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Health systems strengthening in global and national contexts

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Abstract

Despite advances in medical research, the burden of disease in most countries remains high. Further, health inequalities continue to grow and emerging infectious diseases are still wreaking havoc across countries. To respond to contemporary public health challenges, a new systems thinking paradigm has emerged that highlighted a holistic approach towards health systems, resulting to an emerging field - health policy and systems research (HPSR). HPSR seeks to understand and enhance how societies organize themselves in achieving collective health goals, and how different actors interact in the policy and implementation processes. However, research gaps remain particularly in applying this paradigm to strengthen health systems performance across countries. This thesis contributes to HPSR by: a. examining the underlying concepts of health systems strengthening; b. determining how health systems contribute to better health outcomes, particularly on reducing infant mortality rates and improving life expectancies at birth, and c. understanding mechanisms to use findings from health systems strengthening assessments to inform global and national-level health policymaking processes.

In 2015, 40% of the Global Fund investments go toward health systems strengthening (HSS). The global health threats posed by recent viral epidemics such as Ebola and Zika even further increased calls to invest in and develop better health systems. These health systems investments were also in most cases subjected to performance-based funding, but contrary to other monitoring and evaluation methods used for other health programs, health systems monitoring and evaluation demand a new analytical frame due to its complexity, along with the very different country capacities, uneven data sources and data availability and quality, including the varied contexts that drive priority areas for health systems. As such, monitoring these initiatives remain to be highly contentious despite its importance to inform health resource allocation. In particular, studies often highlighted different conceptual and methodological challenges associated with health systems assessments worldwide.

To address these issues, I first introduced a new HSS framework based on existing monitoring and evaluation frameworks collected from my field experience, systematic reviews, and thematic analyses of existing HSS documents and database. Based on the developed HSS framework, existing HSS indicators were also examined to guide further analysis. Further, I quantitatively assessed health systems performance using a new composite indicator based on previous efforts for a global health systems performance index. To do this index, I used data collected from the Demographic Health Surveys, the World Bank Indicators, and the World Health Organisation

(WHO) Global Health Surveys. In particular, I used fixed-effects and random-effects regression analyses to determine how each health system characteristic affects health outcomes, particularly infant mortality rates and life expectancies. Specifically, I examined how global core health indicators can be used to assess each health systems building block (governance, financing, service delivery, health workforce, medical products and technologies, and health information systems. From global health systems assessments, I then examined the use of health systems monitoring and evaluation to assess one of the building blocks – governance – in Cambodia and the Philippines.

In this thesis, I found about 3000 health systems indicators that countries can choose from to guide their current or future health systems performance assessments, while tailoring them into their specific country needs and contexts. In addition, I found a significant gap in country capacities to be able to monitor health systems performance, implying the need for better surveillance and reporting systems particularly in low- and middle-income countries. Further, I also quantified the contributions of each of the health systems building blocks to overall infant mortality rates and life expectancies and found that health systems can only effectively improve health outcomes if all of the building blocks are well-functioning. Using these information, I created an index for health systems performance assessments that can be used for global monitoring and evaluation. Using this index, I found that many countries in Africa and Southeast Asia remain to have the least performing health systems, as well as health outcomes. The index was able to account for the different health systems building blocks, while controlling for socioeconomic factors and other health determinants. When applied in assessing health governance in Cambodia and the Philippines, I found that decentralization significantly contributed to improve Cambodia's infant mortality rates, while finding a lesser effect for the Philippines. Given these findings, I concluded that health systems performance can be quantitatively assessed with these assessments providing comprehensive yet easily understandable overview of health systems performance in both national and global levels; hence, facilitating use in health systems decision-making processes.

Declaration by author

This thesis is composed of my original work, and contains no material previously published or written by another person except where due reference has been made in the text. I have clearly stated the contribution by others to jointly-authored works that I have included in my thesis.

I have clearly stated the contribution of others to my thesis as a whole, including statistical assistance, survey design, data analysis, significant technical procedures, professional editorial advice, and any other original research work used or reported in my thesis. The content of my thesis is the result of work I have carried out since the commencement of my research higher degree candidature and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution. I have clearly stated which parts of my thesis, if any, have been submitted to qualify for another award.

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Publications during candidature

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Contributions by others to the thesis

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health systems, global health, delivery science, health metrics, evidence-informed policy

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List of Abbreviations Used

AIHW	Australian Institute of Health and Welfare
BoD	Burden of disease
CD	Communicable diseases
CMR	Child mortality rates
CMC	Century month code
COHRED	Council on health research for development
DHS	Demographic health surveys
DSF	Demand-side financing
EC	European Commission
Euro	European region
Gavi	Gavi Vaccine Alliance
GDP	Gross domestic product
GHDonline	Global health delivery online project
GHDx	Global health data exchange
GIFT	WHO global information full text
GNI	Gross national income
HEF	Health equity funds
HFG	USAID's health finance and governance project
HICs	High-income countries
HiTs	Health systems in transition reports
HPSR	Health policy and systems research
HSPA	Health systems performance assessment
HSS	Health systems strengthening
IHME	Institute for Health Metrics and Evaluation
IMR	Infant mortality rates
KMO	Kaiser-Meyer-Olkin test for sampling adequacy
LE	Life expectancy
LMICs	Low- and middle-income countries
MDGs	Millennium Development Goals
MoH	Ministry of health
NCD	Non communicable diseases
NGOs	Non-government organisations

NHS	National health service
NIH	National institutes of health
ODA	Official development assistance
OECD	Organisation for economic cooperation and development
OOP	Out-of-pocket expenditures
PBF	Performance-based financing
PEPFAR	President's emergency plan for AIDS relief
PPP	Purchasing power parity
PRISMA	Preferred reporting items for systematic reviews and meta-analyses
RESYST	Resilient and responsive health systems
SBA	Skilled birth attendants
SDG	Sustainable Development Goals
SG2MT	Gavi Strategic goal 2 management team
THE	Total health expenditure
TPE	Total pharmaceutical expenditure
UHC	Universal health coverage
UK	United Kingdom
UMIC	Upper middle-income countries
UN	United Nations
vCOPs	Virtual communities of practice
WB	World Bank
WDI	World Development Indicators
WHA	World Health Assembly
WHO	World Health Organisation

“The very first requirement in a hospital is that it should do the sick no harm.”

Florence Nightingale, a social reformer, statistician, and founder of modern nursing

Introduction

Health systems strengthening (HSS) initiatives refer to improving the six health system building blocks (governance, financing, service delivery, health workforce, medical products and technologies, and health information systems) and their interactions to achieve more equitable and sustained improvements across health services and health outcomes (WHO, 2007). Millions of dollars were allocated under the umbrella of HSS (Warren, Wyss, Shakarishvili, Atun, & de Savigny, 2013). For example, the Global Fund, which is a partnership organisation designed to accelerate the end of AIDS, tuberculosis, and malaria as epidemics (Global Fund, 2015), allocated about 38% of its funding for HSS in 2015 (Warren et al., 2013). Around US$ 296 million was also allocated to specific health systems building blocks relevant to service delivery, human resources, and medicines and technology (Warren et al., 2013). Further, the global health threats posed by recent viral epidemics such as Ebola and Zika increased calls to invest in and enhance health systems performance (Moon et al., 2015).

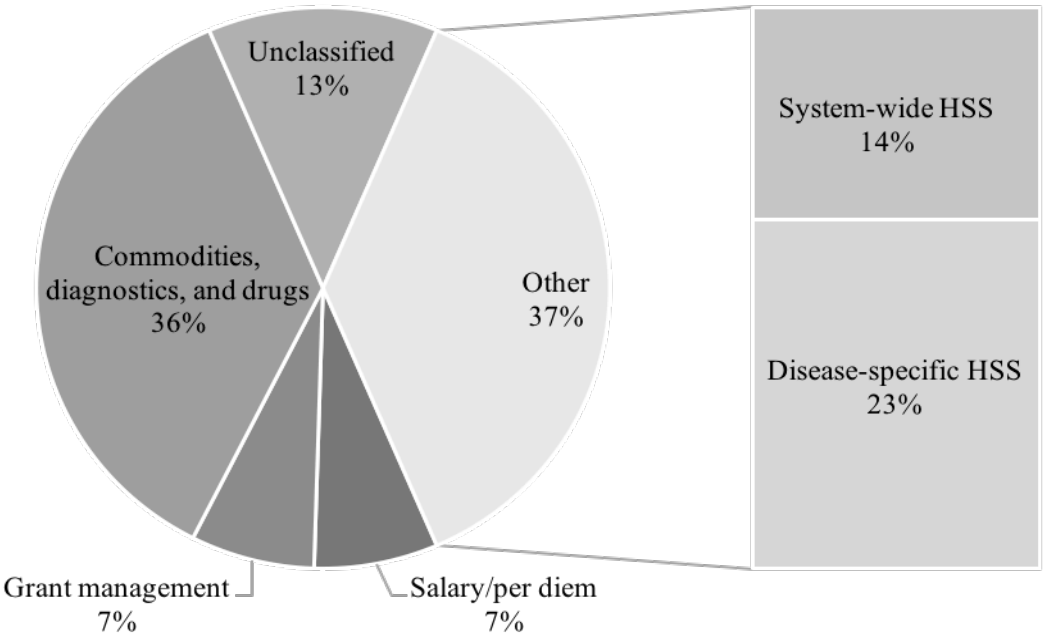


Figure 0.1 Percent distribution for round eight of the Global Fund grants: $184 million (14%) for system-wide HSS and $223 million (23%) for disease-specific HSS
(Adapted from Warren et al., 2013)

Allocation of these HSS resources is also subjected to performance-based funding (Low-Beer et al., 2007). However, compared to other grants mechanisms, monitoring and evaluating health systems demanded a new analytical framework and approach since it is more complex with different country capacities to monitor and report on evaluation criteria. Specifically, countries have uneven

data sources, limited data availability and quality, and varying factors that drive priority areas for health systems in different countries (Adam & de Savigny, 2012; Murray & Evans, 2003) .

Research questions and objectives

To guide health system resource allocation through evidence-based HSS monitoring and evaluation, I examined in detail HSS concepts, frameworks, and measures (Part A) and determined how health systems characteristics influence health outcomes, particularly child mortality rates and life expectancies (Part B). Specifically, I answered:

1. How can HSS initiatives be assessed? This research question also involves answering the question *"*What are the key concepts and measures for assessing HSS"?
   - Objective 1: Determine how the concept of HSS relates to other priority areas for health;
   - Objective 2: Examine HSS concepts and develop an HSS framework based on existing health systems domains and measures; and,
   - Objective 3: Determine existing and potential HSS programme-level indicators tailored to assess specific country capacities and purposes.
2. How significant are HSS initiatives to improve health outcomes?
   - Objective 4: Explore socioeconomic and institutional factors that may significantly influence child health outcomes and life expectancies;
   - Objective 5: Determine opportunities and barriers for developing a composite indicator for health systems performance and identify taxonomies of health systems performance in low- and middle-income countries; and,
   - Objective 6: Examine how HSS assessments can be conducted in specific country contexts.

Contribution to knowledge

One of the best measures of health progress is assessing health systems performance, which refers to the degree of achievement of the health system towards their health goals relative to their resources (Murray & Frenk, 2006). By monitoring and evaluating the health systems performance, aspects of health systems that significantly influenced health outcomes can be determined and resource allocation can be optimized to more efficiently respond to health needs (WHO, 2007). In contrast, inability to do such assessments may lead to failure to achieve health goals (WHO, 2000). Assessing health systems performance has been attempted in previous years, but remained highly contentious. In 2000, the WHO released findings on global assessments of health systems performance (WHO, 2000). However, the indicators and methods used may not necessarily reflect

the country-specific needs and contexts, questioning their usefulness for policymaking (Brundtland, Frenk, & Murray, 2003; Musgrove, 2003). As such, comparative assessments of HSS remained a research gap (Basu, Andrews, Kishore, Panjabi, & Stuckler, 2012). Since HSS concepts and measures have not been agreed upon, it is also difficult to examine how effective HSS initiatives were in meeting their objectives, particularly for low- and middle-income countries[1] (Decoster, Appelmans, & Hill, 2012).

Although LMICs accounted for 84% of the world's population with at least 90% of total disease burden, LMICs most likely do not have enough capacity to continuously monitor health systems progress (Macinko, Starfield, & Erinosho, 2009; Shukla & Johnson Lassner, 2012). This lack of enhance surveillance systems in LMICs may be explained partly by substantially lower per capita total health expenditure in LMICs compared with high income countries (Figure 0.2a). Specifically, average total health expenditure is only at $301 per capita in LMICs, more than ten times lower than that of LMICs at $3,370 per capita. This less government allocation for health in LMICs also implies lesser people who can access healthcare services. In 2000, over one billion people from LMICs living on less than $1 per day were unable to access healthcare services (Frenk, Bobadilla, Sepuulveda, & Cervantes, 1989). The limited health spending was also coupled by increasing disease burden from both non-communicable and communicable diseases (Figure 0.2b) (Knaul, Frenk, & Shulman, 2011; WHO, 2002, 2009b). These circumstances have further pushed people into poverty and increased both social and health inequalities in LMICs (Wilkinson & Marmot, 2003).

Various health systems reforms have been undertaken to address these pressing needs, but there is still limited evidence about the effectiveness of these reforms (Task Force, 2005). Previous studies argued that HSS assessments would have helped best inform policy decisions on health systems reforms (Adam et al., 2012). However, these types of research were even lesser in LMICs, where it is needed the most (Figure 0.2c) (Adam, Ahmad, Bigdeli, Ghaffar, & Røttingen, 2011). Official development assistance (ODA)[2] may have helped increase health resources. Despite increasing ODA from 2000 to 2010 (Figure 0.2d), this increase does not necessarily put HSS assessments high on the agenda even if the development assistance is allocated for health systems (Bonita et al., 2012; Costa Font & Sato, 2012). Hence, research that laid the foundations on HSS assessments

[1] LMICs refer to the World Bank's member economies and all other economies with populations of more than 30,000 that have a gross national income (GNI) per capita of $12,615 or less (as of 2012) (World Bank, 2015e).

[2] ODA are flows to countries and territories provided by the official or executive agencies to promote economic development and welfare of developing countries. ODA is concessional in character and conveys a grant element of at least 25% calculated at a rate of discount of 10% (OECD, 2016).

using data from high quality evidence is needed. However, previous research on assessing HSS has focused on select aspects of health systems rather than on more holistic system-wide approaches for monitoring and evaluation (Murray & Evans, 2003). Countries are also faced with the challenges of translating findings from HSS assessments to their specific country needs and practices (Jamison, 2006), which could have helped achieve more efficient use of health system resources (Hoffman, Rottingen, et al., 2012).

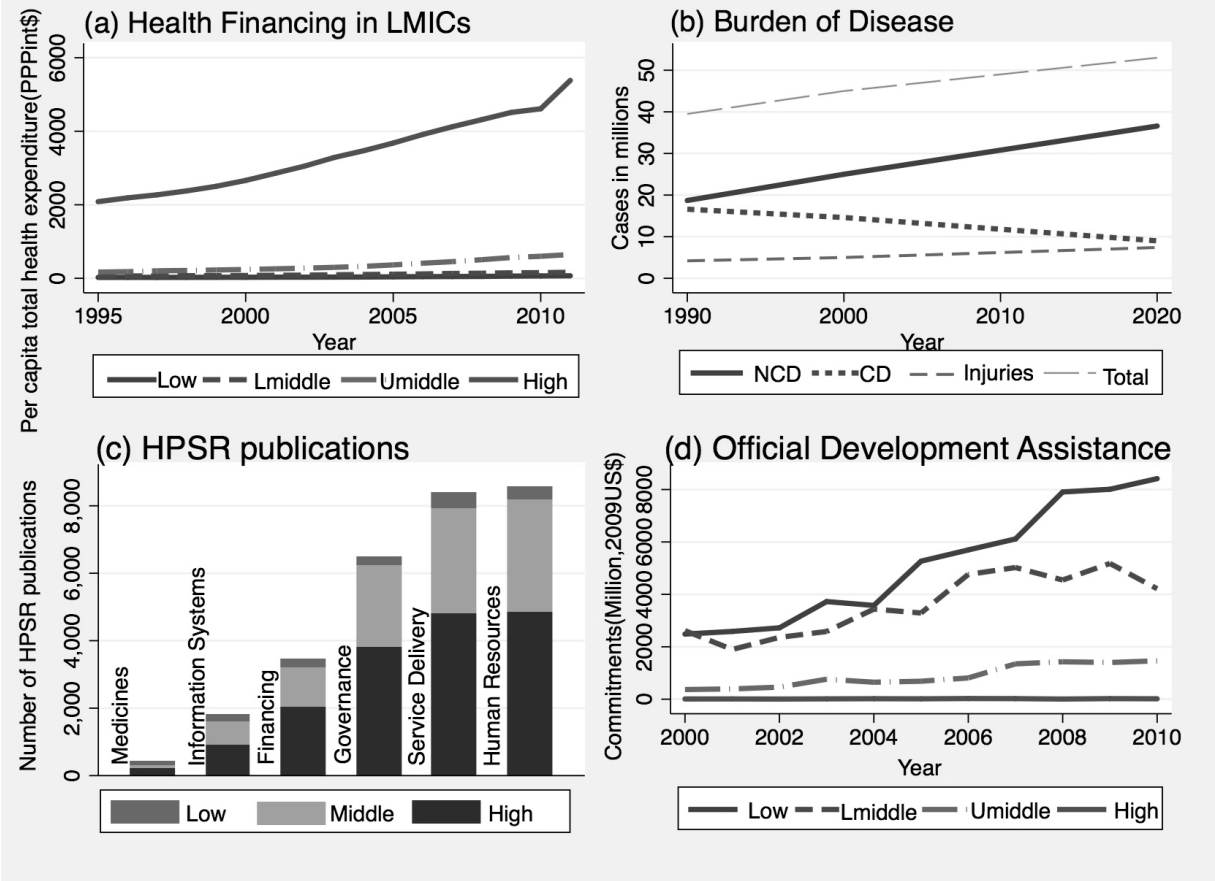


Figure 0.2 LMIC's health systems profile by World Bank Income Groups: a) per capita total health expenditure (in PPPint$); b) burden of non-communicable diseases (NCDs), communicable diseases (CD), and injuries (inj), including total disease burden; c) number of health policy and systems research (hpsr) publications; and, d) amount of ODA commitments (in millions, 2009 US$) World Bank income groups: LIC – low-income countries, LMI - lower middle-income countries, UMIC - upper middle-income countries, HIC – high-income countries (World Bank, 2015e) Source: Author's computations using data from 1990-2013 Demographic Health Surveys for figures a, b, and d (Rutstein & Rojas, 2006); and data from Adam et al (2011) for figure c.

Thesis outline

This thesis follows the steps on HSS assessments outlined by (Murray & Frenk, 2000):

a) conceptualize health systems by exploring their contexts, applying existing frameworks and indicators, and examining each health systems building block; and,

b) determine health system performance by focusing on how a health system has reached its fundamental goal of improving health.

Using both quantitative and qualitative data, this thesis examines HSS concepts and measures and applied findings in global and national contexts by determining how each health systems building block relates to select health outcome indicators such as infant mortality rates, life expectancy at birth, and immunisation coverage. The thesis is divided into two parts:

The first three chapters (Part A) discusses the key concepts and metrics for HSS:

1. Priority areas for health systems strengthening;
2. Key performance frameworks and actors for monitoring and evaluating HSS initiatives; and,
3. Data sources and tailored indicators for programmatic-level monitoring and evaluation of intermediate HSS results.

The last three chapters (Part B) examines the relations between health systems building blocks and health outcomes:

4. Health systems building blocks and health outcomes;
5. Taxonomy of health systems performance in low- and middle-income countries; and,
6. Health systems strengthening in the context of decentralization.

Table 1 provides a summary of the thesis research questions and the corresponding objectives that each chapter seeks to address.

Table 0-1 Thesis outline

Research questions	Objectives	Thesis chapters
Part A. How can HSS initiatives be assessed? What are the key concepts and measures for assessing HSS?	**Objective 1:** Determine how the concept of HSS relates to other priority areas for health;	**Chapter 1:** Priority areas for health systems strengthening
	Objective 2: Examine HSS concepts and develop an HSS framework based on existing health systems domains and measures; and,	**Chapter 2:** Key performance frameworks and actors for monitoring and evaluating HSS initiatives
	Objective 3: Determine existing and potential HSS programme-level indicators tailored to assess specific country capacities and purposes.	**Chapter 3:** Data sources and tailored indicators for programmatic-level monitoring and evaluation of intermediate HSS results
Part B. How significant are HSS initiatives to improve health outcomes?	**Objective 4**: Explore socioeconomic and institutional factors that may significantly influence child health outcomes and life expectancies;	**Chapter 4:** Health systems building blocks and health outcomes
	Objective 5: Determine opportunities and barriers for developing a composite indicator for health systems performance and identify taxonomies of health systems performance in low- and middle-income countries; and,	**Chapter 5:** Taxonomy of health systems performance in low- and middle-income countries
	Objective 6: Examine how HSS assessments can be conducted in more specific contexts.	**Chapter 6:** Health systems strengthening in the context of decentralization

Part A: Basic concepts and metrics for health systems strengthening

Part A responds to the following research questions:

1. How can HSS initiatives be assessed?
2. What are their key concepts and measures?

Part A determines how the concept of HSS relates to other priority areas for health, examines HSS concepts and develops an HSS framework based on identified key health systems domains and measures, and determines existing and potential HSS programme-level indicators tailored to specific country capacities and purposes.

Prior to conducting global and national HSS assessments, transparency with the HSS framework and measures used as a basis for comparing attainment of health systems goals is needed (Braveman, 2003; van Olmen, Marchal, Van Damme, Kegels, & Hill, 2012). However, existing HSS frameworks, including HSS indicators, may not be applicable across many countries (Macinko et al., 2009; Shukla & Johnson Lassner, 2012). This thesis used two approaches suggested in previous studies (Murray & Frenk, 2000): a. examine public health priorities and strategies, and b) identify HSS frameworks and indicators. In particular, Part A highlights a new conceptual framework and compiles a list of HSS indicators that builds upon existing country-driven health systems monitoring and evaluation frameworks and other internal documents gathered from select countries, field observations, and two international organisations. This bottom-up approach ensures that findings are more reflective of the national health systems priority areas and strategies, which were deemed necessary to more responsively inform the formulation of health policies, programs, and priorities. Developing and examining these frameworks and measures were essential to create more informed strategies for assessing health systems and determining priorities for improvement (Papanicolas & Smith, 2013), as well as to improve efficiency, equity, and quality of healthcare deliveries (Arah, Westert, Hurst, & Klazinga, 2006).

Chapter 1 Priority areas for health systems strengthening

This chapter provides an overview of the state of HSS in the field of public health and how inter-sectoral actions, as well as both small-scale and large-scale actors, may influence the HSS agenda. As the number of stakeholders involved in HSS increases, there is a need to frame the HSS agenda in relation to health promotion and public health endeavours. This framing will help clarify further HSS concepts and goals and provide an evidence base for informing HSS initiatives. In this chapter, I did a thematic analysis of sixteen key statements about health promotion and health systems strengthening from 1978 to 2016 to extract key HSS themes and foci. As a way of understanding the historical context for HSS, these themes clarify the health system priority areas and how these areas have evolved over the past years. I found nine themes which were common across all the 16 statements: a. improving equity, access, and social justice; b. increasing funding and better priority setting to achieve universal health coverage (UHC); c. improving governance for health; d. building capacities for research, health workforce, and health systems; e. creating better collaboration and cooperation, as well as integrating and embedding health across sectors; f. reorienting towards improved community action and people-centeredness; g. determining appropriate metrics, and developing better monitoring and evaluation processes for health systems; h. creating a supportive environment for health and addressing key health determinants; and, i. calls for action from different health system actors.

1.1 Consensus statements and global health

Over the years, there has been a growing shift of the global health agenda from disease-specific to systems-thinking approaches. Specifically, ambitious health-related Sustainable Development Goals can only be achieved if countries invest on health systems (Tangcharoensathien, Mills, & Palu, 2015). However, there are essential considerations needed to guide decisions on health priorities:

First, investing more on health systems calls for stronger evidence about health systems priorities and the different bottlenecks that existing HSS interventions aim to address (Shakarishvili et al., 2011; Tangcharoensathien et al., 2015). As such, HSS also demands better technical capacities for data analysis and evidence-based participatory decision-making and action (Brownson, Baker, Leet, Gillespie, & True, 2010; Nutbeam, 1998). Such evidence should inform countries on how to align their country-specific HSS targets to the global HSS targets, provide updates about the development of country-specific HSS frameworks, and define potential measures for monitoring and evaluating HSS progress (Hoffman, Røttingen, et al., 2012; Tangcharoensathien et al., 2015).

Second, HSS research also needs more multi-sectoral interventions from different actors working towards better health outcomes such as international organisations, community health workers, physicians and other allied health workers, as well as ministries of different sectors from health, financing, and education (Shakarishvili et al., 2011). In particular, national leadership and governance play a critical role in HSS (Shakarishvili et al., 2011). National leaders can be held accountable for their health systems performance and in monitoring progress and impact towards global health systems targets (Papanicolas & Smith, 2013). In return, national leaders who track progress possess an essential tool to ensure country coordination and improve implementation (Gostin & Friedman, 2013; ter Veen & Commins, 2011). Otherwise, weak leadership and governance can result to poorer health systems performance; hence, lower achievement of health outcomes (Mehrotra & Jarrett, 2002).

To illustrate these two key considerations, conference or "consensus statements" from global health events can be examined since these statements serve as useful references for a better understanding of what was known about a topic at a particular point in time, including whether gaps in research identified at the time of each conference have since been filled (NIH, 2013). In addition, the conference participants endorse these statements with the goal of providing a call to action and a more concrete guidance (WHO, 2013c), placing pressure on global and regional stakeholders and governments (NIH, 2013). Hence, these statements promoted or advocated a position or specific information and offered guidance to the stakeholder's community regarding an organisation's stance on health care policies and programs (NIH, 2013). Some types of statements were also targeted towards ensuring visibility of the issue being discussed such as HIV/AIDS, and infectious diseases, among others (NIH, 2013). Over the years, different organisations have also been publishing their statements. In PubMed alone, the average number of statements published increased from an average of 20 statements in 2000 to about 80 statements in 2014. Hence, conference statements can be used to identify research gaps and health systems agenda. In particular, statements can provide an evidence base, which can be analysed to give an overview of global priority areas and calls for evidence. As such, I did a thematic analysis of conference statements to see what international organisations tell about their foci, targets and calls for action towards HSS and other health promotion strategies.

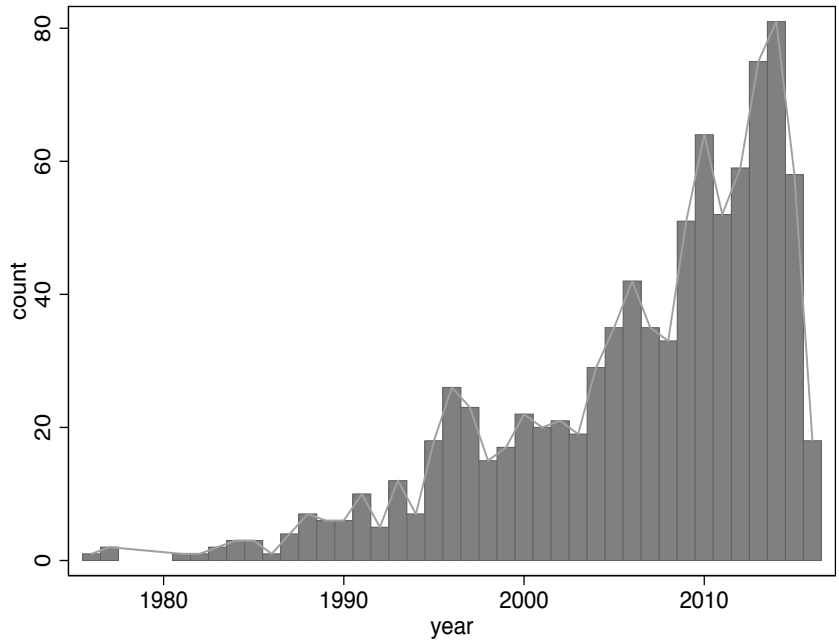


Figure 1.1 The number of records that resulted from PubMed, an online database search engine, using the search word "conference statements" and "consensus statements" published from 1978 to 2016.

When mapped with the key conference statements identified by Ghaffar et al (2016), two records in 1980 increased to about four times within ten years with peaks after the 2008 Global Ministerial Forum on Research for Health (n = 179 in 2009 (Figure 1.2).

1.2 Methods

I selected the 1978 Alma-Ata Declaration as a starting point because it was the first international declaration underlining the significance of primary health care, which has since then been accepted by the WHO Member States as key to achieving the "Health for All" goal (WHO, 1978). To gather more statements published since the 1978 Alma-Ata Declaration, I used internal documents from the WHO headquarters in Geneva, Switzerland and searched other online databases:

First, I used statements available from the websites of organisations involved in global health with past or on-going HSS initiatives such as through provision of HSS grants and/or publications of HSS resources or guidelines (e.g. World Health Organisation, the GAVI Vaccine Alliance, President's Emergency Plan for AIDS relief (PEPFAR), the Global Fund to Fight AIDS, Tuberculosis, and Malaria, and the European Commission).

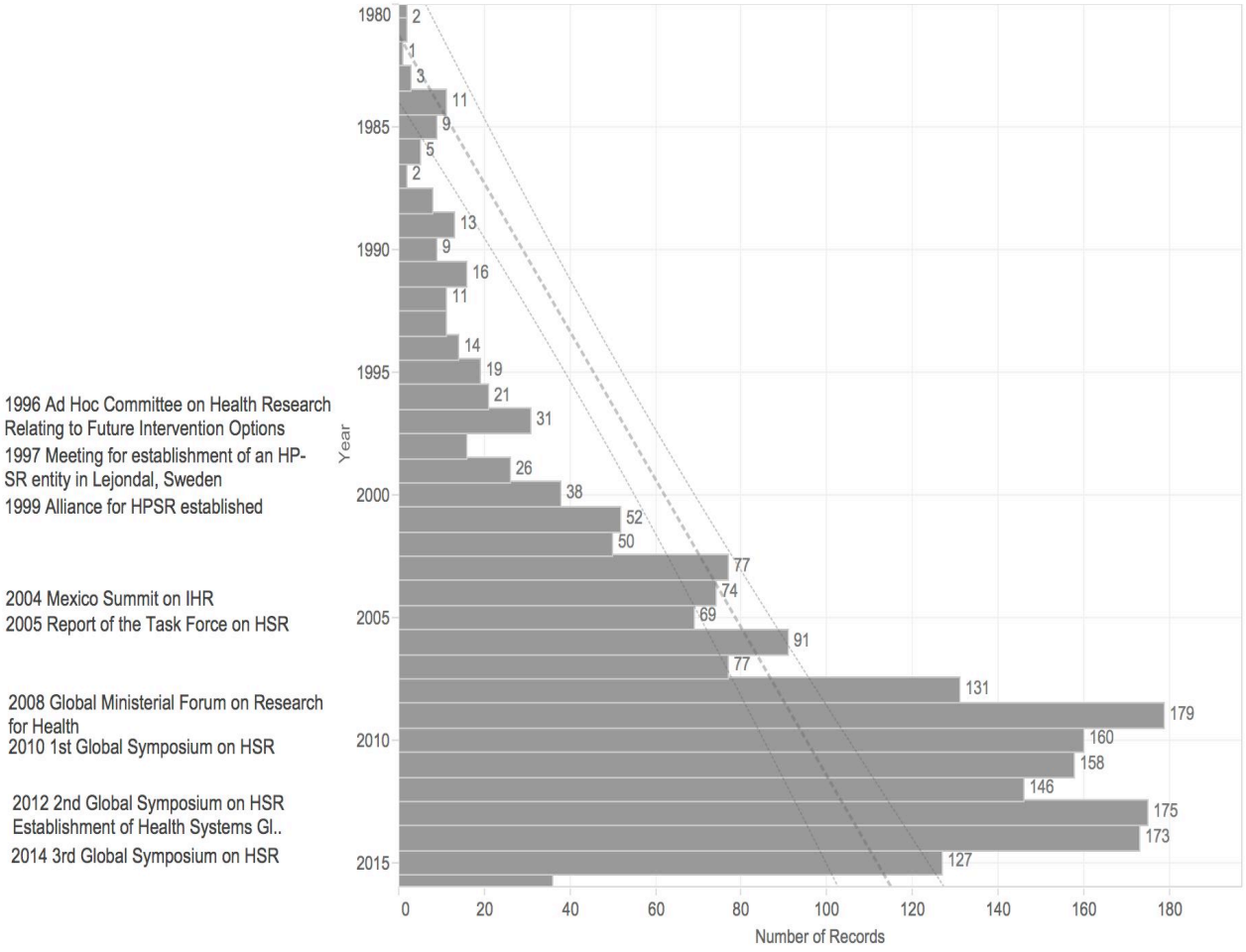


Figure 1.2 Number of HSS-related conference statements released per year and plotted against health policy and systems research milestones. These milestones were adapted from the previous study of Ghaffar et al (2016) (Ghaffar, Gilson, Tomson, Viergever, & Røttingen, 2016).

Second, I used HSS-related statements published by PubMed, Embase, and other online databases. I also retrieved articles from the reference lists of available HSS statements, if any. By and large, I conducted the search from August 2015 to March 2016. To search online databases, I used the search terms "health systems" and "statements" or "health systems strengthening" and "statements" in combination with the WHO health systems building blocks (health financing, service delivery, human resources, health information systems, medicines and technologies and governance) (Figure 1.2). This framework was preferred because it was the most commonly used compared with other HSS frameworks (Marchal, Cavalli, & Kegels, 2009).

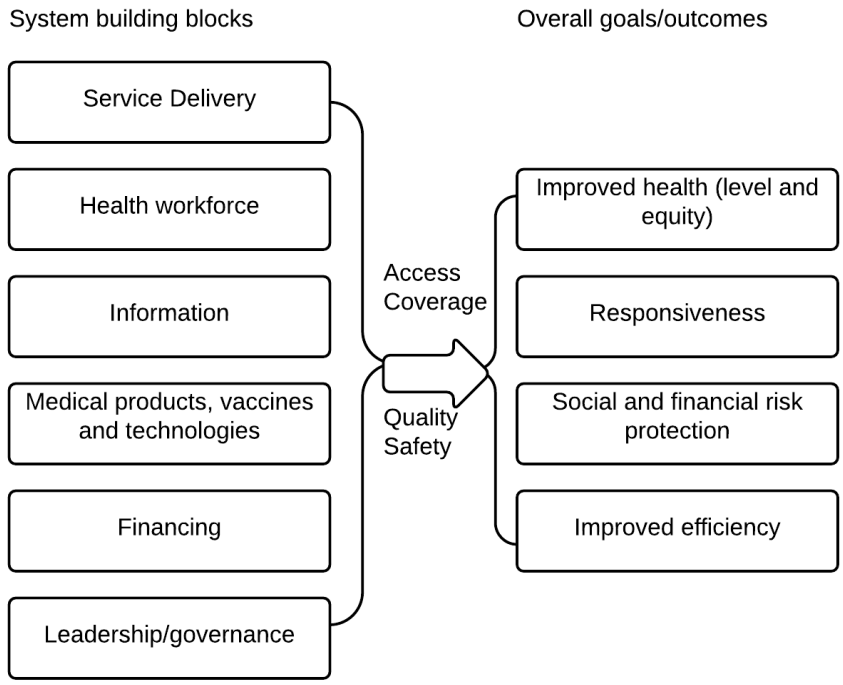


Figure 1.3 The WHO Health Systems Building Block Framework
Adapted from: WHO, 2010b

Inclusion criteria include: a) statements focusing on health systems; b) statements that have a global or regional geographic focus; and c) statements published in English. I excluded journal articles, review articles, books and book chapters.

Overall, I collected 1187 documents, of which 277 duplicates were removed. The 910 retained documents include: 39 documents collected from the HSS organisations; 175 documents from websites of key HSS events; and 696 documents from online databases. I then removed 709 records without concrete HSS targets and proposed actions and statements focusing on disease-specific rather than systems-thinking approaches, retaining 201 statements. Another 185 documents were then excluded due to their geographical focus on national priorities instead of its application to global or regional HSS decision-making. In the end, I had sixteen statements retained for further analysis.

To extract key themes from the statements, I first transcribed and inputted the textual information into RQDA, which is a qualitative analysis software application from R package used to assist in the analysis of textual data (RQDA, 2016). Specifically, I extracted the following information: 1) publication citation including authors, title, journal name, year of publication, and place of publication; 2) corresponding information on the venue and date of the conference where the statement was released; 3) whether the statement focuses on health systems; and 4) any HSS goals,

targets and calls to actions. I then extracted the descriptive characteristics of the retrieved articles in a table to produce a textual summary of the results. This enabled the exploration of themes both within and between the studies reviewed.

After extracting the textual data, I then grouped them into sub-themes and themes, which was done in consultation with three other health systems researchers. I chose thematic analysis, a method that is often used to analyse data in primary qualitative research, because it does not require any pre-existing theoretical framework and can be used within different theoretical frameworks (Braun & Clarke, 2006). I categorized the textual data based on health system goals, targets, and any calls for action. First, I identified health systems goals which may include average level of health or average health adjusted life expectancy, the distribution of health or the differences in health-adjusted life expectancy across social groups, the average level of process outcome or the patient experiences, distribution of process outcome or the differences in experiences between patients across social groups, and financial fairness or the persons in poverty because of health system payments (Franken & Koolman, 2013) Second, I identified health systems targets, which should align new interventions with developing country health systems and provide a clear rationale for each of the desired health systems characteristics (Brooks et al., 2012). Third, I examined any calls to action or statements providing instructions to a target audience with the goal of provoking an immediate response (Vallacher & Wegner, 1985). Then, I selected key themes out of the categories identified for each health system goals, targets, and calls for action. The themes were then discussed with the other authors and refined until an agreement is reached about the thematic areas. Overall, I found nine overarching themes and 44 sub-themes.

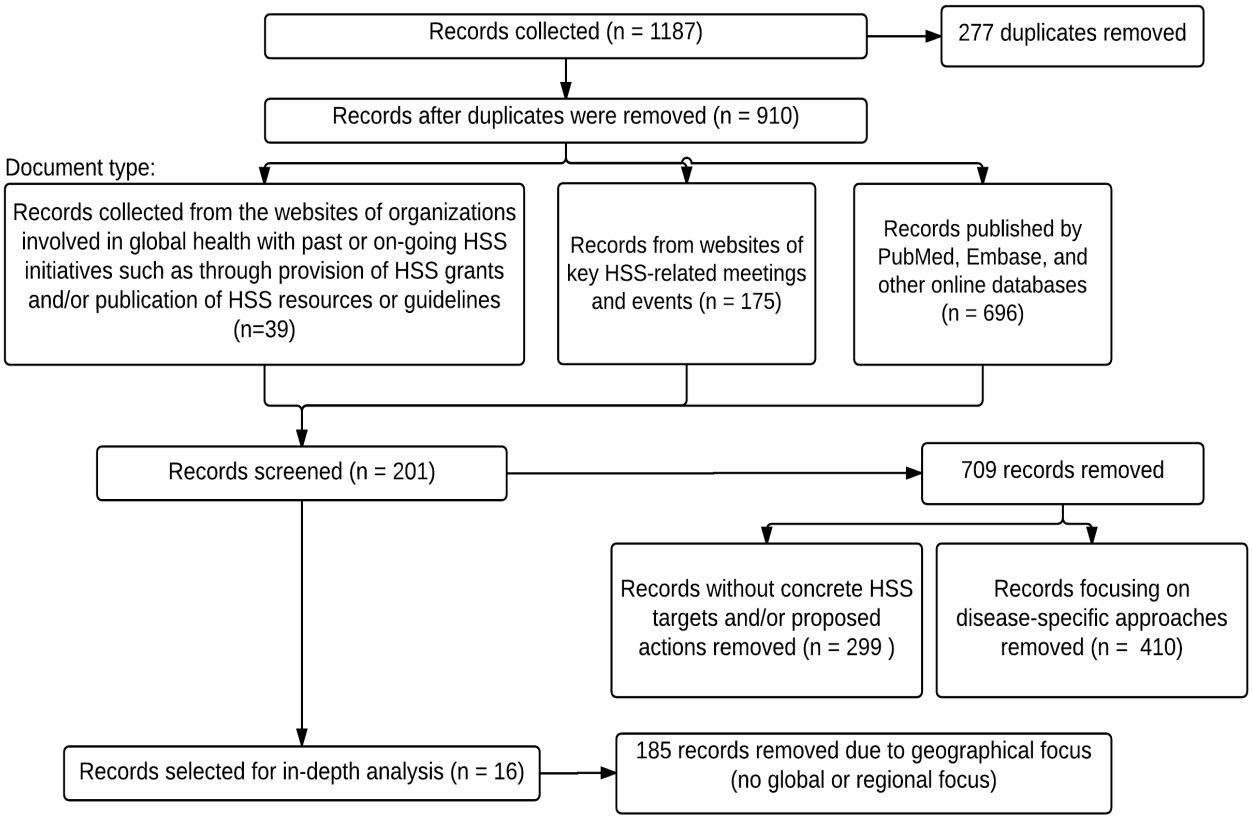


Figure 1.4 Selection flow diagram

The sixteen statements used in the analysis include:

Table 1-1 Conference statements selected for thematic analysis

Year	Title	Conference Name	Venue (Country)	Venue (Country)
1978	Alma-Ata Declaration (WHO, 1978)	International Conference on Primary Health Care	Alma-Ata	Kazakhstan
1986	Ottawa Charter for Health Promotion (WHO, 1986)	First International Conference on Health Promotion	Ontario	Canada
1988	Adelaide Recommendations on Health Public Policy (WHO, 1988)	Second International Conference on Health Promotion	Adelaide	Australia
1991	Sundsvall Statement on Supportive Environments for Health (WHO, 1991)	The Third International Conference on Health Promotion: the Sundsvall Conference	Sundsvall	Sweden
1997	Jakarta Declaration on Leading Health Promotion into the 21st Century (WHO, 1997)	The Fourth International Conference on Health Promotion: New Players for a New Era - Leading Health Promotion into the 21st Century	Jakarta	Indonesia
2000	Mexico Ministerial Statement for the Promotion	Fifth Global Conference on Health Promotion	Mexico City	Mexico

	of Health: From Ideas to Action (Catford, 2000)			
2004	The Mexico statement on health research (WHO, 2004)	Ministerial Summit on Health Research	Mexico	Mexico
2005	The Bangkok Charter for Health Promotion in a Globalized World (WHO, 2005)	Sixth Global Conference on Health Promotion	Bangkok	Thailand
2008	Shaping the future of health promotion: priorities for action (IUHPE, 2008)	International Union for Health Promotion and Education (IUHPE)	Vancouver	Canada
2008	Tallinn Charter: Health Systems for Health and Wealth (WHO, 2008b)	WHO European Ministerial Conference on Health Systems	Tallinn	Estonia
2009	Venice concluding statement on maximizing positive synergies between health systems and global health initiatives (WHO, 2009d)	High-level Dialogue on Maximizing Positive Synergies Between Health Systems and Global Health Initiatives	Venice	Italy
2010	Montreux Statement (HSG, 2010)	First Global Symposium on Health Systems Research	Montreux	Switzerland
2012	Beijing Statement (HSG, 2012)	Second Global Symposium on Health Systems Research	Beijing	China
2013	The Helsinki Statement on Health in All Policies (WHO, 2013e)	8th Global Conference on Health Promotion	Helsinki	Finland
2014	Cape Town Statement (HSG, 2014)	Third Global Symposium on Health Systems Research	Cape town	South Africa
2016	Bangkok Statement (Mahidol, 2016)	Prince Mahidol Award Conference	Bangkok	Thailand

1.3 Results

1.3.1 Common themes on priority areas, targets and calls for action

I found nine thematic areas: a) enhancing equity, access, and social justice; b) increasing funding and better priority setting to achieve UHC; c) improving governance for health; d) building capacities for research, health workforce, and health systems; e) creating better collaboration and cooperation, as well as integrating and embedding health across sectors; f) reorienting towards improved community action and people-centeredness; g) determining appropriate metrics and developing better monitoring and evaluation processes for health systems; h) creating a supportive environment for health and addressing key health determinants; and i) calling for action from different health system actors (Figure 1.6).

a. Enhancing equity, access, and social justice

Fifteen of the 16 statements highlighted the need to address equity, access and social justice. Equity refers to gender equity (WHO, 1986) (WHO, 1988) (WHO, 1991) (WHO, 1997) (WHO, 2009d) (HSG, 2012), access to medicines (WHO, 2009d) (HSG, 2014), inequities in health information, and emerging technologies. Specifically, the statements call for the use of reliable, unbiased and timely health information (WHO, 2004) (IUHPE, 2008) and high-quality health care services (WHO, 2008b), while relying on the best available evidence. The digital divide was apparent since 2008. Specifically, emerging technologies was said to lead to rapid structural changes to inequalities (WHO, 1988) despite its importance to improve health and support more informed decision-making (IUHPE, 2008; WHO, 2008b). Using technology allows primary health care to be based on practical, scientifically sound and socially acceptable methods and technology made universally acceptable to individuals (WHO, 1978). It is a valuable tool for priority setting for health (HSG, 2014; Mahidol, 2016). As such, re-channelling of health resources should also include the transfer of safe and reliable technology (WHO, 1991). Meanwhile, access to medicines was called for since the 1978 Alma Ata Declaration (WHO, 1978), along with the equitable delivery of vaccines and diagnostics (WHO, 2004), and the ethical and effective use to support evidence-informed decision-making (WHO, 2008b) (WHO, 2009d). Similarly, social justice was called for since the 1978 Alma-Ata Declaration. Social justice was identified as a pre-requisite for health with the basic principle of ensuring access to health (WHO, 1988). Hence, primary health care is a key part of development in the spirit of social justice (WHO, 1978) (WHO, 1991) (WHO, 1997) (WHO, 2013e).

b. Increasing funding and better priority-setting to achieve Universal Health Coverage

All statements called for the need to increase funding and better priority-setting towards Universal Health Coverage (UHC). These calls affirmed the need to bring more effective HSS to accelerate UHC (HSG, 2010) (HSG, 2012), specifying UHC not only as a health systems task but a societal goal (HSG, 2014). Further, it calls for UHC to be led by citizens, local and national governments rather than external actors (Mahidol, 2016), recognizing that UHC will require difficult trade-offs between the number of people covered and the scope of services provided. To achieve UHC, HSS needs to develop and embed evidence-informed and transparent priority-setting processes into UHC decisions (Mahidol, 2016).

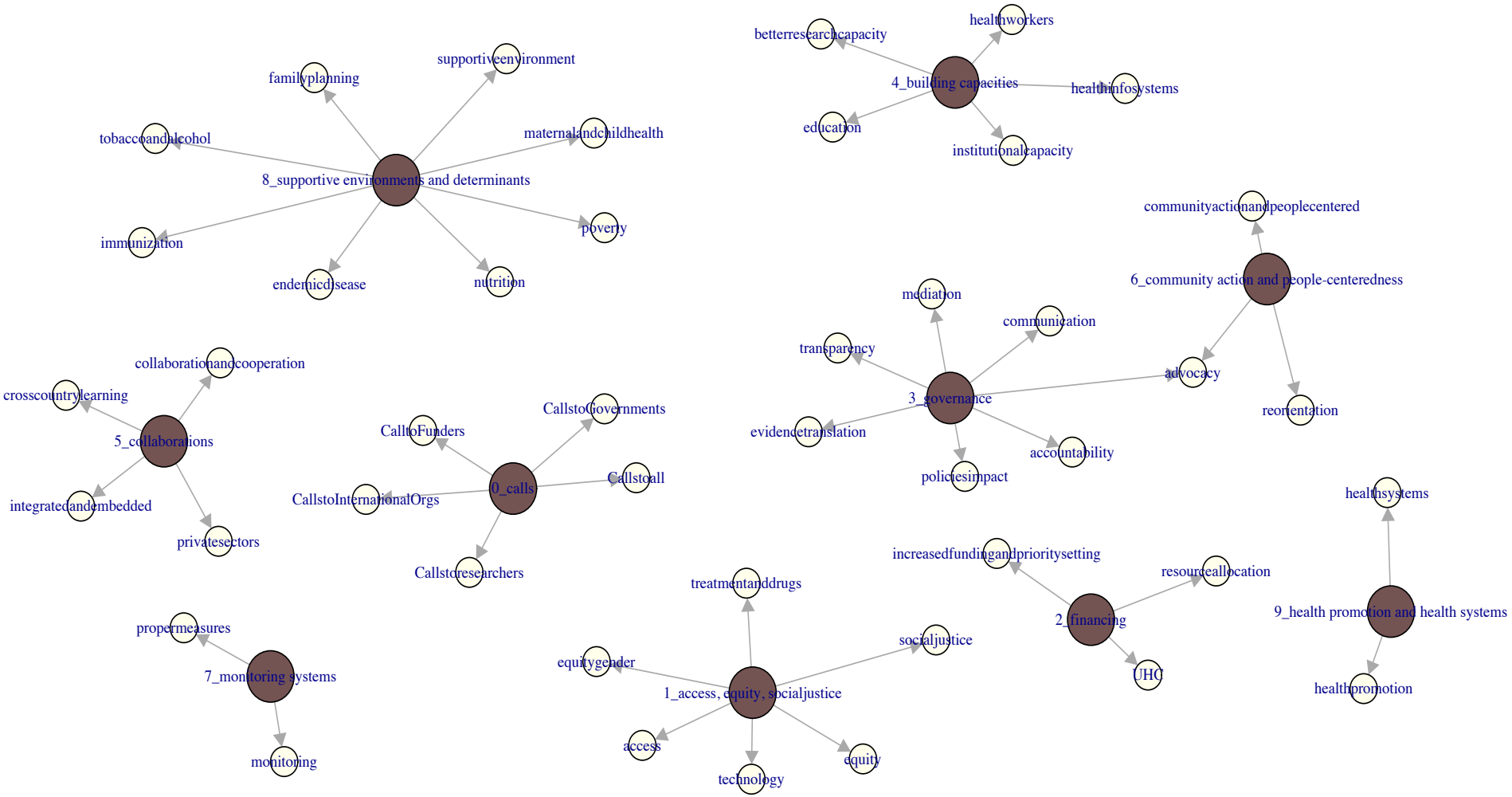


Figure 1.5 The different themes and sub-themes identified using thematic analysis as illustrated by RQDA.

c. Improving governance for health

All statements highlighted the importance of better governance systems for health, including the need to ensure accountability, strengthened advocacy, better evidence translation and transparency: First, governance requires accountability of both the national and global sectors. Specifically, accountability demands a clear political commitment to health and equity (WHO, 1986) (WHO, 1988) (WHO, 1991) (IUHPE, 2008) (WHO, 2008b) (WHO, 2013e). At the global level, the United Nations was also called to be accountable for the health impact of the development agenda (Catford, 2000). In addition, governance entails heightened advocacy, which also necessitates improved communication mechanisms. Specifically, decisions should be communicated with the groups mostly affected by the policy concerned (WHO, 1988), as well as the communities and governments involved (WHO, 1991) (IUHPE, 2008) (HSG, 2012) (HSG, 2014). To support this approach, media support for community capacity and empowerment should be sought (WHO, 1997) (WHO, 2004) (HSG, 2010) (WHO, 2013e). Third, calls for evidence translation was traced back as early as the 1978 Alma-Ata Declaration when it called for primary health care to be based on practical, scientifically sound, and socially acceptable methods and technology (WHO, 1978). Using high quality research, experts can then be mobilized to translate the evidence and ensure its usefulness for policy-making (Mahidol, 2016) (WHO, 2004) (IUHPE, 2008) (WHO, 2008b) (HSG, 2010) (WHO, 2009d) (HSG, 2012). Evidence translation is also a pre-requisite towards transparent governance mechanisms (WHO, 1997) (WHO, 2004) (WHO, 2008b) (WHO, 2013e) (Mahidol, 2016). Last, statements also highlighted the need to mediate, which demands consultation and negotiation (WHO, 1988). In particular, coordination among all concerned (WHO, 1986), particularly among those with conflicting interests in society, is needed (WHO, 1991). For example, mediation among politicians and the private sectors is said to be essential for advocacies (IUHPE, 2008) to strengthen the capacity of the Ministries of Health (WHO, 2013e).

d. Building capacities for research, health workforce, and health systems

Another theme was on building better research and institutional capacities. It was particularly emphasised during the 2004 Mexico Statement on Health Research (WHO, 2004). To build capacities, current health information systems and its human capacities should be developed through quality education and training. For health information systems, highly integrated, functional, and mutually supportive referral systems are needed (WHO, 1978) (WHO, 2009d) (HSG, 2012) to evaluate the impact of policy and practice (WHO, 1988) (IUHPE, 2008), to ensure

a single point of access (WHO, 2004), and to assist those at the frontlines of healthcare (HSG, 2014). For the health workforce, education and training were said to be the keys in building institutional capacities (IUHPE, 2008; WHO, 2008b; HSG, 2014; WHO, 1978; WHO, 1986; WHO, 1988; WHO, 1991; WHO, 1997; IUHPE, 2008; WHO, 2008b; WHO, 2009d; HSG, 2010; HSG, 2014).

e. Creating better collaboration and cooperation, integrating and embedding health across sectors

Calls for better collaboration and cooperation, as well as integrated and embedded health promotion, were noted in all statements. Since the 1978 Alma-Ata Declaration, all countries have been requested to cooperate in the spirit of partnership and service to ensure primary health care for all (WHO, 1978; WHO, 1986; WHO, 1988; WHO, 1991; WHO, 1997). Strengthened mechanisms of collaboration are urgent to address the social, economic, and environmental determinants of health (Catford, 2000). This collaboration includes global and public-private partnerships (WHO, 2004; WHO, 2005; WHO, 2013e), particularly building alliances with the civil society (WHO, 2005) and health professionals (IUHPE, 2008). In addition, collaboration includes coordinated interventions and approaches, such as linking health efforts to economic and social policies, as well as education, transport, housing and urban development. Of particular importance is the need for South-South exchange of innovations specifically to achieve UHC (HSG, 2012). In return, collaboration will facilitate exchange of information on which strategies have proved to be effective and in which settings (WHO, 2008b; WHO, 2009d; HSG, 2010), as well as support mutual assistance within and among countries (WHO, 1997; IUHPE, 2008; WHO, 2008b; WHO, 2009d; HSG, 2012; Mahidol, 2016).

f. Reorientation towards improved community action and people-centeredness

Reorientation of health systems towards improved community action and people-centeredness has also been called for since the 1978 Alma-Ata Declaration. Individuals are the main health resource and their voices are of utmost importance to healthcare (WHO, 1986). Specifically, people have the right and duty to participate individually and collectively in healthcare planning and implementation (WHO, 1978). Collective efforts are then central to foster healthy public policy as these efforts ensure community involvement and control (WHO, 1988; WHO, 1991). To achieve people-centeredness, there is also a need for community capacity and empowerment (WHO, 1997;

WHO, 2004; WHO, 2005; IUHPE, 2008; WHO, 2009d; HSG, 2012; WHO, 2013e; HSG, 2014; Mahidol, 2016).

g. Determining appropriate metrics and developing better monitoring and evaluation processes for health systems

Monitoring and evaluation of health system processes and determining more appropriate metrics are also needed to assess the impact of policy (WHO, 1988) and to make health services more responsive to people's needs (WHO, 1997; HSG, 2014). Evidence from monitoring and evaluation also guides the design and implementation health system reforms (WHO, 2008b) as it considers the complexity of health systems, policies, and implementation processes; thereby, capturing the historical origins, current status and future long-term health impacts (HSG, 2012; WHO, 2004; IUHPE, 2008; Mahidol, 2016). Essential to these monitoring mechanisms is the development of adequate health and social measures, which are responsibilities of the governments (WHO, 1978). Measures include developing and using indicators, their methods, and instruments to assess health progress and reduce mortality and morbidity (IUHPE, 2008; WHO, 2008b; HSG, 2010; HSG, 2012). In addition, developing conflict of interest measures (WHO, 2013e) and agreeing on clear targets and indicators for health systems strengthening (Mahidol, 2016) are also needed.

h. Creating supportive environments for health and addressing key health determinants

Supportive environments may mean proper loving and working environments (WHO, 2013e), effective environments (HSG, 2014), or enabling environments for priority setting processes (Mahidol, 2016). These environments are essential for health promotion (WHO, 1986; WHO, 1997; IUHPE, 2008) and serve as the main aim of healthy public policy (WHO, 1988). Further, these environments also call for the inevitable need to prevent and control diseases from locally endemic diseases (WHO, 1978), new and re-emerging infectious diseases (WHO, 1997; Catford, 2000; IUHPE, 2008), mental health problems (WHO, 1997), other communicable and non-communicable diseases (WHO, 2004; WHO, 2008b; HSG, 2010), sexual and reproductive health, injuries, violence (WHO, 2004), and maternal and child health (WHO, 1978; WHO, 2009d; HSG, 2010). Lastly, these environments also include promotion of food supply and proper nutrition (WHO, 1978; WHO, 1986; WHO, 1988; WHO, 2009d).

i. Calls to action from different health system actors

All health system actors such as governments, the international community, funders, and research community are also called for to increase accountability for health (WHO, 1978; WHO, 1988; WHO, 1991; WHO, 1997; Catford, 2000; WHO, 2004; WHO, 2008b; WHO, 2013e). Actors were also called to build capacities that will help advance the promotion of health and proliferate funding for health, health systems, and health research (WHO, 1978; WHO, 1988; Mahidol, 2016; WHO, 2008b; HSG, 2014; WHO, 2013e; WHO, 2004; WHO, 2012c; WHO, 2009d). In addition, health actors were called to improve guidelines and policies based on the principles of sustainable development (WHO, 1988; WHO, 2005; WHO, 1991; WHO, 2009d), assist the development of enabling environments for health and health systems, and increase their commitment to health. Further, health actors should coordinate and strengthen current health and health system networks (WHO, 1978; WHO, 1988; Jakarta Declaration; WHO, 1997; WHO, 2008b; WHO, 2013e; WHO, 2004; Mahidol, 2016; WHO, 2009d). Health actors were also invited to share the key health messages, and establish activities to communicate, improve access to, and promote the utilization of health information (WHO, 1997; WHO, 2004; WHO, 2013e).

1.4 Reframing health service delivery to address system-wide priority areas

Findings showed nine themes, which were common among all 16 statements delivered from 1978 to 2016 (Figure 1.7). These themes echoed across all health actors and were not driven by individual or organisational health priorities. Instead, the themes reflected global consensus among the different health systems actors that may also have conflicting interests. As such, these themes can be a good starting point to resolve any conflicting interests for health investments. Hence, these themes demonstrate priority areas for health that resonate across various health actors, serving as a tool to achieve the health goals across sectoral boundaries.

The years 1998 to 2008 were considered as the grand decade of global health (Lidén, 2013), when global health approaches shifted from a problem-focused to a more system-focused approach. Specifically, the main approaches include establishment of partnerships, improved coordination, and attempts to introduce objective evidence-based decision-making for the allocation of multilateral resources (Lidén, 2013). However, I found that these themes have been called for even before the grand decade of global health. What seems to change in 2008 was not the approach, but the emphasis given to these key themes (Figure 1.8). In 2008, two key statements with global impacts, Shaping the future of health promotion and the Tallinn Charter, have specifically been identified. As such, although the nine themes consistently resonated throughout the years, the

intensity of the messaging around the themes change with some years stressing one area over the others (Figure 1.8). Nevertheless, systems-wide dimensions of equity, universal health coverage, and governance have remained common areas of interest, implying that global health approaches have ever since taken a comprehensive view of health. Hence, moving the discussions forward would always require going beyond the organisational vision and avoiding the risks of overlooking significant global health dimensions.

The repetitiveness in the themes may seem to be interpreted in two ways. First, these themes meant consistency in the global health approaches that transcends beyond the political will and conflicting interests of the Member States. On the other hand, this repetitiveness may also be viewed as a cyclical global health process or a never-ending global health burden without much progress, implying that more innovation is needed to move the discussions forward. To innovate, reporting on progress against these identified key themes should be considered. This reporting will guide further tracking and monitoring of progress made against key issues identified and ensure that statements were not just cyclical and rhetorical. To facilitate reporting on progress, recent developments in health information systems create timely opportunities (Ledikwe et al., 2013). Using advances in information systems, global health targets should be backed up by relevant data for each recognized theme to also unify sporadic global health efforts. To improve health information systems especially data availability and quality, international stakeholders have conducted consultative workshops, particularly with LMICs (COHRED, 2005). These data can be starting points for further academic work on each of the themes and to facilitate their translation for evidence-informed decision-making (Rice, 2013).

Other than tracking progress against these themes, another challenge is on propose concrete actions to address HSS issues. In particular, impact assessment and results framework are seldom developed to monitor global health statements. An interim assessment mechanism for these themes may include setting concrete parameters for each of the priority themes agreed upon. Hence, tracking progress and proposing concrete actions should be part of a shared accountability among the various health actors. Specifically, accountability implies the existence of well-established transparent processes for monitoring progress and performance of the different stakeholders in achieving their own targets. Accountability is also needed to inform current processes for health planning and decision-making. Other than accountability, the themes and other priority areas by each organisation should always be made transparent to the broader community. To achieve

transparency, statements should be made to include a more inclusive policy dialogue and better evidence-informed healthcare decisions.

Overall, examining these statements was vital to determine priority areas in global health. Not only will monitoring health statements enhance accountability and inclusiveness of the different health stakeholders, it will also provide an overview of the state of governance in global health and how inter-sectoral actions, as well as both small-scale and large-scale actors affect progress and performance in healthcare. This chapter was intended to provide a global overview of the health systems situation with statements that have global implications. Given this objective, any statements with implications specific were excluded. For example, many statements were found from the US National Institutes of Health, but the implications of these statements were also limited within the jurisdiction of the US. Future studies may examine these statements at a national level. Ideally, global health statement and commitments should be accompanied by clear objectives, goals, and monitoring and evaluation processes, which reflect sound logic and sufficient robustness. It may also include proposed budgets, as well as more specific, measurable, and attainable targets and strategies for health systems strengthening. Future studies may consider expanding these statements to include other consensus documents of different health actors. More importantly, future studies should examine related data sources and other relevant indicators to track progress against these global health themes.

To examine these data sources and indicators, this thesis further examines the different aspects of health systems, and the potential measures that can be used to frame a more comprehensive monitoring and evaluation system for health care services. Future chapters use the themes identified from this chapter to guide further work on developing an HSS framework (Chapter 2), and examining potential and existing HSS indicators (Chapter 3) before applying these HSS measures in global (Chapters 4 and 5) and national contexts (Chapter 6).

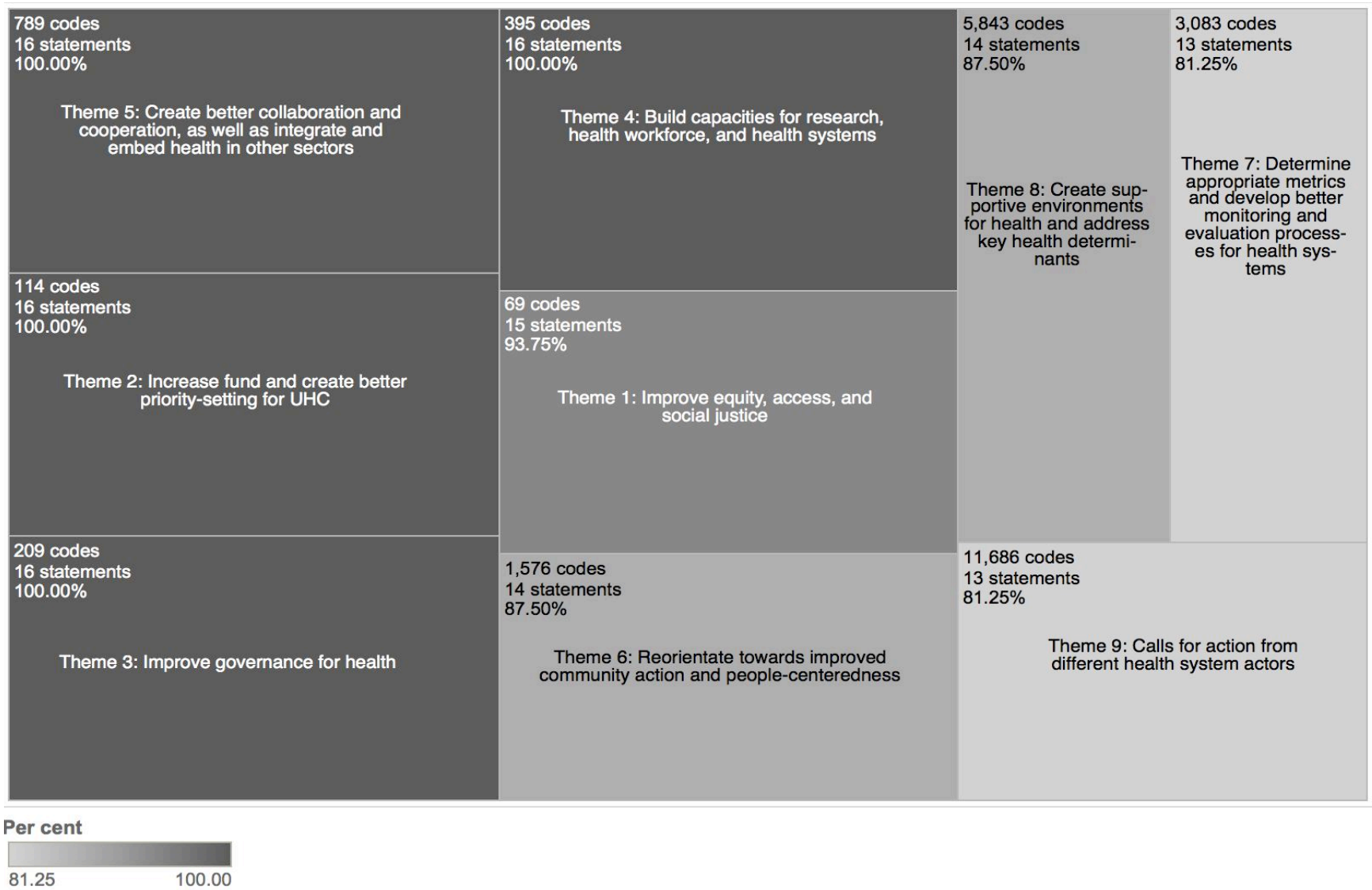


Figure 1.6 Nine common themes identified from the thematic analysis. These themes were found common across all the sixteen global consensus statements delivered from 1978 to 2016

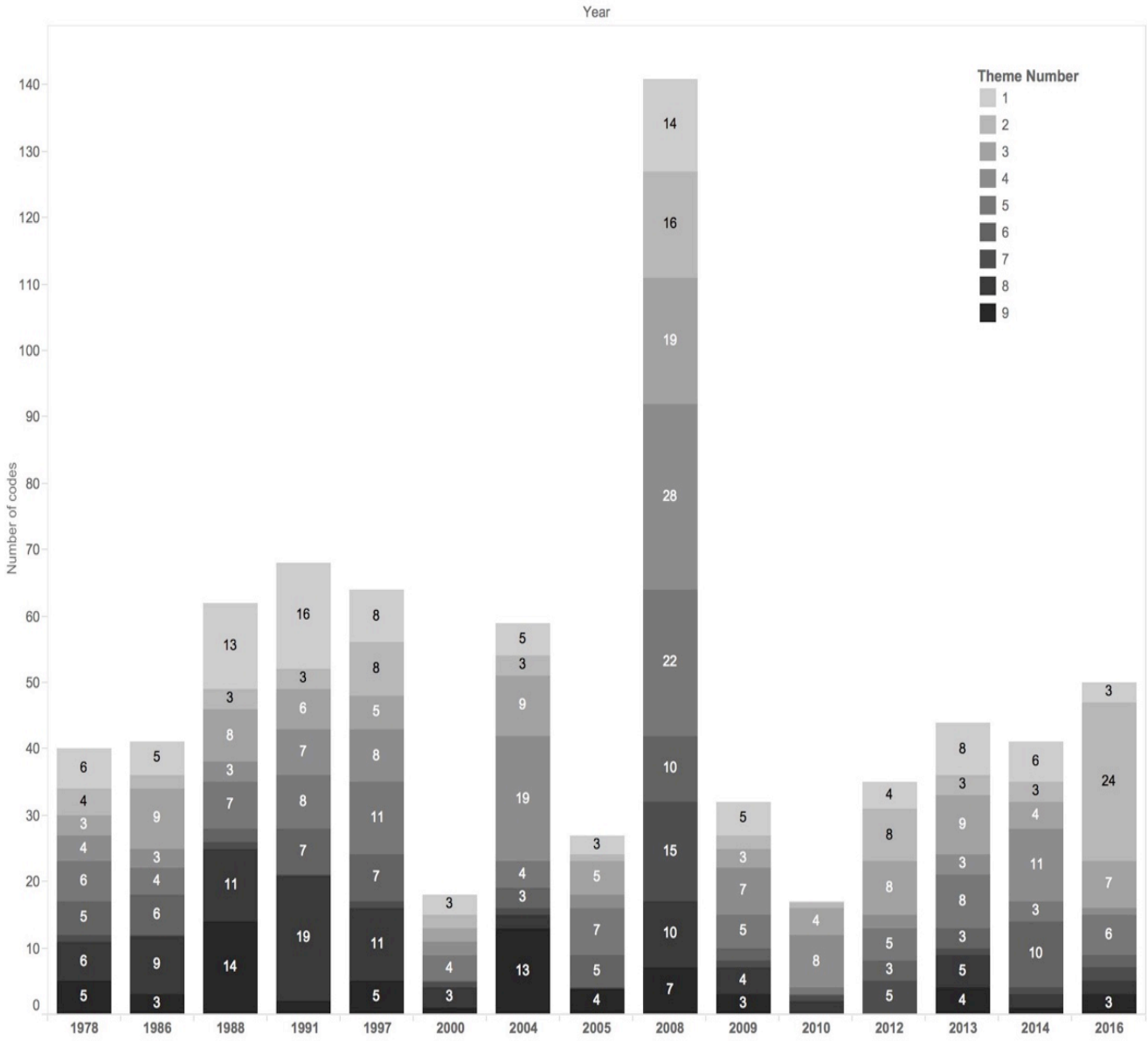


Figure 1.7 Diversity of thematic areas and the number of codes identified per year of publication. The number of words (codes) related to the nine thematic areas that were found from the sixteen global consensus statements. These codes were plotted against the years when the associated consensus statement was delivered from 1978 to 2016.

Chapter 2 HSS performance theoretical frameworks and key actors

Chapter One identifies nine common themes emerging from global health statements that highlight how global health discussions moved towards system-wide priority areas for health. It also discusses the need to provide clearer and more specific health targets, as well as provide concrete measures to monitor such targets. By examining existing concepts, frameworks, and domains used, as well as key health actors, for HSS monitoring and evaluation across the WHO European Member States, I developed an expanded theoretical framework for conceptualising HSS based on an analysis of country-driven frameworks from the 53 Member States of the WHO Regional Office for Europe and using the WHO health systems building blocks framework. Overall, this chapter provides baseline information on how HSS monitoring and evaluation is being done across the European Region. Where data permit, I developed a template for HSS monitoring and evaluation framework and processes that other countries can use as a guide for their own. This chapter is based on research I did during an internship with the WHO Regional Office for Europe Division of Information, Evidence, Research, and Innovation. Using internal documents, transcripts of interviews made among select WHO Member State representatives, administrative data and other health systems-related reports published online and provided by the WHO Europe's Country Offices, I examined existing HSS frameworks and domains used by select WHO Europe Member States to monitor and evaluate HSS initiatives. Findings were used to inform ongoing research on Europe's regional HSS monitoring and evaluation guidelines using the HSS definitions, domains, indicators, and processes examined in this chapter.

2.1 Defining health systems strengthening

In examining HSS initiatives, it is first necessary to define health systems and other related concepts. (Hammer & Burill, 2012). Generally, health systems are defined using the WHO's definition, which refers to all activities whose primary purpose is to promote, restore or maintain health (WHO, 2009c). Specifically, HSS is described as improving the six health system building blocks (governance, financing, service delivery, medical products and technologies, health workforce and health information systems) and managing their interactions to achieve more equitable and sustained improvements across health services and health outcomes (WHO, 2000). Due to complexity and the multifaceted relationships among health systems functions, it is difficult to operationalize the definition of HSS that will be useful for more dynamic and holistic monitoring and assessment processes (De Savigny & Adam, 2009). As such, although the thesis is initially

guided by the WHO health systems definition and the WHO Health Systems Building Block framework, findings revealed other relevant health system areas, which are also existing measures used by the Member States.

2.2 Research gaps in HSS assessments

Health policymakers have emphasized the importance of using health systems evidence to improve performance (El-Jardali et al., 2012). To provide evidence, HSS monitoring and evaluation can help determine aspects of health systems that significantly influence health outcomes and enable resource allocation to make service delivery more efficient (Palen et al., 2012). Determining these aspects will aid governments that are pressured to provide better health services, while also restraining taxation levels (Lopez Acevedo, Krause, Mackay, & World, 2012). These scenarios motivated governments to create formal systems for monitoring and evaluation on a regular, planned and systematic basis to provide evidence and inform health decision-making processes (Lopez Acevedo et al., 2012).

However, conceptualising health systems and assessing their performance are driven by two competing needs. On the one hand, there is a need to have a common framework and agreed-upon measures. On the other hand, different countries have different capacities to comply with a common framework. Country-specific contexts also matter, implying that a common framework and set of measures may not be as responsive to local needs considering the country's priorities, levels of resources, data availability, and local capacity to monitor and evaluate. Therefore, there is a need for a framework that is general enough to be applicable in different contexts but is also able to accommodate within country differences (Berman & Bitran, 2011; Murray & Frenk, 2000). Hence, multilateral organisations recommended that countries should have their own HSS framework and measurement systems that are more likely in line with their national priorities and health needs (Papanicolas & Smith, 2013).

However, not all countries have the capacity to do their own HSS frameworks and measures. In a report released in 2015 by the WHO European Region, only 32 of the 53 Member States claimed to have an existing HSS monitoring and evaluation system, of which mostly are poorer countries (Tello & Baez-Camargo, 2015). Despite the need for evidence to guide allocation of their limited resources, poorer countries have less capacity to conduct data collection and monitoring systems. These countries also tend to have national monitoring and evaluation systems that were also chronically challenged by persistently incomplete reporting and inaccurate data, which undermined

the translation of evidence into policies and practices (Ekouevi, Karcher, & Coffie, 2011). To address this gap, comparative HSS assessments may be able to respond to the limited availability of comparable data, while providing a vast potential for both within and cross-country learning (Murray & Frenk, 2006; Nakaima, Sridharan, & Gardner, 2013; Papanicolas & Smith, 2013; Rasmussen, Collins, Doty, & Garber, 2013). However, challenges remain on how evidence from HSS assessments of other countries can be used to improve current HSS efforts (De Savigny & Adam, 2009). To ensure responsiveness to current health needs and health systems priorities, community participation for HSS monitoring and evaluation is significant (Donnelly et al., 2011; Valdez-Vivas et al., 2015). Communities play a vital role in setting the scene, priorities and also future directions of HSS and should, therefore, be mapped and analysed (Hoffman, Røttingen, et al., 2012). Therefore, aligning HSS with national priorities and health needs requires better understanding of how health systems interact with the wider economic, political and social structures (Papanicolas & Smith, 2013).

2.3 HSS monitoring and evaluation in the European context

HSS monitoring and evaluation in Europe and beyond has largely been catalysed by various organisations, signature events and policy or program statements and frameworks (Avila, Menser, & McGreevey, 2009). For example, the Organisation for Economic Co-operation and Development (OECD) convened policymakers to discuss progress in pursuing a performance measurement and improvement cycle (OECD, 2002). This event included studies on international comparisons highlighting important aspects of performance, and outlined the range of levers that policymakers and healthcare managers can use to improve their health systems (OECD, 2002). Meanwhile, the Member States of the WHO Regional Office for Europe committed to improve people's health by strengthening health systems, acknowledging that high-performing health systems contribute to economic development and wealth in 2008 (WHO, 2010a). These commitments formed part of the Tallinn Charter that also calls for more health systems investments, as well as promoting transparency and accountability for HSS to achieve measurable results and health system reforms (WHO, 2010a). To implement the Tallinn Charter, the WHO supported its Member States in the development of health systems and in providing cross-country coordination, as well as the measurement of performance and the exchange of experiences in implementing their commitments (WHO, 2010a).

In addition, the European Observatory on Health Systems and Policies also reported about the various opportunities and challenges for performance measurement, examined the levels at which

HSS assessments were to be undertaken, and outlined the technical instruments and tools available, as well as their implications for policymaking (P. Smith, Mossialos, & Papanicolas, 2008). Since then, many other notable health systems publications were released (P. Smith et al., 2008; WHO, 2012a; WHO, 2012b). In 2014, the European Commission along with its Member States also formed an Expert Group[3] on HSS monitoring and evaluation, specifying the need to better understand how health systems were progressing and to use this information to carry out HSS interventions. The Commission also noted that a sound HSS was essential to identify good and bad practices, strengthen the effectiveness of care, increase accessibility, and improve patient-safety (EuropeanCommission, 2015b). HSS assessments have also been widely emphasized in many of the Commission's high-level meetings (EuropeanCommission, 2015d). The Expert Group also emphasised the importance of developing practical, accessible and resilient health systems and of creating modern, responsive and sustainable health systems (EuropeanCommission, 2015c). In 2015, German Chancellor Angela Merkel and the WHO Director-General Dr Margaret Chan also highlighted the need for all countries to have stronger and more resilient health systems (WHO, 2015i). However, resilience cannot be achieved without a better understanding of how current health systems are performing (Avila et al., 2009; Dalziell & McManus, 2004). To support these health systems monitoring, baseline information on the existing HSS domains and indicators are needed.

To summarise the various activities done by the Member States to strengthen health systems accountability, the WHO European Region conducted a study, which found that some Member States were developing overarching national health strategies for a whole-of-government responsibility, rather than health sector plans (Tello & Baez-Camargo, 2015). This scenario created new challenges when it came to monitoring HSS, as it expanded the scope beyond the five health systems building blocks defined by the WHO. The Report also showed that at least 32 of the 53 Member States claimed to have HSS assessments already in place, of which some also had existing HSS indicator packages (Tello & Baez-Camargo, 2015). By 2020, the WHO European Region envisions improve health for all, reduce the health divides, and improve leadership and participatory governance for health (WHO, 2013b). To do these visions, the Region plans to invest in health through a life-course approach and people empowerment; tackle Europe's major health challenges: NCDs and communicable diseases; strengthen people-centred health systems, public health

[3] This Expert Group included members from Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

capacities and emergency preparedness, surveillance and response; and, create resilient communities and supportive environments **(Table 2-1)** (WHO, 2013b).

Table 2-1 The Health 2020 European Policy Framework

Two strategic objectives:			
Working to improve health for all and reducing the health divide		Improving leadership, and participatory governance for health	
Four common policy priorities for health:			
Investing in health through a life-course approach and empowering people	Tackling Europe's major health challenges: NCDs and communicable diseases	Strengthening people-centred health systems, public health and capacities and emergency preparedness, surveillance and response	Creating resilient communities and supportive environments

Source: WHO 2015

Countries also adopted a European policy framework and strategy for the 21st century titled Health 2020, wherein one of the priority areas focused on strengthening people-centred health systems (WHO, 2012d). This monitoring framework is intended to identify the core areas of health and highlights the need for establishing accountability mechanisms for every country (WHO, 2013b).

Table 2-2 Health 2020 Policy Monitoring Framework

Reduce premature mortality	**Increase life expectancy**	**Reduce inequalities**	**Enhance well-being**	**UHC and right to health**	**National targets**
Premature CVD, cancer, diabetes, and chronic respiratory mortality **Tobacco use** **Alcohol consumption** **Overweight and obesity** **Vaccination coverage** **External causes of mortality**	Life expectancy at birth	Infant mortality Life expectancy at birth Primary school enrolment* Unemployment rate* National inequality policies GINI coefficient	Life satisfaction Objective indicators	Out-of-pocket expenditure as percent of total health expenditure Vaccination coverage Total health expenditure as percent of gross domestic product	National policies aligned with Health 2020 Implementation plan Accountability mechanism

Source: WHO 2015

Examining HSS was particularly relevant in the context of the European Region, where there was wide variability in HSS monitoring and evaluation practices (Tello & Baez-Camargo, 2015). Since countries within the European Region are members of many international organisations that are

doing HSS, there is a need to better understand these existing concepts and measures before attempting to develop standardised HSS frameworks and measures. Furthermore, different international organisations may have different HSS frameworks that were provided to countries as a guide thereby potentially creating confusion and in some cases, reporting nightmare. Hence, this makes examining the overall picture of what HSS is for these countries extremely important. WHO had the widest reach across Europe with 53 Member States as of April 2016. Of these 53 Member States, 20 of them were exclusive only to the WHO Europe and were not part of the OECD and the European Commission. 28 of the WHO Member States were also members of the European Commission and 26 of the WHO Member States are also members of the OECD. 21 Member States were also members of both the European Commission and the OECD.

Table 2-3 International organisation memberships of the countries in the European Region

Membership:	**Number of countries:**	
Exclusive to the WHO	20	Albania, Andorra, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyzstan, Macedonia, Moldova, Monaco, Montenegro, Russia, San Marino, Serbia, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan
Both the WHO and the OECD	5	Iceland, Israel, Poland, Switzerland, and Turkey
Both the WHO and the European Commission	7	Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta, and Romania
All: WHO, European Commission, and OECD	21	Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, and United Kingdom of Great Britain and Northern Island

Source: Author's computations using internal data from WHO Europe (last updated August 2015)

Given that there are various frameworks, concepts and approaches that were being utilised by each of these international organisations such as the OECD and the European Commission, determining existing HSS measures is not only vital to ensure coherence and achieve a minimum degree of comparability across all countries. Moreover, a better understanding more country-driven HSS processes will prevent any potential confusion in the recommended approaches or in setting guidelines for HSS monitoring and evaluation across countries, while limiting or eliminating any reporting burden to countries. Such an approach is expected to lead to better country-specific population health goals (Gottret, Schieber, & Waters, 2008). As specified by Tello and Baez-Camargo (2015):

> *"The process of reviewing and assessing HSS against stated outcomes enables decision makers to develop and implement the necessary measures to assure continued improvement of health outcomes in an evidence-based manner"* (Tello & Baez-Camargo, 2015).

Given the variety and complexity of existing HSS frameworks and monitoring and evaluation initiatives, this chapter examines HSS as used in the European context by identifying the different definitions, critical domains, and indicators used by the Member States. It also explores why Member States undertake HSS and describes the principal actors involved in conducting HSS. This approach allows me to develop a consistent conceptual framework and provide a set of recommendations for appropriate measurement, monitoring and evaluation. Based on field observations and to the best of knowledge, no previous research has examined and described the different packages of system level indicators for HSS through a bottom-up approach. This has highlighted these concepts and measures in such depth and breadth across the different HSS domains and indicators used by each Member State. Findings were expected to assist other countries in developing and designing HSS monitoring and evaluation systems and towards achieving the health systems targets set in the Health 2020 Policy Framework and the Tallinn Charter that Member States committed into.

2.4 Conceptual framework

As discussed above, the European Region was characterised by a broadly common approach to HSS monitoring and evaluation, with general dimensions and similarities, but also country-specific variations. To deal with this variability, I used a conceptual framework that identified core dimensions involved in HSS to capture the relevant information pertaining to HSS, while still taking into account the different approaches currently in place across the European Region. Strengthening health systems was one of the six items on the Agenda of the WHO and it envisioned to establish core and additional health system metrics to track health system performance for use by countries and external agencies (WHO, 2010a). Through this, governments may be able to monitor their progress and be more informed on whether their investments in health systems have actually translated to better health outcomes (WHO, 2010a).

Other international organisations and government agencies such as the World Bank, United States, Australia and other OECD countries follow their own HSS monitoring and evaluation framework. In this study, I used the WHO health systems building block framework to further operationalise the definitions of health systems and its core HSS requirements. I chose the WHO health systems framework because all the 53 countries included in this research were WHO Member States. This framework included six essential health system building blocks: service delivery, health workforce, information, medical products, vaccines and technologies, financing, and leadership/governance

(WHO, 2015d). Intermediate results of effective and efficient health systems building blocks were expected to include improved access, coverage, quality and safety of health services (WHO, 2015d). These were all vital to achieve the expected overall goals and outcomes of a health system (WHO, 2015d).

2.5 Methods

2.5.1 Data sources

Data sources include health systems-related documents (e.g. national strategic plans for health or health systems, HSPA reports, national health target reports) for each Member State. Initially, I purposively sought for the HSPA reports cited in the Accountability Study. Then, I searched for other health system-related documents from the websites of ministries of health, national boards of health, national health institutes or agencies, other government resources, and publications of international organisations (i.e., WHO, European Commission, the OECD). I gathered health systems-related documents published from 1993 to 2016. These documents include national health accounts, joint annual reviews, national health targets and other health development strategy reports, health systems in transition reports, and health system reviews from international organisations.

2.5.2 Selection criteria and screening process

Initial data collection resulted in 640 records, which included 326 publications from PubMed and Embase (n = 326); national health accounts, joint annual reviews, and other health development strategies or health target reports taken from official websites of national institutions (n = 134), health system reviews conducted by international organisations such as OECD and the European Commission (n = 11), health systems in transition report of the European Observatory on Health Systems and Policies (n = 84), and records identified through database searching (n = 85). Of the 640 records, 312 duplicates and documents without publicly available records were removed and 328 records were retained. Fifty-seven documents, of which 51 documents focused on regional comparison of health systems performance and not on country-level measurement, were further removed. The other six documents removed from the final selection focused on discussing general concepts of health systems performance instead of existing health systems measures used by the Member States. These studies were excluded in the analysis because the focus of the research was

on country-driven HSS monitoring and evaluation that should also reflect concrete measures on national level HSS initiatives. After this initial screening, I was left with 271 documents.

Each Member State may have several reports related to HSS such that one Member State may have an OECD health system review, health systems in transition reports (HiTs), and an HSS report released in different years. Since the goal of this research was to describe the most recent HSS monitoring and evaluation practice in each WHO Member State, I selected only the latest report per Member State for further analysis. The selection follows this order of preference: complete HSS reports, partial HSS reports, national health systems reviews, national strategic reports, national health targets, joint annual reviews, OECD health systems reviews, HSS articles or journals and HiTs. Per consultations with WHO experts, I gave priority to documents that explicitly stated that it was an HSS report e.g. title used or the description of the report stated that it was an "HSS monitoring and evaluation" report or a "health systems (performance) monitoring and evaluation" report. These reports may either be complete (n = 9) or partial (n = 6) for every Member State. A complete HSS report had HSS domains and indicators explicitly stated. A partial HSS report meant that it provided information about the conduct of HSS in the Member State but did not necessarily provide a comprehensive list of HSS indicators. The second type of report included interview transcripts from the WHO Regional Office for Europe. To get these transcripts, key representatives from the Member States' Ministry of Health were interviewed to provide their insights on how they do HSS monitoring and evaluation. I included partial HSS reports in the study because they still reported HSS domains that can provide insights into the HSS priority areas of each country. For those Member States without any full or partial HSS report, a national strategic report or review (n = 34) was then selected next since these reports were country-driven and still reflected HSS priority areas. To be included in the study, these reports should also have a section on "assessing health systems" or "monitoring and evaluating HSS."

OECD health systems studies (n = 3) then followed, after which HiTs (n = 20) were used. The order of preference for the documents was consulted with the WHO Europe. All HiTs were considered as national strategic reports. OECD reviews of health systems were in-depth studies of the health system of Member States with a particular focus on economic issues (Arah et al., 2006; Hurst & Jee-Hughes, 2001; Reinhardt, Hussey, & Anderson, 2002). OECD reports assessed the performance of health systems in a comparative context, identified the main challenges faced by the country's health system and put forward policy options to better meet health systems challenges (Arah et al., 2006; Hurst & Jee-Hughes, 2001; Reinhardt et al., 2002). According to the OECD, these reviews were initiated at the request of the country to be examined, placing emphasis on specific issues of

key policy interest (Arah et al., 2006; Hurst & Jee-Hughes, 2001; Reinhardt et al., 2002). Each report described the country's health system, assesses its strengths and weaknesses regarding access and insurance coverage, responsiveness to patient needs and quality of care, efficiency in health service provision, and financial sustainability (Arah et al., 2006; Hurst & Jee-Hughes, 2001; Reinhardt et al., 2002). It also included an analysis of the major recent reforms or programs of particular relevance to the country and recommended how to address policy and performance challenges (Arah et al., 2006; Hurst & Jee-Hughes, 2001; Reinhardt et al., 2002). OECD reviews of health systems were informed by comparative data analysis, specific indicators and benchmarking of policies from other OECD countries (Arah et al., 2006; Hurst & Jee-Hughes, 2001; Reinhardt et al., 2002). The OECD Secretariat analysed the country-specific documentation and data for the country under review (OECD, 2015a). Meanwhile, health systems in transition series (HiTs) were used to provide an overview of the health system (Albreht et al., 2009). HiTs were reports from the European Observatory on Health Systems and Policies, which *"systematically described the functioning of health systems in countries as well as reform and policy initiatives in progress or under development"* (EuropeanObservatory, 2015a). HiTs were available for most WHO Member States, as well as some additional OECD countries, were updated on a regular basis, and were mostly available in English (Albreht et al., 2009; Glenngård, Hjalte, Svensson, Anell, & Bankauskaite, 2005).

I consulted WHO's HSS experts throughout the study selection. Overall, 52 documents were selected for final analysis and to represent the most recent HSS practice for each of the 52 (out of 53) Member States of the WHO Europe. I did not find any relevant document to reflect HSS measures used in Serbia, and the documents used in Israel did not list any indicators. All the documents selected for analysis were in English. I excluded reports in local languages due to limited capacity for translating the contents of the report. Each WHO country office or the Ministries of Health contacted for the study was also not required to provide translated materials in English. As of date, they were not contacted again to validate or verify the selected HSS reports used for the analysis.

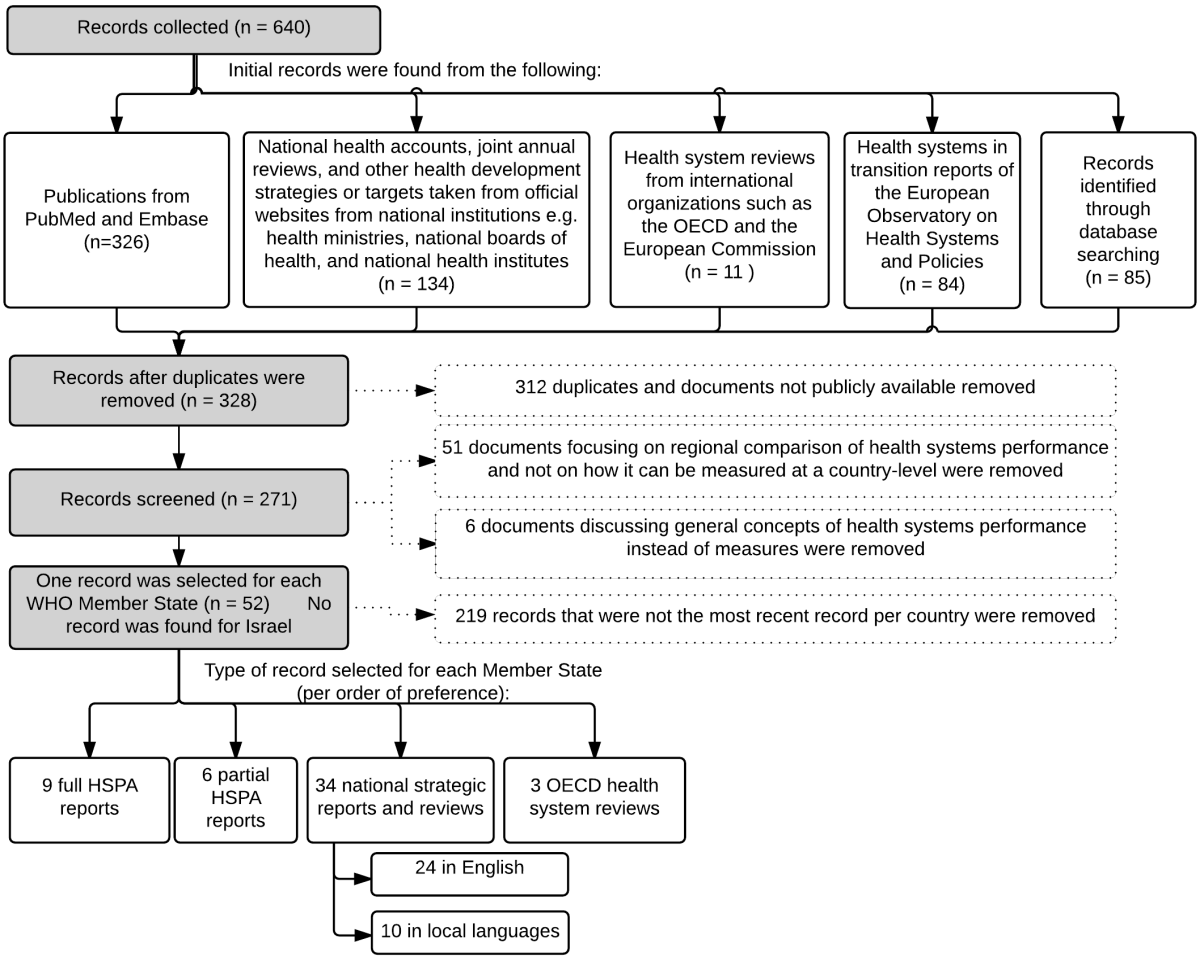


Figure 2.1 Selection flow diagram

2.5.3 Analysis

To extract the data, I copied any health systems domains and indicators identified from the document into an excel spreadsheet. In the excel sheet, I created two categories: themes and indicators. Specifically, I copied the headings of the report in verbatim and categorized them as "themes". Similarly, any subheading and figure or table titles were copied as is and categorized as "indicators". Every indicator corresponds to its theme that was specified in the document. The list resulted to about 3000 indicators. I, in collaboration with two other health systems researchers, screened the list and retained the information if the indicator: a) assesses health system performance or progress, b) is measurable and specific, and c) has data that is readily available or can be reasonably collected. I also removed any duplicates in the indicators. After repeatedly screening the list, I retained 2,282 indicators. Further, I also extracted HSPA frameworks illustrated in any of the documents we have initially collected regardless of whether the report satisfied our initial inclusion criteria or not. Overall, I found 13 HSPA frameworks.

During the initial phase of the study, I coded each heading in the report and classified them as 'HSS domains' and any specific indicators for each heading in the HSS report were also coded and classified as 'HSS indicators.' Each HSS domain was then clustered under each of the WHO health systems building blocks as discussed in the section above. I did a semantic similarity analysis (SSA) to identify domains and indicators used for HSS monitoring and evaluation by calculating the normalized Google distance for each identified domains. Keywords with the same or similar meanings in a natural language sense tend to be close in units of normalised Google distance, while words with dissimilar meanings tend to be farther apart. Specifically, the normalized google distance between two keywords x and y is:

$$NGD(x,y) = \frac{\max\{\log f(x), \log f(y)\} - \log f(x,y)}{\log N - \min\{\log f(x), \log f(y)\}} \quad (2.1)$$

where N is the total number of web pages searched by Google multiplied by the average number of singleton search terms occurring on pages; *f(x)* and *f(y)* are the number of hits for search terms *x* and *y*, respectively; and *f(x,y)* is the number of web pages *n* which both *x* and *y* occur (Cilibrasi & Vitanyi, 2007). If *NGD(x,y)* = 0 then *x* and *y* are viewed as likely possible, but if *NGD(x,y)* ≥1, then x and y are very different (Cilibrasi & Vitanyi, 2006, 2007).

After retaining similar words, I then used the Cortical.io keyword extraction software (http://www.cortical.io/keyword-extraction.html) to generate the keywords from the pool of domains identified (De Sousa & Eduardo, 2016). The Cortical.io is a natural language processor and an automatic keyword generator, search engine optimizer, and content classifier (De Sousa & Eduardo, 2016). It works by parsing the input text and creating a semantic fingerprint for the entire input test as well as for each of its individual terms (De Sousa & Eduardo, 2016). These fingerprints were compared with the text fingerprints to determine their semantic overlap, which is then weighed together with the proportion of occurrences of each term in the input text in comparison with its frequency within the entire coding Retina to determine its overall important to the text (De Sousa & Eduardo, 2016). I also created new HSS clusters for every domain identified from the records that did not directly fall under the WHO health systems building block. For the indicators, I removed any indicator disaggregates or stratifiers (e.g. gender, age, or equity) to identify unique indicators.

2.6 Results

2.6.1 Correlation between types of report and country memberships

I first examined whether countries with most memberships also produced more types of health systems reports (e.g. complete HSS, partial HSS, national health target reports). At least nine different types of reports have been identified as relevant to health systems assessments for countries with memberships for all three international organisations that also have different HSS frameworks: the WHO, the European Commission and the OECD. I collected the most number of documents from the United Kingdom with nine strategic reports, one HiT, one complete HSS report, one partial HSS report, and two health systems reviews. In contrast, I found the least number of reports from Belarus (one HiT), Montenegro (one strategic report). These two countries are also exclusive members of the WHO.

Table 2-4 Types of documents collected per Member State

Number of types of documents	Frequency	Percent
1	4	7.55
2	24	45.28
3	16	30.19
4	5	9.43
5	2	3.77
6	1	1.89
9	1	1.89
Total	53	100

Source: Author's computations using internal data from the WHO Europe 2015
Note: The frequencies referred above include countries with documents written in either English or in local languages. The table only represents the number of documents collected for each country.

A simple linear regression revealed that the number of a country's memberships to international organisations is significantly associated with the number of types of health systems assessment documents produced by that country (ß=0.358; p <0.01).

Table 2-5 OLS estimates for the number of memberships and the number of types of documents published by each Member State

	Types of documents
Number of memberships	0.358**
	0.008
N	53
adj. R-sq	0.111

Standardised beta coefficients; p-values in parentheses
* p<0.05, **p<0.01, *** p<0.001

Source: Author's computations using internal data from the WHO Europe 2015

2.6.2 HSS goals, purposes, and definitions as defined by the Member States

I found that the terms used to refer to HSS vary across the Member States. Alternative terms used in the HSS reports to refer to health systems strengthening include the following:

Table 2-6 Alternative terms used in the reports that were found to be similar to the definitions used for HSS monitoring and evaluation

Terms used	Frequency
health care performance assessment	12
health system monitoring	5
health systems reviews	23
health systems strategy	4
health target indicators	2
healthcare quality and efficiency	1

Source: Author's computations using internal data from the WHO Europe 2015

Some reports have explicitly specified their motivation for conducting an HSS monitoring and evaluation report as listed in Table 2-7 below. These purposes may include the use of HSS as a governance tool or as a means to ensure accountability, while others specified how it can be used as a benchmark for their individual performance over the years compared with other countries.

Table 2-7 Country commitments that motivated the development of an HSS report identified from the records collected

Purpose of conducting HSS	Countries
As part of the commitments to the Tallinn Charter	Armenia, Belgium, Estonia, Georgia, Hungary, Moldova, Netherlands, Turkey
As part of the commitments for Health 2020	Croatia, Czech Republic, Israel
As part of Israel's Healthy People 2010 strategy	Israel
To achieve Health for All	Israel, Georgia
As a follow up to the WHO report on Health Systems in 2000	Israel, Georgia
As a submission to OECD	Sweden, Malta
As a report to funding organisations	Kyrgyzstan

Source: Author's computations using internal data from the WHO Europe 2015

Other uses are identified as follows:

- as a dissemination tool showing health system progress over the years,
- as a monitoring tool for their health systems or as a priority-setting, and strategic or planning tool to assist Member States in making evidence-informed policy decisions,
- as a capacity building tool,
- as a coordinating tool,
- as a health information system tool, and
- as a sustainability tool.

Other than these explicit descriptions the reports contained no further descriptions or explanations of how HSS monitoring and evaluation or what outcomes were achieved after HSS assessments.

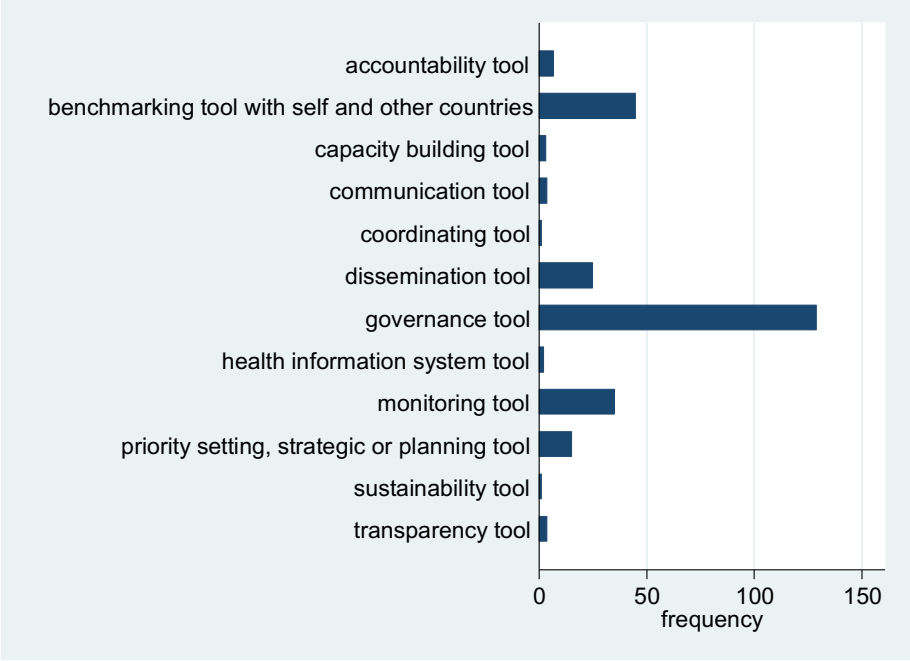


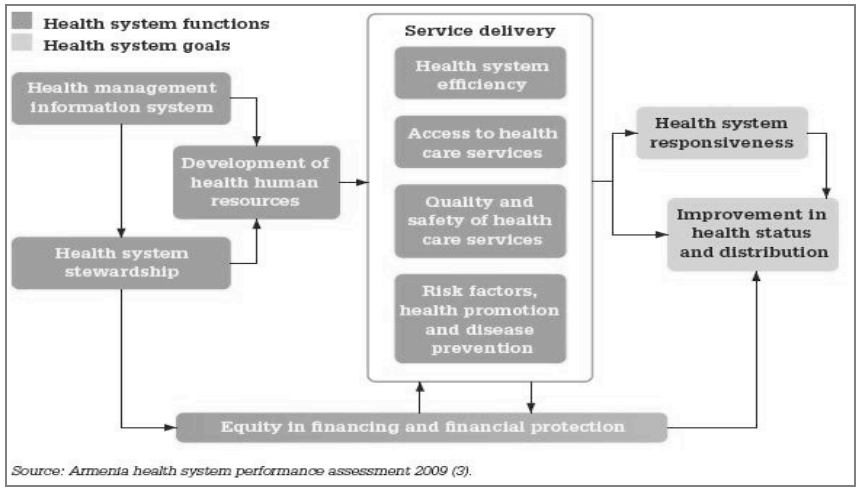
Figure 2.2 Themes for the purposes of HSS monitoring and evaluation as explicitly stated in the reports collected for analysis. Frequency refers to the number of times the specific purpose was mentioned in the report.

Member States also defined HSS assessment in their reports as:

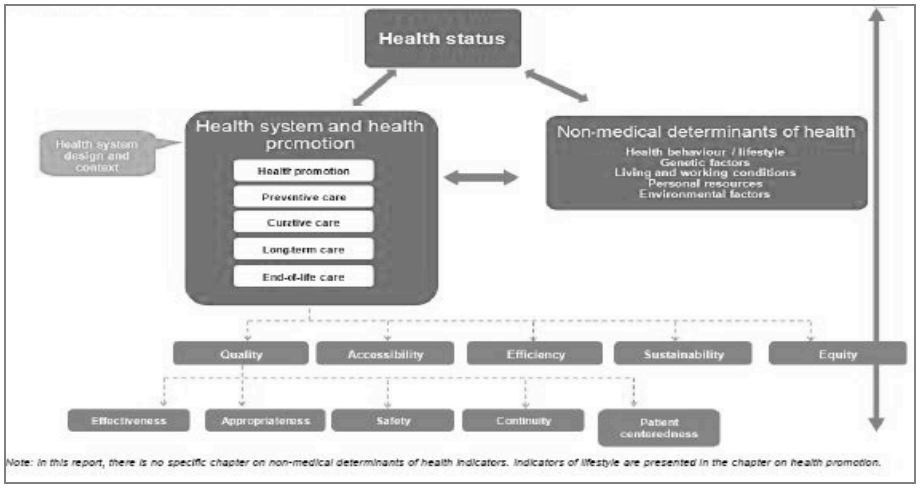
Table 2-8 Sample HSS definitions as reported in the records collected and analysed

Country	Definitions used
Belgium	• A country-owned process that allows the health system to be assessed holistically • A health check of the entire health system • Based on statistical indicators which provide signals aiming to contribute to the strategic planning of the health system • Developed along the lines of a strategic framework specific to the country
Austria	• Assesses both efficiency as well as effectiveness of health care delivery • Includes public health aspect via the integration of a broad range of health-related outcomes (in particular life styles) • Does not include health determinants outside the scope of the health care system, which are usually addressed by Health in All Policies (HiAP) and public health frameworks.

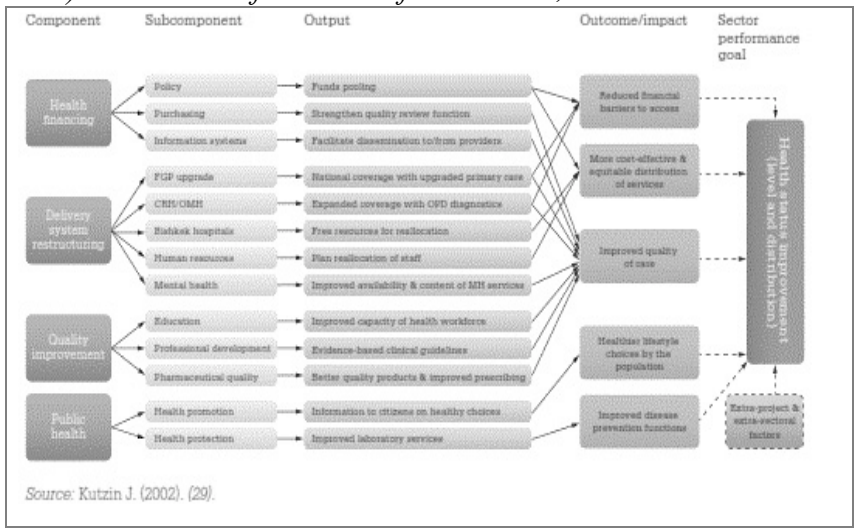
The definitions used in Table 2-8, similar to that of the WHO's, described HSS monitoring as a "country-driven" process used to achieve health systems goals. Further, performance assessments should include specific measures or statistical indicators, as well as other health determinants such as socioeconomic indicators. To further contextualize these definitions, I found 14 Member States to have developed their own national HSS frameworks: Armenia, Austria, Belgium, Bosnia and Herzegovina, Estonia, Georgia, Hungary, Kyrgyzstan, Moldova, Netherlands, Portugal, Tajikistan, Turkey, and the United Kingdom. Sample HSS frameworks are listed in Figure 2.3.



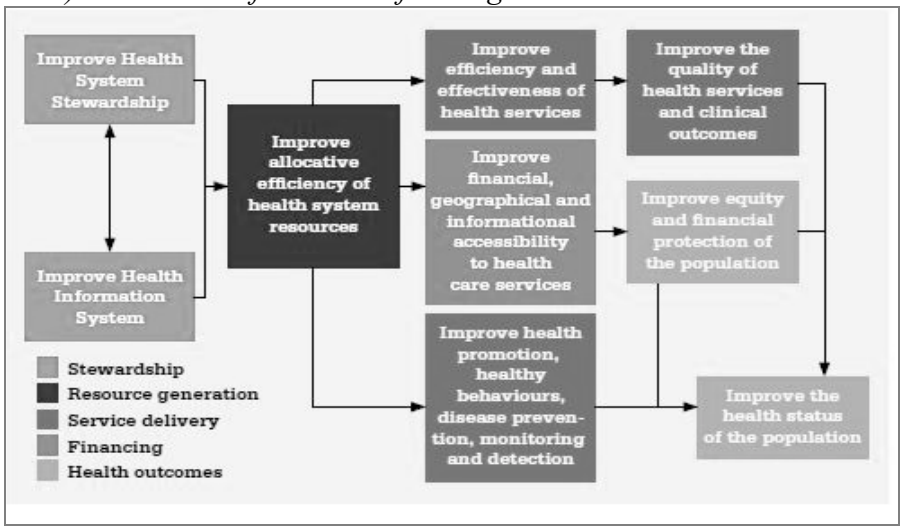
a) Assessment framework for Armenia, 2009



b) Assessment framework for Belgium



c) Assessment framework for Kyrgyzstan, 2002



d) Assessment framework for Georgia, 2009

Figure 2.3 Sample HSS Frameworks collected from the records used in this study

2.6.3 Domains identified and categorized following the WHO health systems framework

Results of the semantic similarity analysis showed wide variability across the different domains used by each Member State. Overall, I found 485 domains used by countries in their HSS monitoring and evaluation. These domains spanned into different health systems contexts, health systems functioning, health outcomes and outputs. I computed for the semantic similarity scores and used the cortical.io to generate keywords. After that, I validated each keyword identified with select experts from the WHO health systems department to determine whether or not they agreed with the semantic analysis results. Figure 2.4 below shows the resulting cortical fingerprint from the semantic analysis of the all collected records generated from cortical.io. This fingerprint is similar to a human fingerprint, which shows the biological identity of a single person. Likewise, a semantic fingerprint is the identity card of a single concept, which defines a unique, descriptive way that the meanings are associated with that concept. This semantic analysis is more comprehensive than other textual analyses because the semantic analysis enables the creation of a unique fingerprint automatically by structuring huge amounts of texts into clusters. As shown in Figure 2.4, each data point, which corresponds to each word, is shown to be related to the specific set of words forming clusters of data points. Each of these clusters was identified and coded as a specific domain of HSS. This computer-generated method is vital for this analysis, which used large textual databases of HSS reports gathered from the 53 WHO Europe Member States.

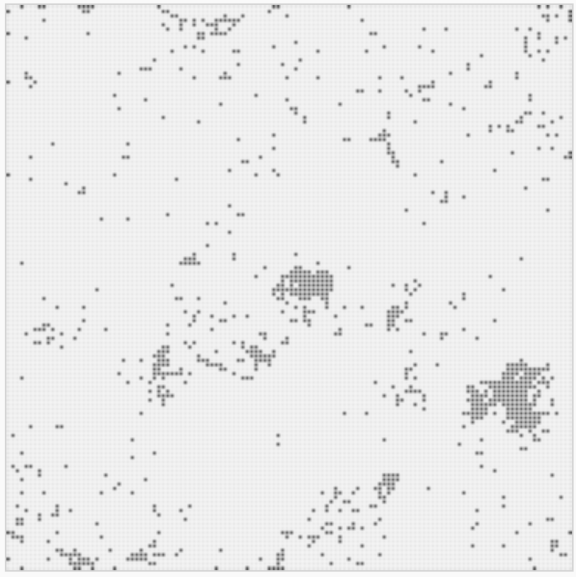


Figure 2.4 Resulting cortical fingerprint from the semantic analysis of all records collected. A cortical fingerprint is used in the semantic analysis to identify clusters of relevant keywords used in the records collected for analysis. Each fingerprint shows the clusters of data points (keywords) identified as the main theme from the records collected.

The identified clusters from the analysis showed 27 keywords (themes) from the 485 sub-domains:

1) access,
2) efficiency,
3) financing,
4) governance,
5) health information systems,
6) health status,
7) medicines and technology,
8) quality of health services,
9) responsiveness,
10) safety,
11) health service delivery,
12) social and financial risk protection,
13) health workforce,
14) appropriateness of service delivery,
15) availability of healthcare services,
16) competence,
17) continuity and sustainability,
18) cultural and environmental contexts,
19) effectiveness,
20) equality,
21) equity,
22) impact,
23) inter-sectoral,
24) assessment of their own monitoring and evaluation system,
25) other health determinants,
26) people-centeredness and empowerment,
27) socioeconomic contexts.

Table 2-9 lists the number of domains found per Member State. Looking at the said list, I found out that the most number of domains was available in Albania (n = 29), Andorra (n = 21), Macedonia (n = 19), Latvia (n = 17), and Sweden (n = 16). However, the least number was found in Austria, Germany, Kyrgyzstan, Monaco, and Russian Federation (n = 3). After doing another semantic analysis for the remaining domains, I uncovered four overarching themes from the initially identified 27 key domains:

a) determinants or domains that described the contexts surrounding the HSS,
b) health systems functions, which referred to each of the WHO health system building blocks identified by the WHO Health Systems Framework (WHO, 2010a),
c) intermediate results, which referred to direct outcomes from health systems functions related to access, appropriateness, availability, competence, continuity and sustainability, effectiveness, efficiency, equality, equity, quality, responsiveness, safety, and social and financial risk protection;
d) health outcomes, which referred to the overall health status and health impact.

Two other crosscutting themes were identified:
a) inter-sectoral linkages and
b) monitoring and evaluation of existing HSS practices.

Table 2-9 Number of HSS domains identified per Member State based on the keyword determined from the semantic analysis

Country	Number of domains	Country	Number of domains
Albania	29	Lithuania	11
Andorra	21	Luxembourg	6
Armenia	10	Macedonia	19
Austria	3	Malta	9
Azerbaijan	12	Moldova, Republic of	6
Belarus	13	Monaco	3
Belgium	13	Montenegro	4
Bosnia and Herzegovina	12	Netherlands	8
Bulgaria	10	Norway	10
Croatia	12	Poland	8
Cyprus	9	Portugal	4
Czech Republic	7	Romania	9
Denmark	4	Russian Federation	3
Estonia	5	San Marino	7
Finland	6	Slovakia	10
France	8	Slovenia	11
Georgia	8	Spain	11
Germany	3	Sweden	16
Greece	13	Switzerland	5
Hungary	8	Tajikistan	11
Iceland	11	Turkey	9
Ireland	10	Turkmenistan	8
Italy	10	Ukraine	11
Kazakhstan	10	United Kingdom	9
Kyrgyzstan	3	Uzbekistan	10
Latvia	17		

Source: Author's computations using data gathered from the WHO Europe 2015

The identified themes were used to develop a new theoretical framework for the recognised HSS domains. This framework was proposed to the WHO Regional Office for Europe and further research is ongoing to refine and validate it across all Member States. Figure 2.5 presents the expanded HSS theoretical framework.

Figure 2.5 Summary of all identified HSS domains further categorized into four different clusters
Source: Author's illustration based on themes identified from the analysis

2.6.4 Sample indicators for select HSS domains

An initial listing of the HSS domains and indicators used in the reports resulted in 4,720 indicators. I found out that the highest number of indicators used was in Tajikistan with 648 indicators, followed by Spain (n = 238), Germany (n = 177), Norway (n = 173), Bulgaria (n = 163), and Sweden (n = 161). On the other hand, the least number of indicators used was found in Monaco (n = 7), Kyrgyzstan (n = 13), Montenegro (n = 18), Macedonia (n = 19), Finland (n = 20), Estonia (n = 22), and Poland (n = 22). As discussed above, I found no records available for Israel.

Some indicators collected for this analysis included stratifiers or disaggregates. For example, the 'bed occupancy rate' can be disaggregated into bed occupancy rate for males and females. To select only the core meaning of each indicator, these disaggregates attached to every indicator was removed. After removing them, I identified 628 unique indicators. Chapter 3 uses this pool to further identify indicators that were most relevant for a program-level (that is intermediate outcome-level) HSS monitoring and evaluation.

Table 2-10 Number of HSS indicators identified per Member State

Country	Number of indicators	Country	Number of indicators
Israel	0	Cyprus	79
Monaco	7	Romania	80
Kyrgyzstan	13	Armenia	82
Montenegro	18	Switzerland	82
Macedonia	19	Kazakhstan	88
Finland	20	Ukraine	88
Estonia	22	Andorra	91
Poland	22	Lithuania	93
Austria	29	Azerbaijan	96
Ireland	32	Iceland	99
Latvia	33	Italy	100
Denmark	36	Greece	113
Hungary	36	United Kingdom	114
Czech Republic	43	Malta	115
Luxembourg	43	Uzbekistan	117
Albania	45	Slovenia	122
Portugal	56	Croatia	125
France	58	Belarus	131
Bosnia and Herzegovina	60	Slovakia	135
Georgia	61	Netherlands	154
Turkey	64	Sweden	161
Turkmenistan	64	Bulgaria	163
Moldova	65	Norway	173
San Marino	65	Germany	177
Belgium	68	Spain	238
Russian Federation	77	Tajikistan	648
		Total	4,720

Source: Author's computations using data gathered from the WHO Europe 2015

The number of domains and indicators illustrates the variability and heterogeneity of measures used for HSS monitoring and evaluation in Europe. Table 2-11 provides examples of the variability of the indicators used in different countries. For example, the domain 'accessibility' was measured differently by Armenia and Moldova. Armenia used 'hospitalization rate per 100 population' while Moldova used 'number of hospital admissions.' For the domain 'health service delivery,' although most Member States used the 'average length of hospital stay,' some like Bosnia and Herzegovina and Moldova used 'average length of stay for hospital patients,'. On the other hand, Belgium used 'average length of stay for normal delivery,' while Malta used 'average length of stay only for select diagnoses.'

Table 2-11 Sample HSS indicators identified from the records collected

Domain	Country	Sample Indicators
Accessibility	Armenia Moldova	Hospitalization rate per 100 population Number of hospital admissions
Effectiveness	Kyrgyzstan Netherlands	Quantity of areas covered by health promotion programs Number of hospital admissions per 100000 population
Efficiency	Spain Netherlands	Health care expenditure per capita Health expenditure in relation to life expectancy
Financing	Netherlands Moldova Switzerland Croatia Malta	Total health expenditure at macro level and by sector Expenditure for health per person US$ purchasing power parity Expenditure on promotion as share of current health expenditure Expenditures for health care per capita Expenditures for health care as percentage of GDP
Service Delivery	Bosnia and Herzegovina, Moldova Belgium Malta	Average length of stay for hospital patients Average length of stay for normal delivery Average length of stay for limited diagnoses

2.6.5 Key HSS actors: Typologies and coordination mechanisms

In each of the HSS report, I have identified the different actors involved when conducting HSS assessments. It was relevant to note which institutions have been involved in creating HSS monitoring and evaluation systems to serve as a guide for other countries when forming their own HSS monitoring and evaluation or reforming their current HSS assessment systems.

From the collected records, I listed down some data on the various individuals, institutions, and/or countries responsible for or involved in conducting HSS monitoring and evaluation. Following another semantic similarity analysis, I found out that the following key HSS actors involve: universities (n = 166), other countries such as the United Kingdom and the United States (n = 64), ministries of health (n = 47), national registration agencies (n = 43), the World Bank (n = 28), the European Observatory (n = 24), the WHO Europe (n = 23), health insurance fund agencies (n = 20), local associations for health (n = 17), other professional associations of health care workers (n = 13), the WHO country offices (n = 11), country experts (n = 8), local government units (n = 7), the WHO headquarters (n = 7), the European Commission (n = 5), and the Ministry of Finance (n = 5), among others (where n refers to the number of times it was stated to be involved in HSS assessments).

The findings show that HSS assessment included multiple players outside the commonly known health institutions such as the Ministries of Health and health insurance organisations. This result supported previous discoveries that successful HSS conduct may require different actors to be involved and that there is a need for a strong coordinating body to bring them together to help ensure the development of a comprehensive and integrated plan for HSS (WHO, 2010).

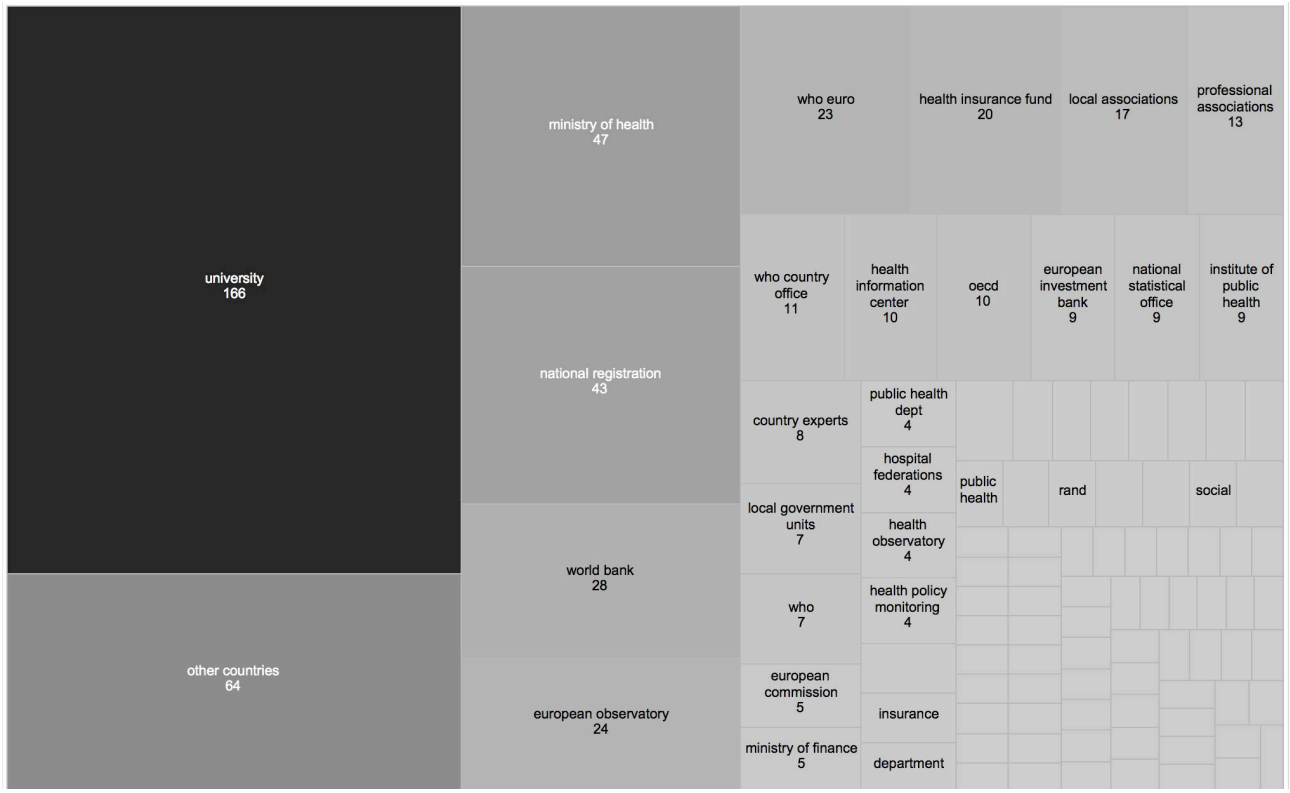


Figure 2.6 Actors involved in conducting HSS monitoring and implementation as identified from the records collected
Source: Author's computations using internal data from the WHO Europe 2015

Some records also showed how each organisation contributed to the HSS assessment. I carried out another semantic analysis for each identified role and found six keywords on how the different actors contribute to HSS assessments:

1. **As an advisory group:** Universities and academic institutions were frequently involved as advisory groups for HSS surveillance. Unless the national ministry of health (MoH) has a separate health policy monitoring unit or an ad hoc group for HSS surveillance, Health Ministries commissioned advisory responsibilities to academic institutions. International organisations such as the Commonwealth Fund, the Global Fund, the Rand Corporation, the World Bank, and the WHO Regional Office for Europe were also part of advisory panels. Public health institutes also joined the advisory group of some countries, along with other

professional associations, hospital federations and local foundations. In some cases, the HSS advisory group also included government ministries of other sectors outside health (e.g. council of ministers, the ministry of food and environment, and the ministry of social affairs or social security).

2. **As an author or editor of the HSS report**: Members of the universities and academic institutions were primary authors of the HSS monitoring and evaluation reports with some being co-authored by MoH and international organisation representatives mostly from the WHO Regional Office for Europe, the WHO country offices, or the European Observatory. One HSS monitoring and evaluation report has also been co-authored by a representative from the Ministry of Finance.

3. **As members for capacity building on HSS surveillance:** Institutions involved in capacity building for HSS monitoring and evaluation primarily included the MoH along with other sectoral government committees. In some countries, an MoH sub-unit was formed to take part in HSS capacity-building initiatives such as a health information centre within the MoH. Some policymakers played a role in initiating, developing, and monitoring HSS practice. Some countries have also involved country experts and formed a health transformation program unit. Other statistical units such as the Department of Household Surveys also took part in HSS capacity-building initiatives.

4. **As a provider of HSS data or clearinghouses:** Actors involved in collecting, maintaining and disseminating HSS data included public health institutes, state health agencies, the European Observatory, health information centres, and national statistical offices. This include OECD, the WHO, and the World Bank. These institutions were responsible for data collection and validation needed for HSS.

5. **As external validators and reviewers:** Some reports mentioned that some institutions such as the World Bank, the European Observatory, the OECD, and university representatives served as external validators and reviewers for the HSS assessments.

6. **As funders:** Funding for HSS usually came from the MoH as part of budgets allotted for improving the country's health information systems. Others found financial support from the European Commission and/or the European Union.

Bosnia and Herzegovina and Croatia also identified their lead institutions as the Ministry of Health headed the HSS assessments. In Belgium for instance, their National Institute of Health was identified as their lead for HSS monitoring and evaluation. Conversely, Armenia specified that the HSS was led by the country but for the purpose of reporting to donors and other development partners. On the other hand, Kyrgyzstan's HSS was led by the national government driven by the need to monitor and evaluate effects of implementing their national health programs. Apart from that, there were also the three countries that claimed to have an established and structured HSS monitoring and evaluation group that were mostly formed on an ad hoc basis with the first two establishing an HSS assessment task force in 2005 and the latter in 2002.

2.7 Discussion

Various international health partnerships and initiatives led to global calls for a coherent HSS monitoring and evaluation approach (McCoy et al., 2012; Storeng, 2014). However, such a standard monitoring and evaluation framework remains a challenge due to very different country capacities, disparate data sources and data availability across the various countries, and also varied contexts that drive priority areas for health systems (Ramalingam, Mitchell, Borton, & Smart, 2009; Veillard & Maurice, 2012). As an essential component of developing a comparable but contextually sensitive HSS monitoring and evaluation framework, this Chapter reports research providing a comprehensive suite of domains and indicators that overview the regional level of capacity of each WHO European Member State to monitor achievement towards the Health 2020 European policy framework and other overarching goals such as the Sustainable Development Goals. The HSS inventory developed from this research and identified from country-driven data sources can be used to identify relevant regional or global health system priority areas and provide insights on data availability and comparability.

In summary, I found 27 HSS domains and identified 628 unique indicators that spanned four broader themes: determinants, health system functions, intermediate results, and health outcomes. As specified above, 14 Member States were also found to have developed their own national HSS frameworks. Moreover, I also found that there are different actors involved in conducting HSS assessment. Apart from the Ministries of Health, the WHO and local communities or professional associations, universities and other international organisations were also included. These results illustrate the complexity of HSS and of developing global and regional guidelines for HSS assessments, which should not only focus on the different health system building blocks or functions, (e.g. governance, financing, service delivery, health workforce) but also take into

consideration how these building blocks may be influenced by other factors such as the social determinants of health and other intermediate results of HSS. The findings also showed that outcomes of HSS assessments can be based on the other output and outcome measures such as parameters related to improved health (level and equity), responsiveness, social and financial risk protection, improved efficiency, and other more intermediate HSS results (e.g. access, appropriateness, availability, competence, continuity and sustainability, effectiveness, efficiency, quality, and safety).

Hence, domains and indicators for HSS assessment were not only focused on the WHO Health Systems Building Blocks, but also involved other factors that may either be directly or indirectly related to HSS. The domains and indicators identified above also fit the priority areas in the Health 2020 European Policy Framework (WHO, 2013b). In this framework, the domains and indicators used in conducting HSS have spanned the different strategic objectives and the four common policy priorities for health (WHO, 2013b). Furthermore, the goals listed in the Health 2020 monitoring framework (reduce premature mortality, increase life expectancy, reduce inequalities, enhance well-being, UHC and right to health, and national targets) were also captured in the resulting expanded theoretical framework. HSS assessments, therefore, can be a way to monitor and evaluate how strategic objectives for the Health 2020 monitoring framework, as well as the Tallinn Charter, will be met to provide evidence on health systems progress (WHO, 2010a). The framework described in this Chapter added context to the domains used in the Health 2020 monitoring framework by matching these to the HSS indicators that were already being used by the Member States. This approach avoids further duplication in monitoring and evaluation tools and further burdening of countries arising from the various reporting processes for HSS grants and resource allocation. The framework also showed the different determinants and pathways that may influence the achievement of the Health 2020 objectives.

Moreover, the results also validated how the Health 2020 framework reflected the priority areas for health and health systems of the European Region. Since accountability mechanisms were part of the national targets of the Region, HSS assessments may also be a transparent mechanism for illustrating the government's accountability for health systems. The four common policy priorities for health were also similarly linked to the HSS domains: investing in health through a life-course approach and empowering people; tackling Europe's major health challenges such as NCDs and communicable diseases; strengthening people-centred health systems, public health and capacities and emergency preparedness, surveillance and response; and creating resilient communities and supportive environments. Likewise, NCDs and communicable diseases were also part of the HSS

identified HSS domains as a key output to assess HSS outcomes. The key principles of people-centeredness, capacities and resources were also captured in the HSS domains identified in this Chapter and were noted to be vital to the functioning of the health systems. Resiliency, as well as sustainability, can also be both assessed by looking at the inter-sectoral HSS practice as well as in seeking progress in the way HSS were being monitored and evaluated over the years.

However, the marked differences in HSS monitoring and evaluation across the Member States made comparability and quantification of HSS domains and indicators challenging. Nevertheless, this Chapter also identified that there is a greater need for better structure and clearer guidance from the WHO and other international organisations in relation to its assessment. The various HSS frameworks and domains used by each Member State suggested that WHO technical guidelines on HSS framework, domains, and indicators should direct HSS assessments in the Region, and that such guidelines should also consider each Member State's particular contexts. Measurement and reporting differences and cycles, and varying contextual factors also made regional comparison arduous since effective regional comparison required either measurement and reporting cycles to be standardised or comparisons to be appropriately sensitive to differences; likewise, for uncontrolled contextual factors. Therefore, key planning considerations for regional comparisons include variability across HSS definitions, domains and indicators used; different reporting cycles per country; and any uncontrollable contextual factors affecting health and HSS progress, among others. HSS monitoring and evaluation was also found to serve as an accountability tool to monitor and evaluate performance; hence, it should also be made transparent. Therefore, WHO and other international organisations may need to increase capacity to document and update existing HSS practices in the Region, while addressing potential factors that may limit access and analysis of available data on HSS assessments such as language barriers.

The variability in the domains and indicators found in this research also reiterated the need for a 'systems thinking lens' (De Savigny & Adam, 2009), which offered a practical approach to strengthening health systems (De Savigny & Adam, 2009). This approach highlights that as investments in health are increasingly directed to HSS, there is also a demand to understand not only what works, but also for whom and under what circumstances (De Savigny & Adam, 2009). A systems thinking lens was asserted to be highly relevant when monitoring how health systems were progressing and in identifying key strengths and weaknesses of existing systems (De Savigny & Adam, 2009). There were two key principles identified for a systems thinking lens: a) that systems adjust and readjust at many interactive timescales (De Savigny & Adam, 2009); and, b) that the high degree of connectivity means that change in one subsystem affects the others (De Savigny &

Adam, 2009). I also found these as characteristics of HSS assessments. HSS monitoring and evaluation was found to not only be complex and comprehensive but also a dynamic process that countries were undergoing. HSS assessments, therefore, need to be carefully designed with existing HSS domains that a country has found to be most appropriate and responsive to their existing capacities, health needs, and priorities. Such conduct was also not only limited to quantitative or statistical indicators, but may also include qualitative parameters (e.g. quality of healthcare services, access, and distribution) that provide further meaning and contexts to the country's health systems.

Findings also provide evidence that different sectors including the private sectors, financial agencies, and universities participated in the process of conducting HSS assessments. The variety of actors involved in HSS assessments further highlights the need to enhance communications and collaborations across Ministries of Health and these different stakeholders to achieve more comprehensive HSS assessments. Engaging these different actors may help develop a shared vision towards a more coherent, integrated, efficient and useful HSS assessment (Dodds, 2015). These actors may include producers and users of information, those involved in the actual health service delivery as frontline health workers, and funding agencies, as well as other international level organisations (WHO, 2007). When different groups are involved in HSS assessments, findings from these assessments may become more responsive and efficient to health systems needs and challenges (Guest, Ricciardi, Kawachi, & Lang, 2013; Mutale, 2014). Specifically, a multi-sectoral approach for HSS assessment provides more responsive outcome-based indicators, as well as inputs and process indicators that tailor more in addressing the different countries (Kusek & Rist, 2004; Shield et al., 2003). Such process not only engaged more sectors in the process but also provided vital inputs to the current HSS implementation mechanisms to ensure development of a well-integrated and more comprehensive HSS practice (Busse, Aboneh, & Tefera, 2014; Israel, Schulz, Parker, & Becker, 1998). Such community involvement was also relevant in managing different expectations among the various health systems actors and foster HSS monitoring and evaluation ownership (Barker, 2015; Naimoli, 2009). Hence, the findings highlighted how HSS assessments cut across various sectors, including non-state actors, universities, and academicians, among others.

2.8 Conclusion

This chapter provides a comprehensive description of the different concepts, domains, and indicators used for HSS assessments across the European Region, which can serve as vital baseline information for future work in developing regional and global HSS assessments. More importantly, the said findings can also be used for the initial design phases of HSS for other countries who are

yet to design and conduct HSS monitoring and evaluation. Hence, the findings provided countries with resources to choose from to map, measure, and assess their own HSS and/or improve their current HSS assessment practices. Such inventory of domains and indicators may also be tracked over time to examine at a country level how HSS frameworks and priority areas change in line with current health systems policies and reforms. Compared to previous studies, this research gathered information from country-driven resources and applied a bottom-up rather than a top-down approach for developing a monitoring and evaluation framework. There are many ways in which the findings of this research can be used to motivate future work in this area. Similar to the 'Strengthening health systems accountability' report of Tello & Baez-Camargo Camargo (2015), this research was not intended to provide an exhaustive account of all HSS measures. Reviewing the literature was primarily done by the author and was not compared with views of others. I examined the material in its entirety and only included records that fit the selection criteria of the study and were available online. Omitting HSS materials that were excluded due to language or failing to fit the search criteria may also significantly influence my findings. The findings were also limited to studies, which focused on the European region and used specific HSS measures. Moreover, I also only communicated with close contacts of the WHO Europe. As such, none of the country offices were required to send HSS reports. Despite such limitations, the findings reported in this Chapter can serve as benchmark indicators not only for the Member States of the WHO European Region but also across other countries. Though regional comparisons remain a challenge primarily due to the wide variability and heterogeneity across domains and indicators used by each Member State, my findings also showed that there were common areas or themes that most of them monitor for HSS. The findings from this study can also be used to tailor future work on understanding target audiences when developing a technical guidance document for HSS assessment since they provided an overview of what was currently measured across the Member States reflecting their existing capacities and priority areas for health systems. Understanding these existing concepts and measures of health systems using a bottom-up approach should be taken into consideration before making any attempt to do a regional framework for HSS assessments that countries should adhere to or report against to avoid reporting burden and to ensure responsiveness. Furthermore, an individual country's capacity for evidence-informed decisions for HSS should not depend on that country's level of resources allocated to monitoring and evaluation processes. Hence, HSS assessment should reach at least a minimum degree of quality and comparability across countries.

Chapter 3 Data sources and tailored indicators for program-level monitoring and evaluation of intermediate HSS results

In the previous chapters, I discussed HSS goals and calls to action (Chapter 1) and proposed an expanded theoretical framework (Chapter 2) based on an empirical analysis of existing HSS frameworks and domains that can be used for HSS monitoring and evaluation. This chapter extends the framework to program-level HSS monitoring and evaluation using data sources gathered and field observations while at the Gavi Vaccine Alliance[4] in Geneva, Switzerland. In particular, this chapter develops a new set of tailored indicators for monitoring the intermediate results of HSS initiatives that countries can choose from for new and future HSS grant applications to funding organisations. This chapter:

1. Identifies indicators from the Global Reference List of 100 Core Health Indicators (WHO, 2015d) which are relevant to Gavi HSS grants;
2. Identifies additional tailored HSS indicators from existing HSS grants, based on available HSS monitoring and evaluation frameworks and HSS frameworks from each Gavi recipient country. These are internal documents available within Gavi Each HSS framework has been consulted with the ministries of health and have been validated and supported by a decision letter to use the indicator for HSS monitoring and evaluation signed by the Gavi-eligible country and Gavi;
3. Creates a database of tailored HSS indicators based on systematic analysis of existing indicators from these different sources, identifying any existing strengths and limitations of the tailored HSS indicators; and
4. Creates a guidance document for countries explaining how they can use the list to select their tailored HSS indicators, and under what circumstances/conditions they may differ from the list.

Using data gathered from field observations at the Gavi Vaccine Alliance, a resulting reference guide for sample tailored indicators for assessing HSS intermediate results was the key output of this study. This chapter has been considered alongside the 2016 Gavi Reporting

[4] The Gavi Vaccine Alliance, referred here as "Gavi", was created in 2000 as an international organisation dedicated to bring together public and private sectors with the shared goal of creating equal access to new and underused vaccines for children living in the world's poorest countries (Gavi, 2016).

and Renewal Guidelines (Gavi, 2015b, 2016). In summary, indicators were selected based on examining monitoring and evaluation reports, other publications, grey literature and internal documents within Gavi and its partners. This includes WHO which provided the indicators and measures that can be used to monitor program-level health system strengthening projects to support vaccine service delivery. The selection of indicators was based on specific criteria. The indicators were also initially selected from the Global Reference List of 100 Core Health Indicators (WHO, 2015d) and was then supplemented by additional HSS indicators from other data sources available within Gavi which they have identified as tailored to the country's needs and contexts, as well as its specific grant objectives.

3.1 The Gavi Vaccine Alliance and health systems strengthening for vaccine service delivery

Gavi Vaccine Alliance, referred as 'Gavi,' was created as an international organisation dedicated to bring together public and private sectors with the shared goal of creating equal access to new and underused vaccines for children living in the poorest countries (Gavi, 2016). Although the primary mandate is to increase access to immunisation, Gavi recognised that immunisation coverage was constrained by health system barriers (Marchal et al., 2009). As such, Gavi considerably invested in health systems strengthening particularly attending to health systems functions that were essential for the implementation of immunisation programmes: i.e. cold chain storages for vaccines, refrigerated vehicles for transporting vaccines, training of health workers on the expanded program on immunisation, among others (Marchal et al., 2009; Naimoli, 2009). Strengthening health systems remains as one of the Gavi's strategic goals for 2016 to 2020 as presented in Figure 3.1 (Gavi, 2016). Specifically, Gavi aims to *"increase effectiveness and efficiency of immunisation delivery as an integrated part of strengthened health systems"* (Gavi, 2016) by providing financial support called "HSS grants" to assist countries in addressing health system bottlenecks and improve immunisation (Gavi, 2016). With these grants, countries are allocated a dollar amount based on their Gross National Income and population (Galichet et al., 2010). Ministries of Health were invited to use available health sectoral reviews to identify health systems constraints and plan health systems to improve immunisation and wider primary health care services (Galichet et al., 2010). The funding is to be considered as additional and complementary to existing government and other local health sources (Galichet et al., 2010).

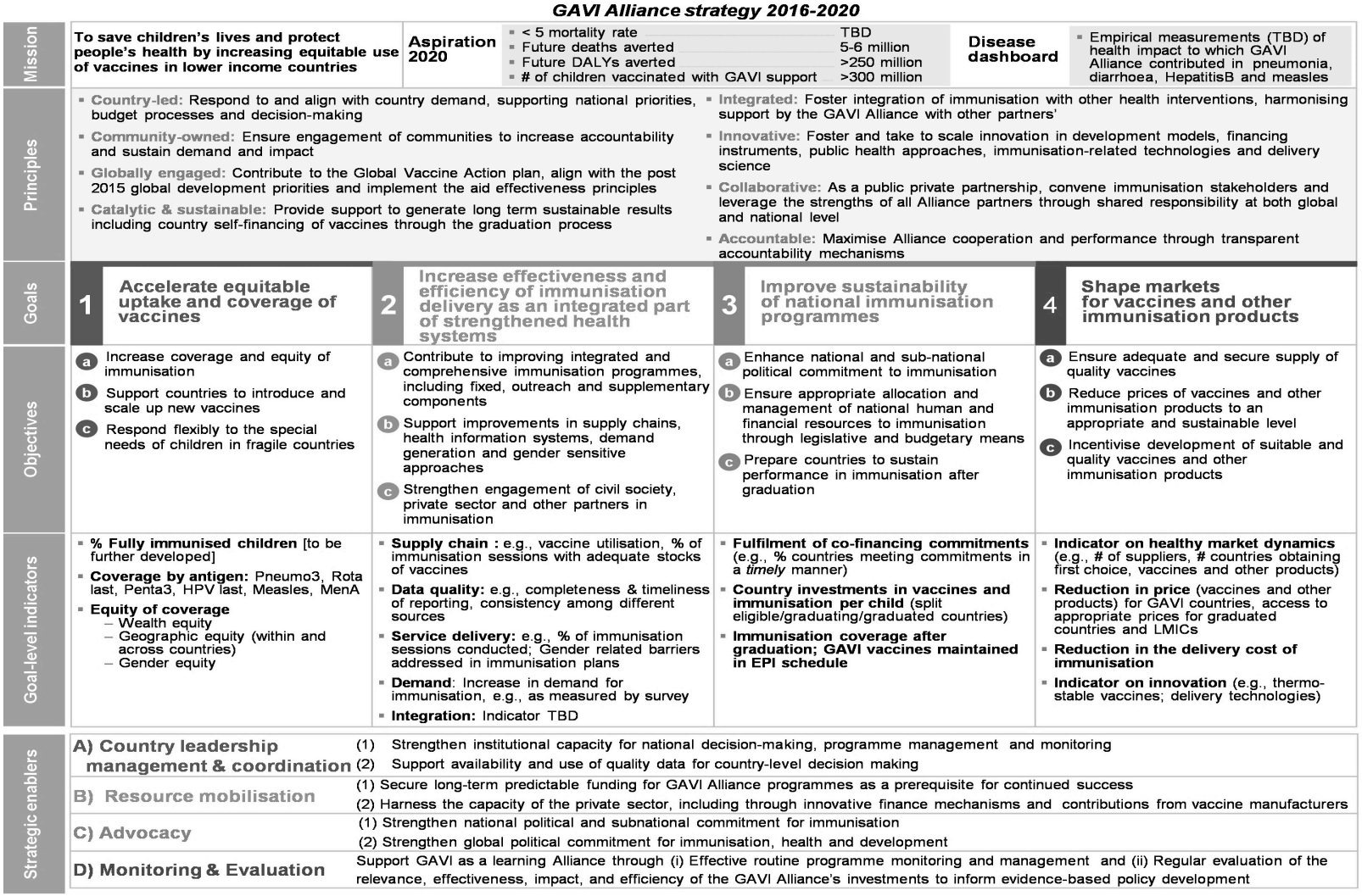


Figure 3.1 Strategic framework for the Gavi Vaccine Alliance 2016-2020 with disease dashboard and goal-level indicators
Source: Gavi 2016 (Gavi, 2016)

The application process required the countries to submit core and tailored indicators to form part of their Grant Performance Framework, which is a new monitoring and reporting tool introduced by Gavi in early 2015 The Grant Performance Framework is an upfront agreement between a country and Gavi on the key metrics that Gavi can use to monitor and report on grant performance during HSS implementation. A list of 20 mandatory core indicators at every level of the results chain for both vaccine and cash support has already been developed and were based on standard definitions which were already, in almost every case, being monitored by countries. The indicators include agreed baselines, target, data sources, and reporting schedule. However, core indicators were found to be insufficient to measure performance for the HSS grants because of specific activities and objectives that vary across countries (Gavi, 2015b).

As such, Gavi's Grant Performance Framework was adjusted to include a combination of core and tailored indicators (Gavi, 2015b). Core indicators were unlikely to be sufficient to measure performance along each grant's result chain because of the variability of specific objectives across grants. Core indicators, therefore, needed to be complemented by a small number of additional indicators tailored to the particular objectives of each grant and aligned with the specific country contexts. Similar to the findings highlighted in Chapter Two, HSS frameworks needed to be dynamic and linked to specific country contexts. This combination of core and tailored indicators ensures that the Grant Performance Framework provides a complete overview of how Gavi's HSS funding support is being used by the recipient countries. The Grant Performance Framework should show how intermediate results between the implementation of an activity and the intended outcomes could be measured; not just the number or quality of a product but if and how these products were used (Gavi, 2015b). Gavi has selected the core indicators for each step of the HSS grant result chain as identified in the 2016 Gavi Grant Performance Indicator Reference Sheet (**Figure 3.2**). The Framework also specified that tailored indicators may include the following (Gavi, 2015b):

1. A small number of tailored outcome indicators may be included to reflect country-specific circumstances or grant objectives. These indicators were especially important for HSS as progress against them is used by Gavi to inform decisions on grant renewal (Gavi, 2015b).
2. A small number of tailored intermediate results indicators should be included to

ensure monitoring of each grant objective. These indicators were especially important for HSS as progress against them is used by Gavi to inform decisions on disbursement (Gavi, 2015b). For most countries, tailored indicators comprise the set of indicators that measure progress achieved in the HSS process and intermediate results level (Gavi, 2015b).

3. A small number of tailored process indicators should be included to monitor the implementation of the most significant activities of Gavi cash grants. Progress against these indicators is also used by Gavi to inform decisions on disbursement. These indicators should align with the content of countries' interim financial reporting to Gavi (Gavi, 2015b).

To date, there is a limited number of tailored indicators for Gavi's HSS grants. For the past years, the Gavi Secretariat has observed that countries' capacities to select and develop their own tailored HSS indicators were varied. Most countries applying for HSS grants stated that a reference list of tailored indicators would have guided them in creating their own HSS framework. Tailored indicators may be used at three levels of the performance framework (Gavi, 2015b):

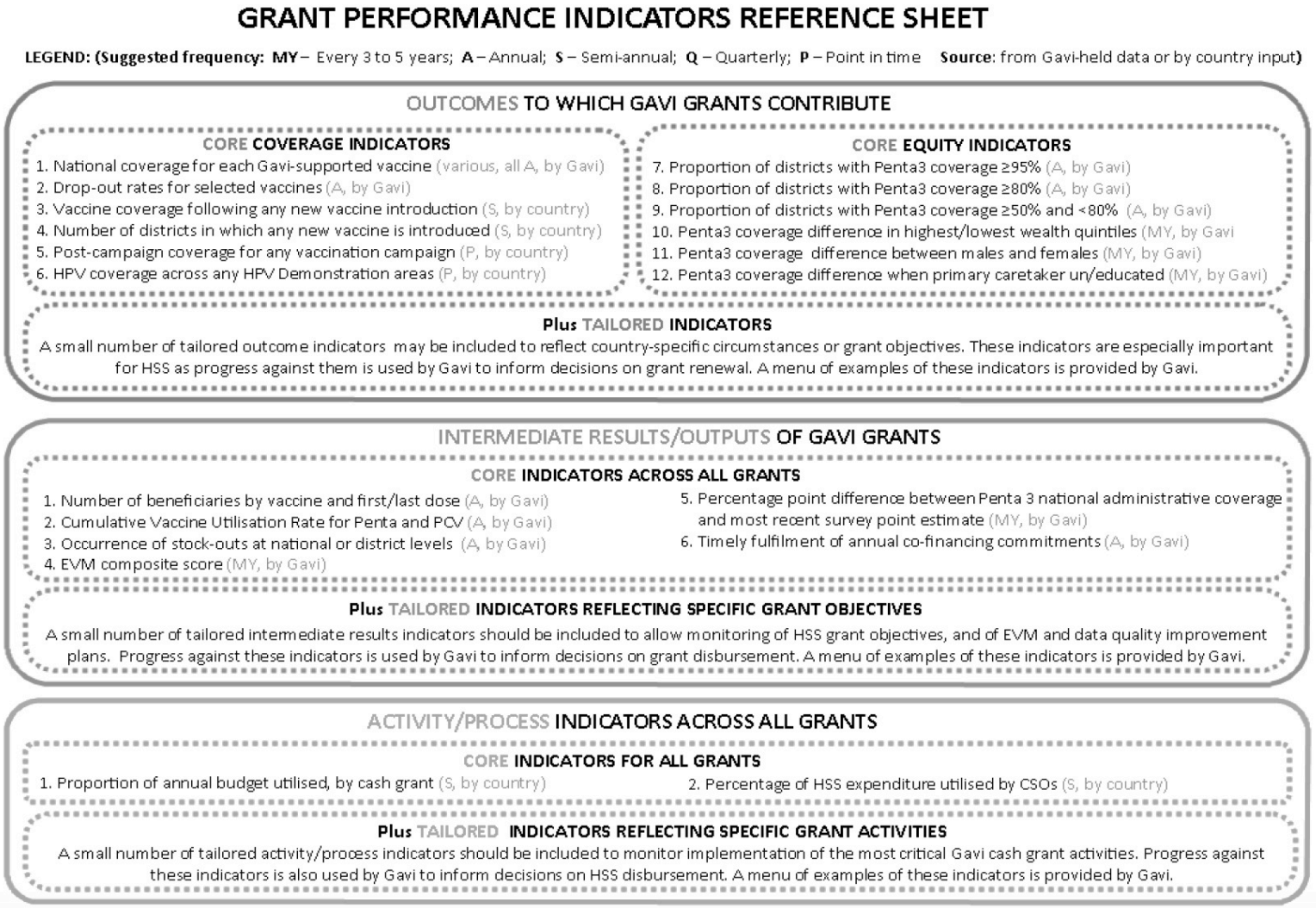


Figure 3.2 Gavi Grant Performance Indicators Reference Sheet with core and tailored identified for each type of indicator (process, intermediate results, and outcomes) Source: Gavi 2016

The previous chapter proposed a new conceptual framework for HSS monitoring and evaluation that identified core dimensions involved in the intermediate results of HSS projects to capture the relevant information about HSS while still taking into account the variation in approaches currently in place across the different countries. These domains were then used to further guide data collection for Gavi's tailored HSS intermediate result indicators. This chapter focuses on tailored indicators at the intermediate results level for HSS grants, while the succeeding chapters will focus on using the different tailored process HSS indicators identified in this Chapter and applied in different contexts. Tailored process and outcome indicators are available within Gavi.

Intermediate results indicators for monitoring HSS grant objectives need to be proposed by countries (Gavi, 2015b). The number of intermediate results indicators varies depending on the complexity and duration of the grant. Between five to ten indicators is ideal at a minimum: with one to two specific, measurable, available, scientifically robust and time-bound (SMART) intermediate results indicators per objective (Gavi, 2015b; Lopez Acevedo et al., 2012). Performance against these intermediate results shall inform joint appraisal assessments of the sufficiency of the progress a country has achieved and associated modifications to Gavi's support (Gavi, 2015b). The findings in this chapter are intended to provide a menu of tailored intermediate results indicators from which countries can select – or define their own – especially if relevant indicators were already tracked by countries through their existing monitoring and evaluation systems, such as periodic Health Facility Assessments or Immunisation Dashboards (Gavi, 2015b).

Figure 3.3 provides an overview of how the Gavi Grant Performance Framework is used for Gavi's HSS grant mechanisms based on my observations. As specified in this flowchart, annually before January 15, countries can setup their own grant performance framework through Gavi's online portal system by contacting the Gavi representative in their country. Through a series of consultations, countries agree to the metrics that will be used in their performance framework which may include both core and tailored indicators. Gavi then reviews and approves the grant application and each country is expected to report against their own grant performance framework. Reporting is also done online through the Gavi country portal. Although countries can always apply for HSS grants, renewal of HSS grants is based on a country's reported performance against the HSS intermediate results indicators

for both core and tailored indicators. Hence, funding for HSS used a performance-based approach and as such, selection of appropriate intermediate results indicators is vital in determining continuing investments for health systems strengthening.

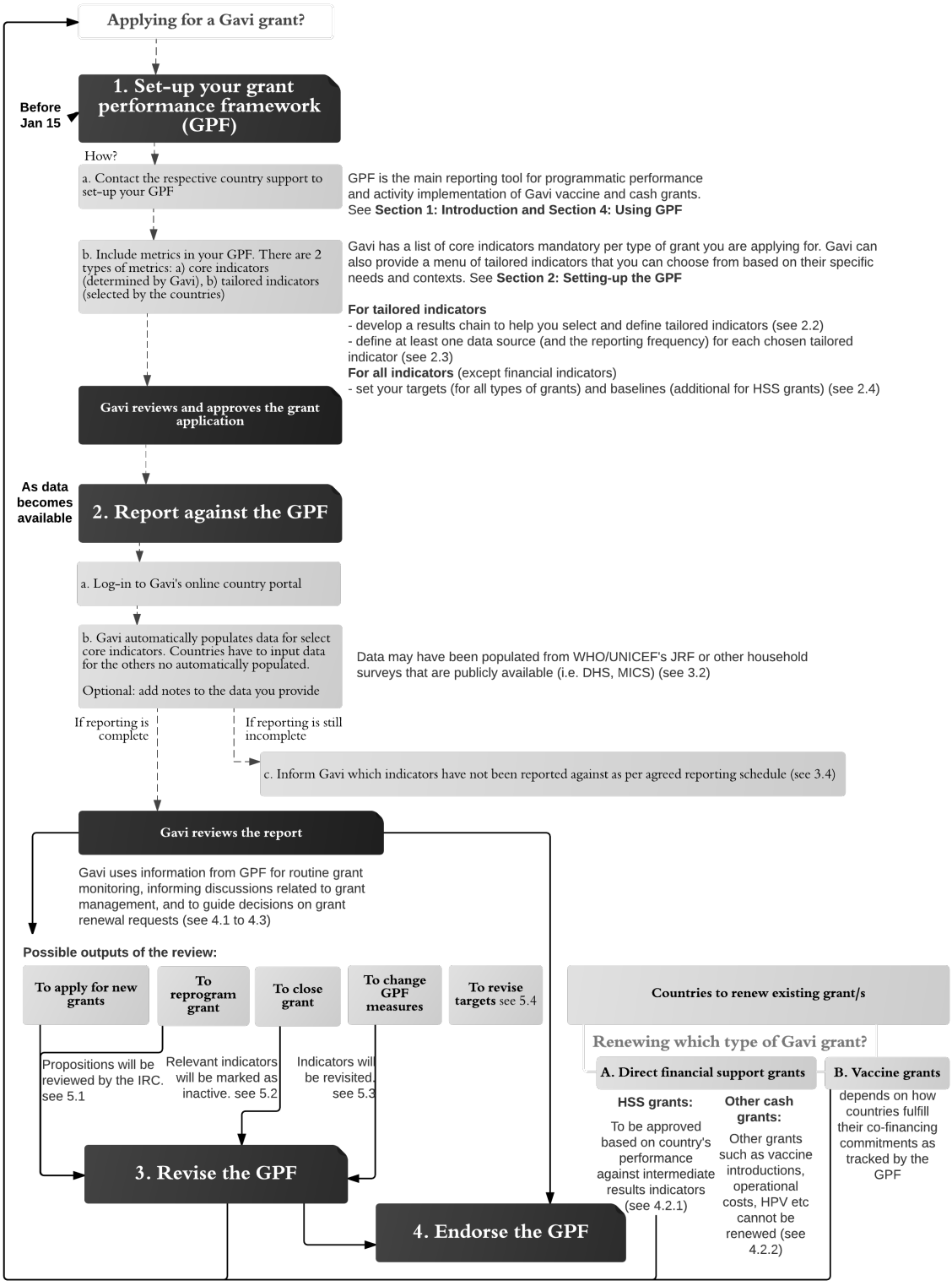


Figure 3.3 Gavi HSS grant cycle based on observations while on field work
Source: Author's illustration from observations while on field work.

There are many potential sources for HSS intermediate results indicators. In 2014, the WHO conducted a rapid assessment of the burden of indicators and reporting requirements for health monitoring (WHO, 2015d). This evaluation revealed how global investments in disease- and programme-specific monitoring and evaluation programmes by different agencies have contributed to a vast number of indicators, varying indicator definitions and reporting frequencies, fragmented data collection, and uncoordinated efforts to strengthen national institutional capacity (WHO, 2015d). This existing system of reporting also led to an unnecessary burden on countries and inefficiencies in strengthening country health information systems as scarce resources are devoted to compliance and reporting (WHO, 2015d). As a result, WHO developed the "Global Reference List of 100 Core Health Indicators" to guide the monitoring of health results nationally and globally, reduce excessive and duplicative reporting requirements, and enhance the efficiency of data collection investments in countries (WHO, 2015d). This list was confined to indicators for global and regional assessment levels and excluded indicators for national health systems (WHO, 2008b). It also ruled out indicators requiring more detailed programme management at the national and sub-national levels or for financial tracking of specific grants and projects that were highly relevant to Gavi's monitoring and evaluation and grant management needs (Gavi, 2016; WHO, 2008b). Hence, this limited the number of indicators directly or indirectly linked to HSS grants was (Gavi, 2016; WHO, 2008b). The vast variation in each Gavi-supported countries' monitoring and evaluation systems challenged how the Gavi Secretariat and the Alliance partners individually help each country in developing robust indicators for the tailored intermediate result HSS indicators. Although countries were entirely free to develop these indicators to monitor progress on HSS grants, a common reference list has to be provided to guide them in choosing intermediate result HSS indicators. This list can serve as a tool to facilitate Gavi's support for countries and also to develop robust indicators responsive to each country's needs and contexts, while ensuring standard quality guidance across countries. It is expected to provide an enhanced means of monitoring and learning from the impact of Gavi's HSS programmes and to improve future grant mechanisms. Therefore, a reference list intended to act as a helpful resource for countries will also to ensure efficiency and quality country-driven monitoring of HSS grants. Countries can then continue to propose their tailored indicators based on the specific objectives of their grant, available data sources and systems.

3.2 Methods

The primary objective of this chapter is to develop a list of tailored indicators for monitoring and evaluating HSS intermediate results that can be used for further research and from which countries can choose from for new and future HSS grant applications. To achieve this, relevant literature was examined to identify HSS indicators to allow monitoring of the intermediate results of Gavi's HSS grants and to assist in conceptualising future research in this area. Consultations with the Gavi Secretariat and the Strategic Goal 2 Management Team (SG2MT) were conducted to assist with conceptualising the study approach and consolidating the tailored intermediate results indicators for HSS grants. The SG2MT is part of the technical consultation group of Gavi that recommends and informs the development of the indicators and targets for the Gavi strategic goals and the indicators for the disease dashboard (Gavi, 2016). Specifically, the SG2MT was responsible for identifying indicators specific to Gavi's Strategic Goal 2 to *"increase the effectiveness and efficiency of immunisation delivery as an integral part of strengthened health systems"* (Gavi, 2016). In collecting the relevant documents, a desk study was also conducted based on a search for the period of 2012 to 2015 for all Gavi-supported countries. Indicators were also grouped based on Gavi's cost categories and also classified following the proposed HSS framework discussed in Chapter 2.

3.2.1 Data sources

Overall, 350 HSS materials were collected from internal and external search, of which 75 records were retained after excluding any duplicates and policy documents that did not include HSS indicators. The following data sources were retained: the Global Reference List of 100 Core Health Indicators (WHO, 2015d), the immunisation-specific guidelines from the Global Vaccine Action Plan (WHO, 2015a), the most recent Grant Performance Framework from 48 countries and additional eleven Gavi's HSS monitoring and evaluation frameworks for countries with approved HSS grants from 2012-2015. The latter HSS monitoring and evaluation frameworks were used by countries for HSS monitoring prior to the development of a grant performance framework. These frameworks may not necessarily include the core indicators for HSS intermediate results, but were expected to have tailored intermediate results HSS indicators. Five more national monitoring and evaluation results framework from pooled funds and national country planning cycles and eight additional immunisation-related

HSS reports from other international organisations were also collected. These country planning cycles provide a country-by-country overview of national planning, health program and project cycles together with information on donor involvement and technical support (WHO, 2015g). The planning cycles aim to improve coordination and synchronization of country health system planning efforts (WHO, 2015g). The reports from international organisations include three from the WHO, one from the Global Fund, two from the European Commission, one from the World Bank, and one from the USAID. Another USAID HSS survey dataset was also used. Data was last collected on 31 December 2015.

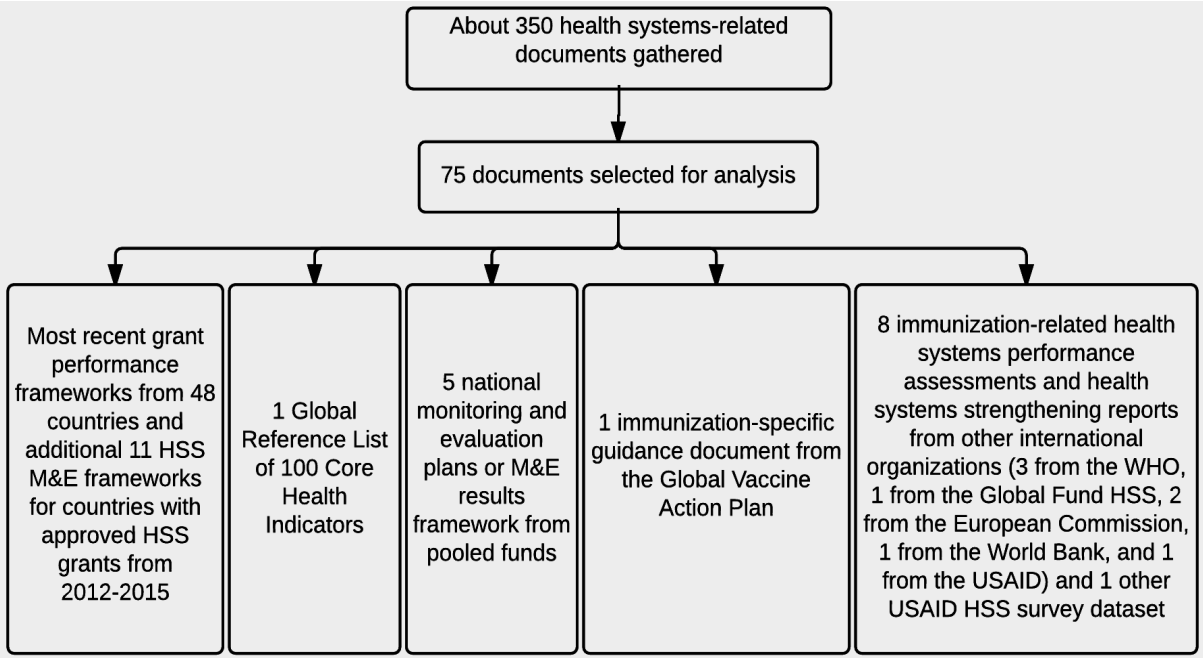


Figure 3.4 Selection flow diagram for Chapter Two
Source: Author's illustration.

3.2.2 Translations

I collected raw intermediate results HSS indicators in English and French with 542 and 176 indicators, respectively. Indicators in French were translated into English using translation support from Gavi. Figure 3.5 shows the breakdown of countries had data sources submitted in English and in French.

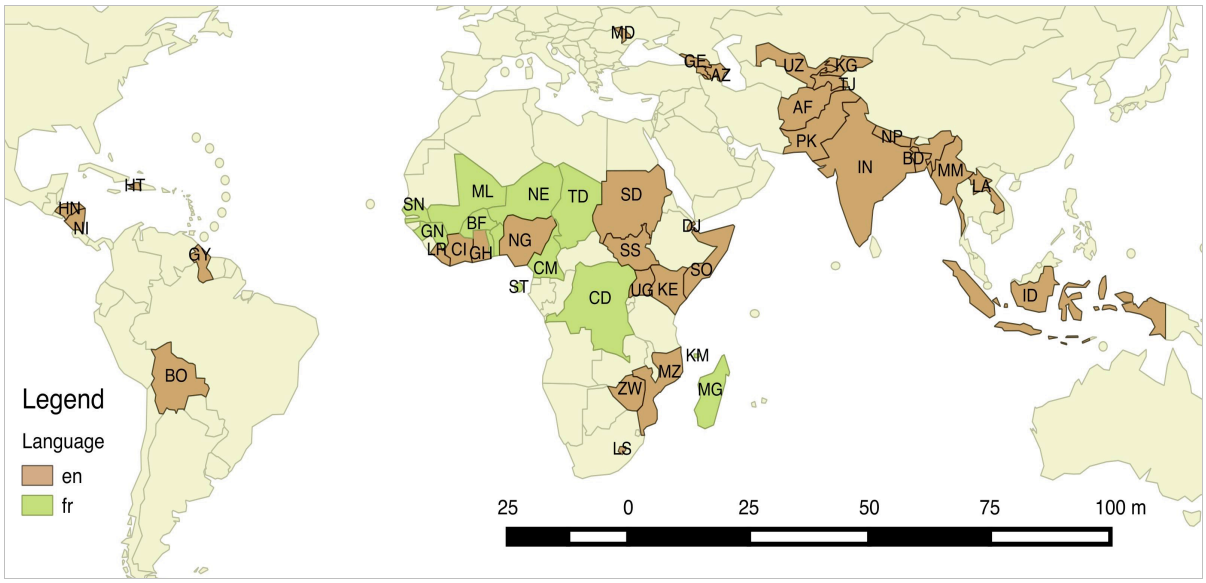


Figure 3.5 Language used by the records collected for Chapter Three
Source: Author's computations using primary data collected from the field work.

English indicators were found for: Afghanistan, Cote d'Ivoire, Cuba, Djibouti, Ghana, Haiti, Honduras, India, Kenya, Kyrgyzstan, Lesotho, Liberia, Moldova, Mozambique, Myanmar, Nepal, Nicaragua, Pakistan, Somalia, South Sudan, Sudan, Uganda, and Uzbekistan. French indicators were found from Burkina Faso, Comoros, Democratic Republic of Congo, Guinea, Madagascar, Mali, Niger, Sao Tome and Principe, Senegal, and Togo.

3.2.3 The tailored HSS indicators database

After identifying an exhaustive indicator set, an HSS indicators metadata database was developed from the different data sources identified in the previous section. To guide the database development, the same outline and metadata used in the Global Reference List of 100 Core Health Indicators was followed. These include the following (WHO, 2015d):

a. Indicator definition, including numerator and denominator. Definitions of the indicators were fine-tuned based on the most common definition that was used across countries;
b. Disaggregations, which include equity stratifiers as deemed appropriate (e.g. age and sex, geography, socioeconomic status, place of residence, equity and sustainability);
c. Additional dimensions such as frequency of reporting, pros and cons of using the indicator, and additional information on countries that have used the indicators, including accompanying contexts if available.

Indicators for significant HSS areas for which the Gavi health systems team lacked standard measures such as leadership management coordination and civil society areas were purposely sought. Additional indicators, which may not have been previously identified, were added if they were considered to be crucial for tracking Gavi's HSS grant implementation. SG2MT members' expertise was crucial in determining the indicators. Overall, 718 programme-level indicators were collected from the data sources, of which 197 indicators were from the country monitoring and evaluation framework. 27 indicators were from the Gavi Vaccine Action Plan, 19 indicators were from the Global Core Health Indicators, and 475 indicators were from the Gavi performance frameworks. Countries which had Grant Performance Frameworks available within Gavi and the corresponding number of intermediate HSS indicators found from each country Grant Performance Framework are presented in Figure 3.6. Any duplicates for the indicators were removed in the analysis. Data were securely stored in a password-protected computer within Gavi.

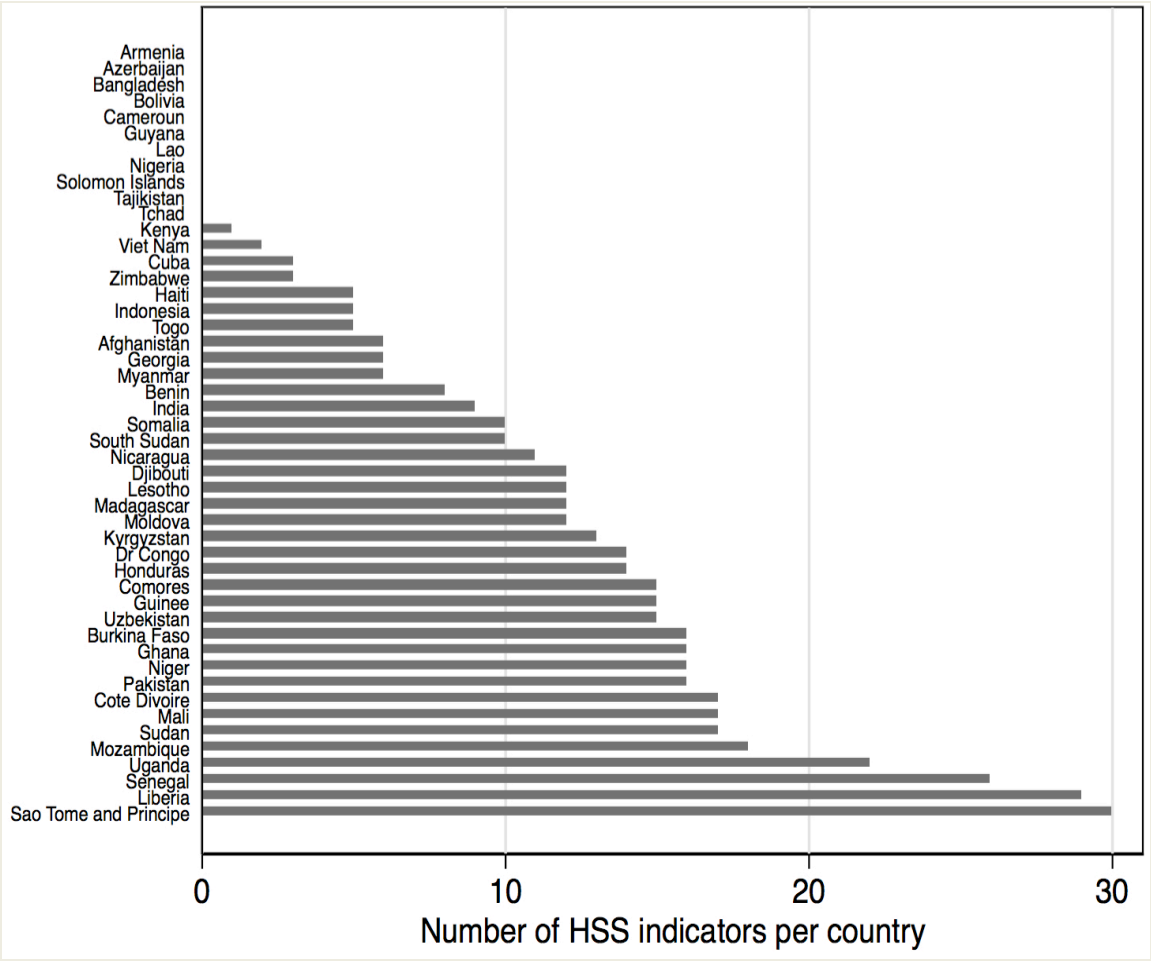


Figure 3.6 Intermediate HSS indicators found from each country's Grant Performance Framework Source: Author's computations using primary data collected.

3.2.4 Indicator classifications, selection and prioritization

Each indicator was coded and assigned keywords. Similar keywords were matched using the same semantic analysis methods discussed in Chapter Two. Each keyword generated was grouped under each HSS domain illustrated in the WHO HSS Building Block framework. The domains were then linked with each Gavi HSS cost category to ensure their relevance and alignment with Gavi's HSS internal grant processes. Indicators that did not directly link to any of these categories were allocated their own categories.

The Gavi HSS cost categories were already pre-determined by Gavi (Gavi, 2015a). The cost categories were intended to provide ideas for HSS activities to grant applicants and to allow Gavi to analyse its HSS support by type of grants (Gavi, 2015a). The cost categories are not a prescriptive list of activities and countries can identify their own activities to be included in their proposal. The cost categories were structured around the WHO Health Systems Framework which additional activities were included to also cover communities and program management activities (Gavi, 2015a).

Table 3-1 Gavi HSS cost categories and sub-categories

Grant category	Grant sub-category
1. Scale-up and improve accessibility and quality of service delivery, including community level services and implementation support: outreach, access, mobilisation	1.1 Capital investment in infrastructure including upgrading and renovations 1.2 Improve service organisation and facility management, including integrating immunisation services within maternal and child health services (maternal, neonatal and child health and integrated management of childhood illness) 1.3 Improve quality of care, including testing innovative service delivery models 1.4 Improve the transportation system for vaccines and service providers for outreach activities, including vehicle procurement 1.5 Improve the waste management system 1.6 Support maintenance and operating costs - recurring costs - of the delivery of immunisation services
2. Produce, distribute and retain skilled health and community workforce and human resources	2.1 Provide pre-service training of health professionals and/or improve pre-service training systems 2.2 Provide in-service training of health professionals and/or improve pre-service training system 2.3 Conduct supervision of health professionals and/or improve in-service training system 2.4 Scaling-up trained workforce (health professionals) 2.5 Address workforce retention of health professionals

	2.6 Scaling-up volunteer/community health workers
	2.7 Address volunteer/community health worker retention
	2.8 Train and supervise volunteer/community health worker
	2.9 Establish, support and strengthen performance-based incentive systems
	2.10 Establish and/or strengthen the human resources management information system
3. Strengthen procurement and supply chain management system, including access to essential medicines and commodities management	3.1 Scaling-up or upgrading procurement and supply management infrastructure
	3.2 Build and/or rehabilitate cold chain facilities
	3.3 Procure cold chain equipment
	3.4 Procure other immunisation-related equipment and consumables
	3.5 Improve the supply chain management system for immunisation services, including resources (computers, etc.) and processes (forecasting, storage, distribution, etc.)
	3.6 Procure commodities, other than drugs and vaccines (Gavi HSS funds cannot be used to procure drugs or vaccines)
4. Strengthen facility reporting and health information systems	4.1 Strengthen routine health data reporting system and harmonisation of parallel reporting systems and electronic data capture, includes monitoring and evaluation indicators of Gavi HSS grant
	4.2 Strengthen supportive supervision and training on data recording and data reporting practices
	4.3 Improve analytical and research capacity, including the strategic use of data and information for programme management
	4.4 Strengthen vaccine preventable disease surveillance
	4.5 Strengthen logistics management information systems
	4.6 Strengthen data quality through both self and independent assessments followed by costed improvement plans
	4.7 Conduct health facility surveys to assess readiness to provide immunisation and other health services, including availability of staff, tracer items and valid vaccines
	4.8 Strengthen adverse events following immunisation monitoring systems
	4.9 Conduct household surveys to assess immunisation coverage and factors associated with non-immunisation
5. Empower community and other local actors	5.1 Support demand generation activities including: communication for immunisation, social mobilization, mass media management, material development and capacity building
	5.2 Enhancing enabling environment and advocacy
	5.3 Establish public private partnerships with civil society organisations
	5.4 Strengthen the capacity of community groups and networks
6. Create enabling legal, policy and regulatory environments, including national strategic planning	6.1 Strengthen the governance system of immunisation programs, including regulatory and oversight mechanisms
	6.2 Develop, ratify, and execute non-discriminatory, evidence-based laws, policies, national plans, regulations,

and management	coordination and quality assurance mechanisms
	6.3 Build capacity to implement laws, policies, and regulations, including strengthening capacity of any national regulatory authorities
	6.4 Develop and support independent mechanisms to supervise, monitor and report on implementation of laws and policies
7. Ensure adequate financing of the health and community system	7.1 Improve revenue collection, pooling and purchasing for ensuring financial sustainability of service delivery
	7.2 Improve equity of healthcare and community level financing
	7.3 Improve public financial management of health system, including accurate tracking of government and donor investments (national health account, mid-term expenditure framework, etc.)
8. Other	8.1 Any activity not captured in other categories e.g. seeking effective synergies with other immunisation resources like the polio eradication systems and their workforce, and campaigns/supplementary immunisation activities
9. Programme management, planning and administration	9.1 Cover management costs, including financial audits
	9.2 Provision of technical support for grant implementation
	9.3 Provision of technical assistance to build local capacity of individuals (service providers, managers, etc.) institutions (expanded program on immunisation unit, etc.) and organisations (civil society, non-government) etc.
	9.4 Conduct operations research and any special studies such as knowledge attitude, and perceptions survey, related to health system strengthening and immunisation services, relevant to the Gavi HSS grant

Source: Gavi 2015 (Gavi, 2015a)

In consultation with the HSS and monitoring and evaluation experts within Gavi, I removed the disaggregates for every indicator to select only the core intermediate results HSS indicators; hence, retaining only the unique indicators. These disaggregates were similarly described in the previous chapter. For example, a bed occupancy rate may have been disaggregated into two: bed occupancy rate for males and bed occupancy rate for females. For these types of indicators, these disaggregates were removed. Using the example given, these two indicators were clustered under "bed occupancy rates". Separating disaggregates reduced the number of raw indicators from 718 to 127 unique indicators. Three external reviewers and coders who were experts from the Gavi Vaccine Alliance Health Systems and Information Strengthening and the Monitoring and Evaluation Departments assessed each of the 127 unique indicators identified. These reviewers separately scored the indicators based on the following criteria:

1. The indicator should be specific, measurable, available, scientifically robust and time-bound (SMART) (Lopez Acevedo et al., 2012). This criterion was subjective and was based on the reviewer's perception.
2. There should be a strong suitability of the indicator for HSS monitoring and/or a strong track record of measurement experience with the indicator. The indicator should be frequently measured across countries. More frequently collected indicators are prioritised to allow a more in-depth analysis of the progress since analysis based only on one or two data points will not make it possible to visualize the progress of HSS grants in the future. However, in many Gavi recipient countries, indicators may not necessarily have accompanying regularly collected data. In such cases, indicators may still be selected to be part of the Gavi's HSS tailored indicators as long as they satisfy at least one of any other indicator criteria. To inform decisions on this criterion, information on the frequency of reporting for each indicator was collected and provided to external reviewers for their reference.
3. The indicator should satisfy a minimum level of comparability, coherence, and consistency between the way the indicator is measured by Gavi-supported countries and the way the measure can be applied to monitor Gavi's HSS grants. Information on whether an indicator is reported by at least two countries was also provided to external reviewers to inform their decisions for this criterion.
4. The indicator should align with Gavi's strategic goals, which include:
    - To contribute to strengthening the capacity of the health system to deliver immunisation and other health services in a sustainable manner;
    - To accelerate the uptake and use of underused and new vaccines and associated technologies and improve vaccine supply stability; and
    - To increase the predictability and sustainability of long-term financing for national immunisation programs.

Each reviewer was asked to give a score of '0' if they thought the indicator did not meet the specific criterion or '1' if they agreed that the indicator met a specific criterion. Hence, the maximum score an indicator can receive is four if they meet all four criteria specified above. Average scores per indicator were then computed. Indicators that received an average score of '0' were dropped from the list. The indicators were then sorted and their inclusion in the

reference list of tailored HSS indicators was prioritised based on their average scores received from all three external reviewers:

Table 3-2 Average scores received by each unique indicator identified

Average score	Number of indicators
3.01 - 4.00	40
2.01 - 3.00	42
1.01 - 2.00	30
0.01 - 1.00	13
0.00	2
Total	127

Source: Author's computations based on scores given by the reviewers

Further consultations on the selected indicators that were undertaken with other Gavi stakeholders such as those represented at the SG2MT, across the Alliance partners such as the WHO and the UNICEF, and other key HSS actors that were identified as crucial for HSS assessments as discussed in Chapter Two, including Gavi's regional heads and senior country managers.

3.3 Results and discussion

3.3.1 Sample tailored intermediate results HSS indicators

As specified above, the initial 718 indicators were reduced to 127 indicators. Further information was gathered for each of the 127 indicators, including the indicator's definition, numerator, denominator, disaggregation/additional measure, method of measurement or estimation, data sources, and countries which have used the indicator in their past Grant Performance Frameworks.

I found additional information for 105 of the 127 indicators. The other 22 indicators were removed from the reference list due to lack of information on how they can be measured. Table 3.3 presents the number of indicators retained per Gavi HSS cost category and health system function.

Table 3-3 Number of indicators per Gavi HSS cost category and health system building block

Health system building block	Gavi HSS Cost Category	Indicators
Governance	1 Policy and governance	5
	2 Programme management planning and administration	7
Health workforce	3 Health and community workforce	3
	4 Empower community and other local actors	8
Medical products and technologies	5 Strengthen procurement and supply chain management system	2
Health financing	6 Ensure adequate financing of the health and community system	6
	7 Programme support costs	4
Health service delivery	8 Scale-up and improve accessibility and quality of service delivery	28
Health information systems	9 Improve availability, quality and use of immunisation and health systems data	10
Others	10 Others	32

Source: Author's computations based on internal data collected

Sample indicators for each Gavi HSS cost category are presented below. The full list of the indicators is undergoing further review and can be accessed from the Gavi Vaccine Alliance country portal website.

Table 3-4 Sample indicators per health system building block and Gavi HSS cost-category

Health system function	Gavi HSS cost categories	Sample indicators
Governance	1. Policy and governance	Proportion of localities or health facilities with Effective Vaccine Management (EVM) scores of at or above 80% Vaccine wastage rates or proportion of localities with vaccine wastage rates that are aligned with the national policy aiming to reduce wastage (or proportion of reduction in vaccine wastage rates compared to existing rates)
	2. Programme management planning and administration	Number of technical committees at the national level Presence of an independent technical advisory group that meets defined criteria

Financing	3. Ensure adequate financing of the health and community system	Total government funds allocated to EPI budget or proportion of traditional vaccines with funds allocated from the national budgets or Proportion of funds for routine immunisation provided by the government direct contribution
	4. Programme support costs	Proportion of utilisation of Gavi HSS annual budget (or Rate of financial execution of Gavi RSS) Proportion of multi-year aid commitments disbursed by development partners
Medical products and technologies	5. Strengthen procurement and supply chain management system	Proportion of pharmaceutical companies with good laboratory practices (GLP) and good manufacturing practices (GMP) Average procurement time process for immunisation-related goods and services at specific levels (e.g. at the level of the ministry of health/public health) Extent to which procurement departments meet certification requirements
Workforce	6. Health and community workforce	Proportion of volunteers and community health workers who received immunisation training according to standards; OR Percent or total number of targeted communities with volunteers or CHWs trained to undertake EPI activities Proportion of active and practicing CHWs
	7. Empower community and other local actors	Level of community knowledge on immunisation Proportion of target districts that benefitted from communication and advocacy
Service delivery	8. Scale-up and improve accessibility and quality of service delivery	Proportion of districts with at least one Comprehensive Emergency and Obstetric Neonatal Care site
	9. Improve availability, quality and use of immunisation and health systems data	Proportion of health facilities regularly submitting surveillance data on reportable diseases including VPD and AEFI integrated disease surveillance
Others	10. Others	Proportion of households with a specific place for hand washing where water and cleansing agents are present Evidence of improved infection prevention and health care waste management Proportion of mothers who have initiated breast feeding within first hour following birth

3.3.2 Considerations for conducting program-level HSS monitoring and evaluation

Interest in a common monitoring and evaluation framework for Gavi's health systems strengthening grants was stimulated as a result of various international health partnerships and initiatives undertaken in the past (WHO, 2009a). However, such a common health system monitoring and evaluation framework still remains a challenge due to the very different country capacities, uneven data sources and data availability and quality across countries, including the varied contexts that drive priority areas for health systems (De Savigny & Adam, 2009; Hong & Huibin, 2002; WHO, 2003). As part of a strengthened focus on results, Gavi has introduced performance-based funding for HSS grants, drawing on the International Health Partnerships Plus (IHP+) Monitoring and Evaluation framework and has been working with partners on the intermediate results for HSS (Shorten, Taylor, Spicer, Mounier-Jack, & McCoy, 2012). Performance-based or outcomes-based funding for programs is increasingly common not only for health, but also for other service delivery areas (Fretheim, Witter, Lindahl, & Olsen, 2012; Odden & Busch, 1998; Soeters & Vroeg, 2011; Toonen, Canavan, Vergeer, & Elovainio, 2009). The intermediate results provided the link between HSS grant activities and improved immunisation outcomes, such as coverage and equity (Glassman & Savedoff, 2011). For reporting on immunisation results, Gavi recommends that countries identify and use tools for data collection that are appropriate for their country's context. Gavi collaborates with the WHO and other partners in using standardised tools that measure data quality, service readiness, and service availability (Gavi, 2010). As a key component of such M&E framework, this research provided a comprehensive suite of indicators that may also give an overview of the national and regional level of capacity of each Gavi-supported country and assist in monitoring their achievements towards the overall Gavi strategic goals. Findings ensure that the monitoring and evaluation framework for HSS grants is responsive and flexible while also enabling the use of standard measures and methods.

Indicators were classified across the WHO health systems building blocks and the different strategic objectives and HSS cost categories of Gavi. The results of this research showed that under each of the WHO health systems building block, Gavi HSS cost-categories can also be utilised for more program-focused HSS grant monitoring. Each of the indicators identified from the Grant Performance Frameworks and other core data sources fit into each of the priority areas were also aligned with global health development goals. The HSS grant

indicators specified above can then be used for monitoring and evaluating progress towards each of the WHO health systems building blocks, and towards achieving more resilient and sustainable health systems. Since the indicators have been identified from the Gavi performance frameworks and submissions from each Gavi-supported country, they can also reflect the relevant policy areas and provide insights on data availability and comparability. This can provide a more transparent mechanism for illustrating the government's accountability for their country's health progress. The findings also showed multi-stakeholder support and inter-sectoral indicators that were vital for HSS, supporting the results discussed in the previous chapters.

3.3.3 Limitations

While this chapter led to the development of a new indicator set that can be used by grant-receiving countries for performance-based accountability reporting back to Gavi, it does also suffer from some limitations. In particular, only intermediate results indicators for Gavi's HSS grants were included. Outcome and process tailored indicators were not identified and the database was not expanded to include broader HSS indicators. The indicator list is also not exclusive but indicative. This chapter was also restricted to a desk review of data sources available within Gavi - those that were submitted as part of HSS funding applications and previous findings of the author on HSS concepts and metrics as discussed in previous chapters. To my knowledge, this is the first comprehensive listing of program-level intermediate results HSS indicators derived from country-driven HSS monitoring and evaluation results frameworks. The indicators were selected from HSS monitoring and evaluation frameworks that countries have committed to for monitoring their health systems strengthening progress. However, the list of indicators was developed from Gavi's HSS assessments and for the context of immunisation-relevant health systems support. As such, other indicators were excluded due to language or search criteria. Some that were excluded may also be relevant for HSS monitoring and evaluation.

As specified in the findings in Chapter Two, HSS indicators and benchmarks may need ongoing revision to enhance their responsiveness to health systems needs and should be adapted for different contexts (Gabrysch, Zanger, Seneviratne, Mbewe, & Campbell, 2011). This means that the indicators identified in this chapter are not universally relevant in all contexts. For example, the majority of indicators were available on a national and regional

scale, but its application to small areas may be limited (Gabrysch et al., 2011; Mulligan, Appleby, & Harrison, 2000). Restrictions on scalability, funding, periodicity, and availability of data sources also further limit the applicability of the list of indicators for HSS monitoring and evaluation despite its potential relevance. The definitions selected for each indicator were also the most commonly accepted. The sources of information for the calculation of the indicators were highly heterogeneous with the institutes of statistics, and information from health administrations and social welfare being the principal sources of data (Mulligan et al., 2000). Furthermore, the reference year of these sources varies across countries. Moreover, this chapter only included data that were readily available within Gavi or its Alliance partners. For internal documents, country attempts to satisfy donor requirements may also create reporting bias for the definitions of each indicator may change with specific country contexts. Frequent communications and consultations with relevant Gavi experts were conducted to minimise the impact of these limitations. As much as possible, this research included triangulation of the findings with reports and recommendations of health systems experts within Gavi and its Alliance partners. Nevertheless, since the data sources were validated and agreed upon by the HSS-recipient countries, it has been assumed that country's monitoring and evaluation capacities and specific contexts were taken into consideration when countries have agreed to be monitored against such performance framework. The listing of the indicators has so far encompassed quantitative indicators. Future work on this area may include more qualitative indicators that can then be more reflective of a country's health systems performance, and to complement existing Gavi core and tailored health indicators. These indicators can then be more responsive to illustrate Gavi-supported countries' health systems support needs and priority areas. The approaches used in this chapter can form the basis for further work on this research area.

3.4 Conclusion

The findings in this Chapter provide baseline information on how health systems strengthening can be assessed to inform grant applications and funding investments. These indicators can also then facilitate the creation of more standard measures not only for Gavi-supported programs but also to aid other ongoing and future HSS programs. This list of indicators for HSS monitoring and evaluation can be a tool for program-focused or grant-focused HSS, which is also necessary to support health systems accountability and governance mechanisms. The list of indicators also showed that many standard and

commonly used indicators can then be updated or revised according to each country's capacities and health systems priorities. The indicators identified were also agreed upon by both the funding organisation and the HSS-recipient countries using a bottom-up approach for HSS monitoring and evaluation wherein an appraisal of feasible indicators for countries was the first step in selecting indicators. The transparency in the approaches used, the data sources and other relevant information can support future work on this area. Other researchers can also provide more contextual information on each of the countries selected for the study, which may include further data verification, validation, indicator selection and screening, according to identified needs and purposes of its use. Proper translations to overcome language barriers in HSS M&E indicator selection and screening can also be considered for future work. More importantly, the inventory of indicators and the accompanying database developed in this research can be further enriched with additional information that can be gathered from other data sources or more updated versions of the core data sources used in this study. To assist in this goal, this research provided initial design phases and a set of indicators for HSS that can be used at different levels to aid in conducting more structured monitoring and evaluation frameworks and practices, and help countries in mapping and assessing their very own health systems performance.

Part B: Health systems strengthening initiatives and health outcomes

Part B responds to the following research question:
How significant are HSS initiatives for improving health outcomes?

Using the concepts and measures identified from Part A, Part B first examines how these measures, controlling for socioeconomic factors, significantly influence health outcomes. Second, Part B develops an index for each of the health systems building block and an overall index for health systems performance to provide a global overview of health systems progress over the years. Third, Part B identifies taxonomies of health systems performance specifically in low- and middle-income countries using the index that was developed. Lastly, Part B moves from the global to the national context and examines a specific health system building block – leadership and governance – in two countries: the Philippines and Cambodia.

The main aim of any health system is to improve health outcomes for the people it serves (WHO, 2007), and the key to such improvement is strengthening the national health systems (Liu et al., 2012; Sepúlveda et al., 2006). Health outcomes are often the first area considered when evaluating the performance of a health system, requiring aggregated data on the health status and any health improvements of the population. Assessing health outcomes can also be attractive from a political point of view because it demonstrates how key policy reforms are affecting the overall population health. Among all health outcome measures, a more immediate measure is infant mortality rates (IMR), which is accurately measured by birth registries (Kang, Cho, & Jung, 2012; Pascual & Cantarero, 2005; H. Uchimura, 2008; M. Uchimura, Kizuki, Takano, Morita, & Seino, 2014). Significant declines in IMR also allows understanding of which aspects of health systems have effectively contributed in addressing major health risks (Alwan et al., 2010; Beaglehole et al., 2011; Wilkinson & Marmot, 2003). However, long term health system interventions are needed before these interventions can create significant changes in health outcome measures. In other words, considering the long-term nature of HSS, the impact of health systems interventions may not necessarily be captured yet in existing datasets because their impact may only be determined after a certain number of years (Ingram et al., 2012). This approach does not appeal to health systems

reforms that should be done rapidly to address pertinent health needs. Hence, relying on health outcomes measures alone to understand if a health system reform is effective or if the health system is performing well may not be adequate. This is specifically seen when policymakers and other practitioners would want to know the immediate effects of an intervention. Therefore, measuring how health systems influence immediate health outcomes remains a challenge for research (Tandon, Murray, Lauer, & Evans, 2010). This implies the need for other measures of health systems performance, which this thesis responds to by developing a composite indicator.

Higher-performing health systems are expected to lead to better population health (Ingram, Scutchfield, Charnigo, & Riddell, 2012). However, in addition to health systems, national economic factors such as GDP and individual socioeconomic characteristics are also strong and immediate determinants of population health especially in resource-poor settings (OECD, 2012). This influence of other health determinants may be more evident in LMICs, wherein wider social and health inequalities exist (Frenk et al., 1989; Wilkinson & Pickett, 2006). Given this complexity, confoundedness, and high spill-over effects of HSS interventions, examining how improving health systems alone led to better health was found to be difficult (Wilkinson & Marmot, 2003; Zakus & Bhattacharyya, 2007). In response, Part B controls for socioeconomic factors as it examines health systems performance in LMICs, while also accounting for comprehensive indicators for each of the health system buiing blocks and the overall health systems performance in both global and national contexts. In particular, Part B includes three chapters:

- Chapter 4: Health systems building blocks and key health outcomes
- Chapter 5: Taxonomy of health systems performance in low- and middle-income countries
- Chapter 6: Health systems strengthening in the context of decentralization

Chapter 4 Health systems building blocks and key health outcome indicators

4.1 Health status in low- and middle-income countries

Central to the work towards health systems strengthening is the analysis of how each health system building block affects health outcomes. In many low- and middle-income countries (LMICs),[5] health outcomes have been continuously improving over the years but it remains unclear whether the overall status can be attributed to certain characteristics of HSS (Berger & Messer, 2002; Gani, 2009). Using survey datasets, this chapter examines the relationship between key health systems indicators identified in Chapters 2 and 3 in relation to the different measures of health outcomes, including infant mortality rates, child mortality rates, life expectancy rates, and diphtheria-pertussis-tetanus (DTP3) immunisation coverage.

Child survival, indicated by infant, under-five, and child mortality rates, is an important measure of the overall health development of a country since it captures health of the most vulnerable group. Specifically, child survival often rises earlier and faster than other population health measures (UNHCR, 2013). In LMICs, under-five mortality rates significantly decreased from 1970 to 2010 from an average of 150 deaths per 1,000 live births in 1970 to almost half lower at 89 deaths per 1,000 live births in 1990. This further declined to 52 deaths per 1,000 live births in 2010, but still much higher compared with 7 per 1,000 live births in high income countries (IJsselmuiden, 2007). Specifically, mortality remains high in Sub-Saharan Africa with 157 deaths per 1,000 live births on average from 1970 to 2010. This average is followed by Asia (84 deaths per 1,000 live births), North Africa/Middle East (70 deaths per 1,000 live births), Latin America (54 deaths per 1,000 live births), Oceania (55 deaths per 1,000 live births), Caribbean (49 deaths per 1,000 live births) and Europe (25 deaths per 1,000 live births). Other than under-five mortality rates, neonatal mortality rates as another measure of child survival also showed a decline from 1970 to 2010. However, Sub-Saharan Africa was still lagging with an average of 41 deaths per 1,000 live births. Again, this is followed by Asia (33 deaths per 1,000 live births), North Africa/Middle

[5] LMICs refer to World Bank (WB) member economies and all other economies with populations of more than 30,000 that have a gross national income (GNI) per capita of $12,615 or less (as of 2012). GNI means gross national income converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over GNI as a U.S. dollar has in the United States (T. World Bank, 2013).

East (28 deaths per 1,000 live births), Oceania (27 deaths per 1,000 live births), Caribbean (22 deaths per 1,000 live births), Latin America (20 deaths per 1,000 live births), and Europe (12 deaths per 1,000 live births) (Figure 4.1).

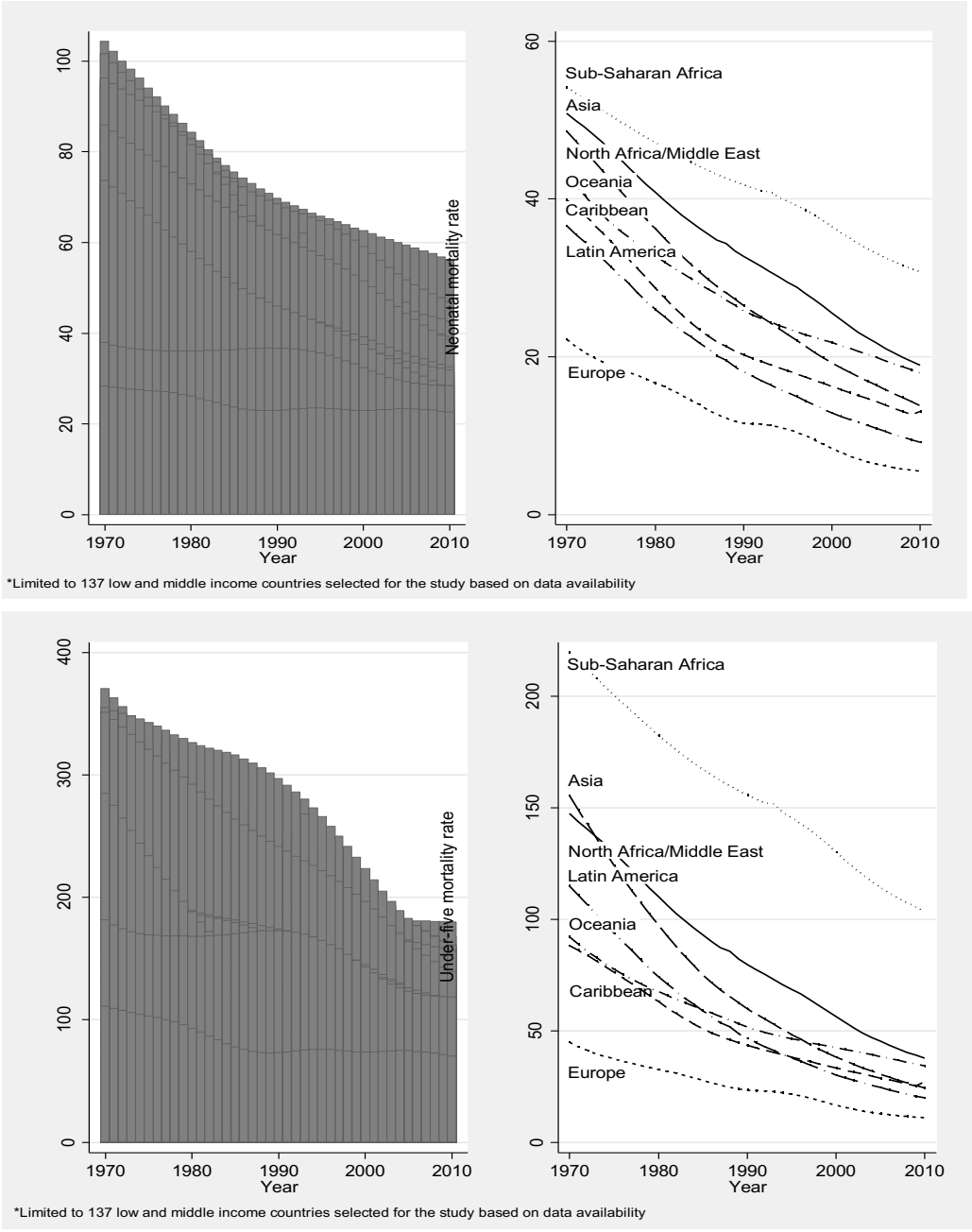


Figure 4.1 Child survival in LMICs as indicated by neonatal mortality rates (Panel A) and under-five mortality rates (Panel B) from 1970 to 2010 showing decreasing trends at the global level with the regions of Sub-Saharan Africa and Asia having the highest rates compared to other regions calculated using estimates from the IHME Global Health Data Exchange (IHME, 2014)

Another health outcome measure is life expectancy, which reflects the overall population mortality. In terms of life expectancy, people in high income countries live on average seven

years longer than those in LMICs (WHO, 2013d). Another health outcome measure is disease burden, which is used to assess and compare the relative impact of different diseases and injuries on populations by quantifying health loss due to disease (AIHW, 2013; Boutayeb & Boutayeb, 2005). In LMICs, disease burden remains high and this poor health status further widen health inequalities as disease burden tends to be higher among those with lower socioeconomic status (Ataguba, Akazili, & McIntyre, 2011; Di Cesare et al., 2013; Hosseinpoor et al., 2012; Miszkurka et al., 2012).

Another emerging concern is on population ageing. Population ageing refers to the increasing share of older persons in the population (Rechel et al., 2009). Life expectancies may significantly differ between countries, but populations of nearly all countries are ageing (Anderson & Hussey, 2000). The accelerated increase in aging and life expectancy influenced public health such that a substantial and rapid adaptation of the health system to the increasing demands for health care services is needed (Abrams, 2006; Jacobzone & Oxley, 2002). This ageing population further challenges an overburdened healthcare system (Beaglehole et al., 2008) and can lead to unprecedented demands in healthcare with detrimental economic and social impacts (Bloom, Canning, & Fink, 2010). Globally, population ages 65 and above was at 6% on average with the highest for Japan at 24.4% in 2012 and the lowest for United Arab Emirates at 0.33% in 2011 (Table 4-1). Meanwhile, LMICs have 4.6% of its total population who are in ages 65 and above, more than twice lower than the 9.88% in LMICs (Figure 4.2).

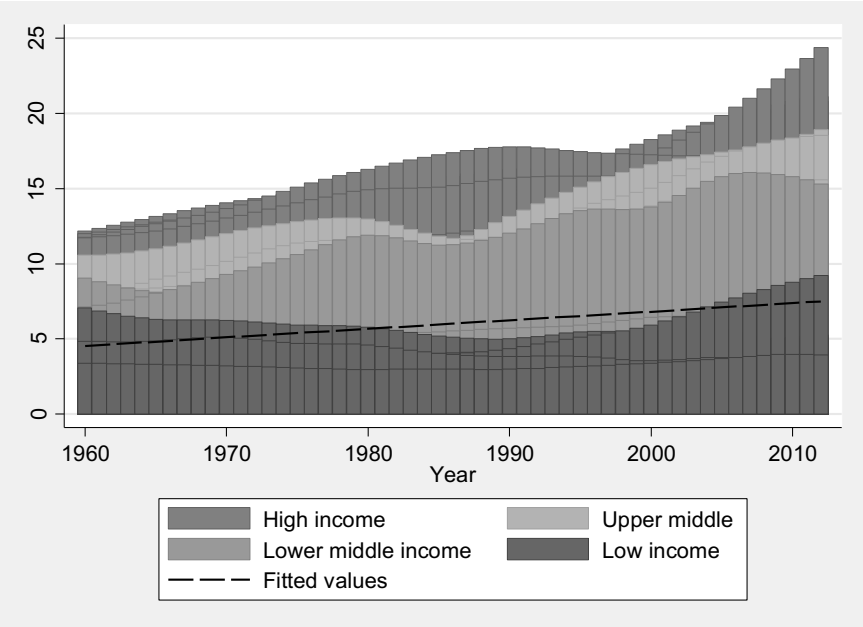


Figure 4.2 Population ages 65 and above from 1960 to 2012 for each income group

Table 4-1 Countries with the highest and lowest percentage for population ages 65 and above in low- and middle-income countries

	Wave 1	Wave 2	Wave 3
Highest	Latvia (12.36%)	Bulgaria (17.19%)	Bulgaria (18.27%)
	Bulgaria (11.57%)	Latvia (16.50%)	Latvia (18.24%)
	Serbia (11.19%)	Ukraine (15.16%)	Ukraine (15.79%)
	Ukraine (10.86%)	Lithuania (14.78%)	Lithuania (15.48%)
	Lithuania (10.77%)	Romania (14.37%)	Romania 14.88%)
	Uruguay (10.40%)	Belarus (14.32%)	Bosnia and Herzegovina
	Belarus (10.22%)	Georgia (13.97%)	(14.84%)
	Romania (9.79%)	Serbia (13.69%)	Georgia (14.35%)
	Russia (9.36%)	Uruguay (13.41%)	Belarus (14.08%)
	Georgia (9.26%)	Russia (13.38%)	Uruguay (13.85%)
Lowest	Eritrea (1.76%)	Eritrea (1.92%)	Eritrea (2.1%)
	Niger (1.97%)	Afghanistan (2.03%)	Afghanistan (2.16%)
	Afghanistan (2.18%)	Sierra Leone (2.44%)	Rwanda (2.32%)
	Palestine (2.18%)	Palestine (2.46%)	Angola (2.42%)
	Papua New Guinea	Angola (2.46%)	Uganda (2.45%)
	(2.25%)	Niger (2.53%)	Burkina Faso (2.49%)
	Timor-Leste (2.32%)	Uganda (2.56%)	Gambia (2.51%)
	Djibouti (2.52%)	Papua New Guinea	Chad (2.52%)
	Rwanda (2.54%)	(2.58%)	Burundi (2.55%)
	Fiji (2.61%)	Gambia (2.59%)	Sierra Leone (2.55%)
	Malawi (2.61%)	Burkina Faso (2.62%)	

**Excludes the following countries: Palau, Tuvalu, Marshall Islands, Dominica and Kosovo*
Source: Author's computations using Health Systems 20/20 project's database

Hence, to further examine how health systems in LMICs change and adapt to current demands for health care service delivery, this chapter aims to determine the similarities and differences in health systems performance across 135 low- and middle-income countries. 25.17% of the data (n = 8640) came from countries under the low income category, 37.76% of the data (n = 12,960) came from countries under the lower middle income category, and 37.06% of the data (n = 12,720) came from countries under the upper middle income category.

Table 4-2 Number of observations collected per income group

Income group	Frequency	Percent
Low income	8,640	25.17%
Lower middle income	12,960	37.76%
Upper middle income	12,720	37.06%

Source: Author's computations using the Health Systems 20/20 data

Without a properly working health system, LMICs continuously suffer from poor health outcomes (Schell, Reilly, Rosling, Peterson, & Ekström, 2007). Although increasing amount of official development assistance for health aims to achieve better health outcomes (OECD, 2011), the per capita total health spending remains low for LMICs at $301 on average compared to the $3,370 average for high income countries (Frenk et al., 1989). This lack of resources compels evidence-informed resource allocation, implying the need to enhance HSS assessments that will best inform proper allocation and maximize limited health resources. Hence, health systems performance assessments will enable more health resources to be allocated to aspects of health systems that best improve health (Costa Font & Sato, 2012; Di Cesare et al., 2013).

4.2 Methods

To do a cross-country comparative analysis of each health systems building block from the framework developed in Chapter Two and examine how each of these block relate to health outcomes, this chapter uses three waves of data from the USAID Health Systems 20/20 project for 137 LMICs. Using previous studies on health systems performance assessments as a starting point, this chapter updates and expands the health systems indicators that can be used to assess each building block and the overall health systems performance. The effects of building blocks and overall health systems performance were then compared against health outcome measures: infant mortality rates (IMR), under-five mortality rates (UMR), life expectancy (LE), and diphtheria-tetanus-pertussis (DTP3) immunisation coverage.

4.2.1 Data Sources

Data sources include the USAID Health Systems database (USAID, 2013), which compiles and analyses national-level health system data from multiple sources such as the Demographic and Health Surveys (Rutstein & Rojas, 2006),[6] the World Health Organisation (WHO, 2015k),[7] the World Development Indicators (World Bank, 2012),[8] and the World

[6] The Demographic Health Surveys (DHS) were nationally-representative household surveys that provide data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. The DHS has been implemented in overlapping five-year phases based on a stratified two-stage cluster design (Rutstein & Rojas, 2006).

[7] The World Health Surveys was built upon the WHO Multi-country survey study and was gathered using a valid, reliable, and comparable household survey instrument The total sample size, using nationally representative samples, included over 300,000 individuals aged 18+ years (WHO, 2015k).

Governance Indicators (World Bank, 2016d).[9] Although the original data sources were coming from multiple surveys, the database used for this study was a single database used in the Health Systems 20/20 project. Further, I averaged the data into three or every five years. Specifically, the dataset has a pooled cross-sectional time series structure with country as the unit of analysis. The records are country-period observations with repeated observations for countries over time.

4.2.2 Dependent variables

I used four health outcome indicators: a) infant mortality rates (IMR), b) under-five mortality rates (UMR), c) life expectancy at birth (LE), and d) immunisation coverage for DTP3. IMR is the probability of dying before the 1st birthday (DHS, 2015b). It is considered to be the single most exhaustive indicator of health because it is based on birth registries, implying more complete and accurate measurements (Kang, Cho & Jung 2012: 1; Rubio 2011: 3907-3917). CMR is the probability of dying between the 1st and 5th birthdays of a child (DHS, 2015b). Based on extrapolations from child mortality data and assumed life-length tables (Cantarero, Pascual 2008: 109-111; Uchimura, Jütting 2009: 1926-1934), LE indicates the number of years a newborn infant would live if prevailing patterns of mortality at the time of birth were to stay the same throughout life (World Bank, 2016b). IMR and CMR were estimated using data from the Demographic Health Surveys (DHS, 2015b), while LE were estimated using data from the World Development Indicators (World Bank, 2016b).

4.2.3 Independent variables

Using the indicators identified from Chapters Two and Three, I used the indicators with existing data to represent each of the health systems building block: governance, financing, service delivery, workforce, medical products and technologies, and health information systems. Specifically, I used the following indicators:

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[8] The World Development Indicators is the primary World Bank collection of development indicators, compiled from officially-recognized international sources. It presented the most current and accurate global development data available, and included national, regional, and global estimates (World Bank, 2012).

[9] The World Bank's Governance Indicators reported aggregate and individual indicators for 215 economies over the period 1996-2014 for six dimensions of governance: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and corruption. These aggregate indicators combined the views of a large number of enterprise, citizen and expert survey respondents in industrial and developing countries (World Bank, 2016d).

Governance. I used six indicators collected from the World Governance Indicators, which uses six indicators aggregated at the national-level and are available from 1996 to 2014. These six indicators reflect the six dimensions of governance: control of corruption[10], voice and accountability[11], regulatory quality[12], political stability and absence of violence/terrorism[13], government effectiveness[14], and rule of law[15] (World Bank, 2016d). All indicators are reported as governance scores ranging from -2.5 to 2.5 with higher values corresponding to better governance index. These units are computed by combining into one score the views of a large number of enterprise, citizen and expert survey respondents across different countries (World Bank, 2016d). Specifically, these scores are based on over 30 individual data sources produced by a variety of survey institutes, think tanks, non-governmental organisations, international organisations, and private sector firms (World Bank, 2016d).

Financing. I used six indicators: external resources for health as a percentage of total health expenditure (WHO, 2015b), out-of-pocket expenditure on health as a percentage of private expenditure on health (US$) (WHO, 2016b), per capita government health expenditure (PPPint) (WHO, 2015e), per capita total health expenditure (WHO, 2015j), private expenditure on health as a percentage of the total health expenditure (WHO, 2016b), and private prepaid plans as a percentage of private expenditure on health (WHO, 2016b). External resources for health are funds or services in kind that are provided by entities not part of the country in question (World Bank, 2015b). The resources may come from international organisations, other countries through bilateral arrangements, or foreign nongovernmental organisations (World Bank, 2015b). Out of pocket expenditure, part of private health expenditure, is any direct outlay by households, including gratuities and in-kind payments, to health practitioners and suppliers of pharmaceuticals, therapeutic

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[10] Control of corruption refers to extent to which public power is exercised for private gain.

[11] Voice and accountability measures the extent to which countries are able to participate in selecting their government, freedom of expression and association, and free media.

[12] Regulatory quality measures the ability of the government to formulate and implement sound policies.

[13] Political stability and absence of violence/terrorism measures perceptions of the likelihood of political instability and/or politically-motivated violence, including terrorism

[14] Government effectiveness measures perceptions of quality of public services, civil service and the degree of its independence from political pressures, quality of policy formulation and implementation, and the credibility of the government's commitment to such policies

[15] Rule of law measures the extent to which agents have confidence in and abide by the rules of society, and in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence

appliances, and other goods and services whose primary intent is to contribute to the restoration or enhancement of the health status of individuals or population groups (World Bank, 2016c). Private prepaid plans refer to the relative weight of voluntary health insurance payments in total health expenditure (WHO, 2015h).

Medical products and technology. I used four indicators: pharmaceutical public spending per capita at US exchange rates, pharmaceutical private spending per capita at US exchange rates, and total pharmaceutical expenditure at US exchange rates. Pharmaceutical spending includes expenditures on prescriptions on medicines and over-the-counter products. In some countries, the data also include other medical non-durable goods adding approximately 5% to the expenditure (OECD, 2015b). The spending also includes pharmacists' remuneration when the latter is separate from the price of medicines. Indicators related to the per cent of pharmaceuticals consumed per country were excluded in the analysis due to data availability (missing data >94%). Final expenditure on pharmaceuticals include wholesale and retail margins and value-added tax (OECD, 2015b).

Service delivery. I used four indicators: pregnant women who attended at least one antenatal care visit, HIV test results received in the last twelve months of female population ages 15 to 49 years old, improved sanitation facilities and improved water source.

Workforce. I used three indicators: births attended by doctors, births attended by other health professionals, and births attended by skilled health staff as a percentage of total births.

4.2.4 Control variables

I used three control variables: fertility rate, gross domestic product (GDP) per capita, and the Gini index. Fertility rate is the number of births that occurred in the three years before the survey to women between the ages of 15 to 49 years divided by the number of women-years of exposure in the three years before the survey for women in the same age group (DHS, 2015a). GDP per capita (constant 2005 US$), which is calculated by dividing the gross domestic product with midyear population, is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products (World Bank, 2015c). The Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a

perfectly equal distribution (World Bank, 2015d). A Gini index of zero represents perfect equality, while an index of 100 implies perfect inequality (World Bank, 2015d).

4.2.5 Analysis

Assuming that higher scores for each health systems building blocks lead to better health outcomes, I quantified the performance for each health systems building blocks and their effects on health outcomes using fixed effects and random effects longitudinal regression models for 137 LMICs. These models consider the dependencies in the data associated with having repeated observations on countries over time. Using the fixed effects model makes the model consistent and unbiased and does not make any assumptions about the distribution of the country-level unobserved effects (Wooldridge, 2015). However, fixed effects models fail to directly estimate the impacts of time-invariant variables on the dependent variables and only use within-country variation. Hence, using fixed effects model is inefficient in cases when there are little within-country variations. Likewise, random-effects model may be useful to create an optimal combination of between and within country variations. However, such model assumes that the unobservable and observable variables affecting health outcomes are uncorrelated, which is unlikely for the variables included in the study. Therefore, considering these limitations of both models, findings for both random and fixed effect regression models were also discussed below. Following the work of Gani (2009), I examined the relationships between each health system building block and outcomes using the following structural equation:

$$\gamma_{it} = f(H_{it}, X_{it}) \tag{4.1}$$

where γ refers to the different health outcome indicators, reflecting health status of country i, H refers to the different health system building block indicators for country i in time t, X is a vector of the control variables used for country i and time t.

In the regression analysis, equation 4.1 is expressed in four forms as follows:

$$IMR_{it} = \alpha + \beta_1 HS1_{it} + B_2 HS2_{it} + \beta_3 HS3_{it} \ldots + \beta_4 HSX_{it} + \beta_6 Fert_{it} + \beta_7 GDP_{it} + \beta_8 Gini_{it} + \mu_i + u_{it} \tag{4.2}$$

$$CMR_{it} = \alpha + \beta_1 HS1_{it} + B_2 HS2_{it} + \beta_3 HS3_{it} \ldots + \beta_4 HSX_{it} + \beta_6 Fert_{it} + \beta_7 GDP_{it} + \beta_8 Gini_{it} + \mu_i + u_{it} \quad (4.3)$$

$$DTP3_{it} = \alpha + \beta_1 HS1_{it} + B_2 HS2_{it} + \beta_3 HS3_{it} \ldots + \beta_4 HSX_{it} + \beta_6 Fert_{it} + \beta_7 GDP_{it} + \beta_8 Gini_{it} + \mu_i + u_{it} \quad (4.4)$$

$$LE_{it} = \alpha + \beta_1 HS1_{it} + B_2 HS2_{it} + \beta_3 HS3_{it} \ldots + \beta_4 HSX_{it} + \beta_6 Fert_{it} + \beta_7 GDP_{it} + \beta_8 Gini_{it} + \mu_i + u_{it} \quad (4.5)$$

In this model, γ is the health outcome variable of country *i* in year *t.* HSx, where x is the corresponding health systems building block, include each of the indicators described above for each of the building block in country i and year t. I run separate models for every health system building block before running one model considering all blocks. I then controlled for the following variables: $Fert$ is the fertility rate in country i and year t, GDP is the gross domestic product in country i and year t, and $Gini$ is the Gini coefficient in country i and year t. In the model, u_i is assumed to be independent and identically distributed with a mean of zero and constant variance and uncorrelated with any of the explanatory variables. The error term in the above equation is u_{it} with the assumption that $u_{it} \approx iid\ (0,\ \sigma^2)$. The expected effects are that the indicators for each of the health systems building blocks are positively associated with health outcomes such that better health systems performance results to reduced mortality rates and improved immunisation coverage and life expectancy. To take into account country-specific differences, a fixed-effects estimation procedure including country-specific dummy variables was used. Given the nature of the data, the possibility of AR(1) errors is likely and so the fixed-effects estimation procedure corrected for AR(1) errors was used. Since outliers can cause bias results by pulling or pushing the regression line in a particular direction resulting to biased regression coefficients, I also removed outliers or countries with extremely high or low numbers for each of the indicators by testing for outlying observations, multicollinearity and regression stratification across income groups. Assuming all variables are linear, I initially examined exploratory scatterplots

of the variables of interest and transformed variables into its logarithmic form for data with evident curvature in the relationships.

4.3 Results

4.3.1 Descriptive statistics

I run separate samples for each regression model and for every health system building block. I have different numbers of observations across variables. For some measures like GDP per capita, I have on average 40 waves of data per country, but for the outcome variables, with the exception of LE, I only have between two to three waves per country. Appendix three indicates the overall mean for the variables included in the study or the mean of country-years. The table also presents the between statistics, which are country level means, and the within statistics, which showed the deviations of the country by time scores from the country means. The following discussion presents the averages in the whole dataset:

Health outcomes. Average IMR was at 67 deaths per 1000 live births. The maximum IMR recorded was at 152 deaths per 1000 live births. Average CMR is at 106 deaths per 1000 live births with the lowest recorded at 12 deaths per 1000 live births and the highest at 326 deaths per 1000 live births. Life expectancy at birth or the number of years a newborn infant would live is at 59 years old on average and can range from only 20 years old to as high as 80 years old. Specifically, San Marino and Sierra Leone had mean annual population growth rates of 1.38% and 1.95% respectively, yet their mean life expectancies were at the extreme sides with San Marino having one of the highest life expectancy of 81.50% and Sierra Leone with only 37.80%. Highest mean life expectancies after San Marino were from Iceland (77.39%), Sweden (77.07%), Japan (76.99%) and Switzerland (76.69%). Meanwhile, lowest life expectancies were from Sierra Leone (37.80%), Angola (41.27%), Mali (41.88%), South Sudan (42.25%), and Mozambique (43.15%). Immunisation coverage for DTP3 for 1 year olds is at 60.45% on average and can range from only 2.60% to as high as 97.90%.

Health systems building blocks. Almost all LMICs have negative scores for governance with an average score of -0.50 across all the six dimensions of governance. Of the 137 LMICs included in the study, Chile scores the highest in terms of control of corruption with a mean of 1.44, followed by Antigua and Barbuda (1.09) and Uruguay (1.02). Least among all

these countries are Somalia (-1.72), Afghanistan (-1.58), North Korea (-1.54), Myanmar (-1.46), and the Democratic Republic of Congo (-1.45). Government effectiveness is also highest in Chile with an average score of 1.21. This is followed by Malaysia (1.05) and Mauritius (0.674). Meanwhile, least scores were from Somalia (-2.18), North Korea (-1.92), Democratic Republic of the Congo (-1.70), South Sudan (-1.68) and Comoros (-1.58). In terms of political stability (PS), five highest countries include: Tuvalu (1.36), Kiribati (1.35) and Palau (1.17). Least scores were from: Somalia (-2.83), Afghanistan (-2.43), Democratic Republic of the Congo (-2.29), Sudan (-2.26) and Iraq (-2.23). Regulatory quality is also highest in Chile (1.48) followed by Lithuania (1.02) and Latvia (0.96). Least scores were from: Somalia (-2.83), Afghanistan (-2.43), Democratic Republic of the Congo (-2.29), Sudan (-2.26) and Iraq (-2.23). Rule of law is also highest in Chile (1.26), followed by Antigua and Barbuda (0.97) and Tuvalu (0.96). Least scores were from Somalia (-2.36), Afghanistan (-1.81), Democratic Republic of the Congo (-1.71), Iraq (-1.64) and Zimbabwe (-1.57). In terms of voice and accountability (VA) or the extent to which citizens are able to participate in selecting their governments, highest scores were from the small islands: Marshall Islands (1.19), Palau (1.17) and Saint Lucia (1.12). Least scores were from North Korea (-2.17), Myanmar (-2.03), Turkmenistan (-1.96), Somalia (-1.95) and Uzbekistan (-1.91). Overall, average government resources in LMICs is at 46.7% for wave one of the data decreasing to 46.05% in wave two and then increasing to about 47.8% in wave three. Private health resources also contributed to health systems financing with an average of 44.9% in wave one, decreasing slightly to 43.02% in wave two, and further decreasing in wave three at 40.96%. Most LMICs also receive external resources for health, which were continuously increasing with 8.40% in wave one to 10.93% in wave two and 11.25% in wave three.

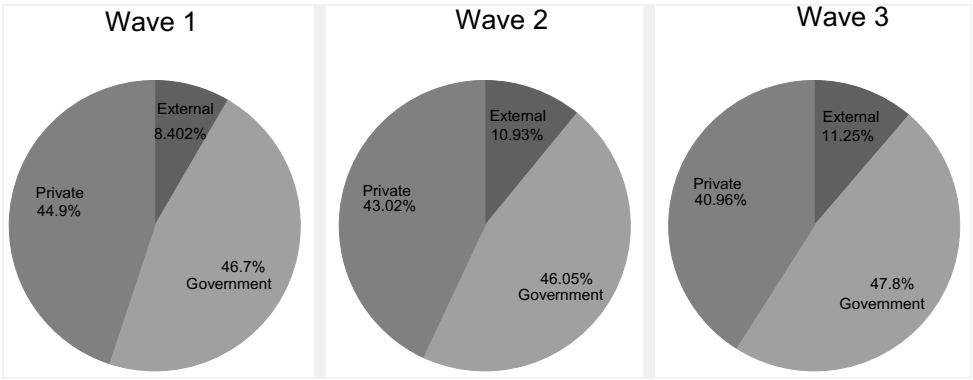


Figure 4.3 Percent distribution of health resources for LMICs compared every five years
Source: Author's computations using Health Systems 20/20 project's database

The total health expenditure for the 137 LMICs included in the study is comprised on average of 11.72% external resources for health and 47.87% private expenditure on health, while the rest are from government resources. Of the private expenditure on health, 80.29% of the total health expenditure is out of pocket expense, while 9.89% were from private prepaid plans. On average, the total expenditure on health is at 275.02PPPint with 159.14PPint coming from government expenditure. Overall, per capita public spending for pharmaceuticals is at 10.37US$ using 2013 exchange rates, while private spending is at 19.35US$ on average. Of the total health expenditure for each country, total pharmaceutical expenditure on average is at 26.49% or at 28.68 US$.

Further, 79.74% of pregnant women attended at least one antenatal care visit. The minimum recorded is at 24.50% and the maximum is at 98.70%. On average, 4% of female population aged 15 to 49 years old received HIV test results in the last 12 months and the highest recorded is at 40%. In terms of sanitation, 58.02% have improved sanitation facilities, which also range from only about 2.3% to as high as 100%. Water sources have also improved for 77.98% on average. This available water sources range from only 4.80% to as high as 100%. On average, 23.55% of the total births were attended by doctors, while 32.85% were attended by other health professionals, and 80.31% were attended by skilled health staff. Overall, average fertility rates were at 4.37% and range from 1.58% to 1.20%. Meanwhile, GDP per capita is at 1950.17 on average, while Gini index is at 43.29.

4.3.2 Regression results per health system building block

Given the data differences among the variables, each regression is run on a slightly different sample. Note that most of the significant effects are in the random effects models. Given the data used in the study, this probably reflects cross-national differences between countries such that countries with stronger health systems have better health outcomes than countries with weaker health systems. This section discusses the results from each of these models.

Governance. I found that control of corruption has a significant effect on all health outcome indicators (IMR, CMR, LE, and DTP3) when using a random effects models with government effectiveness showing significant effects on child mortality rates and life expectancy. The random effects estimate is a weighted average of between and within effects, implying that it averages cross-sectional differences between countries and over time

differences within countries. I found that there is more cross-sectional variation (between country variation) in these governance measures than over-time (within) variation (Table 4.1). Thus, the random effects estimates reflect that countries with better corruption control and government effectiveness have better health outcomes than countries with worse corruption control and government effectiveness. Every unit of increase in government effectiveness reduces child mortality rates by 0.17% (re) at $p<0.05$ to 0.33% (fe) at $p<0.05$ and improves life expectancy by 0.25 (re) at $p<0.01$ to about 0.33 (fe) at $p<0.01$. Meanwhile, every unit of increase in the rule of law significantly improves immunisation coverage by 0.47 controlling for fertility rates, GDP per capita, and Gini index.

Financing. I found statistical significance for the health financing indicators when they are run separately for each health outcome indicator, while controlling for fertility rates and GDP. However, if all of the health financing indicators were added in the model, only external resources for health showed significance in improving health outcomes. Specifically, I found that external resources for health significantly improved life expectancy by 0.26 at $p<0.05$, while private expenditure on health significantly affects infant mortality rates by 0.27 at $p<0.05$ controlling for fertility rates, GDP per capita and Gini index. Other than these, I found no significant influence of the other financing indicators on the different health outcome variables.

Service delivery. The percent of pregnant women who attended at least one antenatal care visit significantly reduced IMR (0.56 for re, 0.86 for fe; $p < 0.001$) and CMR (0.41 for re and 0.68 for fe; $p <0.001$). LE improved by 0.275 (re) to 0.38 (fe) at $p<0.001$, while DTP3 immunisation coverage also increased by 0.34 at $p<0.05$ while controlling for fertility rates and GDP per capita. In the service delivery equation, I removed controls for Gini index because this leads to multicollinearity when using the indicator for pregnant women who attended at least one antenatal care visit. The multicollinearity was found only with the model for service delivery, but was not found for any of the separate models for the other health systems building blocks.

Medical products and technologies. Pharmaceutical public spending significantly decreased IMR by 0.348 at $p<0.05$ in a random effects model, but showed no significance in a fixed effects model. Pharmaceutical public spending also significantly influenced DTP3

immunisation coverage by 2.45 at $p<0.05$, but showed to decrease coverage instead of improving it. No other variables showed significant relationships with any of the health outcome indicators while controlling for fertility rates, GDP per capita and Gini index.

Workforce. Births attended by skilled health staff significantly influenced all health outcome indicators, decreasing IMR by 0.536 at $p<0.01$ in a random effects model and by 0.686 in a fixed effects model. CMR also decreased by 0.523 at $p<0.001$ (re) and by 0.578 at $p<0.01$ (fe). The effect also includes an improved life expectancy by 0.372 at $p<0.05$ (re) and 0.477 at $p<0.01$ (fe), while DTP3 immunisation coverage also increased by 1.243 at $p<0.001$ in a random effects model controlling for fertility rates, GDP, and Gini index.

In summary, for the five out of the six health systems building blocks that I examined, I found the strongest associations for reduced corruption, improved government effectiveness, and enhanced rule of law. I also found that external resources are positively associated with life expectancy, while the availability of more private resources for health significantly reduced infant mortality rates. I also found that improving the percent of pregnant women who attended at least one antenatal care visit is associated with a significant improvement in health outcomes. Further, I found that the pharmaceutical public spending significantly reduced IMR and improved DTP3 immunisation coverage. Similarly, the percent of births attended by skilled health staff significantly improved all health outcome indicators. After running separate regression models for each of the health systems building blocks for every health outcome indicator, I created an index for each of the health system building blocks and then an overall index using factor analysis. These models are discussed in Chapter Five.

Table 4-3 Fixed effects and random regression results for governance and health outcome variables

	IMR		CMR		LE		DTP3	
	re	fe	re	fe	re	fe	re	fe
Governance								
control of corruption	0.153*	0.22	0.192**	0.258*	-0.124*	-0.145	-0.338**	-0.224
	-0.041	-0.082	-0.003	-0.029	-0.026	-0.076	-0.008	-0.612
government effectiveness	-0.124	-0.317	-0.177*	-0.327*	0.249**	0.338**	0.154	0.292
	-0.225	-0.063	-0.042	-0.036	-0.001	-0.006	-0.366	-0.674
political stability and absence of violence	0.124	0.379	0.135	0.331	-0.153	-0.248	-0.078	-0.287
	-0.161	-0.085	-0.066	-0.089	-0.047	-0.08	-0.609	-0.618
regulatory quality	-0.044	0.009	0.002	-0.049	-0.068	-0.07	-0.292	0.057
	-0.729	-0.969	-0.988	-0.814	-0.504	-0.642	-0.216	-0.974
rule of law	0.004	0.134	0.039	0.155	-0.061	-0.031	0.469**	-0.111
	-0.969	-0.386	-0.618	-0.265	-0.398	-0.753	-0.007	-0.805
voice and accountability	0.141	0.012	0.108	-0.021	-0.042	-0.025	0.022	0.588
	-0.129	-0.96	-0.153	-0.923	-0.611	-0.873	-0.888	-0.607
Control variables								
fertility rate	0.703***	0.794	0.740***	0.826*	-0.649***	-0.343	0.148	-1.405
	0	-0.07	0	-0.039	0	-0.2	-0.441	-0.384
GDP per capita	-0.188	-0.101	-0.133	0.087	0.103	0.098	0.308	0.002
	-0.176	-0.769	-0.251	-0.776	-0.372	-0.658	-0.21	-0.999
GINI Index	-0.062	0.177	-0.095	0.142	0.078	0.09	0.411	-0.544
	-0.543	-0.393	-0.263	-0.438	-0.354	-0.497	-0.064	-0.564
N	54	54	54	54	54	54	41	41

Standardised beta coefficients; p-values: * p<0.05, ** p<0.01, *** p<0.001; re means random effects model; fe means fixed-effects model

Table 4-4 Fixed effects and random effects regression results for financing data and health outcomes

	IMR		CMR		LE		DTP3	
	re	fe	re	fe	re	fe	re	fe
Financing								
external resources for health as % of total expenditure on health	-0.094	-0.339	-0.077	-0.334	0.123	0.267*	0.161	0.132
	-0.426	-0.08	-0.472	-0.053	-0.192	-0.039	-0.445	-0.736
OOP as % of private expenditure on health	0.133	-0.391	0.196	-0.215	-0.058	0.122	-0.075	0.404
	-0.306	-0.278	-0.096	-0.491	-0.643	-0.596	-0.764	-0.64
per capita government expenditure on health, PPPint	0.323	0.49	0.203	0.339	-0.075	-0.105	0.183	0.084
	-0.251	-0.195	-0.428	-0.301	-0.721	-0.66	-0.775	-0.938
per capita total expenditure on health, PPPint	-0.311	-0.542	-0.112	-0.444	-0.066	0.217	0.344	0.585
	-0.285	-0.209	-0.673	-0.239	-0.758	-0.43	-0.648	-0.697
private expenditure on health as % of THE	0.277*	0.303	0.175	0.496	-0.016	-0.298	-0.183	-1.029
	-0.042	-0.505	-0.158	-0.224	-0.895	-0.317	-0.464	-0.477
private prepaid plans as % of private expenditure on health	0.236	-0.219	0.286	0.07	-0.192	-0.174	-0.205	-0.376
	-0.169	-0.629	-0.064	-0.86	-0.229	-0.555	-0.559	-0.782
Control variables								
fertility rate	0.777***	0.488	0.845***	0.457	-0.781***	-0.533*	-0.023	-0.733
	0	-0.162	0	-0.138	0	-0.027	-0.93	-0.611
GDP per capita	-0.187	0.126	-0.249	0.411	0.324	-0.304	-0.032	-1.243
	-0.354	-0.857	-0.175	-0.51	-0.068	-0.508	-0.947	-0.509
GINI Index	-0.189	0.107	-0.219	-0.129	0.225	0.266	0.128	-0.32
	-0.139	-0.763	-0.058	-0.678	-0.058	-0.257	-0.588	-0.673
N	57	57	57	57	57	57	41	41

Standardised beta coefficients; p-values: * p<0.05, ** p<0.01, *** p<0.001; re means random effects model; fe means fixed-effects model

Table 4-5 Fixed effects and random effects regression results for service delivery data and health outcomes

	IMR				LE		DTP3	
	re	fe	re	fe	re	fe	re	fe
Service delivery								
pregnant women who attended at least one antenatal care visit	-0.555***	-0.855***	-0.407***	-0.685***	0.275***	0.379***	0.335*	0.364
	0	0	0	0	0	0	-0.047	-0.681
HIV test results received in the last 12 months of female population aged 15 to 49	0.112	0.165	0.05	0.107	-0.064	-0.085	0.018	0.295
	-0.373	-0.158	-0.638	-0.304	-0.15	-0.057	-0.918	-0.291
improved sanitation facilities	-0.747**	-1.394**	-0.659**	-1.285**	0.319*	0.167	0.179	3.554*
	-0.002	-0.002	-0.002	-0.002	-0.024	-0.29	-0.606	-0.026
improved water source	0.112	0.136	0.118	0.205	0.055	0.142	0.145	-3.617*
	-0.484	-0.416	-0.384	-0.197	-0.492	-0.103	-0.604	-0.049
Control variables								
fertility rate	0.014	-0.722**	0.146	-0.491*	-0.033	0.09	-0.113	-0.075
	-0.936	-0.003	-0.324	-0.013	-0.662	-0.215	-0.636	-0.932
GDP per capita	-0.422**	-0.775***	-0.273*	-0.408*	0.250***	0.312**	0.003	-0.814
	-0.005	-0.001	-0.033	-0.016	-0.001	-0.001	-0.99	-0.217
N	52	52	52	52	54	54	39	39

Standardised beta coefficients; p-values: * p<0.05, ** p<0.01, *** p<0.001; re means random effects model; fe means fixed-effects model

Table 4-6 Fixed effects and random effects regression results for medical products and technologies data and health outcomes

	IMR		CMR		LE		DTP3	
	re	fe	re	fe	re	fe	re	fe
Medical products and technology								
pharmaceutical public spending per capita	-0.348*	-0.088	-0.268	0.025	0.068	0.033	-0.34	-2.453*
	-0.034	-0.787	-0.068	-0.924	-0.551	-0.778	-0.544	-0.033
pharmaceutical private spending per capita	-0.569	-0.353	-0.329	-0.023	0.186	0.009	-0.923	-1.741
	-0.328	-0.721	-0.532	-0.977	-0.682	-0.986	-0.484	-0.314
total pharmaceutical expenditure as % of THE	-0.19	0	-0.208	0.087	0.11	-0.038	-0.288	-0.41
	-0.191	-0.999	-0.099	-0.794	-0.318	-0.798	-0.115	-0.511
total pharmaceutical expenditure at US exchange rate	0.753	0.381	0.553	-0.023	-0.302	0.088	1.519	3.539
	-0.288	-0.765	-0.386	-0.982	-0.582	-0.888	-0.354	-0.174
Control variables								
fertility rate	0.610***	0.341	0.646***	0.207	-0.554***	-0.268	-0.443**	-2.549***
	0	-0.219	0	-0.331	0	-0.092	-0.009	0
GDP per capita	-0.266	-0.545	-0.319	-0.384	0.379*	-0.022	-0.578*	-2.234
	-0.207	-0.426	-0.084	-0.483	-0.048	-0.951	-0.048	-0.198
GINI Index	-0.097	0.129	-0.112	0.14	0.027	-0.16		
	-0.533	-0.766	-0.413	-0.692	-0.851	-0.501		
N	37	37	37	37	38	38	60	60

Standardised beta coefficients; p-values: * p<0.05, ** p<0.01, *** p<0.001; re means random effects model; fe means fixed-effects model

Table 4-7 Fixed effects and random effects regression results for health workforce data and health outcomes

	IMR		CMR		LE		DTP3	
	re	fe	re	fe	re	fe	re	fe
Workforce								
births attended by doctors, % of total births	-0.011	0.047	0.03	0.118	0.003	0.05	-0.869	-0.859
	-0.965	-0.872	-0.862	-0.566	-0.989	-0.836	-0.253	-0.218
births attended by other health professionals, % of total births	-0.065	-0.076	-0.025	-0.059	-0.039	-0.045	-0.346	-0.797
	-0.686	-0.676	-0.816	-0.645	-0.777	-0.762	-0.476	-0.109
births attended by skilled health staff, % of total births	-0.536**	-0.686*	-0.523***	-0.578**	0.372*	0.477*	1.243*	0.638
	-0.009	-0.014	0	-0.005	-0.033	-0.03	-0.04	-0.331
Control variables								
fertility rate	0.523***	0.78	0.527***	0.716*	-0.397***	-0.043	-0.274	-2.308*
	0	-0.05	0	-0.016	-0.001	-0.883	-0.373	-0.031
GDP per capita	0.042	0.211	0.079	0.329	0.131	0.236	-0.586	0.382
	-0.731	-0.595	-0.421	-0.25	-0.25	-0.473	-0.09	-0.713
GINI Index	-0.018	0.127	-0.093	0.156	0.033	0.388	0.555*	0.645
	-0.857	-0.753	-0.272	-0.581	-0.731	-0.261	-0.034	-0.538
N	42	42	42	42	42	42	37	37
adj R-sq		0.463		0.592		0.069		0.347

Standardised beta coefficients; p-values: * p<0.05, ** p<0.01, *** p<0.001; re means random effects model; fe means fixed-effects model

4.4 Discussion

Findings demonstrate how each of the health systems building block are affecting health outcomes across LMICs, implying that recent progress on life expectancy and mortalities may have been to strengthening national health systems. Specifically, these findings support that improved health outcomes can be attributed to increasing income per capita (Li & Zhu, 2006), improved medical technologies and interventions (Papageorgiou, Savvides, & Zachariadis, 2007) and strengthened global collaborations (Chu, Jayaraman, Kyamanywa, & Ntakiyiruta, 2014; Elobu et al., 2014). Hence, strengthening national health systems may lead to further improvements in life expectancies and reduction in mortalities.

4.4.1 Controlling corruption, ensuring government effectiveness, and implementing rule of law

I found the different government attributes such as controlling corruption, ensuring government effectiveness, and implementing the rule of law that significantly influence health outcomes. These attributes may potentially provide an explanation why existing health systems reforms such as decentralization did not necessarily translate to better health outcomes. Specifically, previous literature has favoured more decentralized governments in maximizing health systems performance; and thereafter, improving health outcomes. In this view, health outcomes are better achieved because governments are controlled by the majority, leaders are more accountable for the benefit of all rather than minor groups of society, and mechanisms for selecting competent leaders to implement policies are deemed stronger (Walt & Gilson, 1994). However, findings showed that despite such transitions, LMICs may still be faced with poorer health outcomes and health statuses that are far beyond health targets if these key governance attributes of controlling corruption, ensuring government effectiveness, and implementing the rule of law are not addressed. Hence, these findings argue that proper conditions must first be met before claimed gains of health system reforms such as decentralized health care management are achieved.

4.4.2 The importance of external and private resources for health

Findings showed how important external resources for health are to improve health outcomes. This is not to discount the importance of public spending on health, which has been widely emphasized in previous studies. For example, in India, it was found that increasing public expenditures with an additional US$6-US$7 per person per year or about 1% increase in gross domestic product would provide universal access to key health interventions and have a favourable effect on population health (Deolalikar, Jamison, Jha, & Laxminarayan, 2008). Although public spending on health may

as well be important to improve health outcomes in LMICs, majority of LMICs may need more external and private resources to create significant health outcomes. This may also be caused by the governments' lack of capacity to spend more on healthcare. As such, boosting these sectors may be needed in the future. My results were consistent with findings in 2007 that emphasized how an additional US$20-US$70 billion annually may be vital in meeting targets for the Millennium Development Goals. At that time, only US$5 billion is spent on health by majority of LMICs (Schieber, Gottret, Fleisher, & Leive, 2007).

4.4.3 Improving pregnant women's access to antenatal care

Findings also emphasized the importance for pregnant women to have at least one antenatal care visit. Good care during pregnancy has been shown to not only affect the health of the mother, but also the development of the unborn baby and life expectancy at birth (WHO, 2016a). These are similar to the claims made by the WHO on the importance of increasing antenatal care coverage (WHO, 2016a). Antenatal care introduces the woman and her family with the formal health system (WHO, 2016a), which can then also increase the chance of using a skilled attendant at birth and contribute to good health throughout the life cycle. Empowering women and engaging them more in antenatal care has proven as a success story to improve health outcomes in many countries (Mbuagbaw et al., 2016; Phillippi, 2009; Shortall et al., 2013). The WHO recommends that all pregnant women receive at least four antenatal care visits evenly spaced from the first trimester, which include getting an essential package of health services such as infection screening, nutrition advice, education on pregnancy and birth warning signs, among others (Mbuagbaw et al., 2016).

4.4.4 Increasing pharmaceutical public spending

Findings showed how increasing pharmaceutical public spending significantly affects IMR and DTP3 immunisation coverage, supporting similar previous studies examining pharmaceutical spending and health outcomes evident in Canada (Crémieux et al., 2005), in many European countries (Blasquez-Fernandez, Gonzalez-Prieto, & Moreno-Mencia, 2013), and in the Eastern Mediterranean Countries (Enayatollah et al., 2013). In particular, these studies showed that pharmaceutical public spending improved health outcomes, while the private spending did not have significant relationship with health status (Enayatollah et al., 2013). However, previous studies have also raised concerns on an increasing pharmaceutical expenditure. For example, in Taiwan, pharmaceutical expenditure grew from 62.2 billion Taiwan new dollars ($NT) in 1996 to $NT94.5 billion in 2003. The government has since then introduced many strategies to control pharmaceutical expenditure stating that conflict of interests have arisen because hospitals and

clinics were allowed to earn profit from the sale of pharmaceuticals leading to inappropriate prescribing of drugs and fraud on insurance claims (Yue-Chune, Ming-Chin, Yu-Tung, Chien-Hsiang, & Sun-Bing, 2006). Hence, although increasing pharmaceutical public spending may result to improved health outcomes, management of pharmaceuticals is still essential to ensure that its potential health outcomes are achieved. This may include ensuring efficiency on which drugs have to be subsidized by the government and better ways to establish reference pricing of medical products and technologies (Braae, McNee, & Moore, 1999).

4.4.5 Health workforce as key to improving health outcomes

Findings showed how important improving the health workforce is to achieve better health outcomes. Previous studies have emphasized that limited studies have integrated the link between human resources for health and health outcomes, and that these studies arrive at different conclusions (Anand & Bärnighausen, 2004). In this chapter, findings have consistently showed the importance of the health workforce across any health outcome measure. Similar to Anand & Bärnighausen (2004) study, I also found that the influence of the health workforce is reflected most significantly in child health outcome indicators, particularly when the measure of the density of health personnel is used. However, there are other factors that may be included when examining health workforce and outcomes such as the distribution of the health personnel. Limited data on health workforce distribution is available in many LMICs. Future studies may include how the geographical dimension of access to health workforce and health service delivery are both essential to maximize its full potential to improve health (Dussault & Franceschini, 2006). Addressing such inequities in the global health workforce were also found to be an important link to improve health in many Sub-Saharan African countries (Anyangwe & Mtonga, 2007).

4.5 Limitations

Some assumptions of multiple regression cannot be tested explicitly. As such, further sensitivity analysis should be done to test the robustness of the findings. To test the robustness of the final model, I used stratified analyses and explored whether health systems factors associated with health outcomes were consistent across regions and among country income groups. In addition, given the potential for high correlation among the large number of independent variables considered for inclusion in the models, Pearson correlation coefficients, variance inflation factors and tolerance estimates were calculated to test for multi-collinearity between groups of related covariates. As in many other cases of regression analyses, findings are focusing on statistical associations, and not on the underlying causal mechanisms. While I was able to control for a number of potentially

confounding variables, the study is limited because I could not include a few important potential determinants of health due to data availability. Future studies may consider using indicators for financing arrangements or strategies that are used in LMICs, which may also influence the outcome variables. Health systems financing arrangements vary from one country to another and may also influence the results on health financing and outcomes. Unfortunately, there is no available quantitative data on such financing arrangements that I can use to include in the model. Hence, data availability and quality is also an important issue to consider. Further, the health systems data used is also mostly constrained by the aggregated national data compiled through each country's national health accounts. Other studies have also found that mortality rates are dependent on the mix of health care expenditures and types of health insurance coverage and this is also a concern that has yet to be explored (Bennett, Creese, & Monasch, 1998; Skocpol, 1993; Van Damme, 2007). The empirical analysis here does not compare health outcomes between the rich and the poor or those living in urban or rural areas. It can be argued strongly that the rich may be able to access better healthcare services than the poor. Similarly, urban areas may have more accessible and advanced healthcare resources than those in rural areas or who may have been living in remote areas, which are mostly the case in many LMICs. The data utilised here are national aggregates that do not differentiate between these different strata. Hence, such data limitations constrain further analysis on the issue. Nevertheless, compared to other studies and despite these constraints, this study has attempted to examine a more exhaustive list of health systems and health outcome variables to demonstrate the importance of how addressing each of the health systems building blocks, while controlling for other socioeconomic measures, reflects significant improvements in health outcomes. Note that interaction terms were also initially added to the model, but the results were not significantly different from the findings presented above. There is also a high model specification error and multicollinearity when the different indicators for each block or the addition of interaction terms are run using the same models.

4.6 Conclusion

The results in this Chapter highlighted which areas of each health system building block significantly influence health outcomes. Discussions focused on how improving controls of corruption, ensuring government effectiveness, and implementing the rule of law, as well as increasing external and private resources for health are highly correlated with reduced child mortality rates and improved life expectancies. Findings also reiterated the particular importance of antenatal care coverage in LMICs and how pharmaceutical public spending may also aid in ensuring access for medical products and technologies; hence, further increasing health outcomes.

In summary, findings showed how every unit of increase in the scores for governance, service delivery and workforce leads to two to three more months of life for every child and how each unit of increase in health workforce saves seven more infants and 536 children per 1000 live births. These results highlight how essential it is to continue efforts to strengthen the different building blocks of the health system and also better understand how they relate to different health outcome indicators that are being used to assess the different health systems strengthening initiatives. As specified above, not all health outcome indicators may consistently reflect significance of the existing initiatives on health systems. Therefore, there is a need to understand how indicator selection may also influence findings; hence, affecting policy decisions for health systems strengthening. Future studies may also consider other outcome indicators such as amenable mortality or the combined indicator for health outcomes, which was initially proposed by Gerring et al (2013). Specifically, Gerring et al (2013) found that the combination of life expectancy and IMR (log) offers a more reliable, more sensitive and more insightful measure of public health than either would provide on its own (Gerring et al., 2013). To compensate for the lack of access to such outcome measures, I instead used four different health outcome indicators that measures health status at a population level.

Chapter 5 Taxonomy of health systems performance in low- and middle-income countries

Previous chapters highlighted how each health systems building block and most commonly used indicators relate to health outcomes, particularly child mortality rates, life expectancies, and vaccine coverage. Findings provide evidence on how each health system characteristics influence the achievement of these health outcomes. However, more research has been called for to translate such findings into effective decision-making about strengthening health systems (Graham et al., 2006; Lavis, Robertson, Woodside, McLeod, & Abelson, 2003). Health systems are complex phenomena that are arguably more comprehensive, dynamic, and complexly interacting than merely additive functions of different components and building blocks. Therefore, research needs to assess health systems, wholly and comparatively rather than just examining them as the sum of their parts with the latter being the focus of Chapter 4 (Bowling, 2014; Checkland, 1983; Langley, 1999; Rotmans & van Asselt, 1999). Hence, an understanding of the combined components of health systems necessary for effective decision-making may need to be considered (Marchal et al., 2009; Shakarishvili et al., 2010). Previous research has also pointed out that the design and implementation of HSS requires the development of an adequate HSS classification (Peters, 2009). To do a more holistic comparison of health systems performance that will potentially be more useful for decision-making, this chapter develops a taxonomy of health systems strengthening to identify any new patterns of cluster configurations for health systems, differentiate these configurations of health systems performance in LMICs, and reveal common characteristics and distinctions for each configuration.

5.1 The role of taxonomies for health systems strengthening

Classifications allowed scientists to identify, group, and properly name organisms using a standardised system based on a variety of characteristics and understand how all living things were interconnected (Bowker & Star, 2000; Capra, 1996). As such, classifying living things made communicating science easier by conveying complex relationships about how organisms are related to each other (Bowker & Star, 2000; Capra, 1996). Such an approach is also beneficial for health systems. Previous studies recommended that classifying health system characteristics, different health interventions and program outcomes provided a framework for further research and a map for program developers who needed to examine how different factors were related and how the interplay among them led to behaviour change and outcomes (Nudelman & Shiloh, 2015). These classifications can also provide useful means for optimizing cost-effectiveness of promotion and intervention programs; hence, increasing health and decreasing health care burden (Nudelman & Shiloh, 2015).

The two basic approaches to classification outlined by Smith (2002) are typology and taxonomy. Typologies conceptually separated a given set of items multi-dimensionally representing concepts more than empirical cases (K. Smith, 2002). The dimensions of typologies were based on the notion of an ideal type, a mental construct that deliberately accentuates certain defining characteristics (Weber, 1949). Hence, typologies provide useful and systematic basis for comparisons and are technically a formal or conceptual classification system that comes from theoretical principles specified in advance (K. Smith, 2002). However, typologies are neither exhaustive or mutually exclusive since they are often based on arbitrary or ad hoc criteria and indistinct boundaries between types. Typologies are also often descriptive rather than explanatory or predictive (Bailey, 1994; K. Smith, 2002). On the other hand, a taxonomy classifies items on the basis of empirically observable and measurable characteristics (Bailey, 1994). Taxonomies were more often used in the biological than in the social sciences (Sneath & Sokal, 1972), but taxonomic methods, which include a family of methods generally referred to as cluster analysis, are useful tools for disciplines that need to derive classification schemes empirically from observed cases (Mezzich & Solomon, 1980).

Given these considerations, I used taxonomies to provide a way to classify health systems in terms of similarities and differences in health systems strengthening across countries with varied contexts. Taxonomies can be a useful similarity measure to explore mechanisms that lead to HSS successes and failures (Geisler, 2000; Klein et al., 2012). In a taxonomy, entities like countries can be classified on the basis of empirically observable characteristics (McKelvey, 1982; K. Smith, 2002). Taxonomies have been widely used for this purpose in the fields such as social sciences and urban planning, but few studies have developed taxonomies of HSS (Geisler, 2000; Klein et al., 2012). If used for HSS, taxonomies may be useful to guide allocation of resources and to get the most impact on improving outcomes (Geisler, 2000; Klein et al., 2012). In particular, taxonomies can be relevant for prioritising HSS initiatives, for defining the current focus and priorities of HSS, and for classifying HSS projects and funding schemes (Greenberg, 1987; Levasseur, Richard, Gauvin, & Raymond, 2010; Maroney, 2006). For example, previous efforts to develop an HSS taxonomy found that such taxonomies provided foundations for assessing current health policy issues (Bazzoli, Shortell, Dubbs, Chan, & Kralovec, 1999). Further, classifications of health systems provided insights on appropriate management and financial resources for each classification cluster making HSS assessments more tailored to their specific needs and purposes (Bazzoli et al., 1999). By highlighting the distinctive characteristics of HSS clusters, the developed taxonomy can provide insights about how to optimize existing health systems (Hammer & Burill, 2012; Nutley, Walter,

Davies, & West, 2002). Taxonomies can also be the basis for tracking health systems performance progress over time (Bazzoli et al., 1999).

5.2 Research gaps on classifications of health systems strengthening

Classifying health systems has focused on assessing health system capacities through exploring the institutional context of healthcare (Burau & Blank, 2006). In the past, HSS was classified at the level of whole national systems or subsystems such as by health financing options or by healthcare delivery types (Bossert, 2012). For example, health systems were classified according to public funding of healthcare, which includes national health services, social insurance schemes, private insurance (Burau & Blank, 2006). However, a central drawback to classifications based on subsystems is the failure to consider components of health systems other than the subsystem being classified, which can impede the utility of such classifications. For instance, a classification based on financing that ignores the health workforce or leadership and governance factors may not be useful if these omitted factors themselves matter for performance outcomes that the classification is intended to inform (J. Smith et al., 2010). To address current uses and limitations of classifications of health systems, key dimensions of health systems should be complemented by others factors such as types of political systems, and wider cultural, economic, and social contexts since these factors are also significantly affecting health systems performance and outcomes.

Despite its significance, empirically classifying health systems faces both conceptual and methodological challenges, including the difficulty of using sophisticated quantitative analysis to cluster health systems. This difficulty may be due to few comparable national systems and the many different characteristics and historical trajectories that confound the analyses (Bossert, 2012). Nevertheless, robust research on whole national systems can compare evidence, facilitate cross-country learning, and inform policy choices on HSS across different contexts (Ember, 1970). In fields such as public policy, taxonomies have been central for comparative policy studies across countries (Burau & Blank, 2006; Ember, 1970; Lincoln, 2014). For example, a taxonomic classification scheme took a broad set of policy issues and sought to ascertain whether, among a general population of a political unit, they can be empirically divided into two categories on the basis of generally accepted characteristics (K. Smith, 2002). The traditional approach produced a set of hypotheses about the activity patterns that by the very act of classification have been assumed to exist within a policy arena (K. Smith, 2002). Meanwhile, the taxonomic approach created a set of hypotheses about differing patterns of behaviour between different arenas; hence, clearly generating comparative and predictive hypotheses (K. Smith, 2002). Taxonomic approaches were able to create policy categories and subsequently, can also generate comparative, empirically testable

hypotheses on the theoretical expectations of how the categories differ (Bradley, Curry, & Devers, 2007; K. Smith, 2002).

Although the demand for such comparative analyses is high, there are still ongoing debates about the appropriate methods and approaches to use, including debates on how to facilitate cross-country learning through its findings (Boonstra & Broekhuis, 2010; Castillo, Martínez-García, & Pulido, 2010; Murray & Evans, 2006). For example, a taxonomy of health systems may have several limitations in their findings such that the data may affect the ability to fully assess the dimension of integration of health systems (e.g. number of specific mix of physicians participating in specific health service arrangements, number of contracts associated with efforts to integrate health care delivery) (Bazzoli et al., 1999). There is also a need to further refine the empirical framework and measures, as well as to collect new data recommending continuous validation and refinement of the taxonomy to keep pace with the rapid changes occurring for national health systems (Bazzoli et al., 1999). Previous studies in taxonomy also gave rise to questions on what differences exist in key performance measures across different health system clusters (Bazzoli et al., 1999).

To address this research gap specify health systems similarities and differences across countries, I develop a taxonomy of HSS through quantitative analysis of most recent health systems data. Chapters one to three of this thesis have clearly identified the key concepts and measures that can be used for HSS assessments. Across many countries, health information systems have also substantially improved (Travis et al., 2004). Such growth in health information has also led to a deeper understanding of the shared roles, responsibilities and health challenges countries worldwide were experiencing (Marmot et al., 2008). Maximizing these opportunities and using cluster analyses, this chapter adds to existing debates on taxonomies of health systems by exploring empirical classifications for health systems performance in LMICs. The chapter begins by discussing the theoretical framework used in previous studies and reviewing the approaches currently utilised in creating system taxonomies. The succeeding sections focus on creating clusters of health systems based on the WHO health system building blocks. Then, I explore existing taxonomies of health systems and how health system characteristics differ across clusters. Using factor analysis was a vital step before pointing out the similarities and differences of health systems across countries and examine their overall health systems performance. Since health systems are complex, factor analysis was needed to reduce a large number of variables into a few interpretable underlying factors (Loehlin, 1998; O'Rourke, Psych, & Hatcher, 2013; Thompson, 2004; Thurstone, 1947). The concluding section focuses on how taxonomies of health systems based on system clusters can further facilitate cross country learning among countries with limited resources.

5.3 Theoretical framework

To build a taxonomy of health systems, I used the theoretical framework proposed in Chapter Two , which build upon a common framework for analysis that is essential for any taxonomy (Sicotte et al., 1998). Using this proposed framework that applies across different countries also enables conducting cross country comparisons (Hofstede & Hofstede, 2001). To recap, Chapter Two of this thesis develops a comprehensive theoretical framework for HSS assessments based on existing country-driven HSS frameworks and other data sources from the WHO Member States. There are six dimensions of the proposed framework in Chapter Two that were common across all other health systems frameworks and were also widely used by the WHO (Murray & Frenk, 2000; WHO, 2013a) and the OECD (Arah et al., 2006): governance, health financing, service delivery, workforce, medical products and technologies, and health information systems. These building blocks were also highlighted in Chapter Three when each Gavi HSS cost category and the indicators collected from the HSS-grant recipients' monitoring and evaluation frameworks used the same building blocks to organize the HSS grant process. Further, the data source used in the study follows the same theoretical framework (USAID, 2015a). Hence, using the health systems building blocks and the identified measures discussed in Chapters Two and Three provides this research with the necessary requirements for developing taxonomies that are based on empirically observable and measurable characteristics. These characteristics also differentiates this taxonomy from other previous classifications of health systems because the setting used in the analysis is in a global context.

5.4 Methods

To support the argument that health systems should be assessed holistically or in sum rather than in individual parts, I used comparative cross-country factor and cluster analyses of the health systems building blocks in 135 low and middle income countries using three data waves from the USAID Health Systems 20/20 Database. In Chapter 4, I discussed how each of the health systems building block relate to health outcomes. In this chapter, I further describe how I used principal components analysis for each of the health system building blocks to develop components that can form the basis for a classification. To categorize health systems. I then used cluster analysis to group countries with similar health system characteristics together and examine how their overall health systems performance change across three time periods: before the year 2000, from 2001 to 2006, and from 2007 to 2012.

5.4.1 Data sources

I used the same data sources for Chapter Four , which combines the data per health system building block and have 80 indicators (USAID, 2013). I normalized the datasets into three time periods (average for below the year 2000, from 2001 to 2006, and from 2007 to 2012) for 135 LMICs. Health information system was not represented in the Health Systems data. As a proxy, I used the WHO international health regulations (IHR) monitoring framework available from the Global Health Observatory (WHO, 2008a). Under the IHR, countries were required to have or to develop minimum core public health capacities to implement IHR effectively (WHO, 2008a). The IHR monitoring process involved a self-assessment questionnaire sent to States Parties, the implementation status of 13 core capacities (WHO, 2008a). Specifically, the IHR monitoring framework assessed country-level regulatory monitoring for legislation, coordination, surveillance, response, preparedness, risk communication, human resources, laboratory, points of entry, zoonosis, food safety, chemical and radio-nuclear (WHO, 2008a).

5.4.2 Analysis

I used two methods: a) principal components analysis (PCA);[16] and b) cluster analysis.[17] PCA investigates concepts that were not easily measured directly by collapsing a large number of variables into a few underlying components (Loehlin, 1998; O'Rourke et al., 2013; Thompson, 2004; Thurstone, 1947). Since there were initially 80 indicators available in the Health Systems 20/20 database that were all linked to each of the health system building blocks, I first applied PCA to reduce the number of indicators and to detect structure in the relationships between variables, similar with previous studies (Loehlin, 1998; O'Rourke et al., 2013; Thompson, 2004; Thurstone, 1947). In mathematical terms, from an initial set of n correlated variables, PCA creates uncorrelated indices or components where each component is a linear weighted combination of the initial variables such that (Vyas & Kumaranayake, 2006):

$$HSBlock_1 = \alpha_i X_i + \alpha_{i+1} X_{i+1} + \cdots + \alpha_{in} X_n \quad (1)$$

$$\vdots$$

$$PC_m = \alpha_{mi} X_i + \alpha_{m(i+1)} X_{(i+1)} + \cdots + \alpha_{mn} X_{mn} \quad (2)$$

[16] PCA systematically reduces a large number of variables to a smaller, conceptually more coherent set of variables that are linear combinations of the original variables called principal components (Dunteman, 1989).

[17] Cluster analysis refers to the technique used to group entities into homogenous subgroups on the basis of their similarities across several observed characteristics. It can be used to partition data set into subsets or clusters that share common characteristics (Dush & Keen, 1995). Cluster analysis was the most important analytic tool in developing an organisational taxonomy (Bazzoli et al., 1999).

where α_{mn} is the weight for the mth principal component and the nth variable based on the eigenvectors of the co-variance matrix; (λ) is the variance for each component calculated using the eigenvalue of the corresponding eigenvector. For further analysis, I chose the first principal component, which shows the largest possible amount of variation in the original data considering that the sum of the squared weights ($\alpha_i^2 + \alpha_{i+1}^2 + \cdots + \alpha_{in}^2$) is equal to one. Meanwhile, λ_i/n is the proportion of the total variation in the original data set accounted by each principal component, given that the sum of the eigenvalues equals the number of variables (i = 80) in the initial data setλ_i/n. Succeeding components (PC_2) explains additional but less variation that the first component. [18]The higher the degree of correlation among the original variables in the data, the fewer components required to capture common information (Vyas & Kumaranayake, 2006). Since the variables used have different units of measurement, I first standardised them by subtracting the mean and dividing the result by the variable standard deviation. In selecting the principal components, I selected the first PCA result. After doing PCA for each of the health systems building blocks, I then applied cluster analysis to the components since the goal of this chapter was to classify overall health systems performance based on the similarities and differences for the different health systems building blocks. As part of the initial explorations of the data, I mapped the component score for each health system building block.

To partition observations into homogenous subgroupings and to assess reliability and stability of cluster observations, I used cluster analysis in a stepwise fashion by: a) dividing observations into randomized split halves to conduct separate cluster analysis so that cluster solutions can be compared; and b) conducting separate cluster analysis for observations grouped by the year of data collection to assess the stability of the cluster solutions over a certain time period (Bazzoli et al., 1999). Specifically, I categorized the 135 countries on the basis of the indices of their health systems building blocks, which were calculated from the results of the PCA following the methods used by Bazzoli et al (1999). Further, I used k-means cluster analysis [19] to identified relatively homogenous subgroups while maximizing the variability between clusters. To examine the homogeneity of cases within a cluster, I calculated the total within-sum of squares and moved cases

[18] Subsequent components are uncorrelated with previous components and each component captures an additional dimension in the data, while explaining smaller and smaller proportions of the variation of the original variables (Vyas & Kumaranayake, 2006).

[19] K-means cluster analysis identifies relatively homogenous groups of cases based on the different health systems characteristics, using an algorithm that can handle large number of cases (Hearty & Gibney, 2012). This method starts by selecting k initial cluster seeds and subsequently assigns each observation to the nearest seed on the basis of Euclidean distance, forming temporary clusters (Lo Siou, Yasui, Csizmadi, McGregor, & Robson, 2011).

from one cluster to another so that the total within-cluster of squares was minimized (Hearty & Gibney, 2012). Differences between the resulting patterns were explored further by comparing the health systems composition and by plotting the mean component scores of components across clusters. In mathematical terms, the between-cluster variance for group j was defined as follows:

$$V_{between\text{-}clusterK,j} = \left(\frac{1}{K\text{-}1}\right) \times \sum_{i=1}^{k} (\bar{x}_{ij} \text{-} \bar{\bar{x}}_j)^2 \quad (3)$$

where $\bar{x}_{ij}$ was the centroid of the cluster C_i for the health systems performance group j, based on n_i observations in cluster C_i, and $\bar{\bar{x}}_j$ refers to the overall mean. The optimal number of clusters was given by the cluster solution that has many health systems performance groups with large ratios.

To calculate for the overall health systems performance index, I used two approaches. First, I run all the 80 indicators available in the dataset in one model, then repetitively run the indicators in the same model while reducing the number of variables used to decrease specification errors and avoid multicollinearity among the variables. Second, I run all the indices for each health system building block in one model, adding controlling factors and other interaction terms. I then repetitively did the same process by reducing the number of indices inputted in the model in each repetition. Afterwards, I examined the distributions of the component scores and grouped them per region and per income groups. I also did a scatterplot matrix for the four building blocks with three waves of data to determine if there is any linear correlation between the multiple variables and to pinpoint specific variables that are highly correlated. To explore how each component scores are related to a measure of health outcome, I also created scatterplots for the first component score of each building block and life expectancy at birth.

5.5 Results

5.5.1 Principal components of health systems

Calculating the scores for each health system building block using their corresponding indicators discussed in Chapter Four, I found a wide variation in each of the health systems building blocks. When comparing per income groups, low income countries had the poorest performance, while upper middle income countries performed better, as expected. The lower middle income countries have relatively higher scores than low income countries, but these group of countries also have the highest variation in scores, particularly for health financing. Specifically, least scores were mostly found for countries in Africa. Further, the low income countries also have the least performance scores across all health systems building blocks (Table 5-1).

Governance. Using the governance indicators (control of corruption, government effectiveness, political stability, regulatory quality, rule of law, and voice and accountability), I found a principal component with an eigenvalue = 2.2, difference: 2.28, and cumulative proportion = 1.08 (Figure 5.1). Chile ranked highest across all waves with an average component score of 2.85 (average over three wave periods), followed by Antigua and Barbuda (mean = 2.24). Somalia ranked lowest with average score of -2.45, followed by Congo, Afghanistan, Iraq, North Korea, and Myanmar (Table 5-1). Almost all these countries are conflict-affected areas, if not with a military-controlled government. Generally, the box plots for governance suggest a wide ranging governance performance across countries with an overall negative governance scores in LMICs. Distributions were most compressed in East Asia and the Pacific, suggesting that this region have a more similar governance performance. In contrast, the distributions had the longest spread in Latin America and the Caribbean followed by Sub-Saharan Africa, implying wide variations in governance (Figure 5.2).

Financing. Using financing indicators (per capita total expenditure on health at average US$ exchange rate, general government expenditure on health and total expenditure on health), I found a principal component with an eigenvalue = 0.99, difference = 0.95, and cumulative proportion = 1.30 (**Figure 5.1**). Countries with highest health financing across three waves include Palau, Marshall Islands, Seychelles and Micronesia. Almost all these countries are small countries with low population. Meanwhile, countries with low health financing scores across all waves include Myanmar, Pakistan, and India (**Table 5-1**). There is least variability in scores for Sub-Saharan Africa. Countries in the Latin America and the Caribbean showed higher financing scores. Similar with findings in governance, financing scores were lesser for South Asia and Sub-Saharan Afric. East Asia and the Pacific also showed longer upper whiskers, which suggest higher variability for countries with positive financing scores (**Figure 5.2**).

Service delivery. Using service delivery indicators (HIV test results, fertility rates, immunisation rates and improved sanitation), I found a principal component with eigenvalue = 1.97, difference = 1.86, and cumulative proportion = 1.11 (**Figure 5.1**). Other indicators such as hospital beds per 1000 people, contraceptive prevalence among women 15 to 49, births attended by health professionals, prenatal care, malnourished under-5 children and diarrhoea treatment were excluded due to large missing data. Across all waves, countries with the highest service delivery scores include Bulgaria, Belarus, Serbia, and Macedonia. Meanwhile, countries with the least service delivery scores across all waves include: Niger, Chad, Somalia, Ethiopia, Mali, and Congo (**Table**

5-1). In general, service delivery scores were higher in Europe and Central Asia and lowest in Sub-Saharan Africa (**Figure 5.3**).

Health workforce. Using workforce indicators (density of pharmaceutical personnel per 1000 people and births attended by health professionals), I found a component with an eigenvalue = 0.65, difference = 0.89, and cumulative proportion = 1.61 (**Figure 5.1**). Countries with high workforce scores across all waves include Belarus, Ukraine, Lithuania, and Russia. In contrast, countries with least workforce scores across all waves include Chad, Niger, and Afghanistan (**Table 5-1**). In general, health workforce is higher for countries in Europe and Central Asia (**Figure 5.3**).

Medical products and technologies. Using these indicators (public spending on pharmaceuticals per capita at US exchange rate, private spending on pharmaceuticals per capita at US exchange rate, and total pharmaceutical expenditure per capita), I found a component with eigenvalue = 2.47, difference = 1.94, and cumulative proportion = 0.82 (**Figure 5.1**). However, no data was available for wave three. For wave one, countries with the highest scores included Argentina, Lebanon, Uruguay, Brazil, Chile, Mexico, Dominica, Jordan, El Salvador, and Jamaica. For wave two, highest countries include Mexico, Venezuela, Uruguay, Lithuania, Albania, Chile, Brazil, Dominica, Jamaica, and Bulgaria. Least scores were found for Papua New Guinea, Thailand, Romania, Samoa, Moldova, Mongolia, Turkmenistan, Belarus, Solomon Islands and Malawi for wave one and Thailand, Turkmenistan, Papua New Guinea, Samoa, Solomon Islands, Saint Vincent and the Grenadines, Malawi, Mongolia, Bhutan and Chad for wave two (**Table 5-1**).

Overall health systems performance index. When running the initial model using all the 80 indicators, no components were found. This resulted to high multicollinearity among the variables and prevented further analysis. On the other hand, running the indices for each of the health system building block was able to retain seven components. The first component shows eigenvalue = 6.9, difference = 6.32, proportion = 0.90 (Figure 5.1). Health information systems data were only available for wave three with Latvia having the highest score, followed by Kazakhstan, Romania, Lithuania, Niger, Indonesia, Jordan, Philippines, South Africa, and Malaysia. Least countries were Tonga, Haiti, Marshall Islands, Mozambique, Peru, Burundi, South Sudan, Papua New Guinea, Lao and Samoa (Table 5-1). Overall, I found that countries generally had higher scores in wave three of the data compared to wave one except for health workforce where there does not seem to be significant changes when comparing waves two and three (Figure 5.3). When placed in scree plots (the plot of $\widehat{\lambda_\iota}$ versus i with the eigenvalues ordered), I found that the number of components were highest for health information systems and least for medical products and technology. The number

of component was determined at the point beyond which the remaining eigenvalues were relatively small and of comparable size (**Appendix 2**).

Table 5-1 Component loadings and Keiser-Meyer-Olkin measure of sampling inadequacy

	Variables	Loadings*	Uniqueness	kmo
Governance factor	Control of corruption	0.89	0.20	0.70
	Regulatory quality	0.78	0.39	0.85
	Rule of law	0.91	0.17	0.68
Financing factor	Per capita total expenditure on health (average US$)	0.70	0.51	0.52
	General government expenditure on health	0.54	0.69	0.54
	Total expenditure on health	0.45	0.76	0.56
Service delivery scores	HIV test results	0.12	0.90	0.40
	Fertility rates	0.82	0.32	0.72
	Immunisation rates	0.79	0.35	0.72
	Improved sanitation	0.80	0.35	0.74
Workforce scores	Density of health personnel per 1000 people	0.57	0.67	0.50
	Births attended by health professionals	0.57	0.67	0.50
Medical products and technology scores	Public spending on pharmaceuticals per capita (at US exchange rate)	0.82	0.002	0.30
	Private spending on pharmaceuticals per capita	0.89	0.0007	0.35
	Total pharmaceutical expenditure per capita	0.10	0.0001	0.42
Health information system	Chemical	0.78	0.24	0.91
	Coordination	0.74	0.37	0.95
	Food safety	0.83	0.20	0.92
	Human resources	0.57	0.56	0.91
	Laboratory	0.73	0.41	0.95
	Legislation	0.75	0.31	0.90
	Points of entry	0.68	0.43	0.93
	Preparedness	0.81	0.25	0.93
	Radio-nuclear	0.66	0.37	0.91
	Response	0.82	0.25	0.94
	Risk communication	0.73	0.36	0.93
	Surveillance	0.66	0.39	0.90
	Zoonosis	0.65	0.44	0.92

Note: Component loadings shown are the first component scores estimated based on data for 137 low- and middle-income countries (Chapter Four: Data Sources).

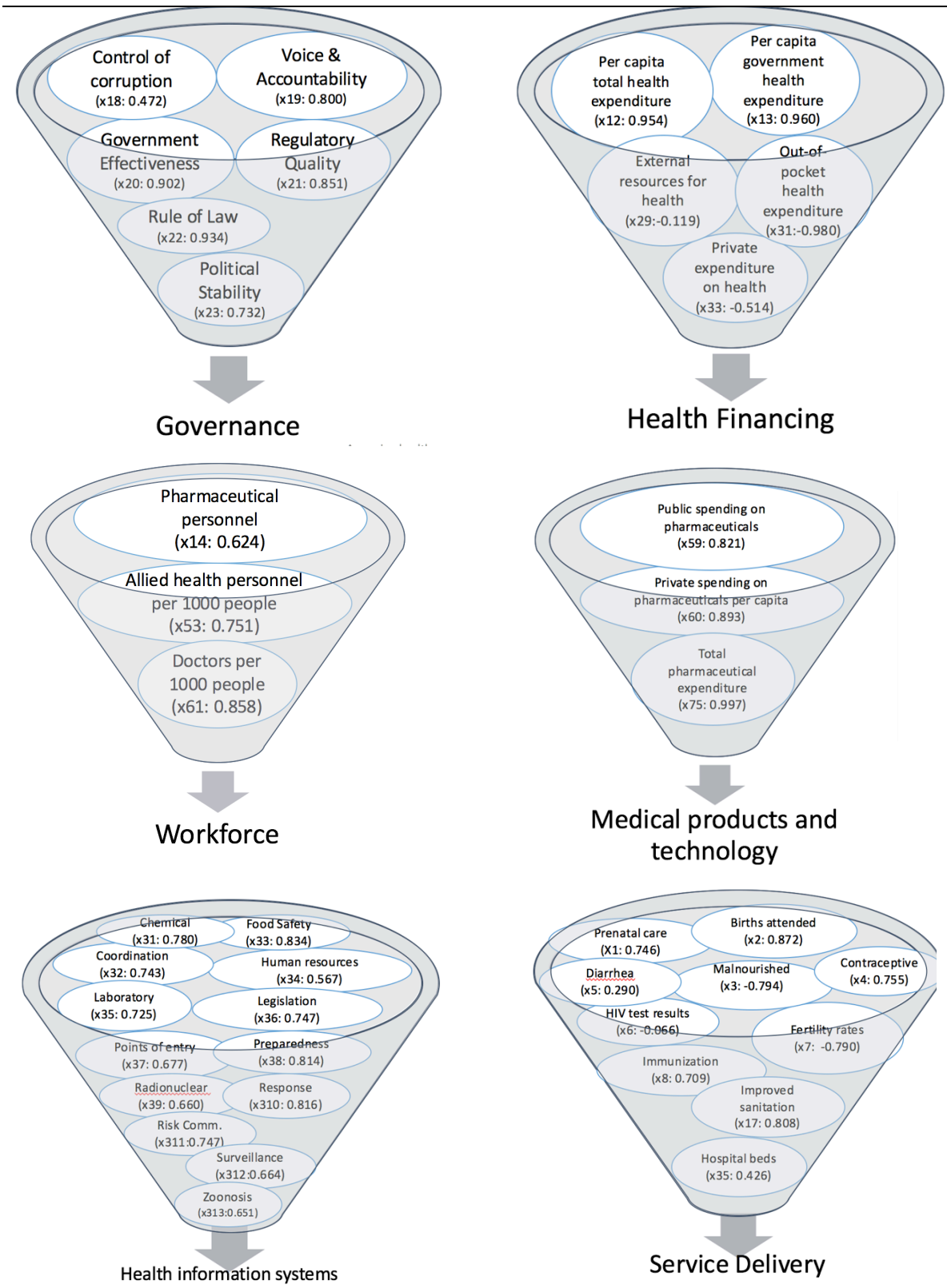
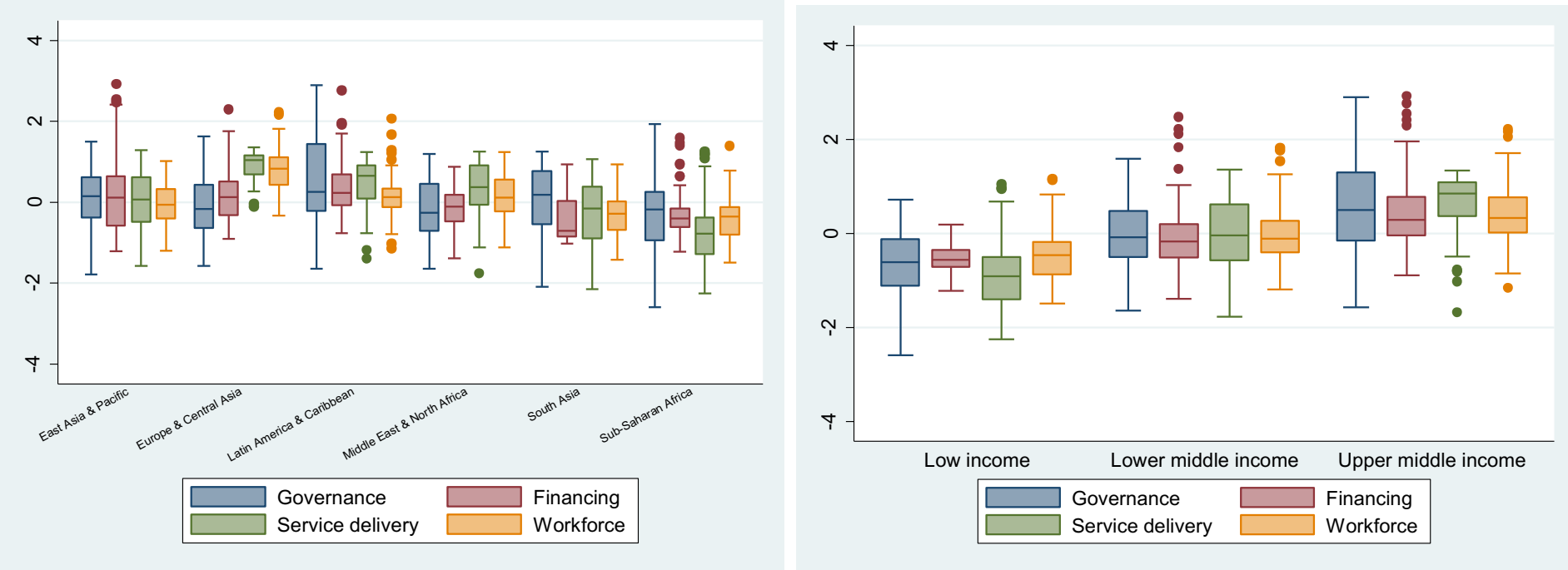


Figure 5.1 Funnel representations for the PCA done per health system building block showing the different indicators available from the Health Systems 2020 and the Global Health Observatory and how these indicators were categorized into each building block.



a) Component scores per WHO region

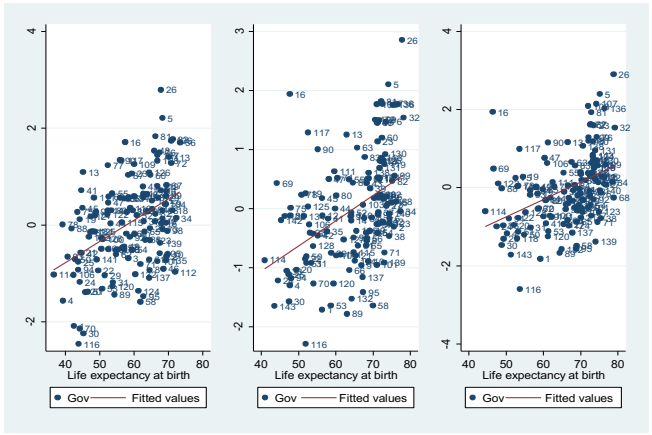
b) Component scores per World Bank income groups

Figure 5.2 Box plots of four health systems building block factor scores: governance, financing, service delivery, and health workforce

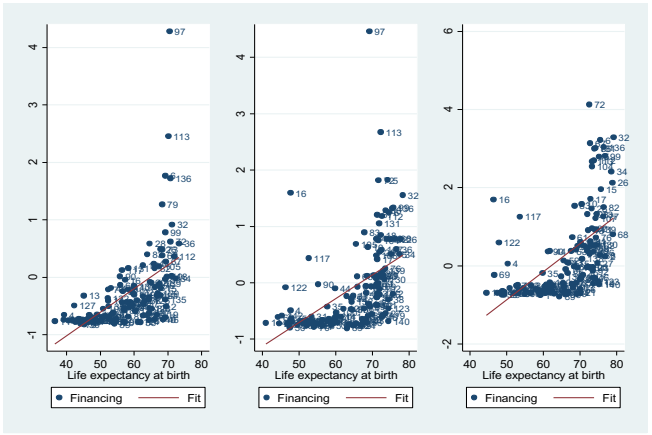
5.5.2 Scores for health systems building blocks and health outcomes

I found that life expectancy at birth increases along with higher performance scores for each of the building blocks with some countries lagging behind.

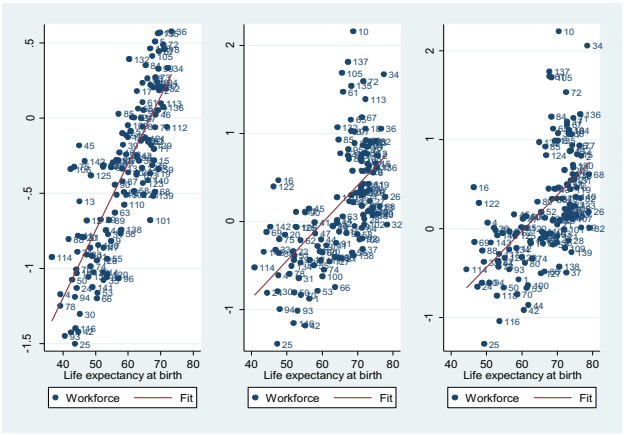
a. **Governance and life expectancy.** Somalia (country id = 116) was substantially behind other LMICs, yet this inequality in scores seems to decrease over the years. Meanwhile, countries like Botswana (country id = 16) may have significantly improved governance scores in wave three, but life expectancy remained lower compared to other countries with similar or slightly higher governance scores (Figure 5.3).
b. **Financing and life expectancy.** Across LMICs, scores reflected improved health financing. However, Botswana had much lower life expectancy rates compared to other countries with similar positive financing scores. For both waves one and two, Palau (country id = 97) and Seychelles (country id = 113) showed significantly higher financing scores and life expectancies compared to other LMICs. In wave three, Lithuania (country id = 72) had high financing scores, but lower life expectancy rates compared to other countries.
c. **Service delivery and life expectancy.** Scores substantially improved when comparing wave one and two, but plateaued after. Noticeably, Chad (country id = 25) had very low service delivery and life expectancy rates similar with Somalia.
d. **Workforce and life expectancy.** There seems to be lesser gap for health workforce in LMICs when comparing wave one and two, but this also plateaued after. Belarus (country id = 10) Cuba had the highest workforce scores with also high life expectancies compared to other LMICs.
e. **Medical products and technologies and life expectancy**. Scores were significantly higher in Argentina (country id = 6) and Lebanon in wave one, while the rest of the LMICs were lagging behind. Wave two showed that many LMICs had an increase in their medical products and technologies with others still lagging behind. Although Thailand ranked lowest, life expectancy of the country was also substantially higher compared to other LMICs.
f. **Health information systems and life expectancy.** Due to data availability, scores were only available for wave three, but showed high variability for health information system scores across LMICs.



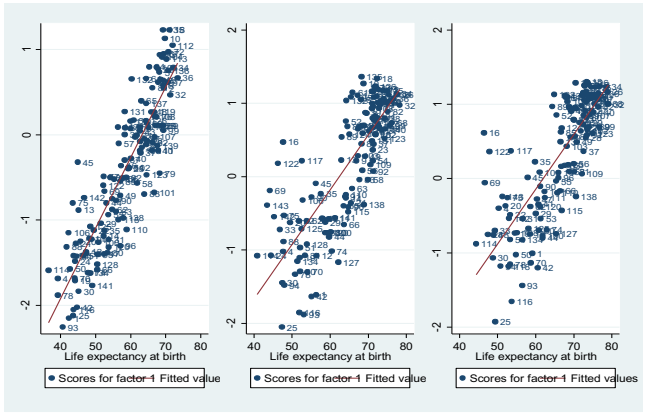
a) Governance



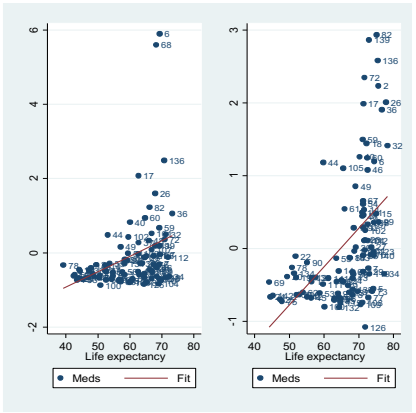
b) Financing



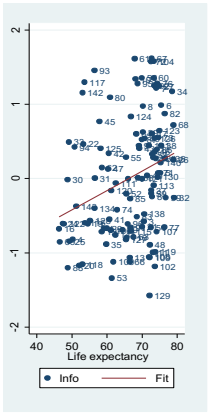
c) Health workforce



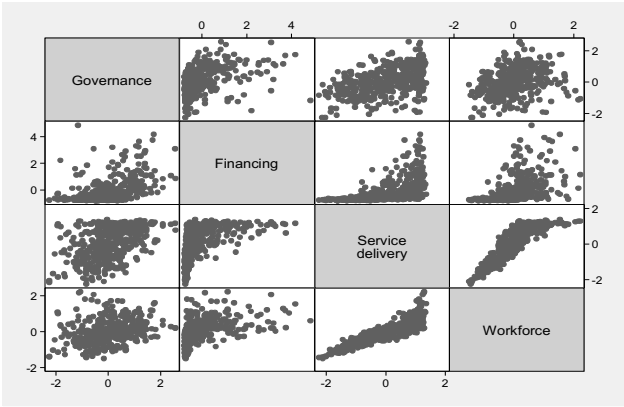
d) Service delivery



e) Medical products



f) Info systems



g) Graph matrix for all building blocks

Figure 5.3 Scatter plots showing the component scores for each health system building block compared with life expectancy at birth for three waves of data collected from the Health Systems database

5.5.2 Mapping health systems performance per health system building block

Using geographic information systems, I found the locations of each point in the plot and determined whether places with high component scores clustered in a particular region. Specifically, I found many countries in Africa and Asia lagging behind in terms of health systems performance and these scores did not seem to change substantially over the years when comparing across regions (**Table 5-2**).

a. **Governance.** Before the year 2000, majority of countries in Africa, including Russia, had negative scores, implying poor governance performance (**Figure 5.4**). The countries with the lowest governance scores included Sudan, Democratic Republic of the Congo, Angola, Liberia, Guinea-Bissau, Tajikistan, Burma and Haiti. These countries also had the least life expectancy except for Iraq and Tajikistan. The least scores for both life expectancy and governance was found for Angola. However, positive governance scores were not necessarily accompanied by above average life expectancies. Countries like Botswana, Namibia, South Africa, Morocco, Mali, and Bolivia had positive governance scores but below average life expectancy. Meanwhile, the majority of the South American countries had positive governance scores with Chile had the highest and above average life expectancy, which may also be a function of per capita income in these countries other than governance. Life expectancy then significantly improved from 2001 to 2006 with South American and Asian countries having above average life expectancies.
b. **Financing.** Before the year 2000, financing was lowest in many parts of Africa and Asia (**Figure 5.5**). The least was in the United Republic of Tanzania, Democratic Republic of Congo, Nigeria, Senegal, Gambia, Guinea-Bissau, Liberia, Cote d'Ivoire, Togo, Nigeria, Cameroon, Sudan, Uganda, Burundi, Iraq, Georgia, Armenia, Azerbaijan, Pakistan, India Tajikistan, Nepali, Bangladesh, Burma, Cambodia, and Indonesia. Financing then improved from 2001 to 2006 in Libya, Brazil and South Africa. In contrast, scores decreased in Mongolia and Argentina. After 2007, majority of the countries have improved financing and life expectancy. However, countries such as Chad, Guinea-Bissau, Cote d'Ivoire, Cameroon, Yemen, Azerbaijan, Tajikistan, Pakistan, India, Bangladesh, Burma, and Cambodia remained to have the least financing scores.
c. **Service delivery** has improved over the years with mostly African countries left with negative service delivery scores (Figure 5.6). Mali, Angola and Sierra Leone were among the countries with poor service delivery scores and least life expectancies. Most European countries had positive scores for service delivery, while many Asia Pacific countries have

improved except for India, Papua New Guinea and Lao People's Democratic Republic. Almost all countries with positive service delivery scores had above average life expectancies except for South Africa. From 2001 to 2006, all South American, Asian and European countries had positive service delivery scores and only countries in Africa, particularly Niger, Chad and Ethiopia, had least service delivery scores. This corresponds with low life expectancies in many African countries. After 2007, many African countries have improved in terms of service delivery, particularly Namibia, Angola, Congo, Mozambique, Ethiopia and Niger. These countries also have below average life expectancies.

d. Workforce. Before the year 2000, Haiti, Bolivia and Paraguay had the lowest score compared to other South American countries (**Figure 5.7**). Despite almost similar workforce score, Bolivia had below average life expectancies compared to Paraguay and other South American countries. Guatemala and Nicaragua also had below average life expectancies despite positive workforce scores. Least workforce was concentrated in many African countries with Angola, Chad, Mali, Niger, Nigeria, Ethiopia, Yemen and other African countries having the least scores for both workforce and life expectancies. Among all Asian countries, only Lao and Vietnam had the least workforce scores. From 2001 to 2006, progress in workforce scores was seen particularly in many South American, Asian and European countries. Similar with other health system building blocks, workforce was, however, lowest in many African countries, particularly in Ethiopia and Chad. Life expectancy was also lowest in many African countries. From 2007, although further improvements can be seen in workforce scores even for many African countries, Chad remains to have poor workforce scores and life expectancy.

e. Medical products and technologies. Most of Africa, Asia and Europe, have very low medical products and technologies scores (Figure 5.8). However, majority of countries in Africa have missing data on medical products and technologies before the year 2007. Scores improved from 2001 to 2006, particularly in Europe. In contrast, Africa still had very poor medical products and technologies performance scores from 2001 to 2006. In many countries, pharmaceutical spending in both public and private sectors also remained low.

f. Health information systems. I found that many countries in South America, except for Peru, Belize, and Haiti, have positive health information system scores (**Figure 5.9**). In Asia, Lao, Bhutan, Viet Nam, Yemen, Timor-Leste, Papua New Guinea and Sir Lanka remain low. Many African countries have the least information systems score, particularly Angola, Chad, Djibouti, and Mozambique. Information systems are missing for Mali, Guinea, Sierra Leone, and Liberia.

Table 5-2 Countries with the highest and lowest factor scores for each health system building block per wave: governance

Governance	Average before the year 2000	Average for years 2001-2006	Average for years 2007-2012
Highest	Chile (2.80)	Chile (2.85)	Chile (2.90)
	Antigua and Barbuda (2.21)	Antigua and Barbuda (2.10)	Antigua and Barbuda (2.40)
	Mauritius (1.83)	Botswana (1.93)	Saint Lucia (2.14)
	Costa Rica (1.77)	Mauritius (1.82)	Saint Vincent and the Grenadines (2.09)
	Uruguay (1.75)	Saint Lucia (1.77)	Uruguay (2.03)
	Botswana (1.71)	Dominica (1.77)	Botswana (1.93)
	Dominica (1.70)	Saint Vincent and the Grenadines (1.77)	Mauritius (1.93)
	Grenada (1.53)	Uruguay (1.76)	Dominica (1.77)
	Malaysia (1.50)	Costa Rica (1.54)	Latvia (1.63)
	Saint Lucia (1.44)	Samoa (1.50)	Lithuania (1.61)
Lowest	Somalia (-2.46)	Somalia (-2.29)	Somalia (-2.59)
	Congo (-2.24)	Myanmar (-1.78)	Afghanistan (-1.82)
	Liberia (-2.14)	Afghanistan (-1.71)	Zimbabwe (-1.72)
	Afghanistan (-2.09)	Zimbabwe (-1.65)	Myanmar (-1.67)
	Iraq (-1.59)	Iraq (-1.64)	Turkmenistan (-1.57)
	Angola (-1.59)	Haiti (-1.64)	North Korea (-1.57)
	North Korea (-1.48)	Congo (-1.57)	Iraq (-1.49)
	Myanmar (-1.44)	Turkmenistan (-1.53)	Congo (-1.47)
	Burundi (-1.38)	North Korea (-1.42)	Venezuela (-1.38)
	Guinea-Bissau (-1.37)	Angola (-1.30)	Chad (-1.31)
Missing data	No data for Timor-Leste, Montenegro, Palau, Kosovo and South Sudan	No data for Kosovo, South Sudan and Palau	None

Source: Author's computations using Health Systems 20/20 project's database

*Continuation…*Table 5.2 Countries with the highest and lowest factor scores for each health system building block per wave: financing

Financing	Average before the year 2000	Average for years 2001-2006	Average for years 2007-2012
Highest	Palau (2.41)	Palau (2.55)	Palau (2.91)
	Marshall Islands (2.22)	Tuvalu (2.12)	Cuba (2.77)
	Seychelles (1.40)	Marshall Islands (2.11)	Tuvalu (2.70)
	Argentina (1.29)	Seychelles (1.60)	Marshall Islands (2.48)
	Uruguay (1.26)	Micronesia (1.37)	Lithuania (2.30)
	Tuvalu (1.058)	Cuba (1.14)	Costa Rica (1.96)
	Micronesia (1.02)	Costa Rica (1.05)	Uruguay (1.92)
	Costa Rica (0.84)	Antigua and Barbuda (1.04)	Micronesia (1.83)
	Antigua and Barbuda (0.79)	Lithuania (0.96)	Latvia (1.76)
	Kiribati (0.76)	Botswana (0.95)	Turkey (1.74)
Lowest	Iraq (-1.39)	Myanmar (-1.19)	Myanmar (-1.21)
	Congo (-1.22)	Afghanistan (-1.02)	Pakistan (-0.90)
	Myanmar (-1.19)	Congo (-0.96)	Chad (-0.89)
	Sudan (-0.95)	Pakistan (-0.92)	South Sudan (-0.84)
	Pakistan (-0.94)	Tajikistan (-0.90)	Cambodia (-0.84)
	Cameroon (-0.93)	Guinea (-0.90)	India (-0.81)
	Guinea (-0.88)	Guinea-Bissau (-0.90)	Cameroon (-0.76)
	Georgia (-.88)	Azerbaijan (-0.90)	Afghanistan (-0.76)
	Azerbaijan (-0.86)	India (-0.89)	Tajikistan (-0.74)
	India (-0.85)	Laos (-0.88)	Guinea (-0.74)
Missing data	No data for Palestine, North Korea, South Sudan, Afghanistan and Kosovo	No data for North Korea, Palestine, Kosovo, and South Sudan	No data for Somalia, Zimbabwe, North Korea, Palestine, Kosovo

Source: Author's computations using Health Systems 20/20 project's database

*Continuation…*Table 5.2 Countries with the highest and lowest factor scores for each health system building block per wave: service delivery

Service delivery	Average before the year 2000	Average for years 2001-2006	Average for years 2007-2012
Highest	Bulgaria (1.23)	Latvia (1.17)	Bulgaria (1.30)
	Ukraine (1.23)	Bosnia and Herzegovina (1.17)	Thailand (1.29)
	Belarus (1.13)	Macedonia (1.17)	Belarus (1.29)
	Serbia (1.05)	Serbia (1.19)	Serbia (1.26)
	Lithuania (0.97)	Seychelles (1.20)	Iran (1.26)
	Latvia (0.95)	Lithuania (1.22)	Mauritius (1.25)
	Macedonia (0.94)	Thailand (1.23)	Albania (1.24)
	Romania (0.91)	Belarus (1.27)	Cuba (1.24)
	Seychelles (0.89)	Bulgaria (1.33)	Bosnia and Herzegovina (1.23)
	Moldova (0.80)	Ukraine (1.36)	Macedonia (1.23)
Lowest	Niger (-2.25)	Chad (-2.05)	Chad (-1.93)
	Afghanistan (-2.15)	Niger (-1.88)	Somalia (-1.65)
	Chad (-2.12)	Somalia (-1.85)	Niger (-1.44)
	Somalia (-2.05)	Ethiopia (-1.63)	Ethiopia (-1.20)
	Ethiopia (-2.02)	Afghanistan (-1.61)	South Sudan (-1.19)
	Mali (-1.88)	Nigeria (-1.48)	Nigeria (-1.18)
	Congo (-1.84)	Congo (-1.45)	Mali (-1.15)
	Yemen (-1.77)	Mali (-1.33)	Liberia (-1.13)
	Burkina Faso (-1.71)	Liberia (-1.30)	Congo (-1.07)
	Angola (-1.68)	Guinea (-1.29)	Guinea (-1.02)
Missing data	No data for Timor-Leste, South Sudan, Montenegro, Kosovo, Tuvalu and Palestine	No data for Palau, Palestine, South Sudan, Kosovo and Tuvalu	No data for Kosovo, Palau, Palestine, Dominica, and Tuvalu

Source: Author's computations using Health Systems 20/20 project's database

Cont…Table 5.2 Countries with highest and lowest factor scores for each health system building block per wave: medical products and technologies

Medical products	Average before the year 2000	Average for years 2001-2006	Missing data
Highest	Argentina (5.89)	Mexico (2.93)	For wave 1: No data for Mozambique, Congo, Ghana, Togo, Libya, North Korea, Tuvalu, Timor-Leste, Seychelles, Comoros, Vanuatu, Zimbabwe, Benin, Sudan, Palestine, Syria, Marshall Islands, Liberia, Tanzania, South Sudan, Bosnia and Herzegovina, Ethiopia, Palau, Burundi, Tajikistan, Albania, Namibia, Congo, Swaziland, Yemen, Niger, Sao Tome and Principe, Eritrea, Botswana, Iraq, Tunisia, Venezuela, Iran, Mauritania, Morocco, Sierra Leone, Kiribati, Guinea-Bissau, Somalia, Gambia, South Africa, Kosovo, Micronesia, Mauritius, Madagascar, Montenegro, Nigeria For wave 2: No data for Marshall Islands, Comoros, Liberia, South Sudan, Botswana, Swaziland, Kosovo, Iran, Somalia, Congo, South Africa, Timor-Leste, Guinea-Bissau, Cote d'Ivoire, Iraq, Tanzania, Mauritius, Mozambique, Sao Tome and Principe, Congo, Lebanon, Togo, Palestine, Tunisia, Zimbabwe, Montenegro, Tuvalu, Sudan, Mauritania, Niger, Madagascar, Kiribati, Eritrea, Sierra Leone, Micronesia, North Korea, Palau, Seychelles, Nigeria, Morocco, Libya, Angola, Vanuatu, and Ghana
	Lebanon (5.59)	Venezuela (2.86)	
	Uruguay (2.49)	Uruguay (2.58)	
	Brazil (2.08)	Lithuania (2.34)	
	Chile (1.60)	Albania (2.23)	
	Mexico (1.22)	Chile (2.01)	
	Dominica (1.06)	Brazil (1.98)	
	Jordan (0.94)	Dominica (1.91)	
	El Salvador (0.82)	Jamaica (1.50)	
	Jamaica (0.68)	Bulgaria (1.44)	
Lowest	Papua New Guinea (-0.87)	Thailand (-1.07)	
	Thailand (-0.84)	Turkmenistan (-0.81)	
	Romania (-0.84)	Papua New Guinea (-0.80)	
	Samoa (-0.80)	Samoa (-0.76)	
	Moldova (-0.79)	Solomon Islands (-0.75)	
	Mongolia (-0.77)	Saint Vincent and the Grenadines (-0.74)	
	Turkmenistan (-0.76)	Malawi (-0.73)	
	Belarus (-0.75)	Mongolia (-0.72)	
	Solomon Islands (-0.75)	Bhutan (-0.71)	
	Malawi (-0.73)	Chad (-0.70)	

Source: Author's computations using Health Systems 20/20 project's database
Note: No available data for wave 3 (average for years 2007-2012)

*Continuation…*Table 5.2 Countries with the highest and lowest factor scores for each health system building block per wave: health workforce

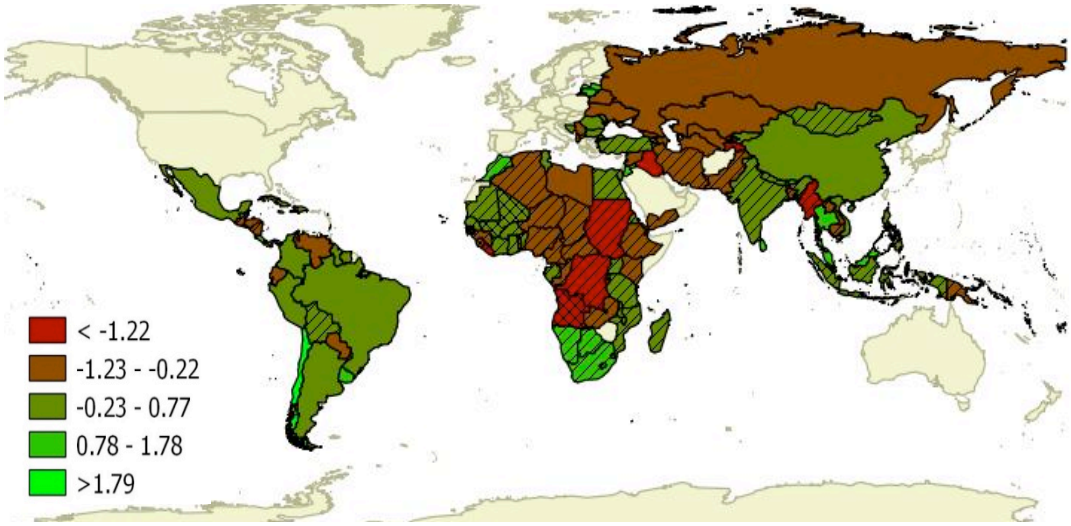
Workforce	Average before the year 2000	Average for years 2001-2006	Average for years 2007-2012
Highest	Dominica (0.57)	Belarus (2.16)	Belarus (2.22)
	Belarus (0.57)	Uzbekistan (1.81)	Cuba (2.06)
	Ukraine (0.57)	Russia (1.69)	Uzbekistan (1.77)
	Antigua and Barbuda (0.51)	Cuba (1.67)	Kazakhstan (1.71)
	Lithuania (0.49)	Lithuania (1.60)	Russia (1.70)
	Saint Vincent and the Grenadines (0.46)	Ukraine (1.54)	Lithuania (1.53)
	Bulgaria (0.46)	Kazakhstan (1.47)	Uruguay (1.29)
	Latvia (0.45)	Seychelles (1.39)	Moldova (1.26)
	Russia (0.41)	Latvia (1.18)	Libya (1.24)
	Turkmenistan (0.39)	Kyrgyzstan (1.15)	Brazil (1.20)
Lowest	Chad (-1.50)	Chad (-1.39)	Chad (-1.30)
	Niger (-1.45)	Ethiopia (-1.18)	Somalia (-1.04)
	Afghanistan (-1.43)	Somalia (-1.15)	Ethiopia (-0.92)
	Ethiopia (-1.42)	Niger (-1.10)	Gabon (-0.86)
	Somalia (-1.40)	Nigeria (-0.10)	South Sudan (-0.75)
	Congo (-1.30)	Afghanistan (-0.88)	Liberia (-0.74)
	Mali (-1.25)	Liberia (-0.83)	Haiti (-0.67)
	Laos (-1.20)	Central African Republic (-0.81)	Guinea (-0.67)
	Nigeria (-1.19)	Guinea (-0.80)	Central African Republic (-0.65)
	Angola (-1.17)	Congo (-0.79)	Papua New Guinea (-0.64)
Missing data	No data for Palestine, Kosovo, South Sudan, Timor-Leste and Montenegro	No data for Palestine, Kosovo, South Sudan	No data for Kosovo and Palestine

Source: Author's computations using Health Systems 20/20 project's database

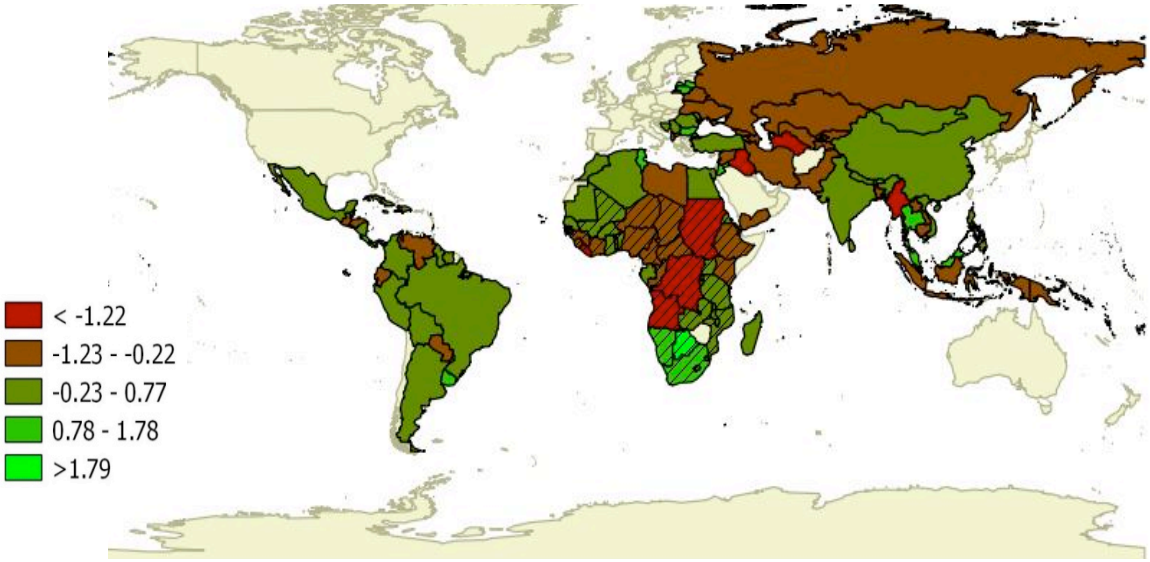
*Continuation…*Table 5.2 Countries with the highest and lowest factor scores for each health system building block per wave: health information systems

Health information systems	Highest	Lowest
Average for years 2007-2012	Latvia (1.62)	Tonga (-1.57)
	Kazakhstan (1.61)	Haiti (-1.34)
	Romania (1.58)	Marshall Islands (-1.30)
	Lithuania (1.57)	Mozambique (-1.20)
	Niger (1.45)	Peru (-1.18)
	Indonesia (1.35)	Burundi (-1.17)
	Jordan (1.35)	South Sudan (-1.15)
	Philippines (1.34)	Papua New Guinea (-1.12)
	South Africa (1.30)	Lao People's Democratic Republic (-1.12)
	Malaysia (1.28)	Samoa (-1.07)

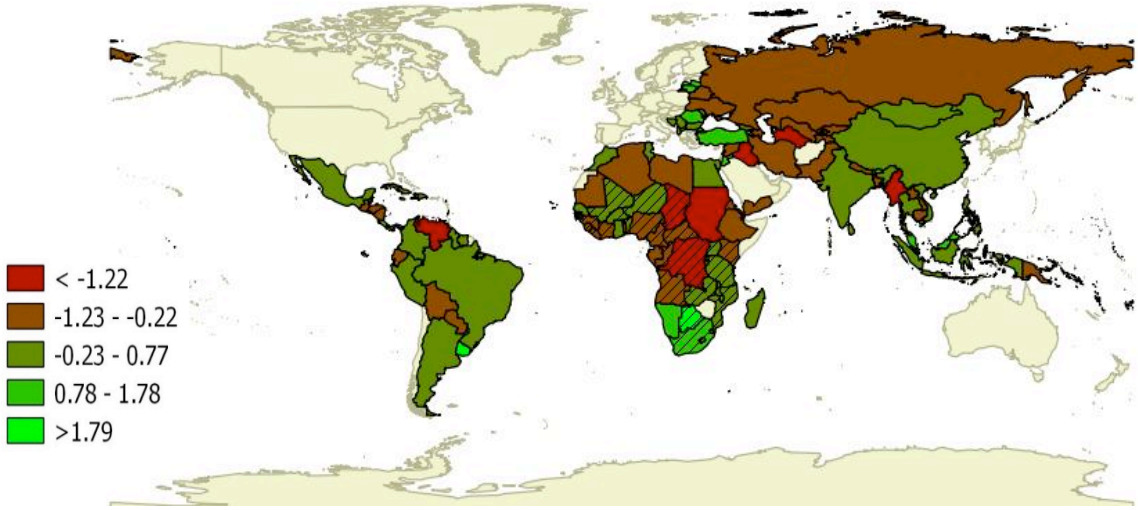
Source: Author's computations using Health Systems 20/20 project's database
Note: No available data for waves 1 and 2 (average before the year 2000; average for years 2001-2006)



a) Average governance scores before the year 2000 for 135 LMICs

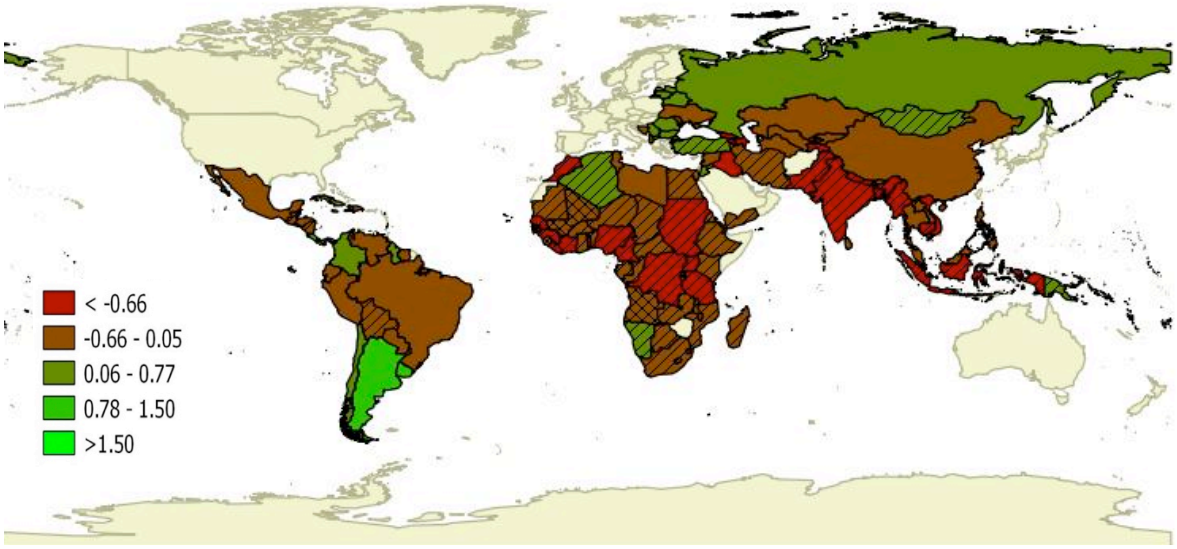


b) Average governance scores for years 2001 to 2006 for 135 LMICs

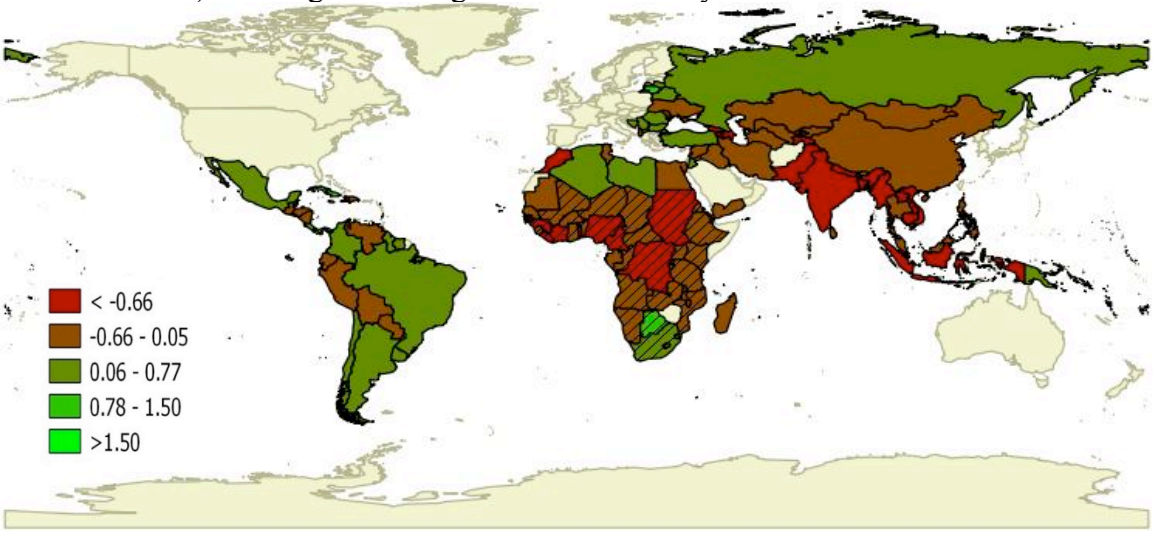


c) Average governance scores for years 2007 to 2012 for 135 LMICs

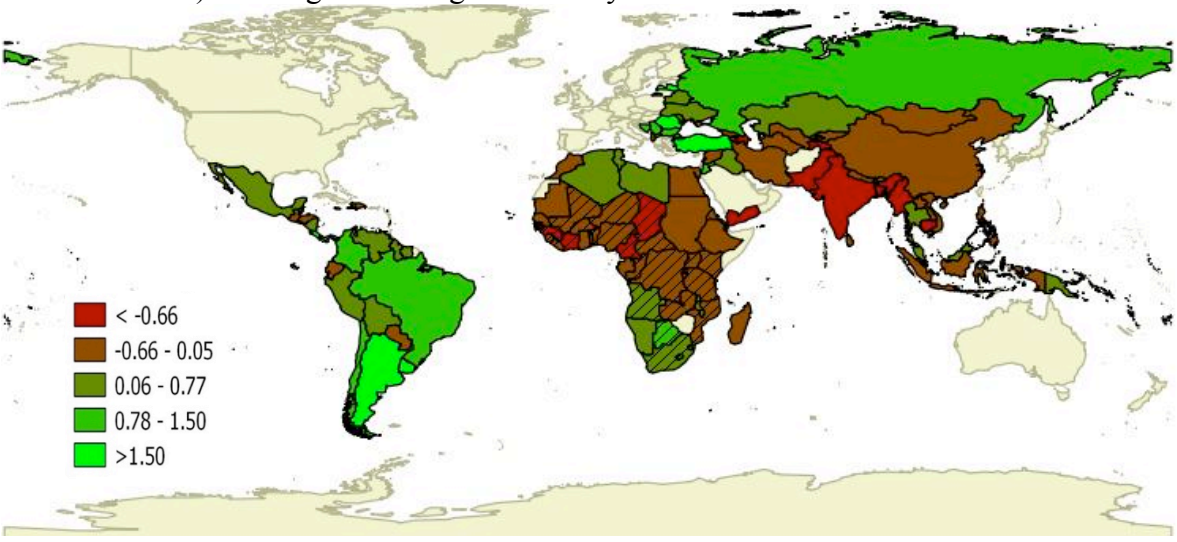
Figure 5.4 Geographical distribution for the governance index for three data waves. Countries marked with lines have below average life expectancy rates.



a) Average financing scores before the year 2000 for 135 LMICs

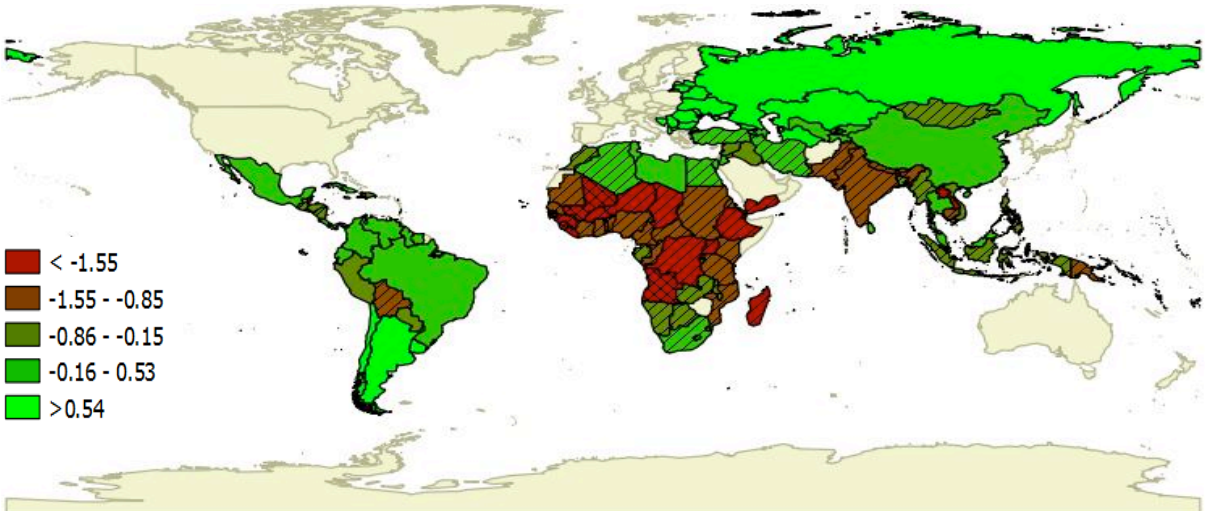


b) Average financing scores for years 2001 to 2006 for 135 LMICs

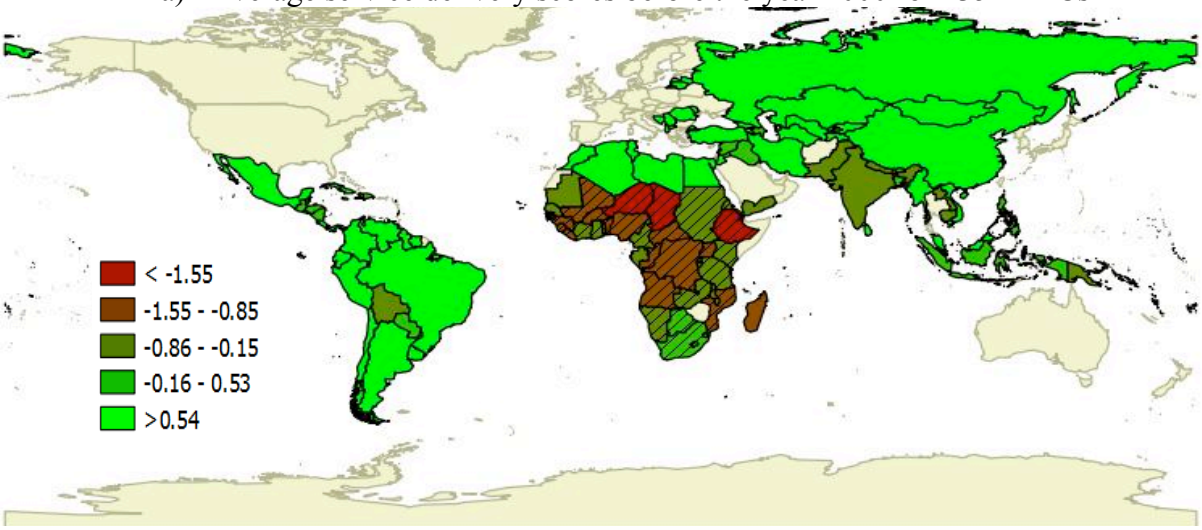


c) Average financing scores for years 2007 to 2012 for 135 LMICs

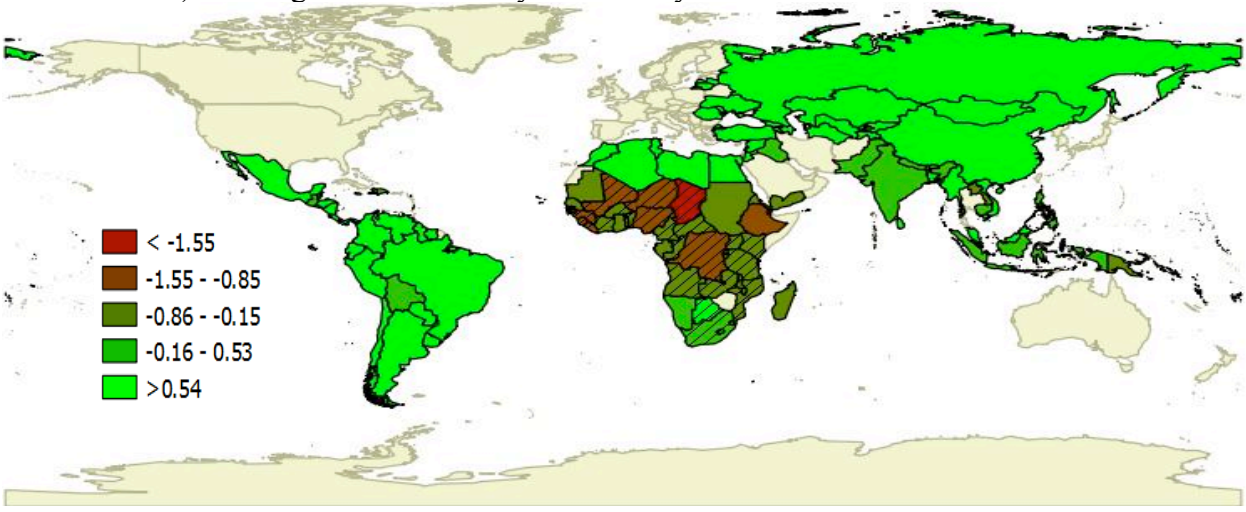
Figure 5.5 Geographical distribution for the financing index for three data waves. Countries marked with lines have below average life expectancy rates.



a) Average service delivery scores before the year 2000 for 135 LMICs

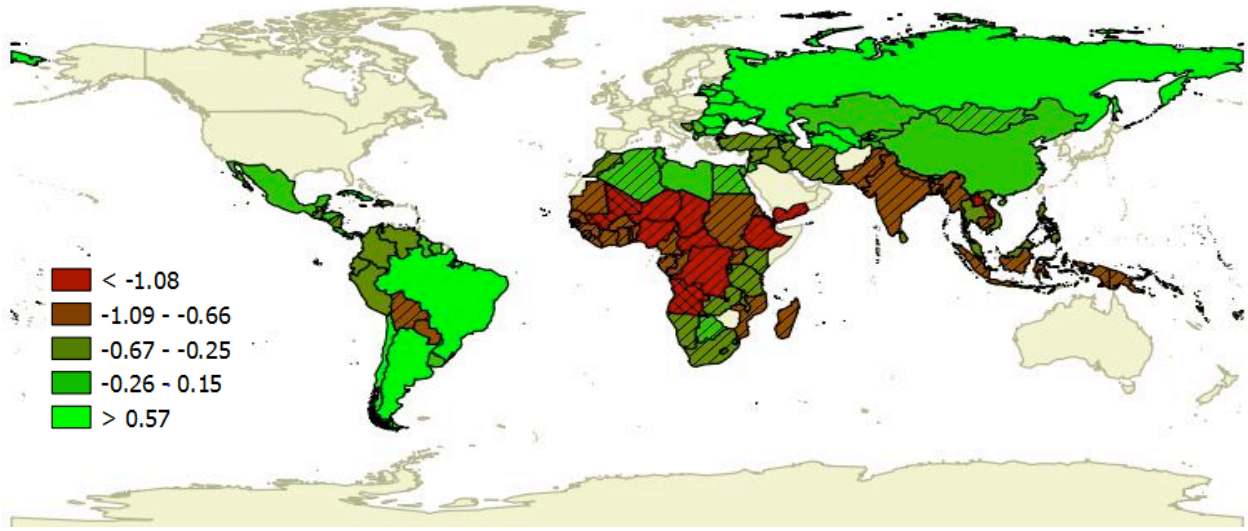


b) Average service delivery scores for years 2001-2006 for 135 LMICs

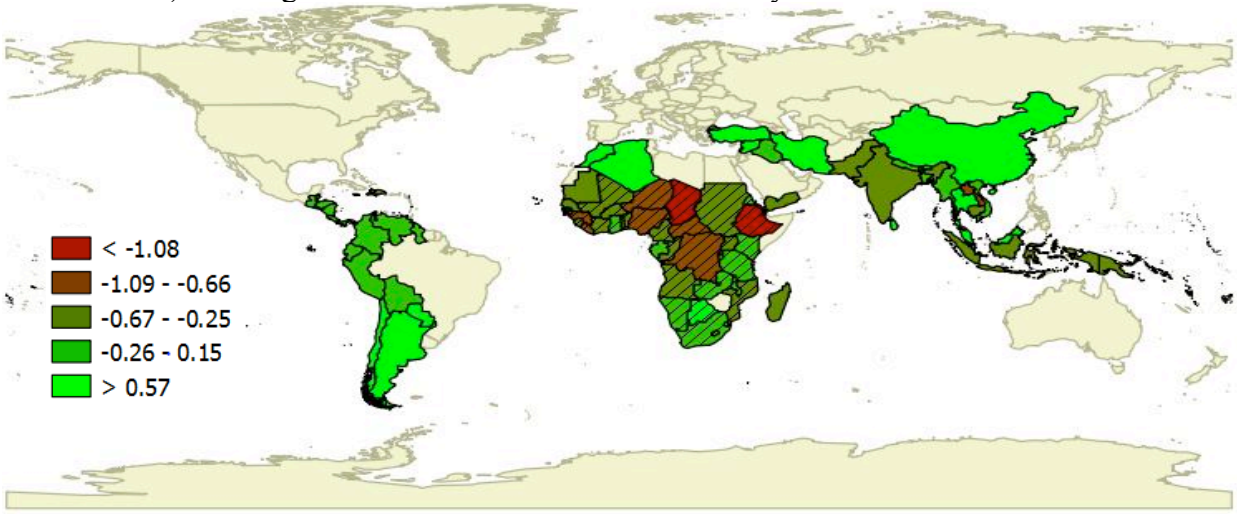


c) Average service delivery scores for years 2007-2012 for 135 LMICs

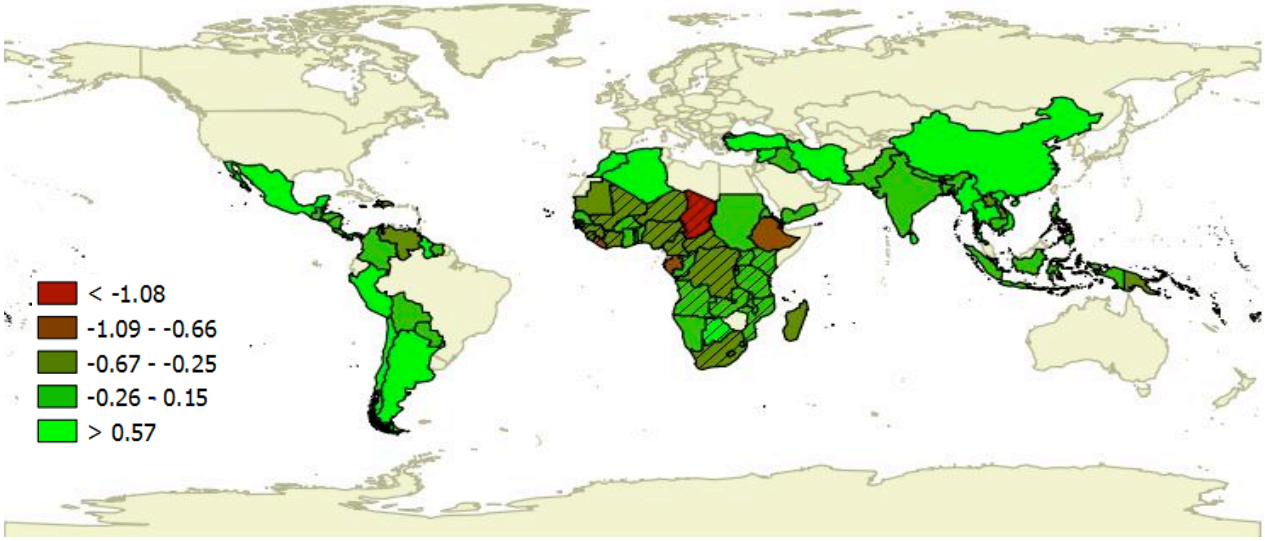
Figure 5.6 Geographical distribution for the service delivery index for three data waves. Countries marked with lines have below average life expectancy rates.



a) Average health workforce scores before the year 2000 for 135 LMICs

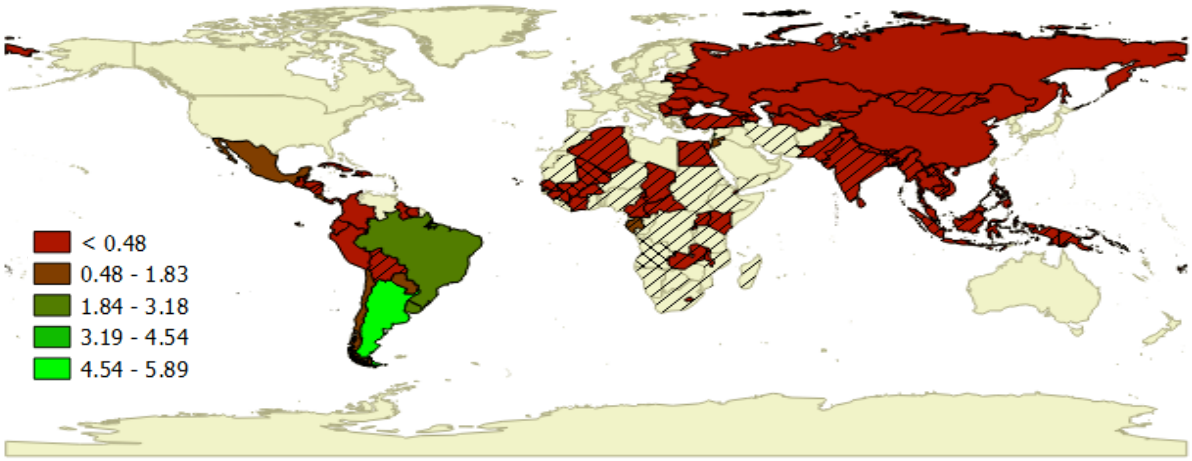


b) Average health workforce scores for years 2001-2006 for 135 LMICs

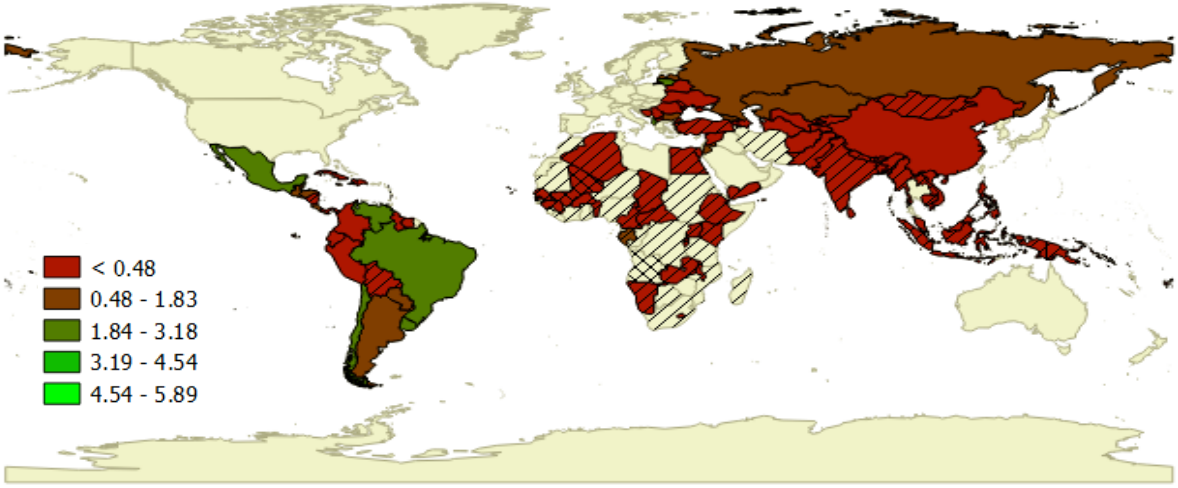


c) Average health workforce scores for years 2007-2012 for 135 LMICs

Figure 5.7 Geographical distribution for the health workforce index for three data waves. Countries marked with lines have below average life expectancy rates.

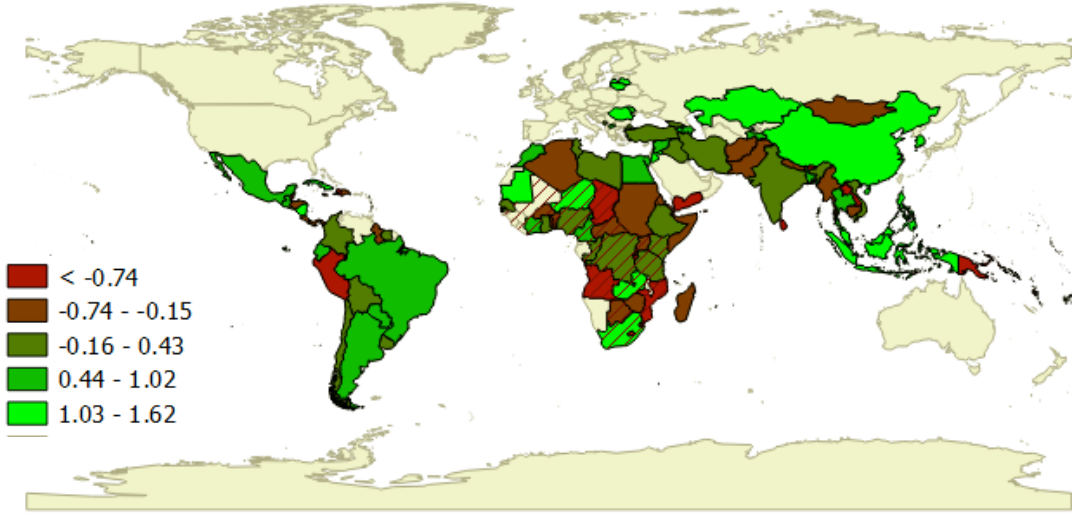


a) Average medical products and technologies scores before the year 2000



b) Average medical products and technologies scores for years 2001-2006

Figure 5.8 Geographical distribution for the medical products and technologies index for three data waves. Countries marked with lines have below average life expectancy rates.



Average health information system scores for years 2007-2012 for 135 LMICs

Figure 5.9 Geographical distribution for health information systems index for three data waves. Countries marked with lines have below average life expectancy rates.

5.5.3 Clusters of health systems in low and middle income countries

By clustering the component scores discussed in previous sections, I found three potential clusters for the health systems building blocks: [20] a) stagnant health systems, b) transitioning health systems, and c) positive health systems. The clustering was done because the models discussed in previous sections may fail to account for the interactions among the different health systems building blocks. This failure was due to the resulting multicollinearity and high model specification errors when running all the building blocks in one model alone. In response, I applied cluster analysis to the resulting principal components. This approach allowed creating typologies based on the performance on each health system building blocks, potentially accounting for their interactions without resulting to model specification and multicollinearity. In other words, this may somehow account for interactions among the variables that needs to be done due to the very nature of health systems as complex and dynamic. Further, this will also guide further interpretation about what makes one country health systems differ from the others, leading to further differences in health outcomes. Solely relying on the scoring for each of the health system building block discussed in previous sections are not as useful for decision-making processes especially since the results showed weak performance across all health system building blocks. Hence, using this approach provides not only an overview of health systems, but also represents how each of the building blocks interact to form clusters:

a. **Stagnant health systems performance**. The term stagnant was used since these countries did not show significant changes in mean performance scores for each health system building block across the three waves of data. This cluster includes: Angola, Bangladesh, Benin, Bolivia, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Republic of the Congo, Cote d'Ivoire, Djibouti, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Guinea-Bissau, Haiti, India, Indonesia, Iraq, Kenya, Laos, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Myanmar, Nepal, Niger, Nigeria, Pakistan, Papua New Guinea, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Solomon Islands, Sudan, Tanzania, Togo, Uganda, Vanuatu, Yemen and Zambia.

[20] The building blocks exclude medical products and technologies, which were dropped from the analysis due to insufficient number of observations, but average scores were provided for medical products and health information systems by cluster after clustering. Twelve countries were also excluded due to insufficient data: Afghanistan, Dominica, Kosovo, Montenegro, North Korea, Palau, Palestine, Somalia, South Sudan, Timor Leste, Tuvalu, and Zimbabwe.

b. **Transitioning health systems performance**, which means that these countries had moved from low to high scores in some health system dimensions. Overall, these countries had noticeable increase in one or two building blocks shifting from negative performance scores to positive performance scores, particularly in terms of financing (from -0.23 in wave 1 to 0.15 in wave 3) and in service delivery (from 0.087 in wave 1 to 0.85 in wave 3). This cluster includes: Albania, Algeria, Armenia, Azerbaijan, Belarus, Belize, Bosnia and Herzegovina, China, Colombia, Dominican Republic, Ecuador, Egypt, El Salvador, Fiji, Gambia, Georgia, Guatemala, Guyana, Honduras, Iran, Jamaica, Kazakhstan, Kyrgyzstan, Lebanon, Lesotho, Libya, Macedonia, Mexico, Moldova, Mongolia, Morocco, Nicaragua, Paraguay, Peru, Philippines, Russia, Serbia, Sri Lanka, Suriname, Swaziland, Syria, Tajikistan, Tonga, Tunisia, Turkmenistan, Ukraine, Uzbekistan, Venezuela, and Vietnam.
c. **Positive health systems performance**. On average, these countries have maintained positive performance scores until wave three. This cluster includes: Antigua and Barbuda, Argentina, Bhutan, Botswana, Brazil, Bulgaria, Cape Verde, Chile, Costa Rica, Cuba, Grenada, Jordan, Kiribati, Latvia, Lithuania, Malaysia, Maldives, Marshall Islands, Mauritius, Micronesia, Namibia, Panama, Romania, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Seychelles, South Africa, Thailand, Turkey and Uruguay.

Table 5-3 Taxonomies of health systems performance

Health system building blocks	Wave	Stagnant Health Systems Performance n = 51	Transitioning Health Systems Performance n = 49	Positive Health Systems Performance n = 31
Governance	1	-0.49	-0.10	1.15
	2	-0.54	-0.12	1.17
	3	-0.48	-0.14	1.18
Financing	1	-0.58	-0.23	0.43
	2	-0.48	-0.14	0.58
	3	-0.34	0.15	1.18
Service delivery	1	-1.31	0.087	0.20
	2	-0.75	0.73	0.76
	3	-0.48	0.85	0.86
Workforce	1	-0.90	-0.13	0.02
	2	-0.43	0.56	0.51
	3	-0.27	0.60	0.52
Medical products and technologies	1	-0.53	-0.07	0.33
	2	-0.45	0.22	0.45
Health information systems	3	-0.25	0.23	0.11

Source: Author's computations using Health Systems 20/20 data for three time periods: average scores before the year 2000, average scores from 2001 to 2006, and average scores from 2007 to 2012.

In summary, stagnant countries have negative performance scores across all building blocks and across all waves of data. Although increases can be noted in performance scores within the cluster, such increase remained to be negative with life expectancy at 55 years old. Meanwhile, transitioning countries have higher performance scores in select building blocks with average life expectancy at 68 years. Lastly, positive health systems performance includes countries that have started with a positive performance score in wave 1 and has maintained or improved such scores over time. These countries have a life expectancy of 69 years.

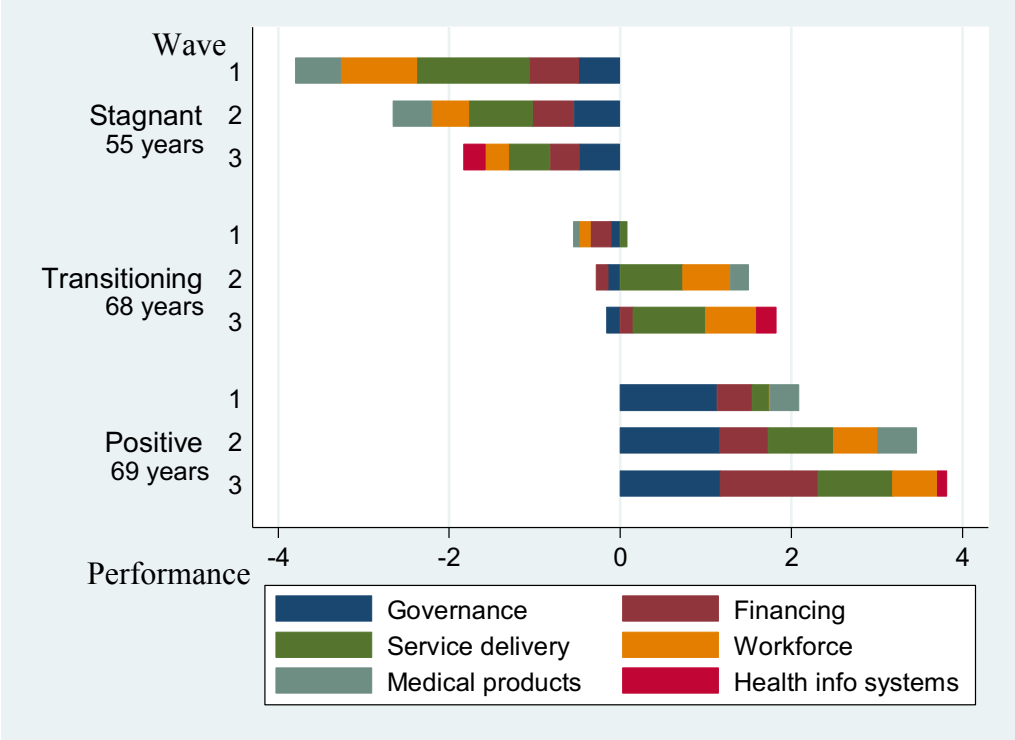


Figure 5.10 Health system performance clusters per wave and building blocks computed using the Health Systems 2020 data

When these clusters are mapped, stagnant health systems performance are mostly from most countries in the African and Asian region except for South Africa that had a positive health system performance compared with its neighbouring countries. Despite having a positive health systems performance, child health outcomes in South Africa still remain below average compared to all other countries with positive health systems performance. These countries with positive performance are mostly concentrated in Latin American countries and some parts of Asia. Except for South Africa, none of the countries with positive systems performance had below average child health outcomes. Meanwhile, transitioning health systems were mostly in Asia, Russia and some of the northern parts of Africa and Latin America. However, none of these countries had below average infant mortality rates.

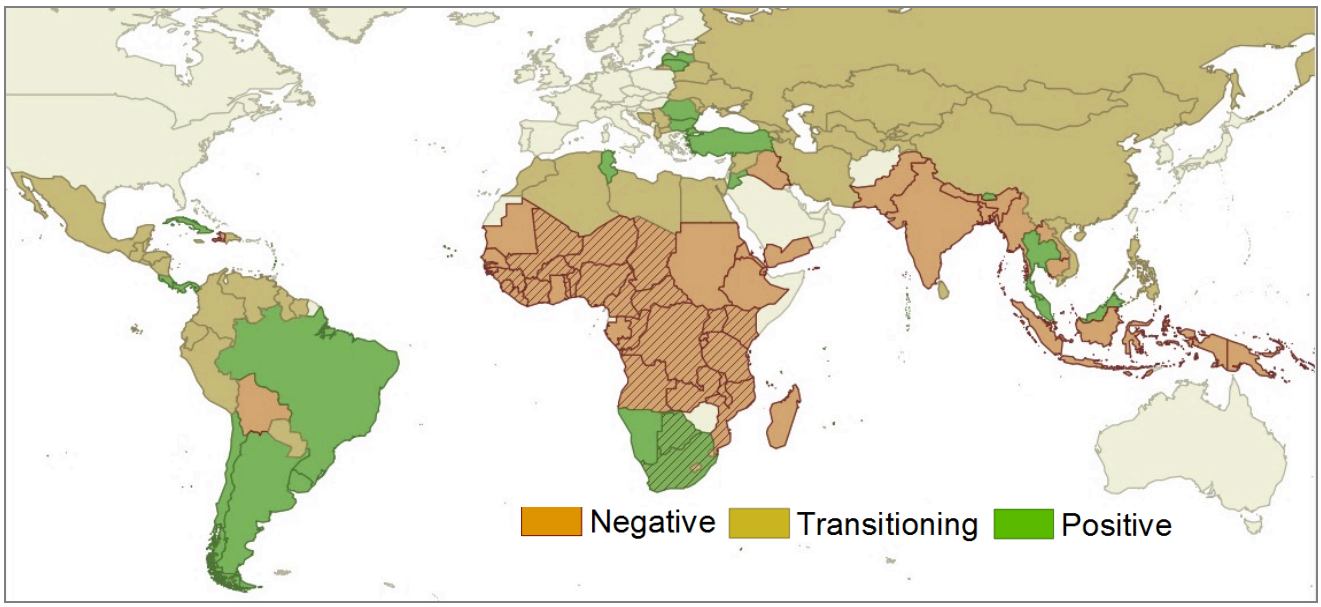


Figure 5.11 Geographical distribution of clusters of health systems performance mapped using Health Systems data.

5.6 Discussion

In the past, health systems researchers have worked on creating performance assessment frameworks and parameters that can be used, considering the complexities of health systems and the many dimensions of its health systems building blocks (Glanz, Rimer, & Viswanath, 2008; Lee, 2006; Mossialos, 2010; Murray & Frenk, 2000). Using PCA and cluster analyses allowed reducing the number of these dimensions without much loss of information. Specifically, I found the similarities and differences of health systems performance across countries, showed how these differences affect health outcomes, and examined how overall health systems strengthening progressed over the years. I also found Africa and Asia to have the least health system performance scores, which calls for more health systems strengthening initiatives in these areas. In particular, the model showed lower service delivery scores in Sub-Saharan Africa and lower health workforce scores in Asia. In addition, I found how many countries in Africa and some parts of Asia had weaker health systems and how these systems performance are also related to poorer health outcomes. Findings can provide evidence in guiding existing and future health system policies and priorities particularly at the global level.

Past studies have attempted to also do similar country-level taxonomies (Bazzoli, Shortell, & Dubbs, 2006; Castillo et al., 2010; Dubbs et al., 2004; Hernández et al., 2015; Ikezuagu, Yang, Daghstani, & Kaelber, 2012; Luke, 2006; Montes & Webb, 2015; Najaftorkaman, Ghapanchi, Talaei-Khoei, & Ray, 2015; Pallas, Curry, Bashyal, Berman, & Bradley, 2012; Salvador-Carulla et al., 2010; Shay & Mick, 2016; Xie & Zhang, 2006). For example, a previous taxonomy of health

systems using survey data from hospital respondents created three clusters of integration, differentiation, and centralization (Bazzoli et al., 1999). However, these taxonomies focused more on strategically important dimensions for hospitals, but not necessarily on systems. Compared to other studies, the taxonomy I developed was based on a more expanded set of health systems dimensions using a framework that has been widely accepted for health systems analysis and that was found to be appropriate for global health monitoring and evaluation. Mapping the results of the cluster analysis, I found that health system performance in South Africa is also a case to be further examined. Evidence from this study showed that overall health systems performance in South Africa was much better than the rest of the LMICs, yet health outcomes remain weak. This may imply that there are other factors outside the health systems building blocks that should further be examined as a key contributor to health outcomes. These findings supported claims that although the health system in South Africa successfully transformed into an integrated, comprehensive national service system, many failures remain in the system burdened by the massive HIV epidemic and poor health outcomes (Chopra, Daviaud, Pattinson, Fonn, & Lawn, 2009; Coovadia, Jewkes, Barron, Sanders, & McIntyre, 2009; Kahn et al., 2007; Leon, Arana, & de Leon, 2013; D. L. Marais & Petersen, 2015; H. Marais, 2011; Seedat, Niekerk, Jewkes, Suffla, & Ratele, 2009).

Many others view health systems as too comprehensive, complex and even as chaotic systems (Bazzoli et al., 1999), but I found important and meaningful similarities that exist across health systems despite different contexts. The resulting taxonomy provides a new lexicon for characterizing global health systems and better understanding of its structural characteristics, providing a potential tool for global decision-making processes and priority-setting. Hence, these taxonomies of health systems may lead to more appropriate and responsive evidence-informed policy decisions and can serve as a roadmap for HSS initiatives.

Future studies may consider updating the database. Data quality and availability remains a challenge for many LMICs (Lopez, Mathers, Ezzati, Jamison, & Murray, 2006; WHO, 2010b) because many data reporting mechanisms are neither sufficiently standardised nor reported accurately (Mechael et al., 2010). Specifically, I found insufficient number of observations for two building blocks: medical products and technologies and health information systems. Other than data constraints, conceptual and methodological constraints may arise from the choice of the framework used for analysis. My findings were only limited to six building blocks and failed to include other variables that also affect health systems performance and outcomes. Consequently, the framework determines the choice of variables for the analysis. In as much as health systems performance can include many other factors that may be outside the scope of the health systems building blocks, the

framework used was based on the commonly used framework for health systems research and derived from the previous studies discussed in Part A of the thesis. The analysis also has various methodological limitations. PCA and cluster analysis tend to give more emphasis to variables that have higher variances than variables with very low variances. In effect, the results of the analysis depend substantially on how much variation exists on different health systems variables. Nevertheless, the analysis done covered a broad range of countries and contexts and additional data and indicators were added to a point of reaching saturation, suggesting that incorporating additional data may not yield to substantially new information.

Hence, using observable characteristics provide insights about cross-national and temporal variations in health systems performance. Specifically, findings showed the characteristics and the geographical locations of least performing health systems, which were not yet examined in the current literature. The results can serve as quality scorecards used in healthcare delivery showing variation in performance that can be used to determine characteristics of poorly performing health systems and identify health systems barriers. Resulting information can then guide existing and future strategies for health systems strengthening.

Chapter 6 Health systems strengthening in the context of decentralization

Compared to previous chapters that focus on global health systems monitoring methods, this chapter examines health systems strengthening in a national context. Global-level methods are often critiqued for failing to consider context-specific information that can be useful for national-level policymaking and practices (Bevan & Hood, 2006; Gilson et al., 2011; Musgrove, 2003). For example, previous studies argued that indicators may not be comparable across countries and that general attainment and performance estimates are of no use for judging how well a specific health system performs (Musgrove, 2003). Hence, the performance of a health system should be based on a methodological consensus and specific to the national priority areas for the evidence to be useful (Musgrove, 2003). In other words, examining why other countries have better overall health systems than poorer countries is of little significance to the latter and will not guide existing and future HSS initiatives in the country (Musgrove, 2003). Nevertheless, international comparisons may still be useful for reforming global health care systems (Murray & Frenk, 2010). The international comparisons show the big picture that can be used for routinely tracking performance and comparing results across countries over time (Murray & Frenk, 2010). Breaking down performance along one or more of the health systems building block or making it more focused than an overall assessment may then make it more useful for policymaking. Using a more specific scenario, I focused on one health system building block – governance – in Cambodia and the Philippines. Specifically, I focused on the transitions from centralized health systems to a more decentralized health system. In particular, I examined how decentralized health systems relate to infant mortality and fertility rates and determined how health systems operate in a decentralized system.

I chose governance as the health system building block because one key health system reform that has happened over the years is decentralization. However, decentralization has not been studied in previous chapters. To recap, the governance data used in previous studies include only six dimensions of governance: voice and accountability, political stability and absence of violence, government effectiveness, rule of law, and control of corruption (World Bank, 2016d). Hence, it did not capture decentralization, which is also vital yet debated issue in the context of health system reforms (Bossert, 1998; Huther & Shah, 1998; Tobi & Regmi, 2014). Although greater decentralization may make governments more honest and efficient while making systems more responsive (Azfar, Kahkonen, Lanyi, Meagher, & Rutherford, 1999), decentralization can also

create coordination problems and obstacles to reform, leading to less effective provision for public healthcare services (Treisman, 2000).

I selected Cambodia and the Philippines as the cases for this study. The Philippines has the widest range of functions devolved to local government units (Bossert & Beauvais, 2002). In general, devolving more government functions was found less effective in providing public healthcare services and infrastructure (Treisman, 2000). However, the Philippines has achieved substantial progress towards its health goals, particularly in reducing child mortality despite devolving more government functions (Kraft, Nguyen, Jimenez-Soto, & Hodge, 2013; Wagstaff, 2000). Similarly, decentralization in Cambodia contracted healthcare services to nongovernmental organisations and claimed to have substantially positive health implications (Mills, Rasheed, & Tollman, 2006). However, other studies claimed that the current health system structure affected by decentralized government functions did not actually show any marked improvement in healthcare; hence, less progress in achieving better health outcomes (Arsenio Balisacan, Hill, & Piza, 2008; Rodan & Hughes, 2012; Turner, 2006). Hence, in this chapter, I will examine the two contesting findings about the effect of fiscal decentralization on health outcomes in the Philippines and Cambodia and determine whether decentralizing government functions have a positive impact on healthcare service delivery.

6.1 The role of decentralization for health systems strengthening

Critical to HSS initiatives is to ensure the quality and effectiveness of public health systems in the context of decentralized health care functions (Hotchkiss, Eisele, Djibuti, Silvestre, & Rukhadze, 2006). Decentralization is the transfer or sharing of decision-making power from a central authority to lower-level units or the end users (Béné et al., 2009). The term is associated with the theory of fiscal federalism (Oates, 1972), which states that allocative and productive efficiency increases as the provision of public goods and services become more responsive to local needs and more competitive across regions (Oates, 1972). There are different types of decentralization: First, devolution looks at decentralization as a political reform designed to promote autonomy at the local level (Jiménez-Rubio, 2011; Rubio, 2011). In devolution, locally elected government bodies exercise full powers in regulating, financing, and delivering public goods and services (Martinez-Vazquez & Timofeev, 2008). Budget devolution was identified as the most important step in decentralization and most studies synonymously used decentralization with devolution (Rubio, 2011). Second is delegation, wherein locally elected government bodies assume new responsibilities subject to strict regulations by the upper-level government (H. Uchimura & Jütting,

2009). Third, de-concentration provides the local government with some autonomy, particularly on the delivery of services, while the central government reserves the powers to regulate and raise finances (Martinez-Vazquez & Timofeev, 2008; H. Uchimura & Jütting, 2009). To date, there is no agreed-upon single indicator of the extent of decentralization in a country.

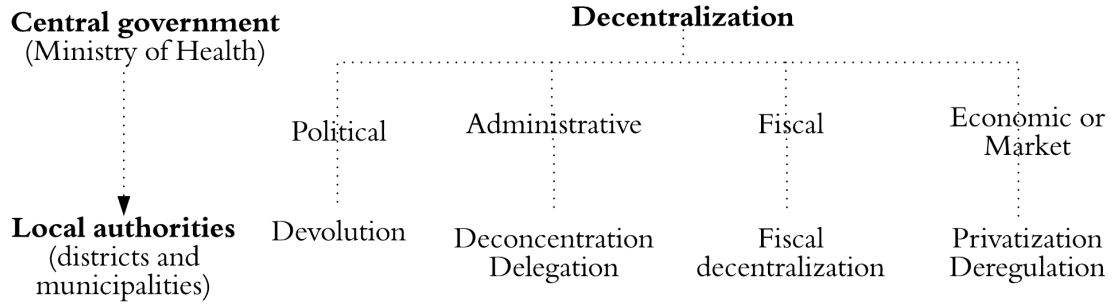


Figure 6.1 Types of decentralization

There are two conflicting views about the effects of decentralization on health care systems:

First, some claim that decentralization improves health systems. Decentralized healthcare system is asserted to ensure increased government accountability to the population (Bossert, Larranaga, Giedion, Arbelaez, & Bowser, 2003; Jiménez-Rubio, 2011; Kang et al., 2012). This increased accountability expedites the bureaucratic process and induces policy innovation as regions become more competitive (Kang et al., 2012). Further, it improves community participation in decision making and implementation, increasing the level of representation of local populations (Mansuri & Rao, 2004) and aligning public services more closely with local preferences (Kang et al., 2012). In addition, corruption was also said to be lower in countries wherein subnational governments have a larger share of fiscal revenues and expenditures (Altunbaş & Thornton, 2012; Thornton, 2012). Hence, decentralization, along with stronger national political parties, increases economic growth, quality of government, and public goods provision (Enikolopov & Zhuravskaya, 2007).

In contrast, decentralized health systems were said to widen health inequalities among regions when competitiveness across the regions becomes detrimental to national unity (Collins & Green, 1994). Specifically, as poorer regions with insufficient revenues struggle to compete with others, lesser investments are also placed in healthcare (S. Fan, Zhang, & Zhang, 2002; Fukasaku, 1999). It can also reduce national bargaining, increasing prices of services delivered locally (Azfar et al., 1999). Relying on local governments increases risks for corruption and may also lead to inefficient planning and management of public goods and services (Rubio, 2011; Prud'Homme, 1995; Treisman, 2000). Hence, decentralization can lead to poor economic growth (Prud'Homme, 1995)

In between these two contrasting ideas, some claim that the effects of decentralized health systems on population health are positive to a certain level of decentralization, but beyond this level, gains from decentralization may no longer be realized (Kang et al., 2012). Further, there seems to be a pressure to decentralize government functions given that most advanced economies have decentralized governance systems such as the United States, United Kingdom, Italy, and Spain (Bray, 1999; Keating, 1998; Saltman & Figueras, 1998). Many international donor organisations have also promoted decentralized health systems as key to improved population health, but some have argued that this is primarily politically driven (Cassels, 1995; Walt & Gilson, 1994).

6.2 Decentralization and child health in the context of the Philippines

Despite its long tradition of centralism, the Philippines is the first country to decentralize its services in the Southeast Asian region and has done so more rapidly than others (Turner, 2007). However, devolving health care was the last (Grundy, Healy, Gorgolon, & Sandig, 2003). Seven years after devolution, the Philippine Department of Health (DOH) is still restructuring itself to complement the devolved system and help local governments implement public health programs and services (Brillantes & Fernandez, 1986; Grundy et al., 2003). Despite its efforts to devolve health functions, 72 devolved hospitals were again re-nationalized in 2003 (Capuno, 2013; Langran, 2011). Twenty years after decentralization, debates about whether health systems should be decentralized are still on-going (Bossert & Beauvais, 2002; Lieberman, Capuno, & Van Minh, 2005; Veljanovski & Stojkov, 2013). Further, decentralization also led to double spending on health, resulting to high levels of government spending (Bossert & Beauvais, 2002).

The Philippines is divided into local government units (LGUs), which include regions divided into provinces (Grundy et al., 2003) **(Figure 6.2)**. Except for the National Capital Region, provinces can be further subdivided into cities and municipalities, which are then composed of barangays (Wallich, Manasan, & Sehili, 2014) **(Figure 6.3)**. Each LGU is run by a governor (province), mayor (city or municipality), or captain (barangay) with a three-year term of office and three term limits (Rood, 1998). In 1991, the Philippines enacted the Local Government Code that formalized decentralization (Brillantes, 1998), transferring the provision of major government functions and services such as public health to LGUs (Wagstaff, 2000). The Code was envisioned to make LGUs more financially viable and independent by allowing them to impose their own local taxes and giving them increased borrowing power such as in contracting loans, credits or bonds (Ishii et al., 2007). Specifically, the LGUs are responsible for any regulations and delivery of basic public

services. the while the central government provides additional resources (Brillantes, 1998). In terms of resources, central governments are exclusively assigned with major taxes from individual and corporate taxes, while LGUs are allowed to collect real property taxes, local business tax, and other specified taxes (Yilmaz & Venugopal, 2013).

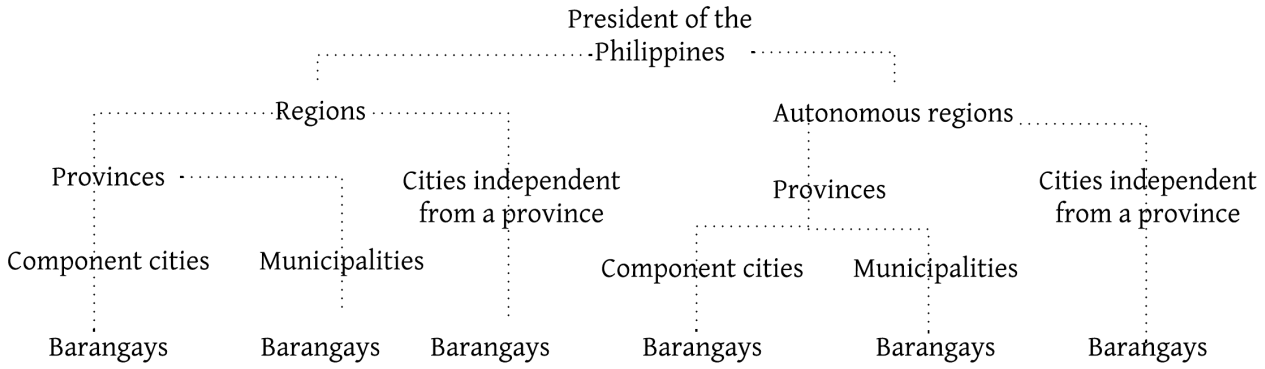


Figure 6.2 Local governance structure in the Philippines
Source: Author's illustration

The transfer of resources from the central government to the LGUs is done through the Internal Revenue Allotment (IRA), which has been questioned for its inadequacy and predisposition to corruption (Diokno, 2009). Specifically, central governments should transfer 40% of the revenues collected three years before the year of the distribution to the LGUs (Guevara, 2004). As long as the LGUs earmark their annual budgets an amount of no less than 20% for local development projects, LGUs can decide on how to utilize their IRA (Guevara, 2004). Meanwhile, there is no specific threshold for LGU allocation on specific healthcare services (Guevara, 2004).

There are two contrasting views on the decentralization in the Philippines. Others claim that decentralization negatively affected resource allocation. In the end, provinces received substantially reduced resources despite having the most government functions (Diokno, 2009). Further, decentralization increased government inequities with some LGUs receiving less resources for local income generation and weaker ties at the national level than other LGUs (Langran, 2011). In addition, health inequities also increased because LGUs least prioritised healthcare services (Langran, 2011). In contrast, others argue that decentralization led to better health outcomes, specifically lowering infant mortality rates (Asfaw et al. 2007: 17-35). However, the decline in infant mortality rates in the Philippines was said to be slower than expected at 22 deaths per 1000 live births in 2015 (La Vincente et al., 2013).

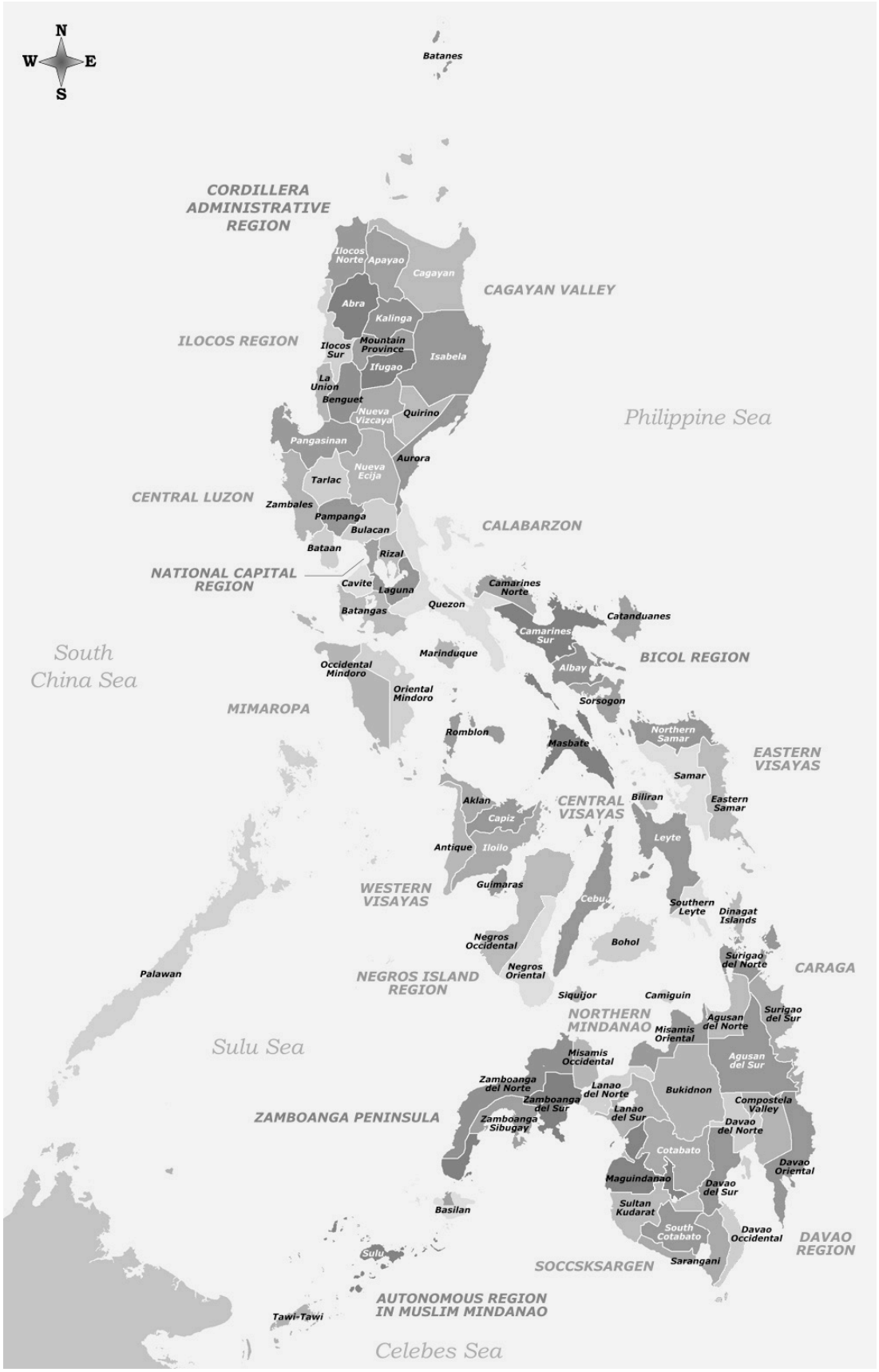


Figure 6.3 Map of the Philippines showing 17 regions (in capital letters) and their provinces

6.3 Decentralization and child health in the context of Cambodia

Cambodia was under the Khmer Rouge from 1975 to 1979 and in a state of civil war until 1991. Afterwards, the United Nations in Cambodia oversaw a transition leading to the restoration of civil rule after years of civil war and foreign intervention (Anon, 2015). When the election was held in 1993, the Cambodian People's Party refused to accept the election results instigating violence and leading to the UN backing down (Anon, 2015). Since then, Cambodia has endured traumatic and violent elections almost every five years (Anon, 2015). Although Cambodia still faces a number of development challenges, the country has attained the lower middle-income status in 2015. In particular, its economy grew rapidly with a change from central to a market-driven economy (Annear, 1998; Hill & Menon, 2013) (**Figure 6.4)**. With these economic reforms, Cambodia has begun significant health systems transformations to address increasing disparities (Helman & Ratner, 1992; Annear, 1998), particularly by improving distribution of its limited health resources (Helman & Ratner, 1992). Specifically, health reforms included expanding rural health services, rebuilding the district health infrastructure and implementing market-based financing practices (Annear, 1998). Reforms also include increasing active international and non-government aid organisations and different policy innovations in planning, contracting, and financing healthcare (Grundy, Yi Khut, Oum, Annear, & Ky, 2009). Since 1996, more policy shifts towards strengthening health systems were implemented (Peat, 2013). In 2001, Cambodia has started decentralization with an approved basic legal framework called Commune Law, which establishes and operates democratically elected local councils called Sangkat Councils (Romeo & Spyckerelle, 2004).[21] Although prevented from direct borrowing, communes have their own financial resources, budget and assets and have the right to collect direct revenues from local taxes, fees, and other service charges (Romeo & Spyckerelle, 2004).

[21] The 'Sangkat' is the equivalent of a commune in a municipality. Communes are predominantly rural, and Sangkats are normally urban, but there are also "urbanized" Communes and "rural" Sangkats (Romeo & Spyckerelle, 2004)

Figure 6.4 Map of Cambodia showing the boundaries for the 24 provinces

The creation of commune councils was found to improve local governance, as well as access to resources for local development and service delivery. In contrast, the commune councils has also been questioned for the lack of clearer assignment of responsibility as councils do not have a specific service delivery mandate (Romeo & Spyckerelle, 2004). Further, decentralized health systems were found to favour areas where elected members reside or from which they originate (Romeo & Spyckerelle, 2004). Despite health reforms, the high incidence of preventable diseases, poor quality of health workforce, low availability of health facilities, and lack of access to medicines remain (Annear, 1998). However, overall child mortality rates decreased faster than expected in Cambodia (Estanislao Castro et al., 2014). Specifically, average IMR was at 101 deaths per 1000 live births before decentralization, which decreased to 24 deaths per 1000 live births in 2015.

This chapter has two research objectives: a) to examine how decentralized health systems in Cambodia and the Philippines relate to infant mortality rates; b) to determine how different health systems strengthening initiatives in Cambodia and the Philippines operate in a decentralized health system. Using fixed effects regression analysis, I examined how decentralized health systems relate to infant mortality rates using regional-level income and expenditure data for Cambodia and the Philippines.

6.4 Methods

6.4.1 Quantitative analysis

Data sources. To model the relations between decentralized health systems and health outcomes in Cambodia and the Philippines, I used data from the national demographic health surveys (NDHS),[22] the Philippine Statement of Income and Expenditure,[23] and the Cambodian national health accounts available from 1960 to 2012. I used regions as the unit of analysis considered over waves of data about five years apart.

Independent variables. To measure decentralization, I computed for vertical balance (VB) adapted by Martinez-Vazquez & Timofeev, 2008. Vertical balance (VB) indicates the degree of local fiscal autonomy calculated as the ratio of the local government's total expenditure across all activities to their total revenue from all activities (Helman & Ratner, 1992; Pascual & Cantarero, 2007). In this study, I used vertical balance based on health revenue and expenditure. To measure VB:

$$VB_l = \frac{Exp_l}{Rev_l} \tag{6.1}$$

where the subscript l refers to the local government or commune, Exp_l is the local government's total expenditure and Rev_l is the local government's total revenue. A VB which is less than one indicates that the local government's resources are sufficient to cover its total expenditures. If VB is greater than one, the local government's expenditure exceeds the local government revenue for health. The higher the VB, the more local dependence there is to the central government. This high VB implies that other external resources such as IRA, shares under special laws, grants, and aids are needed to address the fiscal gap at the local level (Schwartz, Guilkey, & Racelis, 2002).

Dependent variable. First, I used infant mortality rates (IMR) or the number of infants who die within the first year of life expressed as a rate per 1000 live births. Second, I used total fertility rates (TFR) or the average number of children that would be born per women if all women lived to the

[22] The NDHS is a nationally representative survey conducted by the National Statistics Office and ICF Macro every five years since 1968 to assess the demographic and health situation in the country. It was designed to collect information on health-related topics such as fertility, and maternal and child health (MEASURE & Calverton, 2004).

[23] The SIE provides the LGUs fiscal and financial performance and includes details on tax revenue, non-tax revenue (or receipts), and other sources of income such as loans, grants, transfers, borrowings, and shares from the national government. Locally-sourced income includes tax revenues from real property, business, and other local taxes, and non-tax receipts from fees and charges, government business operations, and other miscellaneous income. Externally sourced income includes the Internal Revenue Allotment (IRA), shares under special laws, grants, and aids and other transfers to LGUs. It also provides expenditure data for each basic services, any surplus, and the amount of resources to be carried forward by the local government to the subsequent budget year (Virola et al., 2010).

end of their childbearing years and bear children in accordance with age-specific fertility rates of the specified year (World Bank, 2016a). TFR was used because previous studies showed strong associations between decentralization and reproductive health policies (Aitken, 1998). IMR is calculated as (Benfeng & Yu, 2011):

$$IMR = \left(\frac{D_{(t,0)}}{B_t}\right) x\ 1000 = \left(D_{(t\text{-}1,t,0)} + \frac{D_{(t,t,0)}}{B_t}\right) x\ 1000 \quad (6.2)$$

where $D_{(t\text{-}1,t,0)}$ is the number of babies born in the year of (t-1) who die in the year of t, $D_{(t,t,0)}$ is the number of babies born in the year of t and die in the year of t.

TFR is calculated as:

$$TFR = \sum ASFR_a \text{ for 5-year age groups} \quad (6.3)$$

where $ASFR_a$= age-specific fertility rate for women in age group a expressed as a rate per woman.

Control variables. I controlled for antenatal coverage, percent distribution of live births assisted by a doctor during delivery (*Asst*), percent distribution of live births delivered in a health facility (*Place*), percent of married women who know at least one contraceptive method (*Cont*), and percent distribution of the de facto female household population age six and over who at least completed elementary (*Educ*) **(Table 6-1)**.

Table 6-1 Descriptions of the variables used

Variables	Description
Infant mortality rates (IMR)	Number of deaths of children less than 1 year of age per 1000 live births
Vertical balance (VB)	Summation of the provincial expenditure over summation of the provincial revenues
Antenatal coverage (ANC)	Percent distribution of women who had a live birth in the five years preceding the survey receiving at least one antenatal care visit during pregnancy. ANC is an intervention vital to maternal and child health.
Assisted births (Asst)	Percent distribution of live births in the five years preceding the survey receiving assistance from a skilled birth attendant. It shows use of delivery care services and is mostly used as a measure of the health system's functioning.
Place of birth delivery (Place)	Percent distribution of live births in the five years preceding the survey delivered in a health facility. It is the optimal long-term objective of all births to ensure any obstetric complications can be

	treated when they arise.
Knowledge of contraceptive methods (Cont)	Percentage of currently married women who know at least one contraceptive method
Educational Attainment (Educ)	Percent distribution of the de facto female household population age six and over who had no education
Total Fertility Rates (TFR)	Total fertility rate for the five years preceding the survey

Source: (WHO, 2010b, p. 85)

Analysis. To do a fixed effects regression model, I built a pooled region-period data set for Cambodia and the Philippines. I have data on 36 regions at about 4.4 time periods each with each wave about 5 years apart. In total, I have 159 observations with about 4.4 observations per region. Assuming that local governments have full fiscal autonomy in health resource distribution:

$$\mathrm{IMR_{it}} = \alpha + \alpha_i + \beta_{1t}\mathrm{VB_{it}} + \beta_{2t}\mathrm{ANC_{it}} + \beta_{3t}\mathrm{Asst_{it}} + \beta_{4t}\mathrm{Place_{it}} + \beta_{4t}\mathrm{Cont_{it}} + \beta_{4t}\mathrm{Educ_{it}} + \varepsilon_{it} \quad (6.4)$$

$$\mathrm{Fert_{it}} = \alpha + \alpha_i + \beta_{1t}\mathrm{VB_{it}} + \beta_{2t}\mathrm{ANC_{it}} + \beta_{3t}\mathrm{Asst_{it}} + \beta_{4t}\mathrm{Place_{it}} + \beta_{4t}\mathrm{Cont_{it}} + \beta_{4t}\mathrm{Educ_{it}} + \varepsilon_{it} \quad (6.5)$$

where IMR is the infant mortality rate per region i and year t and Fert is the total fertility rate per region i and year t; α_i is the region-specific effect; VB represents vertical balance per region i and year t; ANC_{it} is the antenatal coverage per region i and year t; $Asst_{it}$ is the percent distribution of live births assisted by a doctor during delivery; $Cont_{it}$ is the percent of married women who know at least one contraceptive method; $Educ_{it}$ is the percent distribution of the de facto female household population age six and over who at least completed elementary.

6.5 Results

6.5.1 Summary results for the Philippines

Infant mortality rates. Seventeen regions were included in this study from time periods from 2001 to 2008 at approximately five year intervals. From 2001 to 2008, the average infant mortality rate was 32.65 per 1000 live births. The highest IMR was in Region VIII at 61.4 per 1000 live births in 2001 and 60.8 per 1000 live births in 2003. The lowest IMR was in Region IX and CAR both with

14 per 100 live births in 2005 and in 2004, respectively. Overall, IMR decreased from 40.77 per 1000 live births in 2001 to 26.71 per 1000 live births in 2008.

Total fertility rates. TFR was at 3 births per woman aged 15 to 49 years old. The highest TFR ever recorded was at 5.91 in 2003 for Region VIII and 5.87 in 2001 for Region VIII. The lowest recorded TFR was 2.3 for NCR in 2008 and 2013.

Vertical balance. The average vertical balance was less than one throughout the Philippines, although this has been improving over the years. Average VB decreased from 0.98 in 2001 to 0.86 in 2008, implying lesser fiscal gaps across regions. The highest ever calculated was from 2001 to 2003 at 1.049 for Region VI, 1.043 for Region IV-B, and 1.043 for Region III. The lowest ever calculated was a VB of 0.77 for Region I in 2008 and 0.79 for Region II in 2005.

Control variables. Average antenatal coverage was at 32.85% ranging from 11.3% to 81.3%. The highest ever recorded was for NCR from 81.3% in 1993 to 75.3% in 1998, and 74% in 2003 and 2013. The lowest ever recorded was in ARMM from 11.6% in 1998 to 12.4% in 2013. Region XII and Region IX followed with 12.1% in 2008 and 12.5% in 2004.

On average, assisted birth deliveries were at 28.87% with the highest ever recorded for Region III at 39% in 2001 followed by Region IV-A at 43.1% in 2005. The lowest ever recorded was at ARMM from 3.4% in 1998 to 9% in 2013 followed by Region IX with 10.1% in 2001. Average percentage of assisted birth deliveries was from 20.67% in 2001 to 28.4% in 2013.

On average, the percentage of women who know at least one contraceptive method was at 98.21% ranging from 77.9% to 100%. Regions that reached 100% include CAR in 2008, CARAGA from 2003 to 2008, Region I from 2003 to 2008, Region II in 2004, Region II from 2005 to 2008, Region IVA in 2008, Region V in 2005, Region VI from 2003 to 2008, Region VII in 2005, Region VIII in 2008, Region X in 2003 and 2005, and Region XI in 2008. The lowest ever recorded was in the ARMM from 77.9% in 1998 to 82.6% in 2008.

Six percent of the de facto female household population had no education with the highest in ARMM at 30.4% in 1998 and 23.1% in 2003 followed by Region XII with 20.4% of its population who did not received any formal education. Region I and NCR had 100% of its population able to attend at least some primary education. Less than 0.5% of the populations in Region II, Region III,

Region IV-A, and Region V did not receive any formal education. Overall, 9.35% did not received any formal education in 2001, which decreased to 5.39% in 2008 and increased to 11.05% in 2013.

6.5.2 Summary results for Cambodia

Infant mortality rates. Twenty-four regions were included. From 2001 to 2014, the average IMR was at 72.80 per 1000 live births ranging from 95.85 per 1000 live births in 2000 to 42.5 per 1000 live births in 2014. The highest recorded was in Ratanak Kiri (id = 20) and Mondul Kiri (id = 19) both with 169.80 per 100 live births in 2000 and 122 per 1000 live births in 2005. This was followed by Pursat (id = 10) and Kampong Chnang (id = 3) with mortality rates at 139.4% and 129.3%, respectively. The lowest ever recorded was in Phnom Penh (id = 8) with 13% in 2008 and 17% in 2014. This was followed by Kampong Speu (id = 4), Battambang (id = 15), and Pailin (id = 22) with IMR less than 30% in 2014.

Total fertility rates. Total fertility rates were almost similar for the Philippines and Cambodia with TFR at an average of 3% for Cambodia from 2000 to 2014. The highest recorded TFR was 6.3% in 2000 for both Mondul Kiri (id = 19) and Ratanak Kiri (id = 20) followed by 5.2% for the same areas in 2005. The lowest ever recorded was in Phnom Penh with an average of 2% from 2000 to 2014, then by Kampong Speu (id = 4) with 2.1% and Kampong Chnang (id = 3) at 2.4%.

Vertical balance. Using the Cambodian government budget and financial audit reports, none of the regions had a vertical balance of more than 1 and average VB was at 0.76 . The lowest VB was at 0.36 and the highest was 1.0 for Takeo (id = 13) in 2005, 2008 and 2014; Kampong Chnang (id = 3) in 2000 and 2005; Pursat (id = 10) in 2000 and 2012; Prey Veng (id = 9) in 2014; and Svay Rieng (id = 12) in 2013 and 2014. The lowest recorded VB was 0.36 for Preah Vihear (id = 18) in 2005, followed by Otdar Meanchey (id = 14) at 0.40 in 2000 and Prey Veng (id = 9) at 0.44 in 2013. Average VB started from 0.72 in 2000 and increased to 0.80 in 2008, before it decreased again in 2014 at 0.79.

Control variables. Antenatal coverage improved from 1% in 2000 to 6.14% in 2008. The highest antenatal coverage was in Phnom Penh from 11.9% in 2005 to 67.2% in 2008. The least coverage was in Stung Treng, Kampong Speu, and Kamping Thom with an average of less than 0.5% antenatal coverage. Assisted births only grew from 1.9% in 2000 to 8.1% in 2008 with the highest recorded in Phnom Penh at 73.2% in 2008 and lowest in Mondul Kiri and Ratanak Kiri at 0.1% in

2005. Births delivered in a health facility grew from 9.24% in 2000 to 39.50% in 2008. The highest recorded was in Phnom Penh at 1.9% and least in Otdar Meanchey and Siem Reap at 1.9% in 2000.

Knowledge of at least one contraceptive method was highest in Phnom Penh, Kampng Chnang, Kampong Thom, Prey Veng, Pursat, Siem Reap, Svay Rieng, Otdar Meanhchey, Kampot and Kep with 100% coverage. Least coverage was in Mondul Kiri and Ratanak Kiri at 21.5%, followed by Siem Reap at 29.3%. Overall, contraceptive knowledge increased from 91.66% in 2000 to 99.67% in 2014. The highest proportions of the population with no formal education were in Mondul Kiri and Ratanak Kiri where 75.1% of the population reported not receiving any formal education in 2000. Only less than 15% of the population in Phnom Penh did not receive any formal education from 2000 to 2014.

6.5.3 Estimation results for infant mortality rates, total fertility rates, and vertical balances in Cambodia and the Philippines

I fitted six equations using fertility rates and infant mortality rates as the dependent variables and the vertical balance as the independent variable. I used the same controls for each equation. Two of the equations were limited to data from Cambodia, two of them were limited to data from the Philippines, and the last two equations used combined both datasets from Cambodia and the Philippines. A change in vertical balance for Cambodia was significantly associated with infant mortality rates such that every unit of increase in vertical balance implies 0.135 decrease in infant mortality rates controlling for births assisted, place of delivery, ANC, contraceptive knowledge and educational attainment. Place of birth delivery also showed significant associations with the total fertility rate and infant mortality rate in Cambodia and the pooled dataset, but not in the Philippines at $p<0.001$. In the Philippines, only assisted birth deliveries and contraceptive knowledge showed significance at $p<0.01$ for both total fertility rates and infant mortality rates. Across all datasets, vertical balance was not significantly associated with fertility rates in either country.

Table 6-2 Estimation results for infant mortality rates, total fertility rates, and vertical balances in Cambodia and the Philippines

	Cambodia		**Philippines**	
	1	2	3	4
	TFR	IMR	TFR	IMR
VB	0.016	-0.135*	0.062	0.123
	(0.31)	(1.97)	(0.56)	(0.82)

ANC	0.069	0.118	0.234	-0.346
	(0.71)	(0.91)	(0.79)	(-0.91)
Asst	-0.097	-0.185	-1.219**	-0.114
	(-0.81)	(-1.15)	(-3.22)	(-0.23)
Place	-0.375***	-0.471***	0.318	0.164
	(-4.52)	(-4.26)	(1.51)	(0.59)
Cont	0.012	-0.081	-0.223	-0.757**
	(0.20)	(-1.07)	(-1.34)	(-3.11)
Educ	0.611***	0.369***	-0.203	-0.354
	(8.48)	(4.26)	(-1.27)	(-1.58)
N	64	64	34	34

6.5.2 How the different health systems strengthening initiatives in Cambodia and the Philippines operate in a decentralized system?

Decentralization, as indicated by vertical balance, was found to significantly affect the infant mortality rates in Cambodia, but did not seem to have major contributions to the reductions in infant mortality rates in the Philippines. Meanwhile, total fertility rates were not affected by vertical balances. The influence of decentralization may be more apparent in Cambodia, wherein none of the financial reports showed a vertical imbalance, implying no fiscal gap between the local government's revenues and expenditures.

Further increasing vertical balance in Cambodia would lead to significant decrease in infant mortality rates. At the start of decentralization, the infant mortality rate in Cambodia was at 95.85 with a vertical balance at 0.72. Five years later, infant mortality rate had decreased to 91 with a vertical balance increasing at 0.74. In post-conflict Cambodia, contracting of health services to other non-government organisations was the key health strategy used by the government (Soeters & Griffiths, 2003). The contracting of health services was initially an experimental strategy, wherein contracts were called from non-government organisations to attain specific health coverage targets for selected groups of the population (Gwatkin, Bhuiya, & Victora, 2004). This contracting may have led to competition in awarding contracts resulting to increased service delivery output and better quality of health services (Gwatkin et al., 2004; Soeters & Griffiths, 2003; Jacobs et al., 2010) . Since implementation of this approach, coverage in the poorest 20% of the population of eight basic services improved from 15% to 40% (Gwatkin et al., 2004), resulting to increased health service utilization (Soeters & Griffiths, 2003). Although the strategy was found to have positive

impacts, the challenge was in transitioning back private services into government systems, particularly in ensuring that proper financial remuneration still remains for its health workers (Jacobs et al., 2010).

Health equity fund schemes (HEFs) was another strategy used by Cambodia for financing health systems. HEFs were supported through the Health Sector Support Program, wherein funds from various development partners and the Royal Government of Cambodia pays for the bill for each patient's treatment fee, meals, transport, and other additional costs (World Bank, 2015a). However, studies on their outcomes have mixed findings. Some have found HEF to improve financial access for the poor with a support for 16% of hospitalized patients in 2004 alone (Hardeman et al., 2004). Others claim that HEFs still have weak performance, poor policy design, and underfunding (Meessen, Damme, Tashobya, & Tibouti, 2007). Despite mixed findings, HEF were consistently found to be effective if there was local involvement in its management and implementation. Other studies also found that identification of HEF fund recipients would have been more successful and effective if done by community members. Such community involvement was found to be feasible and accrues minimal direct costs (Jacobs & Price, 2006; Noirhomme et al., 2007). Specifically, pagoda-managed equity funds resulted to higher community participation, while indigenous community-based organisations resulted to reduced administrative costs (Noirhomme et al., 2007).

Results also showed the regional differences in terms of vertical balances, infant mortality rates, and total fertility rates in Cambodia and the Philippines. In both countries, results consistently showed that areas with more fiscal gaps, which were mostly in rural areas or conflict-affected areas like ARMM for the Philippines and Mondul Kiri and Ratanak Kiri for Cambodia also had poorer health outcomes, implying also that the potential of decentralized health systems may not necessarily be fully achieved in areas with larger vertical imbalances. According to previous studies, one of the factors that likely affected the lack of rural development in the Philippines appears to be the continuous industrial protection that lowers the relative price of agricultural products and acted as a disincentive to agricultural sector development (A Balisacan, 2004). Hence, as long as an LGU spends more than its revenues, healthcare is most likely least prioritised despite increasing intergovernmental transfers and fiscal capacity. With decentralization, a heavy reliance on local government units emerged, raising issues on the direction of public health management (Fukasaku, 1999). Alternative approaches for financing may be able to address the fiscal gap: a) increasing local revenues; b) increasing LGU taxing authority; c) increasing transfers from national government; and d) more efficient use of existing financial resources in service delivery (Manasan, 1997). With the vast taxing powers given to the LGUs, the level of total income was inherently

dependent on the capacities of LGUs on the different areas of tax administration: registration, collection, and compliance (Bird, Ebel, Wallich, & Oates, 1998).

6.6 Conclusion

I found that decentralization played a significant role in reducing infant mortality rates in Cambodia, but not in the Philippines. For both countries, I also found substantial inequities among regions in terms of the fiscal transfers, infant mortality rates, and total fertility rates. Results also showed that areas with more fiscal gaps were mostly in rural or conflict-affected areas like ARMM for the Philippines and Mondul Kiri and Ratanak Kiri for Cambodia. These areas also had poorer health outcomes; hence, the potential of decentralized health systems may not necessarily work in these areas with larger vertical imbalances. Although as Hill and Menon (2013) note Cambodia's 'policy settings were unusual, owing to its history, size, location, and also deliberate policy choices', lessons from these health systems reforms can play a key role in guiding health system reforms of other similar post-conflict affected or low and middle income countries wherein disparities, particularly in terms of health, were very similar with that of Cambodia and the Philippines. In both countries, corruption and differences in political priorities with least priority given for health were also identified as a potential barrier for effective health service delivery leading to less effects of vertical balances on infant mortality rates. It is apparent that local economic development needs strong leadership from the local government to continually manage the flow of financial resources.

The benefit of decentralization is not only in encouraging people to participate in local government, but also in providing them with an avenue to increase the demand for health services by putting pressure to their leaders. Studies in Cambodia identified that contracting services to non-governmental organisations and increasing community participation may have contributed to health outcomes. Hence, other than ensuring vertical balances across regions, countries like the Philippines may also consider health systems strengthening initiatives encouraging increased community participation for local health service delivery and decision-making processes. For example, citizen watchdog or an involved/informed constituency for financial planning, budgeting, expenditure and accountability, may be able to translate to increased demand for health services, leading to lower IMR.

Simplifying decentralization into a single dimension becomes more complicated when other aspects of decentralization are considered at the same time. For example, the level of autonomy becomes

unclear when we compare a local government with significant fiscal decentralization and deconcentrated authority to a local authority with few resources but devolved authority. These measures may require taking into account the interrelationship of the dimensions. In cases in which there was no fiscal data available in certain years but data were available for others, linear trends obtained through regression analysis of available data also filled the missing years. As most fiscal indicators are variables that change incrementally over time, this approach was not likely to change the results. Interpolating the data across years provided more cases for analysis, though the results were unchanged by using data from a single year alone. Further, understanding that confounders may be able to distort the relationship between the independent and dependent variables and that this distortion can lead to erroneous conclusions, I controlled for confounding in this research. Confounding can be controlled through the design and analytical stages. For the design stage, randomization, restriction, and matching of the dependent variables can be done (Ashengrau & Seage, 2014). I controlled for confounding at the analytical stage through standardization by urban and rural classification and regions, stratified analysis, and multivariate analysis. Although matching allowed balance distribution of data in each strata, smaller standard error, and narrower confidence interval, my analysis of the dataset did not find an exact match.

In both countries, findings also showed that local financial resources and fiscal capacity as indicated by VB have been steadily improving since decentralization. Tax revenues have been the single source of income among affluent areas. In contrast, poor provinces are still highly dependent on national transfers like the Internal Revenue Allotment, implying a need to further strengthen the taxing capacities of the local governments to make them more financially viable and ultimately achieve financial independence. With this, emphasis on capacity building in the major areas of local taxation like property valuation, land administration and tax collection were deemed necessary. LGUs can then expand their fiscal space and be able to put more resources in strategic development programs on health and education. Equally important, low-income provinces have been struggling to provide social services at a wider coverage as evident for both Cambodia and the Philippines with the same areas getting the poorest values for almost all measures used in this study. These areas, which were also mostly ravaged by past or ongoing conflicts, consistently had poorer health outcomes and may need more attention from central governments. On the expenditure side, local government units have traditionally allotted their expenses to general public services with little priority to health and education services. If this trend continues, the inefficiency on local government spending was counterproductive in achieving the national targets in improving health outcomes. Reforms in the budgeting and expenditure process should be introduced across the internal systems of local governments to make them more responsive and impact-oriented to public

health outcomes. The policies on budget excesses and debt servicing can be revisited as another way to improve the financial management of LGUs (van Olmen et al., 2012). In the final analysis, the health care systems in the Philippines and Cambodia need to be continually refined to remain responsive to the needs of the people especially in the face of the devolution of health service delivery to the LGUs. Financing is certainly a big part of the issue. Equally important is the combined leadership and motivation of the local government officials, the support of the national government, and participation of the people in the community (Valdez-Vivas et al., 2015; Veillard & Maurice, 2012).

Chapter 7 Summary, Conclusions, and Recommendations

Health Systems Strengthening (HSS) is about improving the overall system that is directly responsible for better health outcomes, and if HSS is done in an evidence-informed way, health outcomes will improve. In this thesis, I contributed to HSS research by improving conceptualisations, measurement and accountability reporting, and also carried out empirical examinations to see if HSS was associated with health outcomes relating to child and infant mortality and life expectancies. In particular, this thesis examined the relations between HSS initiatives and child health outcomes, as well as life expectancies. This thesis also examined HSS concepts, frameworks, and measures that can be used for assessing HSS initiatives to inform global and national policymaking and practices.

Millions of dollars are allocated annually under the umbrella of HSS. However, conducting HSS monitoring and evaluation is difficult because of the complexity involved (De Savigny & Adam, 2009). For example, other socioeconomic factors and health service interventions may also significantly affect a country's health systems performance and health outcomes (Adam & de Savigny, 2012). Hence, assessing progress on HSS and determining whether these HSS initiatives are effectively achieving their goals remain challenging (Adam & de Savigny, 2012). Further, HSS concepts, frameworks, and measures that are required to guide HSS monitoring and evaluation highly vary across countries (Gerring et al., 2013). To this end, there are no widely accepted HSS assessment concepts, frameworks, and measures (Hong & Huibin, 2002). Countries also have varying capacities to conduct HSS monitoring and evaluation with some countries conducting more comprehensive HSS assessments than others primarily due to resource constraints. As such, more evidence is needed to help set the minimum standards for HSS monitoring and evaluation to ensure its quality and usefulness for policymaking and practice, while still considering existing country capacities and health systems challenges. Addressing these research gaps in HSS monitoring and evaluation will also help guide decisions for HSS grant allocations, which are mostly subjected to performance-based funding approaches.

By determining the key concepts, frameworks and indicators that can be used for HSS monitoring and evaluation based on existing documents from HSS grant recipient-countries, I found that this monitoring and evaluation involves a comprehensive and complex picture of HSS to include assessments across the different health systems building blocks (governance, financing, service

delivery, workforce, medical products and technologies, and health information systems). Using results from systematic analyses of HSS concepts and measures, I also created and developed taxonomies of health systems performance that can be used to inform global and regional-levels of HSS monitoring and evaluation. However, I found that these global and comparative methods also faced multiple constraints, which influence their effective use in national policymaking. In particular, ranking a country's health systems performance may not necessarily inform the health system reforms needed by these countries. Due to different country contexts, HSS assessments may be better applied to a narrower and more specific context than to overall global and national assessments. To apply these methods in a national context, I examined HSS initiatives in the context of decentralized health systems and determined how decentralizing health services may have affected child health outcomes, particularly infant mortality rates, using the cases of Cambodia and the Philippines.

Research Question 1: How should we conceptualize and assess HSS initiatives?

The concept of HSS and its relations to global priority areas for health

Previous studies mapped how the concept of HSS may have evolved from a disease-specific approach for healthcare service delivery to a more system-wide approach for improving health (Galichet et al., 2010). I supported such findings with evidence identifying how key public health conferences and events have pushed the global health agenda towards more preventive and promotive aspects of health care. **Chapter One** presented the results from this review of key public health statements made over the past four decades. Specifically, I found nine key themes: a) improving equity, access, and social justice; b) increasing funding and better priority setting to achieve UHC; c) improving governance for health; d) building capacities for research, health workforce, and health systems; e) creating better collaboration and cooperation, as well as integrating and embedding health across sectors; f) reorienting towards improved community action and people-centeredness; g) determining appropriate metrics, and developing better monitoring and evaluation processes for health systems; h) creating supportive environment for health and addressing key health determinants; and i) calling for action from different health system actors. These nine themes cut across the inputs needed for health systems strengthening. These findings suggested the shift from solely disease-focused interventions towards more system-wide approaches to achieve health outcomes and acknowledged that health is complex and comprehensive; hence, requiring an even more holistic approach for health service delivery.

Developing an HSS framework based on identified HSS domains and measures

As stated above, HSS assessments require having a better understanding of key HSS concepts and measures. To achieve this objective, **Chapter Two** provided baseline information on how HSS monitoring and evaluation was done across the European Region and where data permit, a template for HSS monitoring and evaluation framework and processes that other countries and HSS program providers can use as a guide for their own. Specifically, chapter two provides a comprehensive description of the different concepts, domains, and indicators used for HSS assessments across the Region. Europe was selected to address this research objective because compared to all other regions, Europe had its own Task Force for Health Systems Strengthening Performance Assessments and have made Member States commit to assessments of the health systems when these countries signed the Tallinn Charter (WHO, 2008b). Using the WHO Health Systems Building Block framework as a guide, additional data sources were sought from the Member States and examined to identify the key HSS domains that already existed and were identified as relevant by the countries themselves. These domains were then used to develop a new HSS monitoring and evaluation framework that combines all the potential domains that other countries can examine and use for their own HSS assessments. This framework can be used for the initial design phases of HSS, particularly for countries who are yet to structure their monitoring and evaluation systems. These findings provided countries with resources to choose from to map, measure, and assess their own HSS and/or improve their current HSS assessment practices.

Existing and potential HSS program-level indicators tailored to specific country capacities and purposes

After identifying the framework and key dimensions that are available within countries, the next step to guide HSS assessments was to identify existing and other potential programme-level HSS indicators that were tailored to specific country capacities and purposes. To achieve this objective, **Chapter Three** identified indicators from existing HSS monitoring and evaluation frameworks of HSS grant recipients. Prior to receiving HSS grants, countries commit to the indicators that will be used to determine their health systems progress and to guide allocation of HSS grants specifically intended to improve immunisation outcomes. From the monitoring and evaluation frameworks that countries submitted, I identified additional tailored HSS indicators to complement the existing core indicators for HSS grants. Based on a systematic analysis, interviews, and internal review processes, I identified existing and potential indicators that can be used to streamline the monitoring and evaluation of HSS grants, while considering country's capacities to track and perform against these indicators. Findings showed the wide variability for HSS indicators across HSS-recipient

countries. Internal scoring was done to assess the validity of each indicator for HSS and examined how such measures can be used to track performance and progress against HSS grant objectives. Findings provide baseline information on how HSS can be assessed to inform existing and future HSS grant allocations. This process can also then facilitate creation of more standard measures to assist other ongoing and future HSS programs.

How significant are HSS initiatives to improve health outcomes?

Socioeconomic and institutional factors that may significantly influence child health outcomes and life expectancies

Central to the work towards health systems strengthening was the analysis of how each health system building block affected health outcomes. Despite the vast research done on HSS, little research has still been conducted to determine how each health system building block is related to health outcomes especially in the context of LMICs (Mounier-Jack et al., 2014). **Chapter Four** examined the relationship between key health systems indicators and different measures of health outcomes, including infant mortality rates, child mortality rates, and life expectancy rates, using cross-sectional data from 137 low and middle income countries from 1990 to 2010. Health systems performance and health outcomes have been continuously improving in LMICs over the years, but it remains unclear how much of this can be attributed to HSS (Berger & Messer, 2002; Gani, 2009). My discussion focused on how improving controls for corruption, ensuring government effectiveness, and implementing the rule of law, as well as increasing external and private resources for health would potentially reduce child mortality rates and improve life expectancies. Findings also reiterated the importance of antenatal care coverage particularly in LMICs and how pharmaceutical public spending may also aid in ensuring access for medical products and technologies; hence, further increasing health outcomes. Overall, results showed how every unit of increase in the scores for governance, service delivery and workforce also leads to 2 to 3 more months of life for every child and how each unit of increase in health workforce saves 7 more infants and 536 children per 1000 live births. Findings highlighted the importance of continuing efforts to strengthen these different functions of the health systems and also better understand how they relate to health outcome indicators that are being used to assess HSS initiatives.

Opportunities and barriers for developing a composite indicator for health systems performance and identify taxonomies of health systems performance in low- and middle-income countries

Chapter Five developed a taxonomy of HSS initiatives to clearly point out the similarities and differences in health systems performance of different countries; to discuss how differences in health systems characteristics influences health outcomes; and to understand how overall HSS progressed over the years. Despite the limitations, assessing health systems performance using observable characteristics is necessary and can be informative. The taxonomy developed builds on indicators identified in previous health systems performance assessments that were constantly monitored and made comparable across countries. While context specificity is important and many other factors related to health systems may not be accounted for in national databases, I argue that such empirically derived taxonomies can still be used to identify country-level and global progress on key health systems performance indicators. This information may also be used to determine which measures matter for global monitoring of trends on HSS. In a similar way that quality scorecards are used in healthcare delivery, the resulting taxonomy can also be used to improve systems-level approaches. The OECD has provided a springboard for many comparative analyses of health policies that examined how sector-specific institutional contexts shape health policies (Burau & Blank, 2006; Mossialos, 2010). Findings provided an overview for the progress on each health system building block that were dominant and comparable in many countries (Mossialos, 2010). Evidence showed the characteristics and the geographical locations of least performing health systems, which were not yet examined in the current literature. Findings may also be used to assist in determining such characteristics of poor performing health systems and can also be used as a starting point or guide for health systems performance monitoring. It can then provide insights to improve strategies for HSS and to identify health systems barriers. Taxonomies can also help capture targets central to achieve health goals, contributing towards evidence-informed health policies and interventions across countries. Taxonomies can also be used to set national improvement priorities (WHO, 2013f).

Factors to be considered when assessing HSS in Cambodia and the Philippines

In **Chapter Six**, I focused on the governance dimension of HSS, particularly the transitions from centralized health systems to a more decentralized one. This chapter moved the discussions forward from the global contexts of HSS discussed in previous chapters to a national-level context for health systems analysis. Specifically, this chapter addresses whether decentralized health systems translate to positive child health outcomes. In particular, I examined how decentralized health systems in Cambodia and the Philippines relate to infant mortality rates and fertility rates and determined how

the different HSS initiatives in Cambodia and the Philippines operate in a decentralized system. I found that decentralization significantly affects regional-level infant mortality rates in Cambodia, but did not show significant difference for the Philippines. Despite widening fiscal decentralization in the Philippines and better vertical balances for its regions, previous studies showed that local government units in the Philippines did not spend more on health systems. I also found significant inequalities across regions, particularly in terms of local resources allocated for improve health outcomes. In both countries, results showed that areas with more fiscal gaps were mostly in rural areas or conflict-affected areas like ARMM for the Philippines and Mondul Kiri and Ratanak Kiri for Cambodia. These countries also had poorer health outcomes, implying that the potential of decentralized health systems may not necessarily be realised in areas with larger vertical imbalances. These findings also suggest that as long as an LGU spends more than its revenues, healthcare is most likely least prioritised despite increasing intergovernmental transfers and fiscal capacity.

Main conclusions and recommendations

In this thesis, I gathered evidence that can be put into practical use in health systems monitoring and evaluation. This thesis provided a new framework for assessing HSS initiatives, developed a reference list of indicators for health systems performance, and examined different cases of HSS initiatives at the global and national levels. The main conclusions and recommendations are:

- Health Systems Strengthening (HSS) concepts, frameworks, and measures should be defined to facilitate comparison, judge validity and improve quality of HSS monitoring and evaluation. This thesis, particularly chapters one to three, contributed to achieve this objective.
- Methods for quantifying the effects of HSS on child health outcomes, particularly infant mortality rates and life expectancy at birth should be determined and examined to assist in tracking performance and progress towards achieving the health systems goals. Different regression models, principal components analyses, and clustering were applied in Chapters four and five, which were developed for use in HSS assessments. These models can be based on a combination of factors from the six health systems building blocks and other variables identified as relevant for HSS in the previous frameworks. Meanwhile, Chapter six provided two cases of HSS assessments. In particular, Chapter six focused on the governance aspect of health systems using the cases of decentralised health systems in Cambodia and the Philippines, examining how HSS assessments can be used to further inform and guide health policymaking and practices.

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Appendices

Appendix 1. Supplementary information for Chapter One

Table A1. Dimensions of health systems performance compared across different existing health systems frameworks

Dimensions	Chapter 2	WHO	OECD	CF	UK	Canada	USA
Leadership/governance	√	√	√		√	√	
Health financing, expenditure or costs	√	√	√	√	√	√	√
Service delivery or health care activities	√	√	√	√	√		√
Health workforce	√	√	√	√		√	√
Medical products and technologies	√	√				√	
Health information systems	√	√					
Socioeconomic contexts	√		√				
Cultural and environmental contexts	√				√		
Other health or non-healthcare determinants	√		√				
Access	√	√	√	√	√	√	√
Appropriateness	√			√		√	
Availability	√						
Competence	√					√	
Continuity and sustainability	√			√		√	
Effectiveness	√		√	√	√	√	√
Efficiency	√	√				√	√
Equality	√						
Equity	√	√	√		√	√	√
People-centeredness and empowerment	√	√	√	√	√	√	√
Responsiveness	√	√	√	√	√	√	√
Safety	√	√	√		√	√	√
Social and financial risk protection	√	√					
Health status	√	√	√				
Health impact	√						
Inter-sectoral linkages	√						
Quality		√	√				

Notes: WHO, World Health Organisation (WHO, 2000); OECD, Organisation for Economic Cooperation and Development (Arah et al., 2006); CF, Commonwealth Fund (Arah et al., 2006; CommonwealthFund, 2015); UK, United Kingdom (Arah et al., 2006; EuropeanObservatory, 2015b); USA United States of America (Arah et al., 2006) Source: Author's findings discussed in Chapter 2 and findings of Arah, 2006 (Arah et al., 2006).

Appendix 2. Supplementary information for Chapter Four

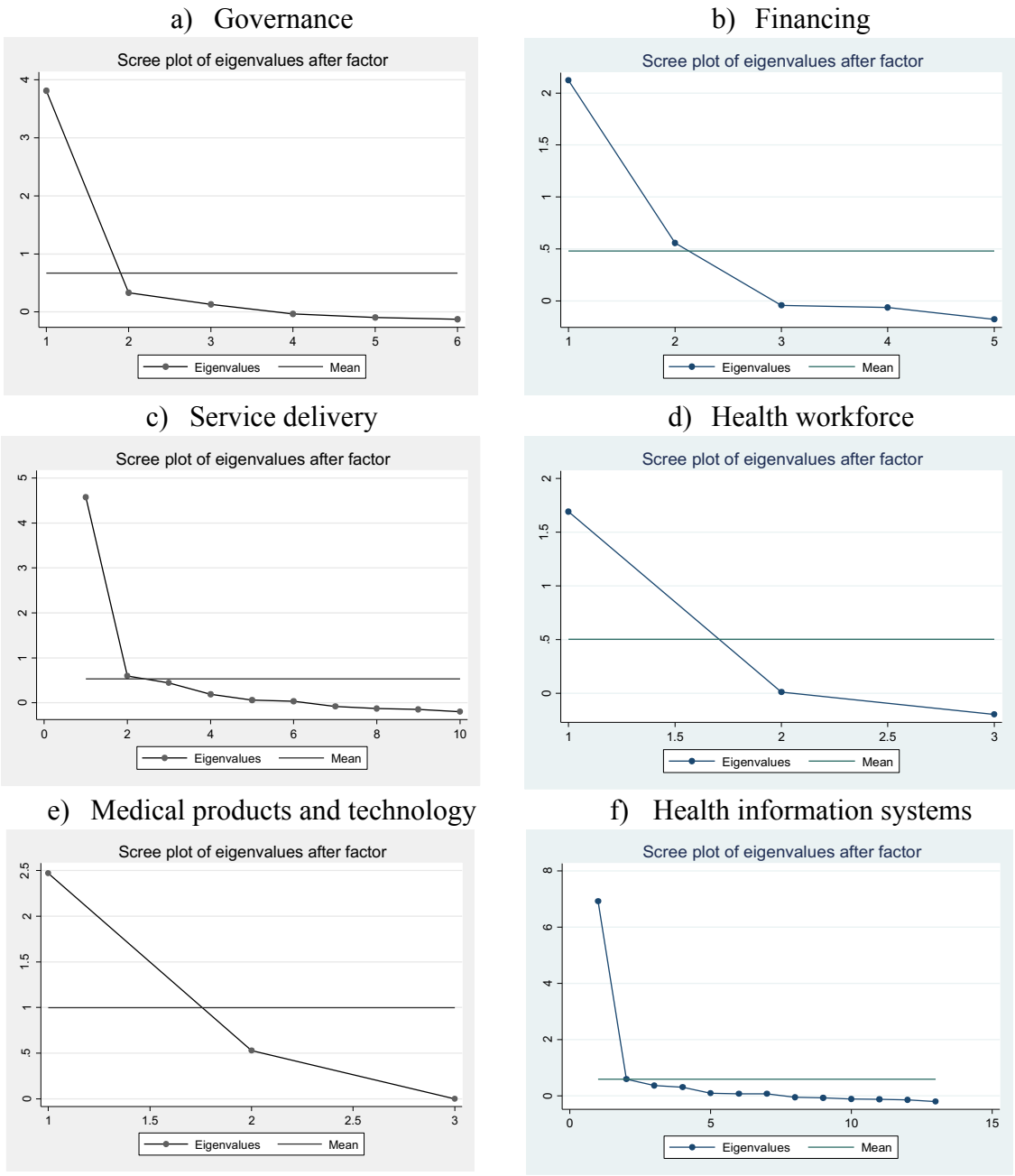

Figure A2. Scree plots of eigenvalues per HS building block calculated using principal components analysis. Panel A plots the eigenvalues after factor for governance indicators, Panel B for health financing indicators. Panel C for service delivery indicators, Panel D for health workforce indicators, Panel E for medical products and technologies, and Panel F for health information systems.

Appendix 3. Supplementary information for Chapter Four and Five

Table A3. Summary statistics for the data used for each building block

Variable		Mean	Std Dev	Min	Max	Observations
Dependent variables						
IMR	overall	67.45	29.41	11.1	152.5	N = 227
	between		28.22	13.85	135.5	n = 83
	within		12.47	34.47	104.72	T = 2.73
CMR	overall	105.61	59.98	11.6	326.2	N = 227
	between		56.21	15.3	282.17	n = 83
	within		22.38	41.14	178.11	T = 2.73
LE	overall	59.01	10.81	19.5	79.56	N = 7113
	between		9.24	37.8	73.98	n = 142
	within		5.86	29.23	80.78	T = 50.09
DTP3	overall	60.45	22.66	2.6	97.9	N = 192
	between		19.45	15.95	96.2	n = 72
	within		13.24	14.55	94.28	T = 2.67
Governance						
control of corruption	overall	-0.5	0.62	-2.06	1.56	N = 1953
	between		0.58	-1.72	1.43	n = 137
	within		0.21	-1.43	0.6	T-bar = 13.66
government effectiveness	overall	-0.51	0.64	-2.45	1.28	N = 1946
	between		0.61	-2.18	1.21	n = 137
	within		0.2	-1.62	0.42	T-bar = 13.61
political stability and absence of violence	overall	-0.41	0.94	-3.32	1.54	N = 1939
	between		0.88	-2.83	1.37	n = 137
	within		0.34	-2.51	1.1	T-bar = 13.56
regulatory quality	overall	-0.49	0.73	-2.68	1.64	N = 1948
	between		0.69	-2.43	1.48	n = 137
	within		0.23	-1.83	0.67	T-bar = 13.62
rule of law	overall	-0.52	0.7	-2.67	1.38	N = 1969
	between		0.68	-2.36	1.25	n = 137
	within		0.19	-1.44	0.94	T-bar = 13.77
voice and accountability	overall	-0.39	0.84	-2.28	1.31	N = 1978
	between		0.81	-2.17	1.19	n = 137
	within		0.21	-1.65	0.41	T-bar = 13.8322
Financing						
external resources for health as % of total expenditure on health	overall	11.72	15.41	0.01	105.05	N = 2150
	between		13.43	0.06	70.97	n = 137
	within		7.6	-27.05	67.88	T = 15.47
OOP as % of private expenditure on health	overall	80.29	20.82	0.55	100	N = 2330
	between		20.37	2.04	100	n = 137
	within		5.42	51.54	105.79	T = 16.64

per capita government expenditure on health, PPPint	overall	159.14	187.05	0.12	1222.41	N = 2340
	between		169.43	2.38	1064.97	n = 137
	within		79.2	-172.12	610.35	T = 16.71
per capita total expenditure on health, PPPint	overall	275.02	281.54	9.23	1605.32	N = 2326
	between		254.48	16	1411.37	n = 137
	within		121.24	-193.73	937.98	T = 16.73
private expenditure on health as % of THE	overall	47.87	20.08	0.02	99.61	N = 2330
	between		19.04	0.14	87.13	n = 137
	within		6.7	7.05	87.84	T = 16.64
private prepaid plans as % of private expenditure on health	overall	9.89	14.2	0.01	86.5	N = 1642
	between		13.09	0.09	73.96	n = 107
	within		4.78	-20.9	55.93	T = 15.35
Service delivery						
pregnant women who attended at least one antenatal care visit	overall	79.74	18.23	24.5	98.7	N = 176
	between		16.36	29.1	98.7	n = 71
	within		7.32	54.97	103.84	T = 2.48
HIV test results received in the last 12 months of female population aged 15 to 49	overall	4	3.78	0.1	40.32	N = 1750
	between		3	0.3	13.51	n = 137
	within		1.58	-6.61	30.81	T = 12.41
improved sanitation facilities	overall	58.02	29.73	2.3	100	N = 2939
	between		29.55	7.15	99.78	n = 137
	within		5.13	24.39	82.48	T = 20.69
Medical products and technologies						
pharmaceutical public spending per capita	overall	10.37	14.71	0.04	117.37	N = 976
	between		12.78	0.06	102.37	n = 105
	within		5.36	-12.05	41.8	T = 9.30
pharmaceutical private spending per capita	overall	19.35	22.24	0.32	157.97	N= 959
	between		24.54	0.84	135.57	n = 102
	within		10.4	-51.98	84.81	T = 9.40
total pharmaceutical expenditure as % of THE	overall	26.49	12.03	5.77	68.01	N = 1142
	between		11.45	8.7	64.92	n = 124
	within		5.3	-5.35	61.9	T = 9.21
total pharmaceutical expenditure at US exchange rate	overall	28.68	31.92	0.84	199.53	N = 1142
	between		29.7	1.33	144.92	n = 124
	within		13.64	-65.07	125.57	T = 9.21
Workforce						
births attended by doctors, % of total births	overall	23.55	26.69	0.3	97	N = 177
	between		26.76	0.4	91.2	n = 75
	within		7.19	-7.13	59.57	T = 2.36
births attended by other health professionals, % of total births	overall	32.85	21.33	2	97.9	N = 179
	between		22.28	3	97.9	n = 75
	within		8.51	-0.43	63.77	T = 2.39

births attended by skilled health staff, % of total births	overall	80.31	25.62	5.6	100	N = 1017
	between		26.73	7.1	100	n = 137
	within		6.45	49.11	111.11	T = 7.21
Control variables						
fertility rate	overall	4.37	1.58	1.2	11.3	N = 228
	between		1.51	1.3	7.1	n = 84
	within		0.57	1.92	8.62	T = 2.71
GDP per capita	overall	1950.17	2011.28	50.04	14678.61	N = 5589
	between		1915.1	156.75	9467.01	n = 139
	within		818.55	-3472.37	8626.41	T-bar = 40.21
GINI Index	overall	43.29	9.98	21.6	74.33	N = 791
	between		9.04	27.66	69.12	n = 121
	within		3.68	26.11	66.37	T = 6.54

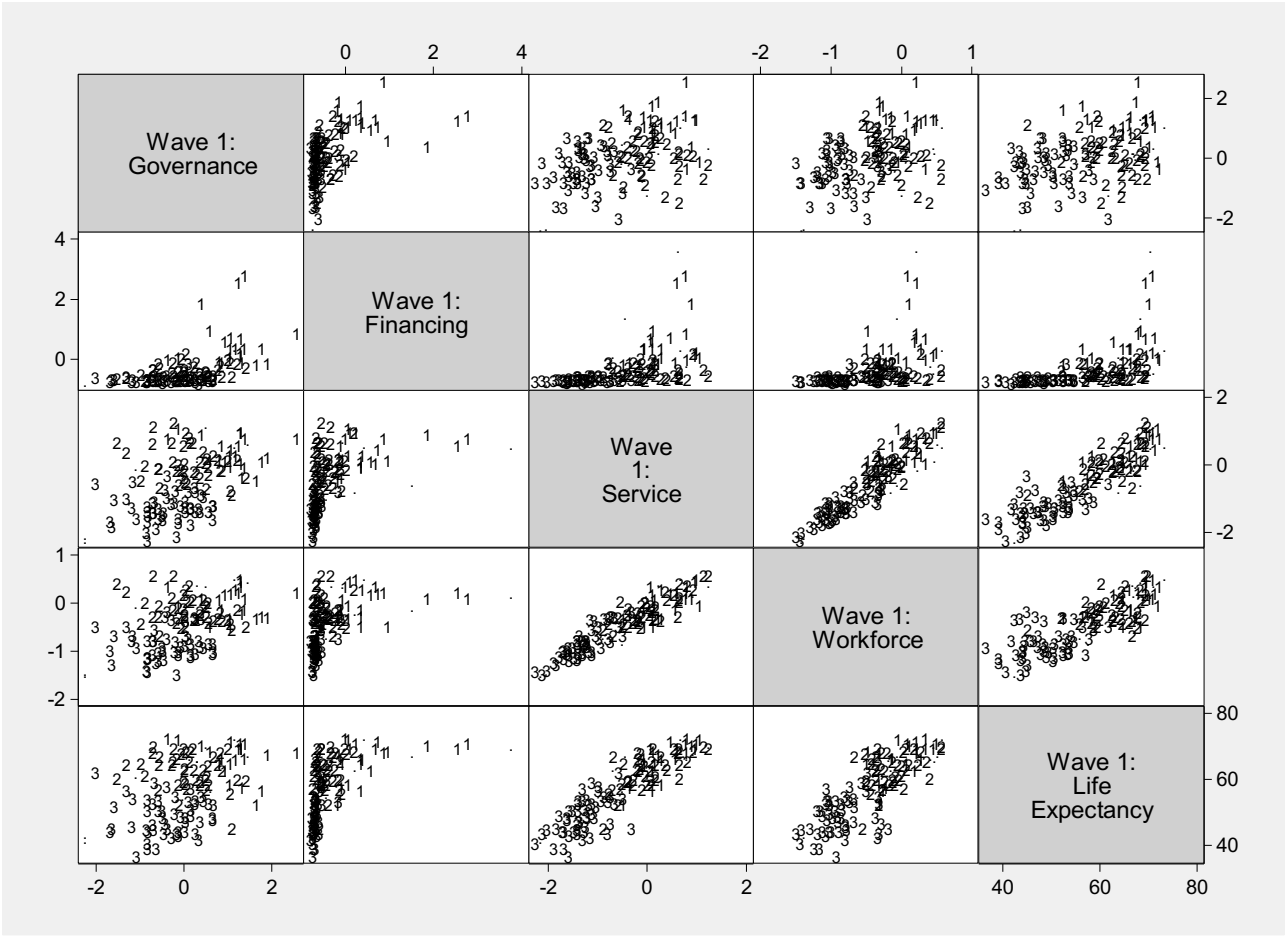

Figure A3.1 Scatterplot matrices for each health system building block and life expectancy at birth for wave one; 3 - low income countries; 2 - lower middle income countries; and 1 - upper middle income countries

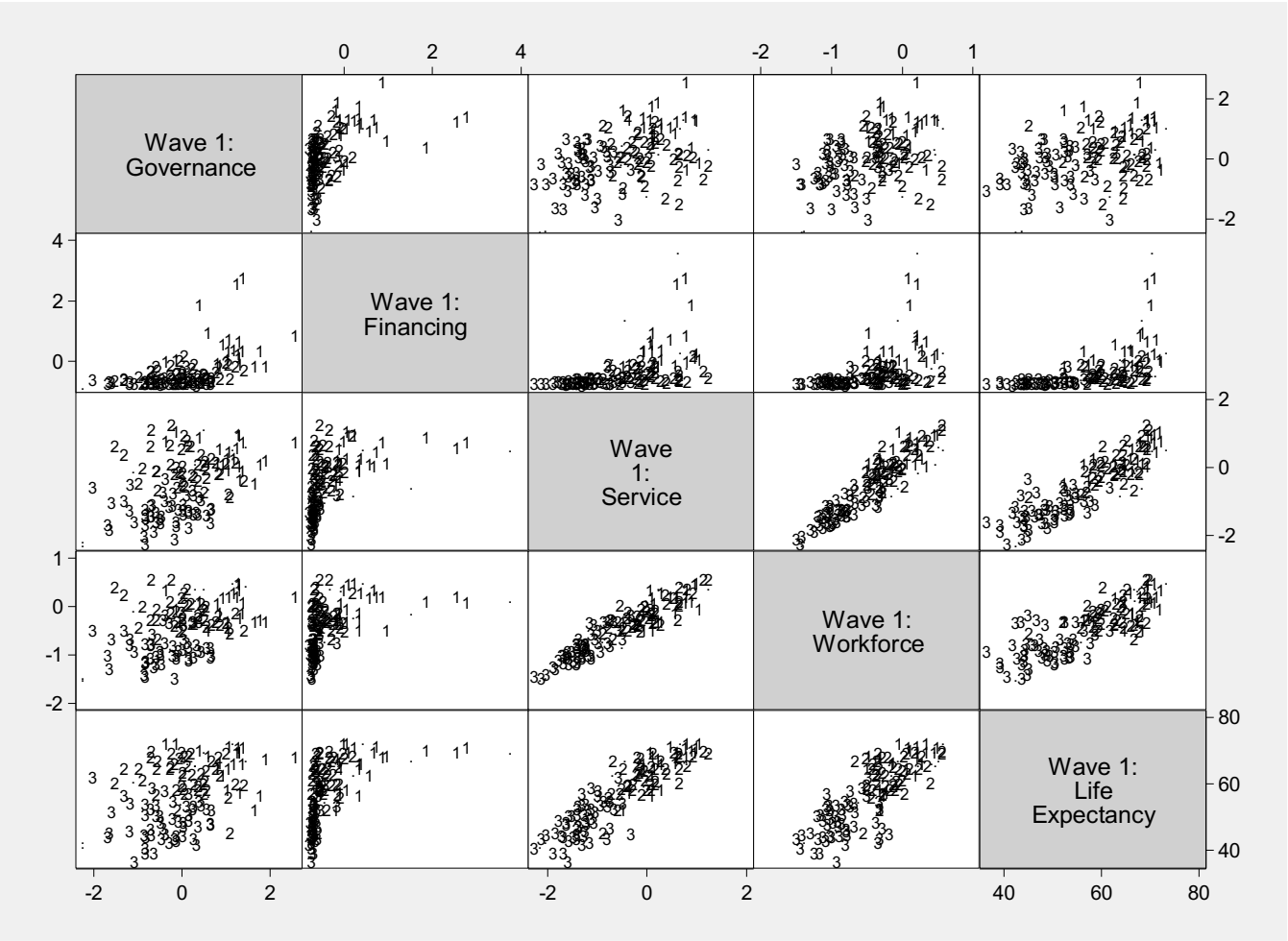

Figure A3.2 Scatterplot matrix for each health system building block and life expectancy at birth for wave two of the data; 3 - low income countries; 2 - lower middle income countries; and 1 - upper middle income countries

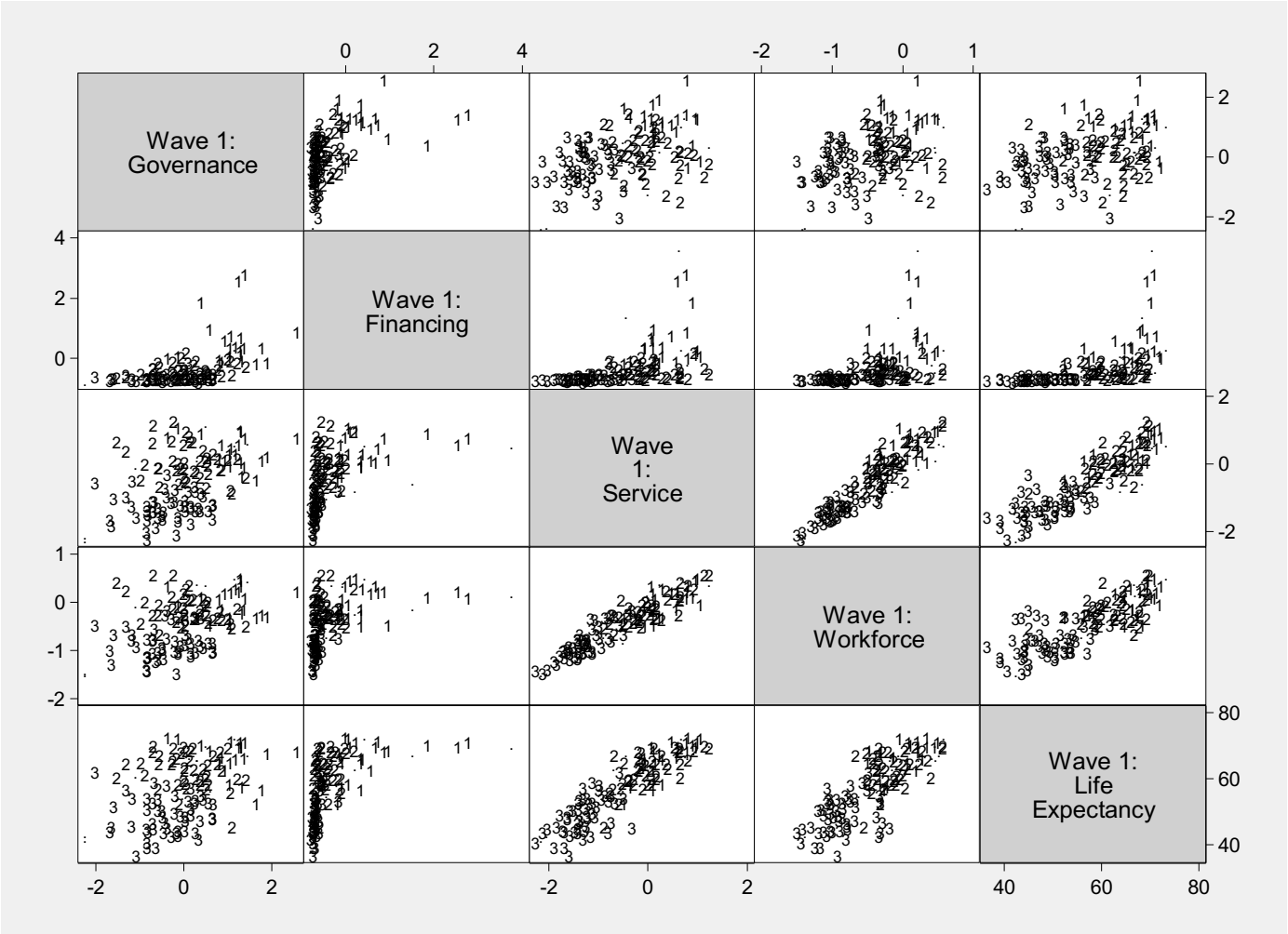

Figure A3.3 Scatterplot matrix for each health system building block and life expectancy at birth for wave three of the data; 3 - low income countries; 2 - lower middle income countries; and 1 - upper middle income countries

Appendix 4. Supplementary information for Chapter Six

Table A4.1 Summary statistics for the regional dataset in the Philippines

Variable		Mean	Std. Dev.	Min	Max	Obs
IMR	overall	32.65	11.07	14.00	61.40	N = 82
	between		6.69	22.56	46.03	n = 17
	within		9.02	7.21	51.57	T-bar = 4.82
Fertility	overall	3.83	0.74	2.30	5.91	N = 82
	between		0.55	2.53	4.76	n = 17
	within		0.51	2.70	5.11	T-bar = 4.82
VB	overall	0.90	0.07	0.78	1.05	N = 75
	between		0.03	0.85	0.95	n = 15
	within		0.06	0.80	1.04	T-bar = 5
ANC	overall	32.85	15.75	11.60	81.30	N = 82
	between		15.20	15.28	73.48	n = 17
	within		5.08	17.57	45.37	T-bar = 4.82
Asst	overall	28.87	14.20	3.40	67.50	N = 82
	between		12.84	8.10	61.68	n = 17
	within		6.79	14.21	53.21	T-bar = 4.82
Place	overall	28.20	14.48	4.00	72.40	N = 82
	between		10.59	6.40	51.90	n = 17
	within		10.29	8.80	56.00	T-bar = 4.82
Cont	overall	98.21	4.28	77.90	100.00	N = 82
	between		3.60	85.55	99.88	n = 17
	within		2.74	84.77	104.86	T-bar = 4.82
Educ	overall	6.22	5.13	0.00	30.40	N = 82
	between		4.34	2.26	21.33	n = 17
	within		3.26	2.51	16.84	T-bar = 4.82

Source: Author's computations using the Philippine NDHS and government financial reports

Table A4.2 Summary statistics for the regional dataset in Cambodia

Variable		Mean	Std. Dev	Min	Max	Observations
infant mortality rates	overall	72.798	31.00	13.00	169.80	N = 96
	between		17.41	27.40	111.45	n = 24
	within		25.84	26.45	134.85	T = 4
total fertility rate	overall	3.581	0.87	2.00	6.30	N = 96
	between		0.58	2.15	4.83	n = 24
	within		0.66	2.06	5.06	T = 4
vertical balance	overall	0.761	0.15	0.36	1.00	N = 144
	between		0.10	0.59	0.97	n = 24
	within		0.12	0.41	1.02	T = 6
antenatal coverage	overall	3.794	8.34	0.00	67.20	N = 96
	between		5.43	0.73	23.88	n = 24
	within		6.41	-13.98	47.12	T = 4
assisted births	overall	6.461	9.74	0.10	73.20	N = 96
	between		7.20	1.95	36.63	n = 24
	within		6.69	-19.66	43.04	T = 4
place of delivery	overall	32.446	26.94	1.90	96.00	N = 96
	between		10.17	18.95	64.70	n = 24
	within		25.01	-9.48	85.67	T = 4
contraceptive	overall	69.432	27.91	21.50	100.00	N = 96
knowledge	between		5.96	54.53	78.48	n = 24
	within		27.29	31.86	112.21	T = 4
educational attainment	overall	28.091	12.07	8.80	75.10	N = 96
	between		9.23	11.60	53.78	n = 24
	within		7.95	8.22	49.69	T = 4

Source: Author's computations using the Cambodian NDHS and government financial reports

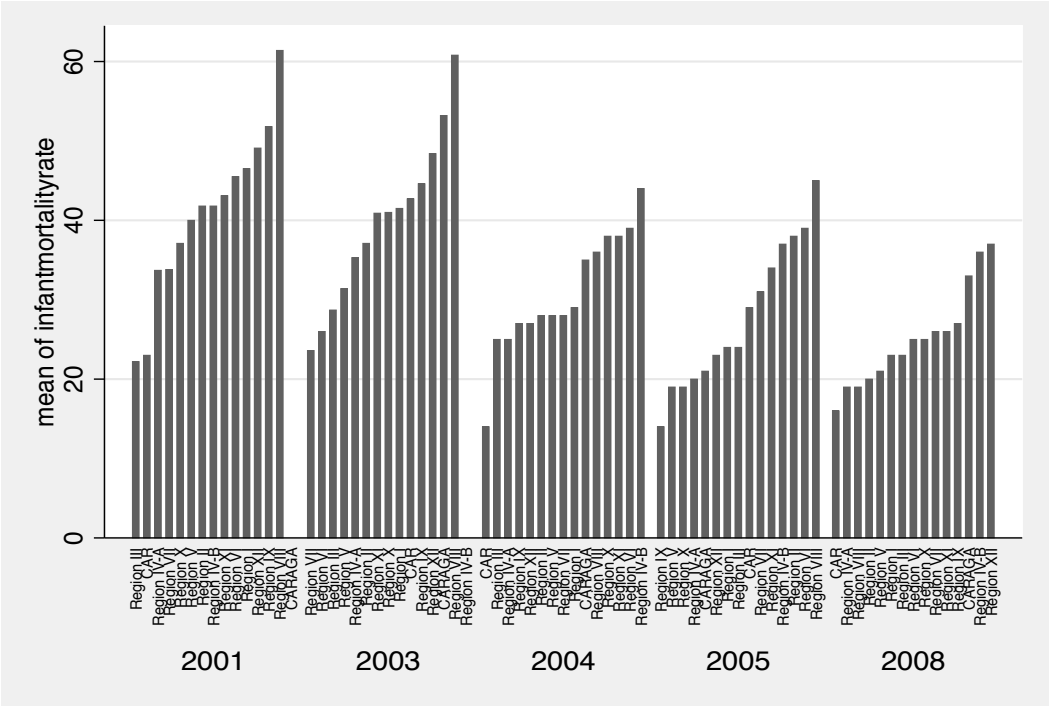

Figure A4.1 Regional infant mortality rates for the Philippines from 2001 to 2008

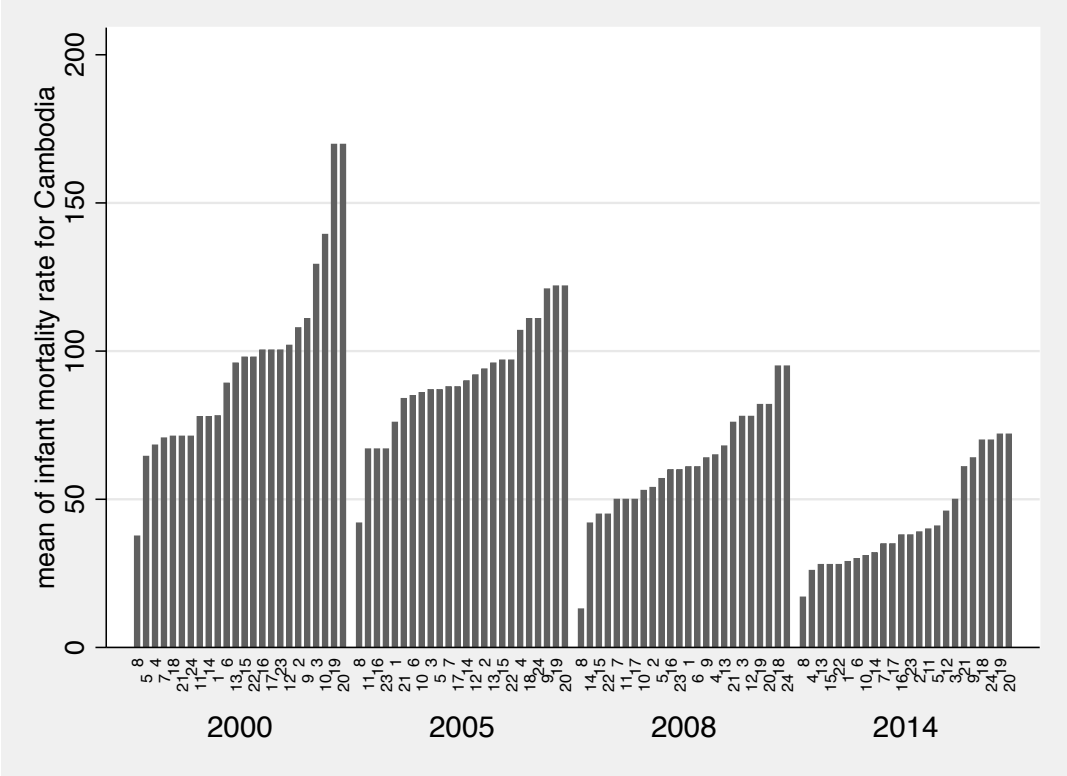

Figure A4.2 Regional infant mortality rates in Cambodia from 2000 to 2014

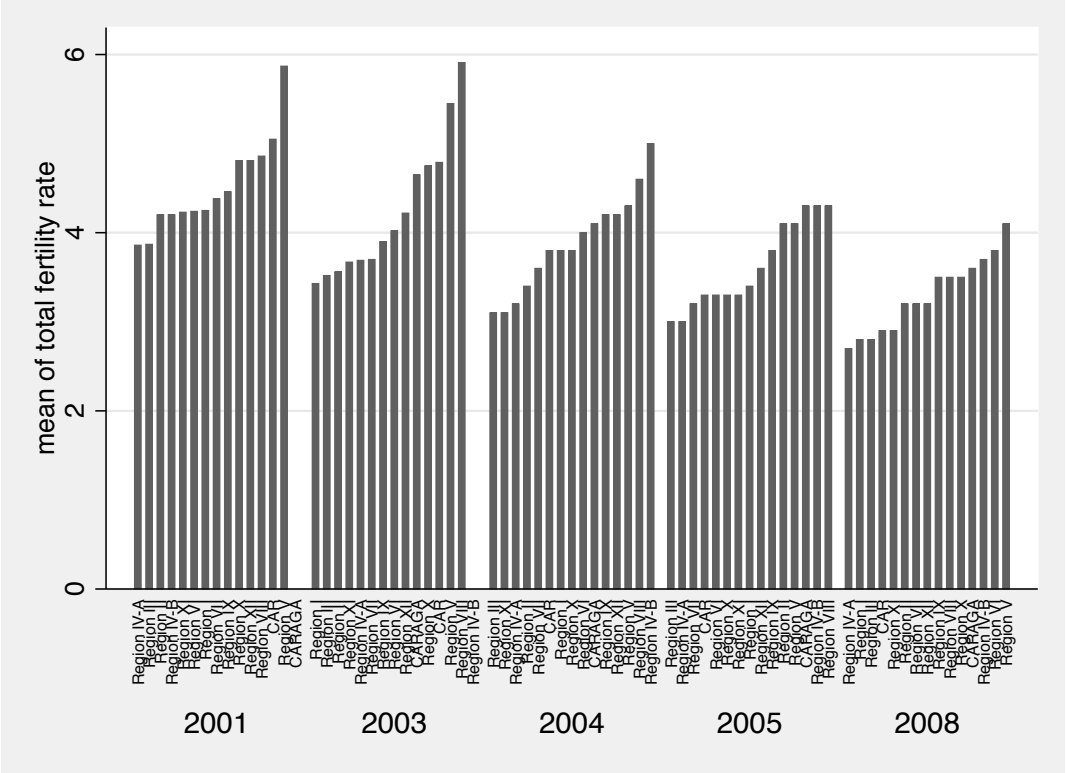

Figure A4.3 Regional total fertility rates in the Philippines from 2001 to 2008

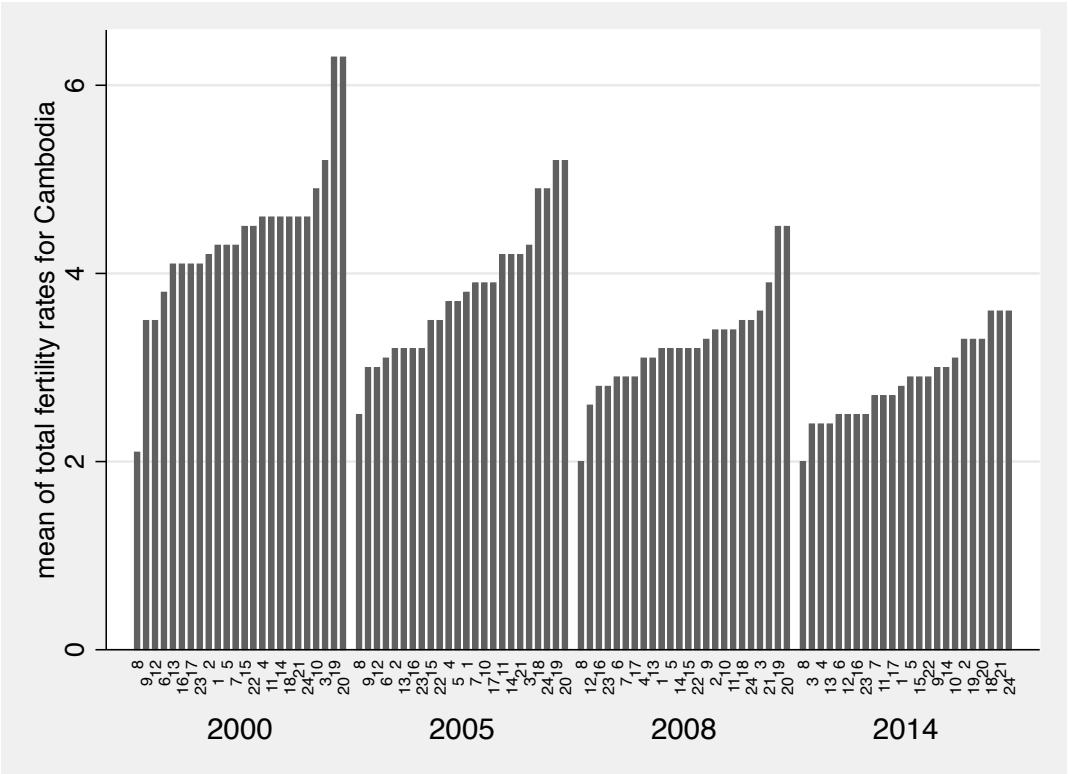

Figure A4.4 Regional total fertility rates in Cambodia from 2000 to 2014

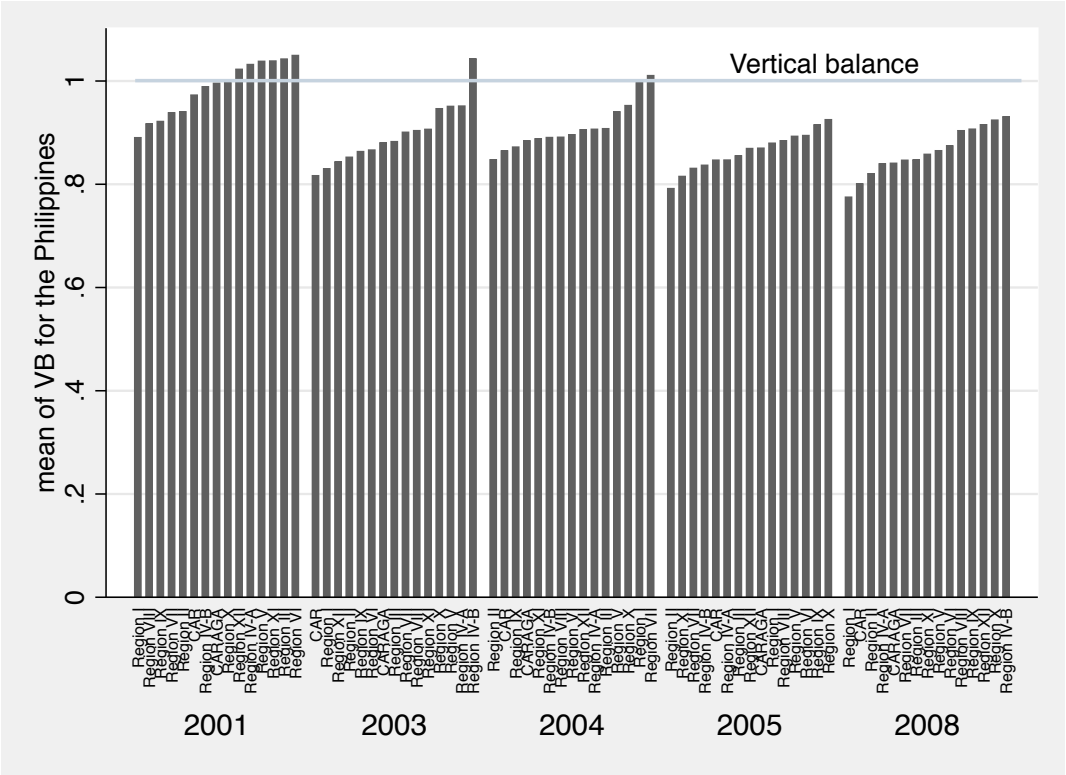

Figure A4.5 Regional vertical balance values in the Philippines from 2001 to 2008

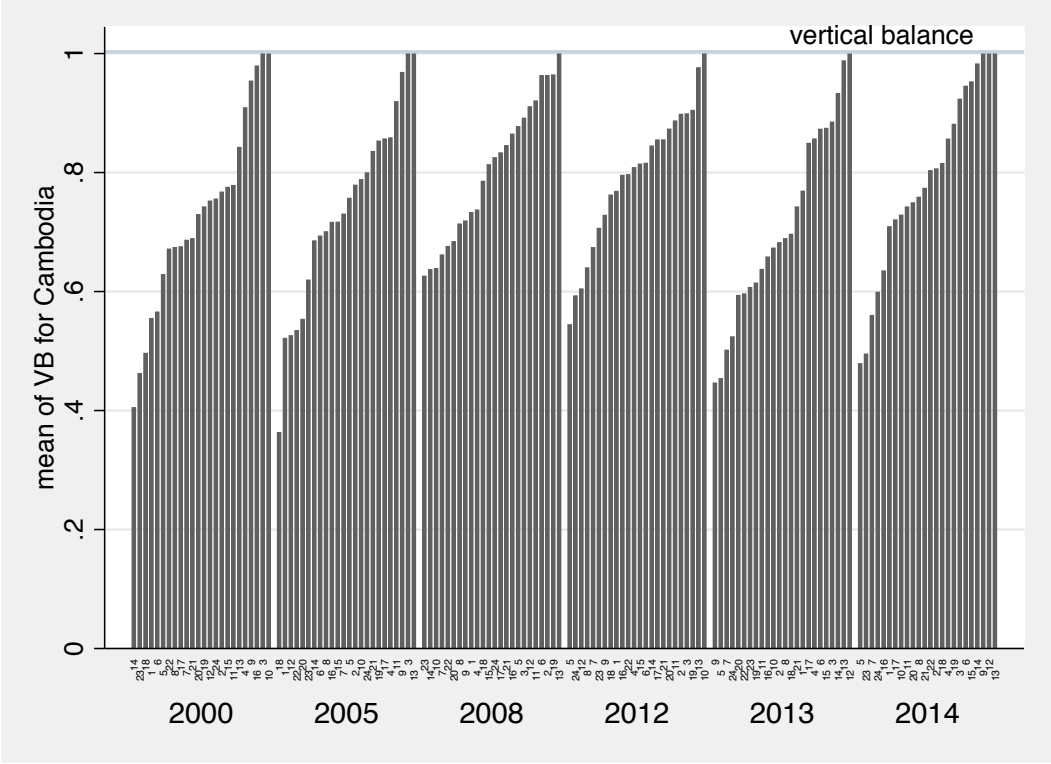

Figure A4.6 Regional vertical balance in Cambodia from 2000 to 2014