population.

2.3 Readmissions

2.3.1 Why readmissions?

Hospital readmissions are frequent, costly and sometimes life-threatening [87]. The reduction of readmissions is an important health system goal, with specific national policies pursued across several countries [88]. This works firstly in the interests of patients themselves, and secondly for improved system effectiveness. Using the Kruk and Freedman framework, readmissions may be considered within quality of care, under the dimension of effectiveness [4 89 90]. Pathways to impact may range across improving initial treatment to improving discharge instructions.

Two broad categories of readmissions may be defined: planned and unplanned. Planned readmissions are those intentionally scheduled as part of patient care, such as for chemotherapy, kidney dialysis or cardiac catheterization [91]. All other readmissions are considered unplanned, including acute illness or complications of previously received care. Only unplanned readmissions are a signal of impaired quality of care. Special methods involving algorithms are typically used to distinguish between the two readmission categories.

The risk of readmission is influenced by several factors, which can be identified by the extent to which they are modifiable. Non-modifiable factors include those at the individual level, such as patient age, comorbidities and the severity of the initial hospitalization [92-96]. Community-level factors are also an important factor, including socioeconomic status and poverty [92 94 97]. Factors that to some extent are modifiable include hospital quality of care, as well as the discharge instructions given and patient compliance with these. Other relevant factors include hospital size, volume and geography, but these are less understood [96 98-100].

2.3.2 Readmission approaches

The most commonly used measure is 30-day all-cause readmissions, although 7-day, 60-day or 90-day readmissions have also been used. The rationale for having 30-days is because we expect the large majority of such readmissions to have been preventable, and therefore provide useful information for operational or policy decision-making. Public payers predominantly use all-cause readmissions, albeit with a few specific exclusion criteria (e.g. trauma, chemotherapy) to improve the validity of the performance measure. Readmissions can also be cause-specific, and these tend to be used by private insurance. The overall logic of using all-cause readmissions is that the body is complex, and at a population scale it is difficult to rule out a primary or contributing relation between most readmission and initial admission diagnoses. Also, using an all-cause measure restricts the potential for circumvention by some providers using coding changes. From the perspective of national health systems, it is important to get readmissions generally right, rather than specifically wrong. However, this also underlines the importance of having a sufficient denominator to minimize the role of miss-attribution or chance.

Readmission is generally calculated as the number of readmissions as a proportion of index cases, within a specific timeframe. Different systems may use variations, including for example a comparison of expected to actual readmissions and adjusted by national average. In all circumstances, the numerator is a subset of the denominator population, and all of the latter has the 'opportunity' to be within the numerator. This second point is relevant when considering data cut-offs at specific time-points. Hospital readmission rates are typically risk-adjusted, for example for casemix and age, to allow comparisons across hospitals.

Various prediction models for readmission risk have been developed, typically using administrative data to predict the likelihood of readmission of different patients. A direct application of these would be to inform interventions for reducing readmission. However, such models have been found to be poor at risk prediction, commonly with only 60-70% chance of a correct result [101].

2.3.3 Pay-for-performance impact on hospital readmissions

Financial incentives have been linked to the reduction of readmissions through pay-for-performance, including a few large-scale programs. We previously elaborated on the mixed impact and design limitations of the HRRP in the US (see 2.1.3). In contrast to this, the 2010 Hip Fracture Best Practice Tariff (BPT) in England focused specifically on hip fractures and had a simpler P4P design [102 103].

The BPT scheme paid hospitals a supplement for each hospitalization that met six specific process-based criteria (e.g. assessments, time to surgery) [102 103]. Following implementation, mortality decreased among elderly patients with hip fracture, and

a previously increasing trend of readmissions was reversed [102]. However, it is relevant to note the difficulty of disentangling the impact of the P4P itself, as the BPT was part of a broader initiative also involving a national clinical audit and database development [102].

2.4 Patient perspectives

"To cure sometimes, to relieve often, to comfort always."
– aphorism adopted at the Saranac Lake sanatorium (19th century)

2.4.1 Why patient perspectives?

Listening to persons seeking care has been recognized by healers for thousands of years, across ancient civilizations including those in China, Egypt and India. A fundamental aspect of early Hippocratic medicine was accompanying the patient and meeting their individual goals. A modern age revival of the role of patients began in the 1950s, through the works of Michael and Enid Balint in the UK, and George Engel in the US [104-106]. These early initiatives emphasized the need to understand and empathize with the patient, and recognize the social, mental and environmental context of patients.

Over the past four decades several landmark reports have underlined the inclusion of patients and their perspectives. These include Griffith's Report (1983, UK), the Institute of Medicine (IOM; 2001, US), and the World Health Assembly, which in 2016 adopted the Framework on Integrated People-centered Health Services, stressing the patients' role in defining their needs and co-producing health services reforms [107-109]. In 2018, the IOM also called for an expansion towards person-centeredness, whereby the care provided is "respectful of and responsive to individual preferences, needs and values" [110 111]. Patient-centeredness has also been called "the doorway to all qualities", a view that is also adopted by the World Health Organization, the World Bank and the Organisation for Economic Co-operation and Development (OECD) [111 112]. Physician-patient communication skills also became part of many national medical curricula. It is notable, however, that patient engagement is predominantly at the individual level regarding their treatment, and only rarely do health systems engage patients regarding system development or reform.

2.4.2 What are patient perspectives?

The earliest conceptualization of patient perspectives was through the concept of 'patient satisfaction'. This has been extensively researched since the 1960s, and also gave rise to hospital patient satisfaction surveys in many countries [113]. As early as 1966, Avedis Donabedian emphasized that the effectiveness of care to achieve health and satisfaction "is the ultimate validator of the quality of care" [5]. But precisely what satisfaction meant was less clear, and the difficulty of its measurement was also recognized [5].

Expectation theories were predominant in approaching patient satisfaction, considering patient expectations to play a central role in satisfaction. These included value expectancy model, fulfilment theory, discrepancy theory, disconfirmation theory and others [114]. However, the evidence has failed to support a major role for these theories, perhaps in part due to the complexity of expectation itself (different types and levels), and the influence of other factors on satisfaction [114-116]. Another critique is that patient satisfaction was derived from consumerist theories (portraying patients as customers), yet the receipt of healthcare was a more complex phenomenon than a consumer product. Most patients cannot be expected to 'step out' of their illness and take on the role of a 'rational consumer', nor have the technical knowledge to evaluate some aspects of care [117]. Also, in many cases patients cannot easily turn down 'the product' or seek an alternative [117].

This is not to say that expectation does not play it role in satisfaction; it most likely does. Both expectation and satisfaction are multi-dimensional, but they are also ambiguous and under-theorized [114 118]. That several decades of research had not considerably clarified patient expectation and satisfaction underscores the need for another approach regarding patient perspectives. It is relevant to note that satisfaction also closely involves emotions, and is of a generally subjective nature [118]. This poses additional challenges to understanding satisfaction. Altogether, although efforts to understand satisfaction should still be pursued, there remains a need for a wider approach which considers other patient perspectives as well.

Measures of patient perspectives that were later developed included those of the patient experience. These may be considered more focused on perceptions of quality of care (particularly structures and processes), compared to satisfaction measures. It is challenging to generalize across these measures, since different tools have incorporated different dimensions. Some notable examples of patient experience tools include the Ethiopian Patient Experiences with Inpatient Care (I-PAHC), Indian Patient Perceptions of Quality (PPQ), and the US Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) [119]. The HCAHPS, for example, includes 29 questions, of which 10 are used by CMS for the VBP hospital scoring: two global satisfaction measures (overall rating of hospital, recommendation of hospital), three communication measures (doctors, nurses,

medications), three clinical process measures (staff responsiveness, care transition, discharge planning), and two environmental measures (cleanliness, quietness) [120 121]. Despite the widespread use of tools for measuring patient perspectives, this remains a topic that is not well understood.

The evidence on the relation between patient experience and health outcomes is unclear. Various studies have found a relation between better experiences and improved outcomes such as mortality, readmission and complications, while others did not, or otherwise had mixed findings [122-127]. Overall, positive associations between patient experience and clinical outcomes are more commonly found than no associations [128]. Mixed findings may be in part due to study designs and measure limitations, although it is notable that the dimensions of patient-doctor and patient-nurse communication tend to be often associated with better outcomes than other patient experience dimensions [123 124 127]. Nevertheless, a better patient experience is an outcome in and of itself, or, as Donabedian noted 'health *and* satisfaction' [5 129]. It is also the one aspect of care that is evaluated directly by patients, not providers [129].

A common and major limitation of patient survey tools is their validity and reliability, which should be addressed to better understand patient perceptions and inform quality improvement [130-132]. Also, the full potential of patient engagement is largely unexplored in some directions, and such tools also do not capture all the information that is available from engaging patients. Some have suggested that patients should be actively engaged to co-design health systems, with a focus on the actual experiences, and not only processes and outcomes in place [133 134].

2.4.3 Patient perspectives and pay-for-performance

Patient perspectives accounted for 25% of the total performance score within the VBP in the US. This formed a strong incentive for hospitals to improve the patient's experience, at least nominally. The HCAHCPS tool was used to evaluate patient experience, using random samples of patients discharged between 48 hours and six weeks. Investigation at years three, four and six after VBP announcement found no impact of the program on patient experiences [36 121 135 136]. There was also no difference between safety-net and non-safety-net hospitals, noting that the former group were more likely to be penalized (further deteriorating resources) [121 137]. These findings included the two global satisfaction measures, on 9 or 10 out of 10 rating and on recommending the hospital, whose long-term trends remained suggested a slowing down after VBP, but possibly attributable to other factors [121].

Given the failure of VBP to improve patient experience, some suggestions have included the need for program redesign, measuring experience in non-hospital settings, and interventions beyond financial incentives or P4P [121 135]. Other concerns have also been raised, such as instances of hospitals providing designer gowns or

valet parking, and of consultants coaching nurses' verbal communication ('teaching to test'), all to influence patient perceptions [117 130]. In addition, caregiver behavior may also become more guarded, for example physicians failing to engage patients on smoking or obesity, or on non-favorable prognosis, for fear of antagonizing patients [130 138]. Limitations to surveying patient experience also include the potential for over-prescription or unnecessary care (e.g. treating solely to 'satisfy the patient'), potentially harming patient outcomes and increasing costs [139]. Such evidence provides increased awareness of the complexity involved in measuring patient perspectives, and the importance of incentive design.

One review of interventions to improve patient experiences (as measured by HCAHCPS) concluded there was minimal evidence to inform on what interventions work at scale, and in which contexts [140]. A prominent limitation noted by the review was the abundance of pre-post designs which do not account for secular trends [140]. In following the pathway from intervention to change in patient perceptions, it is worthwhile to revisit some of the assumptions involved. It is assumed that the intervention will change provider behavior (or not); that any change will be perceived by patients, and that the measurement tool would detect any change. Unlike the measures used for outcomes such as readmission or mortality, surveys on patient perspective have a lower precision. This is in part due to the nature of the data used (survey on a sample), but also non-response bias with, for example, sicker patients being less likely to respond [141 142]. Generally, responses to patient surveys tend to be very positive, and can overstate the perceptions of patients [143]. For this reason, it is typical to find satisfaction proportions of 80-90% across hospitals in different countries.

2.5 Knowledge gaps on pay-for-performance

There are several knowledge gaps regarding different aspects of P4P. A non-exhaustive list which is not specific to this thesis includes:

1. How can stakeholder buy-in and engagement be achieved?
2. What are the contextual factors, including health system, organizational culture and patient population?
3. What are appropriate measures or components?
4. Which measures or components reflects quality of care?
5. A limited understanding of impact on outcomes.
6. How can P4P be patient-centered?
7. To what extent can findings be generalized to other contexts?
8. How sustainable is P4P?
9. What is the optimal incentive design?
10. How can P4P be integrated with other payment models?
11. What are appropriate transparency and feedback mechanisms?
12. What are the unintended consequences, spillover effects, and impact on individual morale?
13. To what extent P4P may exacerbate inequalities.
14. How can P4P integrate social determinants to adjust for outcomes?
15. What is the long-term impact on hospitals and health system?
16. What are the perceptions of hospitals, health professionals and the public towards P4P?

This thesis primarily addresses gaps 1-6, and contributes to a more limited extent regarding gaps 8-11.

Conclusion

This chapter provided a definition of health system 'performance'; the theoretical underpinnings for P4P; the evidence on hospital P4P; an introduction to each of casemix index, hospital readmissions, and patient perspectives; and a list of recognized P4P knowledge gaps.

In the next chapter we will provide an introduction to Lebanon, where this thesis work is located, and to the Lebanese health system, and the P4P models implemented by the MoPH in 2014 and 2018/2019.

3 Background and Interventions

"Pity the nation that wears a cloth it does not weave, eats a bread it does not harvest, and drinks a wine that flows not from its own wine-press."
– Gibran Khalil Gibran (1883-1931)

This chapter begins with an introduction to Lebanon and its health system, and then continues with information about the P4P models of 2014 and 2018/2019, including their components.

3.1 Lebanon

Lebanon lies in West Asia, on the eastern coast of the Mediterranean Sea. Its location resulted in it being at the cross-roads of civilizations for several thousands of years. It has an area of about 10,452 km^2, and currently a population of about 6.8 million people, including almost 2 million refugees, most of whom have arrived after 2011 due to the conflict in neighboring Syria. It is among the top 20 countries by population density. The geography of Lebanon includes four regions: a coastal plain, two mountain ranges, and the valley between them. It has a length of about 217 km, and a width that varies between 48-89 km.

In the modern age, after gaining its independence in 1943 Lebanon has had alternating periods of stability and conflict, including the 1975-1990 war. Since 1990, Lebanon has struggled to develop in several sectors, due to a mix of factors including corruption and poor governance. The period starting 2005 has been marked with intermittent political instability, in parallel with conflict in other countries in West Asia.

More recent developments that have shaken the country include the economic crisis that began at the end of 2019, largely due to a national Ponzi scheme and poor governance. The impact of the crisis was further exacerbated in 2020 by the COVID-19 pandemic, and the explosion at the Beirut port in August of the same year. The consequences of the economic crisis included doubling to 82% of the population into multi-dimensional poverty [144].

3.2 Health system

The Lebanese health system is characterized by a mix of public and private payers and providers. Most payers are public, while most providers are privately owned. About four-fifths of citizens are under the coverage of the Ministry of Public Health or the National Social Security Fund (NSSF) [145]. The MoPH coverage extends to citizens who lack NSSF or other formal insurance and includes hospital care. The NSSF coverage is wider, additionally including subsidization of medication and outpatient care, and covers formal sector employees and their dependents.

The 1975-1990 period was expectedly a highly unregulated environment. Out of necessity, a large increase in private health facilities, given the decimation of the public infrastructure. By the early 1990s, there was a large number of private hospitals, with a widely variable quality of care. The stability of the 1991-2005 period saw increased initiatives to improve hospital care. This included a national hospital accreditation program, public hospital construction, and the development of a national network of primary care centers. Alongside other MoPH initiatives, this contributed to the improvement of outcomes such as infant and maternal mortality, life expectancy and out-of-pocket expenditure on healthcare.

In 2001, the MoPH linked hospital accreditation with reimbursement tiers. This financial incentive was intended to motivate hospitals to improve their quality of care, vis-à-vis achieving accreditation [146]. Within a few years, the limitations of this model had become more apparent. These included the absence of a measure for hospital case complexity and of any outcome measures. It was within this context that new model was initiated, namely hospital pay-for-performance.

3.3 Interventions using pay-for-performance

3.3.1 Hospital pay-for-performance model of 2014

In 2013, investigation of the long-term impact of the accreditation-reimbursement linkage had revealed that case complexity varied widely within and across reimbursement tiers [147]. This argued against the assumption that a higher tier implied more complex cases. Hospitals and other stakeholders were engaged regarding these findings during 2013-2014. In August 2014, the MoPH held an engagement event for hospital leadership and managers, announcing the adoption of a new model linking performance to reimbursement. This was legalized through Ministerial Decision #1980/1 (November 2014). The new model included a mix of weighted components, which were used to determine the Total Performance Score (TPS) of

each hospital (see table 1). The components were weighted based on their perceived relative importance by the MoPH, but also engaging the Syndicate of Private Hospitals.

Table 1: Components of the 2014 P4P

#	Component	Weight
1	Accreditation	40%
2	Casemix index	35%
3	Patient satisfaction	10%
4	ICU case proportion	5%
5	Surgical case proportion	5%
6	Deduction proportion	5%

The model retained accreditation status to maintain some direct incentive towards improving structures and processes. The TPS of hospitals was standardized using z-scores. All hospitals with an above-average TPS were categorized in the top reimbursement tier (T1); those within 0.5 standard deviations of the mean were categorized in the middle tier (T2); and those below 0.5 standard deviations were categorized in the lower tier (T3). The same model was applied among public and private hospitals, but standardized separately. This meant that public hospitals were compared with each other, and the same applied to private hospitals.

3.3.2 Hospital pay-for-performance model of 2018/2019

In January and March 2018, the MoPH held two events announcing the updated pay-for-performance model. These events included hospital leadership, quality managers and financial managers. The first event was centered on the policy level, while the second event was largely at the technical level. The new model benefited from updated literature and the lessons learned following the 2014 model, including its impact on different measures. The new model was legalized through Ministerial Decision #925/1 (May 2019), which also disseminated the component weights (see table 2). The period between announcement and legalization was due to the intervening parliamentary elections and new government formation.

Six components were included, three had been retained but differently weighted (accreditation, casemix index, patient satisfaction), two were new components (readmissions, elderly cases proportion), and one had been modified (ICU cases & beds). Component weights had been in part determined within the MoPH technical

team, using an analytic hierarchical process and further refined using an iterative process with pre-defined rules for balancing components.

Table 2: Components of the 2018/2019 P4P

#	Component	Weight
1	Accreditation	30%
2	Casemix index	45%
3	Patient satisfaction	20%
4	Readmissions	2%
5	ICU cases & beds	2%
6	Elderly cases proportion	1%

Hospitals that had accreditation status received a complete score on this component, while those that had not, received a partial score. This differed from the 2014 process, which had penalized hospitals with a 'caution' note on their most recent accreditation report.

The casemix index was calculated separately for medical, surgical and mixed cases, and the first was further segregated into short, medium and long-stay medical cases. Casemix results were weighted by case type volume to calculate the 'all-stay' casemix index.

The results of the most recent patient satisfaction survey were used for the third component. This included a composite score based on patient responses on eight items regarding the admission desk, doctor and nurse interactions, pain relief, dignity and respect, cleanliness, recommendation of hospital to others, and receiving a receipt after payment at the hospital.

The readmission component included four conditions: general cases, pneumonia, cholecystectomy and stroke. Their selection was based on review of other initiatives, and their incidence, trends and utility in using these within the Lebanese context. Case definitions were developed, specifying the calculation, and inclusion and exclusion criteria. Within each readmission measure, hospitals within +0.5 standard deviations received the full score (0.5%), while those above received none. This design took into account variation around the mean, while also providing incentives for the reduction of readmissions.

The elderly cases proportion measured adults aged 64 years and older, among all adults (18 years and older). The intention behind this component was two-fold. Firstly, this would compensate for the exclusion of age-adjustment in casemix

calculation. Secondly, it was intended to discourage cherry-picking by some hospitals which may avoid hospitalization of elderly persons.

The ICU component had been calculated in 2014 based on the proportion of ICU cases among all hospitalizations. This was revised in 2018 into two separate subcomponents: the proportion of ICU to total cases; and the proportion of ICU to total beds. This was motivated by the lack of a consensus in the literature regarding which approach is more effective at incentivizing hospitals to increase their ICU capacity. The scores of components #3, #5, and #6 were standardized and capped within two standard deviations of the mean.

A similar approach was used for determining the hospital TPS as in 2014. However, a -0.75 standard deviation was used as the cut-off between T2 and T3 reimbursement tiers. Figure 7 illustrates an example of the performance card disseminated to each hospital in 2019.

Four domains have been used to describe the structure of US Medicare programs: program scope (broad or narrow), performance (absolute or relative), awards (achievement, improvement or both), and incentive (reward, penalty or both) [148]. Using a similar approach, the Lebanese P4P model may be described as having a mixed scope, and rewarding achievement based on relative hospital performance. The incentive for hospitals is to increase (or maintain) their reimbursement tier. Since the P4P was integrated within the MoPH mechanism for determining reimbursement tiers, and not relying on separate funds, it was by design sustainable. The Lebanese P4P shared certain aspects with the US and French P4P models, such as readmissions and certification/accreditation, respectively.

Conclusion

This chapter provided an introduction to Lebanon and its health system, and information about the MoPH P4P models of 2014 and 2018/2019.

In the next chapter we will provide the conceptual framework for the P4P model developed at the MoPH, and where the four papers included in this thesis fit within this framework.

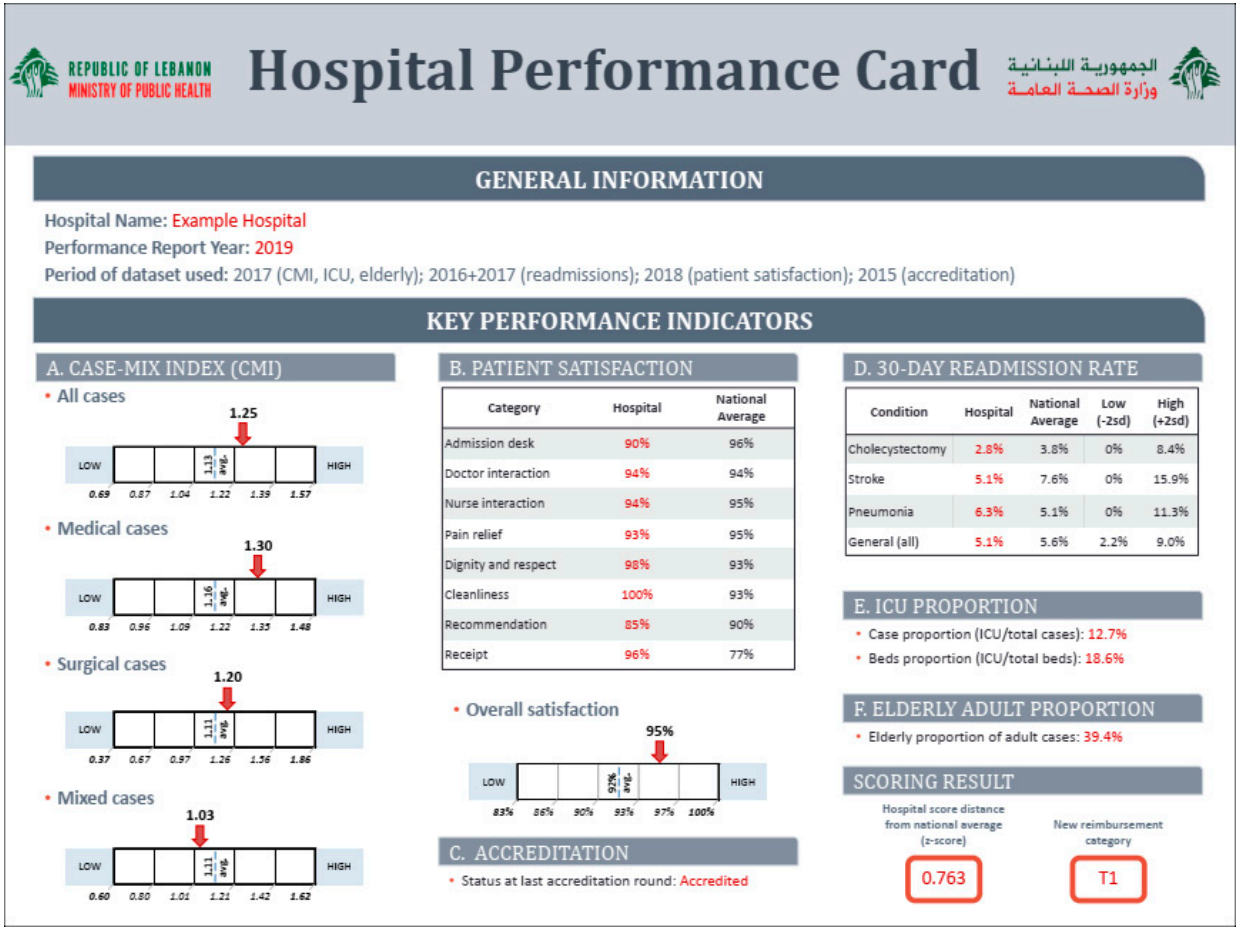


Figure 7: Hospital performance card example disseminated to each hospital in 2019.

4 Conceptual Framework

"Be kind to people, be ruthless to systems"
– Michael Brooks (1983-2020)

This chapter provides the conceptual framework for the P4P model developed at the MoPH, and where the four papers of this thesis fit within this framework.

Recognizing the complexity of pay-for-performance in health systems, we developed a conceptual framework for the model developed at the MoPH (see figure 8). Since the goals of this research are based on the MoPH P4P, we sought to clarify the various aspects involved. This framework includes several dimensions: the intervention, contextual and mediating factors, response expected and organization.

The intervention is the P4P model, which includes several characteristics that are relevant for impact. These include the size of the incentive and the weight of individual components, both of which would be expected to influence if and to what extent hospitals respond to the P4P. A model that is easier for hospitals to understand is also more likely to result in a response, as would one that has a more frequent evaluation (e.g. annually) compared to one that is less frequent. Transparency would be expected to increase trust among hospitals regarding the fairness of the model, and in other instances this involves having performance measures determined not by the payer, but by a third party. Sustainability is also relevant, as it signals to hospitals whether the P4P model is a transient initiative or a longer-term one. Because the total performance score of hospitals is a composite score, is also affected by the variation within each score. For example, if two components were equally weighed, but the first varied between 80-90%, and the second between 60-90%, then the second will have a greater effect on the TPS.

Internal factors include the hospital-perceived cost-benefit, resources available to them, how knowledgeable they are about the model and ways to respond effectively. The reimbursement tier may also be a factor: hospitals who perceive themselves near the top of the highest tier, or the bottom of the lowest tier, may not be as incentivized to respond to P4P as those who are closer to the tier boundaries. The alignment between the model and hospital values may also affect their response.

External factors include the political, financial and socioeconomic context. These may be relevant in different ways. For example, outputs or outcomes may be less

modifiable by hospitals serving a more socioeconomically disadvantaged population. Changes in healthcare regulations or other initiatives may also affect hospital P4P response.

Organizational factors include the types of services a hospital provides, and the relevance of the P4P components to these. The volume of cases a hospital receives may also be relevant, particularly in terms of patients covered by the MoPH. For example, if MoPH patients represent a small proportion of total hospital cases, a hospital may be less incentivized to respond to P4P. In another manner, due to the 'law of large numbers', we may expect more variability in outputs and outcomes among low-volume hospitals. Additional organizational factors relate to the location and ownership of the hospital (public/private).

The response expected and outputs/outcomes are based on the components of the 2018/2019 P4P, but include most of the 2014 components as well. We expect that hospitals would respond to the model components to different extents, possibly targeting all components or a selection of them. The mechanism by which hospitals would do this is labelled 'black box'. This label is used because this represents one of the main gaps in the general evidence base on P4P, and the limited MoPH insight regarding such mechanisms. We also acknowledge the important role that unintended consequences may have in interventions such as P4P.

The reasons leading to the development of P4P, including the overall context and MoPH-hospitals relation, are the subject of Paper 1 (see figure 9). Decreasing unnecessary hospitalizations is measured vis-à-vis casemix changes and represents improved effectiveness and patient outcomes. This is the subject of Paper 2. Decreasing readmissions also represents improved effectiveness and patient outcomes and are the subject of Paper 3. Improved patient perspectives are another outcome; in Paper 4 we explore what patient perspectives are and how to relate these to P4P. We do not measure changes in patient perspectives, due to construct validity limitations regarding this topic, and other issues noted in 2.4.3.

Conclusion

This chapter provided the conceptual framework for the P4P model developed at the MoPH, and where the four papers of this thesis fit within this framework.

In the next chapter we will provide the theoretical foundation for the study design and analysis. This includes a discussion on causality, interrupted time series design, and the Newey-OLS and ARIMA mechanisms. We end with an introduction to the analytical approach and data collection method used in our qualitative investigation.

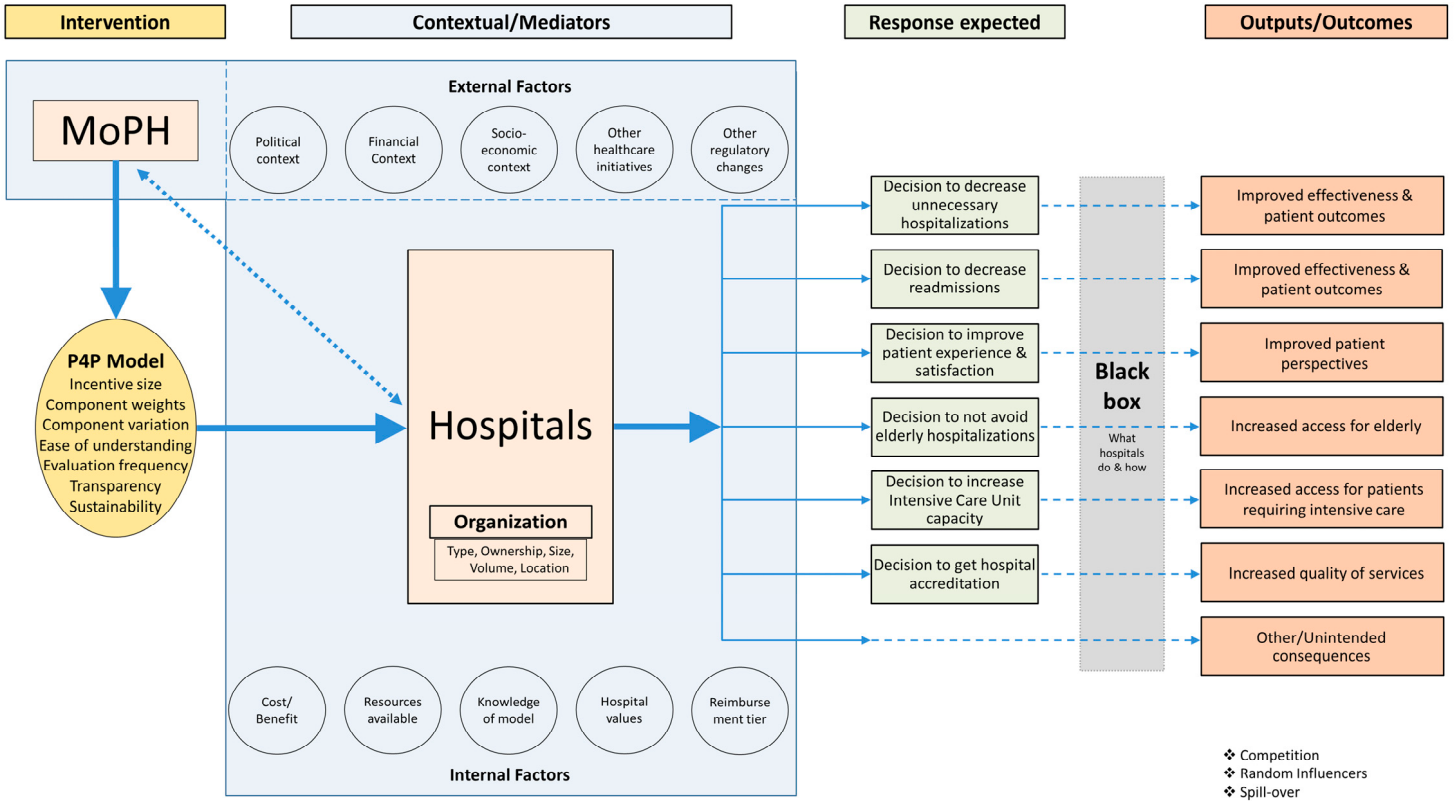


Figure 8: Conceptual framework for the P4P model developed at the MoPH .

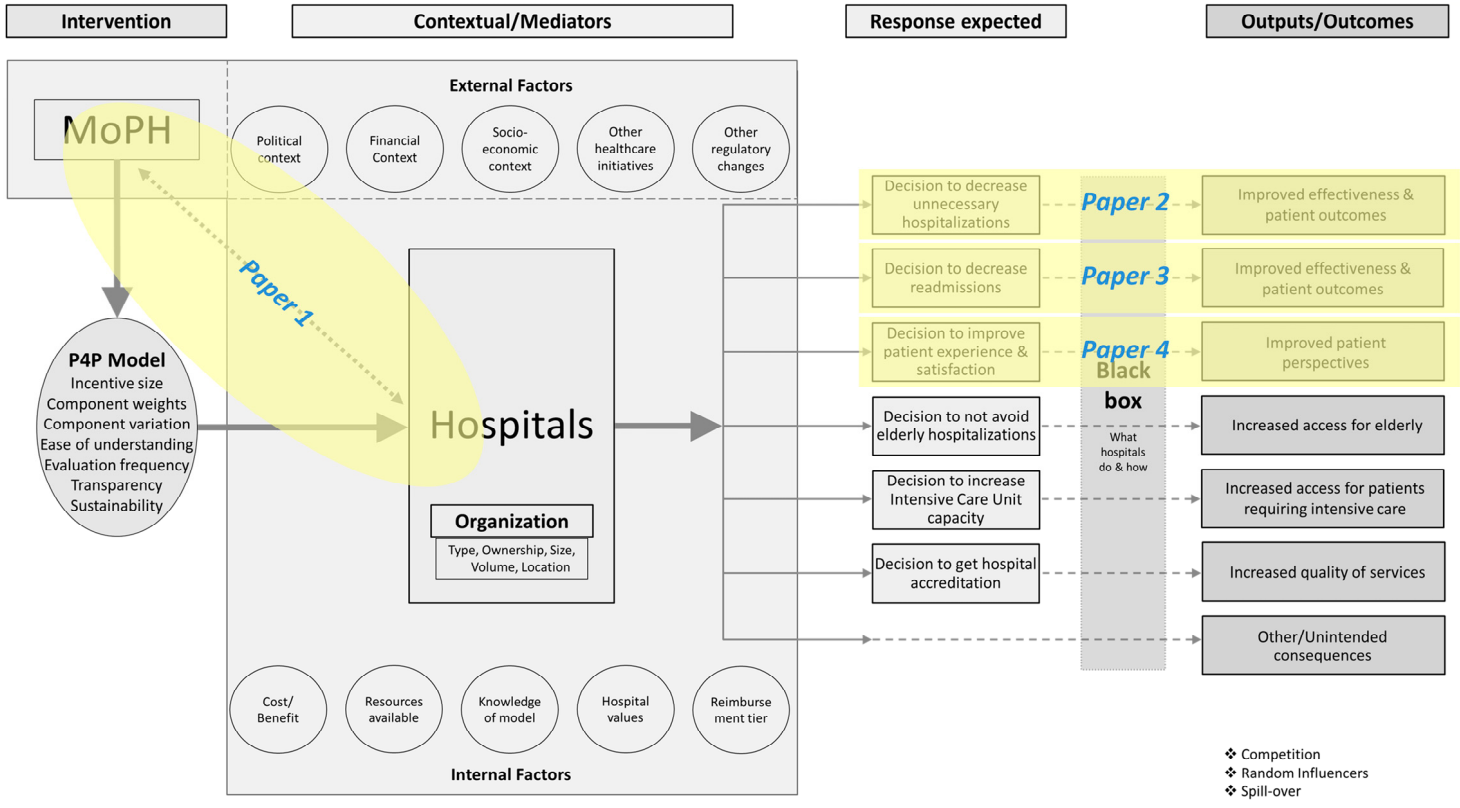


Figure 9: Highlighting the four papers of this thesis within the conceptual framework for the P4P model.

5 Theoretical Foundation for Study Design and Analysis

> *"Since the extensive use of randomized experiments is limited to the last half century, and in fact is not used in much scientific investigation today, one is led to the conclusion that most scientific 'truths' have been established without using randomized experiments."*
>
> *– Rubin, 1974, p.688, as cited in McCleary et al. (2017)* [149]

This chapter begins with an introduction to the history of causality, how it is understood within some disciplines, and the role of experiments and quasi-experiments. We establish that quasi-experiments have the potential to provide causal inference. This is followed by an introduction to interrupted time series (ITS) design, its accompanying four validities, and different types of impact that can be investigated using ITS. We then describe the mechanism of using Newey-OLS and ARIMA for ITS. The last section presents the qualitative approach (content analysis) and the data collection method (focus group discussions; FGD) chosen for exploring patient perspectives.

5.1 On causality

From a health or epidemiological perspective, we pursue knowledge on causality to better understand how to prevent disease and improve well-being. But the history of thinking on causality is diverse, stemming from different roots, and contributing to different meanings of causality, depending on one's discipline.

Aristotle defined four types of causes (material, formal, efficient, final), and was interested in the deeper philosophical purpose of objects or processes. David Hume developed a subjective and psychological construct of causality (as a response to the 'induction problem'). John Stuart Mill approached this differently from Hume, arguing that causality is based on our empirical observations and is reliable in understanding the external world, despite limitations. These three examples represented the philosophical, natural and empirical traditions on causality, with the

third having the greater influence on modern scientific understanding of causality [150p.133-134].

Numerous important contributions were made in the 20th century, including those of Ronald Fisher (randomization, confounding), Jerzy Neyman (counterfactuals) and Donald Rubin (potential outcomes framework for estimating causal effects). All three developed methodologies and statistical tools for drawing causal inferences using observational data. On experimental designs in particular, Donald Campbell developed the quasi-experimental framework for deriving causal inferences in real-world contexts or when randomization was not possible.

It is not uncommon for epidemiologists and other scientists to avoid using the term 'causal', since our approaches allow us to infer causality to varying degrees of confidence, but not prove it as a universal truth. The stronger the ability to rule out alternative explanations, the closer our approximation of the truth is. From a health perspective, for example, we cannot be fully certain that a specific exposure caused the disease in a person, because we do not know with certainty what would have happened had the exposure not occurred (i.e. the counterfactual).

It is useful to briefly illustrate the difference regarding causality in disciplines such as physics and chemistry, as opposed to epidemiology and health sciences. The first are mainly concerned with understanding fundamental laws and mechanisms at the microscopic level, using reductionist approaches and deterministic models. Contrary to this, the complexity of the systems studied in epidemiology and health sciences does not allow similar reductionist approaches, due to the variable factors involved (e.g. biological heterogeneity, ethics, social and environmental determinants). Therefore, making causal inferences in this latter category is more challenging. Physics and chemistry usually produce mechanistic evidence, while epidemiology and health sciences usually produce probabilistic evidence, though noting important exceptions (e.g. in quantum mechanics, in biology).

An instructive example of the different 'causalities' across disciplines is with the COVID-19 pandemic. The different interpretations contributed to the failure of many health institutions to recognize that the airborne spread of SARS-CoV-2 could be prevented using tools such as masking and ventilation. Such tools are applications of the physical and chemical sciences, and typically have national agencies that maintain regulated standards since decades [151] [152]. Epidemiologic approaches are not equipped to disprove such scientific findings established using the physical and chemical sciences [153-157]. Rather, their role can be to increase knowledge on how such tools can be scaled up and adopted in the complex real-world environment.

In epidemiology and health sciences

The modern approach and reasoning on causality within the health sciences has been built on important contributions of persons such as Ignaz Semmelweis, Louis Pasteur, Robert Koch and Jakob Henle. We say approach and reasoning, because there is no algorithm or checklist for inferring causality. However, there are some very useful guidelines. The most prominent of these has been the considerations developed by Austin Bradford Hill in 1965. These originally included strength of association, consistency, specificity, temporality, biological gradient, plausibility, coherence, experiment and analogy [158]. Over the subsequent decades these have been debated and revised in some instances [150p.167 159p.382-383]. However, it is important to note that Bradford Hill never intended these as 'criteria', but rather as considerations to guide decision-making. The consequence of action based on evidence may also play a role in determining the level of evidence that is sufficient [158].

> *"What I do not believe - and this has been suggested - is that we can usefully lay down some hard-and-fast rules of evidence that must be obeyed before we accept cause and effect. None of my nine viewpoints can bring indisputable evidence for or against the cause-and-effect hypothesis and none can be required as a sine qua non. What they can do, with greater or less strength, is to help us to make up our minds on the fundamental question - is there any other way of explaining the set of facts before us, is there any other answer equally, or more, likely than cause and effect?"*
>
> *– Austin Bradford Hill (1965)* [158]

Causal inference and study design are interlinked but distinct issues [150p.175]. In and of themselves, there is no design that confirms causality or cannot add to the evidence, but experimental designs tend to provide greater support [150p.175].

Many individuals have contributed to the development of our understanding of an 'experiment' vis-à-vis the scientific method. These include Epicurus, Ibn al-Haytham, Ibn Sina, Francis Bacon, Galileo and many others. Our modern definition of an experimental design draws heavily from the works of Ronald Fisher, particularly his emphasis on randomization, control and replication, which remain features of what is considered an experiment. A 'quasi-experiment' differs from this in that "the investigator lacks full control over the allocation and/or timing of intervention. [The] inability to allocate subjects randomly is a common situation that may be best described as a quasi-experiment" [160]. This is not to be confused with a 'natural experiment', where investigators lack control of the independent variable, and may lack a control group.

There has been much emphasis on randomization in research, and specifically the role of randomized control trials (RCTs). Although these are sometimes considered the 'gold standard' for evidence, they are not. All study designs have their pitfalls and limitations [150p.175]. Randomization is generally the best approach to strengthen the internal validity of an investigation, by minimizing confounding and selection bias, whether through participant self-selection or by researchers [159p.383 161p.47-49]. As such, it intends to produce groups that are similar in baseline characteristics. Randomized designs are therefore powerful when studying phenomenon at the level of individual human body. However, there are many instances when randomization is not possible, not desirable, or both.

Firstly, the strengthening of internal validity comes as a trade-off with external validity (generalization). This limits the utility of such approaches at the population level. It is also used to study specific interventions in tightly controlled environments; such control is usually not possible in complex environments or real-world settings. Secondly, there are several ethical issues that should be considered before a randomized design is used. There should be a situation of equipoise, whereby there is uncertainty as to whether one intervention or the other is more beneficial to participants [161p.50 162p.157]. Such uncertainty should be genuine and widespread, and not limited to the researchers alone. History records numerous instances when equipoise was absent, in unethical human experimentation such as the Tuskegee study (syphilis) and the Vipeholm study (dental caries). Thirdly, some interventions cannot be studied using randomized designs due to legal constraints and equity. For example, to study the impact of a law, we cannot randomize some people to be subject to the law, and others not [161p.47-50]. RCTs also require considerable resources and are therefore not often feasible. Important threats to RCT validity also include the Hawthorne effect and Nocebo effect.

> *"Experiment: Occasionally it is possible to appeal to experimental, or semi-experimental, evidence. For example, because of an observed association some preventive action is taken. Does it in fact prevent? […] Here the support for causation hypothesis may be revealed."*
>
> *– Austin Bradford Hill (1965)* [158]

Quantifying a cause-and-effect relation is not limited to randomized designs alone. Firstly, this is because causal inference remains an informed judgement, regardless of the tool used (even randomization). Secondly, focusing only on one methodological aspect risks ignoring other challenges to inferring causality [163p.11]. The general approach is one that considers various uncertainties, and aims to exclude all alternative explanations, to finally express the varying level of confidence regarding the cause-effect being investigated [163p.11]. The harms of tobacco smoking are illustrative of a widely established cause-and-effect across numerous diseases, which has been entirely based on observational studies, and

further complemented by laboratory findings. Although this is seen as settled by most people today, even if it were feasible to conduct an RCT on smoking today, it would be considered unethical [164p.58].

Both Campbell and Rubin recognized that quasi-experimental designs can be used for making causal inferences. In such designs, unanticipated events can approximate the effects of randomization; when approximation is strong, the internal validity is strong [149].

5.2 Interrupted time series analysis

Time series refers to a collection of data points ordered by time. If an intervention is included, it may be seen as an extended pre-post-test. However, the availability of many data points both before and after the intervention may allow, in some instances, for a cause-and-effect investigation.

We may define three types of time series designs: descriptive, correlational and (quasi-)experimental. Descriptive designs explore trends and cycles, but cannot be used for causal inference, because even entirely random processes may generate non-random patterns of change [149p.4]. Correlational designs can investigate causal relations between two series, using their covariance. However, these require a strong theoretical reasoning explaining the relation between the two series. Quasi-experimental time series, sometimes called 'time series experiment', refers to designs that involve data being 'interrupted' by an intervention, and are therefore named interrupted time series. This usually involves non-randomized designs, but can be used in randomized ones as well [161p.128]. Causal inference primarily relies on abrupt interruptions not being a feature of natural time series processes. Hence, an interruption that coincides with an intervention may be interpreted as evidence of cause-and-effect, provided that validities are maintained and alternative explanations are not plausible [149p.8]. In a broad manner, this approach has been used since the start of the 20th century [149p.7].

5.2.1 The four validities

We may define four relevant types of validities, all of which should be met, to allow causal inference from a time series design. This section draws generally on the work of McCleary et al. (2017) [149].

1. Internal validity

This refers to the extent to which a study's design and implementation minimize alternative explanations, other than those that may be attributed to the manipulated

variable. In time series designs, the five plausible threats to internal validity are history, instrumentation, maturation, regression and selection. History concerns the possibility of another event that coincides in timing with the actual intervention. This highlights the importance of understanding the context of the underlying process, and excluding the presence of alternative explanations for any impact. Instrumentation refers to any change in measurement, whether in the form of tools or processes (e.g. changing standards in coding diseases).

Maturation refers to any underlying process, that may otherwise be responsible for observed changes. Failing to control for such trends may result in causality being wrongfully attributed to the intervention. Regression to the mean may be a threat to internal validity when an intervention is applied at a point when the underlying process is at either a considerably high level or low level. Since interventions are often applied as a response to deviation from desired levels, regression should be considered as an alternative explanation in such instances. Having stable and non-short time series data is usually sufficient to avoid this. Finally, selection is relevant in designs with an intervention and a control group, whereby they may differ on some theoretical grounds.

2. External validity

This refers to the extent to which results can be generalized, whether to other populations, contexts, treatments or outcomes. The threats to external validity are due to either variation in subjects and situations, or variation in timeframes. The main threat to external validity is how participants react to being observed (reactivity). Experimental trials almost always use blinding (e.g. with placebo) to address the threat of reactivity. However, in other designs this is not often possible. Another approach is making use of secondary data, which was not originally collected for the purpose of the research. This is one advantage of secondary over primary data, in that we expect reactivity to be minimal or absent. The influence of reactivity may be considerable, also in healthcare. When data is used to evaluate people generating or collecting it, the data is subject to be altered ('Campbell's law of data corruption') [165].

Temporal drift is a threat that may occur when social or behavioral features of a population changes over periods of time. Semantic drift is one form, which may occur when the meaning of specific words or concepts changes over long periods of time. This threat is not usually encountered within the timeframes of most time series designs. Another form may be from short-term temporal variation, for example, weekday to weekend variation in speeding fines.

It would be preferable to control threats to external validity using study design. However, this is not possible in many investigations. The remaining alternative is replications, which is costly, but also necessary.

3. Statistical conclusion validity

This refers to soundness of the statistical analysis and interpretation. For time series design, the first threat to this validity is from low statistical power. Statistical power is a function of *N*, which is usually large in time series data, provided it is well-designed. There is no standard reference for what qualifies as too few. Some refer to at least six data points in each of pre and post-intervention periods However, it is reasonable to assume we need several data points in both periods, and still more if there are seasonal or cyclical patterns in the underlying data. Overall, if the underlying process presents a generally stable trend, we can expect that at least 30 data points would be sufficient for many causal inferences [149p.259]. With less stable time series, a greater number would be required. More than 100 data points may be considered a long time series; however, series that are too long may be detrimental (see construct validity).

Besides time series length, two other factors to consider are forecasting abuses and missing data. From a practical perspective, forecasting approaches may be appealing, however, they are not more advantageous than other approaches, and have a difficulty in distinguishing abrupt-permanent changes from others [149p.261]. Time series often contain missing data, however, this may be imputed or analyzed with no disadvantage, provided that this data belongs to a single time series, is contiguous and not near the intervention [149p.262].

The second threat is from violated assumptions of statistical tests. We have to ensure the normality of the time series data used, since this is an integral assumption of the statistical testing involved. If normality is unmet, this may be addressed using transformations, otherwise this would lead to biased estimates and incorrect inferences. Outliers may also compromise normality and therefore should be assessed, although we may note that outliers are a phenomenon when using sample data, but not population data [149p.258].

4. Construct validity

This refers to whether the measures used truly capture the theoretical construct intended, i.e. they measure what they are supposed to measure. The timeframe for the experiment should be carefully considered. Although a stable time series allows us to incrementally increase statistical power with each new observation, beyond a certain point this would come at the expense of construct validity. That point is when the underlying process is under a different regime or treatment. Therefore, a time series that is too long would include factors we are unaware of or did not intend to include, and this would threaten any inference regarding the intervention.

A second threat is periodicity. The data in a time series may be aggregated at different levels, for example, daily, weekly, monthly or quarterly. Although this depends on the underlying process, using daily or weekly periods may result in a non-normal time series. Non-normality can be resolved using transformation, but

normal processes are preferable. Quarterly periods may result in normality, but also decrease the number of data points available. Monthly data points are usually more likely to provide both normality and sufficient periods, though it may be debatable if 28-day months are better than calendar months.

Two additional threats are 'fuzzy' onsets and 'fuzzy' responses. An example of the former is when an intervention is implemented at slightly different times among two or more subgroups of the target population. The latter may involve an intervention that alternates between active and inactive, or high and low activity. Such threats may be controlled by carefully understanding the underlying theory regarding the intervention and its impact. A final threat is alternative worldviews, relating to different motives or interests of parties collecting the same data (e.g. national health authority and private insurance).

To allow causal inference from a time series design, all four validities presented above should be met. Particularly internal validity may be the most consequential. This is because it refers to the confidence with which we can infer a causal relation, or the extent to which the observed effects are attributable to the intervention rather than other factors. What distinguishes time series designs is the reliance on a statistical model to control against some of the common threats to internal validity [149p.10]. Therefore, these threats play a smaller role than those related to the three other validities, provided that the study is well-designed.

5.2.2 Impact models using interrupted time series design

Different types of impact may be encountered when using interrupted time series designs. Before analysis is conducted, it is important to clearly define the relation of the intervention to the outcome, as well as what type of impact is excepted [166]. An a priori theoretical basis for both these aspects strengthens the validity of our investigation. The type of impact may be defined using the literature, past experience or logical argument based on the mechanism of change [166]. If none of these are available, exploratory analysis of alternative data may be used [166]. Generally, the impact may be abrupt or gradual, and temporary or permanent. Different variations of simple and complex impact may be encountered.

Figure 10 illustrates some of the more common types of impact, with changes in level and/or slope.

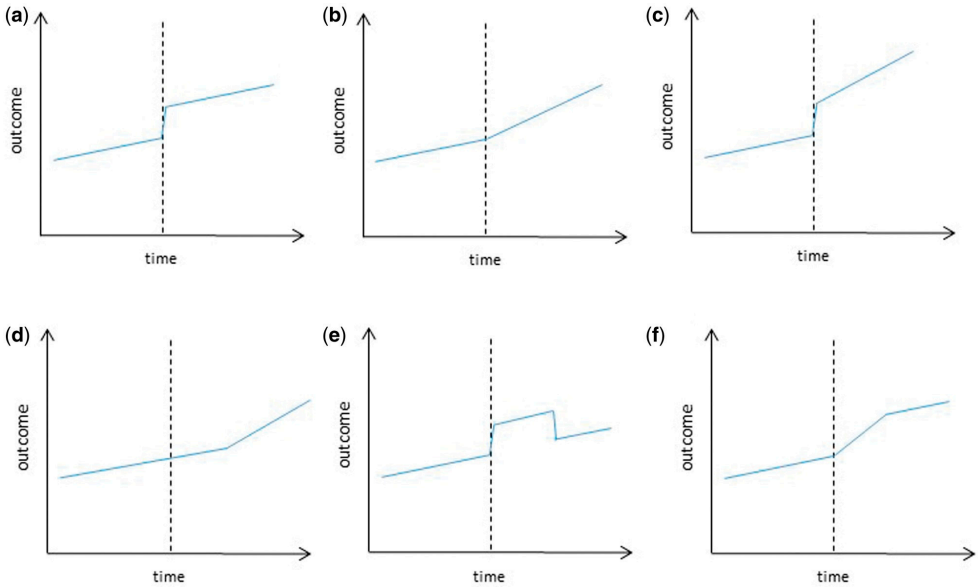


Figure 10: Examples of impact models used in ITS [166]

(a) Level change (b) Slope change (c) Level and slope change (d) Slope change following a lag (e) Temporary level change or pulse change (f) Temporary slope change leading to a level change.

5.2.3 Newey ordinary least-squares regression (Newey-OLS)

The method of Ordinary Least Squares (OLS) is a widely used approach in linear regression models. It aims to find the line of best fit between data points, based on which gives the smallest sum of squared differences between the observed and predicted values (i.e. sum of squared 'residuals'). Newey-OLS is a type of OLS that uses the Newey-West estimator, which corrects for autocorrelation and heteroscedasticity, to improve the OLS model. Newey-OLS uses heteroscedasticity and autocorrelation consistent (HAC) estimation, using weighted averages of the residuals, which decrease over time.

Autocorrelation refers to when values in a time series at a particular point are related to values at a previous point. Addressing autocorrelation in time series analysis is important because its presence violates assumptions of independence among observations, which is used in different statistical tests. Heteroscedasticity refers to when residuals in a regression model have a variable variance (spread), as opposed to having the same variance (homoscedasticity). Left unaddressed, heteroscedasticity may result in regression models having biased coefficients of the

standard errors in the regression model, and thereby any inferences made. The use of Newey-OLS rather than classic OLS therefore provides less biased and more accurate results.

5.2.4 Autoregressive Integrated Moving Average (ARIMA)

The underlying mechanism of ARIMA models is to predict future values in a time series, based on past values, changes between past values and discrepancies between observed and predicted values in the past. The latter two components denote differenced values and random error terms, respectively.

George Box and Gwilym Jenkins are credited with the development of ARIMA models in the 1970s, building on previous work by Peter Whittle (1951). There has been increasing use of such models over the past few decades, with some minor development of the analytical approaches and increasing emphasis on model usefulness and interpretability. There has also been increasing use of ARIMA models in public health over the past several years, alongside other ITS models [167].

Three components comprise the ARIMA model. An AutoRegressive (*AR*) component represents the relation of an outcome variable to its own past values and a stochastic term (randomness). A Moving Average (*MA*) component represents the influence of past error terms on the current error term (not to a moving average of the outcome variable). An Integrated (*I*) component indicates a transformation (integration) function which is only used if we need to normalize the time series. In essence, an *AR* process remembers past realizations, while an *MA* process remembers past shocks. If the time series data has a cyclical or seasonal pattern, this may be incorporated to develop a seasonal ARIMA model (also called SARIMA). Values at the defined seasonal lags would therefore be included in the process. Such a seasonal component results in a powerful model which is able to capture seasonal dynamics and relations. We will use an example of monthly rainfall as a simple illustration of this process.

We would like to use previously recorded rainfall data spanning several years to forecast future rainfall, using an ARIMA model. The *AR* component would look at how the rainfall in the past affects the rainfall today. If it was rainy last month, it would be more likely to be rainy this month. From a first look at the data, if we detect that a long-term or seasonal trend was occurring (e.g. increasing rainfall), then we can use the *I* component to filter out this trend, and allow us to focus on the short-term changes instead. The *MA* component will look at the average rainfall and how it relates to previous miss-matches between our predicted and actual rainfall; if we had been over or underestimating rainfall, it would help adjust our model. Of course, real weather prediction is intrinsically far more complex, and uses other specialized models.

The basic equation for a seasonal ARIMA model may be expressed as follows.

$$Y_{\mathrm{t}} = c + \sum_{i=1}^{p} \phi_{\mathrm{i}} Y_{\mathrm{t\text{-}i}} + \sum_{j=1}^{q} \theta_{\mathrm{j}} e_{\mathrm{t\text{-}j}} + \underbrace{\sum_{s=1}^{S} \Phi_{\mathrm{s}} Y_{\mathrm{t\text{-}s}} + \sum_{s=1}^{S} \Theta_{\mathrm{s}} e_{\mathrm{t\text{-}s}}}_{\text{Seasonal component}} + e_{\mathrm{t}}$$

Equation 2

Here, Y_t represents the time series data at time t; c is a constant term for the intercept; ϕ_{i} are the *AR* coefficients for non-seasonal lags $i=1$ to p; Y_{t-1} is the value of the time series at lag i; θ_j are the *MA* coefficients for non-seasonal lags j=1 to q; e_{t-j} is the error term at lag j (difference between predicted and observed values); S represents the seasonality period (e.g. 12 months); Φ are the seasonal *AR* coefficients at seasonal lags $s=1$ to S; Y_{t-s} is the value of the time series at seasonal lag s; Θ_{s} are the seasonal *MA* coefficients for seasonal lags s=1 to S; e_{t-s} is the error term at seasonal lag s; and e_t is the error term at the current time t.

A pre-condition for running ARIMA models is that the time series data be stationary. Stationarity denotes that the mean, variance and co-variance of the values do not change over time. This is because the analytical mechanism requires that a time series process operate identically in the future as it has in the past. If the data is non-stationary, then we can use the *I* component to difference the data until it is stationary. Otherwise, using non-stationary data would threaten statistical conclusion validity and therefore any inferences drawn from our analysis.

ARIMA models should also be examined for autocorrelation and partial autocorrelation. Partial autocorrelation denotes correlation between a point and its previous values (at specific lags), excluding the influence of intermediate values. The autocorrelation function is used to determine the required *MA* order, and the partial autocorrelation function to determine the required *AR* order.

5.3 Content analysis and focus group discussions

5.3.1 Qualitative content analysis

> *"In qualitative content analysis interpretation involves a balancing act. On one hand, it is impossible and undesirable for the researcher not to add a particular perspective to the phenomena under study. On the other hand, the researcher must 'let the text talk' and not impute meaning that is not there."*
>
> *- Graneheim and Lundman (2004)* [168]

Content analysis is an analytical approach which involves an investigation of text, images or symbols, not necessarily from the author's or reader's perspective [169p.10]. In some regions, such systematic analysis dates back at least as early as the 17th century and church investigations of content in written newspapers [169p.10]. It is probable that the first well-documented content analysis was in 18th century Sweden [169p.10]. With the advent of mass media in the late 19th and early 20th century, much of the focus was on quantitative analysis of newspapers. It was also used in political and propaganda initiatives during the Second World War. However, some limitations of quantitative content analysis became increasingly apparent, for example the potential to provide shallow or insensitive information [169p.16]. This drove the interest in developing qualitative approaches that could be systematic, valid and reliable [169p.16]. In subsequent decades, qualitative content analysis was applied by researchers in different disciplines, including psychology, history and anthropology. Various approaches have developed in both quantitative and qualitative content analysis, and these are widely used today for different applications. Examples within the latter include discourse analysis, rhetorical analysis, social constructivist analysis and conversation analysis.

The early emphasis of content analysis was on establishing meaning at the manifest (or evident) level. This was at least in part motivated by the desire to ensure validity and reliability, through using an objective and systematic approach and avoiding 'reading between the lines' [169p.25]. Later developments saw content analysis also including the latent (or underlying) meaning, which denotes a greater depth of understanding and level of abstraction [170]. Some of the reasons for this change were recognition that the content need not have single meanings, is influenced by the reader's own understanding, and communicates something beyond the actual content alone [169p.27-29]. One may argue that increased inference by the researcher threatens the external validity of findings. However, it is important to recall that qualitative investigation pursues having a nuanced, contextualized and in-depth understanding, rather than generalization to other contexts. It is rooted in a

constructivist view of science, which views knowledge as something that is constructed through the interaction between participants and researchers.

There is a diversity of approaches to content analysis by social scientists today. This reflects different historical perspectives and researchers' diverse perspectives on the nature of reality [168]. Graneheim and Lundman (2004) present one such approach, which has been widely utilized in health research. This approach adopts an underlying assumption that "[…] reality can be interpreted in various ways and the understanding is dependent on subjective interpretation" [168]. In this approach, the unit of analysis is the entire interview or transcript, and the meaning unit is words, sentences or paragraphs which are connected through their content and context. Following a shortening process of the content (condensation), grouping under higher order headings is done, creating codes, categories and themes at different levels.

As suggested by Graneheim and Lundman (2004), codes are used as a heuristic to support the thinking process. Content areas are assigned to reflect explicit areas of the content, generally at a manifest level. Categories aggregates content in a manner that may be described as internally homogeneous and externally heterogeneous, although this may not always be possible when dealing with experiences [168 171]. These are also considered as an expression of the manifest level. Themes are then developed, reflecting the latent level, which may be seen as threads of an underlying meaning, running through meaning units, codes and categories [168].

Qualitative content analysis differs from other commonly used approaches such as phenomenology and grounded theory. Phenomenology focuses on understanding the essence of the lived experiences of participants, without using preconceived categories, and is more distanced from the researcher than content analysis [172p.18]. Grounded theory is an inductive approach which aims at generating theories or conceptual frameworks. It also avoids using preconceived frameworks, and is 'grounded' in the data, allowing theories to be developed from observations [173p.4].

5.3.2 Focus group discussions

Focus group discussions are a specific form of data collection and have a long history in research. In the late 1930s and 1940s social scientists were investigating approaches for nondirective interviews, to reduce the role of the interviewer, and shift more attention towards the participant. During the second world war, increased interviewing in group formats was done, mainly to increase military morale [174p.7]. This subsequently got popularized over the following three decades particularly in market research, which sought to understand the thinking of consumers [174p.8]. In the 1980s there was a resurgence in the use of focus group discussions among social scientists, which become more prominent in the 1990s [175p.5].

Participating in group discussions plays a role in forming our attitudes and perceptions across various issues. A focus group discussion resembles everyday social interactions far more than interviews. Creating a permissive and non-threatening group environment may allow participants to share information that would not be accessible through questioning. The aim is to encourage self-disclosure among focus group participants. In the selection of participants, a greater emphasis is placed on commonality rather than diversity [174p.14]. The interest is not to drive at a consensus or agreement on certain points, but rather to gather a range of perceptions or attitudes, regarding an event, experience or topic. Within such a format, it is expected that participants would also influence each other and motivate further discussion among the group [175p.6]. The discussions are carried out in a generally predetermined manner and using open-ended questions.

> *"I submit to you that there is no unanimity of goals or practice in these groups. Nor is there a uniform similarity in educational background among the moderators of these groups. The reason is that the focus group is to qualitative research what analysis of variance is to quantitative research. The technique is robust, hardy, and can be twisted a bit and still yield useful and significant results."*
>
> *– Gerald Linda (1982), as cited in Krueger (1994)* [174p.20]

Conclusion

This chapter provided an introduction to the history of causality, how it is understood within some disciplines, and the role of experiments and quasi-experiments. This chapter included an introduction to interrupted time series design and the four most relevant validities, and the mechanisms of Newey-OLS and ARIMA for ITS. We also included an introduction to content analysis and focus group discussions, which were used in our qualitative investigation on patient perspectives.

In the next chapter we will provide the methods and materials used in this thesis, including study design, data collection and preparation, data analysis and ethical considerations.

6 Methods and Materials

> *"All scientific work is incomplete – whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time. Who knows, asked Robert Browning, but the world may end tonight? True, but on available evidence most of us make ready to commute on the 8.30 next day."*
>
> *– Austin Bradford Hill (1965)* [158]

This chapter provides the overall approach (mixed methods) used in this thesis, including both qualitative and quantitative study designs. It also includes details on data collection and preparation, data analysis and ethical considerations. We follow a breakdown by paper within each section.

6.1 Study design

This thesis uses a mixed methods approach, combining quantitative and qualitative traditions to research [176]. Recognizing the complexity of P4P development, implementation and impact, we choose this approach to enable us to address research questions on different aspects of P4P. Mixed methods approaches are problem-centered, with the research problem strongly guiding the research design [176p.165]. This 'mixed methods way of thinking' does not rely on one particular theoretical framework or philosophy, although a pragmatist position is common [176p.168].

The main aspects of pragmatism are: [176p.169 177]

1. Recognition of both the natural/physical and social/psychological worlds.
2. Knowledge is both understood and based on the reality of the world we experience and live in.
3. Theories are valuable as tools, and are true to the extent they apply in particular circumstances.
4. Action is emphasized over philosophizing.

Table 3: Overview of the methods used in the papers of this thesis.

#	Goals	Design	Data collection	Participants	Period	Main analysis
1	Describe how and why hospital P4P was developed in Lebanon.	Observational and primarily qualitative.	Project documents, discussions with key personnel	Key personnel involved in ESPISP-2 project	2009-2014	Descriptive analysis
2	Analyze the impact of P4P integration on healthcare effectiveness in Lebanon; *And* Describe how routine data and casemix may be used for hospital performance.	Quasi-experimental, retrospective cohort, ITS.	MoPH hospitalization database	1,353,025 hospitalized cases	2011-2016	ITS analysis using Newey-OLS regression
3	Analyze the impact of P4P on hospital readmissions in Lebanon.	Quasi-experimental, retrospective cohort, ITS.	MoPH hospitalization database	1,333,691 hospitalized cases	2011-2019	ITS analysis using ARIMA
4	Explore patient perspectives on hospital care in Lebanon, and contribute insights that may improve P4P design and effectiveness.	Qualitative, cross-sectional.	Eight focus group discussions	42 persons previously hospitalized during the preceding 3 months.	2017	Qualitative content analysis

The first paper sought to described how and why hospital P4P was developed in Lebanon. This paper documented the rationale and process behind the P4P initiative, including the overall goals that the MoPH had pursued during 2009-2014. This paper involved an observational approach with a primarily qualitative focus, and some limited quantitative information.

The second paper assessed the impact of the 2014 P4P, specifically on the complexity of the average hospitalized case (casemix). It also describes how routine data and casemix can be used for hospital performance in limited resource settings. The approach used a quasi-experimental interrupted time series design, including a retrospective cohort of 1,353,025 hospitalizations during 2011-2016. Newey-OLS regression was used within an intervention impact model.

The third paper sought to analyze the impact of the 2018 events held by the MoPH, which announced the inclusion of readmissions into the new P4P model. This used a quasi-experimental interrupted time series design, with a retrospective cohort of 1,333,691 hospitalizations during 2011-2019. An autoregressive integrate moving average model was used to assess the impact across four types of readmissions.

The fourth paper explored patient perspectives on hospital care in Lebanon. The purpose included gaining insight that may help improve P4P design and effectiveness, as well as to contribute to the knowledge on engaging patients towards person or people-centered health systems. A qualitative approach was used, involving 42 participants in eight focus group discussions held in 2017. A pile sorting exercise was also included, to increase our understanding of how patients prioritized different factors regarding their hospitalization. Content analysis based on Graneheim and Lundman (2004) was used to analyze the FGD data [168].

The four papers address different research questions regarding the P4P initiative in Lebanon, which figure 9 broadly illustrates. Neither a concurrent nor sequential approach was planned for the four studies involved. However, the first paper documented the P4P context and contributed to the framing of the subsequent papers. The second and third papers both used an ITS design, but with considerably different analytical tools. The ITS design was necessitated by the nature of the P4P interventions, and the legal constraints on the MoPH to contract with all hospitals with the same framework. While the first paper described P4P from the perspective of key personnel involved in this process, the fourth paper explored patient perspectives, with the intention to subsequently contribute to P4P and the health system in general.

6.2 Data collection and preparation

6.2.1 Context of pay-for-performance

The idea of this paper arose as an opportunity to review and document the experience of the MoPH reforms throughout 2009-2014, a period during which the Ministry ran the Second Emergency Social Protection Implementation Support Project (ESPISP-2), as a grant from the World Bank. The project had formally ended in 2014, however, the activities were largely sustained by the MoPH with support of the WHO Lebanon country office. The MoPH was embarking on a new phase of its hospital performance initiative, having been awarded a grant from the Health Systems Research Initiative (HSRI). Documentation of the MoPH experience had been spread across numerous documents and reports, and none sufficiently captured the underlying rationale and process.

We first collected from project personnel all documentation at the MoPH regarding the ESPISP-2 project and related activities. These were reviewed and relevant information extracted and summarized. An extract was used from the MoPH hospitalization database, containing anonymized administrative data on all medical hospitalizations, but not those that were surgical or mixed hospitalizations.

Discussions were conducted with project participants including the chairs of all three committees (utilization review, performance contracting, admission criteria), the MoPH lead on hospital quality and reimbursement, and the Ministry Director-General.

6.2.2 Casemix and readmissions

The second and third papers both rely on data extracted from the MoPH hospitalization database. The database is maintained by the Information Technologies (IT) department at the Ministry. Extracts including administrative data of all medical, surgical and mixed hospitalizations were requested and received from the IT department, with patient identifier anonymized. The variables included unique admission record number, case identifier, hospital code, admission and discharge dates, length of stay, total charge, medical code on admission and on discharge (ICD-10), and surgical procedure code (CPT). For Paper 2, the dataset was comprised of medical and surgical cases between January 2011 and December 2016, and mixed cases between January 2012 and December 2016. For Paper 3, the dataset included medical and surgical cases between January 2011 and December 2019.

Both datasets were cleaned from cases with likely data entry errors, which totaled to about 10-20 per year (age>120 years, missing ICD-10 codes, or missing total charge). They were also subject to specific exclusion criteria, which differed between the two datasets. For Paper 2, we excluded all cases with chemotherapy ICD-10 codes (Z51.1 and Z51.2). Chemotherapy involves low-cost, short-stays, and in high volume. In the Paper 2 dataset, chemotherapy cases formed about 4.4% of total cases. Many hospitals had miss-coded chemotherapy into other cancer-related codes, and the MoPH had engaged with hospitals to improve this coding practice. Therefore, we anticipated chemotherapy codes would increase, and other cancer-related codes would decrease. Retaining chemotherapy codes would have had the effect of artificially decreasing casemix index. These were excluded, but we retained other cancer-related codes.

The Paper 3 dataset excluded the following conditions, which are highly unlikely to be related to the cause of readmission: cardiac catheterization, lithotripsy, renal dialysis, chemotherapy, radiotherapy, malignancy, obstetric cases, motor vehicle accidents, blood transfusion, palliative care and transfer/same-day cases.

Casemix index calculation

The casemix index calculation approach of the MoPH involves using ICD-10 and CPT codes directly, due to the absence of national DRGs (see 2.2.2) [147]. Among medical cases, which are fee-for-service, the weight-setting uses average costs per

code. We used five-year averages to set code weights. Low-volume medical conditions (<20 cases in 5 years) had their weights set at the overall medical case average. Weight-setting process was separated across short-stay (<2 days), medium-stay (2–15 days), and long-stay cases (>15 days) [147].

Since surgical CPT codes are capitated (fixed), the weights were set without using averaging. Eleven procedure codes were capped at a weight of 10.00, to limit the effect of outliers. The 2013 inflation update of procedure costs was controlled by using the same weights based on this update for the entire period (2011-2016). Both primary (main) and secondary procedure codes were included.

The casemix index was calculated using the formula below. This is a modification of the standard generic formula (see 2.2.2), in that the denominator adjustment component is not used. This is because we were interested in the casemix index across the total population, and not that of individual hospitals.

$$\mathrm{CMI} = \frac{\sum(W_{\mathrm{g}}\, N_{\mathrm{gn}})}{\sum_{\mathrm{g}} N_{\mathrm{gn}}}$$

Equation 3

Here, W_g is the weight calculated for each ICD or CPT code; N_{gn} is the number of cases within each code in the total population.

Algorithms were developed using Stata software package (v.11) for calculating the monthly CMI at the national level, for each of the three medical case stays, surgical cases, and mixed cases. The discharge date was used to categorize records into calendar months. An all-stay medical CMI was developed by combining short, medium and long-stay CMI, using a volume-weighted approach. Medical and surgical CMI were calculated.

Readmissions calculation

Case definitions were developed for each of the four types of readmissions: general, pneumonia, cholecystectomy and stroke. This process was informed by a review of the literature and organizational resources such as from the US CMS, with consideration for the preferred attributes of publicly reported outcomes [178 179].

A readmission was identified as a patient having been readmitted within 30 days from previous hospitalization discharge. This was regardless of readmission cause, unless otherwise specified by exclusion criteria (see 5.5.2), and thus is considered an all-cause readmission approach (see 2.3.2). General cases included all medical and surgical hospitalizations, but not mixed cases. Patients with multiple readmissions per year had only the first readmission counted as such, to limit the effect of outliers due to patients with high comorbidities.

Algorithms were developed using Stata software package (v.16), to calculate monthly age-adjusted readmissions rates across the four readmission measures. For general and pneumonia readmissions, this was also done separately across hospital sizes, with small (<50 beds), medium (50-100 beds) and large hospitals (>100 beds). Since the data was provided with an annual timeframe by the MoPH, admissions in December had been artificially limited to an end-of-year discharge date. The calculation of monthly readmissions was therefore made for 11 months per year (January to November), including December cases only for identifying the readmissions, but not the index admission (i.e. in the numerator, not the denominator). This allowed the time opportunity for November cases to be readmitted in December, and in line with preferred attributes [179]. This resulted in 99 monthly data points, comprised of 80 in the pre-intervention period and 19 in the post-intervention period (after March 2018). To improve interpretability, direct linear interpolation was used to populate the values for the month of December between 2011 and 2018.

To account for the potential confounding effect of age changes in the population hospitalized under MoPH coverage, we applied direct adjustment on the calculated crude readmission rates. The 2015 denominator population was used as the standard reference for readmission data across 2011-2019. Each month of 2015 was used as the standard population for the corresponding month of other years. We used this approach since we expect the proportion of ages to vary across different months according to seasonal disease patterns. Six age groups were used: 0-5 years; 6-20 years; 21-40 years; 41-60 years; 61-80 years; and ≥81 years. In effect, the monthly age-adjusted rate was the weighted average of the age-specific (crude) rates.

6.2.3 Patient perspectives

The main motivation for pursuing this paper was to increase our understanding of patient perspectives and use this knowledge to improve how hospital P4P was designed and implemented. We say patient 'perspectives', but this was a term selected after our preliminary review on the literature on patient 'satisfaction' and 'experience' in 2016. An early attempt at a conceptual framework for patient satisfaction was also completed. However, this alongside the focus on 'satisfaction' was abandoned, in favor of the more comprehensive patient 'perspectives'. This was largely motivated by the findings elaborated in section 2.4.2, particularly the lack of conceptual clarity on 'satisfaction' and the limitations of expectation theories.

Based on our reading of the literature and further discussions within the research team, we first developed the themes we were interested in exploring using focus group discussions. These themes were: the meaning of health; description of local healthcare; characteristics of services received; description of 'good' and of 'bad' hospital stays; information needed upon hospital admission; and factors that would

make a person revisit a hospital. We used these to develop open-ended questions within a discussion guide. The guide was piloted in one FGD with eight participants (men). Based on the pilot, we revised some questions and terms to increase their clarity. We had considered conducting a second pilot (women), however, based on our experience with the first pilot, we deemed this to be redundant.

Participants were drawn at random from the MoPH hospitalization database, among persons discharged within the preceding three months, for both the pilot and subsequent eight FGDs. We limited pilot participants to the Beirut region, out of consideration for participants' travel time from other regions. We had used a random sample since we lacked specific knowledge about participants and considered that such an approach would allow a greater variation among participants. Research assistants contacted potential participants by telephone, and recruitment continued until we had a broad variation of men and women across a range of ages, residing in different regions, to participate in the eight FGDs.

Our final sample included 42 participants (22 men, 20 women), with a median age of 49 years (range: 25-65 years). About 21% of contacted persons had agreed and participated in the FGDs. Five discussions were held in mid-July 2017, and three in early September of that year. The main reasons for declining participation were vacationing or having other engagements. We had intended to have 6-8 participants in each FGD, however, group sizes varied due to some late cancellations and rescheduling by participants. Participants were offered two-way complimentary taxi transport and snacks, but no material or financial compensation.

All discussions were held in a private room at the MoPH headquarters in Beirut. The facilitator (author) introduced himself as being involved in the research project on P4P development and evaluation, as a collaboration between Lund University, the American University of Beirut and the MoPH. Two research assistants (Abeer Al Halabi and Elise Barakat) noted the group layout and interactions, but did not participate in the discussions. The facilitator and research assistants met after each FGD to exchange feedback and notes, which were subsequently used to inform the next discussion and subsequent analysis. The median duration of FGDs was 62 minutes (range: 37-82 minutes).

After discussions ended, a pile sorting exercise was conducted. This is a tool used since the 1960s to investigate how people classify items and may be considered a combination of quantitative and qualitative techniques [180-182]. This may include asking participants to sort statements into two piles of 'more' or 'less' important, which we used in this exercise [183]. We had developed 16 statements, based on our assumptions of factors related to patient satisfaction and experience, and on topics addressed in existing literature and survey tools, including the US HCAHPS [184 185]. Statements dealt with topics such as importance of regular contact with personnel, hospital organization, cleanliness, communication, pain and privacy.

6.3 Data analysis

6.3.1 Context of pay-for-performance: descriptive analysis

We used descriptive analysis to detail the experience of the MoPH reforms between 2009 and 2014, as well as why and how the MoPH moved towards hospital P4P. Using the documentation available, we developed a concise description of the history of MoPH hospital contracting reforms and the challenges faced by the health system. We elaborated on the goals of the MoPH through the ESPISP-2 project, which was framed under the themes of the three committees: utilization review, performance contracting and admission criteria. Iterative discussions with key project personnel were used to confirm and where necessary to correct findings, as well as to increase understanding regarding the overall rationale and the approach of the MoPH in engaging stakeholders in this process. Descriptive statistics were drawn on hospitalization frequency, length of stay and cost data, using a dataset drawn from the MoPH hospitalization database on the period from June 2011 to June 2015.

6.3.2 Casemix index: ITS and code-level analysis

The analytical approach of this paper was two-fold. The first was to estimate the impact on casemix index of different hospitalization types across public and private hospitals. The second was to explain these changes in CMI, by investigating changes in medical diagnoses and surgical procedures.

In the first part of our approach, we applied an interrupted time series analysis with historical control and seasonality adjustment, using Newey-OLS regression on the monthly casemix index between 2011 and 2016. This was done separately for surgical cases and then medical cases of different stays: short, medium, long and all-stay. The same was applied starting from 2012 for the medical and surgical components of mixed cases, and both combined. This was undertaken for all hospitals, and repeated among public and private hospitals separately, for a total of 24 ITS models. We had a total of 72 monthly data points for medical and surgical CMI, and 60 data points for mixed CMI. Based on the data points available, this may be qualified as a medium-length time series.

The intervention point was given a two-month lag for expected response, which was set at October 2014. The response time was chosen based on discussions with MoPH personnel most familiar with hospital response times regarding hospitalization and coding (Dr. Jihad Makouk). Sensitivity analysis was undertaken by varying the intervention-to-response lag between zero and four months. Statistical significance was set at $p<0.05$ for all tests. Cumby-Huizinga test was used to assess

autocorrelation, to ensure adequacy of our ITS models. Where autocorrelation was detected, it had been accounted for by the set lag period.

The second part of our approach sought to explain the changes detected in the aforementioned ITS analysis, among medical and surgical cases. We used a pre-post comparison of changes at code level, but in terms of how much these changes explained CMI findings from ITS analysis. Since this involved 14,469 different codes, we used an annual approach to divide the pre-intervention period as 2013-2014, and post-intervention period as 2015-2016. An algorithm was used to calculate the change in CMI, and attribute changes to specific codes. This involved iterative process, with subtraction of a code and CMI calculation, and this process being repeated for each code. For each case type, we choose the top twenty codes that had the greatest effect on CMI in any direction (positive or negative).

The codes which had the greatest impact on overall CMI were identified as a function of code weight in relation to the overall CMI 'average', the code weight itself, and frequency. The codes with the greatest change in terms of their share of CMI are identified as a function of code weight and frequency only.

$$\mathrm{WN}_{0} = (\mathrm{W}_{g}\,\mathrm{N}_{gn})^{2013} + (\mathrm{W}_{g}\,\mathrm{N}_{gn})^{2014}$$

Equation 4

$$\mathrm{WN}_{1} = (\mathrm{W}_{g}\,\mathrm{N}_{gn})^{2015} + (\mathrm{W}_{g}\,\mathrm{N}_{gn})^{2016}$$

Equation 5

$$\text{Code count effect (CCE)} = ((\mathrm{WN}_{1} - \mathrm{WN}_{0}) * (\mathrm{W}_{g} - \mathrm{CMI}_{ref}))^{2}$$

Equation 6

$$\text{Code attributable change (\%)} = \frac{\mathrm{CCE}_{g}}{\sum \mathrm{CCE}} * 100$$

Equation 7

Where W_g is the weight calculated for each ICD or CPT, and N_{gn} is the number of cases within each ICD in the total population.

CMI *share* change formula:

$$\text{Code share change} = \frac{\mathrm{WN}_{1} - \mathrm{WN}_{0}}{\mathrm{WN}_{0}}$$

Equation 8

6.3.3 Readmissions: ITS analysis

We applied an interrupted time series analysis on monthly readmissions, using seasonal Autoregressive Integrated Moving Average models, across 2011-2019. Ten ARIMA models were developed: one for each readmission type, and for general and pneuminia readmissions an additional three models each, by hospital size. The time series was medium-length, based on the 99 non-interpolated data points.

The expected response point was set at April 2018, following the two events in January and March 2018. Sensitivity analysis was undertaken by using February and March as response points. Statistical significance was set at $p<0.05$ for all tests. An iterative identify-estimate-diagnose process was used, which involved evaluating several models before narrowing down on the final model [149p.19]. The analytical process is detailed in table 1 in Paper 3 (see appendix). Although we anticipated an immediate impact of the intervention, resulting in a level change in readmission rates within weeks, we also investigated for a slope and/or pulse change. No other policies that may have affected readmission rates were identified.

We visualized the data by plotting monthly readmission rates and reviewed for potential trends and outliers. Using the pre-intervention data points, we assessed the stationarity of the series (heteroscedasticity), using the Breusch-Pagan/Cook-Weisberg test, and then the Dickey-Fuller test for unit root (non-stationarity). In the event of non-stationarity, differencing was used until the series was stationary. We then used autocorrelation and partial autocorrelation functions (ACF and PACF), to assess autocorrelation and stationarity, and to select the *AR* and/or *MA* terms of our final model. Seasonal ARIMA models were developed, using 12 months. Models were developed in an iterative manner, aiming for the most parsimonious model, through removing non-significant parameters and using the Bayesian information criterion (BIC). The most practically useful model was selected. Following this, intervention variables were generated for level, slope and pulse changes, and the data was visualized to support interpretation.

Model diagnostics were then run, to confirm that the assumptions necessary for our analytical approach were maintained. This involved comparing residuals to white noise, and tests of normality and independence. We plotted the residuals to assess for ACF, PACF and non-heteroscedasticity. Kernel density plot and standardized normal probability plots were used, followed by the Kolmogorov-Smirnov test. A scatter plot of residuals by time was used, followed by the Ljung-Box test. The model was considered statistically adequate once normality and independence criteria were confirmed. We did not use a forecasted-to-observed difference, to avoid the potential errors associated with this approach [149p.167]. We chose to compare our analysis, using single-group ITS with Newey-OLS regression and seasonality adjustment (as used in Paper 2).

6.3.4 Patient perspectives: qualitative content analysis

Qualitative content analysis was chosen as our analytical tool, because we were interested in the content that would be gained from engaging patients, and to interpret these at the manifest and latent levels. Specific research questions had been developed, though we were open to other issues that may arise during the discussions. Our intent was not to focus on generating new theories regarding patient perspectives.

The recordings from the eight focus group discussions were concurrently transcribed and translated from Lebanese Arabic to English verbatim, by the two research assistants. The transcriptions were checked for accuracy and sense-making by the facilitator and research assistants, with corrections made where necessary.

We analyzed the transcripts based on the approach developed by Graneheim and Lundman (2004) [168]. All transcripts were read several times before coding was begun. Statements were not condensed, and were directly coded using NVivo software v.12.0. Statements were analyzed in relation to the specific research questions, which also formed the basis for the content areas. Related codes were used to construct categories based on the manifest and latent meaning. The latter was used to develop themes. Table 4 provides an example of this process.

Table 4: Example from the analytical process, moving from text to code and category.

Text	Code	Category
You have nothing even if you don't have health, even if you own the whole world. (FGD1-P5)	Without health we have nothing	More important than money or wealth
Briefly, health is the whole life, who does not have good health, has nothing because the sick person is always depressed. (FGD3-P1)	Without health we have nothing	
Health is everything, if you have all the money in the world but you have poor health, it means you are poor and you own nothing. (FGD2-P3)	Health is more important than money	
At the end you give priority to health over other needs, this is how I think, for example I buy anything cheap, but I don't buy a cheap medicine to save money, and same for the doctor [...] a person should be frugal on everything except on his health, this is how I think [...]. (FGD3-P3)	Being frugal except with your health	

6.4 Ethical considerations

Ethical approval was sought and granted from the Institutional Review Board (IRB) at the American University of Beirut (ID: FHS.FE.21), for the research protocols of Papers 2 to 4. Paper 1 involved a retrospective review of project documents and discussions with project personnel (which included the author), and did not require ethical approval. Papers 2 and 3 had the requirement for patient consent waived by the IRB, as the datasets provided by the MoPH IT department to the project team were in a format with patient identifiers anonymized.

Oral patient consent was provided by all focus group discussion participants regarding Paper 4, in compliance with IRB requirements. All participants were initially contacted by telephone and provided with oral information in the invitation to participate, and this information was repeated on-site prior to the start of each FGD. This included the study's purpose, fully voluntary nature of participation, the right to refuse, and that the decision to participate and any information shared would not be associated with or affect their MoPH coverage. They were also assured that all material would be handled confidentially and no results would be presented that may be used to identify participants. Participants were given the choice of whether or not to allow the researchers to use a digital audio-recorder (all accepted). They were also asked to respect that what is said in the group stays in the group, as researchers could only ensure confidentiality on behalf of the research team.

All research team members had to undergo the Collaborative Institutional Training Certificate training program for 15 modules regarding Social and Behavioral Research curriculum, and obtain the score necessary to pass certification (80%) [186]. The research included in this thesis was consistent with the Belmont Report and the Declaration of Helsinki.

Conclusion

This chapter presented the mixed methods approach used in this thesis, with details on quantitative and qualitative study designs, data collection and preparation, data analysis and ethical considerations.

In the next chapter we will present the main results of our analyses.

7 Main results

"During World War II rescue workers, digging in the ruins of an apartment house blown up in the London blitz, found an old man lying naked in a bathtub, fully conscious. He said to his rescuers: 'You know, that was the most amazing experience I ever had. When I pulled the plug and the water started down the drain, the whole house blew up.'"
– Fred Ederer (1975) [187]

This chapter provides the main results of this thesis, with a breakdown of one section for each paper. It presents the reasons and approach for P4P development, the impact of the 2014 and 2018 P4P interventions on casemix index and readmissions, respectively, and the explored patient perspectives.

7.1 Why and how was hospital pay-for-performance developed?

The MoPH contracted with 26 public hospitals and 105 private hospitals to provide hospitalizations for more than 200,000 cases per year. In most cases, patients had a co-payment of 5% (later 10%) at public hospitals, and 15% at private hospitals, with the MoPH paying hospitals the remainder. For each hospital, the MoPH set global budgets and one of three reimbursement tiers. The financial amount generally varied between 10-30% across reimbursement tiers, depending on surgical procedure and base-rate. Between 2001 and 2013 the reimbursement tiers were solely determined by accreditation results (see figure 11).

The linkage between accreditation and reimbursement was instrumental in incentivizing hospitals to improve their structures and processes. However, by 2009, both the MoPH and hospitals had recognized several limitations of the accreditation-reimbursement linkage. These included the heterogeneity among hospitals, particularly the severity of cases admitted and the associated complexity of care delivered. Another factor was that the standards included in hospital accreditation had become numerous, and challenged the reduction of information into a single

'final score' to determine reimbursement tier. This context was favorable for undertaking new reforms.

The 2009-2014 MoPH reforms had three main goals:

1. To improve the appropriateness and fairness of MoPH-hospitals contracting.
2. To improve the efficiency of MoPH spending.
3. To promote good provider practices and discourage misuse/abuse of services.

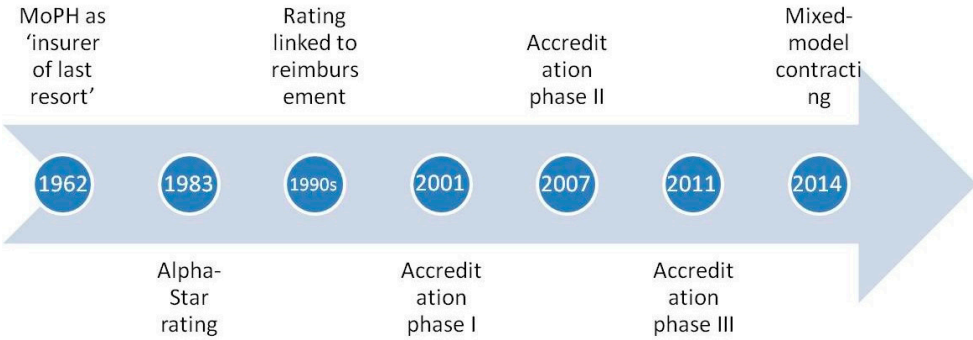


Figure 11: Timeline of MoPH hospital contracting reforms.

The MoPH developed three committees to pursue these interrelated goals. These were focused on utilization review, admission criteria, and performance contracting. Committee members included medical, public health and information technology professionals, with affiliations including several universities and hospitals, and the MoPH. Relevant information was communicated across committees, allowing them to build over each other's work.

The performance contracting committee (P4P development) used information developed by the utilization review committee to review approaches for evaluating case complexity and performance indicators. The utilization review committee developed information using hospitalization data, which were used by another committee to determine which frequent and expensive conditions to develop hospital admission criteria for. These processes were supported by annual inter-committee meetings, and having one overlapping member across committees to facilitate coordination.

Among the evidence developed were research findings that casemix varied widely across and within hospital reimbursement tiers, suggesting that using accreditation as a sole determinant of reimbursement was inappropriate and unfair (see 3.3.1) [147]. Hospitals were engaged regarding these findings, and a new 'mixed-model' was developed, with casemix, patient satisfaction, accreditation and other minor components (see 3.3.1).

An evaluation of the early impact (one year) of the new model revealed an increase in the average casemix index among private hospitals from 1.14 to 1.18. Also, following the implementation of the new model, numerous hospitals were reported to have sought to improve their coding quality, through trainings held at private universities.

Table 5: Tier-level changes at group level, as a result of the 2014 P4P.

Hospital tier	Before P4P		After P4P	
High	44	34%	38	29%
Medium	58	45%	51	40%
Low	28	22%	40	31%
Total	**130**	**100%**	**129**	**100%**

7.2 What was the impact of pay-for-performance integration on healthcare effectiveness?

The study population totaled to 1,353,025 hospitalizations between 2011 and 2016 (see table 6). This was composed of 55% medical cases, 43% surgical cases and 2% mixed cases. Almost eight out of ten medical cases were medium-stay, with the majority of the remaining being short-stay. There was limited variation across the years in terms of total admissions and case proportions. Public hospitals admitted an increasing share of patients throughout 2012-2016, increasing from 31% to 37%.

Before the intervention in 2014, the monthly casemix index coefficient was 0.975 for medical cases, 1.284 for surgical cases and 1.783 for mixed cases (see table 7). Among short-stay medical cases monthly casemix index was lowest for short-stay cases (0.352) and highest for long stay cases (3.326).

Following the intervention, we had a reversal of a previously decreasing CMI trend among medical cases in public and private hospitals (see figure 12). We also had a large level change in CMI among short-stay but not medium-stay cases (see tables 7 and 8). Overall, for medical cases the largest changes were a level change among short-stays, and a trend change among medium-stays. Among surgical cases, the only change was an increasing trend in CMI in public hospitals. Among mixed cases, the medical component had an increasing trend in CMI in private hospitals only.

Seasonality was observed in medical CMI, and in particular medium-stay cases with a November–December major peak, among other minor peaks and troughs. For

surgical CMI seasonality was limited to private hospitals only, particularly with an April–June major peak. Mixed casemix seasonality had March and October peaks.

Code-level analysis allowed us to attribute casemix changes back to specific diagnoses and procedures. The most impactful changes on CMI were from 2,970 fewer cases of abdominal and pelvic pain, 698 fewer cases of intestinal infectious diseases, 1,001 fewer cases of fever of unknown origin, and 783 fewer cases of essential hypertension (see table 9). Altogether these changes represent about 4.3% of all annual medical cases. The greatest change on medium-stay CMI was due to a decrease of 2,237 cases of diarrhea and gastroenteritis.

Two types of shifting were also seen among several codes: from medium to short-stays (e.g. A09, I10, I20-I25.9), and from three-digit to four-digit ICD10 codes (e.g. J18, J44, P22). The greatest change on short-stay CMI was due to the improved coding of chemotherapy cases under the relevant code (Z51.1) instead of under neoplasms (C00-D49).

Separate investigation was made regarding the large change in vaginal deliveries, which revealed that private hospitals had 36.9% less vaginal deliveries in 2015–2016 than in 2013–2014, while public hospitals increased by less than 1%. Concurrently, cesarean deliveries decreased at private hospitals by 7.5% and increased at public hospitals by 9.2% (increasing surgical CMI at public hospitals). We identified the start of this trend back to early 2014, prior to the P4P intervention.

Change was also found in the share of CMI explained by different codes. The largest of these were for percutaneous transluminal coronary angioplasty (PTCA) and vaginal delivery (surgical); malignant neoplasm of breast and acute lymphoblastic leukemia (short-stays); bronchopneumonia, diarrhea and gastroenteritis (medium-stays).

Table 6: Hospitalization cases under the MoPH coverage at public and private hospitals in Lebanon, 2011-2016.

	Case type		2011		2012		2013		2014		2015		2016		All years	
			n	%	n	%	n	%	n	%	n	%	n	%	n	%
All hospitals	Medical	Short-stay	19,574	10.4	26,044	11.5	27,119	11.5	26,720	11.3	24,578	10.4	24,220	10.5	148,310	11.0
		Medium-stay	79,264	42.3	94,523	41.8	101,132	43.0	101,524	42.9	107,379	45.3	101,772	44.2	585,809	43.3
		Long-stay	2,156	1.1	2,851	1.3	2,793	1.2	2,770	1.2	2,674	1.1	2,494	1.1	15,744	1.2
		All medical cases	***100,994***	***53.8***	***123,418***	***54.6***	***131,044***	***55.8***	***131,014***	***55.4***	***134,631***	***56.8***	***128,486***	***55.7***	***749,863***	***55.4***
	Surgical	Procedures	93,516	-	111,355	-	112,523	-	114,021	-	110,168	-	109,083	-	650,666	-
		Cases	***83,025***	***44.3***	***98,396***	***43.6***	***99,767***	***42.5***	***100,934***	***42.7***	***97,037***	***40.9***	***95,602***	***41.5***	***574,975***	***42.5***
	Mixed	Procedures	5,247	-	6,358	-	6,164	-	6,668	-	8,241	-	8,932	-	41,610	-
		Cases	***3,584***	***1.9***	***4,120***	***1.8***	***4,114***	***1.8***	***4,446***	***1.9***	***5,517***	***2.3***	***6,396***	***2.8***	***28,187***	***2.1***
	Total cases		**187,603**	**100**	**225,934**	**100**	**234,925**	**100**	**236,394**	**100**	**237,185**	**100**	**230,484**	**100**	**1,353,025**	**100**

	Case type		2011		2012		2013		2014		2015		2016		All years	
			n	%	n	%	n	%	n	%	n	%	n	%	n	%
Public	Medical	Short-stay	6,301	12.7	9,263	13.3	9,178	13.0	9,541	12.8	10,051	12.8	10,634	12.4	55,033	12.8
		Medium-stay	20,968	42.2	29,229	41.8	30,672	43.3	33,680	45.3	37,492	47.8	40,832	47.7	193,094	45.0
		Long-stay	501	1.0	747	1.1	633	0.9	630	0.8	669	0.9	704	0.8	3,889	0.9
		All medical cases	***27,770***	***56.0***	***39,239***	***56.2***	***40,483***	***57.2***	***43,851***	***59.0***	***48,212***	***61.5***	***52,170***	***60.9***	***252,015***	***58.7***
	Surgical	Procedures	24,049	-	33,463	-	33,031	-	33,055	-	32,871	-	36,471	-	192,940	-
		Cases	***20,906***	***42.1***	***29,167***	***41.8***	***28,845***	***40.7***	***28,896***	***38.9***	***28,485***	***36.3***	***31,491***	***36.8***	***167,990***	***39.1***
	Mixed	Procedures	1,476	-	2,430	-	2,275	-	2,367	-	2,423	-	2,726	-	13,697	-
		Cases	***957***	***1.9***	***1,453***	***2.1***	***1,492***	***2.1***	***1,593***	***2.1***	***1,678***	***2.1***	***1,997***	***2.3***	***9,180***	***2.1***
	Total cases		**49,633**	**100.0**	**69,859**	**100.0**	**70,820**	**100.0**	**74,340**	**100.0**	**78,375**	**100.0**	**85,658**	**100.0**	**429,185**	**100.0**

	Case type		2011		2012		2013		2014		2015		2016		All years	
			n	%	n	%	n	%	n	%	n	%	n	%	n	%
Private	Medical	Short-stay	13,273	9.6	16,781	10.8	17,941	10.9	17,179	10.6	14,527	9.1	13,586	9.4	93,287	10.1
		Medium-stay	58,296	42.3	65,294	41.8	70,460	42.9	67,844	41.9	69,887	44.0	60,940	42.2	392,721	42.5
		Long-stay	1,655	1.2	2,104	1.3	2,160	1.3	2,140	1.3	2,005	1.3	1,790	1.2	11,854	1.3
		All medical cases	***73,224***	***53.1***	***84,179***	***53.9***	***90,561***	***55.2***	***87,163***	***53.8***	***86,419***	***54.4***	***76,316***	***52.8***	***497,862***	***53.9***
	Surgical	Procedures	69,467	-	77,892	-	79,492	-	80,966	-	77,297	-	72,612	-	457,726	-
		Cases	***62,119***	***45.0***	***69,229***	***44.4***	***70,922***	***43.2***	***72,038***	***44.5***	***68,552***	***43.2***	***64,111***	***44.4***	***406,971***	***44.1***
	Mixed	Procedures	3,771	-	3,928	-	3,889	-	4,301	-	5,818	-	6,206	-	27,913	-
		Cases	***2,627***	***1.9***	***2,667***	***1.7***	***2,622***	***1.6***	***2,853***	***1.8***	***3,839***	***2.4***	***4,058***	***2.8***	***18,666***	***2.0***
	Total cases		**137,970**	**100.0**	**156,075**	**100.0**	**164,105**	**100.0**	**162,054**	**100.0**	**158,810**	**100.0**	**144,485**	**100.0**	**923,499**	**100.0**

Figure 12: Medical and surgical hospitalization monthly casemix index, at public and private hospitals, 2011-2016. A dashed line represents the August 2014 hospital engagement event.

Table 7: Results of the ITS analysis on casemix index, adjusted for seasonality, 2011-2016, with the intervention point of August 2014 (two-month effect lag).

Case type	Hospitals	Before intervention			After intervention			
		Monthly CMI	TREND		TREND		LEVEL	
		coefficient	% (CI)	*Explained by*	% (CI)	*Explained by*	% (CI)	*Explained by*
Medical	All	0.975	↘ 0.10% (0.06 - 0.13%)	*Medium-stay cases*	↗ 0.11% (0.02 - 0.21%)	*Medium-stay cases*	⬆ 2.25% (0.51 - 3.98%)	*Short-stay cases*
	Public	0.941	↘ 0.17% (0.11 - 0.23%)		↗ 0.15% (0.06 - 0.22%)	-	-	-
	Private	0.989	↘ 0.06% (0.01 - 0.11%)		↗ 0.19% (0.06 - 0.32%)	*Short-stay cases*	⬆ 2.70% (0.15 - 5.24%)	*Short-stay cases*
Surgical	All	1.284	↗ 0.05% (0.01 - 0.10%)	-	↗ 0.14% (0.06 - 0.21%)[1]	-	-	-
	Public	1.179	-	*No trend*	↗ 0.13% (0.02 - 0.24%)	-	-	-
	Private	1.326	↗ 0.12% (0.03 - 0.21%)	-	↗ 0.24% (0.13 - 0.35%)[2]	-	-	-
Mixed	All	1.783	-	*No trend*	-	*No trend*	-	-
	Public	1.964	-		-	*No trend*	-	-
	Private	1.689	-		↗ 0.35% (0.10 - 0.60%)[3]	-	-	-

[1]p=0.06, [2]p=0.11, [3]p=0.33 ; no significant change between pre and post-intervention

Table 8: Relative changes, using respective monthly casemix index starting level, percentages.

Hospitals	ITSA aspect	MEDICAL				SURGICAL	MIXED		
		All stays	*Short-stay*	*Medium-stay*	*Long-stay*		*All components*	*Medical component*	*Surgical component*
All	Starting level	0.975	0.352	1.078	3.326	1.284	1.783	1.530	1.991
	Level at 2 months post-intervention	2.25%	2.61%	-	12.55%	-	-	-	-
	Monthly trend, pre-intervention	-0.10%	-	-0.06%	-	0.05%	-	-	-
	Monthly trend, post-intervention	0.11%	0.14%	0.09%	-	0.14%	-	-	-
	Monthly trend, change	0.22%	0.17%	0.16%	-	-	-	-	-
Public	Starting level	0.941	0.356	1.049	2.697	1.179	1.964	1.708	2.200
	Level at 2 months post-intervention	-	2.05%	-	-	-	-	-	-
	Monthly trend, pre-intervention	-0.17%	-	-0.12%	-	-	-	-	-
	Monthly trend, post-intervention	0.15%	-	0.11%	-	0.13%	-	-0.81%	-
	Monthly trend, change	0.31%	-	0.24%	-	0.22%	-	-	-
Private	Starting level	0.989	0.352	1.089	3.498	1.326	1.689	1.421	1.906
	Level at 2 months post-intervention	2.70%	2.56%	-	13.98%	-	-	-	-
	Monthly trend, pre-intervention	-0.06%	-	-	-	0.12%	-	-	-
	Monthly trend, post-intervention	0.19%	0.23%	0.15%	-	0.24%	0.35%	-	0.41%
	Monthly trend, change	0.25%	0.28%	0.18%	-	-	-	-	-

Table 9: Diagnoses and procedures with the greatest change effect on casemix index, pre- versus post-intervention.

Description	ICD/CPT code	Major effects	Notes
Neoplasms	C00-D49	Increased ss-CMI (87%)	Greatest change on ss-CMI ↓10,179 cases, net Mainly due to malignant neoplasm of breast and acute lymphoblastic leukemia Concurrent with increase in chemotherapy Z51.1 ↑11,666 cases
Intestinal infectious diseases (category)	A00-A09		↓961 ms-cases; ↑263 ss-cases
Diarrhea and gastroenteritis of presumed infectious origir	A09	Increased ms-CMI (25%)	Greatest change on ms-CMI ↓2,237 ms-cases; ↑179 ss-cases
Unspecified non-infective gastroenteritis and colitis	K52.9	Decreased ms-CMI (2%)	↑745 ms-cases; ↑108 ss-cases
Abdominal and pelvic pain (category)	R10-R10.4		↓2,970 ms-cases, net
Abdominal and pelvic pain, other/unspecified abdominal pain	R10, R10.4	Increased ms- and ss-CMI	↓1,975 ms-cases; ↑174 ss-cases
Influenza and pneumonia	J09-J18	Decreased ms-CMI (4%)	↑3,909 ms-cases; ↑298 ss-cases
Pneumonia, non-specific	J18		↓1,456 ms-cases
Pneumonia, specific	J18.0, J18.9		↑4,692 ms-cases
COPD	J44-J44.9	Increased ms-CMI (5%)	↑1,306 ms-cases, net
COPD with acute exacerbation	J44.1		↑625 ms-cases
COPD, non-specific	J44		↓234 ms-cases
Acute bronchitis	J20-J20.9	Decreased ms-CMI (3%)	↑1,145 ms-cases
	J20		↑747 ms-cases
Essential hypertension	I10		↓957 ms-cases; ↑174 ss-cases
Ischemic heart diseases	I20-I25.9	Decreased ms-CMI (7%)	↓1,100 ms-cases; ↑275 ss-cases Mainly due to angina pectoris and acute myocardial infarction
Fever of unknown origin	R50	Increased ms-CMI (3%)	↓989 ms-cases; ↓12 ss-cases
Stroke	I64	Decreased ms-CMI (2%)	↓383 ms-cases; ↑12 ss-cases
Respiratory distress of newborn, non-specific	P22		↓334 ms-cases
Respiratory distress of newborn, specific	P22.0		↑287 ms-cases
Vaginal delivery	F9410L1	Increased surgical CMI (43%)	↓3,939 cases Greatest change in absolute and in CMI share among all ICD/CPT codes
Percutaneous Transluminal Coronary Angioplasty (PTCA)	X2983/6	Increased surgical CMI (36%)	↑778 cases

ss: short-stay, ms: medium-stay, COPD: chronic obstructive pulmonary disease.

7.3 What was the impact of pay-for-performance on hospital readmissions?

The study population included 1,333,691 hospitalizations across 2011-2019. The mean monthly readmissions varied across the four conditions between 2.42% (cholecystectomy) and 6.48% (stroke). Index hospitalizations and readmissions were considerably greater for general cases and pneumonia than for cholecystectomy and stroke (see table 10). The time series of all four conditions were found to be stationary and seasonal (see figure 13). We applied a first-order seasonal difference for each of pneumonia, cholecystectomy and stroke models, as this was the most practically useful model, considering our analytical approach [149 p83].

For estimating the impact of the intervention, we anticipated a level change in readmissions. However, given the uncertainty on the type of change, we included all three changes (level, ramp, pulse) in our first iteration of the models. The final models included a level change only. We ran diagnostic tests and plots to confirm that the criteria for independence and normality were met.

We found that following the intervention there was a level change in both cholecystectomy and stroke readmissions following the intervention. Mean monthly cholecystectomy readmissions decreased by about 24.8% (5.1%-44.5%) and stroke readmissions decreased by about 8.5% (1.5%-15.5%) (see table 11). There was no evidence of impact on general and pneumonia readmissions, neither at the level of all hospitals, nor separately among small, medium and large hospitals. Validation using Newey-OLS regression confirmed the decreased level change for cholecystectomy readmissions (by 52.7%, CI: 6.3%-99.0%, p=0.026), but no change was found among stroke, pneumonia or general readmissions.

Table 10: Descriptive statistics of 30-day readmissions for four condtions, 2011-2019

		General cases	Pneumonia	Cholecystectomy	Stroke
Admissions, total		1,333,691	70,585	26,820	13,370
Readmissions, total		80,080	3,569	681	876
Monthly readmission rate	**Mean**	5.91%	4.81%	2.42%	6.48%
	S.D.	0.51%	0.90%	1.02%	2.31%
	Min.	4.65%	3.13%	0.48%	1.71%
	Max.	7.29%	7.65%	4.89%	14.21%

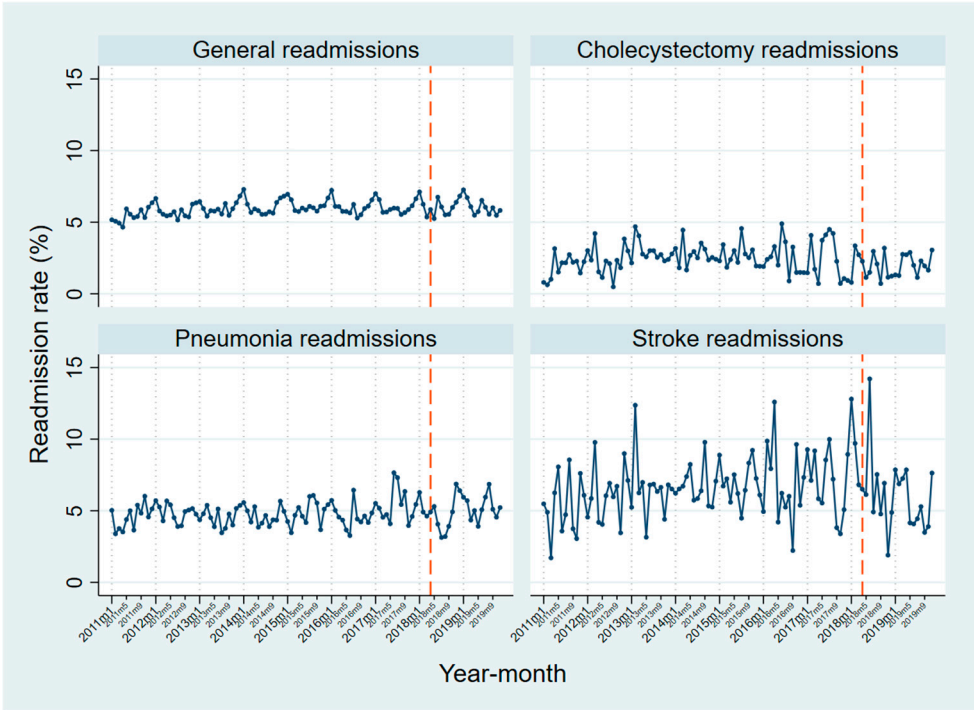


Figure 13: 30-day readmission rates for general readmissions, pneumonia, cholecystectomy and stroke, 2011-2019. A dashed line represents the anticipated impact time point, lagging after the hospital engagement events.

Table 11: Final ARIMA models and results across four readmission types, 2011-2019.

	General cases			Pneumonia			Cholecystectomy			Stroke		
Model	$(1,0,0)\ (1,0,0)_{12}$			$(1,0,0)\ (1,1,0)_{12}$			$(1,0,0)\ (1,1,0)_{12}$			$(0,0,1)\ (0,1,1)_{12}$		
BIC	79.1			215.9			252.2			364.4		
Level coeff., p, (95%CI)	0.256	0.075	(-0.026 to 0.537)	-0.154	0.658	(-0.837 to 0.528)	-0.714	0.048	(-1.420 to -0.008)	-1.637	0.012	(-2.907 to -0.367)
Constant	5.825	<0.001	(5.571 to 6.080)	0.081	0.520	(-0.166 to 0.328)	0.084	0.450	(-0.134 to 0.302)	0.274	0.011	(0.063 to 0.485)
AR	0.348	<0.001	(0.192 to 0.503)	0.270	0.037	(0.017 to 0.523)	0.071	0.585	(-0.184 to 0.326)	-	-	-
SAR	0.664	<0.001	(0.510 to 0.817)	-0.597	<0.001	(-0.774 to -0.420)	-0.502	<0.001	(-0.708 to -0.296)	-	-	-
MA	-	-	-	-	-	-	-	-	-	-0.056	0.693	(-0.331 to 0.220)
MAR	-	-	-	-	-	-	-	-	-	-0.870	<0.001	(-1.190 to -0.550)
Sigma	0.344	<0.001	(0.299 to 0.388)	0.973	<0.001	(0.866 to 1.080)	1.188	<0.001	(1.018 to 1.358)	2.281	<0.001	(1.924 to 2.638)
Log likelihood	-41.1	-	-	-134.9	-	-	-152.9	-	-	-221.1	-	-
Kolmogorov-Smirnov test	-	0.480	-	0.899		-	-	0.950	-	-	0.389	-
Ljung-Box test	-	0.806	-	0.739		-	-	0.949	-	-	0.900	-

BIC: Bayesian information criterion, (S)AR: (seasonal) autoregressive term, (S)MA: (seasonal) moving average term.

7.4 What are patient perspectives on hospital care?

Using qualitative content analysis, we developed five themes and 17 categories, which reflected the underlying and manifest meaning of the discussions, respectively. These are illustrated in figure 14.

Theme 1: Health is everything.
This theme reflected the importance that participants attached to health. It was portrayed as more important than money or wealth, and valued above other goods and services. It was necessary as a means of survival to be able to work and provide for yourself and those dependent on you. This included not only physical health, but also psychological and emotional well-being.

> *"Health is everything, I am a carpenter and I am paid on a daily basis, I have stopped working since a month and a half. Health is the basis of our existence, if we are not healthy we cannot work or do anything else." (FGD4 Men-P3)*

Theme 2: Being turned into 2nd class citizens.
Perceptions of the health system were captured by this theme. Participants recognized that "some hospitals are not for us", which was reinforced by interactions with hospitals. They also felt neglected by the state, with citizens under the coverage of payers other than the MoPH having better healthcare access, services and respect from hospitals. Participants wanted the Ministry to be stronger in standing up for the rights of the poor and "make us feel that we are human beings". Excessive bureaucracy was also a problem, such as needing to travel to different locations for approvals of some surgical procedures.

> *"The hospitals in Lebanon are classified into classes, if you tell someone you are going to [well-known hospital X], they tell you 'this is not for you'; this is the way they reply." (FGD1 Men-P1)*

Participants reported seeing public hospitals neglected and their potential ignored, though they have a major role in supporting the poor. Participants often avoided primary care centers, seeing these as under-staffed, with less qualified or underpaid personnel. They also found 'outsiders' being favored with faster and free services, in reference to refugees covered by international non-governmental organizations and agencies.

> *"If you want to benefit this country you need to think of cutting down on the processes; the current way is very tiring." (FGD4 Men-P4)*

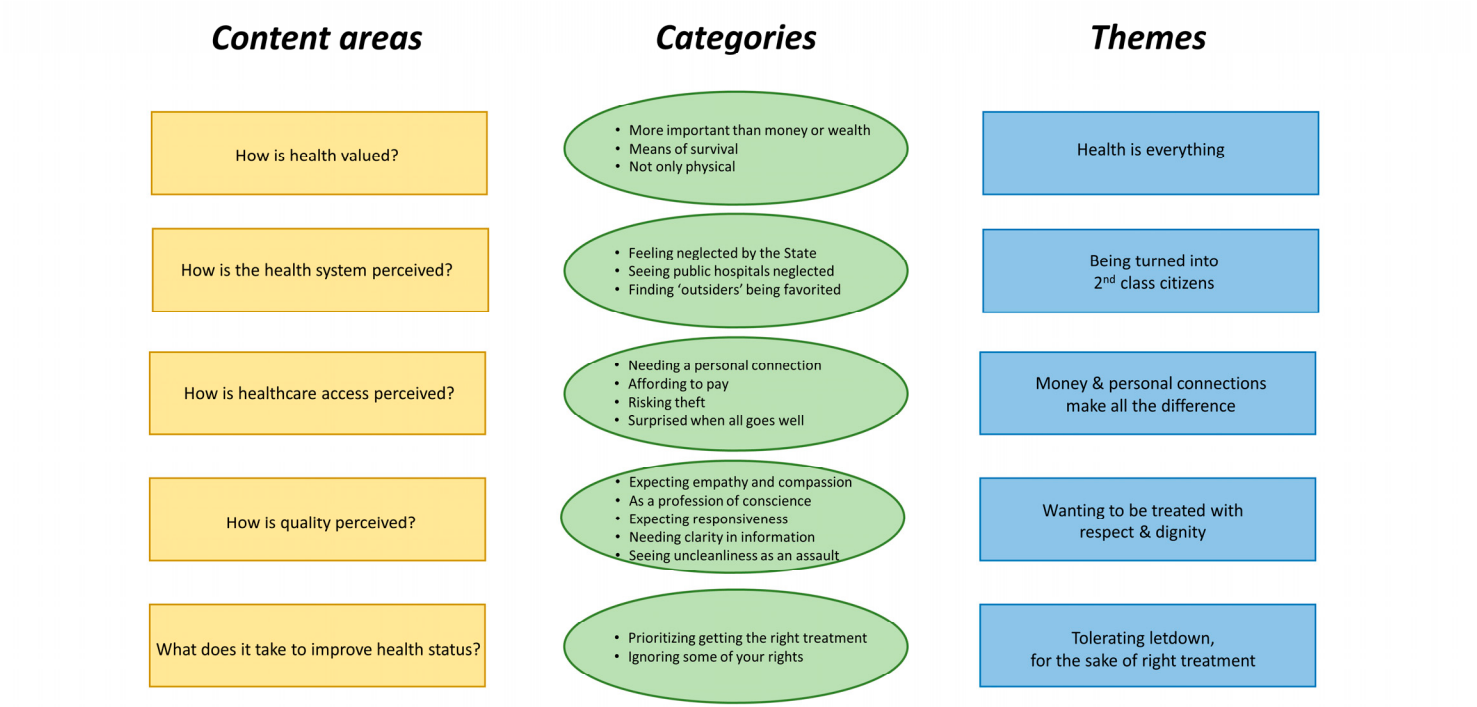


Figure 14: Overview of the main findings including content areas, categories and themes.

Theme 3: Money and personal connections (*wasta)* make all the difference.
This theme reflected participants' perceptions on access to healthcare. Needing a personal connection or having enough money were widely considered to improve access. They also recognized a mutually beneficial relation between some institutions and figures or authorities. For example, they reported that healthcare institutions would be protected from accountability, while political or religious figures/authorities would use their influence to facilitate services for some patients. Personal connections could also be used to decrease hospital bills or resolve perceived injustice or theft. Personal connections can sometimes be positive. For example, regular patients who become familiar to staff may be allowed to 'pay later'. But participants also considered that the health system would be better off without personal connections.

> *"As long as a person wants to be admitted through 'wasta', the hospital will not work properly." (FGD3 Women-P3)*

The financial cost of health services was a major concern for participants, specifically affording to pay. This also affected their perception and behavior towards healthcare. Money was seen as a solution to any problem encountered at hospitals, especially if one lacked a personal connection. Participants noted that sometimes hospitals would claim that no hospital beds were available, to deny admission for those covered by the MoPH. They suggested this was a deceptive practice to allow hospitals to retain more profitable patients covered by other payers, or to compel patients to pay out-of-pocket.

> *"I told the nurse my mother is not the daughter of a minister or a president; I cannot pay [out-of-pocket]. Then we took her to another hospital." (FGD3 Women-P4)*

Unaffordability led some patients to early hospital discharge or to forego medical tests. Some participants recounted a family member being worries about the bill and pretending to be better, to be discharged earlier. Participants recognized this was harmful to their health, but they had no alternative.

> *"When I had breast cancer […] I couldn't do regular tests for checkup. I went through very hard times to do the tests and get the treatment. I sold my wedding ring [to get treatment]. The Ministry couldn't cover all the expenses; I reached a very difficult situation." (FGD7 Women-P1)*

Participants recounted examples of borrowing money from relatives, the vulnerabilities when one has no income, and the difficulties in paying for recurring

costs such as chronic medications. They emphasized that they have a right to health, but they do not know how to realize these rights.

Risking theft when seeking healthcare was emphasized by participants. A common complaint from participants was of a healthcare personnel misinforming on procedures covered by the MoPH. Participants noted that it was common to be asked by hospitals or physicians for payment above the pre-defined co-payment amount, but were unaware this was illegal. They also recognized that not all doctors were the same, and some went far to support patients and their rights.

> *"I didn't have any problem with the process at the Ministry, but they wanted me to pay 3,500 USD at the hospital. We disagreed with them, even the physician disagreed with such payment, then they decreased the amount to 2,500 USD [after the doctor spoke to the hospital]." (FGD4 Men-P3)*

Insufficient information regarding payment meant that patients had a weaker role in their interaction with hospitals. Participants considered themselves the weakest of the three parties, including MoPH and hospitals. They also recognized some of the complex relations between hospitals and the MoPH.

> *"Every patient admitted under the Ministry's coverage doesn't know how much they are expected to pay […]. The Ministry delays its payments to hospitals, so [hospitals] want to benefit from another source." (FGD4 Men-P3)*

Many participants also reported positive interactions with healthcare, whether with the Ministry or hospitals. They were surprised when all goes well. Such as when the admission approval went smoothly, upon receiving coverage by the MoPH (85%) for the hospital bill, or during hospitalization. Such interactions affected the perception and trust of participants towards the MoPH.

Theme 4: Wanting to be treated with dignity and respect.

This theme reflected how patients perceived the quality of care at hospitals, expressed as wanting to be treated with dignity and respect, implicitly and explicitly. It also illustrates how patients view the health profession in itself. Reflecting on their past experiences, participants acknowledged positive and negative interactions. These were not necessarily tied to the bio-physical outcome of treatment, but they did have an impact on how participants perceived hospitals.

Expecting empathy and compassion during their interactions with hospital personnel was important. This included the manner of communication between health professionals and patients, as well as with administrative personnel. Negative interactions had strong impressions on patients and their feelings of self-worth.

They also perceived that patients were treated with dignity and respect at private hospitals, but not public hospitals.

When asked what factors result in a positive experience during a hospital stay participants referred to experiences of compassionate personnel, positive attitude and care of nurses, and doctors striving far to support them.

> *"[The doctor said I needed surgery] and he visited me in the morning, and noon, and night. […] He doesn't take a Lira from me. He knew I am poor and suffering. I told him I'm a farmer […] He said 'my brother, this is helping someone in need.'" (FGD8 Men-P4)*

Seeing health practitioners belonging to a profession of conscience was also an expression of patients' desire to be treated with dignity and respect. They considered that being humane was the most important attribute. They also considered it a fundamental human right to receive care, regardless of ability to pay.

> *"Humanity is the most important thing to be found at hospitals" (FGD2 Women-P1)*

Participants were also expecting responsiveness from personnel. They empathized with the challenging conditions and long work hours of hospital personnel. Responsiveness was particularly important when one was in pain, or needed to use the toilet. Lack of responsiveness in such situations led to strongly negative patient experiences.

> *"When the nurse is in this profession, he must be expecting what he will face, he must not get annoyed and he must be patient. When the patient is at the hospital, he isn't going to be faking it, he will really be in pain. This is why he will be nagging; because no one nags for no reason." (FGD7 Women-P5)*

Participants highly valued the time personnel devoted to them. This included having enough time with the doctor, to get a clear explanation of their condition and treatment options.

> *Moderator: "How would you differentiate between a good and humane doctor, and a bad one?"*
> *P4: "When he provides you with information, as I told you. Because my doctor's clinic is so busy, if I want to ask him a question he says 'there is no need to know about these things, I know about them'; this annoyed me." […]*
> *P5: "The doctor is good when he gives you from his time, even though sometimes he is in a rush, but he has to make you relaxed, to explain your condition to you." (FGD7 Women)*

It was also important to have a doctor you are comfortable with and could rely on. 'Following the doctor' was how participants largely explained their decision to visit or re-visit a hospital. They also acknowledged that chance also plays a role in what doctor you find, and the importance of the recommendation of friends or relatives before choosing a doctor.

Needing clarity in the information provided was highlighted, both from hospitals and the MoPH. This included information on treatment options, length of stay, and co-payment amount. Participants noted that information clarity may be even more important for health services, than in other types of services, since patients are more vulnerable and dependent on others.

More broadly, participants thought it was important to know which hospitals were better performers; the location and medications accessible from medication dispensaries and primary care centers; and the cost (or co-payment) of surgical procedures under MoPH coverage. Many were unaware of the difference between a deposit receipt and their hospitalization bill, or of their right to have a detailed bill. They reported minimal bill information was given at discharge, and this was usually verbal, not written.

Participants saw uncleanliness as an assault and as a danger to themselves, especially regarding the toilet and bedsheets. They noted cues they would use to assess cleanliness, such as the frequency and timing of cleaning. Cleanliness left a strong impression of hospitals among participants; "you see and sense cleanliness" (FGD4 Men-P3).

Theme 5: Tolerating letdown, for the sake of right treatment.

This theme reflected what participants see it takes to improve one's health status. They underscored that their purpose in being in a hospital was to get the right treatment, which they generally prioritized. Some would accept being in a less-favored hospital, if it meant they could 'follow their doctor' and get appropriately treated. Getting the right treatment may involve ignoring some of your rights. Participants would sometimes be compelled to not to complain to personnel, because they did not want to compromise on their treatment outcomes.

> *"I ignore lots of things, you can say that I ignore 40-50% of my rights, the most important thing is to get the treatment." (FGD4 Men-P4)*

The results of the sorting exercise reflected the wide range of factors that patients consider important and affects their satisfaction (see appendix, Paper 4, table 3). This provided 'patient satisfaction' as a sixth patient perspective. The most prioritized statements related to issues that were commonly raised by participants during the FGDs. Specifically, this applied across statements a to k. Having clear

instructions at discharge (b) was an exception though, which suggests a missed opportunity to engage on this during the FGDs.

Conclusion

This chapter provided the main results of this thesis. We found that the 2014 P4P resulted in a decrease in unnecessary hospitalizations and improved coding, with the former being reflected vis-à-vis increased casemix index. The 2018 P4P intervention resulted in a decrease in stroke and cholecystectomy readmissions, but not general and pneumonia readmissions (regardless of hospital size). The MoPH developed P4P, including several components, to increase the appropriateness and fairness of the relation with hospitals. We identified six patient perspectives, reflecting how patients value health, being turned into a second-class citizen, the influence of money and connections, the importance of being treated with dignity and respect, tolerating letdown for the sake of right treatment, and patient satisfaction.

In the next chapter we will discuss the findings of each paper and the thesis as a whole, and then move on to discuss the methodological considerations.

8 Discussion

> *"It does not matter who you are, or how smart you are, or what title you have, or how many of you there are, and certainly not how many papers your side has published, if your prediction is wrong then your hypothesis is wrong. Period."*
>
> – *Richard Feynman*

This chapter provides a discussion of the main findings of this thesis, which is related with the literature where relevant, and organized under general statements. We then move on to the methodological considerations, divided into those relating to the two P4P interventions (interrupted time series design), and the context of P4P and patient perspectives (content analysis).

8.1 Discussion of findings and relation to the literature

This thesis described the development and investigated the impact of hospital pay-for-performance in Lebanon. We have detailed how the Ministry of Public Health used participatory governance in developing P4P, which was intended for improving fairness and transparency in the relation between hospitals and the MoPH, as well as to improve effectiveness.

We have estimated the impact of the 2014 P4P integration, which resulted in improved effectiveness by reducing unnecessary hospitalizations, and improved coding quality. We also demonstrated how casemix index and routine data can be used to improve hospital performance in limited resource settings. We also estimated the impact of the 2018 P4P on hospital readmissions, which resulted in decreased cholecystectomy and stroke readmissions, but not general and pneumonia readmissions. However, readmission components within P4P require careful design and understanding of the specific context.

Our exploration of patient perspectives showed that these include satisfaction, valuing of health, health status, and perceptions of quality, access and the health system. We also described how pay-for-performance can be made more responsive to the patient population, through a broader consideration of their perspectives.

Using participatory governance, pay-for-performance was developed to improve fairness and transparency in the relation between hospitals and the MoPH, and to improve effectiveness.

The MoPH had set several interrelated goals for its reforms throughout 2009-2014, which it approached using features of participatory governance, developing inter-disciplinary committees of a mix of professionals across hospitals and the MoPH. The Ministry was actively involved in this process in providing guidance, resources and institutional commitment. The multi-pronged approach to interrelated goals enabled the three committees to build on each other's work.

A major product of this period was the development of hospital P4P, which was integrated within the MoPH, with the mechanism used to determine hospital reimbursement tiers. Casemix and patient satisfaction were among the components of the P4P model, replacing the previous model which had been solely based on accreditation.

A possibly unique aspect of the P4P design was the inclusion of casemix as a performance measure. This is likely not used elsewhere. More developed systems tend to have had casemix incorporated before the advent of P4P in healthcare, and less developed systems have not attempted such a combination. Another important aspect was the use of ICD-10 and CPT codes to directly determine casemix index, overcoming the challenges due to the absence of national DRGs.

The determination of global hospital budgets is often the purpose of casemix in several countries, whereby casemix and historical volume is used to prospectively set budgets. However, the political support for such use of casemix in Lebanon was absent.

The P4P model provided a more transparent and fair relation between the MoPH and hospitals, particularly through accounting for the variable complexity of cases admitted in different hospitals. Another underlying result of the increased transparency is that it helped counter favoritism and clientelism, whereby hospitals with better political or sectarian 'connections' used to be more able to influence reimbursement tier determination, due to the limitations of the former model based solely on accreditation.

The integration of pay-for-performance in 2014 resulted in improved healthcare effectiveness by reducing unnecessary hospitalizations, and improved coding quality.

The 2014 integration of P4P into the MoPH-hospitals payer-provider relation resulted in a decrease of unnecessary hospitalizations, and improved coding quality. These changes were reflected in the casemix index, particularly among medium and short-stay cases. The in-depth analysis used in Paper 2 allowed us to attribute casemix change to specific codes, and understand the underlying changes. Without this, we would have been limited to our statistical finding of increased casemix, suggesting improved system efficiency. Uncovering that these changes included decreased unnecessary hospitalizations allows us to categorize this under quality of care, within the effectiveness dimension, vis-à-vis the Kruk and Freedman framework for health systems performance measures [4]. Further downstream, we may expect this to reflected in outcomes on patient health status (effectiveness), and on maximizing value of resources (efficiency).

The greatest effect on medium-stay casemix was from decreased hospitalizations for diarrhea and gastroenteritis. We expect that such cases are likely to be responsible for more unnecessary hospitalizations than any other condition, as has been previously suggested [188 189]. Acute gastroenteritis is typically self-limiting, not requiring hospitalization and accompanied with diarrhea. The most common reason for hospitalization is dehydration, particularly among infants or elderly. However, acute gastroenteritis is a good candidate for 'cream-skimming' by hospitals, since it is less complex, with lower expected costs (see 2.2.1) [78].

Prominent decreases were also found in hospitalizations for abdominal and pelvic pain, intestinal infectious diseases, fever of unknown origin, and essential hypertension. These also present opportunities for unnecessary hospitalization [189]. We do not expect such changes to be due to changed disease burden, since the decrease was at least one order of magnitude greater than any change since 2011. For some of these conditions there was also a shift from medium-stays to short-stays, which suggests that not only did hospitalizations decrease, but there was also a decrease in their length of stay (LoS). Generally, changes in LoS are difficult to link to quality of care. However, for these specific conditions it likely reflects improved hospital practices.

The 2014 P4P integration did not influence the annual MoPH setting of global hospital budgets. The P4P incentive was linked to hospital reimbursement tiers. Given the aforementioned changes, one may reason that resources that would have been spent on unnecessary hospitalizations may have facilitated hospitals admitting more complex conditions, such as pneumonia, acute bronchitis and COPD (which increased).

The improvement of coding practices following the intervention was primarily among chemotherapy hospitalizations, with more breast cancer and leukemia treatment being correctly coded. Changes in coding practices following casemix introduction have been reported in other contexts [190] [191]. While such situations can be an example of 'Campbell's law' (see 5.2.1), in this instance coding improvement was confirmed since diagnostic hospitalizations are considerably more costly typical chemotherapy sessions.

Seasonality and other changes in diagnoses and procedures were also detected in our investigation. A prominent example was in vaginal and cesarean deliveries. We were able to disentangle their effect, attributing this to pre-intervention changes.

Casemix index and routine data can be used to improve hospital performance in limited resource settings.

The MoPH did not have to develop new information systems or data collection for its P4P initiative beyond what had already existed at the Ministry. The data used is entered at the hospital level, and centrally stored in the hospitalization database. While this limits P4P to a certain range of measures, it does not involve additional costs to maintain. This demonstrates how effective hospital regulation can be achieved through systematic collection and analysis of routine data. Implementation costs of any P4P initiative are important to consider, and in some contexts these may even exceed the cost of incentives themselves [192]. The P4P integration contributes more broadly to the health system, using an approach that has been increasingly suggested [13] [193] [194].

This thesis demonstrates how casemix may be applied as a performance measure, provided there is an underlying reason. In this instance, the reason was the recognized problem of unnecessary hospitalizations and the potential for 'cream-skimming'. Countries with such contextual challenges may use a similar approach to improve performance, by linking casemix to incentives. In other another context lacking such reasons, using casemix as a performance measure may not be helpful. A casemix component in the Lebanese P4P may be beneficial only up to a point in time when other mechanisms to control unnecessary hospitalizations are strengthened, or when casemix can instead be used for setting global hospital budgets.

Including readmissions within P4P resulted in decreased cholecystectomy and stroke readmissions, but not general and pneumonia readmissions.

The 2018 MoPH announcement that readmissions were to be added as a new P4P component resulted in deceased cholecystectomy and stroke readmissions. These readmission types had generally stable pre-intervention trends, which strengthens the validity of our finding. However, no impact was found on general and pneumonia readmissions, even after aggregating by hospital size.

The diverse findings by readmission type are not unusual, and several factors may plausibly be involved, including case volume and complexity. General and pneumonia readmissions were considerably greater in scale than cholecystectomy and stroke readmissions, and more widely distributed across about twice as many hospitals. A dilution effect may have occurred, whereby improvement across a few hospitals may be more easily reflected at the aggregate level, when the scale is smaller. This is especially noticeable in general readmissions, which did not reflect the decreases in cholecystectomy and stroke readmissions, despite the inclusion of their cases within general readmissions (by definition).

A second factor is case complexity, which also is related to risk of readmission [74 75]. Pneumonia patients tend to be older and more medically complex than other hospitalizations. Such unmodifiable patient characteristics may mean that a large proportion of pneumonia readmissions may be unavoidable. A similar reasoning has been suggested regarding heart failure readmissions in the US HRRP [42]. However, this factor alone would not explain the lack of evidence of impact, since some proportion of pneumonia cases is expected to be avoidable, and has been shown to respond to incentives elsewhere (see 2.1.3) [38].

It is important to consider that the incentive may not have been sufficiently strong for hospitals to address some readmission types, particularly if perceived as high hanging fruit. Each of the readmission types had an equal weight within the readmissions component. Hospitals may have selected to address those that they consider more modifiable or more focused. The P4P inclusion of general readmissions was intended to incentivize broader improvement by hospitals, in the same logic of broader rather than narrower measures [17]. However, hospitals may have considered this too demanding, and perhaps understandably.

Acknowledging the mixed relation of hospital size and readmissions, we had investigated but found no evidence of impact on general and pneumonia readmissions when aggregating by hospital size [97 195 196]. This further suggests that hospitals were either unwilling or unable to address these readmission types.

Including readmissions within P4P requires careful design and comprehensive understanding of context.

Understanding the context, potential pathways to impact and mediating factors is important for all P4P initiatives [14]. This may be particularly stressed when including readmission components. Considerable evidence has emerged highlighting unintended consequences with regards to readmissions in P4P, particularly from the US HRRP experience (see 2.1.3). Specifically, this involved the shifting of hospitals visits from admission to emergency or observation room stays [40 41]. Similar to the HRRP, the Lebanese P4P did not incorporate emergency and observation stays, and such data is not gathered by the MoPH. However, we do not expect this to have had a major impact, since such stays play a small role in the Lebanese context, and change was found in two of the four readmission types. Nevertheless, this is a weakness of the MoPH P4P, and should be addressed by incorporating all hospital visits. The possibility of hospital refusals to re-hospitalize should also be considered, and this likely would require an innovative approach regarding data collection, whether in Lebanon or elsewhere.

Another consideration for readmissions in P4P is to include mortality measures. These may be incorporated into P4P, or used for monitoring unintended consequences. In the US, some findings from the HRRP suggested it may have been associated with an increase in heart failure mortality, though a causal relation has been difficult to infer, due to methodological limitations and background epidemiology (see 2.1.3) [47 50]. Nevertheless, it is logically plausible that mortality may be related, and given the gravity of such outcomes, P4P designs should incorporate an approach addressing mortality. In the Lebanese P4P, mortality was not linked to hospitalization data, due to technical and policy-related reasons. While the lack of mortality monitoring is a weakness, deaths were maintained in the denominator for readmission calculation (unlike standard metrics), and in effect functioned as a form of competing risk model [197]. Such a feature has been suggested as a solution to some unintended consequences, particularly for measures regarding high-risk conditions/procedures and subgroups [197].

Patient perspectives include satisfaction, valuing of health, health status, and perceptions of quality, access and the health system.

Our qualitative investigation of patient perspectives in Lebanon contributes to the limited evidence base on patient perspectives and how patients may be engaged to evaluate their care [198]. A key finding was that patients appear to have a clear idea of how their healthcare experience can be improved, and this extended beyond the boundaries of their hospital stay.

Patients valued health highly, and above other common goods or services. This applied to health itself, as well as health as a prerequisite for daily functioning and work. Patients felt the State neglected them, and neglected public hospitals, which

they perceive as having a major role in supporting the poor. As persons under the MoPH coverage, they felt like second-class citizens compared to refugees and to citizens covered by other payers.

Patients consider that personal connections (*wasta*) and money play a large role in determining access to healthcare. The health system would be better off if nobody would resort to personal connections, although it may occur in a positive manner of familiarity between regular patients and healthcare personnel. A major concern for patients was affording to pay for healthcare, with negative experiences including being over-charged, denied access, or having to forego treatment.

There is clear recognition of the variable dedication that healthcare personnel have for patients. Patients have expectations to be treated with dignity and respect, including empathy and compassion. They consider this to be intrinsic to the healthcare profession, and are disappointed when they are let down. They tolerate some of this for the sake of 'following their doctors' and getting the right treatment. But they are also interested in knowing which are the better performing hospitals. Cleanliness and regular contact with the doctor were highly prioritized by patients.

Our findings aligned with previous research on what matters to patients. They want humane, informative and available health professionals who are not financially-driven money-driven [199-203]. While the purpose of being hospitalized is to be diagnosed or treated, patients place high value on humane personnel and on cleanliness. This concurs with reports that suggest that compassion may be prioritized above medical outcome [204].

Personnel responsiveness may play a large role in shaping patient perceptions, and this has also been linked to the incidence of hospital-acquired infections, suggesting wider hospital problems [205]. Individual experiences have a strong role in shaping patient perceptions to both the hospital and health system, which concurs with other research [206 207]. We also concur with previous research that the patient experience generally reflects the quality of care perceived by the patient [208]. This is a more objective patient perspective than satisfaction, despite their relation.

Most theories attempted to explain patient satisfaction in terms of expectancy theories (see 2.4.2) [114]. However, despite its conceptual and clarity limitations, it remains important for patients. Satisfaction is an emotion reflecting patients' feelings, and is therefore not entirely explainable through objective reasoning. Patients are not 'cool-headed consumers' [117]. Satisfaction should not be used as a global objective measure, as often seen in surveys. Instead, it should be acknowledged as just one of the various patient perspectives.

Pay-for-performance can be made more responsive through a broader consideration of patient perspectives.

Patient surveys are typically developed by experts, without being informed by patients themselves. This limits survey construct validity. The same had applied for the MoPH tool (based on HCAHPS). Our findings identify several issues that are not sufficiently captured by the MoPH tool, such as discharge and information clarity, risk of theft and time spent with personnel. In 2018, based on our findings, the MoPH improved the validity of its survey by updating several items.

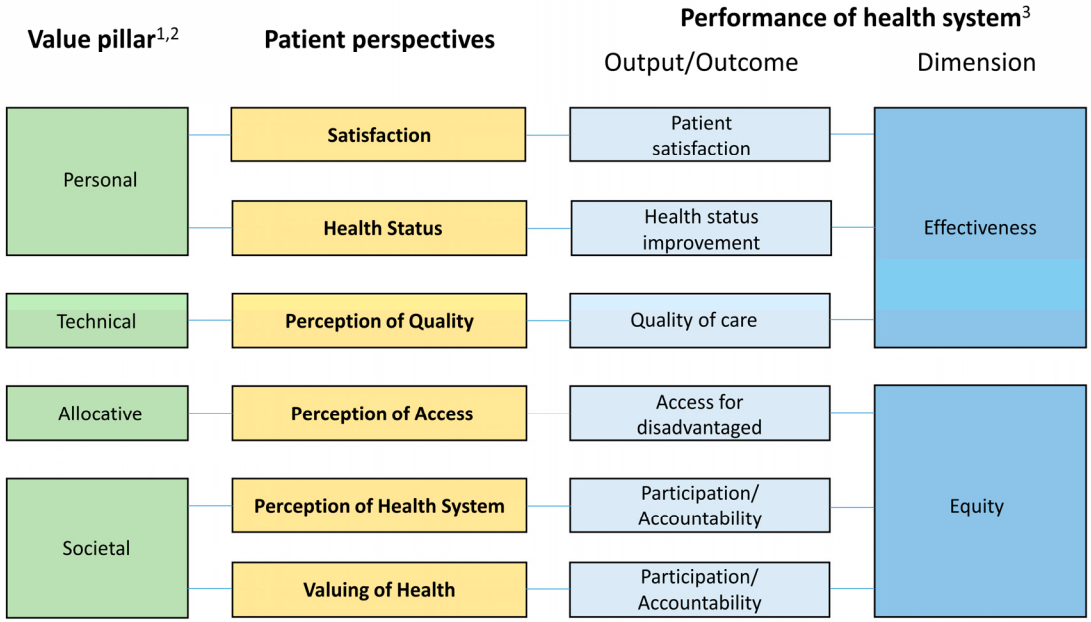
Health systems have an opportunity for wider engagement of patients for their perspectives. This benefits patient-centered care, health system effectiveness and equity.

Patients are usually engaged regarding their satisfaction, treatment (health status), and experience (care quality). However, engagement rarely occurs on the three other patient perspectives we identify: perception of access, perception of health system, and valuing of health. These represent a wider form of engagement, which may be aimed at health system development or reform. Such engagement recognizes patients not solely as healthcare recipients, but also as essential contributors to shaping the values and functions of a health system.

We developed a framework to relate patient perspectives to health systems performance and value-based care (see figure 16). The purpose of this framework is to illustrate the conceptual linkages between these three domains, thus facilitating the organization of wider patient engagement. We use the six patient perspectives we identified, alongside the Kruk and Freedman framework for health systems performance, and the value pillars recently proposed by the WHO EU Health Observatory and the European Commission [4 209 210]. The value pillars include personal, technical, allocative and societal values.

Linking patient perspectives to the value pillars allows value-based programs such as pay-for-performance to consider a wider aim, including allocative and societal values, which are generally neglected. Wider patient engagement may involve assessing healthcare access and the overall health system, thus contributing towards decreasing population inequity. Capturing how patients value health relates to both accountability and participation within a health system. More broadly, health systems which engage widely may not only benefit patient-centeredness, but also form a bridge between patient-centeredness and people-centeredness.

In our research, Lebanese patients placed a high value on health, and strongly supported accountability and the improvement of public hospitals. These are likely not reflected in the priorities and spending of the Lebanese government. In the Lebanese context, examples of wider engagement may include public participation in determining local healthcare needs, and in the development of national strategies.



[1] Smith PC. et al (2020). Building on value-based health care: Towards a health system perspective. European Observatory Policy Briefs. World Health Organization.
[2] European Commission (2019). Defining Value in 'Value-Based Healthcare'. Report of the Expert Panel on effective ways of investing in Health.
[3] Kruk M., Freedman L. (2008). Assessing Health System Performance in Developing Countries: A Review of the Literature; p. 263-276.

Figure 16: Relating patient perspectives to value-based care and health systems performance.

8.2 Methodological considerations

> *"The seeker after the truth is, therefore, not he who studies the writings of the ancients and, following his natural disposition, puts his trust in them, but rather the one who suspects his faith in them and questions what he gathers from them, the one who submits to argument and demonstration, and not to the sayings of a human being whose nature is fraught with all kinds of imperfection and deficiency. It is thus the duty of the man who studies the writings of scientists, if learning the truth is his goal, to make himself an enemy of all that he reads, and, applying his mind to the core and margins of its content, attack it from every side. He should also suspect himself as he performs his critical examination of it, so that he may avoid falling into either prejudice or leniency."*
>
> *– The Optics Of Ibn Al Haytham, Books I-III, On Direct Vision* [211]

This thesis used a mixed methods approach, which we consider to be advantageous in investigating complex interventions such as P4P (see 6.1). We were able to address research questions relating to different aspects of P4P, using quantitative and qualitative analyses. It also included investigations of two different P4P interventions, within the same overall context. The four papers differ considerably in their focus and analytical approach. Investigation of the 2014 and 2018 P4P interventions used a quasi-experimental ITS design, which may be considered the most appropriate, given the nature of the intervention and context. We first reflect on the four validities most relevant for ITS design for Papers 2 and 3, and other general aspects, followed by reflections on Papers 1 and 4.

8.2.1 Casemix and readmissions

1. Internal validity

We do not consider a threat to internal validity from history to be plausible. No other events occurred around the time of the 2014 or 2018 P4P interventions that may have offered an alternative explanation for our findings. Instrumentation changes did occur following the 2014 P4P (chemotherapy codes), and was detected in code-level analysis. This did not threaten the internal validity of our findings, as the contribution of instrumentation was measurable, and other changes were detected that were not attributable to instrumentation. Regarding the 2018 P4P, it is possible that some hospitals may have intentionally miss-coded readmissions to avoid algorithm detection. However, we consider this to be unlikely or at least of negligible impact, due to the wide case definitions used. Our use of an ITS design allowed us to control for any underlying process (maturation), which may have

otherwise explained detected changes. Also, since both our 2014 (casemix) and 2018 (readmissions) time series were stable and of medium length, we do not expect regression to the mean to have been plausible. No selection bias is expected, since we used historical self-controls for all of our time series.

2. External validity

There is a wide variability in P4P designs and contexts. From a design perspective, this may include different incentives, components types and weights. The locations and health systems of countries undertaking hospital P4P should also be considered. These factors limit the generalizability of our findings to other designs and contexts. Nevertheless, our findings apply for the Lebanese P4P and contribute to the limited body of evidence regarding hospital P4P impact. Temporal drift with regards to readmissions was addressed using age-adjusted readmission rates. Although we had no age adjustment for the 2014 P4P casemix investigation, we do not consider this to have had a considerable impact on the changes in casemix found, particularly as our study design controlled for secular trends.

3. Statistical conclusion validity

Our 2014 and 2018 P4P time series were stable in the pre-intervention period, and had a sufficient number of data points. This renders a threat from low statistical power or miss-interpretation less plausible. For the readmissions time series, we had missing data for December readmissions, due to the datasets available from the MoPH. This may be considered a threat to statistical conclusion validity. However, we consider this to be less plausible, since our intervention did not coincide with the missing data period, and the time series was stable. Our analytical approach ensured that test assumptions were not violated, particularly normality and independence.

4. Construct validity

For both 2014 and 2018 P4P time series, we used calendar monthly data points. This allows for sufficient data points, compared to using quarterly data points. Also, we did not use weekly or daily data points which would have been less likely to be normal (requiring data transformation). The use of 28-day months may have increased the construct validity of our investigations, as we can expect some differences in hospitalizations between weekends and weekdays. However, we opted for calendar months, to improve the interpretation of our findings. It is also relevant to note that the first few months of 2011 were the earliest period in the operation of the hospitalization database, with some hospitals lagging behind in the reporting of data to the MoPH. This represents a threat to construct validity. However, given its short duration and distance from the interventions, we do not expect this to have been a major threat. For readmissions in particular, the inability to include the entire spectrum of hospital visits may be considered a threat to construct validity, which should be addressed in future developments.

Overall, we consider that all four validities have been met in our 2014 and 2018 P4P time series investigations, while noting the above limitations. We cannot identify alternative explanations for the major changes we have attributed to the interventions, and express high confidence in the causal inference made.

Investigation of both P4P interventions used ITS design, but involved differences in our analytical approach. The 2018 P4P investigation used ARIMA, which may be considered superior over the Newey-OLS regression approach used for the 2014 P4P investigation [167]. This is mainly due to the greater capability of ARIMA to account for seasonality, and the ability to difference the time series if it is found to be non-stationary. On the other hand, the 2014 P4P investigation may be considered more rigorous, in that it involved not only testing for change, but also attributing this to specific diagnoses and procedures. The analogue of this for the 2018 P4P would be an analysis of which readmission diagnoses or procedures changed, and should be a subject for future research. Given the complexity of outcome-based P4P, it is particularly useful to explain the underlying changes, rather than only estimate impact [212] [213]. This may also involve investigation of the causal pathways, particularly regarding complex interventions [214]. In this thesis, we did not investigate the hospital response mechanisms or 'black box' (see chapter 4). This remains an important aspect of P4P evaluation, as it would provide insight into the motivations, decisions and actions of managers and health professionals.

8.2.2 Context of P4P and patient perspectives

The first paper provided a descriptive analysis addressing why and how P4P was developed in Lebanon. The analytical approach involved using documents developed by the project team, which included this author, in a role coordinating across the committees and being the link between them and the MoPH Director-General. As such, it may be impossible to avoid some bias due to the author's own perspective. Nevertheless, we entirely relied on the documentation produced by the project, and the discussions held with select project participants. This was supplemented by subsequent circulation of the paper's drafts across co-authors. Six of the eight co-authors were project participants, with two others involved in an annual evaluative capacity.

A weakness in the paper may be noted in the table on hospitalization changes, which included summary statistics across June to May for 2011-2014, and December 2014 to June 2015. Aside from being a simple pre/post design, it fails to account for seasonality. This renders the figures of the post-intervention period unreliable, though we note this had been labelled a preliminary analysis requiring subsequent investigation. An additional note is with regard to the quote from the then-minister of public health; this represented his view, but not that of the first author. While utilization review and improved auditing can considerably improve efficiency, we cannot expect to produce savings within a context of rising healthcare costs and increasing coverage for older citizens.

Trustworthiness, credibility, dependability and transferability were elaborated on in Paper 4. Our qualitative investigation did not seek to generalize regarding patient perspectives in Lebanon. However, we document a range of perspectives, many of which are also relevant in contexts other than Lebanon. We also sought a wide variation of patient experiences, with women and men participants coming from different geographic regions. Nevertheless, unforeseen selection bias may have occurred, threatening external validity. Another threat to external validity is due to the influence and interpretation of the researcher, which is impossible to avoid in such research design. However, we expect this was well-balanced, with no meaning imputed that was not present in the participants' discussion, and further improved through discussions with the two research assistants and co-authors.

Conclusion

This chapter provided a discussion of the main findings of this thesis. These included the use of participatory governance principles in developing P4P; the integration of P4P improving effectiveness by reducing unnecessary hospitalizations; how routine data and casemix can be used for hospital performance; the mixed findings of including a readmissions component to P4P; the six patient perspectives identified, and how these can be better considered to make P4P and broader health system development more responsive to the population. We also discussed the methodological considerations of our investigations. We find that the four most relevant validities have been met in our ITS investigations, but also note some limitations. We also note the limitations regarding the first paper, particularly the risk for some bias, and the measures taken for the fourth paper regarding trustworthiness, credibility, dependability and transferability.

In the next chapter, we provide the conclusions based on the research undertaken in this thesis, followed in the final chapter by a list of recommendations and suggestions regarding the P4P model of the MoPH, health system performance and P4P in other countries, and for future research investigation.

9 Implications for policy, practice and research

9.1 For the Lebanese health system and the pay-for-performance model

1. *We recommend* that the MoPH engage the public to capture their perspectives on health system redesign and crisis recovery, to improve access, participation, accountability and quality of care. This should include actively informing patients of their rights.

2. *We recommend* that the MoPH retain the casemix index component in its P4P model, until a time at which casemix is incorporated in setting global budgets of hospitals. Such a step should be made in the near-term, as unnecessary hospitalizations are better addressed through hospital budgets rather than reimbursement tiers. This would also free the P4P model to include new components that are more modifiable across hospitals. Capturing case complexity remains relevant for providing a fair comparison across hospitals, both in terms of casemix itself, as well as an adjustor for other indicators.

3. *We recommend* that the MoPH retain stroke and cholecystectomy within the P4P readmissions component, and remove general and pneumonia readmissions. *We suggest* including other readmissions, but avoiding higher risk conditions/procedures or subgroups (e.g. elderly, children). Maintaining the readmissions component should be conditional on meeting the next recommendation (#4). Alternatively, the readmissions component may be changed to replace readmissions with specific process indicators directly related to them, such as hospital-to-community transitions and discharge instructions, provided that appropriate measurement and monitoring are established. The future of readmissions in P4P likely lies in this last alternative, namely, in process-based components coupled with outcomes-based monitoring.

4. *We recommend* that the MoPH develop its system for hospital data collection, to include the entire spectrum of hospital visits. This would include observation and emergency room visits.

5. *We recommend* that the MoPH establish a linkage between hospital mortality data and its P4P model. Mortality should not be used as a component within P4P, but should be continuously monitored across a broad range of conditions/procedures, including those targeted by the P4P readmissions component.

6. *We suggest* that the MoPH establish linkages with other public and private payers regarding hospitalization data. This path may begin with data standardization and centralization, and leading up to eventual unification.

7. *We suggest* that the MoPH remove the accreditation component within P4P, and instead require all hospitals to be accredited prior to contracting with the MoPH. Hospitals should continue to be incentivized to gain accreditation.

8. *We recommend* that the Lebanese State improve public hospitals and dedicate greater resources for the health system, to more closely reflect the high value on health placed by Lebanese patients. A multi-sectoral initiative to decrease the influence of personal connections (*wasta*) and money is an important component of this. This should ultimately lead up to the establishment of a single Lebanese National Health Service, providing equitable coverage for the entire population.

9.2 For health systems and pay-for-performance in other countries

1. *We recommend* that P4P initiatives be integrated within health systems, rather than become stand-alone programs. P4P models should be developed using principles of participatory governance, and engage patients on their perspectives.

2. *We suggest* that health systems consider including casemix as a P4P component, provided that they do not already use casemix for budgeting and are challenged with unnecessary hospitalizations.

3. *We recommend* that health systems target readmissions using P4P on the condition that monitoring mechanisms are established for capturing the entire spectrum of hospital visits and mortality.

4. *We recommend* that P4P models include locally-relevant components, and exclude high-risk conditions/procedures and subgroups.

5. *We recommend* health systems to more widely engage people for their perspectives, including perception of access, perception of health system, and valuing of health, and not only satisfaction, experience and treatment. This may involve engaging the public in determining local healthcare needs and national strategies. Moving to a genuinely person- and people-centered health system cannot be achieved without wider engagement.

9.3 For future research

1. *We recommend* the use of appropriate interrupted time series analysis for the evaluation of P4P intervention impact in different contexts.

2. *We recommend* further research to investigate the impact of Lebanese P4P interventions on other components not yet investigated. Specifically, this relates to the 2018 impact on casemix, ICU capacity and utilization, and hospitalization of elderly persons, as well as the 'black box' representing hospital mechanisms used to change outputs or outcomes.

3. *We suggest* further research to investigate the impact of the economic crisis, COVID-19 and the Beirut port explosion on hospital performance, vis-à-vis the various P4P components.

4. *We recommend* further research to investigate the changes in causes of readmissions following cholecystectomy and stroke, to possibly attribute the observed readmission decreases to specific diagnoses or procedures.

5. *We suggest* further research to investigate patient perspectives in non-Lebanese contexts, to increase knowledge on the external validity of the framework relating patient perspectives to health systems performance and value-based care.

10 Conclusion

This thesis has described the development and investigated the impact of hospital pay-for-performance in Lebanon. Besides the contribution to the *episteme* on hospital P4P (see Preface), this thesis also documents the *techne* involved in developing and evaluating P4P in Lebanon, including the use of appropriate interrupted time series analysis.

The MoPH used principles of participatory governance to tackle the goals set by the 2009-2014 reforms. A major goal was the development of hospital P4P, which aimed to increase the fairness and transparency of the relation between hospitals and the Ministry. This was also to counter political or sectarian favoritism and clientelism.

The 2014 integration of P4P into the payer-provider relation between the MoPH and hospitals improved system effectiveness, by decreasing unnecessary hospitalizations and improving hospital coding quality. This was reflected in an increased hospital casemix, which was a major component of the P4P model, and confirmed by code-level analysis. Despite the limited resources available, the MoPH was able to use routine data and casemix towards improving hospital performance. This thesis demonstrated how casemix can be applied as a performance measure, provided that the context is appropriate.

The 2018 inclusion of readmissions into the P4P model led to a decrease in stroke and cholecystectomy readmissions, but not general and pneumonia readmission. There was no change in readmissions in the latter two readmission types, regardless of hospital size. Different factors may have contributed to these mixed findings, such as case complexity, dilution effect, and perceived or genuine 'low hanging fruit'. The MoPH does not currently capture the entire spectrum of hospital visits for a readmission component, but this should be addressed in the future.

Patients in Lebanon highly valued health, and were strongly supportive of improving public hospitals, and of accountability to counter the influence of personal connections (*wasta*) and money. Affording to pay is a major concern for patients. Patients had a mix of positive and negative experiences under MoPH coverage in different hospitals. They expect to be treated with dignity and respect by humane health professionals, and highly prioritized hospital cleanliness and regular doctor contact.

We were able to increase the construct validity of the MoPH patient survey tool, using the findings from this thesis. We identified six patient perspectives, including the rarely-addressed patient perception of access, perception of health system, and valuing of health. We also developed a framework to relate patient perspectives to health system performance and value-based care. This may be helpful in improving health systems, particularly regarding public participation, accountability and access. It is important to more widely engage people on health system issues, recognizing them not solely as healthcare recipients, but also as essential contributors to shaping the values and functions of a health system.

Acknowledgements

I am very grateful for all the persons who have accompanied me in this journey. This thesis is the product of many people contributing directly or indirectly, to the work, the thinking and the spirit. This includes my supervisors, mentor, co-authors, project members, colleagues, friends and family. It also includes the many persons who have developed the materials I have cited, and the conceptual and analytical tools used. I am particularly grateful to the patients and health professionals I have engaged with, including during my medical studies and up to the focus group discussions that formed part of this thesis.

Thanks to Björn Ekman, for his supervision of this thesis, encouragement, critical thinking, support and guidance throughout the past several years. Although I lack a counterfactual, it is highly likely I would not have taken this path without your initiative. It has been a great experience climbing yet another mountain with you.

Thanks to Maria Emmelin, for her co-supervision of this thesis, encouragement, creativeness, and in-depth explorations into patient values and perspectives. Your guidance has been instrumental and your presence inspirational.

I have learned much from Björn and Maria over the past several years, and they have kindly shared their knowledge and expertise throughout this journey, in a most interesting experience of multi-disciplinary collaboration.

Thanks to Walid Ammar, for getting me involved in health systems, and being the personification of Aristotle's *phronesis*. His wisdom and insight has not only guided the development of the Lebanese health system over three decades, but also influenced people of varied backgrounds to develop their expertise, and strive for better and fairer systems and patient outcomes.

Thanks to Anette Agardh, for kindly hosting me at the Social Medicine and Global Health research group at Lund University over several years, and providing a very friendly and supportive environment for undertaking research.

Thanks to Josephine Borghi, for kindly accepting to be the opponent for my PhD defense, for travelling from the United Kingdom to Sweden for this event, and for sharing her expertise, time and effort.

Thanks to Johan Jarl, Lina Magnusson and Lars Kayser, for kindly accepting to be members of the examining committee for my PhD defense, and for sharing their

expertise, time and effort. Also thanks to Anders Halling and Johan Harl for their previous roles and feedback during the halfway review of this thesis.

Thanks to my friends and colleagues in Lebanon, with whom I have shared challenges throughout many years as we sought to improve the health system and patient outcomes, while maneuvering around political interference. I am thinking of you Rita Frieha, Hilda Harb, Jihad Makouk, Fadi El Jardali, Jenny Romanos, Abeer Al Halabi, Elise Barakat, Sizar Akoum, Nabil Kronfol, Ghassan Hamadeh, Georges Saade, Nadwa Rafeh, Rasha Hamra, Alissar Rady, Michelle Kosremelli-Asmar, Michel Matta, Ziyad Mahfoud, Kassem Kassak, Rima Afifi, Rita Karam, Randa Hamadeh, Carin Alsokhn, Nader Nassif, Hovig Jarkhedian and many other health professionals who continue the good struggle across hospitals, universities, institutions and elsewhere.

Thanks to Anne Mills, for sharing her wisdom, experience and encouragement as senior advisor on the HSRI project for the Lebanese P4P during 2016-2020.

Thanks to the SMGH administrative staff, Ditte Mårtensson, Elena Aguilar, Katarina Ambohm, Maria Agardh, as well as LU's Anette Saltin, for guidance, support and positive spirit throughout the administrative processes.

Thanks to my SMGH colleagues, past and present, for the great company and interesting discussions over several years, particularly before the pandemic upturned the world. I am thinking of you Natalia Vincens, Benedict Oppong Asamoah, Mats Sundbeck, Markus Larsson, Tanya Andersson Nystedt, Becky Nelson, Jens Wilkens, Tobias Holder, Rebecca Hayes Mejia, Jack Palmieri, Mia Kolak, Pia Svensson, Ochieng Malachi Arunda, Hannah Kaiser, Frida Pilgaard, Joseph Kazibwe, Gilbert Tumwine, Minilik Demissie Amogne, Mahnaz Moghaddassi, Martin Stafström, Dell Saulnier, Jesper Sundewall, Per-Olof Östergren, Devika Mehra, Vikas Choudhry, Susanne Sundell-Lecerof, Cecilia Fernbrant, Fiffi Boman and Anders Emmelin.

Thanks to the many patients I have encountered throughout my life, for teaching me what matters most, and how national priorities should reflect this. Everyone has the right to compassion, dignity and good healthcare. The memory of many of you will always accompany me.

Thanks to my friends, who now inhabit many lands, and are always close to heart and mind.

Thanks to Ramzi Semrani, for his creativity, passion for nature, longstanding friendship and the thesis cover photograph.

Thanks to my family and relatives, including my grandmother Sylvie, my cousins, aunts and uncles, for the support and lifelong experiences. The presence of those departed will also always accompany us: Tony Helou, Joe Khaled, Mahfouz Fawaz,

Ferdinand Gubbels, Marcello Moscatello, Josephine Hajj, Najla and Tanous Khalife, and Ishak Sejaan.

My heartfelt appreciation goes to my parents, my siblings and their families, my wife and my children.

To Liliane and Paul, for their enduring support, wisdom, integrity and dignity. Their influence has been immeasurable.

To Imane, Imad and Noor, for their incredible companionship on my life's path, and to Marco, Patrick, Paul and Jesper, for enriching my journey even further.

To Caroline, for her encouragement and regular visits supporting the family.

To Sophie, for the unwavering dedication and support, and the many stimulating discussions on health, health systems and life.

To Oliver and Nadine, whose companionship means more to me than anything in this world, and for all the moments of play, learning and adventures we have shared, with many more to come.

Køge (Denmark) and Jaj (Lebanon)
August 2023
Jade Khalife

Epilogue

Does hospital pay-for-performance work? It depends! We have a wide diversity in context, designs, incentives, measures and other factors that determine whether or not P4P 'works'. From my perspective, based on the evidence developed in this thesis, hospital pay-for-performance in Lebanon resulted in several positive impacts, improving the relation between hospitals and the Ministry of Public Health, and providing a tool for continuous development of the health system. An important effect has also been curtailing the influence of favoritism and clientelism, through a fairer, more appropriate and transparent evaluation of hospital performance.

Pay-for-performance should also be designed to contribute to health systems, beyond the goals of their components. This includes developing approaches to make better use of routinely collected data. Considering unintended consequences, P4P should be able to 'afford to fail', without harming patients or health professionals in the process. This underlines the importance of monitoring and response within P4P.

Overall, I think hospital pay-for-performance may have an important role to play within health systems, particularly in an integrated form. However, this role is as one among several tools, and should not be the focus of the system. Rather, health systems should be centered on the people, and patient engagement is central to this. P4P initiatives should be developed to reflect this.

In Lebanon specifically, I think a redesign of the health system is needed, taking the best from the past system and developing a Lebanese National Health Service. Such an institution would provide equitable coverage for the entire population, and should be protected from political interference.

All countries will face increasing threats in this new age of pandemics, climate catastrophe and political-economic upheavals. This also represents an opportunity to re-center our health systems on the people, reflecting their high priority on health. A brighter future is one of humane and compassionate health systems.

References

1. Parry R. Episteme and Techne: The Stanford Encyclopedia of Philosophy; 2021 [cited 2023 28 July]. Winter 2021 Edition:[Available from: https://plato.stanford.edu/archives/win2021/entries/episteme-techne/.
2. Latham J. The research canvas: Framework for designing and aligning the "DNA" of your research study. 4th edition ed: Organization Design Studio®Ltd., 2022.
3. Nigel Nicholson NS. The Rhetoric of Medicine: Lessons on Professionalism from Ancient Greece. New York: Oxford University Press 2019.
4. Kruk M, Freedman L. Assessing Health System Performance in Developing Countries: A Review of the Literature2008.
5. Donabedian A. Evaluating the quality of medical care. *Milbank Mem Fund Q* 1966;44(3):Suppl:166-206. [published Online First: 1966/07/01]
6. Gergen J, Josephson E, Coe M, et al. Quality of Care in Performance-Based Financing: How It Is Incorporated in 32 Programs Across 28 Countries. *Glob Health Sci Pract* 2017;5(1):90-107. doi: 10.9745/ghsp-d-16-00239 [published Online First: 2017/03/17]
7. Chee TT, Ryan AM, Wasfy JH, et al. Current State of Value-Based Purchasing Programs. *Circulation* 2016;133(22):2197-205. doi: 10.1161/circulationaha.115.010268 [published Online First: 2016/06/02]
8. Smith R, Hanson K. Health systems in low- and middle-income countries : an economic and policy perspective. Oxford: Oxford University Press 2012.
9. Grace FC, Meurk CS, Head BW, et al. An analysis of policy levers used to implement mental health reform in Australia 1992-2012. *BMC Health Serv Res* 2015;15:479. doi: 10.1186/s12913-015-1142-3 [published Online First: 2015/10/27]
10. Arrow KJ. American economic review. *Uncertainty and the Welfare Economics of Medical Care* 1963;53(5):941-73.
11. Savedoff WD. Kenneth Arrow and the birth of health economics. *Bulletin of the World Health Organization* 2004;82(2):139-40.
12. Josephson E, Gergen J, Coe M, et al. How do performance-based financing programmes measure quality of care? A descriptive analysis of 68 quality checklists from 28 low- and middle-income countries. *Health Policy and Planning* 2017;32(8):1120-26. doi: 10.1093/heapol/czx053
13. Shroff ZC, Bigdeli M, Meessen B. From Scheme to System (Part 2): Findings from Ten Countries on the Policy Evolution of Results-Based Financing in Health Systems. *Health Systems & Reform* 2017;3(2):137-47. doi: 10.1080/23288604.2017.1304190

14. Singh NS, Kovacs RJ, Cassidy R, et al. A realist review to assess for whom, under what conditions and how pay for performance programmes work in low- and middle-income countries. *Social Science & Medicine* 2021;270:113624. doi: https://doi.org/10.1016/j.socscimed.2020.113624

15. Eijkenaar F, Emmert M, Scheppach M, et al. Effects of pay for performance in health care: a systematic review of systematic reviews. *Health Policy* 2013;110(2-3):115-30. doi: 10.1016/j.healthpol.2013.01.008 [published Online First: 2013/02/06]

16. Emmert M, Eijkenaar F, Kemter H, et al. Economic evaluation of pay-for-performance in health care: a systematic review. *Eur J Health Econ* 2012;13(6):755-67. doi: 10.1007/s10198-011-0329-8 [published Online First: 2011/06/11]

17. Vlaanderen FP, Tanke MA, Bloem BR, et al. Design and effects of outcome-based payment models in healthcare: a systematic review. *Eur J Health Econ* 2019;20(2):217-32. doi: 10.1007/s10198-018-0989-8 [published Online First: 2018/07/06]

18. Borghi J, Singh NS, Brown G, et al. Understanding for whom, why and in what circumstances payment for performance works in low and middle income countries: protocol for a realist review. *BMJ Glob Health* 2018;3(3):e000695. doi: 10.1136/bmjgh-2017-000695 [published Online First: 2018/07/11]

19. Cashin C, Chi Y-LS, P. C., Borowitz M, et al. Paying for Performance in Health Care: implications for health system performance and accountability. England: World Health Organization 2014.

20. Sutton M, Nikolova S, Boaden R, et al. Reduced mortality with hospital pay for performance in England. *N Engl J Med* 2012;367(19):1821-8. doi: 10.1056/NEJMsa1114951 [published Online First: 2012/11/09]

21. Kristensen SR, Meacock R, Turner AJ, et al. Long-term effect of hospital pay for performance on mortality in England. *N Engl J Med* 2014;371(6):540-8. doi: 10.1056/NEJMoa1400962 [published Online First: 2014/08/08]

22. Andrew MR. Effects of the Premier Hospital Quality Incentive Demonstration on Medicare patient mortality and cost. *Health Services Research* 2009 doi: 10.1111/j.1475-6773.2009.00956.x

23. Ashish KJ, Karen EJ, Orav EJ, et al. The Long-Term Effect of Premier Pay for Performance on Patient Outcomes. *The New England Journal of Medicine* 2012 doi: 10.1056/nejmsa1112351

24. Terry S, Lauren Hersch N, Jyothi RT, et al. Does pay-for-performance improve surgical outcomes? An evaluation of phase 2 of the Premier Hospital Quality Incentive Demonstration. *Annals of Surgery* 2014 doi: 10.1097/sla.0000000000000425

25. Ryan A, Blustein J, Casalino L. Improvement Among Low-Performing Hospitals Medicare ' s Flagship Test Of Pay-For-Performance Did Not Spur More Rapid Quality. *Health Affairs* 2012

26. Andrew MR, Matt S, Tim D. Does Winning a Pay-for-Performance Bonus Improve Subsequent Quality Performance? Evidence from the Hospital Quality Incentive Demonstration. *Health Services Research* 2014 doi: 10.1111/1475-6773.12097

27. Ryan AM, Burgess JF, Jr., Pesko MF, et al. The early effects of Medicare's mandatory hospital pay-for-performance program. *Health Serv Res* 2015;50(1):81-97. doi: 10.1111/1475-6773.12206 [published Online First: 2014/07/22]

28. Figueroa JF, Tsugawa Y, Zheng J, et al. Association between the Value-Based Purchasing pay for performance program and patient mortality in US hospitals: observational study. *BMJ* 2016;353:i2214. doi: 10.1136/bmj.i2214 [published Online First: 2016/05/11]

29. Souvik B, Danny M, Michael KP-O, et al. Association between degree of exposure to the Hospital Value Based Purchasing Program and 30-day mortality: experience from the first four years of Medicare's pay-for-performance program. *BMC Health Services Research* 2019 doi: 10.1186/s12913-019-4562-7

30. Gilman M, Adams EK, Hockenberry JM, et al. Safety-net hospitals more likely than other hospitals to fare poorly under Medicare's value-based purchasing. *Health Aff (Millwood)* 2015;34(3):398-405. doi: 10.1377/hlthaff.2014.1059 [published Online First: 2015/03/04]

31. Hsueh-Fen C, Saleema AK, Fei W, et al. Financial Performance of Hospitals in the Mississippi Delta Region Under the Hospital Readmissions Reduction Program and Hospital Value-based Purchasing Program. *Medical Care* 2017 doi: 10.1097/mlr.0000000000000808

32. Aaron SK, Young-Rock H, Oliver N, et al. Early Performance of Hospital Value-based Purchasing Program in Medicare: A Systematic Review. *Medical Care* 2020 doi: 10.1097/mlr.0000000000001354

33. Nathan WC, Jan PC. Hospital Performance in the First 6 Years of Medicare's Value-Based Purchasing Program. *Medical Care Research and Review* 2020 doi: 10.1177/1077558720927586

34. Aaron S, Hanadi H, Jing X, et al. Race to the Top of the Hospital Value-Based Purchasing Program. *Journal of healthcare management / American College of Healthcare Executives* 2021 doi: 10.1097/jhm-d-20-00087

35. Adriana GR, Katherine MM, Katherine MM, et al. How Total Performance Scores of Medicare Value-Based Purchasing Program Hospitals Change Over Time. *Journal for Healthcare Quality* 2021 doi: 10.1097/jhq.0000000000000321

36. Lee R, Barbara L-O, John TL, et al. Evaluating the robustness of the CMS Hospital Value-Based Purchasing measurement system. *Health Services Research* 2021 doi: 10.1111/1475-6773.13608

37. Igna B, Jose FF, Jie Z, et al. Impact of Financial Incentives on Early and Late Adopters among US Hospitals: observational study. *BMJ* 2018 doi: 10.1136/bmj.j5622

38. Desai NR, Ross JS, Kwon JY, et al. Association Between Hospital Penalty Status Under the Hospital Readmission Reduction Program and Readmission Rates for Target and Nontarget Conditions. *JAMA* 2016;316(24):2647-56. doi: 10.1001/jama.2016.18533

39. Zuckerman RB, Sheingold SH, Orav EJ, et al. Readmissions, Observation, and the Hospital Readmissions Reduction Program. *New England Journal of Medicine* 2016;374(16):1543-51. doi: 10.1056/NEJMsa1513024

40. Wadhera RK, Joynt Maddox KE, Kazi DS, et al. Hospital revisits within 30 days after discharge for medical conditions targeted by the Hospital Readmissions Reduction Program in the United States: national retrospective analysis. *BMJ* 2019;366:l4563. doi: 10.1136/bmj.l4563

41. Psotka MA, Fonarow GC, Allen LA, et al. The Hospital Readmissions Reduction Program: Nationwide Perspectives and Recommendations: A JACC: Heart Failure Position Paper. *JACC Heart Fail* 2020;8(1):1-11. doi: 10.1016/j.jchf.2019.07.012 [published Online First: 2019/10/14]

42. Chatterjee P, Joynt Maddox KE. US National Trends in Mortality From Acute Myocardial Infarction and Heart Failure: Policy Success or Failure? *JAMA Cardiology* 2018;3(4):336-40. doi: 10.1001/jamacardio.2018.0218

43. Dharmarajan K, Wang Y, Lin Z, et al. Association of Changing Hospital Readmission Rates With Mortality Rates After Hospital Discharge. *Jama* 2017;318(3):270-78. doi: 10.1001/jama.2017.8444 [published Online First: 2017/07/19]

44. Fonarow GC, Konstam MA, Yancy CW. The Hospital Readmission Reduction Program Is Associated With Fewer Readmissions, More Deaths: Time to Reconsider. *J Am Coll Cardiol* 2017;70(15):1931-34. doi: 10.1016/j.jacc.2017.08.046 [published Online First: 2017/10/07]

45. Gupta A, Allen LA, Bhatt DL, et al. Association of the Hospital Readmissions Reduction Program Implementation With Readmission and Mortality Outcomes in Heart Failure. *JAMA Cardiology* 2018;3(1):44-53. doi: 10.1001/jamacardio.2017.4265

46. Khera R, Dharmarajan K, Wang Y, et al. Association of the Hospital Readmissions Reduction Program With Mortality During and After Hospitalization for Acute Myocardial Infarction, Heart Failure, and Pneumonia. *JAMA Network Open* 2018;1(5):e182777-e77. doi: 10.1001/jamanetworkopen.2018.2777

47. Wadhera RK, Joynt Maddox KE, Wasfy JH, et al. Association of the Hospital Readmissions Reduction Program With Mortality Among Medicare Beneficiaries Hospitalized for Heart Failure, Acute Myocardial Infarction, and Pneumonia. *Jama* 2018;320(24):2542-52. doi: 10.1001/jama.2018.19232 [published Online First: 2018/12/24]

48. Khera R, Pandey A, Ayers CR, et al. Contemporary Epidemiology of Heart Failure in Fee-For-Service Medicare Beneficiaries Across Healthcare Settings. *Circ Heart Fail* 2017;10(11) doi: 10.1161/circheartfailure.117.004402 [published Online First: 2017/11/14]

49. Jha AK. Death, Readmissions, and Getting Policy Right. *JAMA Network Open* 2018;1(5):e182776-e76. doi: 10.1001/jamanetworkopen.2018.2776

50. Gupta A, Fonarow GC. The Hospital Readmissions Reduction Program-learning from failure of a healthcare policy. *Eur J Heart Fail* 2018;20(8):1169-74. doi: 10.1002/ejhf.1212 [published Online First: 2018/05/24]

51. Charles NK, Thomas A, Lisa P, et al. Assessing Medicare's Hospital Pay-For-Performance Programs And Whether They Are Achieving Their Goals. *Health Affairs* 2015 doi: 10.1377/hlthaff.2015.0158

52. Quality AfHRa. Quality Indicator User Guide: Patient Safety Indicators (PSI) Composite Measures, 2021.
53. Rajaram R, Barnard C, Bilimoria KY. Concerns About Using the Patient Safety Indicator-90 Composite in Pay-for-Performance Programs. *JAMA* 2015;313(9):897-98. doi: 10.1001/jama.2015.52
54. Kyle HS, Justin BD, Michael JE, et al. Hospital-Acquired Condition Reduction Program Is Not Associated With Additional Patient Safety Improvement. *Health Affairs* 2019 doi: 10.1377/hlthaff.2018.05504
55. Roshun S, Devraj S, Ushapoorna N, et al. Changes in hospital safety following penalties in the US Hospital Acquired Condition Reduction Program: retrospective cohort study. *BMJ* 2019 doi: 10.1136/bmj.l4109
56. Emily A, Justin BD, Ushapoorna N, et al. Changes in Hospital-acquired Conditions and Mortality Associated With the Hospital-acquired Condition Reduction Program. *Annals of Surgery* 2019 doi: 10.1097/sla.0000000000003641
57. Christina AM, Allison RD, Cynthia B, et al. Association Between Hospital Characteristics and Performance on the New Hospital-Acquired Condition Reduction Program's Surgical Site Infection Measures. *JAMA Surgery* 2016 doi: 10.1001/jamasurg.2016.0408
58. Jose FF, David EW, Ashish KJ. Characteristics of hospitals receiving the largest penalties by US pay-for-performance programmes. *BMJ Quality & Safety* 2016 doi: 10.1136/bmjqs-2015-005040
59. Cheryl KZ, Jyothi RT, Andrew MR, et al. Medicare's Hospital Acquired Condition Reduction Program Disproportionately Affects Minority-serving Hospitals: Variation by Race, Socioeconomic Status, and Disproportionate Share Hospital Payment Receipt. *Annals of Surgery* 2019 doi: 10.1097/sla.0000000000003564
60. Sukruth AS, Waken RJ, Alina AL, et al. Association of Stratification by Proportion of Patients Dually Enrolled in Medicare and Medicaid With Financial Penalties in the Hospital-Acquired Condition Reduction Program. *JAMA Internal Medicine* 2020 doi: 10.1001/jamainternmed.2020.7386
61. Boamah SA, Hamadi HY, Spaulding AC. Hospital-Acquired Conditions Reduction Program, Racial and Ethnic Diversity, and Magnet Designation in the United States. *J Patient Saf* 2022;18(7):e1090-e95. doi: 10.1097/pts.0000000000001014 [published Online First: 2022/05/10]
62. Hanadi H, Shalmali RB, LaRee M, et al. Hospital-Acquired Conditions Reduction Program, Patient Safety, and Magnet Designation in the United States. *Journal of Patient Safety* 2020 doi: 10.1097/pts.0000000000000628
63. Matthew RB, Kelly IS, Helen K, et al. Association of Magnet Nursing Status With Hospital Performance on Nationwide Quality Metrics. *Journal for Healthcare Quality* 2019 doi: 10.1097/jhq.0000000000000202
64. Ravi R, Ravi R, Jeanette WC, et al. Hospital Characteristics Associated With Penalties in the Centers for Medicare & Medicaid Services Hospital-Acquired Condition Reduction Program. *JAMA* 2015 doi: 10.1001/jama.2015.8609

65. Emily JL, Kyle HS, Andrew MR. Improving the Hospital-Acquired Condition Reduction Program Through Rulemaking. *JAMA Health Forum* 2020 doi: 10.1001/jamahealthforum.2020.0416

66. Lane K, Samuel AS, Berna D, et al. Complication Rates, Hospital Size, and Bias in the CMS Hospital-Acquired Condition Reduction Program. *American Journal of Medical Quality* 2017 doi: 10.1177/1062860616681840

67. Richard LF, Norbert G, Norbert G, et al. Is the CMS Hospital-Acquired Condition Reduction Program a Valid Measure of Hospital Performance? *American Journal of Medical Quality* 2017 doi: 10.1177/1062860616640883

68. Santé HAd. Dotation financière pour l'amélioration de la qualité 2023 [Available from: https://www.has-sante.fr/jcms/c_493937/fr/dotation-financiere-pour-l-amelioration-de-la-qualite accessed 25 July.

69. Santé HAd. Healthcare Quality and Safety Indicators 2019 [Available from: https://www.has-sante.fr/jcms/c_2044563/en/healthcare-quality-and-safety-indicators.

70. Benoît L, Shu J, Anne G, et al. Evaluation of the effects of the French pay-for-performance program-IFAQ pilot study. *International Journal for Quality in Health Care* 2017 doi: 10.1093/intqhc/mzx111

71. Richardson D, Tarnow-Mordi WO, Lee SK. Risk adjustment for quality improvement. *Pediatrics* 1999;103(1 Suppl E):255-65. [published Online First: 1999/01/26]

72. Hornbrook MC. Hospital case mix: its definition, measurement and use. Part II: Review of alternative measures. *Med Care Rev* 1982;39(2):73-123. [published Online First: 1983/02/05]

73. Hornbrook MC. Hospital case mix: its definition, measurement and use: Part I. The conceptual framework. *Med Care Rev* 1982;39(1):1-43. [published Online First: 1983/01/06]

74. Kramer AA, Higgins TL, Zimmerman JE. Intensive care unit readmissions in U.S. hospitals: patient characteristics, risk factors, and outcomes. *Crit Care Med* 2012;40(1):3-10. doi: 10.1097/CCM.0b013e31822d751e [published Online First: 2011/09/20]

75. Frost SA, Alexandrou E, Bogdanovski T, et al. Severity of illness and risk of readmission to intensive care: A meta-analysis. *Resuscitation* 2009;80(5):505-10. doi: https://doi.org/10.1016/j.resuscitation.2009.02.015

76. Bradley TB, Kominski GF. Contributions of case mix and intensity change to hospital cost increases. *Health Care Financ Rev* 1992;14(2):151-63. [published Online First: 1992/12/04]

77. Bjorvatn A. Private or public hospital ownership: Does it really matter? *Social Science & Medicine* 2018;196:166-74. doi: https://doi.org/10.1016/j.socscimed.2017.11.038

78. Street A, Sivey P, Mason A, et al. Are English treatment centres treating less complex patients? *Health Policy* 2010;94(2):150-57. doi: https://doi.org/10.1016/j.healthpol.2009.09.013

79. Moscone F, Siciliani L, Tosetti E, et al. Do public and private hospitals differ in quality? Evidence from Italy. *Regional Science and Urban Economics* 2020;83:103523. doi: https://doi.org/10.1016/j.regsciurbeco.2020.103523

80. Fetter RB, Shin Y, Freeman JL, et al. Case mix definition by diagnosis-related groups. *Med Care* 1980;18(2 Suppl):iii, 1-53. [published Online First: 1980/02/01]

81. Scheller-Kreinsen D. GA, Busse R. The ABC of DRGs. EuroObserver, 2009.

82. Dixon J. US health care. II: The cost problem. *Bmj* 1992;305(6858):878-80. doi: 10.1136/bmj.305.6858.878 [published Online First: 1992/10/10]

83. Or Z. Implementation of DRG Payment in France: Issues and recent developments. *Health Policy* 2014;117(2):146-50. doi: https://doi.org/10.1016/j.healthpol.2014.05.006

84. Yang CM, Reinke W. Feasibility and validity of International Classification of Diseases based case mix indices. *BMC Health Serv Res* 2006;6:125. doi: 10.1186/1472-6963-6-125 [published Online First: 2006/10/07]

85. Lichtig L. Hospital Information System for Case Mix Management.: New York: John Wiley and Sons Press 1986.

86. Services CfMM. Details for title: FY 2011 Final Rule Data Files 2011 [Available from: https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/AcuteInpatientPPS/FY-2011-IPPS-Final-Rule-Home-Page-Items/CMS1237932.html accessed 15 June 2023.

87. Jencks SF, Williams MV, Coleman EA. Rehospitalizations among patients in the Medicare fee-for-service program. *N Engl J Med* 2009;360(14):1418-28. doi: 10.1056/NEJMsa0803563 [published Online First: 2009/04/03]

88. Kristensen SR, Bech M, Quentin W. A roadmap for comparing readmission policies with application to Denmark, England, Germany and the United States. *Health Policy* 2015;119(3):264-73. doi: 10.1016/j.healthpol.2014.12.009 [published Online First: 2014/12/31]

89. Donabedian A. The quality of care. How can it be assessed? *JAMA* 1988;260(12):1743-8. [published Online First: 1988/09/23]

90. Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care: advantages and limitations. *Arch Intern Med* 2000;160(8):1074-81. doi: 10.1001/archinte.160.8.1074 [published Online First: 2000/05/02]

91. Kim Y, Ejaz A, Xu L, et al. Understanding recurrent readmission after major surgery among patients with employer-provided health insurance. *Am J Surg* 2016;212(2):305-14.e2. doi: 10.1016/j.amjsurg.2016.01.028 [published Online First: 2016/05/10]

92. Gohil SK, Datta R, Cao C, et al. Impact of Hospital Population Case-Mix, Including Poverty, on Hospital All-Cause and Infection-Related 30-Day Readmission Rates. *Clin Infect Dis* 2015;61(8):1235-43. doi: 10.1093/cid/civ539 [published Online First: 2015/07/02]

93. Barnett ML, Hsu J, McWilliams JM. Patient Characteristics and Differences in Hospital Readmission Rates. *JAMA Intern Med* 2015;175(11):1803-12. doi: 10.1001/jamainternmed.2015.4660 [published Online First: 2015/09/15]

94. Calvillo-King L, Arnold D, Eubank KJ, et al. Impact of social factors on risk of readmission or mortality in pneumonia and heart failure: systematic review. *J Gen Intern Med* 2013;28(2):269-82. doi: 10.1007/s11606-012-2235-x [published Online First: 2012/10/12]

95. Friebel R, Hauck K, Aylin P, et al. National trends in emergency readmission rates: a longitudinal analysis of administrative data for England between 2006 and 2016. *BMJ Open* 2018;8(3):e020325-e25. doi: 10.1136/bmjopen-2017-020325

96. Roshanghalb A, Mazzali C, Lettieri E, et al. Stability over time of the "hospital effect" on 30-day unplanned readmissions: Evidence from administrative data. *Health Policy* 2021;125(10):1393-97. doi: 10.1016/j.healthpol.2021.07.009 [published Online First: 2021/08/08]

97. Tsai TC, Orav EJ, Joynt KE. Disparities in surgical 30-day readmission rates for Medicare beneficiaries by race and site of care. *Ann Surg* 2014;259(6):1086-90. doi: 10.1097/sla.0000000000000326 [published Online First: 2014/01/21]

98. Horwitz LI, Partovian C, Lin Z, et al. Development and use of an administrative claims measure for profiling hospital-wide performance on 30-day unplanned readmission. *Annals of internal medicine* 2014;161(10 Suppl):S66-S75. doi: 10.7326/M13-3000

99. Fekri O, Manukyan E, Klazinga N. Associations between hospital deaths (HSMR), readmission and length of stay (LOS): a longitudinal assessment of performance results and facility characteristics of teaching and large-sized hospitals in Canada between 2013-2014 and 2017-2018. *BMJ Open* 2021;11(2):e041648. doi: 10.1136/bmjopen-2020-041648 [published Online First: 2021/02/08]

100. Lindenauer PK, Bernheim SM, Grady JN, et al. The performance of US hospitals as reflected in risk-standardized 30-day mortality and readmission rates for medicare beneficiaries with pneumonia. *J Hosp Med* 2010;5(6):E12-8. doi: 10.1002/jhm.822 [published Online First: 2010/07/29]

101. Kansagara D, Englander H, Salanitro A, et al. Risk prediction models for hospital readmission: a systematic review. *Jama* 2011;306(15):1688-98. doi: 10.1001/jama.2011.1515 [published Online First: 2011/10/20]

102. Metcalfe D, Zogg CK, Judge A, et al. Pay for performance and hip fracture outcomes: an interrupted time series and difference-in-differences analysis in England and Scotland. *Bone Joint J* 2019;101-b(8):1015-23. doi: 10.1302/0301-620x.101b8.Bjj-2019-0173.R1 [published Online First: 2019/08/01]

103. Oakley B, Nightingale J, Moran C, et al. Does achieving the best practice tariff improve outcomes in hip fracture patients? An observational cohort study. *BMJ Open* 2017;7(2):e014190. doi: 10.1136/bmjopen-2016-014190

104. Balint E. The possibilities of patient-centered medicine. *J R Coll Gen Pract* 1969;17(82):269-76. [published Online First: 1969/05/01]

105. Balint M. The doctor, his patient, and the illness. *The Lancet* 1955;265(6866):683-88. doi: https://doi.org/10.1016/S0140-6736(55)91061-8

106. Engel GL. A unified concept of health and disease. *Perspect Biol Med* 1960;3:459-85. doi: 10.1353/pbm.1960.0020 [published Online First: 1960/01/01]

107. Griffiths R, Bett M, Blyth J, et al. NHS Management Inquiry. London, 1983.

108. Institute of Medicine Committee on Quality of Health Care in A. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington (DC): National Academies Press (US) 2001.

109. World Health Organization. Framework on integrated, people-centred health services: report by the Secretariat. Geneva: World Health Assembly, 2016.

110. National Academies of Sciences E, Medicine, Health, et al. Crossing the Global Quality Chasm: Improving Health Care Worldwide. Washington (DC): National Academies Press (US) 2018.

111. World Health Organization, Organisation for Economic Co-operation and Development, The World Bank. Delivering quality health services: a global imperative for universal health coverage. Geneva, 2018.

112. Speakers and moderators at the Policy Forum on the Future of Health: statement by Donald M. Berwick.; 2017; Paris. Organisation for Economic Cooperation and Development.

113. Ware JE, Jr., Davies-Avery A, Stewart AL. The measurement and meaning of patient satisfaction. *Health Med Care Serv Rev* 1978;1(1):1, 3-15. [published Online First: 1977/12/13]

114. Batbaatar E, Dorjdagva J, Luvsannyam A, et al. Conceptualisation of patient satisfaction: a systematic narrative literature review. *Perspectives in Public Health* 2015;135(5):243-50. doi: 10.1177/1757913915594196 [published Online First: 2015/07/19]

115. Staniszewska S, Ahmed L. The concepts of expectation and satisfaction: do they capture the way patients evaluate their care? *J Adv Nurs* 1999;29(2):364-72. doi: 10.1046/j.1365-2648.1999.00897.x [published Online First: 1999/04/10]

116. Bowling A, Rowe G, Lambert N, et al. The measurement of patients' expectations for health care: a review and psychometric testing of a measure of patients' expectations. *Health Technol Assess* 2012;16(30):i-xii, 1-509. doi: 10.3310/hta16300 [published Online First: 2012/07/04]

117. Junewicz A, Youngner SJ. Patient-satisfaction surveys on a scale of 0 to 10: improving health care, or leading it astray? *Hastings Cent Rep* 2015;45(3):43-51. doi: 10.1002/hast.453 [published Online First: 2015/03/11]

118. Ng JHY, Luk BHK. Patient satisfaction: Concept analysis in the healthcare context. *Patient Educ Couns* 2019;102(4):790-96. doi: 10.1016/j.pec.2018.11.013 [published Online First: 2018/11/28]

119. Beattie M, Murphy DJ, Atherton I, et al. Instruments to measure patient experience of healthcare quality in hospitals: a systematic review. *Syst Rev* 2015;4:97. doi: 10.1186/s13643-015-0089-0 [published Online First: 2015/07/24]

120. HCAHPS: Patients' Perspectives of Care Survey: Centers for Medicare & Medicaid Services; 2023 [Available from: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/HospitalHCAHPS accessed 15 June 2023.

121. Nicholas C, Rahul A, Yang S, et al. Association of the Medicare Value-Based Purchasing Program With Changes in Patient Care Experience at Safety-net vs Non–Safety-net Hospitals. *JAMA health forum* 2022 doi: 10.1001/jamahealthforum.2022.1956

122. Khic-Houy P, Rachel C, Marie MB, et al. Associations between patient experiences and clinical outcomes: a cross-sectional data linkage study of the Australian private healthcare sector. *BMJ Open Quality* 2019 doi: 10.1136/bmjoq-2019-000637

123. Carter J, Ward C, Wexler D, et al. The association between patient experience factors and likelihood of 30-day readmission: a prospective cohort study. *BMJ Qual Saf* 2018;27(9):683-90. doi: 10.1136/bmjqs-2017-007184 [published Online First: 2017/11/18]

124. Wang DE, Tsugawa Y, Figueroa JF, et al. Association Between the Centers for Medicare and Medicaid Services Hospital Star Rating and Patient Outcomes. *JAMA Intern Med* 2016;176(6):848-50. doi: 10.1001/jamainternmed.2016.0784 [published Online First: 2016/04/12]

125. Kemp KA, Santana MJ, Southern DA, et al. Association of inpatient hospital experience with patient safety indicators: a cross-sectional, Canadian study. *BMJ Open* 2016;6(7):e011242. doi: 10.1136/bmjopen-2016-011242 [published Online First: 2016/07/03]

126. Kennedy GD, Tevis SE, Kent KC. Is there a relationship between patient satisfaction and favorable outcomes? *Ann Surg* 2014;260(4):592-8; discussion 98-600. doi: 10.1097/sla.0000000000000932 [published Online First: 2014/09/10]

127. Hachem F CJ, Fullam F, Gallan AS, Hohmann S, Johnson C. The relationships between HCAHPS communication and discharge satisfaction items and hospital readmissions. *Patient Experience Journal* 2014;1(2):71-77. doi: 10.35680/2372-0247.1022

128. Doyle C, Lennox L, Bell D. A systematic review of evidence on the links between patient experience and clinical safety and effectiveness. *BMJ Open* 2013;3(1) doi: 10.1136/bmjopen-2012-001570 [published Online First: 2013/01/08]

129. Irwin P, Irwin P, Francis F, et al. Patient satisfaction in pay for performance programs. *Quality management in health care* 2011 doi: 10.1097/qmh.0b013e318213aed0

130. Patient Satisfaction Surveys. *Catalyst Carryover* 2018;4(1) doi: doi:10.1056/CAT.18.0288

131. Bastemeijer CM, Boosman H, van Ewijk H, et al. Patient experiences: a systematic review of quality improvement interventions in a hospital setting. *Patient Relat Outcome Meas* 2019;10:157-69. doi: 10.2147/prom.S201737 [published Online First: 2019/06/14]

132. Banda S, Nkungula N, Chiumia IK, et al. Tools for measuring client experiences and satisfaction with healthcare in low- and middle-income countries: a systematic review of measurement properties. *BMC Health Services Research* 2023;23(1):133. doi: 10.1186/s12913-023-09129-9

133. Bate P, Robert G. Experience-based design: from redesigning the system around the patient to co-designing services with the patient. *Qual Saf Health Care* 2006;15(5):307-10. doi: 10.1136/qshc.2005.016527 [published Online First: 2006/11/01]

134. Yt M. Myth: High patient satisfaction means high-quality care. *Journal of Health Services Research and Policy* 2013 doi: 10.1177/1355819613501426

135. Papanicolas I, Figueroa JF, Orav EJ, et al. Patient Hospital Experience Improved Modestly, But No Evidence Medicare Incentives Promoted Meaningful Gains. *Health Aff (Millwood)* 2017;36(1):133-40. doi: 10.1377/hlthaff.2016.0808 [published Online First: 2017/01/11]

136. Ryan AM, Krinsky S, Maurer KA, et al. Changes in Hospital Quality Associated with Hospital Value-Based Purchasing. *N Engl J Med* 2017;376(24):2358-66. doi: 10.1056/NEJMsa1613412 [published Online First: 2017/06/15]

137. Joynt KE, Jha AK. Characteristics of hospitals receiving penalties under the Hospital Readmissions Reduction Program. *Jama* 2013;309(4):342-3. doi: 10.1001/jama.2012.94856 [published Online First: 2013/01/24]

138. Weeks JC, Catalano PJ, Cronin A, et al. Patients' expectations about effects of chemotherapy for advanced cancer. *N Engl J Med* 2012;367(17):1616-25. doi: 10.1056/NEJMoa1204410 [published Online First: 2012/10/26]

139. Fenton JJ, Jerant AF, Bertakis KD, et al. The cost of satisfaction: a national study of patient satisfaction, health care utilization, expenditures, and mortality. *Arch Intern Med* 2012;172(5):405-11. doi: 10.1001/archinternmed.2011.1662 [published Online First: 2012/02/15]

140. Davidson KW, Shaffer J, Ye S, et al. Interventions to improve hospital patient satisfaction with healthcare providers and systems: a systematic review. *BMJ Qual Saf* 2017;26(7):596-606. doi: 10.1136/bmjqs-2015-004758 [published Online First: 2016/08/05]

141. Malpani R, Adrados M, Mercier MR, et al. Characteristics and Predictors of HCAHPS Nonresponse After Spine Surgery. *Spine (Phila Pa 1976)* 2020;45(8):E448-e56. doi: 10.1097/brs.0000000000003287 [published Online First: 2019/10/15]

142. Mercier MR, Pathak N, Adrados M, et al. Patient Factors and Perioperative Outcomes Affect Hospital Consumer Assessment of Healthcare Providers and Systems Survey Response Rates After Primary Total Hip Replacement. *J Am Acad Orthop Surg Glob Res Rev* 2021;5(4) doi: 10.5435/JAAOSGlobal-D-21-00052 [published Online First: 2021/04/03]

143. Dunsch F, Evans DK, Macis M, et al. Bias in patient satisfaction surveys: a threat to measuring healthcare quality. *BMJ Global Health* 2018;3(2):e000694. doi: 10.1136/bmjgh-2017-000694

144. Nations-ESCWA U. Multidimensional poverty in Lebanon (2019-2021): Painful reality and uncertain prospects, 2021.

145. Ammar W. Health beyond politics. Health beyond politics. Lebanon: World Health Organization, Eastern Mediterranean Regional Office 2009.

146. Ammar W, Wakim IR, Hajj I. Accreditation of hospitals in Lebanon: a challenging experience. *East Mediterr Health J* 2007;13(1):138-49. [published Online First: 2007/06/06]

147. Ammar W, Khalife J, El-Jardali F, et al. Hospital accreditation, reimbursement and case mix: links and insights for contractual systems. *BMC Health Serv Res* 2013;13:505. doi: 10.1186/1472-6963-13-505 [published Online First: 2013/12/07]

148. Joynt Maddox KE, Sen AP, Samson LW, et al. Elements of Program Design in Medicare's Value-based and Alternative Payment Models: a Narrative Review. *J Gen Intern Med* 2017;32(11):1249-54. doi: 10.1007/s11606-017-4125-8 [published Online First: 2017/07/19]

149. McCleary R, McDowall D, Bartos B. Design and analysis of time series experiments. New York, NY: Oxford University Press 2017.

150. Bhopal R. Concepts of Epidemiology. Oxford: Oxford University Press 2016.

151. Respirator Standards, The National Personal Protective Technology Laboratory: National Institute for Occupational Safety and Health; [Available from: https://www.cdc.gov/niosh/npptl/RespStds.html accessed 1 July 2023.

152. GB 2626-2019 Respiratory protection: Non-powered air-purifying particle respirator: State Administration for Market Regulation, Standardization Administration of China; [Available from: https://openstd.samr.gov.cn/bzgk/gb/newGbInfo?hcno=16D8935B45AD7AE40228801B7FADFC6C accessed 1 July 2023.

153. Jimenez JL, Marr LC, Randall K, et al. What were the historical reasons for the resistance to recognizing airborne transmission during the COVID-19 pandemic? *Indoor Air* 2022;32(8):e13070. doi: https://doi.org/10.1111/ina.13070

154. Leo BF, Lin CY, Markandan K, et al. An overview of SARS-CoV-2 transmission and engineering strategies to mitigate risk. *Journal of Building Engineering* 2023:106737. doi: https://doi.org/10.1016/j.jobe.2023.106737

155. Wang CC, Prather KA, Sznitman J, et al. Airborne transmission of respiratory viruses. *Science* 2021;373(6558):eabd9149. doi: 10.1126/science.abd9149

156. Greenhalgh T, Jimenez JL, Prather KA, et al. Ten scientific reasons in support of airborne transmission of SARS-CoV-2. *The Lancet* 2021;397(10285):1603-05. doi: 10.1016/S0140-6736(21)00869-2

157. Cheng Y, Ma N, Witt C, et al. Face masks effectively limit the probability of SARS-CoV-2 transmission. *Science* 2021;372(6549):1439-43. doi: doi:10.1126/science.abg6296

158. Hill AB. The environment and disease: association or causation? *Proc R Soc Med* 1965;58(5):295-300.

159. Moyses Szklo FJN. Epidemiology: Beyond the basics. Ontario: Jones and Bartlett 2007.

160. Porta M. A Dictionary of Epidemiology. 6th ed: Oxford University Press 2014.

161. Katz M. Evaluating clinical and public health evaluations. Cambridge2010.

162. Gordis L. Epidemiology. 4th edition ed. Philadelphia: Saunders, Elsevier 2009.

163. David Savitz GW. Interpreting Epidemiologic Evidence. 2nd edition ed. Oxford: Oxford University Press 2016.

164. Noel S. Weiss TDK. Epidemiologic Methods: Studying the Occurrence of Illness. 2nd ed. Oxford: Oxford University Press 2014.

165. Campbell DT. Assessing the impact of planned social change. *Evaluation and Program Planning* 1979;2(1):67-90. doi: https://doi.org/10.1016/0149-7189(79)90048-X

166. Bernal JL, Cummins S, Gasparrini A. Interrupted time series regression for the evaluation of public health interventions: a tutorial. *International Journal of Epidemiology* 2016;46(1):348-55. doi: 10.1093/ije/dyw098

167. Turner SL, Karahalios A, Forbes AB, et al. Comparison of six statistical methods for interrupted time series studies: empirical evaluation of 190 published series. *BMC Medical Research Methodology* 2021;21(1):134. doi: 10.1186/s12874-021-01306-w

168. Graneheim UH, Lundman B. Qualitative content analysis in nursing research: concepts, procedures and measures to achieve trustworthiness. *Nurse Educ Today* 2004;24(2):105-12. doi: 10.1016/j.nedt.2003.10.001 [published Online First: 2004/02/11]

169. Krippendorff K. Content Analysis: An Introduction to Its Methodology. Fourth Edition ed. Thousand Oaks, California: SAGE Publications, Inc., 2019.

170. Nancy LK, Nancy SW, Daniel RA, et al. Content analysis: review of methods and their applications in nutrition education. *Journal of Nutrition Education and Behavior* 2002 doi: 10.1016/s1499-4046(06)60097-3

171. Michael Quinn P. How to use qualitative methods in evaluation. 1987

172. Paley J. Phenomenology as qualitative research. a critical analysis of meaning attribution: Routledge, Taylor & Francis Group 2017.

173. Urquhart C. Grounded theory for qualitative research. a practical guide: SAGE 2013.

174. Krueger R. Focus Groups: A Practial Guide for Applied Research. 2nd ed. Thousand Oaks, California: SAGE 1994.

175. Hennink M. International Focus Group Research. Cambridge: Cambridge University Press 2007.

176. Leavy P. Research design. [Elektronisk resurs] quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches: Guilford Press 2017.

177. Johnson RB, Onwuegbuzie AJ. Mixed Methods Research: A Research Paradigm Whose Time Has Come. *Educational Researcher* 2004;33(7):14-26.

178. Outcome and Payment Measures: Centers for Medicare & Medicaid Services; 2023 [Available from: https://www.cms.gov/medicare/quality-initiatives-patient-assessment-instruments/hospitalqualityinits/outcomeandpaymentmeasures accessed 5 July 2023.

179. Krumholz HM, Brindis RG, Brush JE, et al. Standards for statistical models used for public reporting of health outcomes: an American Heart Association Scientific Statement from the Quality of Care and Outcomes Research Interdisciplinary Writing Group: cosponsored by the Council on Epidemiology and Prevention and the Stroke Council. Endorsed by the American College of Cardiology Foundation. *Circulation* 2006;113(3):456-62. doi: 10.1161/circulationaha.105.170769 [published Online First: 2005/12/21]

180. Burton ML, Romney AK. A multidimensional representation of role terms. *American Ethnologist* 1975;2(3):397-407. doi: https://doi.org/10.1525/ae.1975.2.3.02a00020

181. Shipstone EI. Some variables affecting pattern conception. *Psychological Monographs: General and Applied* 1960;74, No. 17(Whole No. 504)

182. Yeh HW, Gajewski BJ, Perdue DG, et al. Sorting it Out: Pile Sorting as a Mixed Methodology for Exploring Barriers to Cancer Screening. *Qual Quant* 2014;48(5):2569-87. doi: 10.1007/s11135-013-9908-3 [published Online First: 2014/08/22]

183. Quintiliani LM, Campbell MK, Haines PS, et al. The Use of the Pile Sort Method in Identifying Groups of Healthful Lifestyle Behaviors among Female Community College Students. *Journal of the American Dietetic Association* 2008;108(9):1503-07. doi: https://doi.org/10.1016/j.jada.2008.06.428

184. Fitzpatrick R. Surveys of patients satisfaction: I--Important general considerations. *Bmj* 1991;302(6781):887-9. doi: 10.1136/bmj.302.6781.887 [published Online First: 1991/04/13]

185. Giordano LA, Elliott MN, Goldstein E, et al. Development, implementation, and public reporting of the HCAHPS survey. *Med Care Res Rev* 2010;67(1):27-37. doi: 10.1177/1077558709341065 [published Online First: 2009/07/30]

186. Collaborative Institutional Training Initiative (CITI Program) [Available from: http://www.citiprogram.org/ accessed 7 August 2023.

187. Ederer F. Randomized controlled clinical trial. National Eye Institute workshop for ophthalmologists. Why do we need controls? Why do we need to randomize? *Am J Ophthalmol* 1975;79(5):758-62. doi: 10.1016/0002-9394(75)90733-3 [published Online First: 1975/05/01]

188. To T, Feldman W, Young W, et al. Hospitalization rates of children with gastroenteritis in Ontario. *Can J Public Health* 1996;87(1):62-5. [published Online First: 1996/01/01]

189. Kronfol N, Khalife J, Romanos J, et al. Observations on the Ministry of Public Health program of support to the hospitalization of patients in Lebanon. *J Med Liban* 2014;62(1):33-9. [published Online First: 2014/04/02]

190. Ginsburg PB, Carter GM. Medicare case-mix index increase. *Health Care Financ Rev* 1986;7(4):51-65. [published Online First: 1987/02/04]

191. Goldfarb MG, Coffey RM. Change in the Medicare case-mix index in the 1980s and the effect of the prospective payment system. *Health Serv Res* 1992;27(3):385-415. [published Online First: 1992/08/01]

192. Borghi J, Little R, Binyaruka P, et al. In Tanzania, The Many Costs Of Pay-For-Performance Leave Open To Debate Whether The Strategy Is Cost-Effective. *Health Affairs* 2015;34(3):406-14. doi: 10.1377/hlthaff.2014.0608

193. Soucat A, Dale E, Mathauer I, et al. Pay-for-Performance Debate: Not Seeing the Forest for the Trees. *Health Systems & Reform* 2017;3(2):74-79. doi: 10.1080/23288604.2017.1302902

194. Meessen B, Shroff ZC, Ir P, et al. From Scheme to System (Part 1): Notes on Conceptual and Methodological Innovations in the Multicountry Research Program on Scaling Up Results-Based Financing in Health Systems. *Health Systems & Reform* 2017;3(2):129-36. doi: 10.1080/23288604.2017.1303561

195. Fisher ES, Wennberg JE, Stukel TA, et al. Associations among hospital capacity, utilization, and mortality of US Medicare beneficiaries, controlling for sociodemographic factors. *Health Serv Res* 2000;34(6):1351-62. [published Online First: 2000/02/02]

196. Horwitz LI, Bernheim SM, Ross JS, et al. Hospital Characteristics Associated With Risk-standardized Readmission Rates. *Med Care* 2017;55(5):528-34. doi: 10.1097/mlr.0000000000000713 [published Online First: 2017/03/21]

197. Marang-van de Mheen PJ, Putter H, Bastiaannet E, et al. Competing risks in quality and safety research: a framework to guide choice of analysis and improve reporting. *BMJ Quality & Safety* 2021;30(12):1031-37. doi: 10.1136/bmjqs-2021-012988 [published Online First: 2021/09/19]

198. Batbaatar E, Dorjdagva J, Luvsannyam A, et al. Determinants of patient satisfaction: a systematic review. *Perspectives in Public Health* 2016;137(2):89-101. doi: 10.1177/1757913916634136

199. Deledda G, Moretti F, Rimondini M, et al. How patients want their doctor to communicate. A literature review on primary care patients' perspective. *Patient Education and Counseling* 2013;90(3):297-306. doi: https://doi.org/10.1016/j.pec.2012.05.005

200. Luthy C, Cedraschi C, Perrin E, et al. How do patients define "good" and "bad" doctors? *Swiss Med Wkly* 2005;135(5-6):82-6. [published Online First: 2005/02/25]

201. Borracci RA, Álvarez Gallesio JM, Ciambrone G, et al. What patients consider to be a good doctor, and what doctors consider to be a good patient. *Revista médica de Chile* 2020;148:930-38.

202. Quirk M, Mazor K, Haley H-L, et al. How patients perceive a doctor's caring attitude. *Patient Education and Counseling* 2008;72(3):359-66. doi: https://doi.org/10.1016/j.pec.2008.05.022

203. Wensing M, Jung HP, Mainz J, et al. A systematic review of the literature on patient priorities for general practice care. Part 1: Description of the research domain. *Soc Sci Med* 1998;47(10):1573-88. doi: 10.1016/s0277-9536(98)00222-6 [published Online First: 1998/11/21]

204. HealthWatch-England. What do people want from the NHS and social care in the future, 2018.

205. Saman DM, Kavanagh KT, Johnson B, et al. Can Inpatient Hospital Experiences Predict Central Line-Associated Bloodstream Infections? *PLOS ONE* 2013;8(4):e61097. doi: 10.1371/journal.pone.0061097

206. Rapport F, Hibbert P, Baysari M, et al. What do patients really want? An in-depth examination of patient experience in four Australian hospitals. *BMC Health Serv Res* 2019;19(1):38. doi: 10.1186/s12913-019-3881-z [published Online First: 2019/01/17]

207. Schoenfelder T, Klewer J, Kugler J. Determinants of patient satisfaction: a study among 39 hospitals in an in-patient setting in Germany. *Int J Qual Health Care* 2011;23(5):503-9. doi: 10.1093/intqhc/mzr038 [published Online First: 2011/07/01]

208. Berkowitz B. The Patient Experience and Patient Satisfaction: Measurement of a Complex Dynamic. *Online J Issues Nurs* 2016;21(1):1. doi: 10.3912/OJIN.Vol21No01Man01 [published Online First: 2016/11/18]

209. Smith PC, Sagan A, Siciliani L, et al. European Observatory Policy Briefs. Building on value-based health care: Towards a health system perspective. Copenhagen (Denmark): World Health Organization 2020.

210. European Commission. Defining Value in 'Value-Based Healthcare'. Report of the Expert Panel on effective ways of investing in Health., 2019.

211. Sabra AI. The Optics Of Ibn Al Haytham, Books I-III, On Direct Vision. Translated With Introduction And Commentary. London: The Warburg Institute, University of London 1989.

212. Renmans D, Holvoet N, Orach CG, et al. Opening the 'black box' of performance-based financing in low- and lower middle-income countries: a review of the literature. *Health Policy and Planning* 2016;31(9):1297-309. doi: 10.1093/heapol/czw045

213. de Walque D, Robyn PJ, Saidou H, et al. Looking into the performance-based financing black box: evidence from an impact evaluation in the health sector in Cameroon. *Health Policy and Planning* 2021;36(6):835-47. doi: 10.1093/heapol/czab002

214. Anselmi L, Binyaruka P, Borghi J. Understanding causal pathways within health systems policy evaluation through mediation analysis: an application to payment for performance (P4P) in Tanzania. *Implementation Science* 2017;12(1):10. doi: 10.1186/s13012-016-0540-1

Printed by Media-Tryck, Lund 2023 NORDIC SWAN ECOLABEL 3041 0903

The Development and Evaluation of Hospital Pay-for-Performance in Lebanon

Jade has a background in medicine, health policy and management, and epidemiology. His past experiences include being involved with the Ministry of Public Health (MoPH) in Lebanon, from 2009 to 2020, primarily on health system initiatives regarding hospitals and primary care centers. The purpose of this thesis was to describe the development and evaluate the impact of hospital pay-for-performance (P4P) in Lebanon, and ultimately to contribute to improved design and implementation of value-based healthcare, particularly in limited resource settings. This thesis uses a mixed methods approach, including interrupted time series analysis and qualitative investigations. The findings reveal several positive impacts of pay-for-performance in Lebanon, including the improvement of the relation between hospitals and the MoPH, and providing a tool for continuous development of the health system. The 2014 and 2018 P4P interventions improved system effectiveness and related patient outcomes, by decreasing unnecessary hospitalizations and decreasing some types of readmissions. Patients in Lebanon highly valued health and supported improving public hospitals and measures to counter the influence of personal connections and money. Health systems can more widely engage people for their perspectives, and patients can have a fundamental role in shaping the values and functions of a health system.

LUND UNIVERSITY

FACULTY OF MEDICINE

Department of Clinical Sciences

Lund University, Faculty of Medicine
Doctoral Dissertation Series 2023:105
ISBN 978-91-8021-446-9
ISSN 1652-8220