INTERNATIONAL DEVELOPMENT IN FOCUS

A Labor Market Assessment of Nurses and Physicians in Saudi Arabia

Projecting Imbalances between Need, Supply, and Demand

Taghred Alghaith, Jenny X. Liu, Mohammed Alluhidan, Christopher H. Herbst, and Nahar Alazemi, Editors

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Foreword

The socioeconomic transformation in the Kingdom of Saudi Arabia (KSA) has put the country at the forefront of scientific and regulatory progress, and this inspiring change serves as the driving force for professionals in all fields to contribute to the new landscape of the country. Health care in Saudi Arabia is rapidly developing; it welcomes new people to the workforce, empowers women, and focuses on knowing—and meeting—the needs of its population. Despite the achievements and advancements to date, there are opportunities for additional improvement; Vision 2030 is an exceptional opportunity to turn thinking and innovation into action and work toward an even stronger and resilient health system.

This report offers a great insight into how the growth of KSA connects with its Vision 2030, and the need to plan for a strong and capable health workforce that meets the needs of our growing—and aging—population. It anticipates the future epidemiological need for nurses and physicians in KSA, and the expected supply and demand discourse of the health labor market to meet such needs, highlighting some of the critical and innovative solutions that can be considered to address anticipated challenges. By scaling up the production of a Saudi health workforce for the future, we can embrace opportunities not only to meet the changing health needs of our population, but also to increase the number of Saudi jobs, including among our youth and our women, and thus to contribute toward overall human capital, social, and economic goals of the country.

This book is for those who view evidence-based planning as an essential tool to make KSA's health care more effective and responsive to the needs of its population. It goes beyond a "what-if" approach and suggests a comprehensive list of strategies that can help maximize change in the heath sector and fuel further innovation and active discussion among our health sector leaders in the country. The cutting-edge economic and epidemiological approaches and analyses are expected to be beneficial to researchers and planners, and to all who are interested in strengthening the availability, distribution, and performance of our health workforce.

Tawfig bin Fawzan AlRabiah
Chairman of the Saudi Health Council
Minister of Health, Kingdom of Saudi Arabia

Foreword

The health workforce in Saudi Arabia is critical and central to the goals outlined in the National Transformation Program and Vision 2030, which include increasing the size and performance of the Saudi workforce to meet the population's changing health and employment needs. The health system in Saudi Arabia, as elsewhere, is dependent on the availability, accessibility, and acceptability of its health workers to provide effective and high-quality health services of the highest attainable standard. In turn, this is dependent on adequate policies to increase their availability and to improve their distribution and performance. The health workforce plays a vital role in building the resilience of health systems and protecting the communities, including to respond to health crises such as the current COVID-19 pandemic that is affecting all segments of society. Shaping and preparing a health workforce for the future also presents an opportunity to increase labor market participation of Saudi nationals—including women and youth, which would unlock economic growth potential—another key goal of Vision 2030. The analyses and guidance in this book are designed to support policy makers in Saudi Arabia and beyond, in working toward such goals, while keeping an eye on the changing future needs and economic realities.

This book, produced under the leadership of the Saudi Health Council, is an output of the close collaboration between the Saudi Health Council and World Bank staff, as well as leading nurses and physicians in Saudi Arabia, who came together to answer critical questions about the health labor market from an economic perspective, and to suggest solutions to help guide workforce planning there. This timely and cutting-edge book will be useful in guiding the strengthening and planning its health workforce. We also expect the methodologies and analyses presented in this book to be of interest to researchers and policy makers who work on health systems strengthening and workforce challenges in other countries in the region and beyond. We are grateful to have had the opportunity to participate in the production of this book, which will be a landmark in the field of human resources for health around the globe.

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The technical development of the report was led jointly by individuals from the Saudi Health Council and the World Bank: Taghred Alghaith and Mohammed Alluhidan from the Saudi Health Council, Christopher H. Herbst from the World Bank, and Jenny X. Liu (consultant).

The chapters were written by World Bank and Saudi Health Council staff, as well as external contributors. Contributing authors (in alphabetical order) from the Saudi Health Council include Adwa Alamri, Taghred Alghaith, Hussah Alghodaier, Mohammed Alluhidan, Ayman Hodhaini, and Rana Saber. External authors, consisting of key physician and nursing stakeholders from Saudi Arabia include Lubna Alansary, Mohammed Alghamdi, Nawfal Aljerian, Sami Alnassar, Khalid Fouda, Ziad Nakshabandi, and Nabiha Tashkandi. Contributing authors from the World Bank include Tim Bruckner, Samantha Gailey, Mariam M. Hamza, Mohamed Hassan, Christopher H. Herbst, Tracy Kuo Lin, Jenny X. Liu, and Kate Tulenko. The report benefited from the peer review comments by Edson Araujo and Maud Juquois, World Bank. Administrative support was provided by Fatima Mansouri, World Bank.

Throughout the development of the report, the Saudi Health Council and the World Bank team benefited from guidance and support from His Excellency Nahar Alazemi (Secretary General of the Saudi Health Council), Issam Abousleiman (country director, Gulf Cooperation Council [GCC] Countries, World Bank), Larisa Marquez (operations officer, World Bank), Rekha Menon (practice manager, Middle East and North Africa, Health, Nutrition, and Population, World Bank), and Sameh El-Saharty (program leader, human development, GCC Countries, World Bank).

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Abbreviations

ACO	accountable care organization
COPD	chronic obstructive pulmonary disease
DALY	disability-adjusted life year
FTE	full-time equivalent
GASTAT	General Authority for Statistics
GBD	Global Burden of Disease
GDP	gross domestic product
GHDx	Global Health Data Exchange
GP	general practitioner
HRH	Human Resources for Health
MOH	Ministry of Health
NTP	National Transformation Program
OB/GYN	obstetrics and gynecology
OECD	Organisation for Economic Co-operation and Development
SCFHS	Saudi Commission for Health Specialties
SHC	Saudi Health Council
SHIS	Saudi Health Interview Survey
UHC	universal health coverage
WHO	World Health Organization

Overview

GENERATING EVIDENCE TO SUPPORT STRATEGIC HEALTH WORKFORCE PLANNING IN SAUDI ARABIA

CHRISTOPHER H. HERBST, TAGHRED ALGHAITH, JENNY X. LIU, AND MOHAMMED ALLUHIDAN

BACKGROUND

Saudi Arabia is undergoing a sweeping transformation of its health sector through a multidimensional, multilevel, and multiphased approach. Vision 2030 envisions changing the overall orientation of the Ministry of Health (MOH) and the wider health system from one that treats patients and is centered on tertiary care to one that is more integrated and patient-centered, and that prioritizes prevention and primary care. In practice, this means restructuring the health system to one that centers around accountable care organizations, which are integrated groups of providers (from primary care to tertiary care facilities) designed to bring about more efficiency and quality. The ambition for rapid reform and transformation, ever-growing technology advances, and greater emphasis on doing more with fewer resources are just some of the factors leading to increased pressure on the health sector to ensure that the required workforce is in place to effectively respond to changing contexts and business priorities.

The health workforce in Saudi Arabia is central to the reform and the changing business priorities in the health sector and beyond. Vision 2030 aims to increase the size and performance of the workforce to meet the population's changing needs and health goals (MOH, n.d.). A particular focus of Vision 2030 is the Saudization of the health workforce, or reducing the dependency on expatriate workers by scaling up the number of Saudi nationals. The health workforce represents a significant share of the overall workforce in Saudi Arabia, and in addition to its contribution to meeting health sector goals, shaping the health workforce also represents an opportunity to increase labor market participation of Saudi nationals, and in particular women—another key goal under Vision 2030. In addition, Vision 2030 envisions expanding the private sector in health,

shifting the focus from hospital care toward primary and preventive care, and generating greater quality, efficiencies, and value for money from existing resources. All of these goals have direct implications for the workforce and will need review and policy interventions to ensure that they can be met.

The nursing and physician professions in particular are in need of reform. Despite overall adequate numbers of health workers in Saudi Arabia, important imbalances in its composition and distribution undermine its effectiveness and efficiency in delivering health services. As shown in subsequent chapters, only one-third of all physicians and nurses are Saudi nationals. Among the Saudi health workforce, physicians and nurses are predominantly employed in hospital settings rather than primary care facilities, and mostly practice within the MOH. And many of the nurses in Saudi Arabia are lesser skilled "diploma nurse" technicians (80 percent of the Saudi nursing cadre) rather than bachelor nurses who have been trained over four years; this dependency is especially acute in rural areas where higher-skilled workers are scarce. All of this is made worse by perceived low levels of productivity and subpar performance of Saudi physicians and nurses, in particular in comparison with their expat counterparts. These imbalances reveal vulnerabilities in the Saudi health workforce and highlight areas where increased strengthening is needed to achieve national transformation objectives.

The government of Saudi Arabia has already made some progress in its planning to improve the overall numbers, distribution, and performance of nurses and physicians. Efforts are underway to develop interventions to increase enrollment in public and private nursing and medical schools, support private investment in schools, create partnerships with international colleges, and step up financial support for clinical and postgraduate education. Other efforts include supporting more residency placements at private hospitals, establishing day care facilities in hospitals, implementing part-time and flexible work arrangements, and establishing new bonus and payment schemes for specialty cadres. All of these initiatives are on the table with planners, but they are not underscored by any thorough and rigorous analysis that would lead to a better understanding of actual needs and the supply of and demand for nurses and physicians over the next decade.

SUPPORTING STRATEGIC PLANNING FOR HUMAN RESOURCES FOR HEALTH

Strategic planning for the health workforce of the future is key if health and labor market goals are to be achieved in Saudi Arabia. *Strategic workforce planning* is the process of analyzing, forecasting, and planning workforce needs, supply, and demand; assessing gaps; and identifying targeted interventions to fulfill the mandate and strategic objectives of the health sector. When properly implemented, health workforce planning can help meet changing needs, budgets, and requirements (figure O.1), and ultimately can help ensure that goals are fulfilled and that the health workforce comprises the right people with the right skills in the right places at the right time.

The objective of this report is to generate new rigorous, empirical, and quantitative evidence to support national-level strategic planning efforts for human resources for health in Saudi Arabia. The report, a collaborative effort between the Saudi Health Council and the World Bank, is the first to anticipate

FIGURE O.1

Common challenges that health workforce planning can help resolve

Change in mandate	Realignment needs	Workforce needs	Financing constraints
			
A change in the mandate of the health system means a change in the scope or needs of its work. Strategic planning can help proactively reshape the future workforce skills profile to meet new needs.	The workforce skills and needs in Saudi Arabia will shift over time. By using workforce planning, Saudi Arabia will know where it has existing skill sets and can streamline position transitions with relative ease.	By strategically planning its workforce, Saudi Arabia can identify future expected shortages and identify the number and type of health workers and skills required to meet future, country-specific needs.	By strategically planning its workforce, Saudi Arabia can ensure that it has access to the skills needed across the health system in a context of increasing pressure on public financing.

Source: Original figure for this publication.

and quantify projected future labor market imbalances of physicians and nurses in Saudi Arabia and to identify solutions to close those gaps. The report focuses on Saudi physicians and nurses, and its methods draw on the latest principles and modeling techniques in epidemiology and economics to quantify future supply of, demand for, and need for the physician and nursing workforce in Saudi Arabia in 2030. To date, no other report in Saudi Arabia has simultaneously assessed and projected the future need, supply, and demand of a health labor market.

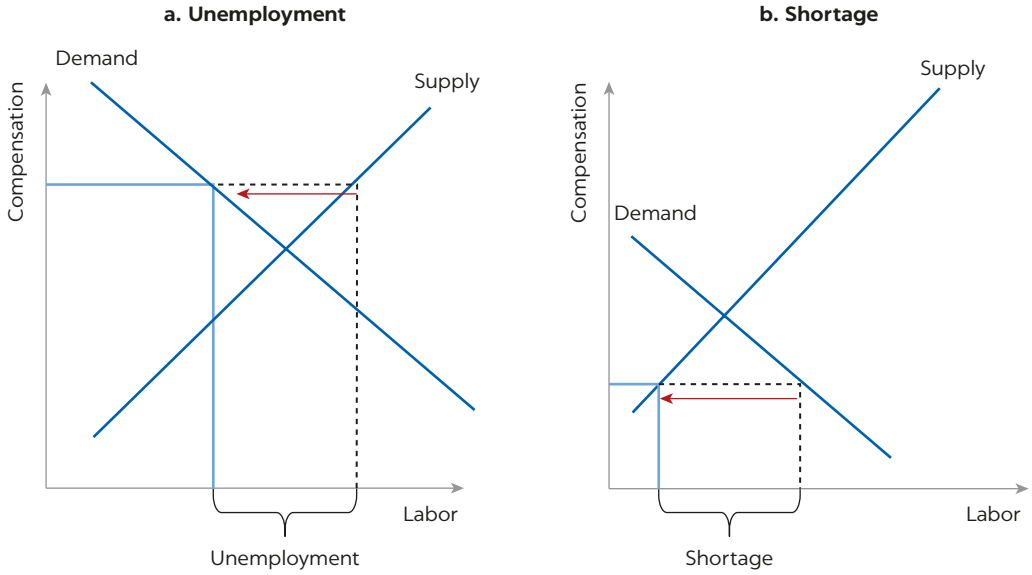
DRAWING ON PRINCIPLES OF HEALTH LABOR MARKET ECONOMICS

Identifying and addressing potential imbalances between health labor market demand for and supply of health workers is critical to mitigate labor market inefficiencies. Quantifying future demand for health workers (the number of jobs that Saudi Arabia's private and public sectors can create with the budget and funds it has) and the supply of workers (the number of trained health workers who can potentially be recruited and are willing to work) is critical to identifying and planning for interventions to address such imbalances.

A key determinant of labor market demand is the overall financing and fiscal space that exists to recruit and absorb health workers. And labor market supply is largely determined by the extent to which a labor market position is attractive, driven by both monetary and nonmonetary explanations.

Inefficiencies in the health labor market are likely unless prevented early on. A labor market in which supply (workers willing to work in a job) exceeds demand (funding and jobs available) can result in a so-called unemployment situation—more workers are in the market than can be absorbed (figure O.2, panel a). And a situation in which supply is lower than demand can result in a shortage—more funded jobs exist than there are workers willing to fill them (figure O.2,

FIGURE O.2
Results of labor markets in disequilibrium



Source: Adapted from Andalon and Fields (2011).

panel b). Identifying and quantifying such imbalances for 2030 can help planners prepare and plan in advance to minimize such inefficiencies and move the market toward equilibrium.

A critical immediate priority of the government is to help plan for the labor market to ensure that supply and demand move more toward equilibrium, but the ultimate goal for planners is to shift the supply of and demand for labor to meet needs. Although the market can be moved in the direction of equilibrium through different education and health labor market interventions (such as adjusting different forms of monetary and nonmonetary compensation), and inefficiency and waste of resources can thus be minimized, the number of health workers corresponding to a labor market in equilibrium might not meet the service delivery and epidemiological needs of the health system. The *need* for health workers is not dependent on compensation or the available pool of workers. Rather, it is a fixed number determined mainly by how health services can be delivered to respond to the burden of disease in the population (figure O.3). Modeling and quantifying Saudi context-specific epidemiological needs for the physician and nursing workforce and quantifying the future gap between need and demand and supply can help planners identify and implement interventions early to help shift labor market supply and demand toward future need.

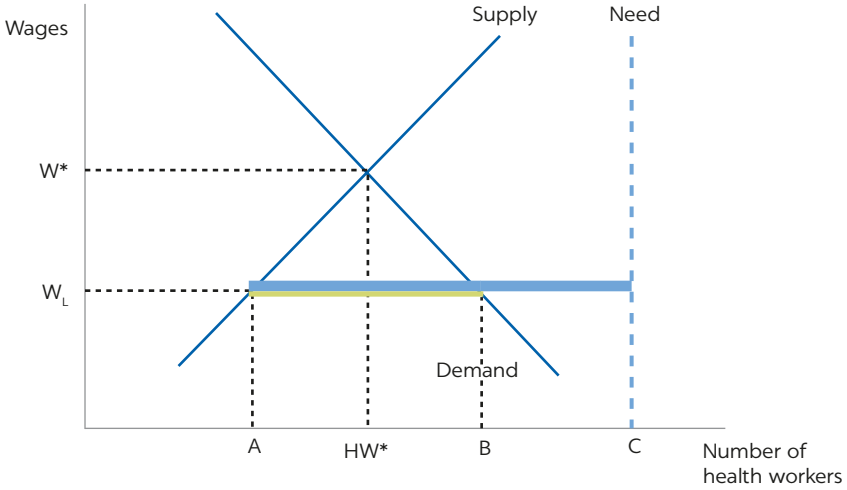
ORGANIZATION OF THE REPORT

The report is organized into eight chapters, drawing on rigorous methodologies to generate quantitative evidence and culminating in a chapter on policy recommendations for planners and policy makers in Saudi Arabia.

Chapter 1, "The Stock, Distribution, and Performance of Physicians and Nurses (Saudi Nationals) in Saudi Arabia," provides a brief overview of

FIGURE O.3

Health worker need relative to market demand and supply



Source: Adapted from Bruckner, Liu, and Scheffler (2016).
Note: HW = health worker; W = wages. In this particular market situation, compensation levels are relatively low (W_L) and the number of workers demanded (B) exceeds the number supplied (A), yielding a demand-based shortage (B–C). Only (A) number of workers can be hired, which is less than the number of workers (HW*) that would be hired if wage compensation levels were optimal (W*). In addition, the level of health workers needed (C) exceeds the number supplied (A), yielding a need-based shortage. The existence of both types of shortages indicates that there is a lack of financial resources to increase compensation to a point that would attract more workers. Furthermore, even if compensation were set at the market optimum (W*), there would still not be enough workers employed to meet what is needed.

Saudi Arabia's current human resources for health situation pertaining to physicians and nurses. The chapter serves as the foundation for understanding the degree to which projected future trends in the supply of, demand for, and need for health workers may deviate from the current situation. The chapter finds that despite overall adequate numbers of physicians and nurses in Saudi Arabia, imbalances exist in their composition and distribution, which undermines the effectiveness and efficiency of the delivery of health services. The Saudi Arabia health system relies heavily on foreign workers; among the Saudi health workforce, physicians and nurses are predominantly employed in hospital settings (rather than primary care); and the health system relies heavily on relatively inexperienced and lesser trained "diploma nurse" technicians. These imbalances reveal vulnerabilities in the Saudi health workforce and highlight areas that need to be strengthened to achieve national transformation objectives.

Chapter 2, "Methods for Projecting the Supply of, Need for, and Demand for Health Workers," provides a general overview of the methods for projecting (1) health labor supply, (2) health labor need, and (3) health labor market demand, including the methods used in this report. A critical element of workforce planning is ensuring that supply can meet future epidemiological needs, and that there is sufficient fiscal capacity (that is, labor market demand) to absorb the health workforce needed to meet future supply and needs. This is particularly important in a context such as that of Saudi Arabia, which is home to a growing and aging population and is facing competition for resources. The chapter places the specific methods used in this report within the wider array of methods that exist globally.

Chapter 3, "A Need-Based Approach to Projecting Physicians and Nurses Required in Saudi Arabia," models and describes future workforce needs. Planning for the health workforce of the future requires producing the type and number of workers who are required to deliver priority health services under national public health goals (that is, need-based demand). The chapter applies an epidemiological need-based approach to estimate and project, to 2030, the number of physicians and nurses needed to treat the current and anticipated burden of disease in Saudi Arabia. The chapter finds that the actual need for full-time equivalent physicians and nurses in 2030 could be anywhere between 60,000 and 112,000, depending on the assumptions made. This requirement translates into densities from 1.64 to 3.58 per 1,000 population in 2030. Overall, Saudi Arabia appears to have no shortage of health workers to address epidemiological need when both Saudi and non-Saudi nationals are considered. There may be a need-based shortage, however, if only Saudi nationals are counted, and particularly when diploma nurses, who do not have a college degree in nursing, are excluded. This circumstance is detrimental to Saudization efforts.

Chapter 4, "Projecting the Supply of Physicians and Nurses in Saudi Arabia," projects the future supply of physicians and nurses in Saudi Arabia to 2030 under an assumption of no additional interventions. The chapter finds that Saudi Arabia's health sector is projected to have enough Saudi health workers to meet the need-based demand (estimated in chapter 3) through 2030, assuming no policy interventions. The vast majority of the increased number of Saudi health workers through 2030 are projected to be employed in the MOH sector. In the MOH, Saudi nurses will continue to outnumber foreign nurses; in the private health sector, the overall employment of Saudi nurses will likely remain low. Without policy interventions, trends in the supply of Saudi health workers suggest there will be a shortage in primary care settings in 2030. The number of Saudi female physicians is expected to grow, but their proportion relative to their male counterparts is projected to decrease without policy intervention.

Chapter 5, "Projecting the Labor Market Demand for Physicians and Nurses in Saudi Arabia," projects future labor market demand from both the public and the private sector in Saudi Arabia to identify the fiscal space that is anticipated to be available in 2030 to absorb the physician and nursing workforce. The chapter finds that overall labor market demand for physicians and nurses (including those with diplomas, bachelor's degrees, and advanced degrees—referred to as *diploma, bachelor,* and *advanced nurses*) in the health worker labor market will increase steadily from 2020 to 2030 if trends in government spending continue as projected. When removing diploma nurses from the nursing cadre, given that they do not perform nursing tasks according to international job classification standards, the number of total nurses the labor market can afford may be lower than estimated. Overall, the chapter finds that in 2020, the public sector was estimated to demand 5.93 physicians and nurses per 1,000 persons. By 2030, the public sector is estimated to increase demand to 6.02 physicians and nurses per 1,000 persons.

Chapter 6, "The Projected Gaps between Need and Health Labor Market Supply and Demand," reflects on the findings of the previous chapters and assesses and quantifies the gaps between future need, demand, and supply. The chapter finds that nationally, by 2030, there will be a sufficient number of Saudi physicians to meet the country's need-based demand, but there will be a need-based shortage of Saudi nurses, assuming no policy change. There will also be a critical gap in the number of Saudi bachelor or advanced nurses through 2030; there are both

insufficient numbers of patient care nurses to meet population health care needs (need-based shortage) and an inability to find enough of these nurses to employ despite available finances (labor market demand–based shortage). Shortages of both Saudi physicians and nurses in the labor market, given anticipated demand, are estimated to persist, assuming no policy change. Finally, the demand-based shortage in the public sector will be substantial—estimated to be more than four health workers per 1,000 persons in 2030, or 167,933 physicians and nurses.

Chapter 7, "The Effect of Simulated Policy Scenarios on Saudi Physician and Nursing Workforce Gaps in 2030," projects the health workforce of the future with policy adjustments. Simulation results suggest that labor market demand–based shortages of physicians and nurses will continue even after considering different policies to increase supply, such as increasing work hours, increasing Saudization of the workforce, delaying retirement, and providing continuing education for diploma nurses. The chapter also finds that encouraging continuing education to train diploma nurses (for example, through bridge programs) to perform more advanced patient care tasks may reduce the need-based shortage for bachelor and advanced nurses. The chapter argues that to reduce both the overall and public sector–specific labor market demand shortage of bachelor and advanced nurses, bridge programs will need to be implemented in conjunction with other policies to augment their supply in accordance with demand. Overall, most policy scenarios show that, through 2030, there will be a need-based *surplus* of Saudi physicians, but a need-based *shortage* of Saudi bachelor or advanced nurses, suggesting that task-sharing may not be the most appropriate or effective policy intervention for reducing workforce gaps.

Finally, chapter 8, "Priority Interventions to Address Labor Market Supply and Demand Challenges in Saudi Arabia," reflects on some of the key priority interventions for consideration to address potential shortcomings on both the supply side and the labor market demand and financing side. The chapter focuses on interventions for physicians and nurses, and on Saudi nationals only. In line with the findings in the previous chapters, a key policy priority is to increase the number of bachelor and advanced nurses, ensure greater gender balance, and steer a greater proportion of supply toward primary care, rural areas, and the private sector. On the demand side, generating greater efficiencies from existing resources and considering shifting a larger proportion of financing to the general population and the private sector are critical. Concomitant interventions are needed to ensure that poorer segments of the population are protected, which is where the majority of public resources should probably be directed.

CORE FINDINGS AND THEIR IMPLICATIONS

This report reveals the need for planners to focus on a number of priority interventions, particularly if key goals under Vision 2030 are to be achieved. Such goals include reducing the dependence on expatriate workers and increasing the Saudization of the physician and nursing workforce, as well as increasing the focus on primary care and prevention, female labor market participation, growth of the private sector, and achievement of overall greater efficiency in the use of resources and quality of service delivery in the health sector.

The report points to the need to focus on scaling up the number of Saudi bachelor and advanced nurses if dependency on expatriates is to be reduced and needs are to be met. When looking only at Saudi physicians and nurses

(all Saudi nurses, including diploma, bachelor, and advanced nurses) and assuming no policy intervention, the health sector is projected to have enough Saudi health workers to meet epidemiological needs in 2030. When counting only Saudi bachelor and advanced nurses, however (that is, leaving out diploma nurses, who have recently been reclassified as technicians), there will be a projected shortage of nurses relative to needs in 2030. Partly because of the low number of Saudi bachelor and advanced nurses, there will be more funded jobs (labor market demand) than available workers to fill them, resulting in a projected labor market shortage. Education and labor market policies are needed to scale up the number of Saudi bachelor and advanced nurses, including scaling up preservice education capacity and financing bridging programs for diploma nurses, that is, additional in-service training to help diploma nurses become bachelor nurses. In addition, there is a need to review and work toward generating greater efficiency of existing financing and expenditures on human resources for health, including reallocating resources to bridging and training programs and task-sharing between cadres.

The report also points to the need to prioritize policies to increase employment in the private sector, in primary care settings, and for women. The projections show that, without policy intervention, the vast number of Saudi health workers will be employed in the MOH sector at the hospital level, and that the majority of physicians will be male. Policy intervention will be crucial to ensuring that the health system meets the objectives of reorienting to center around primary care and preventive care. Similarly, policy changes will be required to ensure that the supply of female physicians meets patient demand. Such interventions have already commenced in Saudi Arabia. They will need to be continued and expanded to meet the needs of changing mandates and priorities and to ensure the Saudi health system is more patient-centered, efficient, and responsive.

CONCLUSION

This report is relevant to planners and policy makers in Saudi Arabia. The report generates important new evidence that can be used for strategic planning of the physician and nursing workforce. Concerted interventions in the education and health labor market will be critical if the goals outlined under Vision 2030 are to be met—including reducing dependency on expatriates; meeting changing health care needs; increasing employment opportunities in the labor market, in particular for women; shifting the health system away from hospital care to primary and preventive care; and generating greater efficiency and quality with existing resources.

The report is also relevant to planners and policy makers outside Saudi Arabia. The report represents the first time that epidemiological needs and labor market demand and supply have been projected simultaneously to identify future imbalances. The findings from and use of such a labor market approach are thus also of interest beyond policy makers and planners in Saudi Arabia. They reveal more broadly the usefulness of such methods to help planners ensure that needs and goals are met and that financial resources are used as efficiently as possible. In addition to their use in Saudi Arabia, the findings can help guide similar efforts elsewhere to generate new and country-specific evidence about workforce

needs, supply, and demand to support planning efforts for the health workforce.

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1 The Stock, Distribution, and Performance of Nurses and Physicians (Saudi Nationals) in Saudi Arabia

MARIAM M. HAMZA, MOHAMMED ALLUHIDAN, HUSSAH ALGHODAIER, ZIAD NAKSHABANDI, NABIHA TASHKANDI, MOHAMED HASSAN, AND JENNY X. LIU

KEY MESSAGES

- Despite overall adequate numbers of health workers in Saudi Arabia according to the World Health Organization (WHO) global benchmark for meeting universal health coverage (UHC), important imbalances exist in the workforce composition and distribution that undermine its effectiveness and efficiency in delivering health services.
- The Saudi health system relies heavily on foreign workers; only one-third of all physicians and nurses are Saudi nationals, the total numbers for which fall short of the international UHC benchmark.
- Among the Saudi health workforce, physicians and nurses are predominantly employed in hospital settings rather than primary care facilities and mostly practice within the Ministry of Health (MOH).
- The health system also relies heavily on relatively inexperienced and lesser trained "diploma nurse" technicians (80 percent of the Saudi nursing cadre); this dependency is especially acute in rural areas where higher-skilled workers are scarce.
- The imbalances reveal vulnerabilities in the Saudi health workforce and highlight areas in which increased strengthening is needed to achieve national transformation objectives.

BACKGROUND

This chapter provides a brief overview of the current stock, distribution, and performance of physicians and nurses in Saudi Arabia. It serves as a foundation for understanding the degree to which projected future trends in the supply of, demand for, and need for health workers may deviate from the current situation. As such, the chapter's main focus is on the subset of physicians and nurses who are Saudi nationals, also referred to as *Saudi physicians* and *Saudi nurses*. Given the strategic efforts of Vision 2030, the Saudi health workforce must scale up to meet demand and need, as further discussed in subsequent chapters. In addition, the main focus of the analysis is on Saudi bachelor and advanced nurses, that is, those who have received four or more years of training, in contrast to Saudi diploma nurses, who, with their two-year training programs, are being increasingly classified as *nursing and health assistants* or *technicians* within the Saudi health system.

Where possible, several data sources are used to ensure robustness and comprehensiveness of resulting inferences. Data sources used include (1) the Saudi Health Council (SHC) 2017–2018 Balanced Distribution Data Set, (2) the 2018 MOH *Statistical Yearbook*, (3) the 2019 SHC Human Resources for Health Data Portal, and (4) the 2019 Saudi Commission for Health Specialties (SCFHS) *Registered Practitioners Report*. Because of differences in the years of the data collected, there is some discrepancy across the different data sources. Nonetheless, multiple sources were examined to triangulate and identify the best (most complete and accurate) information on current health worker stocks.[1]

The remainder of this chapter is organized as follows: The next section focuses on the current stock of health workers in total and across different characteristics: cadre (physicians and nurses), nationality (Saudi or non-Saudi), type of training (specialty among physicians, professional degrees among nurses), facility type (primary care or hospital), and gender. The following section discusses the distribution of Saudi physicians and nurses across urban and rural areas and by sector (MOH and non-MOH). The next section investigates the relative productivity of Saudi health workers in the hospital sector, and the final section concludes.

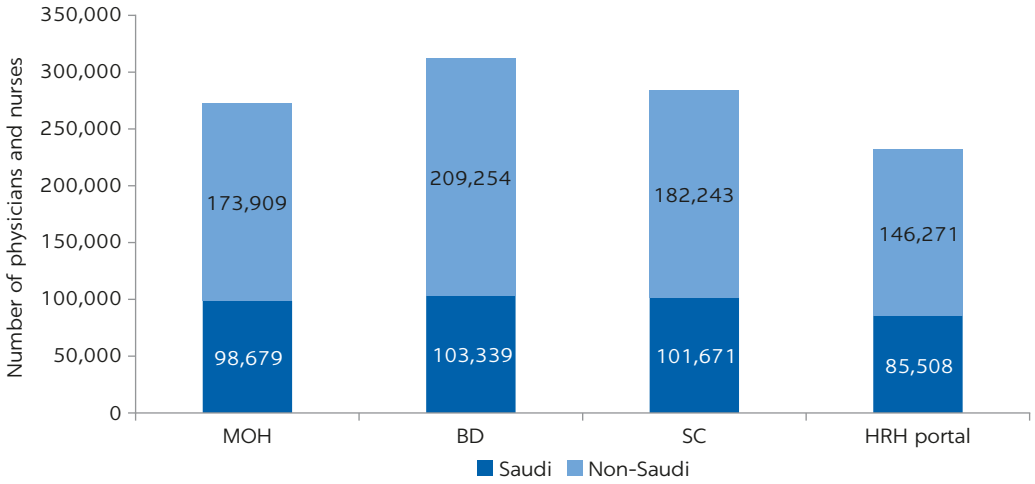
STOCK

According to the most recent data available across different data sources, there are about 300,000 health workers (physicians and nurses) in Saudi Arabia, roughly two-thirds of whom are foreign nationals. Saudi nationals currently comprise about one-third of the country's health workforce (physicians and nurses). All four data sources show similar distributions of Saudi and non-Saudi health workers in recent years. Although there are about 100,000 Saudi physicians and nurses, their non-Saudi counterparts range from about 146,000 to 210,000, depending on the data source (figure 1.1).

Although the total physician and nursing densities (that is, health workers per 1,000 population) exceed the UHC benchmark, this is not the case when considering only Saudi nationals. When standardized by population size, the density of health workers is about 7–9 physicians and nurses per 1,000 population, depending on the database used (figure 1.2). In any case, the density from all databases exceeds the WHO global UHC benchmark of 4.5 physicians and nurses per 1,000 population needed to meet the United Nations' Sustainable Development

FIGURE 1.1

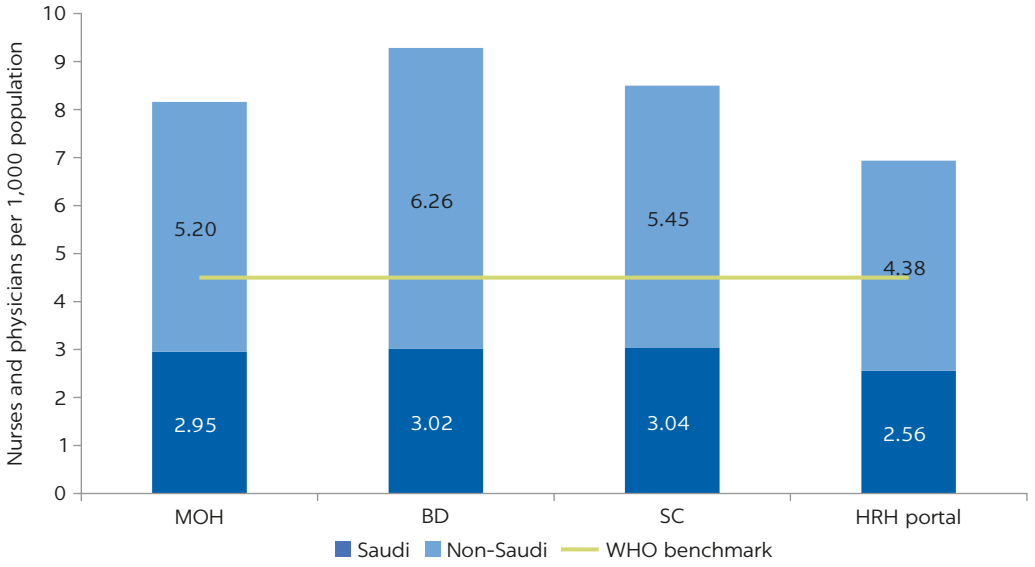
Saudi and non-Saudi physicians and all nurses in Saudi Arabia



Sources: MOH 2019; Saudi Commission for Health Specialties 2019; Saudi Health Council Balanced Distribution Data Set 2018; Saudi Health Council Human Resources for Health (HRH) Data Portal 2019.
Note: The HRH portal excludes medical cities (connected network of providers) and some university hospitals. BD = Saudi Health Council Balanced Distribution Data Set; MOH = Ministry of Health; SC = Saudi Commission for Health Specialties.

FIGURE 1.2

Densities of physicians and nurses, by nationality



Sources: MOH 2019; Saudi Commission for Health Specialties 2019; Saudi Health Council Balanced Distribution Data Set 2018; Saudi Health Council Human Resources for Health (HRH) Data Portal 2019.
Note: The HRH portal excludes medical cities and some university hospitals. BD = Saudi Health Council Balanced Distribution Data Set; MOH = Ministry of Health; SC = Saudi Commission for Health Specialties; WHO = World Health Organization.

Goals by 2030 (Scheffler et al. 2016). However, this density level is somewhat below the average of 11.7 for Organisation for Economic Co-operation and Development (OECD) countries, according to similarly recent data.[2] This density falls further, to about 3 physicians and nurses per 1,000 population, when considering only Saudi health workers, falling short of the WHO global UHC benchmark.

The remainder of this chapter focuses on Saudi physicians and nurses; foreign nationals are excluded.

Focusing only on Saudi nationals, Saudi Arabia has about 2 nurses for every physician (figure 1.3). There are currently about 1 physician and 2 nurses per 1,000 population. This ratio of physicians to nurses is somewhat higher than the ratio in OECD countries, which is about 1 physician for every 2.6 nurses, on average.

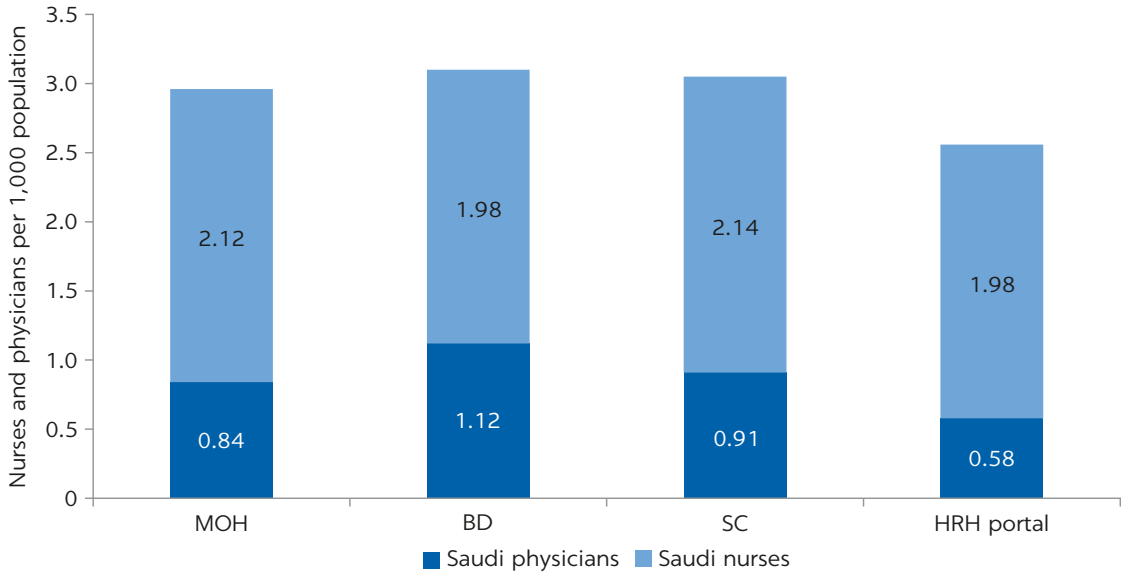
About two-thirds of Saudi physicians are specialists, which is similar to the average among OECD countries (figures 1.4 and 1.5). Among generalists in Saudi Arabia, about 20 percent practice general medicine, and fewer than 10 percent each practice family medicine, pediatrics, or obstetrics and gynecology (OB/GYN). *Generalists* are defined as those who practice general medicine (referred to as general practitioners, or *GPs*), family medicine, OB/GYN, or pediatrics. *Specialists* include all other subspecializations (figure 1.5).

The vast majority of practicing Saudi nurses are diploma nurses (those with a two-year diploma degree); very few are bachelor nurses (those who hold a four-year bachelor's degree) (figure 1.6). Many diploma nurses were trained by private sector institutions, and such training was previously viewed as an initial stop-gap measure to address the nursing shortage. The government is now in the process of implementing the Nursing Practice Act, which will prevent diploma nurses from providing direct nursing care, further reducing the number of Saudis nationally counted as nurses. Saudi bachelor nurses make up only about 20 percent of the nursing population, and advanced nurses[3] make up less than 1 percent.

When diploma nurses are excluded, the density of Saudi physicians and nurses is only 1.4 per 1,000 population (instead of 3.0 per 1,000 population). This density level is well below the 4.5 per 1,000 population UHC benchmark, or even the previous 2.3 per 1,000 population benchmark (WHO 2006) for

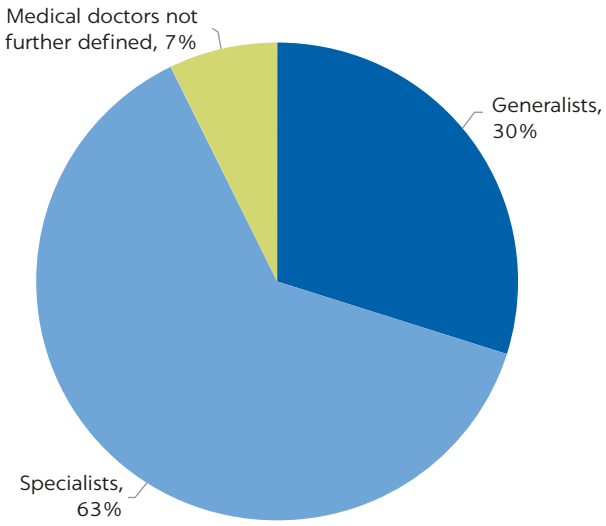
FIGURE 1.3

Densities of Saudi physicians and Saudi nurses (all) per 1,000 population



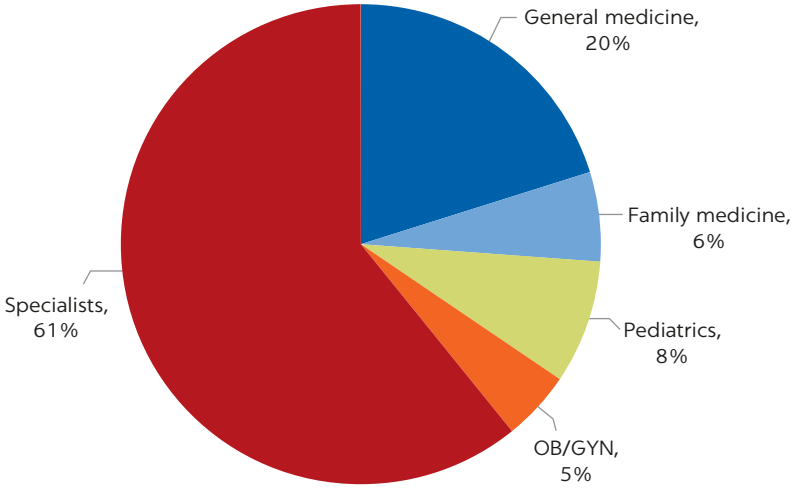
Sources: MOH 2019; Saudi Commission for Health Specialties 2019; Saudi Health Council Balanced Distribution Data Set 2018; Saudi Health Council Human Resources for Health (HRH) Data Portal 2019.
Note: The HRH portal excludes medical cities and some university hospitals. BD = Saudi Health Council Balanced Distribution Data Set; MOH = Ministry of Health; SC = Saudi Commission for Health Specialties.

FIGURE 1.4
OECD generalists and specialists



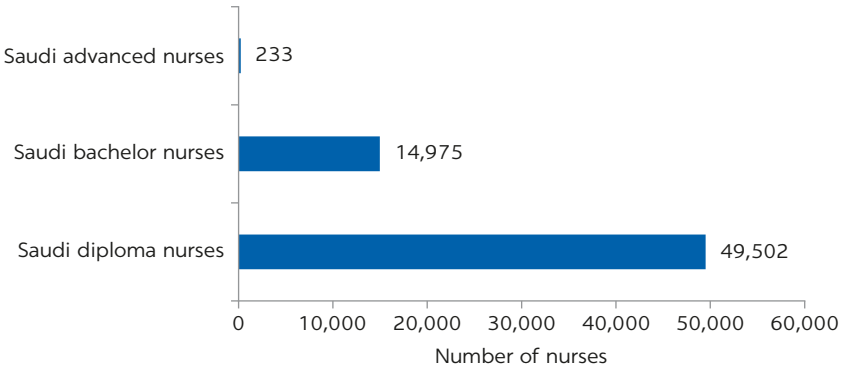
Source: OECD 2017.
Note: OECD = Organisation for Economic Co-operation and Development.

FIGURE 1.5
Saudi generalists and specialists



Source: Saudi Health Council Balanced Distribution Data Set.
Note: OB/GYN = obstetrics and gynecology.

FIGURE 1.6
Saudi nurses, by education level



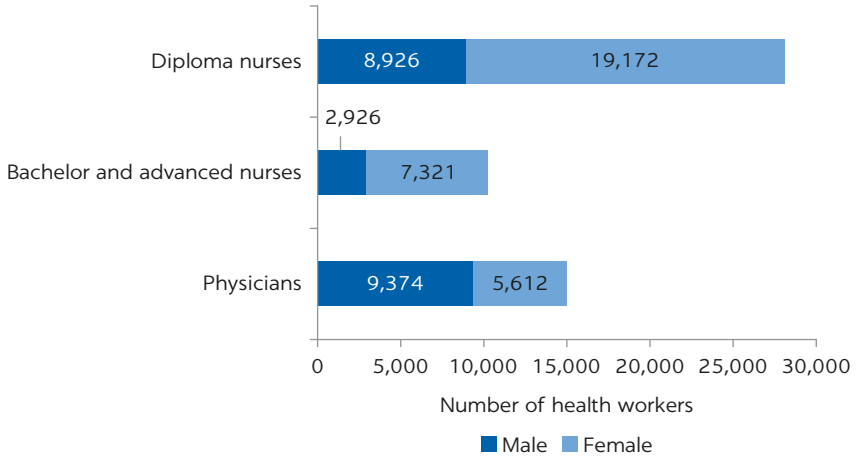
Source: Saudi Health Council Human Resources for Health Data Portal 2019.
Note: Excludes medical cities and some university hospitals.

ensuring a fairly low level of service coverage (for example, 80 percent of births attended by a skilled professional) that was identified for reaching the Millennium Development Goals.

The gender balance seems even when considering physicians and bachelor and advanced nurses combined, but the vast majority of Saudi physicians are male. Although there are similar total numbers of Saudi physicians and bachelor and advanced nurses (about 12,900 females and 12,300 males), the overwhelming majority of males who work in health care are physicians (figure 1.7). Among Saudi female physicians and bachelor and advanced nurses, about 44 percent are physicians and 56 percent are bachelor and advanced nurses (master's or PhD level).

FIGURE 1.7

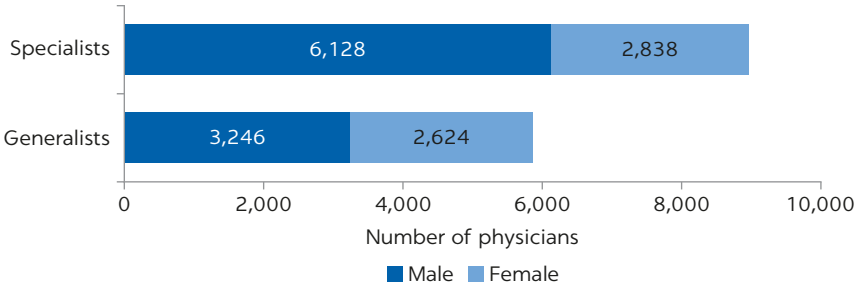
Saudi nurses and physicians, by gender



Source: Saudi Health Council Balanced Distribution Data Set 2018.
Note: Includes only primary care facilities and hospitals; excludes dental clinics, diagnostic clinics, ambulatory care centers, physiotherapy and rehabilitation facilities, and polyclinics.

FIGURE 1.8

Saudi physician generalists and specialists, by gender



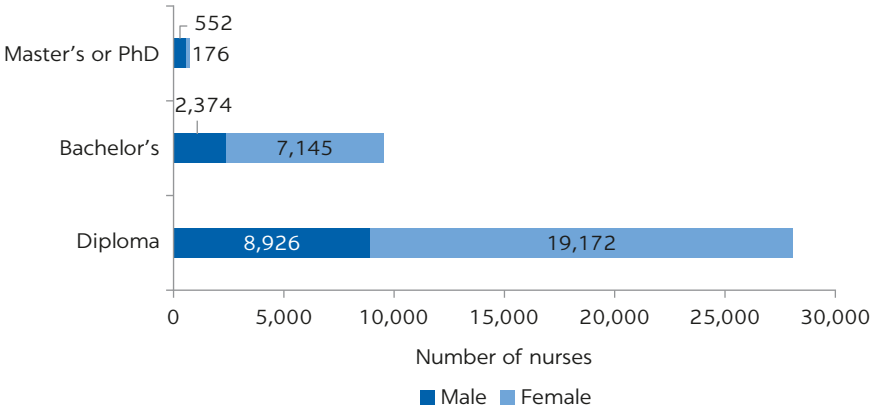
Source: Saudi Health Council Balanced Distribution Data Set 2018.
Note: ***Generalists*** are defined as those who practice general medicine, family medicine, obstetrics and gynecology, and pediatrics. *Specialists* include all other specializations.

However, among Saudi male physicians and bachelor and advanced nurses, 76 percent are physicians and only 24 percent are bachelor and advanced nurses. Thus, women are a minority among Saudi physicians (37 percent), but they comprise the majority of bachelor and advanced nurses (71 percent).

The vast majority of Saudi specialist physicians are male, whereas the gender balance of Saudi generalists is more even (figure 1.8). Among generalist physicians, 55 percent are men. In contrast, 68 percent of specialist physicians are men, even though findings from Saudi Arabia indicate that patients, especially women, prefer treatment from physicians of the same gender in many specialties (Alyahya et al. 2019). Gender equality has yet to be achieved within medical specialties in Saudi Arabia, as around the world, despite studies suggesting that female doctors may be providing higher-quality care than male doctors (Tsugawa et al. 2017).

FIGURE 1.9

Saudi nurses, by education level and gender



Source: Saudi Health Council Balanced Distribution Data Set 2018.

Saudi females outnumber males three to two in both diploma and bachelor nursing categories; however, males dominate the advanced nursing field (figure 1.9). About 68 percent of diploma nurses and 75 percent of bachelor nurses are women. In general, there are few nurses with tertiary-level degrees (master's or PhD degrees), but only 24 percent of them are women, which severely limits the extent to which the gender balance can be improved in higher managerial positions. This may be an area where opportunities for women can be improved by targeted policies making these professional environments more family-friendly and by supporting advanced training and career paths for women.

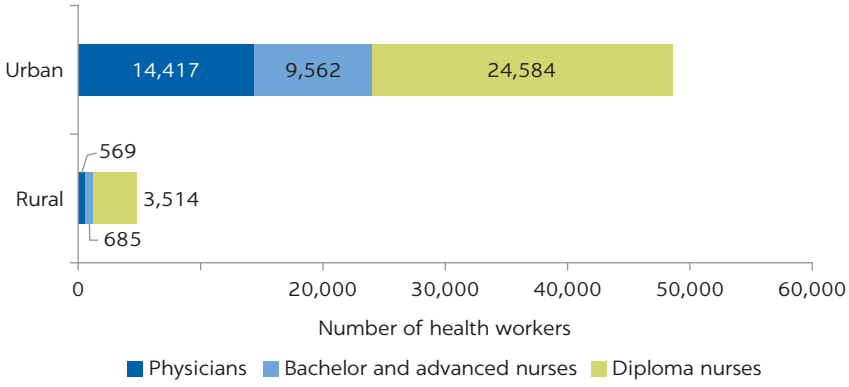
DISTRIBUTION

More than 95 percent of Saudi physicians and bachelor and advanced nurses are located in urban areas, illustrating the high dependency on diploma nurses in rural areas. Figure 1.10 shows that, of a total of 53,331 Saudi physicians and nurses (including diploma nurses), only 4,768 (8.9 percent) are located in rural areas. This imbalance is only slightly less extreme when measured per 1,000 population, given that only about 17 percent of the population in Saudi Arabia lives in rural areas.[4]

There are more Saudi physicians for every bachelor and advanced nurse in urban areas, and more Saudi diploma nurses than bachelor and advanced nurses in rural areas. There are 1.5 Saudi physicians for each bachelor or advanced nurse in urban areas compared with 0.8 physician in rural areas. When diploma nurses are included, the ratio of physicians to total nurses becomes only 0.1 in rural areas and 0.4 in urban areas. When diploma nurses are excluded, the density of 3 Saudi physicians and nurses per 1,000 population (figure 1.2) decreases to fewer than 1 per 1,000 population in urban areas and less than 0.3 per 1,000 population in rural areas (figure 1.11). Finally, there are about 5.1 diploma nurses for each advanced or bachelor nurse in rural areas as opposed to only 2.6 in urban areas. Thus, health care in rural areas is highly dependent on diploma

FIGURE 1.10

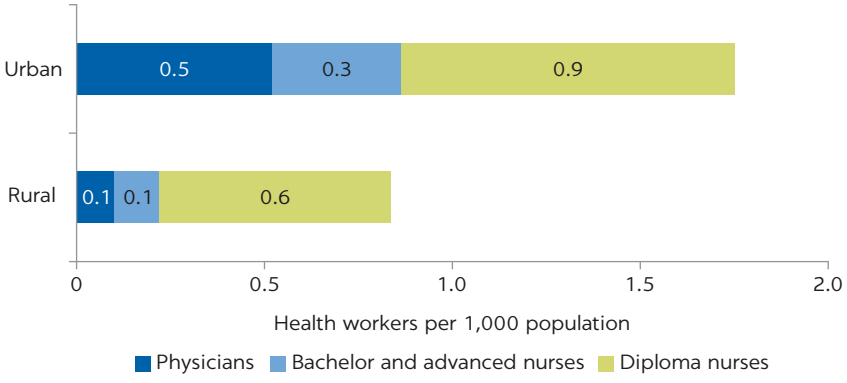
Rural-urban distribution of Saudi physicians and nurses



Source: Saudi Health Council Balanced Distribution Data Set 2018.

FIGURE 1.11

Rural and urban densities of Saudi physicians and nurses



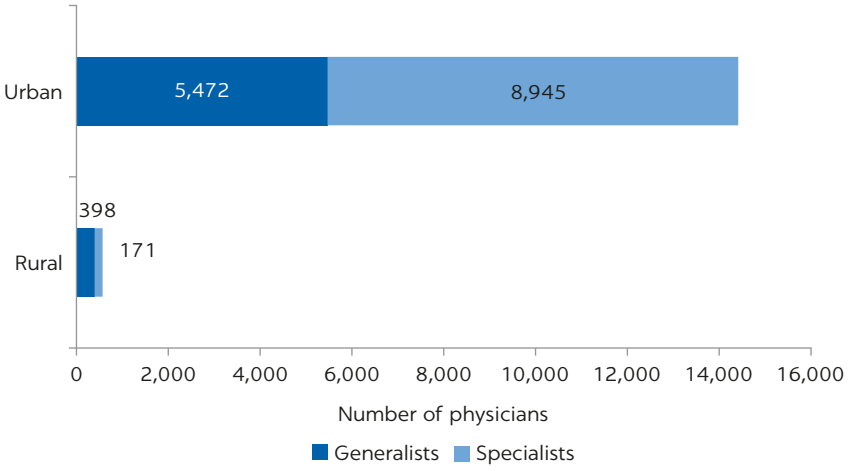
Source: Saudi Health Council Balanced Distribution Data Set 2018.

nurses and may lack appropriate staffing for higher-level patient care from bachelor and advanced nurses or physicians.

The vast majority of Saudi specialist physicians are located in urban areas, with very few practicing in rural areas. In rural areas, only 30 percent (171) of Saudi physicians are specialists compared with 62 percent (8,945) of Saudi physicians in urban areas (figure 1.12). In other countries, research has shown that hospitalization and mortality are both higher among rural populations than among those who live in urban areas, primarily because they lack access to specialists (Johnston, Wen, and Joynt Maddox 2019). This is an even more severe problem in Saudi Arabia because people with chronic conditions such as heart failure or diabetes disproportionately live in rural areas: Albaha and Alqaseem, for example, have larger proportions of rural populations than other regions in Saudi Arabia, and have a 17.9 percent and 26.8 percent prevalence of diabetes, respectively, compared with a national average of 14.7 percent (SHC System Responsiveness Report). Specialists make up only 57 percent and 47 percent of total physicians in Albaha and Alqaseem, respectively, compared with the national average of 61 percent (SHC Balanced Distribution Data Set).

FIGURE 1.12

Rural-urban distribution of Saudi generalists and specialists



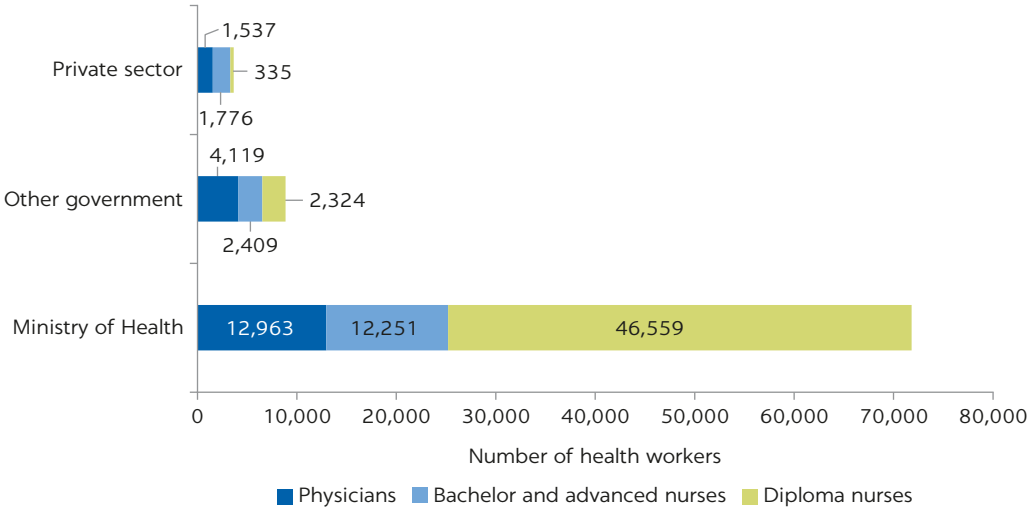
Source: Saudi Health Council Balanced Distribution Data Set 2018.
Note: ***Generalists*** are defined as those who practice general medicine, family medicine, obstetrics and gynecology, and pediatrics. ***Specialists*** include all other specializations.

Most Saudi physicians and nurses are working in the MOH, as shown by the latest data source on human resources for health collected throughout 2019 (via the Saudi Health Council Human Resources for Health [HRH] Data Portal). Small numbers of Saudi health workers are spread across other government entities and the private sector. Among Saudi physicians, 70 percent are employed within the MOH, followed by the Ministry of Defense (9 percent) and private sector employers (7 percent). Saudi bachelor and advanced nurses are mainly working within the MOH (73 percent), followed by the private sector (10 percent) and the National Guard (6.5 percent) (which does not hire any diploma nurses). Only 1.5 percent of Saudi nurses are advanced nurses, one-third of whom work outside the MOH. See figure 1.13.

Very few Saudi physicians and bachelor nurses work in primary care facilities; the vast majority work at the hospital level (figure 1.14). Across both hospitals and primary care facilities, Saudi diploma nurses are the most available compared with other cadres—45 percent of health workers in hospitals are diploma nurses, and 72 percent in primary care facilities. Only about 16 percent of Saudi physicians (30 percent when including dentists) and 15 percent of bachelor nurses practice in primary care facilities. Relatively fewer bachelor and advanced nurses practice in primary care facilities (10 percent, compared with 22 percent in hospitals), a trend similar to that among physicians (17 percent in primary care compared with 33 percent in hospitals). This pattern seems unsustainable with the demand for primary care—according to the MOH, 80 percent of outpatient visits to MOH institutions occurred in the primary health care center (MOH 2019)—and is at odds with the strategic direction to reorient the health system for greater disease prevention.

FIGURE 1.13

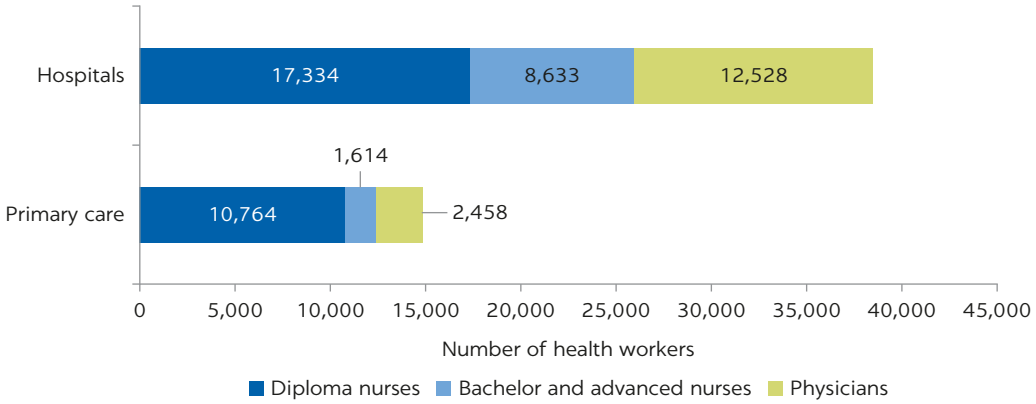
Number of Saudi physicians and nurses, by sector



Source: Saudi Health Council Human Resources for Health Data Portal 2019.
Note: Other government entities are the Ministry of Defense, the National Guard, and so on.

FIGURE 1.14

Saudi nurses and physicians practicing in primary care facilities and hospitals



Source: Saudi Health Council Balanced Distribution Data Set 2018.
Note: Includes only primary care facilities and hospitals, and excludes dental clinics, diagnostic clinics, ambulatory care centers, physiotherapy and rehabilitation facilities, and polyclinics.

PERFORMANCE (PRODUCTIVITY)

This section investigates the productivity of the Saudi health workforce. Given the available data, the relationship between the number of health workers and the number of visits (inpatient and outpatient) was analyzed. The ability to serve more patients with the same number of health workers thus reflects higher productivity. The analysis examines Saudi physicians and bachelor and advanced nurses working in hospital settings to reflect the subset of health workers who directly attend to patients and then reviews the same relationship when including diploma nurses.

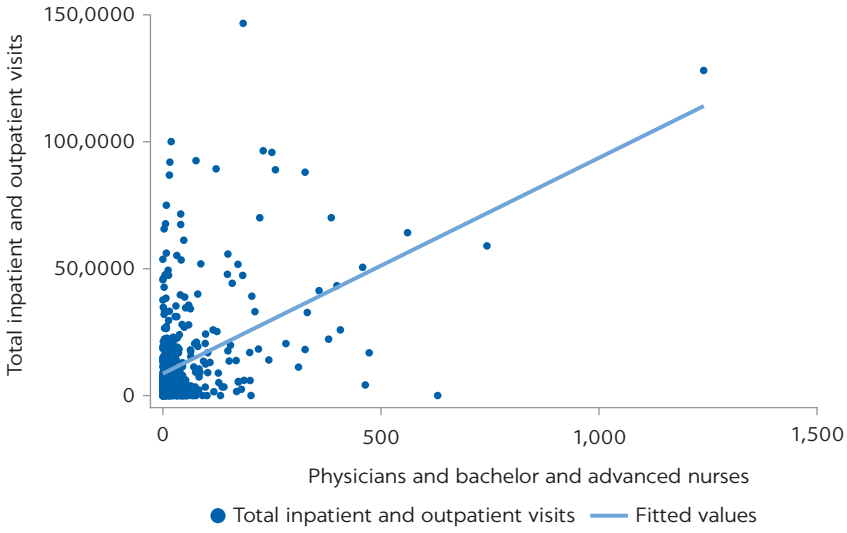
There is little to no relationship between the number of physicians and nurses (bachelor and advanced) working in hospitals and the number of inpatient and outpatient visits. When including all hospitals, a positive relationship between health worker numbers and the number of visits emerges (figure 1.15). However,

this trend is driven mainly by large hospitals located in urban centers. When hospitals with more than 60,000 visits per year are excluded (figure 1.16), no relationship between the number of physicians and nurses and the number of inpatient and outpatient visits is observed.

Similarly, when including diploma nurses, there is little to no relationship between the number of physicians and nurses working in hospitals and the

FIGURE 1.15

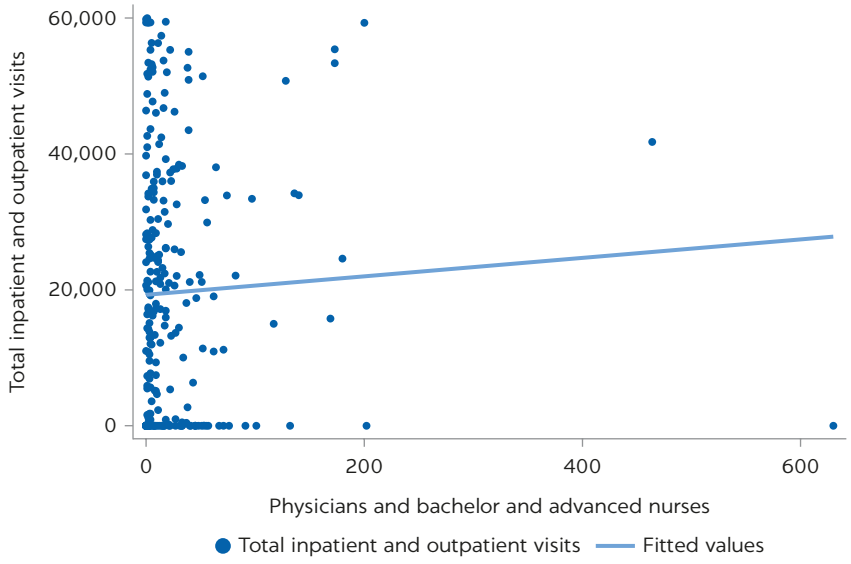
Saudi physicians and bachelor and advanced nurses and total outpatient and inpatient visits



Source: Saudi Health Council Balanced Distribution Data Set 2018.

FIGURE 1.16

Saudi physicians and bachelor and advanced nurses and total outpatient and inpatient visits, excluding large hospitals with more than 60,000 visits per year

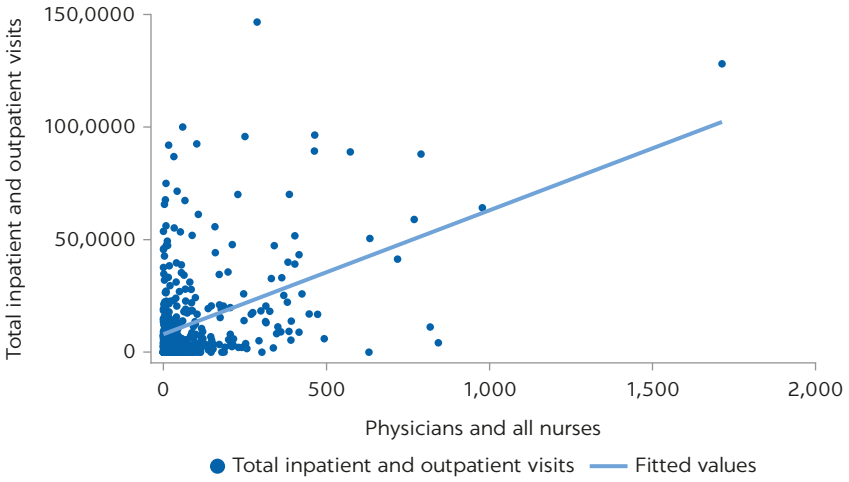


Source: Saudi Health Council Balanced Distribution Data Set 2018.
Note: Includes hospitals only. Hospitals with inpatient and outpatient visits exceeding 60,000 per year were excluded.

number of inpatient and outpatient visits. When including all hospitals, the same positive relationship between health worker numbers and the number of visits emerges (figure 1.17), which becomes less correlated when excluding hospitals with more than 60,000 visits per year (figure 1.18); however, the association is somewhat stronger than when excluding diploma nurses (figure 1.16). This could imply that diploma nurses, while not necessarily engaged in direct patient care, may still contribute to the productivity with which care is delivered.

FIGURE 1.17

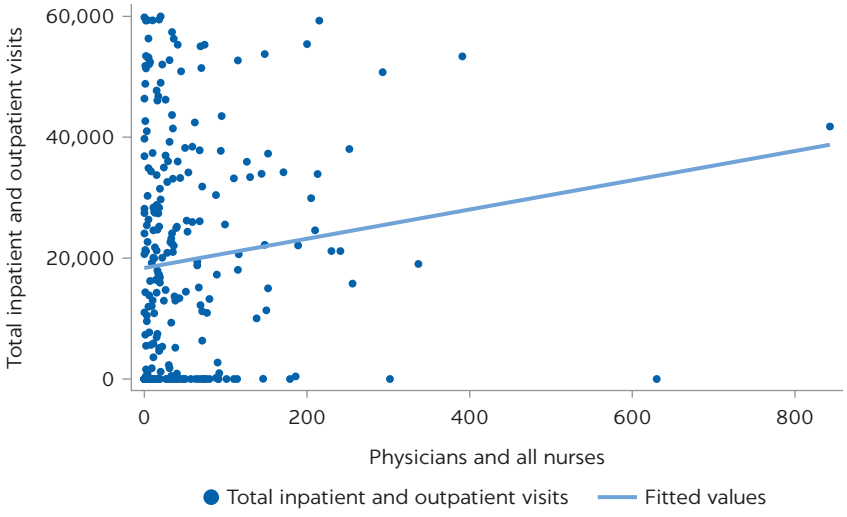
Saudi physicians and nurses (including diploma nurses) and total outpatient and inpatient visits



Source: Saudi Health Council Balanced Distribution Data Set 2018.

FIGURE 1.18

Saudi physicians and nurses (including diploma nurses) and total outpatient and inpatient visits, excluding large hospitals with more than 60,000 visits per year



Source: Saudi Health Council Balanced Distribution Data Set 2018.
Note: Includes hospitals only. Hospitals with inpatient and outpatient visits exceeding 60,000 per year were excluded.

It is important to note that information on the quality of care is not systematically available, and thus additional dimensions of productivity cannot be assessed. In particular, the quality of care (for example, accuracy of diagnoses and treatment, patient-centeredness, follow-up and continuity of care) is also critically important for yielding positive health outcomes. Thus, in relative terms, higher productivity can also reflect the ability to provide higher quality of care per patient for the same number of health workers—aspects of performance that cannot be investigated with the available data.

CONCLUSION

The current density of health workers in Saudi Arabia—about 9 physicians and nurses per 1,000 population across various data sources—exceeds the WHO global benchmark (4.5 physicians and nurses per 1,000 population) for achieving UHC. However, further analysis of the current composition of health workers in Saudi Arabia highlights areas in which further policies are needed to strengthen the health workforce and shape its strategic growth to meet national transformation objectives.

First, Saudi Arabia's health system relies heavily on foreign workers and lesser trained and experienced diploma nurses. Saudi nationals comprise only one-third of all physicians and nurses, among whom the vast majority of practicing Saudi nurses (nearly 80 percent) are diploma nurses with only two years of education. These diploma nurses are not "nurses" in the strictest sense. Hence, the real number of Saudi nurses (those with a bachelor's degree or advanced master's or PhD degree) available for patient care is much lower than often assumed.

Within the Saudi health workforce, additional imbalances by cadre and type of training, facility type, and gender exist. Saudi physicians and nurses are predominantly employed in hospital settings (72 percent) rather than primary care facilities. The large majority of Saudi physicians are men (63 percent), whereas nurses are largely women (68 percent among diploma nurses and 71 percent among bachelor and advanced nurses). Among Saudi physicians, two-thirds are specialists, of which 68 percent are men; women are more represented among generalist physicians (at 45 percent).

Saudi physicians and nurses are further concentrated in urban areas and practice within the MOH. About 95 percent of the workforce is located in urban areas. Even when adjusting for population size, the imbalance is still large (0.8 per 1,000 population in rural areas compared with 1.8 per 1,000 population in urban areas, including diploma nurses). There are more physicians for every bachelor and advanced nurse in urban areas and more diploma nurses to bachelor and advanced nurses in rural areas, showing a high dependency on diploma nurses in rural areas. Saudi physicians are also predominantly employed within the MOH (70 percent), followed by the Ministry of Defense (9 percent) and private sector employers (7 percent). Saudi bachelor and advanced nurses are mainly working within the MOH (73 percent), followed by the private sector (10 percent) and the National Guard (6.5 percent), which hires no diploma nurses.

An examination of the relative productivity of Saudi health workers is inconclusive. From the limited information available, the data suggest that the number of inpatient and outpatient visits is not related to the number of hospital health workers. No data on the quality of care are available to further assess worker

output, highlighting the need to more systematically collect data on the quality of care as one important driver of not just health worker productivity, but also of patient satisfaction and health outcomes overall.

NOTES

1. When looking at total health workers, dentists are counted toward physicians in all data sources. For the specific analysis conducted on Saudi physicians in this chapter, dentists were excluded.
2. OECD 2020, Doctors (indicator) (accessed May 8, 2020), doi:10.1787/4355e1ec-en; OECD 2020, Nurses (indicator) (accessed May 8, 2020), doi:10.1787/283e64de-en.
3. In Saudi Arabia, nurses can have any of the following qualifications: diploma, bachelor's degree, and postgraduate (including master's and PhD) degrees. Advanced nurses in this chapter refers to nurses who have master's or PhD degrees.
4. Rural and urban populations were estimated based on regional urban densities provided by the Ministry of Municipalities and Rural Affairs; values for missing regions were obtained from Aljabari (2008).

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2 Methods for Projecting the Supply of, Need for, and Demand for Health Workers

JENNY X. LIU, TIM BRUCKNER, TRACY KUO LIN, MOHAMMED ALLUHIDAN, AND CHRISTOPHER H. HERBST

KEY MESSAGES

- Evidence-based health workforce planning begins with understanding the future supply of, need for, and demand for health workers.
- Using 11 years of historical data for 20 regions, supply can be projected to 2030 for physicians and nurses by nationality, gender, and facility type.
- To ensure sufficient fiscal capacity to absorb those health workers while meeting population health goals, projected supply should then be compared with both the anticipated need for health workers, estimated through a deterministic model of service delivery given priority health conditions for Saudi Arabia, and the labor market demand for health workers as predicted by total government expenditures and Ministry of Health (MOH) expenditures on health.
- From the projection models, the effect of different policy options can be simulated to understand their likely impacts on ameliorating identified gaps.
- The selection of these methods was driven by the availability of data; additional assumptions are needed to address data limitations and to further adjust health worker projections to better align the analysis with the strategic objectives of the National Transformation Program.

BACKGROUND

This chapter summarizes some of the key methods that can be applied to project (1) health labor supply, (2) health labor need, and (3) health labor market demand. A critical element of workforce planning is ensuring that supply can meet future epidemiological needs, and that fiscal capacity (labor market demand) is sufficient to absorb the health workforce required to meet those future needs. This is

particularly important in a context such as that of Saudi Arabia, which is home to a growing and aging population and is challenged by competition for resources.

Specifically, this chapter has four objectives:

- To focus on projections of supply, need, and demand, and to describe the different forecasting methods that can be applied
- To describe the steps and decisions needed to carry out forecasting exercises, including required data inputs, associated assumptions, and modeling approaches
- To describe how the results of the forecasts can be used to gain an understanding of different planning scenarios
- To indicate which methods for projecting supply, need, and demand were used for the Saudi Arabia context in this report, and why

Projecting the number of health workers into the future involves predictive uncertainty, and the resulting estimates should be interpreted as only indicative. Workforce estimates are more stable at higher levels of aggregation (for example, regions), even though modeling may occur at lower levels of analysis (for example, governorates). In general, using more observations (for example, over geography or time) in statistical modeling exercises will produce more stable estimates. The resulting aggregated estimates can then provide an indication of the general and relative magnitude of health worker numbers and gaps to inform policy and planning.

The remainder of this section outlines the conceptual approach for forecasting future numbers of health workers so that inferences can be made about subnational workforce dynamics. The following three sections outline the methods for projecting supply of, need for, and demand for health workers, respectively, along with a short overview of the methods used for Saudi Arabia. This is followed by an explanation of how the different projections can be aggregated and compared across units to assess shortages and surpluses to inform policy targeting. The subsequent section includes examples of how the forecasting models can be used to simulate different future scenarios with which to understand the implications of various workforce planning options. The final section concludes.

Conceptual framework

The steps in modeling the projected health workforce numbers are described in reference to the illustrative example depicted in figure 2.1. Three components are used for future projections (Bruckner, Liu, and Scheffler 2016; Liu et al. 2017; Scheffler et al. 2008):

Demand (D) reflects the number of health workers that will be demanded in the future given anticipated economic and demographic conditions. This number specifically reveals the size of the workforce that different service delivery organizations (public and private) in a country will likely be able to afford as employers in the labor market.

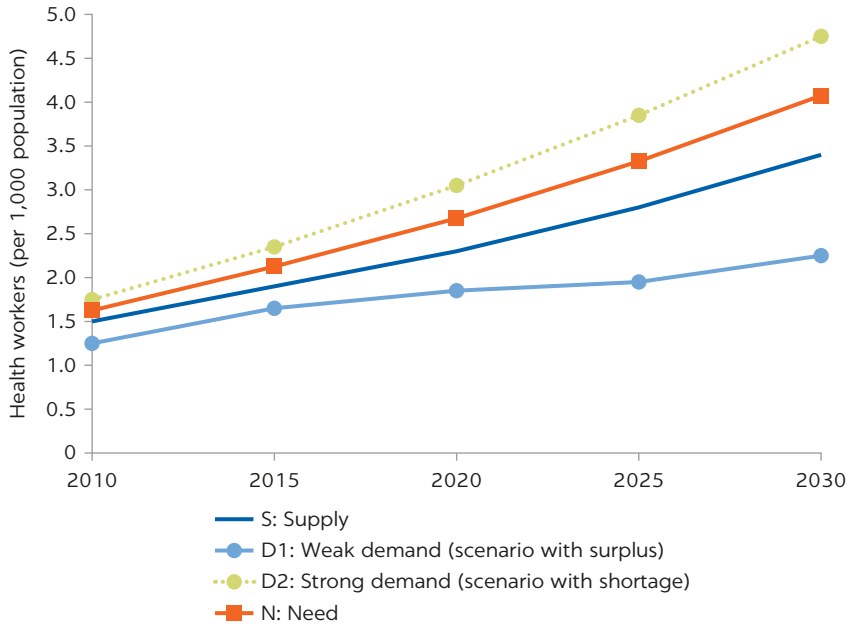
Need (N) estimates the number of health workers that are required to reach a desired benchmark of service utilization. This projection does not account for the ability to support such workers in the labor market. The main driver of increasing need is a growing population; changing disease burden may also be taken into account.

Supply (S) is the total number of health workers with the appropriate skills and qualifications who are willing to enter the health sector labor market and can find acceptable jobs given prevailing wages. Health workers can be supplied from training programs or can migrate from elsewhere, and are offset by those who may leave the health sector for other jobs, retire, leave the country, or die.

Using these different estimates, comparisons can then be made to identify where the most critical gaps in the number of health workers lie, and thus where policy interventions may be needed to ameliorate the situation. For example, in figure 2.1, future economic conditions, including health spending and demographic change (for example, aging) may demand only 2.3 health workers per 1,000 population by 2030, represented by scenario D1. Compared with a projected supply of 3.4 health workers per 1,000 population in 2030 (S), this would represent a surplus of 1.1 health workers per 1,000 population in the labor market. However, in 2030, there will be 4.1 health workers per 1,000 population needed to deliver services at the desired level of coverage, which corresponds to a need-based shortage of 0.7 health workers per 1,000 population. In scenario D1, even though there are surplus health workers in the labor market—indicating that many trained health workers are unable to be employed in the health sector—the number of trained health workers is still well below the optimal number needed to deliver services. Thus, the labor market can neither support the available additional workers nor are there enough workers to satisfy the need-based service delivery target. Workforce planners will need to identify ways to both increase production and find fiscal space for absorbing additional health workers.

FIGURE 2.1

Conceptual framework for projecting health worker labor supply and demand



Source: Based on Scheffler, Herbst, et al. 2016, figure 3.6.

In a different scenario with robust economic growth, represented by D2 in figure 2.1, the demand for health workers may exceed both the supply and the need, suggesting that the economy will likely be able to employ health workers above and beyond the service utilization and coverage targets; however, there will not be enough health workers produced by 2030 to fulfill total need. This situation suggests that additional policy remedies should focus on some combination of increasing the inflows of health workers into the health sector, retaining those already employed, and increasing the efficiency and productivity of existing health workers (for example, through technological innovation). The steps for projecting health worker supply, need, and demand are detailed in the following sections.

It is important to note that demand and supply are endogenously related in the labor market (that is, they simultaneously affect each other). However, different methods were used to project each in an effort to address this potential endogeneity. Specifically, a growth projection model used for supply was based solely on an exogenous time trend and no other factors (see the next section). Furthermore, all parameter inputs into the demand model are lagged to ensure the direction of causality (see the section on demand projections).

SUPPLY PROJECTIONS

Data inputs

Following methods used in the past (Bruckner, Liu, and Scheffler 2016; Liu et al. 2017; Scheffler et al. 2008), projecting the future supply of health workers critically relies on having historical data on the number of health workers per population (for example, since 2000 or as far back in time as possible). Regardless of the specific modeling approach, projecting supply rests on the assumption that the production of future health workers will continue as in the past without any policy adjustments (that is, a baseline scenario). In other words, health worker supply growth is exogenous, and trends only with time following historic patterns. It assumes that migration, entry into the health professions, and retirement and deaths of health workers will all remain constant in the future; changes in these factors can be analyzed in simulations performed on the base model.

If projections for separate occupational groups (for example, general practitioners, nurses) or immigration status are desired, these data should also be disaggregated along these dimensions. If such data are available at the governorate level, the empirical analysis will produce governorate-level projections. However, using individual governorate-level projections to set health worker targets is strongly discouraged because of the inherent uncertainty of statistical models. Rather, aggregating estimates to a higher level (for example, regional) will provide more reliable estimates of the general and relative magnitudes of health workers across these units, which can then inform health worker planning.

Statistical approach

Model specification

Various econometric approaches can be used to project supply numbers, each with advantages and disadvantages, as described in table 2.1. All models assume

TABLE 2.1 Econometric modeling approaches for projecting supply

MODEL	ADVANTAGES	DISADVANTAGES
1. Growth rate	• Simple and straightforward • Only need two data points minimum per country	Potentially less accurate if inappropriate functional form
2. Moving average or distributed lag	• Gives more weight to recent data • Relies less on functional form assumptions	Requires that the workforce numbers be populated for at least some number of continuous years
3. Autoregressive integrated moving average	• Can account for cyclical fluctuations • Relies less on functional form assumptions	Need data for a longer time period (back to 1990 or further) with very few missing observations

Source: Based on Liu et al. 2017, appendix.

that past trends in health worker numbers will continue in the future, using time as the only variable factor. Which model to use largely depends on the amount of data available.

Of the three types of econometric approaches, the *growth rate method* (Model 1) is the simplest and most straightforward and requires the least amount of data, but it may be less accurate given that the predictions largely rely on what functional form for growth (for example, linear or exponential) is specified. Other methods rely less on the functional form assumption but require more data points. A *moving average* or *distributed lag model* (Model 2) gives more weight to the data points surrounding a given time point, but it requires that data be available for a continuous number of years. An *autoregressive integrated moving average model* (Model 3) requires that a long time series be available with very few missing data points.

Empirical forecasts of health worker supply have largely used the growth rate approach (Model 1) given the dearth of reliable health worker data over time. However, Liu et al. (2017) use a more conservative linear relationship, whereas Scheffler et al. (2008) use an exponential model. The functional form can be chosen one of two ways:

1. Exogenously by policy makers who have a strong indication of the underlying growth trajectory of health worker production
2. By the data, through model specification testing.

In general, the number of health workers (*HW*), standardized by population size (*HW per 1,000 population*), can be estimated as

$$HW\ per\ 1{,}000_t = \alpha_0 + \alpha_1 \times year_t + \varepsilon_t \tag{2.1}$$

for each unit of observation (for example, governorate) at time $t = \{0, T\}$ where ε_t is the random disturbance term and α_0 and α_1 are unknown parameters to be estimated; α_1 represents the linear growth rate (that is, a constant mean yearly change in the health worker density level).

Note that equation (2.1) assumes a linear functional form. If an exponential functional form is desired, which assumes that each year is associated with a percentage change in HW density (rather than HW density levels), then the density of HWs can be logged (that is, $\ln(HWs\ per\ 1{,}000_t)$ and the resulting growth rate can be calculated as $exp(\alpha_1) - 1$.

Model specification testing for identifying the preferred functional form could proceed by comparing resulting estimates from each model used and assessing how realistic and stable predictions may be among health workforce planning experts. If data availability allows, within-sample specification tests could also be performed, whereby model predictions with the lowest mean square root of the squared error can be used as a rule to identify the preferred functional form.

Making projections for different subgroups

Equation (2.1) can be used as a generic approach to estimating future trends in any group of health workers. For example, projections can be made for general practitioners, and then also for nurses, assuming data are available for a sufficient number of years for each occupational group. In some countries, projections can also be made for foreign and national health workers with these subgroups. Again, the ability to do so is determined by the availability of data.

Projecting estimated supply

Estimates for each geographical unit of observation can then be made for future years by allowing the year variable to change input values and using the estimated coefficients for α_0 and α_1 from equation (2.1). The projected supply of health workers per 1,000 population for each future year can then be multiplied by the projected population in that year to obtain the absolute numbers of health workers:

$$Number\ of\ HWs_t = (HW\ per\ 1{,}000_t \times population_t)/1{,}000 \qquad (2.2)$$

Dealing with missing data

Missing data may arise in various ways and require additional assumptions for empirical modeling. These assumptions and solutions are summarized in table 2.2. Note that any solution used to address missing data for health worker numbers should be similarly applied for all input data used in the need and demand models.

Method used for projecting the supply of health workers in Saudi Arabia

Given the data available on health workers in Saudi Arabia, the supply of health workers in Saudi Arabia was projected using a linear growth rate approach (that

TABLE 2.2 Ways to address missing data for health workers

TYPE OF MISSINGNESS	POTENTIAL SOLUTIONS
Isolated missingness (for example, specific years)	• Interpolate missing data points between any two real data points • Substitute the mean value
Insufficient data for a geographic unit	• Exclude the unit from the analyses • Substitute the mean value of all known units • Substitute the mean value of "similar" units (for example, rural)
Insufficient data for a specific occupation group	• Calculate a multiplier value that reflects the ratio of the missing health worker group to a known health worker group (for example, ratio of other allied health workers to nurses) and apply this constant for the baseline scenario

Source: Based on SHC and RAS 2020, table 2.

is, Model 1). Regional data (n = 20) were available for only 11 years (from 2007 to 2018) for the number of physicians and nurses, categorized by nationality (Saudi or foreign), gender (male or female), and facility type (hospital or primary care setting). Furthermore, data were available only for health workers employed by the public MOH and private sectors; regional health worker data from non-MOH public sector employers, such as the Ministry of the National Guard and the Ministry of Defense, were not available. Despite these limitations, these data capture the largest portion (75 percent) of those employed in the public sector. The national proportion of non-MOH health workers out of all public sector health workers was projected (in lieu of disaggregated regional-level data for non-MOH public sector health workers) and added to the regional projections of health workers in the MOH and private sectors to obtain the total projected supply of health workers in Saudi Arabia from 2020 through 2030.

NEED-BASED PROJECTIONS

Approaches to defining the need-based criterion

Predicting the future need-based requirement for health workers rests on how *need* is defined. Several approaches for defining this requirement have been used in the past (Ansah et al. 2017; Bruckner, Liu, and Scheffler 2016; Scheffler, Cometto, et al. 2016; WHO 2006). These can be summarized by the six approaches described below.

Workforce-to-population ratio is the simplest approach to determining the number of health workers required to serve a given population. The ratio is often taken from a reference country or region with a slightly more developed health care sector for use as a benchmark. Alternatively, an international standard (for example, a standard from the World Health Organization [WHO]) can be adopted. However, this approach does not consider other factors, such as utilization, and it does not take into account any country-specific details.

Example: *A country could adopt a target workforce-to-population ratio based on another country's workforce density that it would like to reach.*

Utilization-based approaches estimate future health care workforce requirements using the current level of services used by the population as a proxy for satisfied demand. This approach assumes that the current consumption of health care services reflects the desired level of consumption of a population that will seek out and have the ability to purchase health care in the current context of the health care system. In other words, setting current utilization as the need-based criteria assumes that the status quo is acceptable.

Example: *A country could choose the existing utilization level (for example, 70 percent of the population are vaccinated against influenza) and set the corresponding level of health worker density needed to achieve this utilization level as the target; future health worker numbers would then be determined solely by population growth and, by definition, no shortages would currently exist.*

A bottom-up need-based approach projects health workforce requirements based on the current estimated health care needs of a particular population (rather than of a different population) to deliver a specific level of health services. In essence, a fully deterministic model is built to delineate the number of full-time equivalent employees required to provide health services. Additional factors, such as burden of disease, can be taken into account and can determine

the specific illnesses that are a priority for the health care system to address. This approach requires epidemiological data on the prevalence of diseases and a determination of the specific number of health workers (or workdays) per patient in need (that is, staffing ratios) to identify the overall health workers required to deliver care.

Example: *Countries could define a specific service (for example, having 100 percent of the population obtain a primary care checkup every year) and calculate the number of full-time equivalent health workers required to reach that service delivery target for the population.*

A top-down need-based approach uses aggregate variation in service coverage data to identify an acceptable threshold of health worker density that relates to a desired service coverage level (assuming diminishing returns). This threshold is calculated from statistical models that assess the relation between the number of health workers needed and their attainment of key health system targets. Additional factors that influence need (for example, urbanization) may also be added. However, an external decision is still required to identify the desired level of population coverage for the service in question. Notably, the WHO adopted this approach in 2006 to identify a global threshold of 2.28 health workers per 1,000 population as the minimum desired coverage level for having 80 percent of live births attended by a skilled professional (WHO 2006).

At the country level, this approach could use either (1) cross-country data to identify a globally relevant threshold or (2) subnational data within Saudi Arabia to identify a threshold from the internal variation in service delivery coverage and health worker densities. Using cross-country data ensures that any threshold identified is placed within the global context of need, based on the strength of the empirical relationship observed across settings.

Using subnational data implicitly assumes that the variation within a country already encompasses the need-based criteria that could be applied to all of a country (for example, that there are a few areas that represent the desired need-based criteria that planners want the entire nation to achieve).

Example: *Using subnational data on health workers and treatment for mental health illness as the health service delivery indicator, a regression analysis could identify the threshold of health workers needed to achieve 80 percent coverage for mental health screening and treatment.*

The disability-adjusted life year (DALY) weighted approach is a variant of the top-down need-based approach that can identify a threshold of health worker density that relates to achieving multiple service delivery indicators. Again, using aggregate-level variation (for example, aggregated at the country or subnational level), regression analysis is used to empirically identify the health worker density associated with the desired level of coverage for each service delivery indicator, and the resulting health worker densities are then aggregated using DALY weights for each indicator to arrive at the specific health worker threshold for each geographic unit. Using one set of DALY weights for all units will generate one health worker density threshold, whereas using unit-specific DALY weights will generate unit-specific health worker density thresholds.

Example: *Using subnational data on health workers and three indicators for service delivery (for example, treatment for mental health illness, influenza vaccination, and four or more antenatal checkups), separate regression analyses could identify the threshold of health workers needed to achieve 80 percent coverage for each indicator. The final need-based criterion is then a weighted sum (according to*

each service's associated burden of disease relative to DALYs) of the identified health worker densities for all three indicators.

The composite index method further builds on the DALY-weighted top-down approach by first developing a composite index score that reflects the achievement of desired service coverage levels across *many* health indicators, weighted by each health condition's share of the global burden of disease (that is, relative DALY weights). The composite index score is then regressed against the density of health workers to describe the relationship between health worker availability and level of service delivery coverage; the final threshold of desired service coverage, however, still requires policy-maker input or some other external decision rule. This method was recently developed by the WHO for identifying the threshold of 4.5 health workers per 1,000 population as the level of health worker availability needed to achieve the median score (25 percent) for 12 Sustainable Development Goal tracer indicators (Scheffler et al. 2018; Scheffler, Cometto, et al. 2016).

Example: *With subnational data on health workers and three indicators for service delivery (for example, treatment for mental health illness, influenza vaccination, and four or more antenatal checkups), each subnational unit can be assigned a score (from 0 to 3). One point is given for each indicator for which coverage of 80 percent or greater of the population is achieved, and the points across indicators are summed, weighted by each indicator's contribution to the burden of disease within a country (in relation to DALYs). A regression analysis of the composite score and health worker densities across subnational units can then be used to trace this curvilinear relationship. A decision rule can be applied to identify the composite score that best reflects public health planning goals.*

Each method for determining the need-based criterion has advantages and particular considerations, as summarized in table 2.3. The next subsections further explain the methods for approaches 3–6.

Building bottom-up need

This approach does not involve any statistical methods, but rather builds a deterministic model of how services can be delivered at the desired level of population coverage. It begins with the priority health conditions that policy makers want to address through the health system, which may reflect policy makers' anticipation of the future burden of disease. For each of these health conditions, population-based estimates of the prevalence of the conditions are needed to understand the size of the target population in need for each condition. The relevant health service delivery model (including appropriate staffing ratios) can then be applied to the expected volume of inpatient and outpatient services at the level of service coverage that planners desire.

The service delivery model can differ across health conditions and can be informed by the current health system structure and policies, by international standards, or by other sources that recommend a particular staffing ratio or skills mix. Factors that should be considered in defining service delivery models include the proportion of cases needing care on either an outpatient or inpatient basis, the number of expected visits per person, the need for a hospital bed, and staffing full-time equivalents for different occupation groups. Health service delivery needs are calculated for each health condition and then summed across conditions to obtain an aggregate estimate. This process ultimately yields a target count of health workers of different types.

TABLE 2.3 Approaches to identifying the need-based criterion

APPROACH	ADVANTAGES	CONSIDERATIONS
1. Workforce-to-population ratio	• Simple and straightforward • Requires only identifying a reference context • No empirical data needed	• Does not consider actual utilization or service coverage aims • Must assume the reference context is sufficiently similar (for example, health system, burden of disease)
2. Utilization	• Requires only data on current utilization and health workers	• Must assume that current utilization is the desired level for the population and, hence, current workforce-to-population ratios are adequate
3. Bottom-up need	• Is context-specific and builds on the services and delivery system of the context under study • Can incorporate multiple service delivery goals	• Requires data on the prevalence of priority health conditions, treatment coverage targets, and service delivery models for each condition
4. Top-down need	• Is based on empirical analysis of data across contexts (for example, countries, subnational units) • Only one service delivery indicator is needed • Can additionally account for modifying factors that influence service delivery	• Requires data on health workers and at least one service delivery indicator • Requires an external decision to identify the desired population coverage level (for example, 80 percent) for the service indicator • Requires future values of modifying factors to identify a future health worker density need level
5. DALY weighted	• Generates a health worker density threshold for multiple service delivery indicators • Can incorporate differential burdens of disease	• Must estimate separate regressions for each service delivery indicator • Requires data on cause-specific DALYs • Requires an external decision to identify the desired population coverage level for each service included
6. Composite index	• Can incorporate multiple service delivery indicators • Can incorporate differential burdens of disease • Uses only one regression model to identify the health worker density threshold	• The final threshold of desired service coverage still requires an external decision rule • Requires data on cause-specific DALYs • The composite score is not easily interpretable

Source: Based on SHC and RAS 2020, table 3.
Note: DALY = disability-adjusted life year.

Because the user can specify the degree of complexity for this model, different service delivery models that incorporate urban-rural differentials or health worker composition (for example, foreign versus national, or by profession) can be taken into account. However, this approach implicitly assumes that the service delivery models used represent the ideal skills mix and staffing ratios of the future.

Regression analysis for top-down approaches

Approaches 4–6 require statistical analyses that all build on a basic regression methodology. This subsection describes this general regression method to illustrate how it can be used to define a need-based requirement threshold.

It is important to note, however, that the statistical approach requires data for as many units as possible. Past research shows that, at a minimum, about 50 observations are needed to generate stable regression estimates, regardless of the unit of analysis chosen (for example, national, subnational).

Model specification

Using cross-sectional data for subnational units g, a regression model can be used to estimate a curvilinear relationship between service delivery and health worker density:

$$\%ServiceCovered_g = \beta_0 + \beta_1 \times ln(HW\ per\ 1{,}000_g) + \varepsilon_g \quad (2.3)$$

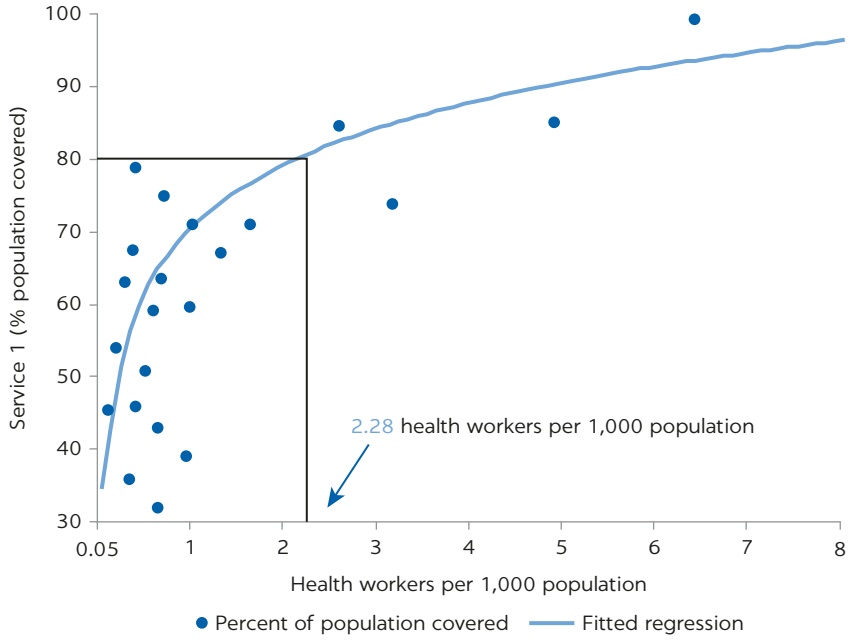
where $\%ServiceCovered_g$ is the percentage of the population receiving the chosen health service for each area *g*, and $\ln(HW\ per\ 1{,}000_g)$ is the natural logarithm of health worker density (to account for diminishing returns). The coefficient β_1 is the slope of the *HW* variable. If the desired level of service coverage is set to 80 percent, entering this value into the equation with the estimated coefficient values will identify the corresponding density of health workers that is needed.

Figure 2.2 illustrates this basic approach. This basic model does not take into account additional influences that may affect a country's need for health workers. For example, if differences across urban and rural areas should be taken into account, variables representing urbanization (percentage of the population living in an urban area) or population density may also be added. Future values of these modifying factors could then be used to identify the future level of health worker density that may be needed. For countries in the Gulf Cooperation Council region, such modifying factors could include the composition of the workforce by immigration status.

Building on this basic regression approach, the DALY-weighted method estimates equation (2.3) for each additional service coverage indicator included, and then identifies the threshold of health worker density that achieves the level of coverage desired for each indicator (which can be different for each indicator).[1] The health worker density thresholds identified for each service can then be summed, weighted by the relative contributions to burden of disease as represented by DALYs, to arrive at one final threshold of health worker density. Whereas the DALY-weighted approach first estimates separate regressions for each service type and then aggregates the identified health worker density thresholds into a single threshold, the composite index method first aggregates coverage levels across service types and then identifies a single health worker density threshold

FIGURE 2.2

Top-down regression method for identifying the need-based criterion



Source: Scheffler, Herbst, et al. 2016, figure 3.1.

that corresponds to the aggregate coverage through a single regression. Thus, they are conceptually similar, but differ slightly in their execution.

Each of the top-down approaches to identifying need-based criteria can be applied to either health workers in aggregate or separately by occupational group, depending on data availability for health worker subgroups and the ultimate aim of the exercise. For example, if the optimal skills mix for achieving the target service coverage level is unclear, the user may prefer to aggregate health workers across occupation groups. Once the target health worker density level is achieved, the skills mix associated with that density and output level can be further investigated within the data. If, however, the user would like to separately identify the threshold of nurses that relates to the optimal service coverage level, regressions can be estimated for this occupation group alone. This approach may be relevant for services in which nurses represent the main occupational group delivering care.

Projecting estimated need

Once the need-based requirement level of health worker density is identified, projecting the estimated numbers of required health workers into the future will require inputting future values of population size. Because the density of health workers will remain constant, applying equation (2.2) to calculate the absolute number of health workers needed will rely only on population growth.

If, however, the top-down approach (item 4 in table 2.3) is used and additional modifying factors (for example, urbanization) are included in the regression analysis, the identified health worker need threshold will also change with time. In effect, by using future values of the modifying factors and keeping target service coverage levels the same (for example, 80 percent), the health worker density need level may change.

Method used to project health worker need in Saudi Arabia

A bottom-up need approach was implemented to estimate the health workforce needed in Saudi Arabia. This approach uses the prevalence of key priority health conditions, identified by the 2030 Health Sector Transformation Strategy, as input data to anchor estimates of physicians and nurses needed (from an epidemiological perspective) in the present day and to 2030. This approach was chosen for three reasons. First, data on prevalence of priority conditions were readily available. Second, the government of Saudi Arabia sought to incorporate several scenarios about workforce productivity and levels of service coverage; these variations are flexibly incorporated into the deterministic bottom-up model. Third, detailed subnational workforce data, and corresponding health coverage information (for example, on more than 50 subnational units within Saudi Arabia), were not available, thus precluding a Saudi Arabia–specific top-down regression approach.

DEMAND PROJECTIONS

A country's ability to pay for health workers is reflected in the demand-based forecasting approach. The demand for health workers represents the joint interests of the government and the private sector in purchasing health services, including the cost of health worker wages. Countries are constrained by their available resources to employ health workers, which can be below the optimal

level needed for the desired level of health utilization or may not equal the number of trained health workers available to deliver services.

The demand for health workers is influenced by factors including household income (that is, the ability of consumers to purchase health services), the fiscal capacity of the government to support the health system and employ public sector workers, the demographic and epidemiological conditions of the population (for example, aging and burden of disease that determine the relative types of health services consumers want), and the level of health insurance coverage, that is, risk pooling and financial protection to enable consumers to access and use health services in times of need.

What drives demand for health workers?

Building the demand function

Previous research has shown that indicators of gross domestic product (GDP) or national income are the best predictors of health expenditures, of which labor is the principal component (Cooper, Getzen, and Laud 2003; Getzen 1990; Newhouse 1977). Early work to project health workforce labor demand largely focused on specific developed countries for which data on health workers are more readily available (Basu and Gupta 2004). More recently, Liu et al. (2017) have extended health worker demand forecasting techniques that not only leverage historical data on health workers but also incorporate factors, in addition to economic growth, that are expected to influence demand for health workers, including demographic structure and health care insurance coverage.

It is important to note that the demand model requires not only rich historical data on health worker densities but also historical and future predictions of demand drivers (see the subsequent discussion). The analysis performs best when the lowest administrative unit possible is used as the empirical foundation, and resulting future forecast predictions for health worker demand are aggregated at a higher level. Aggregated estimates are more likely to be comparable across units, absorb the margins of error associated with individual estimates, and provide a more stable indication of the relative magnitudes of health workers demanded.

The first step in building the demand model is to identify the factors that are theoretically important for determining the demand for health workers in a country context. The next several paragraphs discuss each one and what kinds of variables could be considered for the empirical analyses.

At a minimum, some measure of *health spending* is needed to represent the fiscal capacity to absorb health workers in the labor market. Overall economic growth is expected to drive demand for health care with a positive elasticity as a normal good. Indicators of economic growth have been found to determine health worker employment (Cooper, Getzen, and Laud 2003) and have previously formed the fundamental building blocks of forecast estimates of physician demand by Scheffler et al. (2008). Although having data on spending on health workers is ideal, such data are often unavailable, and more suitable and highly correlated proxies may be health expenditures or national income (for example, GDP).

Indicators for the *generosity of health insurance coverage* may be included if social protection measures are expected to vary within a country (for example, people in urban areas have better access to health insurance than

rural residents). Household out-of-pocket spending can be used as a proxy for insurance coverage. Less generous coverage leaves individuals to pay more out of pocket, and thus lowers the demand for health services and health workers. Although overall health care spending may trend upward with national income, the portion spent out of pocket is largely determined by the level of coverage by health insurance, government subsidies, and other forms of risk pooling and financial protection. Differential access to such protections may further drive disparities in health utilization and health outcomes within a given population. Other proxies for social protection may include the cost of care (for example, user fees or average distance to care), which represents structural constraints on care-seeking.

Demographic drivers are important to include if the burden of disease and population profiles differ across geographic areas. Demographic trends, especially when also viewed from the perspective of epidemiological transitions from communicable to noncommunicable diseases, are likely to influence the types of services demanded, and thus the types of health workers needed to deliver those services. For example, past research has shown that population aging affects the demand for health care services used at older ages (Cooper, Getzen, and Laud 2003). Other demographic drivers may include educational attainment, literacy, fertility, and female labor force participation.

Inclusion of additional structural factors may be warranted given the particular features of a country health system and whether such factors are expected to differ across geographic areas. A lengthier discussion of a country's situation may be needed to identify these factors and their suitable quantitative measures.

Data requirements

For all variables included as health worker demand predictors, historical values are required, preferably for several years earlier than for the values available for health workers to allow for lagged predictors. Estimated future values are also needed to make future forecast estimates of health workers. If estimated future values are not available, additional work to produce such future estimates will be needed.

Statistical approach

Using historical data on health worker densities (the same as used for supply projections) and demand predictor variables, a generalized linear model (see equation (2.4)) can be used to estimate the following:

$$\ln\left(HW\ \ per\ 1{,}000_{gt}\right) = \gamma_0 + \sum_{i=1}^{I}\gamma_1^i \ln\left(hexpd_{gt-i}\right) + \sum_{i=2}^{I}\gamma_2^i inscov_{gt-i} + \sum_{i=1}^{I}\gamma_3^i \ln\left(pop_{gt-i}\right) + \mu_g + \varepsilon_{gt} \tag{2.4}$$

for each subnational unit g at time $t = \{0, T\}$ where the density of $HW\ per\ 1{,}000_{gt}$ is logged and a lagged structure for $i = \{1, I\}$ time periods is included for each predictor variable: logged health expenditures per capita ($hexpd_{gt-i}$), insurance coverage ($inscov_{gt-i}$), and logged population size (pop_{gt-i}); μ_g represents a vector of area-level fixed effects included to account for time-invariant unobservable heterogeneity across geographic units (for example, differences in baseline characteristics); and ε_{gt} is the error term. Note that these predictor variables are generically named for illustrative purposes. The exact variable to be used and its transformation should be further explored, discussed, and justified for inclusion.

To avoid endogeneity, all predictor variables should be lagged for a number of time periods (for example, up to five years) to allow time for such factors to work through the economy and affect the labor market. This approach is similar to what other researchers have done in previous projection exercises (Getzen 1990; Liu et al. 2017; Scheffler et al. 2008). A stepwise approach can be used to select the specific combination of year lags that maximizes the predictive power of each variable. For example, lagged variables that achieve a minimum 1 percent level of significance after repeated iterations can be kept within the model.

Model specification

To identify the model that minimizes the degree of error in predicted values, alternative model specifications can be explored and tested using the following general approach. The data set can be split into two parts—an initialization data set that contains the early half of data years, and a testing data set that includes the latter half of data years.

Each alternative model specification can first be estimated using the initialization data set, using the optimal lag structure identified for equation (2.4). The estimated parameters can then be applied to the actual covariates from the testing data set to obtain predicted values of health worker densities for the latter half of data years. These predicted values can then be compared with actual data for health workers. To formally assess the fit of each model, the mean square root of the squared error can be calculated:

$$\text{Mean error} = \frac{1}{GT}\sum\sqrt{\overline{(\ln\left(HW\ \ per\ 1{,}000_{gt}\right)}\ -\ln(HW\ \ per\ 1{,}000_{gt})^2} \qquad (2.5)$$

Alternative specifications may include variations of the following:

- Using quadratic terms for expenditure variable indicators to additionally account for nonlinearities
- Using different transformations of predictor variables (level versus logged, or percentage versus per capita)

Projecting estimated demand

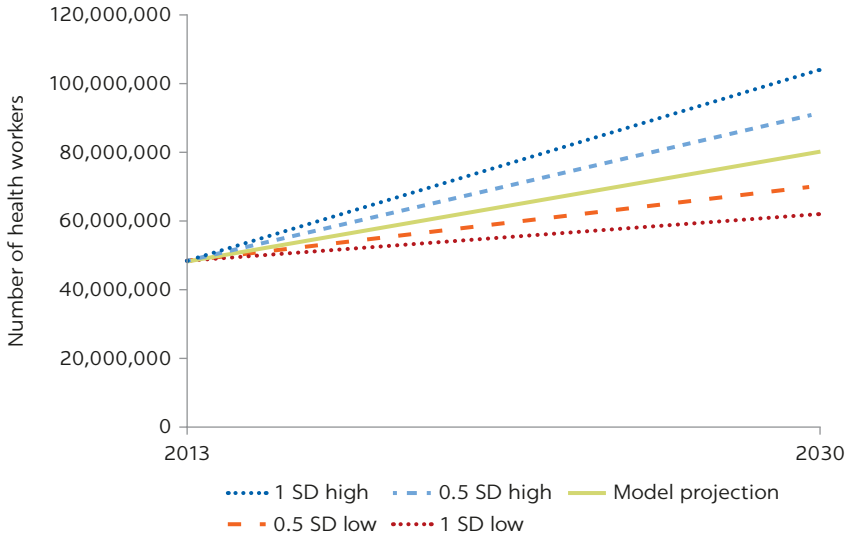
Using the estimated coefficients from equation (2.4) and plugging in future values for each of the demand predictor variables, future values of logged health workers can be calculated (transformed with an antilog and multiplied by a correction factor to account for the skewed distribution). Future values of health workers per 1,000 population can then be multiplied by projected total population size for each year to obtain the absolute number of health workers, following equation (2.2).

Figure 2.3 illustrates a demand projection for health workers for 2030 of an example country, along with confidence intervals for up to one standard deviation. The number of health workers reflects the total estimated across all units of observations used in the data.

The empirical approach to estimating the demand for health workers can be used for any occupational group of health workers. For example, projections can be made for general practitioners, and then also for nurses, assuming data are available for a sufficient number of years for each occupational group.

If future values of regression predictors are unavailable, further steps are needed to obtain estimates of future values, as has previously been done in Liu et al. (2017), and it has its own data requirements.

FIGURE 2.3
Range of health worker demand projections



Source: Liu et al. 2017, appendix figure A.2.
Note: SD = standard deviation.

Method used for projecting labor market demand for health workers in Saudi Arabia

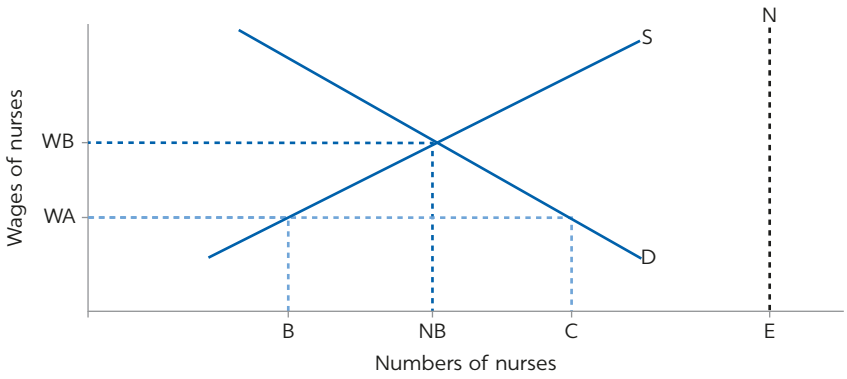
From the available subnational economic data in Saudi Arabia, per capita total government expenditures and MOH expenditures on health were identified as the main predictors for the demand model. These predictors were used to estimate the total number of physicians and nurses (both foreign and Saudi) demanded by (1) the overall health labor market and (2) only the public sector. Data on private sector spending were not available; thus, this model implicitly assumes that future labor market demand for health workers is largely driven by government spending, which may be reasonable for a baseline scenario that reflects the status quo (that is, with no policy intervention to mobilize additional private sector resources, for example). Estimates were adjusted upward to incorporate non-MOH public sector employers, and thus, project demand for the entirety of the Saudi Arabia health worker labor market.

ASSESSING GAPS BETWEEN SUPPLY AND NEED AND DEMAND

The concept of shortages and surpluses

With future projections of health workers supplied, needed, and demanded, estimated health worker shortages or surpluses can be identified. At a conceptual level, a shortage of workers results when the demand or need exceeds the supply. Figure 2.4 is a static depiction of the labor market for nurses. Traditional labor economic analyses assume that, in well-functioning labor markets, disequilibrium (that is, imbalances between demand and supply) is short-lived. A core assumption is that the wage rate is flexible and freely adjusts the incentives to both employers and health workers to influence their employment behavior and preferences such that equilibrium is readily restored.

FIGURE 2.4
Static model of the labor market for nurses



Source: Scheffler, Herbst, et al. 2016, figure 3.5.
Note: The figure depicts the labor market for nurses. WB is the equilibrium wage that matches the demand for (D) and supply of (S) nurses. As the wage falls to WA, demand will exceed supply and there will be a shortage of workers equal to C–B. N represents the number of nurses needed; NE measures health care needs; and NB is the number of nurses employed at the equilibrium wage WB.

However, countries face a binding constraint on the amount of financing available to employ more health workers. In this market, as shown in figure 2.4, a shortage results according to a demand-based model when the wage rate is equal to WA and the quantity demanded (C) exceeds the quantity supplied (B). All else being equal, shortages in this market could be alleviated through additional compensation to increase wages to the level that clears the market (WB) and attract more workers into the market by increasing the production of workers or by importing workers from external markets. Additionally, the estimated number of workers needed (E) exceeds any number of workers supplied; this yields a need-based shortage. Subtracting supply from the need-based health worker volume yields the need-based shortage (or surplus). Similarly, subtracting supply from the demand-based health worker volume yields the demand-based shortage (or surplus).

Quantifying shortages and surpluses

The main advantage of using subnational data to develop health worker projections is that aggregated estimates of shortages and surpluses offer a more reliable estimate of relative magnitude differences. However, the aggregation method requires attention and transparency.

If both shortages and surpluses across geographic units exist, then simply summing the totals across all units implicitly assumes that shortages in one area will offset surpluses in others, which is equivalent to assuming that health workers can be easily redistributed between areas. Such an assumption may not be realistic, especially in the short run. Thus, it is recommended that shortages be aggregated only within the subset of units that have shortages, and likewise for surpluses. Similarly, shortages and surpluses should be aggregated only within occupation subgroups as appropriate.

Method used to quantify the projected gaps in health workers in Saudi Arabia

The gap analysis for Saudi Arabia focuses on the shortages between the predicted numbers of Saudi physicians (generalists and specialists) and Saudi nurses (including only bachelor and advanced nurses, not diploma nurses) and their predicted need-based demand and health labor market demand. The focus on Saudi nationals stems from the strategic goals outlined in the National Transformation Program for increasing health workforce Saudization. Additional adjustments were made to account for the relative lower productivity of Saudi health workers (irrespective of public or private sector employment), and diploma nurses were excluded from the overall projected supply of nurses given that their scope of work is more similar to health technicians than to health workers who provide direct patient care. In combination, these adjustments yield results that better inform health workforce policies in Saudi Arabia in line with strategic goals for ensuring that there are adequate numbers of Saudi health workers with the necessary skills to meet the needs and demands of the health system.

SCENARIO SIMULATIONS

Comparing need- and demand-based projections underscores the importance of understanding whether a shortage stems from supply or economic demand constraints, or both. In areas where supply and demand may both be low, there may be neither enough fiscal capacity to employ more health workers nor adequate numbers of health workers to deliver the priority health services needed by the population. The health workforce projections resulting from the above methods assume no changes in the technology or efficiency of the health care delivery system—that there will be no changes in the organization of the health care delivery system, or in worker productivity or technology. Thus, these projections do not account for potential changes in productivity due to the engagement of other types and levels of health workers, such as physician assistants, community health workers, and other categories of workers.

However, there is likely to be considerable scope for augmenting the production of workers, improving the efficiency of service delivery, and increasing health worker productivity. For example, propagating service delivery models that use more low-skilled cadres (for example, community health workers, nurses, midwives) may achieve greater coverage for essential primary care services with the same resources used to produce higher skilled, but fewer, physicians and specialists. Increases in productivity might also be achieved through technological advances that could reduce the overall number of health workers demanded or shift demand more toward different types of health workers.

The supply projections also do not take into account attrition rates in the existing stock of health workers, and the additional number of workers who will need to be educated and employed to replace those who exit the labor market. Also not considered are the dynamics of the international migration of health workers, particularly foreign health workers, which future health workforce planning may seek to change. These different scenarios for future supply, demand, and need could be simulated to understand the likely direction and magnitude of effects for various intervention measures. Examples of simulation scenarios are provided in table 2.4.

TABLE 2.4 Simulations of different health workforce planning measures

COMPONENT	POTENTIAL SOLUTIONS
Supply	• Increasing the yearly numbers of health workers trained in Saudi Arabia • Reducing the number of expatriate workers each year
Need	• Increasing the target level of service coverage • Changing the basket of services prioritized • Increasing the productivity of health workers
Demand	• Increasing health care spending • Offering more generous health insurance coverage

Source: Based on SHC and RAS 2020, table 4.

Method used to examine different workforce policy considerations in Saudi Arabia

To illustrate the effect of potential policies on closing health workforce gaps in Saudi Arabia, different assumptions from the baseline model projections were relaxed, reflecting a range of alternative simulated scenarios. All simulations start with baseline model estimates that reflect Saudi health workers in all sectors of the economy (public and private) and their lower productivity relative to international standards. Each policy scenario was considered on its own to enable comparison across policy options. Simulations for policies targeting supply-side changes included increasing productivity relative to work hours, increasing workforce Saudization, and delaying retirement. Alternative scenarios affecting need-based demand included increasing coverage of health services (as a result of behavior change education campaigns, for example) and more task-sharing between physicians and nurses. Using the current public sector wage bill, financial resources that may be available for employing health workers in the public sector were evaluated. Together, these simulations give an indication of the relative magnitude of different health worker policies that may be deployed to close predicted health workforce gaps.

CONCLUSION

This chapter summarizes some of the key methods that can be used to project (1) health labor supply, (2) health labor need, and (3) health labor market demand. Resulting aggregated estimates from such projections can provide an indication of the general and relative magnitude of health worker numbers and gaps between supply, need, and demand to inform policy and planning into the future. Although such projections are useful, it is critical to note that projecting health workers into the future involves predictive uncertainty, and resulting estimates should be interpreted only as indicative.

For the analysis on the health workforce in Saudi Arabia, the growth rate approach was used to project supply. A bottom-up need-based approach was used to estimate the health workforce needed epidemiologically to care for the population. And economic models, using total governmental expenditure and MOH expenditure as predictors, were used to project both the overall and public sector–specific health labor market demand for health workers. The selection of these methods was driven largely by the availability of disaggregated data; additional assumptions are needed to address data limitations and further adjust health

worker projections to better align the analysis with the strategic objectives of the National Transformation Program. In the future, with more granular, subnational data, the number of assumptions can be reduced and projections can be made with minimal adjustments to inform policy making for a health system in transition.

NOTE

1. For example, the desired level of vaccination coverage may be set at 90 percent or higher for some communicable diseases, which may reflect the minimum level needed to achieve herd immunity.

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3 A Need-Based Approach to Projecting Nurses and Physicians Required in Saudi Arabia

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KEY MESSAGES

- The need-based model estimates the number of physicians and nurses required to meet the epidemiological need of the population in Saudi Arabia.
- Where country-level data are available, the use of country-specific need-based forecasts is encouraged as a complement to labor market demand–based forecasts, and to move away from the reliance on global benchmarks of 2.28 or 4.5 physicians, nurses, and midwives, which are not country specific.
- Models were based on core assumptions about the capacity of the Saudi health workforce to diagnose and treat health conditions prioritized by the Ministry of Health (MOH). Health care workers were then scaled up to cover all health conditions.
- The effects of public education campaigns that increase awareness, identification, and treatment of diseases were also considered.
- The actual need for full-time equivalent (FTE) physicians and nurses in 2030 could be anywhere between 60,000 and 112,000, depending on the assumptions made. These numbers translate into densities of 1.64 to 3.58 per 1,000 population in 2030.
- Overall, Saudi Arabia appears to have no shortage of health workers to address epidemiological needs, when both Saudi and non-Saudi nationals are considered.
- There may be an existing need-based shortage, however, if counting only Saudi nationals, and particularly when diploma nurses, who do not have a college degree in nursing, are excluded. This circumstance is detrimental to Saudization efforts.
- Whether there is a need-based shortage in relation to the projected supply of physicians and nurses in 2030 is explored in chapter 6 of this book.

BACKGROUND

An effective health care workforce is critical to successfully treat the health needs of a population. Human resources play a crucial role in delivering health services. From a policy- and country-level perspective, health planners and decision-makers must ensure that the right number of people, with the right skills, deliver health services appropriate for the population's health needs. Given the substantial training and resources required to develop a health workforce, planners who can anticipate future health workforce needs will be better equipped to match these resources to the particular demographic and health characteristics of the particular population.

A foundational component to understanding the overall workforce that is needed is an estimate of the health conditions of the population. Several strategies have been proposed to arrive at estimates of an ideal volume and skill mix of the health workforce, and most begin with trying to understand the population's morbidities that are amenable to cost-effective health care treatments and interventions. Some countries, for instance, have a demographically "grayer" population with a predominance of chronic diseases as the leading causes of disability and death. Other populations may have a greater prevalence of risk behaviors (for example, smoking) that produce a unique "signature" of associated illnesses. Regardless of a country's specific demographic and health behavior profile, the planning for an efficient health workforce should involve matching the health workforce to the distribution of health conditions in the population that health workers will address.

Previous estimates of global benchmarks of health worker concentration may not apply to Saudi Arabia. Two previous estimates of physicians and nurses (per 1,000 population) that are needed have been widely used in the literature. These estimates include 2.28 physicians, midwives, and nurses per 1,000 population, taken from the World Health Organization's (WHO's) 2006 *World Health Report* (WHO 2006), and 4.5 physicians, nurses, and midwives per 1,000 population, taken from the WHO's 2016 Sustainable Development Goals report (WHO 2016). These benchmarks, however, may not apply to any specific country, or to Saudi Arabia, given that they were derived from a regression-based exercise using population averages of data on 110 countries, before 2010, and mostly in low- and middle-income contexts with a high burden of infectious diseases. In addition, the 4.5 value assumes a national strategy of universal health care coverage in which health care access, even for nonpriority health conditions, is subsidized by the federal government. Neither the 4.5 nor the 2.28 estimate, moreover, is based on detailed epidemiological evidence on the prevalence of health conditions in a particular country. For these reasons, the relevance of these benchmarks to the need-based estimates of health workers in Saudi Arabia is unknown.

An epidemiological need-based approach was applied to estimate, to 2030, the number of physicians and nurses needed to treat the current and anticipated burden of disease in Saudi Arabia. This approach is well established and enjoys widespread use by governmental and nongovernmental organizations. A need-based approach uses the prevalence of priority health conditions as its foundation to drive estimates of the size of the health workforce (Bruckner et al. 2011; Scheffler et al. 2009).

Importantly, this approach is in contrast to economic or willingness-to-pay approaches that consider the economic aspects of price, supply, and demand

(Liu et al. 2017; McPake, Scott, and Edoka 2014). A need-based approach assumes that the health workforce responds only to *true* illness, rather than to economic factors such as the funding of workers, when matching workers to patients. To this end, the approach used in this chapter should be viewed as epidemiological rather than economic.

The benefit to the planner of a need-based approach involves the important goal-setting exercise that answers the following question: *How many physicians and nurses are needed to deliver cost-effective interventions and treatments to adequately address the health needs of the population?*

This analysis aims to provide estimates of the number of physicians and nurses required to meet the epidemiological needs of the population in Saudi Arabia. Models were based on core assumptions about the capacity of the Saudi health workforce to diagnose and treat health conditions prioritized by the MOH (MOH 2017). Health care workers were then scaled up to cover all health conditions. The effects of public education campaigns that increase awareness, identification, and treatment of diseases were additionally considered. These scenarios are intended to provide planners and policy makers with a range of health workforce planning options—of which a subset may be feasible given political and economic constraints.

METHODOLOGY TO PROJECT THE EPIDEMIOLOGICAL NEED FOR PHYSICIANS AND NURSES

To begin, information on priority health conditions was retrieved from the 2030 Health Sector Transformation Strategy. This strategy document, delivered by the MOH as part of Saudi Arabia's Vision 2030, states that, "Particular areas of concern include heart disease, stroke, diabetes mellitus, respiratory disease, mental health, road traffic accidents and congenital diseases" (MOH 2017, 9). Road traffic accidents were excluded for the purposes of this analysis and scenario calculations because the burden of injuries is more amenable to reduction through population-level prevention strategies than through health care treatments.

Health conditions within these areas of concern were further specified because the service delivery models required to treat these conditions vary widely. For example, within the category of respiratory disease, the care and management of chronic obstructive pulmonary disease (COPD) differs from that of asthma given the distinct risks and age distributions of these conditions (IHME 2018). Health conditions were selected according to the following criteria: (1) they impose substantial disability, morbidity, or mortality in Saudi Arabia; (2) epidemiological data and estimates of the condition are available; and (3) the disease is amenable to cost-effective treatment delivered in a primary care or hospital setting. This process resulted in a list of six priority health conditions: ischemic heart disease, cerebrovascular disease (stroke), major depressive disorder, diabetes mellitus, COPD, and congenital anomalies (including congenital heart defects, neural tube defects, and cleft lip and palate).

The best available estimates of prevalence for these health conditions, by age group, were used to derive the population that may seek care. Prevalence estimates from national health surveys in Saudi Arabia, including the General Authority for Statistics Household Health Survey and the Saudi Health Interview Survey, were prioritized. This priority was given to the Saudi surveys because,

based on experience, local surveys are typically more accurate than modeling strategies conducted on regional (for example, North African) averages of prevalence. For priority conditions not included in these surveys, population-based prevalence estimates were obtained from peer-reviewed epidemiological literature and the Global Health Data Exchange. Annex 3A provides additional details on selection criteria as well as on available population-based prevalence estimates, including for those not selected. Selected prevalence estimates for priority health conditions (table 3.1) were then multiplied by the United Nations population projections for years 2020–30 (UN DESA 2019) to derive the population that may seek care per condition per year.

Information on plausible treatment coverage rates was then applied to each of the priority health conditions. Target coverage rates were determined on the basis of the severity of the health condition, the ability to detect cases, and the probability that patients with the condition will seek care. Based on these factors, and consistent with the literature (Chisholm, Lund, and Saxena 2007; Ortegón et al. 2012; Salomon et al. 2012), the following target coverage rates were established: 80 percent for ischemic heart disease, stroke, diabetes mellitus, COPD, and congenital anomalies; and 33 percent for major depressive disorder.

A relatively high treatment coverage target was assigned to cardiovascular diseases, diabetes mellitus, COPD, and congenital anomalies because of the large burden associated with these conditions in Saudi Arabia and, for acute events, the severity of symptoms and ease of detection. In addition, the Saudi population exhibits a high prevalence of preventable risk factors for cardiovascular diseases, diabetes, and COPD, including tobacco use and inactivity. The World Bank Health Nutrition and Population Statistics (2017),[1] for instance, reports that more than a quarter of men (25.4 percent) smoke tobacco products. According to SHIS (2013),[2] nearly half of women (46.5 percent) are physically inactive. Conversely, a relatively low target coverage rate was assigned to major depressive disorder given that patients may not report symptoms, and physicians in primary care settings may fail to detect cases (Becker 2004).

For each condition, service delivery models of cost-effective interventions were used to estimate the number of outpatient and inpatient visits per year (see table 3A.2). These models were based on results of WHO-CHOICE (Choosing Interventions that Are Cost-Effective) (WHO n.d.) regional analyses and cost-effectiveness studies in upper-middle-income and high-income countries (Bruckner et al. 2011; Chisholm, Lund, and Saxena 2007; Salomon et al. 2012). Treatment models were determined based on (1) the percentage of cases needing care in each service setting (that is, inpatient and outpatient), (2) the average

TABLE 3.1 Population-based estimates of prevalence for priority health conditions and their sources

PRIORITY HEALTH CONDITION	PREVALENCE (%)	SOURCE
Ischemic heart disease	5.50	Al-Nozha et al. 2004
Cerebrovascular disease	0.65	IHME 2018
Major depressive disorder	2.78	IHME 2018
Diabetes mellitus	8.50	GASTAT 2018
COPD	2.40	Wali et al. 2014
Congenital anomalies	1.24	IHME 2018

Source: World Bank, based on references in Source column.
Note: COPD = chronic obstructive pulmonary disease.

annual number of visits per person, and (3) whether or not visits require a bed (see table 3A.3).

The WHO-CHOICE (WHO n.d.) cost-effectiveness models assume that most cases receive treatment at a primary care level, and that patients with more severe, complex, or acute conditions receive treatment at a hospital level. For instance, lifestyle interventions (for example, tobacco cessation programs) and screening and diagnostic services (for example, cardiovascular disease risk assessment) were included at the primary care level, whereas specialist treatment (for example, cardiac surgery) was included at the hospital level. Health care service needs were calculated separately for each condition and values were added together to obtain an aggregate estimate for the population per setting per year (see table 3.2).

Using these outpatient and inpatient visit estimates, treatments were converted into the number of FTE physicians and nurses needed to treat these priority health conditions. Workforce requirements for outpatient services were calculated using the WHO estimates of workforce capacity (Bruckner et al. 2011; WHO n.d.). Models assumed that physicians and nurses work, on average, 225 days per year and have 11 consultations per day. The total number of expected outpatient visits was divided by 2,475 (225 × 11) to obtain an estimate of the number of FTE physicians and nurses needed for outpatient care. To derive the number of FTE physicians and nurses required to meet inpatient needs, bed-days were estimated assuming that hospitals operate at 85 percent capacity (Bruckner et al. 2011). This correction factor (1.15) was applied to obtain the target number of inpatient beds. Staffing ratios were then applied to each treatment setting. In a scenario in which no task-shifting occurs, models assumed that physicians and nurses perform 1.7 percent and 98.3 percent of tasks in outpatient settings, and 10 percent and 90 percent of tasks in inpatient settings, respectively (Bruckner et al. 2011; Chisholm, Lund, and Saxena 2007; WHO n.d.).

Next, health care workers were scaled up to treat *all* health conditions by applying a disability-adjusted life year (DALY) multiplier to the priority health conditions studied. Scale-up models assume that, on average, the health workforce required to treat a health condition is proportional to its contribution to the total burden of disease, as measured by DALYs (see table 3A.5). Using information available in peer-reviewed literature and Saudi health surveys (see table 3.1), the six studied priority health conditions in Saudi Arabia were estimated to

TABLE 3.2 Annual need-based estimates of outpatient visits and inpatient bed-days for priority health conditions in Saudi Arabia, 2030

HEALTH CONDITION	TARGET POPULATION	TOTAL ANNUAL OUTPATIENT VISITS	TOTAL ANNUAL INPATIENT DAYS
Cardiovascular diseases	1,525,396.8	3,050,793.6	3,050,793.6[a]
Major depressive disorder	284,430.7	1,498,949.8	207,634.4
Diabetes mellitus	2,108,272.0	4,216,544.0	843,308.8
COPD	595,276.8	1,506,050.3	357,166.1
Congenital anomalies	25,544.0	6,386.0	109,839.2
Total	n.a.	10,278,723.7	4,568,742.1

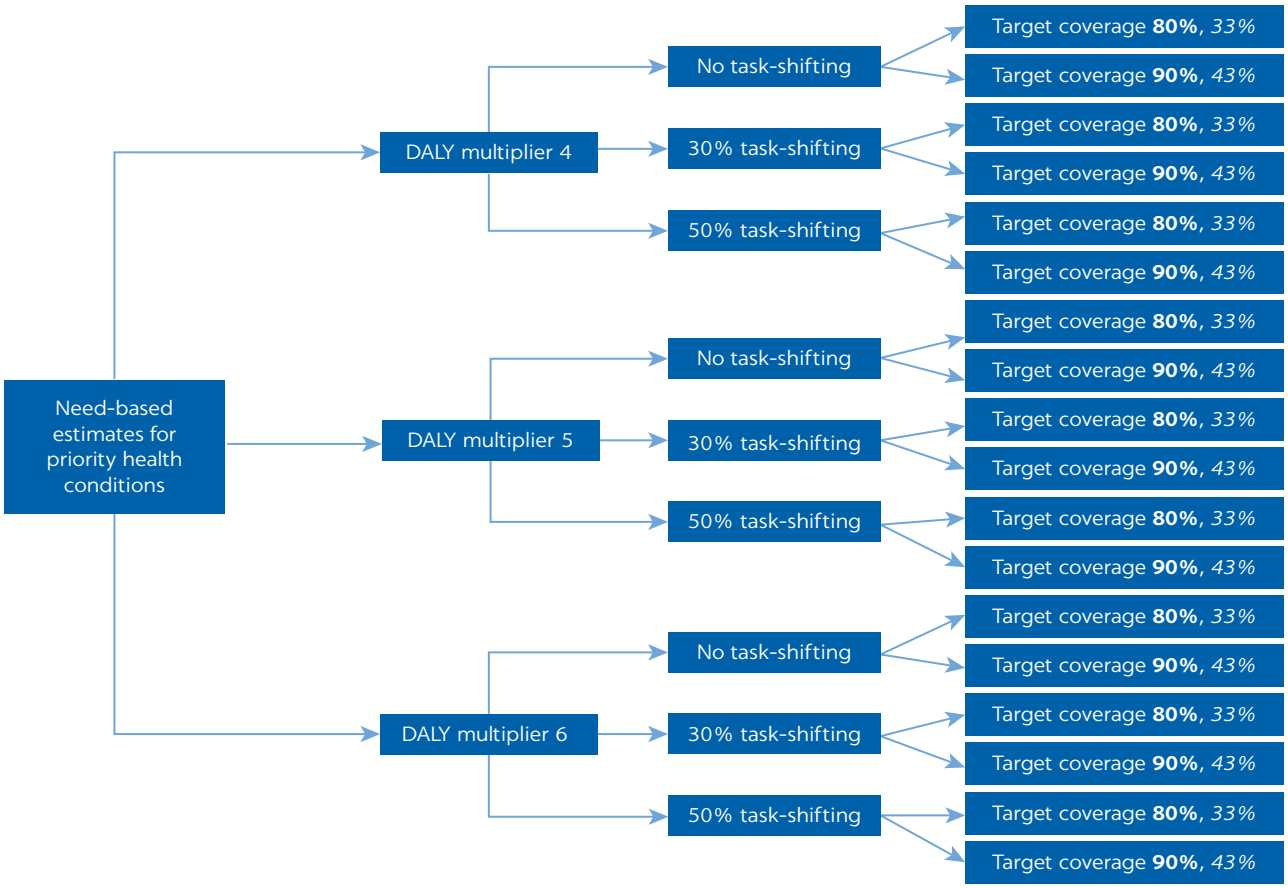
Source: World Bank.
Note: COPD = chronic obstructive pulmonary disease; n.a. = not applicable.
a. The inpatient days number is the same as the outpatient visits number because treatment for cardiovascular diseases ends up happening in outpatient settings 50 percent of the time and in inpatient settings 50 percent of the time.

account for 20 percent of the country's total burden of disease. Based on the proportionality assumption that the FTE health workers needed to treat the 20 percent of DALYs could treat the remaining 80 percent of DALYs with similar efficiency, the number of FTE staff needed to treat priority conditions was multiplied by a factor of 5 to obtain the total number of FTE health workers required to treat all health conditions in Saudi Arabia.

Next, need-based physician and nurse estimates were projected from 2020 to 2030 under various assumptions about scaling, staffing ratios, and target coverage rates (see the schematic diagram in figure 3.1). To meet different assumptions about scaling, two additional DALY multipliers (4 and 6) were applied to account for potential under- or overestimates of the burden of disease contributed by priority health conditions. Next, alternative staffing ratios, which assume that a percentage of tasks (30 percent or 50 percent) can be shifted from physicians to nurses, were applied. Staffing ratios in task-shifting scenarios were adjusted relative to the baseline staffing ratios described above. For instance, in the 30 percent task-shifting scenario, physicians perform approximately 1.2 percent of tasks in an outpatient setting and 7 percent of tasks in an inpatient setting.

FIGURE 3.1

Schematic diagram of 18 scenarios under various assumptions of scaling, task-shifting (across inpatient and outpatient settings), and target coverage level



Source: Original figure for this publication.
Note: Target coverage level percentages: **bold** = chronic conditions; *italics* = mental health disorders. DALY = disability-adjusted life year.

In addition, a speculative scenario was provided in which an educational campaign would increase treatment coverage rates for all health conditions by 10 percent. The resulting target coverage rates include 90 percent for ischemic heart disease, stroke, diabetes mellitus, COPD, and congenital anomalies, and 43 percent for major depressive disorder. The assumption of this education scenario is that persons with these conditions will be more likely to seek care. Modeling all possible combinations of assumptions and corresponding inputs resulted in FTE worker estimates for 18 scenarios (3 DALY multipliers × 3 staffing ratios × 2 levels of target coverage), of which a subset may be feasible given political and economic constraints.

RESULTS: THE EPIDEMIOLOGICAL NEED FOR PHYSICIANS AND NURSES IN 2030

A baseline need-based model was constructed making a number of specific assumptions about the prevalence and burden of priority health conditions, the capacity of the Saudi health care workforce, and the ability to detect cases. The need-based estimates were obtained using a model with the following specific assumptions: (1) priority health conditions account for 20 percent of the total burden of disease in Saudi Arabia (DALY multiplier of 5); (2) no task-shifting occurs; (3) physicians and nurses work 225 days per year and provide, on average, 11 consultations per day; and (4) 80 percent of expected cases receive treatment for cardiovascular diseases, diabetes, COPD, and congenital anomalies, and 33 percent receive treatment for major depressive disorder.

Under these assumptions, it was estimated that 64,000 FTE nurses and physicians would be needed in 2020, and 75,000 will be needed in 2030, to meet epidemiological needs. Using the need-based approach, it was estimated that 4,935 physicians and 59,054 nurses would be required to treat the epidemiological needs of the Saudi population in 2020. These values equate to 2.01 health workers (physicians and nurses) per 1,000 population. Under these same assumptions but using 2030 population projections, estimates were forecasted to expand to 5,788 physicians and 69,399 nurses. This equates to 2.05 physicians and nurses per 1,000 population in 2030. Table 3.3 provides an overview of needs for each year from 2020 through 2030.

The estimated number of FTE health workers needed is less than the total stock of physicians and nurses in Saudi Arabia, but above the stock of Saudi nationals only (excluding diploma nurses). According to recent data (OECD 2020a, 2020b), when counting both Saudi and non-Saudi nationals as well as bachelor and diploma nurses, there are approximately 67,000 physicians and 233,000 nurses in Saudi Arabia, which equates to about 9 health care workers per 1,000 population. This exceeds the need-based estimates calculated above (but does not account for economic factors that may also drive the supply of workers). At the same time, the need-based estimate does not exceed current stock if only Saudi nationals are counted and if bachelor nurses are separated from diploma nurses (that is, those who do not have a college degree in nursing). Only about 100,000 of the physicians and nurses are Saudi, which equates to about 3 physicians and nurses per 1,000 population. Without diploma nurses, the density of Saudi physicians and nurses is only 1.4 per 1,000 population.

TABLE 3.3 Annual baseline need-based physician and nurse estimates in Saudi Arabia, 2020–30

YEAR	PHYSICIANS	NURSES	TOTAL HEALTH WORKERS	HEALTH WORKERS PER 1,000 POPULATION
2020	4,935	59,054	63,989	2.01
2021	5,015	60,026	65,042	2.01
2022	5,096	61,002	66,098	2.01
2023	5,178	61,991	67,169	2.01
2024	5,261	62,998	68,259	2.01
2025	5,346	64,031	69,377	2.01
2026	5,432	65,071	70,502	2.02
2027	5,520	66,147	71,667	2.02
2028	5,611	67,245	72,856	2.03
2029	5,700	68,331	74,031	2.04
2030	5,788	69,399	75,187	2.05

Source: Original calculations for this publication.

The need-based estimates are based on the specific set of assumptions outlined above—which may well not reflect reality and may underestimate actual needs. It remains possible, for example, that the six priority health conditions represent less than 20 percent of the burden of priority health conditions, which affects the DALY multiplier and means that the need-based number of health workers was underestimated. Moreover, the model does not assume a worsening of the burden of chronic diseases over time; such an optimistic assumption also potentially leads to low estimates of need-based health workers (Memish et al. 2014). Assuming that no task-shifting from physicians to nurses occurs, for example, may lead to an overestimation of needed physicians. Furthermore, the assumption that physicians and nurses work 225 days per year and provide, on average, 11 consultations per day may be an overestimate. Lower physician and nurse productivity would mean more FTE health workers would be needed. Finally, the model does not envision health promotion campaigns, which could increase the target coverage rate by about 10 percent.

Alternative scenarios taking into account different assumptions reveal that the actual need for FTE physicians and nurses could be anywhere between 60,000 and 112,000 in 2030. Table 3.4 shows a wide range of need-based scenarios based on different model assumptions. Changes in the DALY multiplier reflect changes to the share that the six priority health conditions account for of the total burden of disease. The scenarios also reflect that task-shifting can occur. For example, enhancements in certifications or in training among nurses may increase task-shifting to between 30 percent and 50 percent, reducing the ratio of physicians to nurses. Some of the scenarios also reflect the impact of educational campaigns that may increase awareness of priority and other health conditions. Under scenarios in which educational campaigns occur, models assume that they succeed in improving case detection and diagnosis. To this end, the presumed target coverage rates for priority conditions is assumed to increase by 10 percent. Finally, the total number needed is adjusted by a scenario of lower productivity, in which health workers provide 7 consultations per day (instead of the previously assumed 11).

TABLE 3.4 Need-based estimates of the number of FTE physicians and nurses in 2030, according to model assumptions

	MODEL ASSUMPTIONS			NEED-BASED HEALTH WORKERS					
SCENARIO NUMBER	DALY MULTIPLIER	TASK-SHIFTING (%)	TARGET COVERAGE RATE (%)	PHYSICIANS	NURSES	TOTAL	PER 1,000 POPULATION	TOTAL PRODUCTIVITY ADJUSTED	PER 1,000 POPULATION
1	4	n.a.	n.a.	4,631	55,519	60,150	1.64	69,642	1.90
2	4	n.a.	+10	5,591	69,129	74,720	2.03	87,618	2.38
3	4	30	n.a.	3,241	56,908	60,150	1.64	69,642	1.90
4	4	30	+10	3,914	70,807	74,720	2.03	87,618	2.38
5	4	50	n.a.	2,315	57,835	60,150	1.64	69,642	1.90
6	4	50	+10	2,796	71,925	74,720	2.03	87,618	2.38
7[a]	**5**	**n.a.**	**n.a.**	**5,788**	**69,399**	**75,187**	**2.05**	**87,053**	**2.37**
8	5	n.a.	+10	6,989	86,412	93,401	2.54	109,522	2.98
9	5	30	n.a.	4,052	71,135	75,187	2.05	87,053	2.37
10	5	30	+10	4,892	88,508	93,401	2.54	109,522	2.98
11	5	50	n.a.	2,894	72,293	75,187	2.05	87,053	2.37
12	5	50	+10	3,494	89,906	93,401	2.54	109,522	2.98
13	6	n.a.	n.a.	6,946	83,279	90,225	2.46	104,464	2.84
14	6	n.a.	+10	8,387	103,694	112,081	3.05	131,427	3.58
15	6	30	n.a.	4,862	85,363	90,225	2.46	104,464	2.84
16	6	30	+10	5,871	106,210	112,081	3.05	131,427	3.58
17	6	50	n.a.	3,473	86,752	90,225	2.46	104,464	2.84
18	6	50	+10	4,193	107,887	112,081	3.05	131,427	3.58

Source: Original calculations for this publication.
Note: DALY = disability-adjusted life year; FTE = full-time equivalent; n.a. = not applicable.
a. Results of the primary baseline model.

CONCLUSION

The need-based modeling shows that the actual need for FTE physicians and nurses in 2030 could be anywhere between 60,000 and 112,000, depending on the assumptions made. This outcome translates into densities from 1.64 to 3.58 per 1,000 population in 2030. These densities fall within the general range of earlier benchmarks reported by the 2006 World Health Report (that is, 2.28) and the WHO Universal Health Coverage Report of 2016 (that is, 4.5) (WHO 2006, 2016). Importantly, however, the current modeling exercise provides a level of granularity for Saudi Arabia and uses detailed epidemiological estimates for one country. For this reason, the current need-based exercise for Saudi Arabia represents a substantial improvement relative to the use of population-level regression averages that rely on low- and middle-income country contexts and assume a social goal of universal health care coverage for all.

Saudi Arabia may not have a sufficient number of Saudi national health workers. Looking at current levels of the physician and nursing stock, and taking into account both Saudis and foreign nationals as well as diploma nurses, Saudi Arabia already has more than enough physicians and nurses to address epidemiological needs (though the need-based approach does not account for economic factors that may also drive the supply of workers). However, there may be an existing

need-based shortage at present, if counting only Saudi nationals, and particularly when diploma nurses—who do not have a college degree in nursing—are excluded. Whether there is a need-based shortage in relation to the projected supply of physicians and nurses in 2030 is explored in chapter 6.

Need-based estimates, although useful for workforce planning, rely on several assumptions. One key assumption is that the input data (for example, data on prevalence of conditions, treatment service coverage, worker productivity) are accurate. Additionally, models are initially based on prevalence estimates of six priority health conditions that impose substantial disability, morbidity, or mortality in Saudi Arabia. This approach may yield different results than one that attempts to enumerate the disease burden for every condition that affects the Saudi population. A scarcity of data is also noted on worker productivity, especially by country, for the number of patients a physician or nurse is able to see per day. Given that changing assumptions about productivity led to the largest variation in need-based worker projections, further examination of Saudi-specific worker productivity is viewed as a key avenue for future work on this topic.

In addition, planners should be reminded that estimates do not account for patient preferences. Patients may prefer a particular gender, a Saudi national versus a foreign health provider, a nurse versus a physician, or a resident versus a consultant. In this exercise, it was assumed that health care worker productivity can be applied equally to patients regardless of patient preferences. Of course, this may be politically and socially untenable or undesirable for the Saudi population from a demand-side perspective. It is therefore critical to understand patients' willingness to pay, as well as economic considerations, for certain provider preferences.

All of the scenarios modeled assumed no worsening in the burden of chronic diseases over time by 2030, other than what will occur as a result of population aging, which may be optimistic. Several projections about the burden of chronic diseases in Saudi Arabia into 2030 and beyond portend an increase in diabetes and heart disease, among other conditions. These increases may arise in part from the aging of the population and continued increases in obesity-related chronic diseases. To the extent that these trends continue, the overall prevalence of heart disease and diabetes could increase over time, and the workforce need-based estimates for Saudi Arabia might therefore be underestimated, regardless of the other assumptions made. Careful attention and monitoring are warranted to understand these conditions into the future.

Important questions of ideal worker mix, moreover, require further inquiry and input from Saudi stakeholders. Important questions remain about the costs of employing and training physicians versus nurses, the quality of training programs for various worker specialties, and goals to reduce reliance on foreign workers. All of these issues represent important policy and economic considerations that are not the focus of this epidemiological exercise but warrant continued attention. The need-based estimates, therefore, should be placed within the larger context of the mix of public and private investments, as well as patient preferences, regarding what gender, worker type, and skill mix would be ideal for Saudi Arabia.

Wealthy neighboring countries with demographics similar to those of Saudi Arabia might benefit from this analysis. The Gulf Cooperation Council (GCC) countries share common challenges associated with health care workers'

availability and distribution (El-Jardali et al. 2007; El-Jardali et al. 2012; Sheikh et al. 2019). Furthermore, evidence shows that very similar patterns of noncommunicable diseases and associated risk factors are observed in the GCC countries (Alhyas, McKay, and Majeed 2012; Alshaikh et al. 2017; Ng et al. 2011; Rahim et al. 2014). This approach may therefore be a viable tool for anticipating the right number of physicians and nurses needed into the future in any other member country of the GCC.

Finally, estimates of need-based workforce densities depend strongly on how *need* is defined (Campbell et al. 2013). A need-based approach is in contrast to economic, or willingness-to-pay, approaches that consider the economic aspects of price, supply, and demand (Liu et al. 2017; MOH 2017). Where country-level data are available, the use of need-based forecasts is encouraged as a complement to labor market demand–based forecasts. Furthermore, integration of preventive and public health efforts as part of the Vision 2030 strategy, which focuses on the social and economic determinants of health, may crucially affect workforce need. Taken together, these multisector strategies will assist with setting appropriate workforce goals and consequent planning for 2030.

ANNEX 3A: NEED-BASED PROJECTION DETAILS

This annex presents more detailed data and sources that underlie the projections of the chapter.

Population-based estimates of prevalence for priority conditions

Priority conditions were identified from the 2030 Health Sector Transformation Strategy document, prepared by the MOH as part of the Saudi Vision 2030 initiative. Population-based prevalence estimates for selected priority health conditions were retrieved from national health surveys conducted in Saudi Arabia, peer-reviewed epidemiological literature, and the Global Health Data Exchange (GHDx) (table 3A.1). The GHDx is a data catalogue, created by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington, that publishes data collected from the Global Burden of Disease (GBD) Study 2017 (IHME 2018).

National health surveys, including the General Authority for Statistics (GASTAT) Household Health Survey and the Saudi Health Interview Survey (SHIS), were prioritized because local surveys generally provide more accurate estimates than those obtained using modeling strategies conducted at a regional (for example, North African) level. When data were available from multiple national health surveys, more recent estimates were selected. For example, the prevalence of diabetes mellitus was estimated at 8.5 percent in 2018 by the GASTAT Household Health Survey (selected), compared with the prevalence estimate of 13.4 percent in 2013 by the SHIS.

Service delivery models

Service delivery models of cost-effective interventions were applied to each condition to estimate the number of outpatient visits and inpatient bed-days per

year (table 3A.2). Service delivery models were based on previous cost-effectiveness analyses of primary prevention, treatment, and secondary prevention strategies to reduce the burden of noncommunicable diseases and mental disorders in upper-middle-income and high-income countries. Table 3A.3 shows the primary source of information (and location in text, if available) used in calculations of outpatient visits and inpatient bed-days for each priority condition.

TABLE 3A.1 All population–based estimates of prevalence for priority health conditions, color coded by data source type

PREVALENCE OF HEALTH CONDITION (%)					
ISCHEMIC HEART DISEASE	CEREBROVASCULAR DISEASE (STROKE)	MAJOR DEPRESSIVE DISORDER	DIABETES MELLITUS	CHRONIC OBSTRUCTIVE PULMONARY DISEASE	CONGENITAL ANOMALIES
2.35	**0.65**[a]	**2.78**[a]	5.46	1.80	**1.24**[a]
5.50		3.0 (males) 9.0 (females)[b]	13.40	**2.40**	
			8.50[a]		
			17.72		

Sources: Data points in the table are color coded to their corresponding source, as shown below.

IHME 2018
Primary source literature
Saudi Health Interview Survey 2013 (http://www.healthdata.org/ksa/projects/saudi-health-interview-survey)
GASTAT 2018
World Bank Health Nutrition and Population Statistics, 2017 (https://databank.worldbank.org/source/health-nutrition-and-population-statistics)
Saudi National Mental Health Survey 2019

Note: **Bold** values represent the prevalence for that column's condition that was used for the need-based exercise.
a. Selected prevalence estimate.
b. Lifetime prevalence.

TABLE 3A.2 Annual quantities of outpatient visits and inpatient bed-days based on target population (cases seeking care) and service delivery models, by priority condition, 2030

	A. HEART DISEASE AND STROKE (COMBINED), TARGET POPULATION *N* = 1,525,397						
	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	TOTAL
Outpatient visits	Percent visiting a PHC: primary prevention (high risk of CVD event): 30%	Average annual visits: 3	Percent visiting a PHC: secondary prevention (established CVD history): 20%	Average annual visits: 4	Percent visiting a PHC: follow-up (after acute CVD event): 15%	Average annual visits: 2	*Total annual outpatient visits:* 3,050,794
Inpatient stays	Percent visiting a hospital (acute MI phase): 10%	Average days: 5	Percent visiting a hospital (acute stroke phase): 10%	Average days: 15	n.a.	n.a.	*Total annual inpatient days:* 3,050,794

continued

TABLE 3A.2, continued

	B. MAJOR DEPRESSIVE DISORDER, TARGET POPULATION *N* = 284,431										
	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	TOTAL
Outpatient visits	Percent visiting day care: 1%	Average annual visits: 50	Percent visiting hospital outpatient service: 20%	Average annual visits: 7	Percent visiting PHC—treat: 30%	Average annual visits: 7	Percent visiting PHC—screen: 7%	Average annual visits: 1	Percent visiting psycho-social care: 20%	Average annual visits: 6	*Total annual outpatient visits:* 1,498,950
Inpatient stays	Percent visiting residential care: 0.5%	Average days: 90	Percent visiting psychiatric units: 2%	Average days: 14	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	*Total annual inpatient days:* 207,634

	C. DIABETES MELLITUS, TARGET POPULATION *N* = 2,108,272		
	ACTIVITY	AVERAGE	TOTAL
Outpatient visits	Percent visiting PHC—primary prevention (for example, glycemic control): 50%	Average annual visits: 4	*Total annual outpatient visits:* 4,216,544
Inpatient stays	Percent visiting a hospital: 10%	Average days: 4	*Total annual inpatient days:* 843,308

	D. CHRONIC OBSTRUCTIVE PULMONARY DISEASE, TARGET POPULATION *N* = 595,277								
	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	TOTAL
Outpatient visits	Percent visiting PHC—primary prevention (for example, tobacco cessation): 30%	Average annual visits: 3	Percent visiting hospital outpatient service (COPD stage II): 20%	Average annual visits: 5	Percent visiting hospital outpatient services (COPD stage III/IV): 7%	Average annual visits: 7	Percent receiving long-term oxygen therapy (COPD stage IV): 2%	Average annual visits: 7	*Total annual outpatient visits:* 1,506,050
Inpatient stays	Percent visiting a hospital: 5%	Average days: 11	Percent visiting ICU: 5%	Average days: 1	n.a.	n.a.	n.a.	n.a.	*Total annual inpatient days:* 357,166

	E. CONGENITAL ANOMALIES, TARGET POPULATION *N* = 25,544						
	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	ACTIVITY	AVERAGE	TOTAL
Outpatient visits	Percent visiting a hospital for an outpatient service (for example, cleft lip repair): 25%	Average annual visits: 1	n.a.	n.a.	n.a.	n.a.	*Total annual outpatient visits:* 6,386
Inpatient stays	Percent visiting neonatal operations—cleft palate repair: 10%	Average days: 3	Percent visiting neonatal operations—heart anomalies: 30%	Average days: 10	Percent visiting prenatal or neonatal operations—neural tube defects: 5%	Average days: 20	*Total annual inpatient days:* 109,839

Source: World Bank.
Note: COPD = chronic obstructive pulmonary disease; CVD = cardiovascular disease; ICU = intensive care unit; MI = myocardial infarction; n.a. = not applicable; PHC = primary health center.

TABLE 3A.3 Service delivery model exemplars for priority conditions

PRIORITY CONDITION	SOURCE	LOCATION IN SOURCE TEXT
Heart disease and stroke (combined)	Salomon et al. 2012 [Technical Appendix]	Main text (pp. 19–20)
Heart disease (acute)	Berger et al. 2008	Figure 1. Hospital length of stay stratified by sample year (p. 7)
Stroke (acute)	Kwok et al. 2012	Table 1. Characteristics of study population [length of stay] (p. 728)
Major depressive disorder	Bruckner et al. 2011	Table 2. Service coverage and mean utilization rate
Diabetes mellitus	Salomon et al. 2012 [Technical Appendix]	Table A25. Annual quantities of inpatient bed-days and outpatient visits for diabetes (p. 25)
Chronic obstructive pulmonary disease (COPD)	Salomon et al. 2012 [Technical Appendix]	Table A18. Annual quantities of inpatient bed-days and outpatient visits for COPD (p. 17)
Congenital anomalies	Higashi et al. 2015	Table 2. Burden of congenital anomalies amenable to surgery in low- and middle-income regions (p. 234)
Cleft lip	Lee, Yen, and Allareddy 2018	Table 2. Length of stay and total charges—all ages and by age groups (p. 532)
Congenital heart disease	Silberbach et al. 1993	Table 2. Influence of preoperative conditions on hospital charge and postoperative length of stay (p. 960)

Source: World Bank.

FULL-TIME EQUIVALENT (FTE) PHYSICIANS AND NURSES

Outpatient visits and inpatient bed-days were converted into the FTE number of physicians and nurses needed to treat priority health conditions. Physicians and nurses were assumed to work 225 days per year and, in non–productivity-adjusted models, provide 11 consultations per day. The total number of expected outpatient visits was divided by 2,475 (225 × 11) to obtain an estimate of the number of FTE physicians and nurses needed for outpatient care. The numbers of FTE physicians and nurses required to meet inpatient needs were estimated under the assumption that hospitals operate at 85 percent capacity. A correction factor of 1.15 was therefore applied to obtain the target number of inpatient beds (table 3A.4) (Bruckner et al. 2011; WHO, n.d.).

Scale-up multiplier

A scale-up multiplier was used to convert FTE physicians and nurses needed to treat priority conditions to FTE physicians and nurses needed to treat all health conditions in Saudi Arabia. Scale-up models assume that, on average, the health workforce required to treat a health condition is proportional to that condition's contribution to the total burden of disease, as measured by DALYs. This assumption was derived from data on the use of health care services, retrieved from the FutureDocs Forecasting Tool[3] and the Global Burden of Disease 2017 (IHME 2018) for select health conditions in the United States (table 3A.5).

TABLE 3A.4 Workforce requirements for outpatient and inpatient services, priority health conditions

WORKFORCE REQUIREMENT	SERVICES		
Total services	Total annual outpatient visits: 10,278,724	Total annual inpatient days: 4,568,742	n.a.
Staffing estimates	Current consultations per day: 11	Working days per year: 225	FTE outpatient staff: 4,153
Outpatient requirements	FTE physicians: 69	FTE nurses: 4,084	n.a.
Inpatient requirements	Inpatient beds: 10,884	FTE physicians: 1,088	FTE nurses: 9,796
Workforce requirements	Physicians: 1,158	Nurses: 13,880	Total: 15,037

Source: World Bank.
Note: FTE = full-time equivalent; n.a. = not applicable.

TABLE 3A.5 Use of health services and burden of disease for selected health conditions, United States

	USE OF HEALTH CARE SERVICES				BURDEN OF DISEASE	
CAUSE	INPATIENT VISITS	OUTPATIENT VISITS	ALL SETTINGS VISITS	SHARE OF TOTAL USE (%)	DALYs	SHARE OF TOTAL DALYs (%)
Respiratory	3,329,320	92,353,798	95,683,118	6.83	6,465,807	6.43
Congenital	1,119,520	3,615,114	4,734,634	0.34	952,072	0.95
Musculoskeletal	2,972,067	130,025,772	132,997,839	9.50	9,682,811	9.63
Mental	2,853,839	72,381,935	75,235,774	5.37	5,371,622	5.34
All causes	37,726,020	1,362,399,266	1,400,125,286	n.a.	100,563,718	n.a.

Sources: Data for the use of health care services are from the FutureDocs Forecasting Tool; data for the burden of disease are from the Global Burden of Disease Study 2017 (IHME 2018).
Note: DALY = disability-adjusted life year; n.a. = not applicable.

NOTES

1. World Bank, Databank, Health Nutrition and Population Statistics, https://databank.worldbank.org/source/health-nutrition-and-population-statistics.
2. IHME, Saudi Health Interview Survey (SHIS), 2013, http://www.healthdata.org/ksa/projects/saudi-health-interview-survey.
3. FutureDocs Forecasting Tool (https://www2.shepscenter.unc.edu/workforce/).

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4 Projecting the Supply of Nurses and Physicians in Saudi Arabia

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KEY MESSAGES

- The Saudi health sector is projected to have enough Saudi health workers to meet need-based demand (estimated in chapter 3) through 2030, assuming no policy interventions.
- Assuming no policy interventions, the vast majority of the increased number of Saudi health workers through 2030 is projected to be employed in the Ministry of Health (MOH) sector.
- In the MOH, Saudi nurses will continue to outnumber foreign nurses, but in the private health sector, the employment of Saudi nurses will likely remain low.
- With no policy intervention, trends in the supply of Saudi health workers suggest there will be a shortage in primary care settings in 2030.
- The number of Saudi female physicians is expected to grow, but their proportion relative to their male counterparts is projected to decrease without policy intervention.

BACKGROUND

To prepare the health workforce in Saudi Arabia to effectively address changing priorities in the health system, it is crucial to understand the health labor market supply—what it is now, and what it will be in 2030. *Health labor market supply* is defined as the number of health professionals with the appropriate skills and qualifications who are willing to take available jobs in the health sector (Liu et al. 2016).

This chapter uses an econometric modeling approach to project the supply of the physician and nurse workforce for 2030, assuming that past and present trends in areas such as education output and emigration continue. In other words, these projections reflect a baseline status quo situation of the total number of health workers available with no new policy intervention. These projections are needed to calculate any gaps between supply and the number of physicians and nurses needed in 2030 (*need-based demand*) or the number of

physicians and nurses that the country can afford in 2030 (*labor market demand*). Such a gap analysis is presented in chapter 6.

The remainder of this chapter is organized as follows: the next section provides a brief overview of the methods used to project labor supply of physicians and nurses. The following two sections summarize the projected physician and nurse workforces, respectively, assuming that past trends in workforce dynamics continue. First, an overview of the total physician and nurse supply, including both foreign and Saudi health workers, is presented; then, the analyses focus on the supply of Saudi health workers by different worker characteristics (nationality and gender) and by facility type (hospital or primary care). The next section presents estimates for the supply of health workers (physicians and nurses) focusing only on the supply of Saudi health workers, and the final section concludes. Annex 4A provides an extensive explanation and all calculations linked to the methodology.

OVERVIEW OF METHODS TO PROJECT SUPPLY

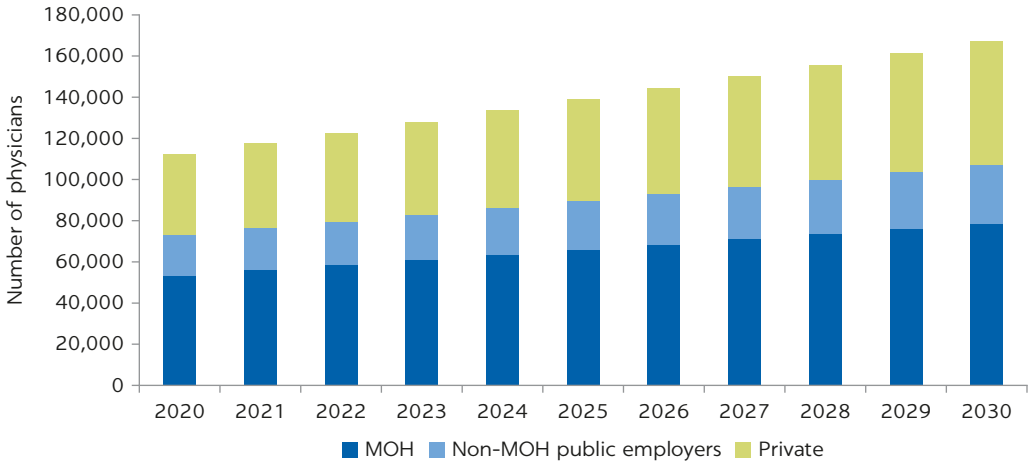
The future supply of physicians and nurses was projected using a linear growth model that assumes that past trends in worker numbers continue. Various econometric approaches can be used to project the supply of health workers into the future, each with advantages and disadvantages (see table 2.1 in chapter 2 for details on the model choices). The most suitable econometric modeling approach for this analysis was determined to be the growth rate method, which has previously been used for health worker projections (Liu et al. 2016; Scheffler et al. 2008). The growth rate method was chosen because historical data for the Saudi health workforce were available for only 11 years (2007–18) (see table 4A.1 for details on variables and time frame).

The growth rate approach uses a linear functional form, based on a status quo scenario that assumes that growth in supply is exogenous and trends only with time, following historic trends. In other words, the approach uses only the past trends of the number of physicians and nurses employed in the health labor market and projects these trends into the future. Education sector output trends, as well as attrition from the labor market, are thus implicitly captured by the model, which assumes that these factors remain constant between now and 2030. This scenario implies a relatively rigid labor market, which may be plausible for a health labor market characterized by limited competition.

To project the supply of MOH and private sector health workers from 2019 to 2030, available regional data on MOH and private sector physicians and nurses were stratified by nationality (Saudi or foreign), gender (male or female), and facility type (hospital setting or primary care setting). Regional data were available for the number of physicians and nurses employed (1) by the MOH only in the public sector, and (2) by all employers in the private sector; regional data did not include physicians and nurses working for non-MOH employers in the public sector, such as the Ministry of the National Guard, the Ministry of Defense, the Ministry of Interior, King Faisal Specialist Hospital & Research Centre, and several other sectors. This limitation is illustrated in figure 4.1, which shows the projected number of physicians from 2020 to 2030 and their breakdown within the public sector and compared with the private sector. The MOH employs approximately 75 percent of physicians and nurses in the public sector and accounts for the largest share

FIGURE 4.1

Number of physicians, by sector, 2020–30



Source: Original calculations for this publication.
Note: MOH = Ministry of Health.

(65 percent) of governmental health expenditure in Saudi Arabia (World Bank 2018). Therefore, despite limitations, these data capture the largest portion of those employed in the public sector, and the resulting analyses provide a useful stratification of different workforce characteristics. Additional analytical steps were taken to account for these data limitations and to generate estimates of the supply of health workers in the overall public sector, as presented in chapter 6. Furthermore, given that data for non-MOH public sector workers were available only at the national level, the projected regional supplies of health workers were first aggregated to generate the national supply of health workers in the MOH and the private sector (including health workers working in hospitals, private clinics, and polyclinics) from 2019 to 2030. Then, national data on the distribution of public sector workers employed by the MOH versus non-MOH providers were used to estimate the total supply of workers in the public sector, which are presented in detail in the gap analysis in chapter 6; these supply projections, however, are not stratified by gender and facility type.

For physicians, the regional data combine the number of physicians and dentists into a single category. However, in the MOH, dentists account for a small portion (10 percent) of the physician and dentist workforce (see the Saudi Health Council Balanced Distribution Data Set 2018), and the data largely capture the physician workforce. Nevertheless, the projection for physicians may reflect an overestimate of the supply of physicians.

For nurses, the data and projections were further adjusted to separate nurses with a diploma (referred to as *diploma nurses*), who are increasingly classified as technicians, from nurses with a bachelor's or advanced degree (referred to as *bachelor* and *advanced nurses*). The data on nurses from the MOH combine diploma, bachelor, and advanced nurses into one group, and the projections of the nurse supply reflect this aggregate definition. However, this categorization likely reflects an overestimate of the true supply of nurses who perform patient care duties according to international standard definitions for the nursing profession. Approximately 67 percent of all nurses (foreign and Saudi) are diploma nurses, whose scope of work is closer to

medical assistants or technicians than to nurses engaged in patient care (data are from 2018 cross-sectional data; see the Saudi Health Council Balanced Distribution Data Set 2018). Given this important difference in categorization, simulations to determine the percentage of bachelor and advanced nurses out of the total nursing cadre were conducted; these findings are presented in chapter 6. Note that data on physicians incorporate both generalists and specialists—the classifications of whom are similar to international professional standards—and a small portion of dentists. The physician data and classification obviated the need for any additional adjustments for worker numbers.

To enable comparison with estimated supply changes associated with policy interventions, projected estimates of health worker numbers were additionally adjusted for worker productivity, yielding a full-time equivalent employee estimate. Additional steps to include worker productivity are discussed in chapter 6. The adjusted full-time equivalent supply of health workers is also presented in chapter 6.

The methodology outlined relies on historical trends in worker supply, building on previous work by the Saudi Commission for Health Specialties. In its report, *The State of the Health Saudi Workforce over the Next Ten Years 2018–2027* (SCFHS 2017), the supply of physicians and nurses from 2017 to 2027 was estimated from data on numbers of medical and nursing students. The stock-and-flow model assumed a set attrition rate for each cadre, varying only by worker nationality (foreign versus Saudi). However, there are additional paths for entry to and exit from the labor force—immigration, death and retirement, change in employment to and from nonhealth sectors—that should also be accounted for in such an approach, but doing so may be challenging because of data availability. The methodology used in the present study accounts for the net total of these flows into and out of the health workforce by implicitely assuming that historical worker numbers reflect labor market equilibrium. In other words, whereas SCFHS (2017) projects forward the output of education institutions and makes assumptions about graduation rates and attrition out of the labor market, the growth rate aproach incorporates production output and exit by projecting forward the past trend of physicians and nurses already employed in the health labor market.

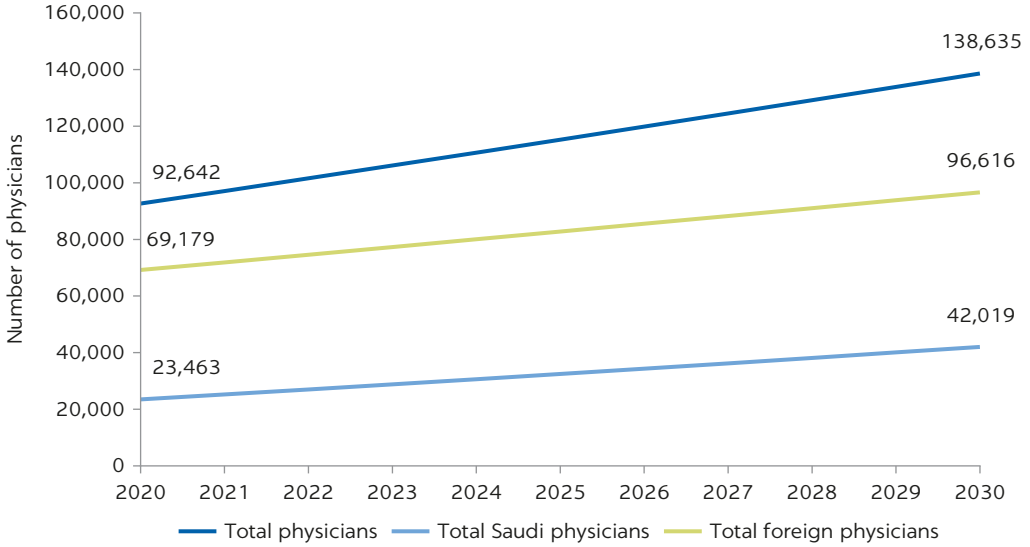
The status quo baseline projections presented in this chapter also assume that entry and exit patterns remain constant, and no other policy intervention that may change the historical trend in supply and productivity. Details on the data and methods underlying the projections can be found in annex 4A. In chapter 6, the historical trend in supply and productivity is further examined. In the simulated scenarios in chapter 7, these assumptions are relaxed; the impact of policy interventions (for example, delayed retirement, Saudization of the workforce, increased productivity) on health workforce supply are evaluated.

PROJECTED SUPPLY OF PHYSICIANS WITH NO REFORM

Without policy change, the number of Saudi physicians will double by 2030, and may be even higher when taking physicians in the non-MOH public sector into account. Figure 4.2 shows that, based on past trends, the number of Saudi physicians will increase from 23,463 in 2020 to 42,019 in 2030—a 79 percent increase. The Saudi physician density per 1,000 population is projected to change

FIGURE 4.2

Projected supply of physicians, MOH and private sectors combined, by nationality, 2020–30



Source: Original calculations for this publication.
Note: Physicians includes dentists. MOH = Ministry of Health.

from 0.67 in 2020 to 1.07 in 2030. As noted, these and all projections in this chapter exclude the roughly 25 percent of physicians employed outside the private sector and the MOH.

With no policy change, foreign physicians will continue to dominate the physician workforce in 2030. Figure 4.2 shows that, assuming no policy change and continuing trends, the total number of physicians employed will grow from 92,642 in 2020 to 138,635 in 2030. However, the percentage of Saudi physicians relative to their foreign counterparts will increase very little—from 25 percent (23,463 out of 92,642) to 30 percent (42,019 out of 138,635).

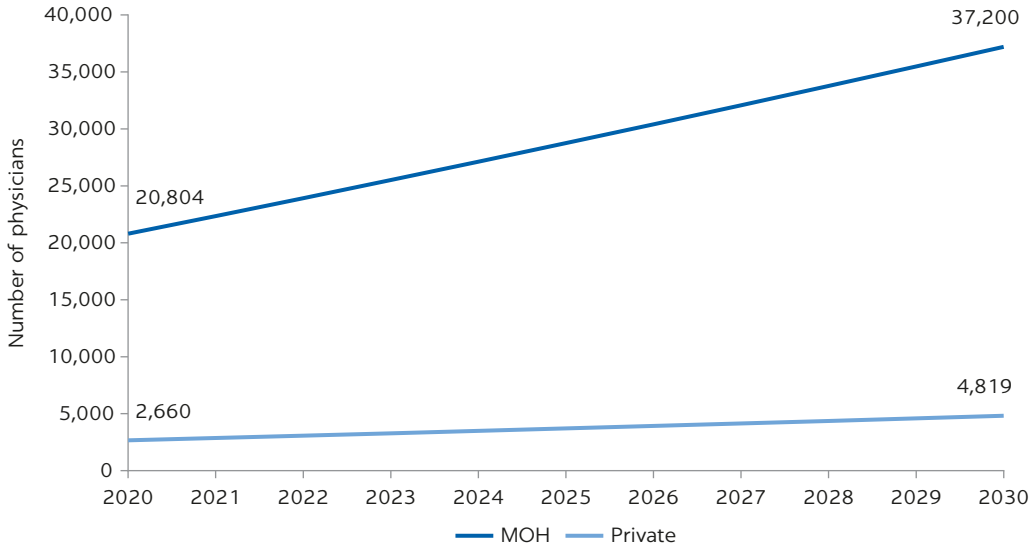
With no policy change, most of the increased supply of Saudi physicians will occur in the MOH sector (figure 4.3), increasing by 79 percent from 20,804 in 2020 to 37,200 in 2030. The number of Saudi physicians employed in private sector facilities is projected to increase by 2,159 or 81 percent from 2,660 in 2020 to 4,819 in 2030.

With no policy change, foreign physicians will still outnumber Saudi physicians in the MOH public sector. Analysis by nationality (figure 4.4) indicates that, based on past trends, the percentage of Saudi physicians employed within the MOH will remain relatively static. In 2020, 89 percent of Saudi physicians (20,804 out of 23,464) were employed in the MOH. Similarly, by 2030, 89 percent (37,200 out of 42,109) of Saudi physicians will be employed in the MOH.

With no policy change, the number of Saudi female physicians will grow, but their proportion relative to their male counterparts will decline by 2030. Based on past trends, Saudi men will continue to dominate the Saudi physician market. Analysis by gender (figure 4.5) shows that the MOH employs fewer female physicians than male physicians (including both Saudi and foreign physicians). The same pattern persists when examining only Saudi physicians (figure 4.6)—and this pattern will likely continue over time with a decreasing proportion of

FIGURE 4.3

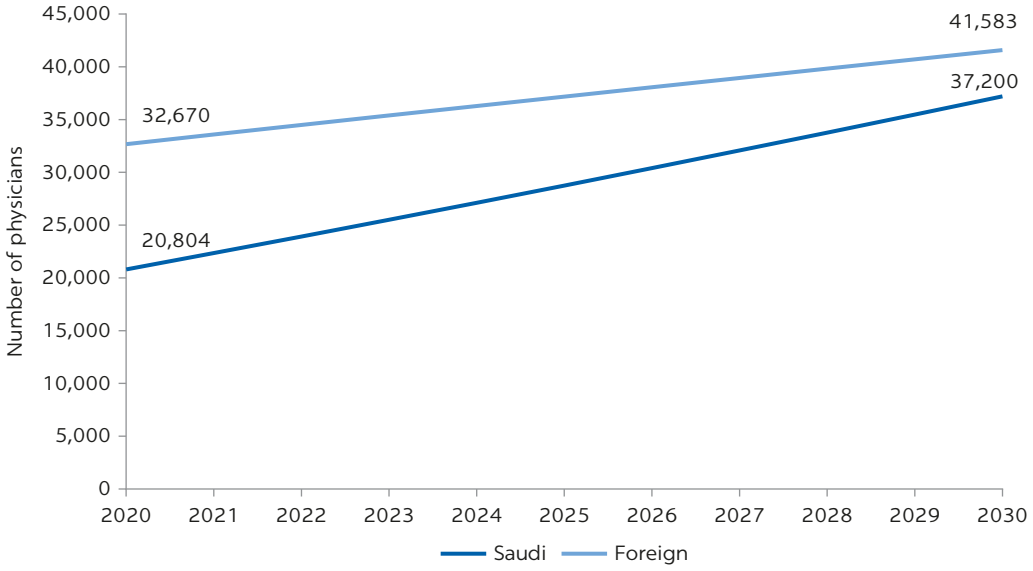
Projected supply of Saudi physicians, MOH and private sector, 2020–30



Source: Original calculations for this publication.
Note: Physicians includes dentists. MOH = Ministry of Health.

FIGURE 4.4

Projected number of physicians in the MOH, by nationality, 2020–30



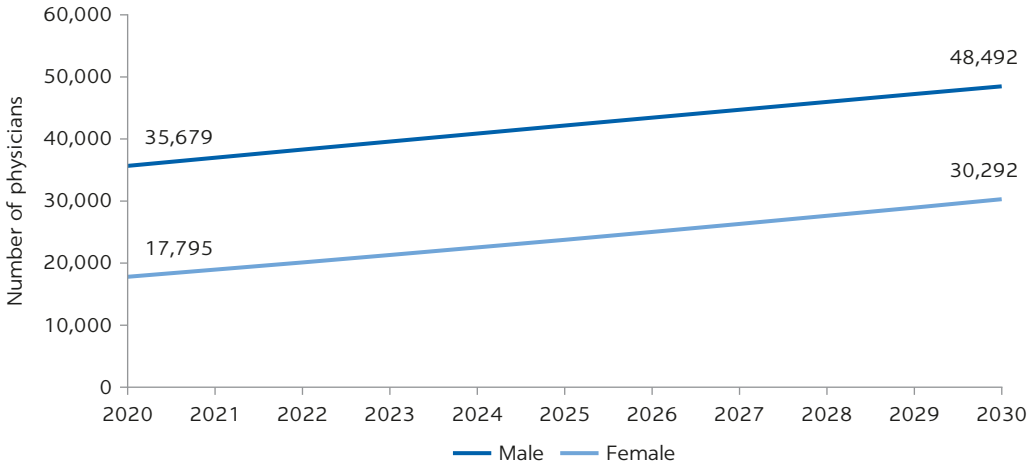
Source: Original calculations for this publication.
Note: Physicians includes dentists. MOH = Ministry of Health.

Saudi women physicians. In 2020, 33 percent (6,797 out of 20,804) of physicians employed by the MOH were female. By 2030, among the 47 percent (37,200 out of 78,784) of MOH physicians who are Saudi, only 31 percent (11,426 out of 37,200) will be female.

With no policy change, increased employment of Saudi physicians in the private sector will be minimal, but will be driven largely by female physicians. Based

FIGURE 4.5

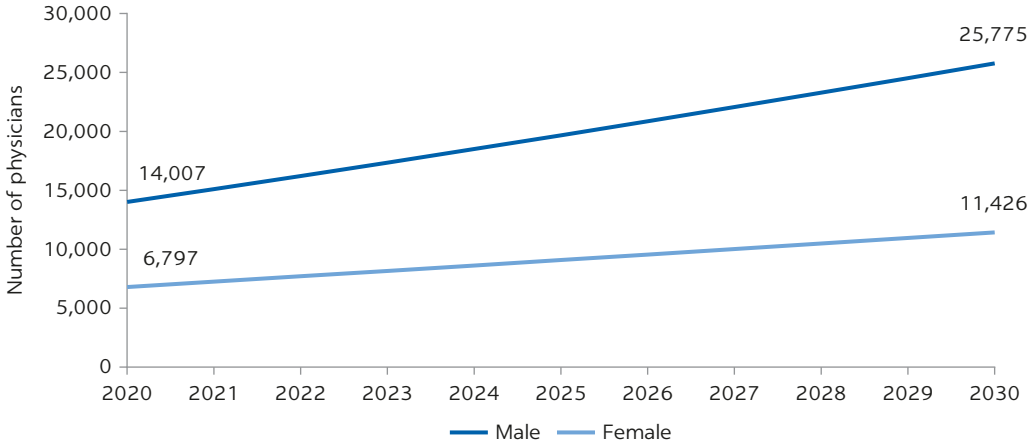
Projected number of Saudi and foreign physicians in the MOH, by gender, 2020–30



Source: Original calculations for this publication.
Note: Physicians includes dentists. MOH = Ministry of Health

FIGURE 4.6

Projected number of Saudi physicians in the MOH, by gender, 2020–30



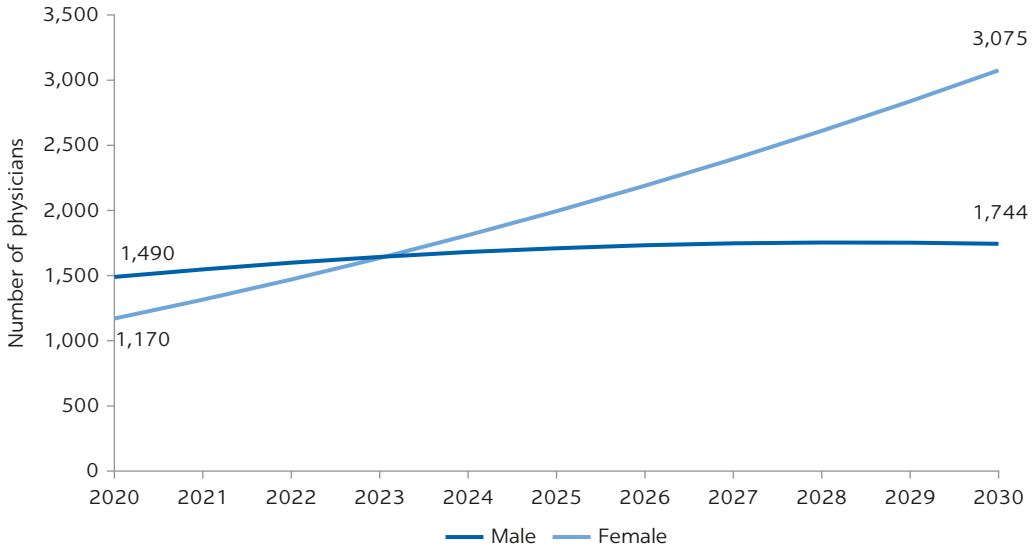
Source: Original calculations for this publication.
Note: Physicians includes dentists. MOH = Ministry of Health.

on past trends, figure 4.7 shows that a progressively larger proportion of Saudi female physicians will be present in the private health care sector. In 2007, only 22 percent (131 out of 594) of Saudi physicians in the private sector were women, which increased to 44 percent (1,170 out of 2,660) by 2020. By 2030, a projected 8 percent (4,819 out of 59,851) of physicians working in the private sector will be Saudi, of whom 64 percent (3,075 out of 4,819) are estimated to be women.

With no policy change, the majority of Saudi physicians will continue to work at the hospital level in 2030 rather than in primary care settings. Figure 4.8 shows that, in 2020, 66 percent (13,829 out of 20,804) of Saudi physicians in the

FIGURE 4.7

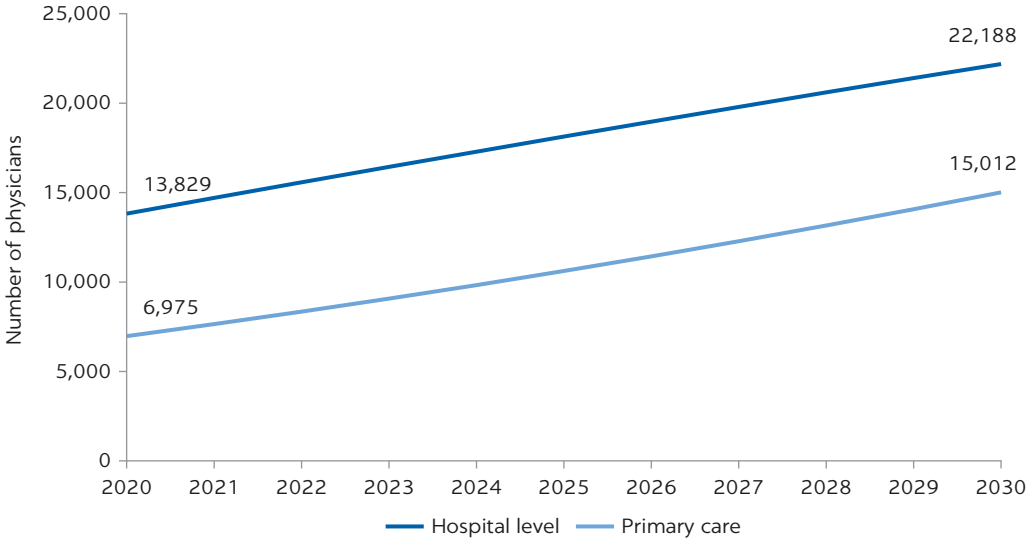
Projected private sector employment of Saudi physicians, by gender, 2020–30



Source: Original calculations for this publication.
Note: Physicians includes dentists.

FIGURE 4.8

Projected number of Saudi physicians in the MOH, by facility type, 2020–30



Source: Original calculations for this publication.
Note: Physicians includes dentists. MOH = Ministry of Health.

MOH worked in hospital settings, which is projected to decline to 60 percent (22,188 out of 37,200) by 2030. The projected distribution of physicians across facility types indicates that 61 percent (35,364 out of 57, 552) of MOH physicians in hospital settings will be foreign and 39 percent (22,188 out of 57,552) of MOH physicians in hospital settings will be Saudi.

PROJECTED SUPPLY OF NURSES WITH NO REFORM

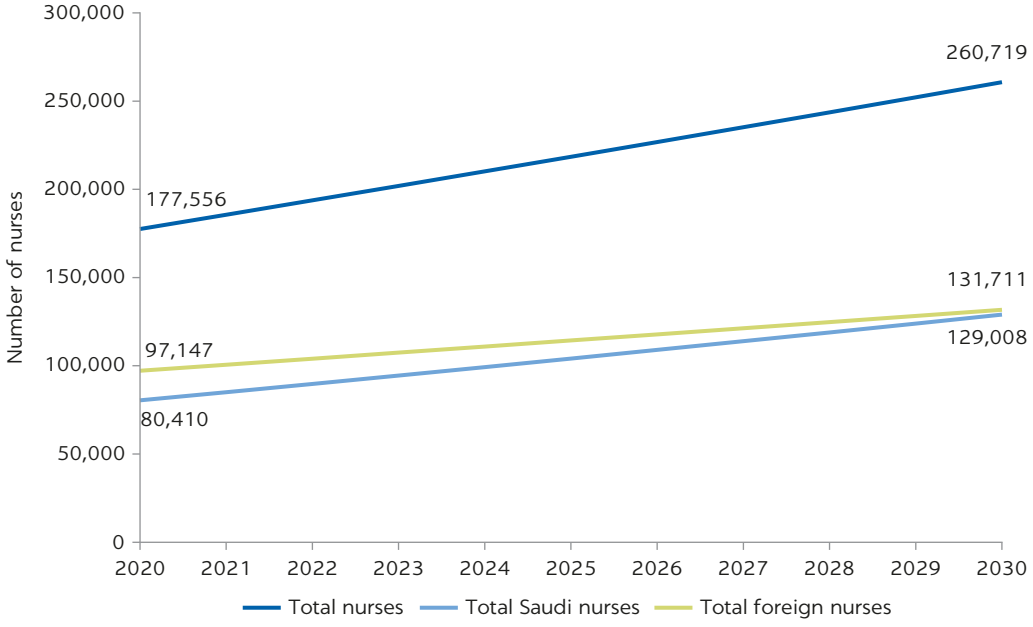
With no policy change, the number of Saudi nurses will increase by 60 percent (from 80,410 to 129,008) by 2030 and may be even higher when accounting for those in the non-MOH public sector. Assuming that past trends continue, and taking diploma, bachelor, and advanced nurses together, figure 4.9 shows that the number of Saudi nurses is estimated to increase from 80,410 in 2020 to 129,008 in 2030. These numbers translate into a density of 1.95 nurses per 1,000 population in 2020 and 3.28 in 2030. The projected numbers are far lower when diploma nurses (more akin to technicians), who comprise approximately 67 percent of all nurses (foreign and Saudi), are excluded. Additional analysis disaggregating subcategories of nurses is presented in chapters 6 and 7.

With no policy change, the proportion of Saudi nurses will increase and be nearly equal to that of foreign nurses by 2030. Figure 4.9 shows that, assuming no policy change and continuing trends, the total number of nurses will grow from 177,556 in 2020 to 260,719 in 2030, a 47 percent increase. Assuming no policy change, the percentage of Saudi nurses relative to their foreign counterparts will increase from 45 percent (80,410 out of 177,556) to 49 percent (80,410 out of 177,556) by 2030. However, this upward trend considers all subcategories of nurses, including diploma, bachelor, and advanced nurses. Additional analysis disaggregating subcategories of nurses is presented in chapters 6 and 7.

With no policy change, most of the increased number of Saudi nurses will likely be employed in the MOH sector; increases in the private sector will be minimal (figure 4.10). The increase in Saudi nurses will occur predominantly in MOH facilities—a 60 percent increase from 77,502 in 2020 to 124,025 in 2030. Comparatively, the increase in the number of Saudi nurses in private sector facilities is projected to grow from 2,908 in 2020 to 4,983 in 2030 (an increase of approximately 71 percent). By 2030, most (96 percent) Saudi nurses (124,025 out of 129,008) will be employed in the MOH sector, assuming no policy change.

FIGURE 4.9

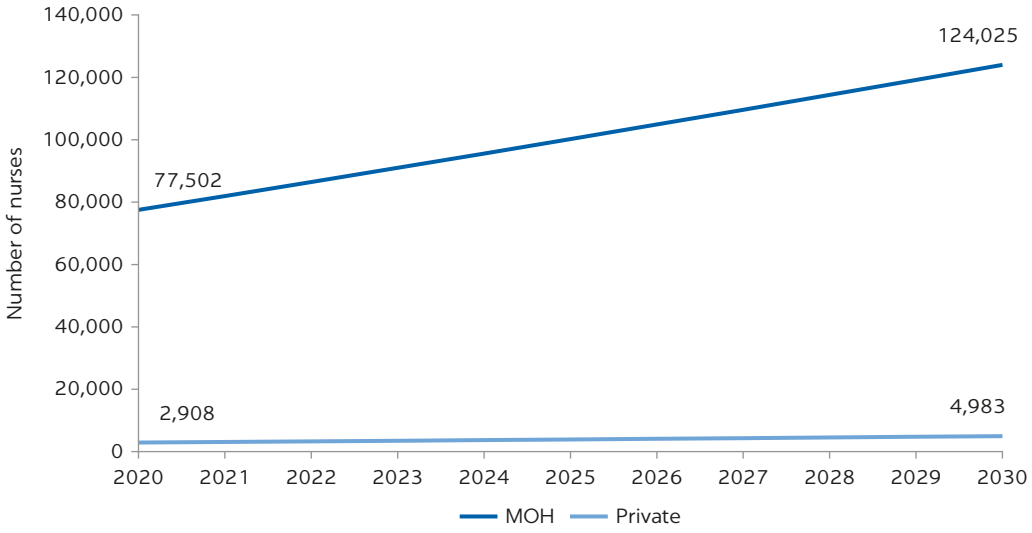
Projected number of Saudi and foreign nurses, 2020–30



Source: Original calculations for this publication.
Note: Saudi and foreign nurses include diploma, bachelor, and advanced nurses.

FIGURE 4.10

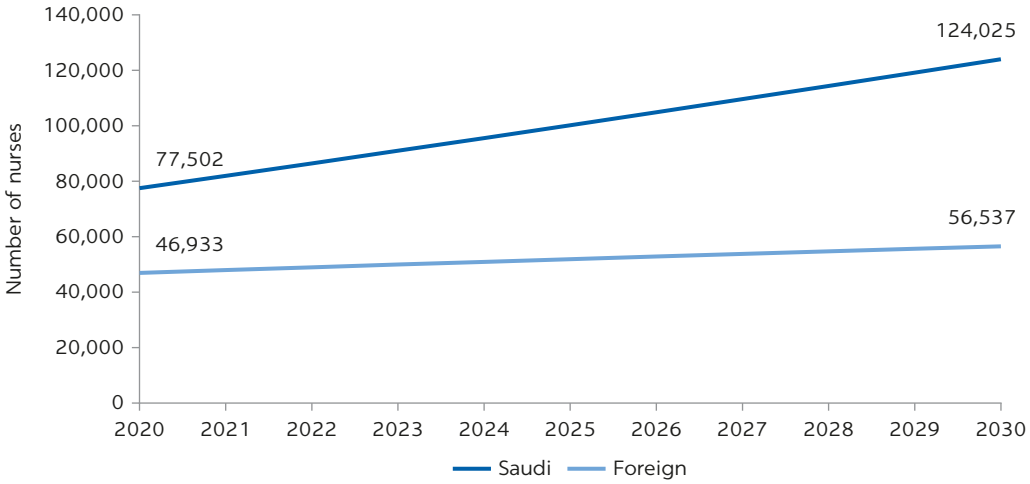
Projected number of Saudi nurses in the MOH versus private sector facilities, 2020–30



Source: Original calculations for this publication.
Note: Saudi nurses includes diploma, bachelor, and advanced nurses. MOH = Ministry of Health.

FIGURE 4.11

Projected number of nurses in the MOH, by nationality, 2020–30



Source: Original calculations for this publication.
Note: Saudi nurses includes diploma, bachelor, and advanced nurses; foreign nurses includes diploma nurses only. MOH = Ministry of Health.

With no policy change, Saudi nurses will continue to outnumber foreign nurses in the MOH, and this difference will grow substantially by 2030, as illustrated in figure 4.11. By 2030, there will be more than twice as many Saudi nurses in the MOH as foreign nurses. However, this picture changes substantially if diploma nurses are excluded from the nursing category. This scenario is addressed in chapters 6 and 7.

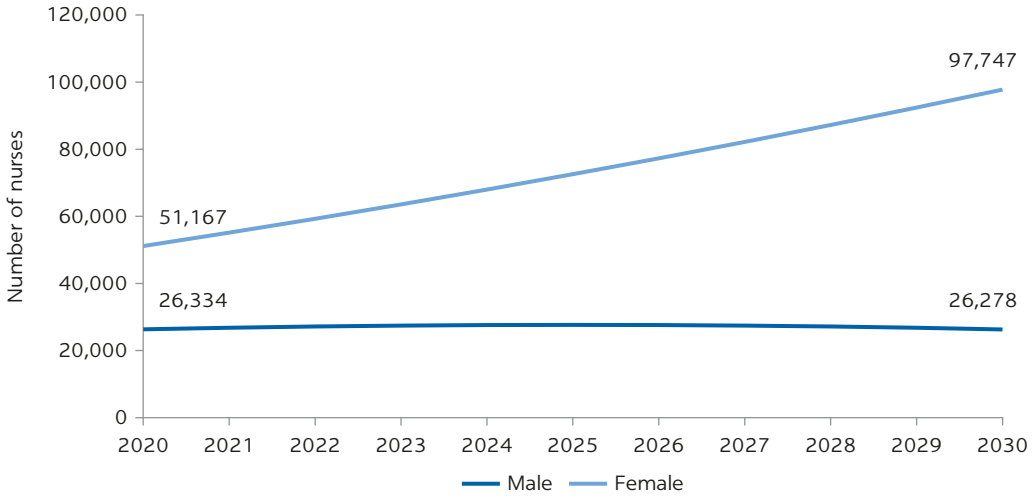
With no policy change, the number of Saudi female nurses will grow rapidly while the number of Saudi male nurses will largely remain flat. Based on past trends and with no policy changes, Saudi female nurses will increase from 51,167 to 97,747 between 2020 and 2030, a 91 percent increase within the MOH.

Within the MOH, the number of Saudi male nurses will remain relatively flat, declining from 26,334 to 26,278, a 0.2 percent decrease, between 2020 and 2030 (figure 4.12).

Although overall employment of Saudi nurses in the private sector is low, it is projected to more than double by 2030 with no policy change, mainly because of the increase in Saudi female nurses. Analysis of nurses by gender in the private sector is presented in figure 4.13. Of the projected Saudi nurses in the private sector, 90 percent (4,473 out of 4,983) will be female and 10 percent (510 out of 4,983) will be male. With no policy change, few male nurses will find their way into the private sector.

FIGURE 4.12

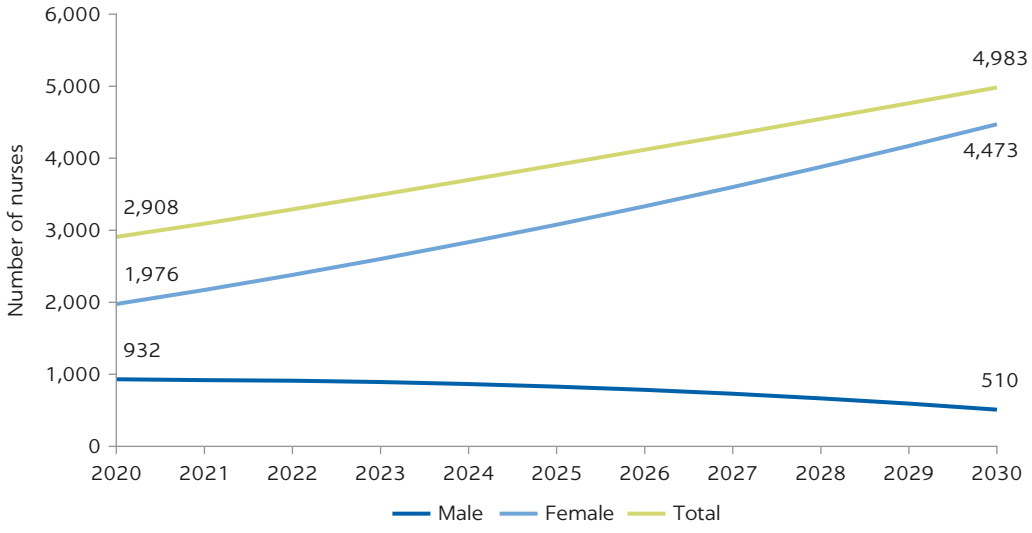
Projected number of Saudi female versus male nurses in the MOH, 2020–30



Source: Original calculations for this publication.
Note: Nurses includes diploma, bachelor, and advanced nurses. MOH = Ministry of Health.

FIGURE 4.13

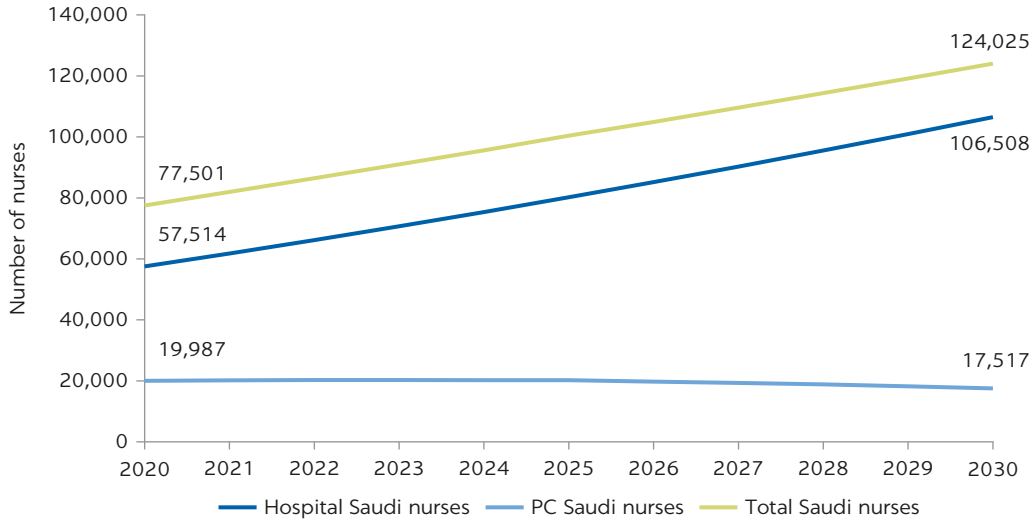
Projected number of Saudi nurses in the private sector, by gender, 2020–30



Source: Original calculations for this publication.
Note: Nurses includes diploma, bachelor, and advanced nurses.

FIGURE 4.14

Projected number of Saudi nurses in hospital and primary care facilities, 2020–30



Source: Original calculations for this publication.
Note: Saudi nurses includes diploma, bachelor, and advanced nurses. PC = primary care.

With no policy change, the main increase in Saudi nurses will be in hospital settings, whereas the number of Saudi nurses in primary care settings will decrease from 2020 to 2030. In 2020, 74 percent (57,514 out of 77,501) of Saudi nurses worked in hospital settings, and this percentage is projected to increase to 86 percent by 2030 (106,508 out of 124,025). Conversely, the number of Saudi nurses at the primary care level will decrease from 19,987 in 2020 to 17,517 in 2030 (figure 4.14).

PROJECTED TOTAL SUPPLY OF SAUDI PHYSICIANS AND NURSES

Assuming no policy change, the supply of Saudi physicians and nurses is projected to increase substantially between 2020 and 2030 (see table 4.1 for overall and figure 4.15 for Ministry of Health, specifically). Taking the projections above and focusing on only Saudi health workers, the total number of Saudi physicians and nurses is projected to increase from 103,873 in 2020 to 171,027 in 2030—a 65 percent increase.

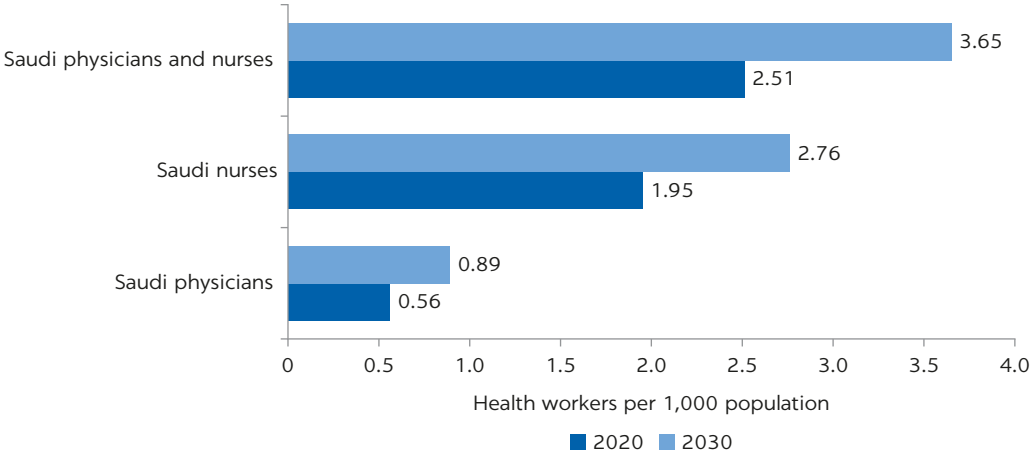
With no policy change, the projected Saudi health worker density of 4.35 physicians and nurses per 1,000 population falls within the range of 2.11 physicians and 15.36 nurses per 1,000 population observed across Organisation for Economic Co-operation and Development (OECD) countries.[1] Furthermore, the projected supply in Saudi Arabia will be able to meet the Saudi-specific need-based demand for health workers, which ranges from 1.64 to 3.58 per 1,000 population under various scenarios (see chapter 3). Note that these worker densities consider all subcategories of nurses, which may overestimate the effective supply of nurses because diploma nurses are included; analyses in later chapters provide separate estimates for nursing subcategories. In addition, the projections presented here exclude non-MOH public sector health workers; therefore, the number of

TABLE 4.1 **Projected supply of Saudi physicians and nurses, 2020 and 2030**

	2020		2030		PERCENT CHANGE	
	NUMBER	DENSITY	NUMBER	DENSITY	NUMBER	DENSITY
Saudi physicians	23,463	0.67	42,019	1.07	79.1	59.7
Saudi nurses	80,410	2.31	129,008	3.28	60.4	42.0
Saudi physicians and nurses	103,873	2.98	171,027	4.35	64.7	46.0

Source: Original calculations for this publication.
Note: Physicians includes dentists. Density is per 1,000 population.

FIGURE 4.15
Projected health worker densities in Saudi Arabia in the MOH, 2020 and 2030



Source: Original calculations for this publication.
Note: Data are for MOH facilities only. Physicians includes dentists. Nurses includes diploma, bachelor, and advanced nurses. MOH = Ministry of Health.

workers may also be slightly underestimated. Estimates including non-MOH public sector health workers and considering worker productivity are further explored in chapters 6 and 7.

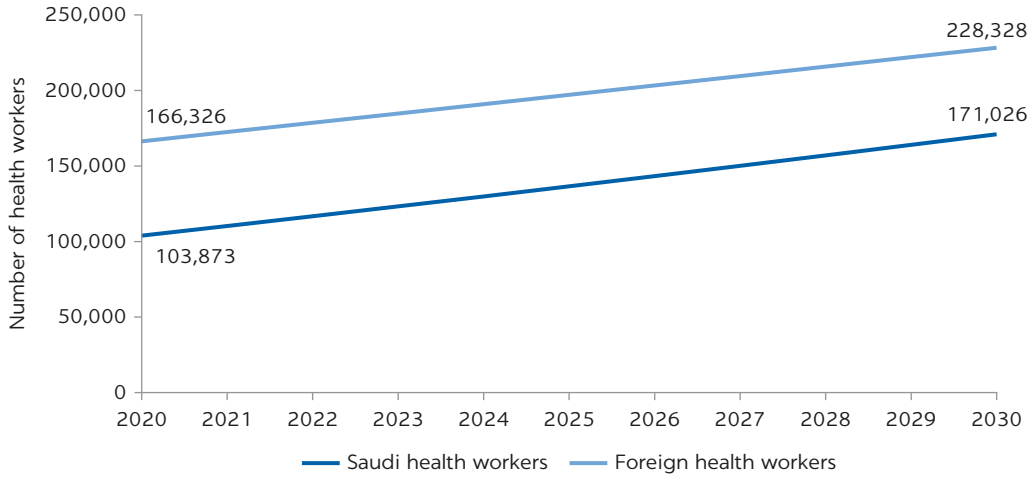
For physicians and nurses together, the percentage of foreign workers is projected to decrease (see figure 4.16). In 2020, 62 percent (166,326 out of 270,199) of health workers were foreign workers. By 2030, it is estimated that 57 percent (228,328 out of 399,354) will be foreign health workers. Despite the projected reduced share of foreign workers, with no policy change, Saudization goals for health workers are unlikely to be achieved by 2030.

Most Saudi physicians and nurses are projected to work for the MOH, and the number is estimated to increase by 2030. With no policy change, by 2030, only 6 percent (9,801 out of 171,026) of Saudi physicians and nurses are anticipated to be working in the private sector. This trend has implications for finances and public sector funding that may run counter to strategic plans to increase the role of the private sector in Saudi Arabia.

Most Saudi health workers are projected to work at the hospital level rather than in primary care. The percentage of Saudi health workers employed in primary care is projected to decrease from 29 percent (30,231 out of 103,874) in 2020 to 22 percent (38,060 out of 171,027) in 2030 (see figure 4.17). This trend runs counter to strategic goals for reorienting the health system around primary care and prevention and increasing the number of primary care workers.

FIGURE 4.16

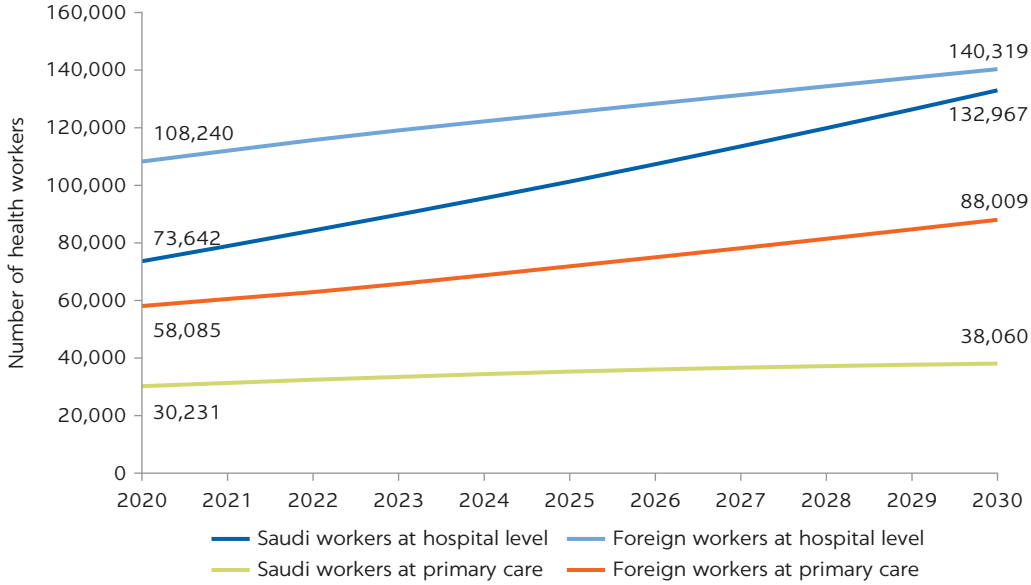
Projected total health workers in Saudi Arabia, by nationality, 2020–30



Source: Original calculations for this publication.

FIGURE 4.17

Projected total health workers, by nationality and facility type, 2020–30

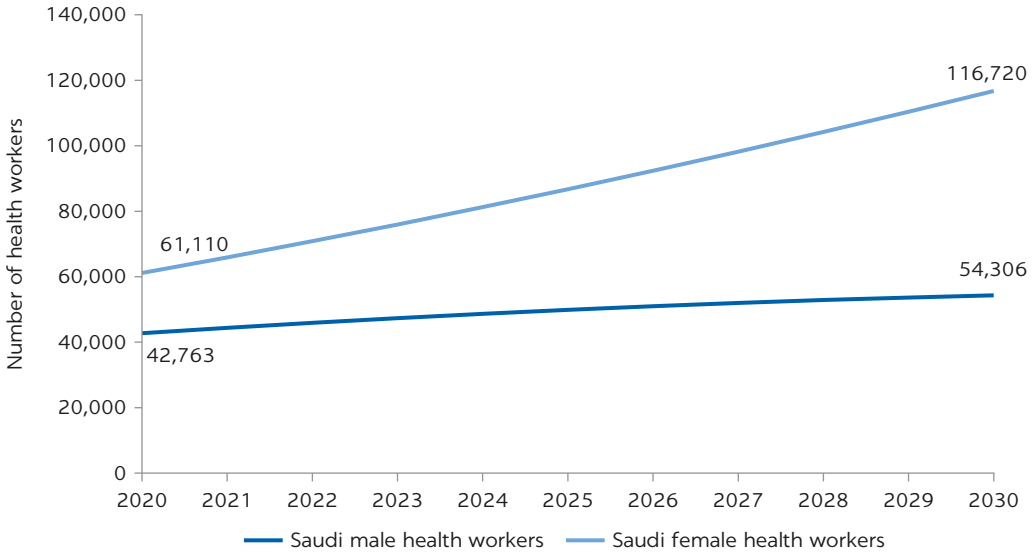


Source: Original calculations for this publication.

By 2030, with no policy change, the gender balance among health workers is projected to have minimal improvement. In 2020, 41 percent (42,763 out of 103,873) of Saudi health workers were male, and by 2030, an estimated 32 percent (54,306 out of 171,026) of health workers will be male (figure 4.18). However, the percentage of female workers is skewed and largely driven by the nursing cadre, which is dominated by female workers. When examining the percentage of Saudi physicians by gender, by 2030, 35 percent (14,501 out of 24,019) will be female and 65 percent (27,519 out of 42,019) will be male (figure 4.19).

FIGURE 4.18

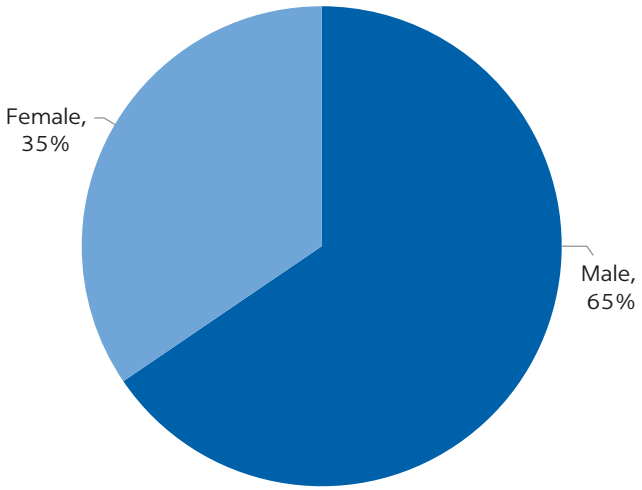
Projected total Saudi health workers, by gender, 2020–30



Source: Original calculations for this publication.

FIGURE 4.19

Projected shares of Saudi physicians, by gender, 2030



Source: Original calculations for this publication.

CONCLUSION

With no policy change, the number of Saudi physicians and nurses is projected to increase steadily between 2020 and 2030.

Assuming no policy intervention, the health sector is projected to have enough Saudi health workers to meet the need-based demand as estimated in chapter 3. However, the projected number of physicians includes dentists, which may overestimate the workforce's ability to meet need-based demand. Similarly, the projected number of nurses in this chapter includes diploma nurses, which

may overestimate the workforce's ability to meet need-based demand because of the limited training that diploma nurses have. As such, the nursing cadre will be unpacked, and subcategories of nurses will be further explored in chapter 6 and chapter 7.

With no policy intervention, most of the increase in Saudi health workers is projected to be employed in the MOH sector. Saudi nurses will continue to outnumber foreign nurses in the MOH and the overall employment of Saudi nurses in the private sector will likely remain low.

Trends suggest that, with no policy intervention, there will be a shortage of Saudi health workers in primary care settings. Saudi health workers are more likely to be working in hospital settings across both the MOH and the private sector.

The number of Saudi female physicians will grow, but their proportion relative to their male counterparts will decline by 2030, assuming no policy change to provide incentives to female physicians to join the workforce. A similar pattern exists for foreign female physicians. Overall, the number of female physicians is projected to decrease, assuming no policy intervention.

Policy intervention will be crucial to ensuring that the objectives of reorienting the health system to center around primary care and preventive care are met. Similarly, policy changes will be required to ensure that the supply of female physicians meets patient demand.

ANNEX 4A: SUPPLY PROJECTIONS

The most suitable econometric modeling approach for this analysis was determined to be the growth rate method, which has previously been used in health worker projections (Liu et al. 2016; Scheffler et al. 2008). This modeling approach was used largely because the time frame for the available data for the Saudi health workforce was only 11 years—from 2007 to 2018 (table 4A.1).

Linear growth model

This growth rate model assumes that current trends in the growth of the number of physicians and the number of nurses will continue as they have historically for each region. The growth rate approach adopts the linear functional form depicted in equations (4.1) and (4.2). Equations (4.1) and (4.2) were estimated for each of the 20 regions in Saudi Arabia from time $t = \{2007, \ldots, 2018\}$ where ε_t is the random disturbance term and α_0, β_0, α_1, and β_1 are unknown parameters, with the last two parameters representing the growth rates to be estimated from the model.

$$\ln(\textit{Physicians per 1,000 population}_t) = \alpha_0 + \alpha_1 \times \textit{year}_t + \varepsilon_t \quad (4.1)$$

$$\ln(\textit{Nurses per 1,000 population}_t) = \beta_0 + \beta_1 \times \textit{year}_t + \varepsilon_t \quad (4.2)$$

Because of data constraints, the analysis uses a more conservative linear specification (as opposed to an exponential specification) based on a status quo scenario that assumes that supply growth is exogenous and trends only with

TABLE 4A.1 Data sources for Saudi Arabia

INDICATOR	UNIT	YEARS	SOURCE
Number of physicians and nurses	Region	2007–18	MOH 2019
Number of physicians and nurses by nationality (Saudi or foreign)	Region	2007–18	MOH 2019
Number of physicians and nurses by gender	Region	2007–18	MOH 2019
Number of physicians and nurses by facility type (hospital or primary care)	Region	2007–18	MOH 2019
Number of physicians and nurses by sector (MOH or private)	Region	2007–18	MOH 2019
Number of physicians and nurses in the public sector by MOH and non-MOH employers	National	2007–18	MOH 2019
Population	Region	2007–18	MOH 2019
Total population and population projection	National	2007–30	UN DESA Population Division 2019

Source: World Bank.
Note: MOH = Ministry of Health.

time, following historic trends. This scenario also implies a relatively rigid labor market, which may be plausible for the health labor market characterized by limited competition.

Regional data used for this analysis were available for the numbers of physicians and nurses employed by the MOH only in the public sector and employed by all employers in the private sector (see table 4A.1). In other words, regional data did not include information on physicians and nurses working for non-MOH employers in the public sector, which were available only at the national level. Available regional data on physicians and nurses were stratified by nationality (that is, Saudi or foreign), gender, and facility type (hospital setting or primary care setting).

Because data on nurses combine diploma, bachelor, and advanced nurses into a single group, projections of the supply of nurses reflect this aggregate definition. This categorization likely leads to an overestimation of the supply of nurses trained to complete nursing tasks if compared with international standards. Approximately 67 percent of overall nurses (based on cross-sectional Balanced Distribution data from 2018) were diploma nurses, who are more similar to medical assistants than to nurses based on international standards. As such, the expectation was that the supply of nurses able to complete nursing tasks was lower than the total numbers of nurses reported. Because of this shortcoming, simulations leveraging an additional cross-sectional data set that disaggregates diploma, bachelor, and advanced nurses are conducted in chapter 6.

Projected future population data by region were required to calculate the number of health workers from projected health worker densities. The same linear growth rate approach was used to obtain projected future population by region. Using the yearly percentage of total national population for each region from 2007 to 2018 (obtained from the MOH),[2] the growth rate for each region was estimated and applied to existing estimates of future national population provided by the United Nations Department of Economic and Social Affairs (UN DESA) Population Division to yield estimated future population by region.

The densities for Saudi health workers and foreign health workers employed by the MOH in the public sector and for all employers in the private sector in each region-year were calculated by dividing the number of workers in each region by the population of each region. Equation (4.1) was estimated for each region for physicians, and equation (4.2) was estimated for each region for nurses. To predict future (2019–30) values of worker densities, the following rules were applied:

- The following groups of physicians were projected separately: Saudi physicians in the MOH, foreign physicians in the MOH, Saudi physicians in the private sector, foreign physicians in the private sector.
- The following groups of nurses were projected separately: Saudi nurses in the MOH, foreign nurses in the MOH, Saudi nurses in the private sector, foreign nurses in the private sector.
- Where at least two data points were available, the estimated linear trend was extended into the future, until 2030, using the estimated coefficients α and β.
- Estimated linear growth for each region was presented with no adjustment.
- For both physicians and nurses, if the predicted number in any year was negative, the number was replaced with 0. This was done in the following instances: private sector Saudi physicians working in hospital settings from 2025 to 2030 and MOH foreign nurses working in primary care settings from 2025 to 2030.

Supply projection model variants

The model variants and outcome variables for physicians and nurses are summarized in tables 4A.3 and 4A.4, respectively. Although the supply of physicians and nurses overall (see equations (4.1) and (4.2)) use worker densities (workers per 1,000 population) as the outcome variable, projections for subcategories of workers by gender were made using worker percentages. These percentages, reflecting different subcategories of workers (for example, Saudi female physicians and nurses, Saudi male physicians and nurses, foreign female physicians and nurses, and foreign male physicians and nurses), were then separately projected for each subcategory. Similarly, calculations for MOH and private sector physicians and nurses by nationality and gender were conducted separately, generating ratios specifically for the MOH and percentages specifically for the private sector. These historical percentages were then projected into the future using the growth rate model. The projected percentages were then multiplied by the projected densities of health workers in their respective nationality group and respective sector to generate estimated densities of Saudi and foreign workers by worker type (physicians, nurses) and gender from 2019 to 2030.

The supply of physicians and nurses by facility type (either a hospital setting or a primary care setting) was projected using only the data on health workers from hospital settings. The reason for focusing on data from hospital settings was because of data inconsistencies. In many cases, the sum of hospital setting physicians and nurses and primary care setting physicians and nurses employed by the MOH and employed in the private sector did not equal

TABLE 4A.2 Outcome variables and definitions for physicians

OUTCOME VARIABLE	DEFINITION
Saudi physicians employed by the MOH	Total number of Saudi physicians employed by the MOH, including Saudi physicians of both genders and working in all facility types
Foreign physicians employed by the MOH	Total number of foreign physicians employed by the MOH, including foreign physicians of both genders and working in all facility types
Saudi physicians employed by the private sector	Total number of Saudi physicians employed by the private sector, including Saudi physicians of both genders and working in all facility types
Foreign physicians employed by the private sector	Total number of foreign physicians employed by the private sector, including foreign physicians of both genders and working in all facility types

Source: Original table for this publication.
Note: MOH = Ministry of Health.

TABLE 4A.3 Outcome variables and definitions for nurses

OUTCOME VARIABLE	DEFINITION
Saudi nurses employed by the MOH	Total number of Saudi nurses employed by the MOH, including Saudi nurses of both genders and working in all facility types
Foreign nurses employed by the MOH	Total number of foreign nurses employed by the MOH, including foreign nurses of both genders and working in all facility types
Saudi nurses employed by the private sector	Total number of Saudi nurses employed by the private sector, including Saudi nurses of both genders and working in all facility types
Foreign nurses employed by the private sector	Total number of foreign nurses employed by the private sector, including foreign nurses of both genders and working in all facility types

Source: Original table for this publication.
Note: MOH = Ministry of Health.

the total number of workers in each respective sector. Therefore, the analysis assumed that the number of physicians and nurses in the primary care setting was the difference between the total number of physicians and nurses and the number of physicians and nurses in the hospital setting in each sector. Then, historical regional ratios of Saudi health workers working in hospital settings and in primary care settings and foreign health workers working in hospital settings and in primary care settings were calculated. Calculations by sector (MOH and private) were conducted separately, generating sector-specific ratios. Using the same linear growth rate approach, these ratios of health workers by facility type were projected into the future and multiplied by the projected number of workers in their respective nationality and sector group to generate the number of Saudi and foreign physicians and nurses by gender and by facility type from 2019 to 2030.

The projected densities for public sector physicians and nurses employed by the MOH and private sector physicians and nurses employed by all private employers for each future region-year were then multiplied by the projected regional population in that year to obtain the absolute number of physicians and nurses. Then, estimates for each region were summed by year and aggregated to the national level to generate a national trend in the projected supply of physicians and nurses.

Additional steps were taken to project the total number of public sector workers, incorporating the supply of physicians and nurses in the public sector

but who were not employed by the MOH. Because yearly data on the number of public sector workers at the regional level were not available, national-level data on the number of public sector health workers in the MOH and outside the MOH were used. The national percentage of physicians and nurses working for the MOH out of total public sector workers was projected into the future. These percentages were then used to calculate the estimated national number of public sector workers, including all public sector employers, from 2020 to 2030.

Projection results for physicians

The projections for physicians by nationality and sector are given in table 4A.4. The overall number of physicians will increase steadily. Foreign physicians in the private sector is the largest group: assuming no policy change, by 2030, 69.7 percent (96,616 out of 138,635) of physicians will be foreign. Furthermore, most (88.5 percent) Saudi physicians (37,200 out of 42,019) will be employed in the MOH.

TABLE 4A.4 Historical and projected number of physicians, by sector and nationality, 2007–30

YEAR	TOTAL PHYSICIANS	TOTAL SAUDI PHYSICIANS	TOTAL FOREIGN PHYSICIANS	MOH		PRIVATE SECTOR	
				SAUDI	FOREIGN	SAUDI	FOREIGN
2007	36,844	5,042	31,802	4,448	17,928	594	13,874
2008	40,998	5,354	35,644	4,619	19,935	735	15,709
2009	42,353	6,572	35,781	5,744	19,842	828	15,939
2010	52,375	7,669	44,706	6,718	24,523	951	20,183
2011	55,876	8,949	46,927	7,713	26,017	1,236	20,910
2012	57,714	10,248	47,466	9,012	26,556	1,236	20,910
2013	66,926	11,045	55,881	10,420	27,503	625	28,378
2014	66,202	12,068	54,134	11,352	26,104	716	28,030
2015	69,962	14,131	55,831	13,294	27,571	837	28,260
2016	72,040	15,070	56,970	14,091	28,248	979	28,722
2017	80,162	19,672	60,490	16,659	29,663	3,013	30,827
2018	84,632	23,555	61,077	19,861	29,230	3,694	31,847
2019	88,229	21,744	66,485	19,284	31,751	2,460	34,735
2020	92,642	23,463	69,179	20,804	32,670	2,660	36,509
2021	97,100	25,213	71,887	22,350	33,586	2,863	38,301
2022	101,584	26,987	74,597	23,918	34,491	3,069	40,105
2023	106,096	28,785	77,311	25,507	35,390	3,278	41,921
2024	110,645	30,608	80,036	27,118	36,284	3,490	43,753
2025	115,224	32,454	82,770	28,749	37,173	3,705	45,597
2026	119,840	34,324	85,517	30,401	38,060	3,923	47,457
2027	124,494	36,217	88,277	32,074	38,945	4,143	49,332
2028	129,184	38,132	91,051	33,767	39,829	4,366	51,222
2029	133,898	40,067	93,831	35,476	40,708	4,591	53,122
2030	138,635	42,019	96,616	37,200	41,583	4,819	55,033

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

The tables and figures in the rest of this section project the number of physicians by category.

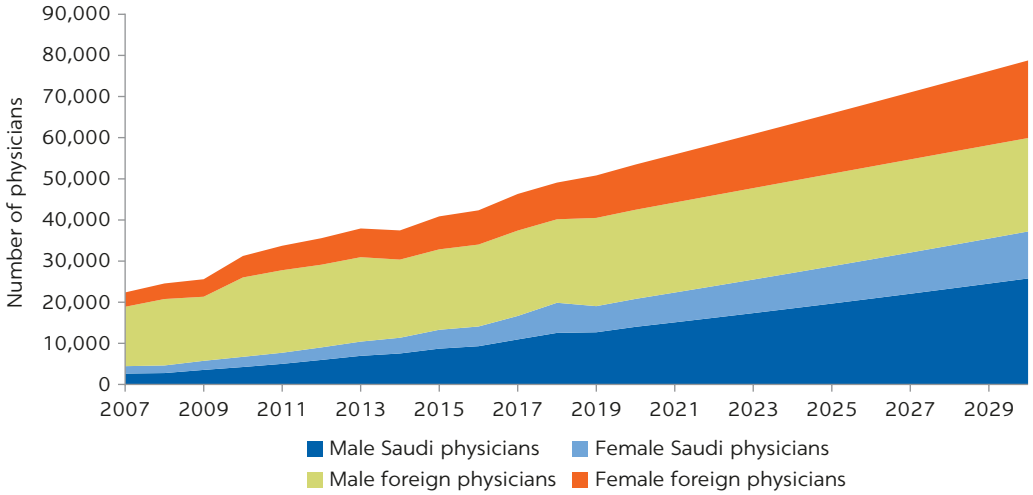
TABLE 4A.5 Historical and projected number of physicians in the MOH, by nationality and gender, 2007–30

YEAR	TOTAL MOH PHYSICIANS	SAUDI PHYSICIANS			FOREIGN PHYSICIANS		
		TOTAL	FEMALE	MALE	TOTAL	FEMALE	MALE
2007	22,376	4,448	1,804	2,644	17,928	3,490	14,438
2008	24,554	4,619	1,852	2,767	19,935	3,782	16,153
2009	25,586	5,744	2,209	3,535	19,842	4,255	15,587
2010	31,241	6,718	2,480	4,238	24,523	5,219	19,304
2011	33,730	7,713	2,705	5,008	26,017	5,947	20,070
2012	35,568	9,012	3,044	5,968	26,556	6,447	20,109
2013	37,923	10,420	3,468	6,952	27,503	6,978	20,525
2014	37,456	11,352	3,819	7,533	26,104	7,098	19,006
2015	40,865	13,294	4,589	8,705	27,571	8,019	19,552
2016	42,339	14,091	4,791	9,300	28,248	8,327	19,921
2017	46,322	16,659	5,715	10,944	29,663	8,904	20,759
2018	49,091	19,861	7,324	12,537	29,230	8,934	20,296
2019	50,785	18,999	6,350	12,687	31,786	10,330	21,457
2020	53,474	20,804	6,797	14,007	32,670	10,998	21,672
2021	55,936	22,350	7,248	15,102	33,586	11,697	21,889
2022	58,409	23,918	7,703	16,215	34,491	12,414	22,077
2023	60,897	25,507	8,159	17,347	35,390	13,150	22,240
2024	63,402	27,118	8,619	18,498	36,284	13,906	22,378
2025	65,922	28,749	9,082	19,667	37,173	14,682	22,491
2026	68,461	30,401	9,547	20,854	38,060	15,478	22,582
2027	71,019	32,074	10,014	22,060	38,945	16,295	22,650
2028	73,596	33,767	10,484	23,283	39,829	17,133	22,696
2029	76,184	35,476	10,954	24,521	40,708	17,990	22,719
2030	78,784	37,200	11,426	25,775	41,583	18,866	22,717

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

FIGURE 4A.1

Historical and projected number of physicians in the MOH, by nationality and gender, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

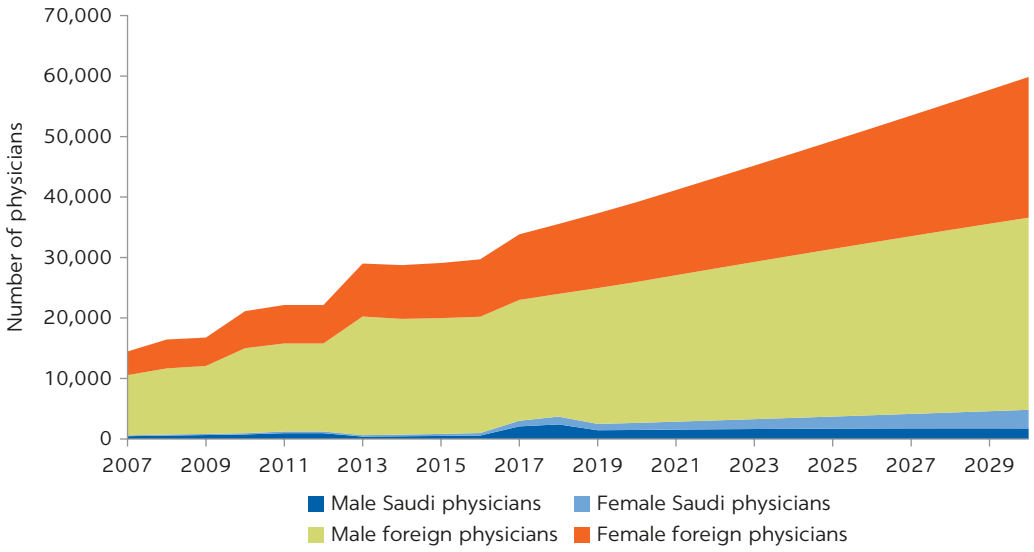
TABLE 4A.6 Historical and projected number of physicians in the private sector, by nationality and gender, 2007–30

YEAR	TOTAL PRIVATE SECTOR PHYSICIANS	SAUDI PHYSICIANS			FOREIGN PHYSICIANS		
		TOTAL	FEMALE	MALE	TOTAL	FEMALE	MALE
2007	14,468	594	131	463	13,874	3,910	9,964
2008	16,444	735	170	565	15,709	4,775	10,934
2009	16,767	828	180	648	15,939	4,694	11,245
2010	21,134	951	203	748	20,183	6,126	14,057
2011	22,146	1,236	279	957	20,910	6,353	14,557
2012	22,146	1,236	279	957	20,910	6,353	14,557
2013	29,003	625	233	392	28,378	8,756	19,622
2014	28,746	716	272	444	28,030	8,891	19,139
2015	29,097	837	335	502	28,260	9,118	19,142
2016	29,701	979	411	568	28,722	9,499	19,223
2017	33,840	3,013	934	2,079	30,827	10,851	19,976
2018	35,541	3,694	1,290	2,404	31,847	11,559	20,288
2019	37,314	2,490	1,051	1,439	34,825	12,366	22,458
2020	39,169	2,660	1,170	1,490	36,509	13,204	23,304
2021	41,165	2,863	1,315	1,548	38,301	14,087	24,215
2022	43,175	3,069	1,470	1,599	40,105	14,995	25,110
2023	45,200	3,278	1,635	1,643	41,921	15,930	25,992
2024	47,243	3,490	1,810	1,681	43,753	16,892	26,860
2025	49,302	3,705	1,995	1,710	45,597	17,882	27,714
2026	51,379	3,923	2,190	1,733	47,457	18,901	28,556
2027	53,474	4,143	2,395	1,748	49,332	19,948	29,383
2028	55,588	4,366	2,611	1,754	51,222	21,025	30,197
2029	57,714	4,591	2,838	1,753	53,122	22,128	30,994
2030	59,851	4,819	3,075	1,744	55,033	23,259	31,774

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.

FIGURE 4A.2

Historical and projected number of physicians in the private sector, by nationality and gender, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.

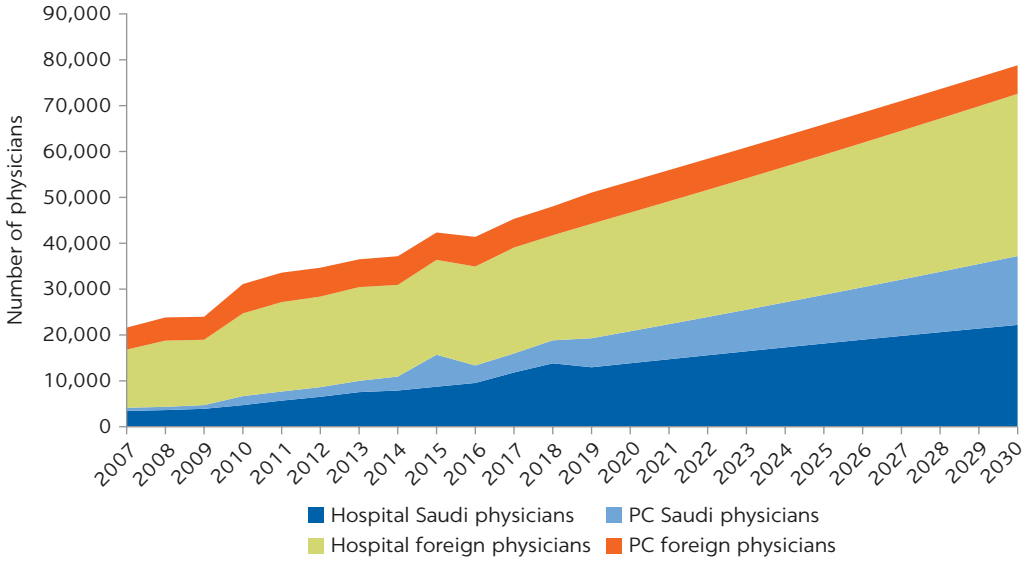
TABLE 4A.7 **Historical and projected number of physicians in the MOH, by nationality and facility type, 2007–30**

YEAR	TOTAL MOH PHYSICIANS	SAUDI PHYSICIANS			FOREIGN PHYSICIANS		
		TOTAL	HOSPITAL	PRIMARY CARE	TOTAL	HOSPITAL	PRIMARY CARE
2007	21,594	4,131	3,439	692	17,463	12,674	4,789
2008	23,819	4,326	3,617	709	19,493	14,436	5,057
2009	23,970	4,716	3,899	817	19,254	14,235	5,019
2010	31,090	6,669	4,699	1,970	24,421	18,035	6,386
2011	33,578	7,664	5,683	1,981	25,914	19,492	6,422
2012	34,656	8,617	6,516	2,101	26,039	19,750	6,289
2013	36,489	9,993	7,534	2,459	26,496	20,428	6,068
2014	37,165	10,931	7,886	3,045	26,234	19,975	6,259
2015	42,336	15,692	8,717	6,975	26,644	20,676	5,968
2016	41,375	13,344	9,536	3,808	28,031	21,576	6,455
2017	45,316	15,963	11,817	4,146	29,353	23,087	6,266
2018	48,018	18,827	13,816	5,011	29,191	22,901	6,290
2019	51,033	19,283	12,948	6,335	31,750	24,953	6,797
2020	53,474	20,804	13,829	6,975	32,670	25,870	6,800
2021	55,936	22,350	14,705	7,645	33,586	26,793	6,792
2022	58,409	23,918	15,575	8,343	34,491	27,720	6,772
2023	60,897	25,507	16,436	9,071	35,390	28,650	6,740
2024	63,402	27,118	17,289	9,829	36,284	29,587	6,697
2025	65,922	28,749	18,133	10,616	37,173	30,530	6,643
2026	68,461	30,401	18,967	11,434	38,060	31,481	6,579
2027	71,019	32,074	19,791	12,283	38,945	32,441	6,504
2028	73,596	33,767	20,604	13,163	39,829	33,409	6,420
2029	76,184	35,476	21,403	14,072	40,708	34,384	6,325
2030	78,784	37,200	22,188	15,012	41,583	35,364	6,219

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: Historical data on the number of physicians in different subcategories by facility type were lower than reported total number physicians. To project the number of workers by facility type only, the inconsistency was addressed by adjusting the number of workers upward. However, the raw historical data are presented as is in this table. MOH = Ministry of Health.

FIGURE 4A.3

Historical and projected number of physicians in the MOH, by nationality and facility type, 2007–30



Sources: Historical data from MOH 2019; projected data are original calculations for this publication.
Note: MOH = Ministry of Health; PC = primary care.

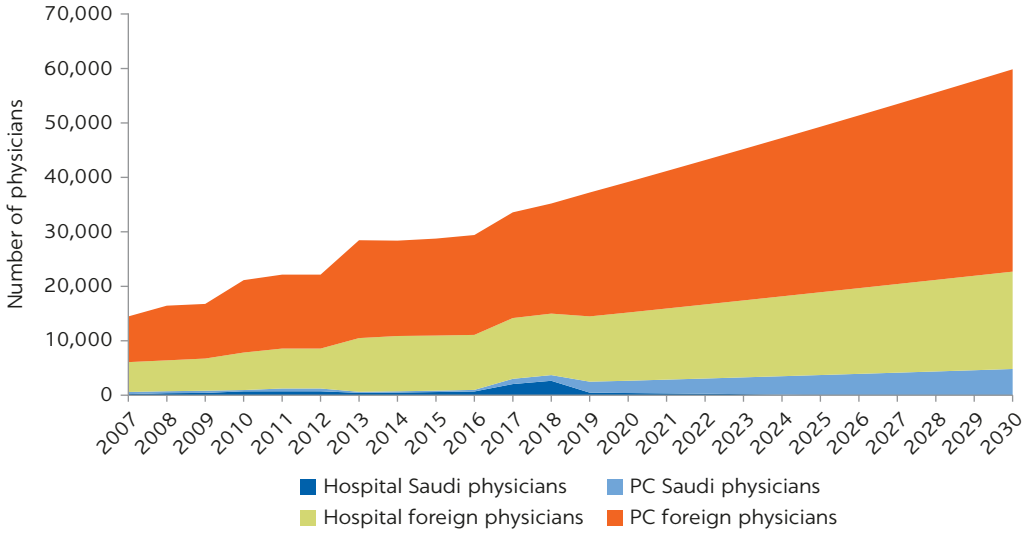
TABLE 4A.8 Historical and projected number of physicians in the private sector, by nationality and facility type, 2007–30

YEAR	TOTAL PRIVATE SECTOR PHYSICIANS	SAUDI PHYSICIANS			FOREIGN PHYSICIANS		
		TOTAL	HOSPITAL	PRIMARY CARE	TOTAL	HOSPITAL	PRIMARY CARE
2007	14,468	594	206	388	13,874	5,482	8,392
2008	16,444	735	377	358	15,709	5,667	10,042
2009	16,767	828	424	404	15,939	5,911	10,028
2010	21,134	951	713	238	20,183	6,887	13,296
2011	22,146	1,236	721	515	20,910	7,330	13,580
2012	22,146	1,236	721	515	20,910	7,330	13,580
2013	28,462	625	434	191	27,837	9,867	17,970
2014	28,387	716	489	227	27,671	10,160	17,511
2015	28,762	837	582	255	27,925	10,118	17,807
2016	29,416	979	689	290	28,437	10,102	18,335
2017	33,582	3,013	2,051	962	30,569	11,161	19,408
2018	35,205	3,694	2,651	1,043	31,511	11,293	20,218
2019	37,224	2,490	474	2,016	34,735	11,987	22,748
2020	39,169	2,660	399	2,261	36,509	12,523	23,985
2021	41,165	2,863	343	2,521	38,301	13,061	25,240
2022	43,175	3,069	273	2,796	40,105	13,598	26,507
2023	45,200	3,278	192	3,087	41,921	14,134	27,788
2024	47,243	3,490	97	3,393	43,753	14,669	29,083
2025	49,302	3,705	0	3,705	45,597	15,205	30,392
2026	51,379	3,923	0	3,923	47,457	15,740	31,717
2027	53,474	4,143	0	4,143	49,332	16,275	33,057
2028	55,588	4,366	0	4,366	51,222	16,810	34,411
2029	57,714	4,591	0	4,591	53,122	17,344	35,778
2030	59,851	4,819	0	4,819	55,033	17,876	37,157

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.

FIGURE 4A.4

Historical and projected number of physicians in the private sector, by nationality and facility type, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: PC = primary care.

Table 4A.9 presents the projected supply of Saudi physicians from 2020 to 2030. Assuming no policy change, by 2030, Saudi Arabia will have approximately 55,420 physicians or 34,914 full-time equivalent employees, which translates to 0.89 physicians per 1,000 population.

TABLE 4A.9 Projected supply of physicians, 2020–30

YEAR	TOTAL PUBLIC SECTOR SAUDI PHYSICIANS[a]	TOTAL PRIVATE SECTOR SAUDI PHYSICIANS[b]	TOTAL SUPPLY OF SAUDI PHYSICIANS[c]	SUPPLY (STATUS QUO PRODUCTIVITY)[d]	SAUDI PHYSICIANS PER 1,000 POPULATION
2020	28,393	2,660	31,053	19,563	0.56
2021	30,487	2,863	33,351	21,011	0.59
2022	32,602	3,069	35,671	22,473	0.63
2023	34,742	3,278	38,021	23,953	0.66
2024	36,910	3,490	40,401	25,452	0.69
2025	39,106	3,705	42,811	26,971	0.72
2026	41,336	3,923	45,258	28,513	0.76
2027	43,593	4,143	47,736	30,074	0.79
2028	45,884	4,366	50,250	31,657	0.82
2029	48,250	4,591	52,841	33,290	0.86
2030	50,601	4,819	55,420	34,914	0.89

Source: Original calculations for this publication.
a. The projected number of Saudi physicians employed by the Ministry of Health and other public sector employers.
b. The projected number of Saudi physicians employed in the private sector.
c. The total projected supply of Saudi physicians in the health workforce in Saudi Arabia.
d. The supply of physicians incorporating the productivity of health workers.

Projection results for nurses

The tables and figures in this section present projections for the number of nurses in Saudi Arabia by category. Nurses include those with diploma, bachelor's degrees, and advanced degrees.

TABLE 4A.10 Historical and projected number of nurses, by sector and nationality, 2007–30

				MOH		PRIVATE SECTOR	
YEAR	TOTAL NURSES	TOTAL SAUDI NURSES	TOTAL FOREIGN NURSES	SAUDI	FOREIGN	SAUDI	FOREIGN
2007	72,254	23,326	48,928	22,571	28,598	755	20,330
2008	77,708	25,554	52,154	24,645	30,730	909	21,424
2009	86,416	32,865	53,551	31,750	31,358	1,115	22,193
2010	103,717	38,553	65,164	36,929	38,854	1,624	26,310
2011	105,906	40,896	65,010	40,037	37,496	859	27,514

continued

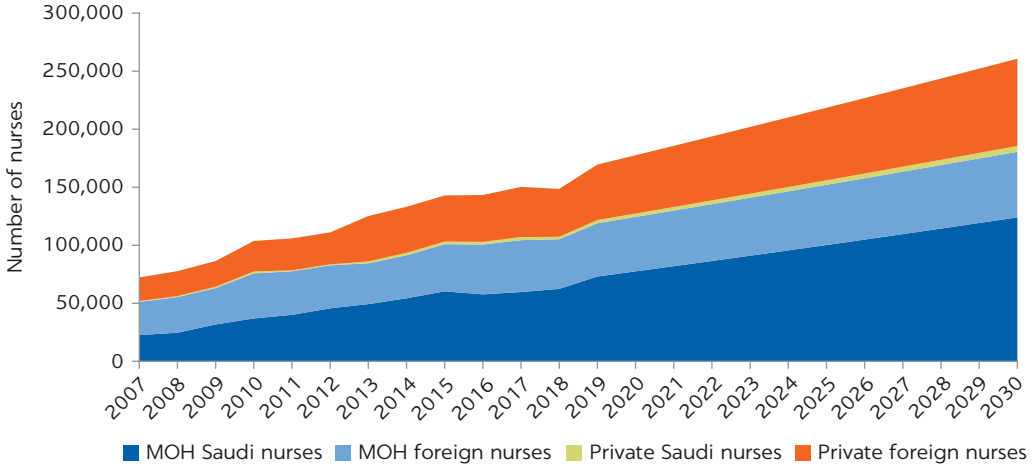
TABLE 4A.10, *continued*

YEAR	TOTAL NURSES	TOTAL SAUDI NURSES	TOTAL FOREIGN NURSES	MOH		PRIVATE SECTOR	
				SAUDI	FOREIGN	SAUDI	FOREIGN
2012	111,067	46,490	64,577	45,631	37,063	859	27,514
2013	125,207	50,876	74,331	49,305	35,165	1,571	39,166
2014	133,120	56,456	76,664	54,286	37,066	2,170	39,598
2015	142,923	62,566	80,357	60,316	40,622	2,250	39,735
2016	143,296	59,946	83,350	57,681	42,977	2,265	40,373
2017	150,302	62,367	87,935	59,688	44,719	2,679	43,216
2018	148,574	64,534	84,040	62,409	42,770	2,125	41,270
2019	169,548	75,836	93,711	73,108	45,891	2,728	47,821
2020	177,556	80,410	97,147	77,502	46,933	2,908	50,214
2021	185,637	85,045	100,592	81,954	47,960	3,091	52,631
2022	193,769	89,740	104,029	86,449	48,966	3,291	55,063
2023	201,944	94,481	107,463	90,987	49,953	3,494	57,510
2024	210,176	99,273	110,903	95,574	50,926	3,699	59,977
2025	218,458	104,111	114,346	100,204	51,886	3,907	62,460
2026	226,799	109,000	117,799	104,882	52,836	4,118	64,964
2027	235,201	113,938	121,263	109,608	53,776	4,330	67,487
2028	243,667	118,925	124,742	114,379	54,709	4,546	70,034
2029	252,174	123,948	128,226	119,185	55,629	4,763	72,598
2030	260,719	129,008	131,711	124,025	56,537	4,983	75,174

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

FIGURE 4A.5

Historical and projected number of nurses, by sector and nationality, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

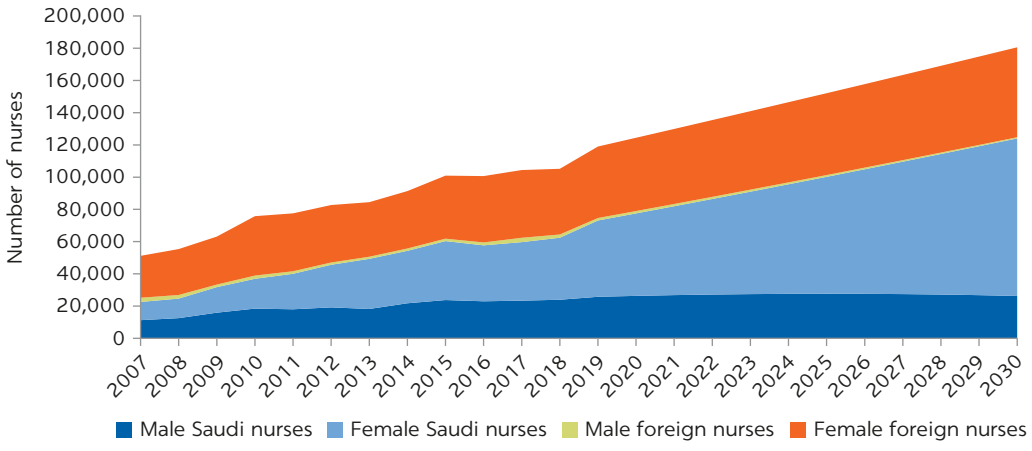
TABLE 4A.11 **Historical and projected number of nurses in the MOH, by nationality and gender, 2007–30**

YEAR	TOTAL MOH NURSES	SAUDI NURSES			FOREIGN NURSES		
		TOTAL	FEMALE	MALE	TOTAL	FEMALE	MALE
2007	51,169	22,571	11,312	11,259	28,598	25,986	2,612
2008	55,375	24,645	12,122	12,523	30,730	28,496	2,234
2009	63,108	31,750	15,846	15,904	31,358	29,768	1,590
2010	75,783	36,929	18,499	18,430	38,854	36,859	1,995
2011	77,533	40,037	22,028	18,009	37,496	35,923	1,573
2012	82,694	45,631	26,438	19,193	37,063	35,645	1,418
2013	84,470	49,305	31,102	18,203	35,165	33,847	1,318
2014	91,352	54,286	32,546	21,740	37,066	35,611	1,455
2015	100,938	60,316	36,571	23,745	40,622	39,121	1,501
2016	100,658	57,681	34,708	22,973	42,977	41,178	1,799
2017	104,407	59,688	36,323	23,365	44,719	42,021	2,698
2018	105,179	62,409	38,481	23,928	42,770	40,757	2,013
2019	118,999	73,108	47,334	25,774	45,891	44,346	1,545
2020	124,434	77,502	51,167	26,334	46,933	45,459	1,474
2021	129,914	81,954	55,153	26,801	47,960	46,558	1,402
2022	135,415	86,449	59,283	27,166	48,966	47,637	1,329
2023	140,940	90,987	63,558	27,430	49,953	48,699	1,254
2024	146,500	95,574	67,983	27,590	50,926	49,748	1,178
2025	152,090	100,204	72,559	27,645	51,886	50,784	1,102
2026	157,718	104,882	77,288	27,594	52,836	51,810	1,026
2027	163,384	109,608	82,173	27,434	53,776	52,827	949
2028	169,088	114,379	87,215	27,164	54,709	53,836	873
2029	174,814	119,185	92,406	26,779	55,629	54,832	797
2030	180,562	124,025	97,747	26,278	56,537	55,816	721

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

FIGURE 4A.6

Historical and projected number of nurses in the MOH, by nationality and gender, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

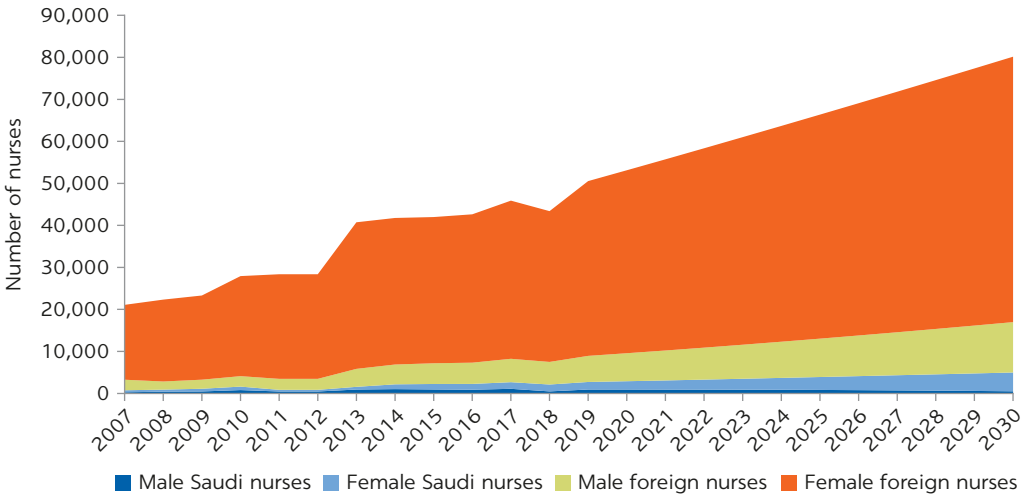
TABLE 4A.12 Historical and projected number of nurses in the private sector, by nationality and gender, 2007–30

YEAR	TOTAL PRIVATE SECTOR NURSES	SAUDI NURSES			FOREIGN NURSES		
		TOTAL	FEMALE	MALE	TOTAL	FEMALE	MALE
2007	21,085	755	491	264	20,330	17,817	2,513
2008	22,333	909	484	425	21,424	19,488	1,936
2009	23,308	1,115	643	472	22,193	20,033	2,160
2010	27,934	1,624	823	801	26,310	23,821	2,489
2011	28,373	859	398	461	27,514	24,901	2,613
2012	28,373	859	398	461	27,514	24,901	2,613
2013	40,737	1,571	641	930	39,166	34,891	4,275
2014	41,768	2,170	1,142	1,028	39,598	34,889	4,709
2015	41,985	2,250	1,297	953	39,735	34,802	4,933
2016	42,638	2,265	1,379	886	40,373	35,315	5,058
2017	45,895	2,679	1,583	1,096	43,216	37,650	5,566
2018	43,395	2,125	1,643	482	41,270	35,892	5,378
2019	50,549	2,728	1,793	935	47,821	41,604	6,216
2020	53,122	2,908	1,976	932	50,214	43,549	6,665
2021	55,722	3,091	2,171	920	52,631	45,502	7,130
2022	58,354	3,291	2,381	910	55,063	47,454	7,609
2023	61,004	3,494	2,602	892	57,510	49,408	8,102
2024	63,676	3,699	2,834	865	59,977	51,365	8,612
2025	66,367	3,907	3,078	829	62,460	53,324	9,136
2026	69,081	4,118	3,333	784	64,964	55,287	9,677
2027	71,818	4,330	3,600	730	67,487	57,254	10,233
2028	74,579	4,546	3,879	666	70,034	59,228	10,806
2029	77,361	4,763	4,170	593	72,598	61,204	11,393
2030	80,157	4,983	4,473	510	75,174	63,178	11,996

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.

FIGURE 4A.7

Historical and projected number of nurses in the private sector, by nationality and gender, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.

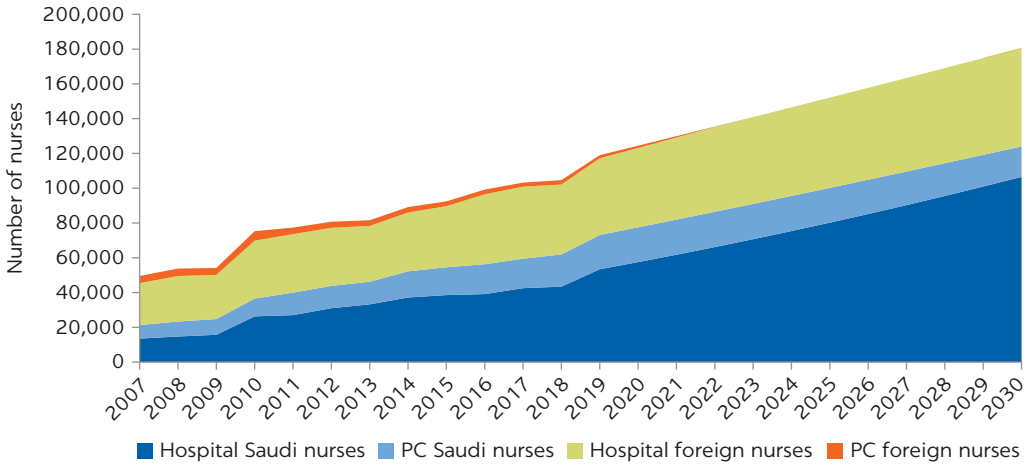
TABLE 4A.13 **Historical and projected number of nurses in the MOH, by nationality and facility type, 2007–30**

YEAR	TOTAL MOH NURSES	SAUDI NURSES			FOREIGN NURSES		
		TOTAL	HOSPITAL	PRIMARY CARE	TOTAL	HOSPITAL	PRIMARY CARE
2007	51,169	21,317	13,542	7,775	28,207	24,110	4,097
2008	55,375	23,337	14,737	8,600	30,454	26,195	4,259
2009	63,108	24,769	15,728	9,041	29,371	25,374	3,997
2010	75,783	36,555	26,307	10,248	38,739	33,291	5,448
2011	77,533	39,963	27,040	12,923	37,381	33,631	3,750
2012	82,694	43,843	31,004	12,839	36,882	33,404	3,478
2013	84,470	46,241	33,225	13,016	35,350	32,083	3,267
2014	91,352	52,200	37,162	15,038	36,941	33,843	3,098
2015	100,938	54,535	38,544	15,991	37,898	35,144	2,754
2016	100,658	56,287	39,122	17,165	42,937	40,239	2,698
2017	104,407	59,473	42,522	16,951	43,737	41,431	2,306
2018	105,179	61,905	43,408	18,497	42,735	40,208	2,527
2019	118,999	73,108	53,408	19,700	45,891	44,119	1,772
2020	124,434	77,502	57,514	19,987	46,933	45,654	1,279
2021	129,914	81,954	61,769	20,185	47,960	47,205	755
2022	135,415	86,449	66,161	20,288	48,966	48,765	200
2023	140,940	90,987	70,693	20,294	49,953	49,953	0
2024	146,500	95,574	75,370	20,204	50,926	50,926	0
2025	152,090	100,204	80,190	20,014	51,886	51,886	0
2026	157,718	104,882	85,159	19,724	52,835	52,835	0
2027	163,384	109,608	90,277	19,331	53,776	53,776	0
2028	169,088	114,379	95,545	18,834	54,709	54,709	0
2029	174,814	119,185	100,955	18,230	55,629	55,629	0
2030	180,562	124,025	106,508	17,517	56,537	56,537	0

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

FIGURE 4A.8

Historical and projected number of nurses in the MOH, by nationality and facility type, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: MOH = Ministry of Health; PC = primary care.

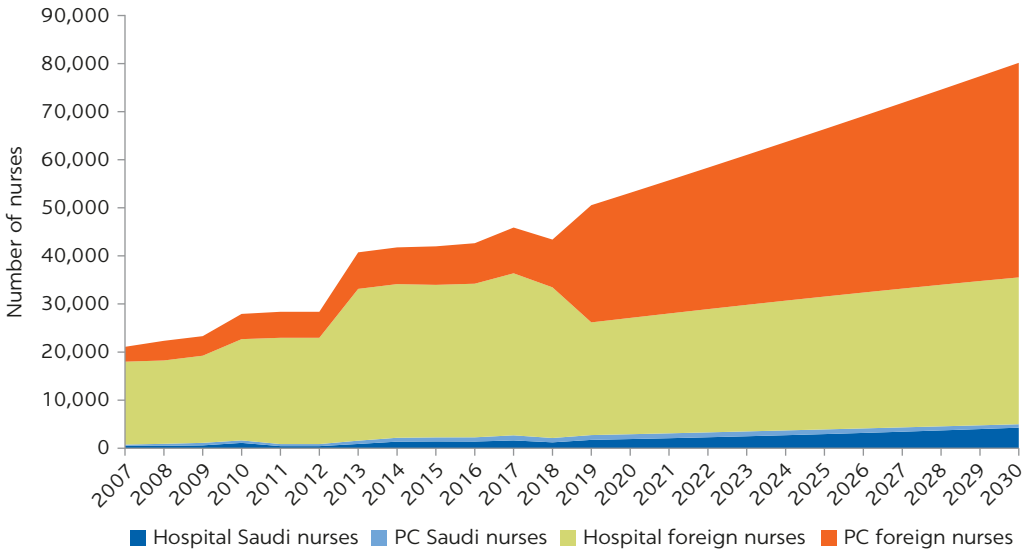
TABLE 4A.14 Historical and projected number of nurses in the private sector, by nationality and facility type, 2007–30

YEAR	TOTAL PRIVATE SECTOR NURSES	SAUDI NURSES			FOREIGN NURSES		
		TOTAL	HOSPITAL	PRIMARY CARE	TOTAL	HOSPITAL	PRIMARY CARE
2007	21,085	755	490	265	20,330	17,241	3,089
2008	22,333	909	487	422	21,424	17,339	4,085
2009	23,308	1,115	590	525	22,193	18,123	4,070
2010	27,934	1,624	1,106	518	26,310	21,063	5,247
2011	28,373	859	429	430	27,514	22,107	5,407
2012	28,373	859	428	431	27,514	22,107	5,407
2013	40,737	1,571	886	685	39,166	31,567	7,599
2014	41,768	2,170	1,363	807	39,598	31,958	7,640
2015	41,985	2,250	1,407	843	39,735	31,723	8,012
2016	42,638	2,265	1,386	879	40,373	31,948	8,425
2017	45,895	2,679	1,616	1,063	43,216	33,701	9,515
2018	43,395	2,125	1,218	907	41,270	31,334	9,936
2019	50,549	2,728	1,732	996	47,821	23,444	24,377
2020	53,122	2,908	1,900	1,008	50,214	24,194	26,020
2021	55,722	3,091	2,079	1,012	52,631	24,926	27,705
2022	58,354	3,291	2,276	1,015	55,063	25,636	29,427
2023	61,004	3,494	2,483	1,011	57,510	26,323	31,187
2024	63,676	3,699	2,703	997	59,977	26,990	32,986
2025	66,367	3,907	2,934	974	62,460	27,636	34,824
2026	69,081	4,118	3,177	941	64,964	28,261	36,703
2027	71,818	4,330	3,432	898	67,487	28,866	38,621
2028	74,579	4,546	3,699	846	70,034	29,450	40,584
2029	77,361	4,763	3,979	784	72,598	30,008	42,590
2030	80,157	4,983	4,271	712	75,174	30,542	44,633

Sources: Historical data from MOH (2019); projected data are original calculations for this publication.

FIGURE 4A.9

Historical and projected number of nurses in the private sector, by nationality and facility type, 2007–30



Sources: Historical data from MOH (2019); projected data are original calculations for this publication.
Note: PC = primary care.

TABLE 4A.15 Projected supply of nurses, 2020–30

YEAR	TOTAL PUBLIC SECTOR SAUDI NURSES[a]	TOTAL PRIVATE SECTOR SAUDI NURSES[b]	TOTAL SUPPLY OF SAUDI NURSES[c]	SUPPLY (STATUS QUO PRODUCTIVITY)[d]	NURSES PER 1,000 POPULATION
2020	104,800	2,908	107,708	67,856	1.95
2021	110,791	3,091	113,882	71,746	2.03
2022	116,837	3,291	120,128	75,681	2.11
2023	122,939	3,494	126,433	79,653	2.19
2024	129,108	3,699	132,807	83,669	2.27
2025	135,342	3,907	139,249	87,727	2.36
2026	141,641	4,118	145,759	91,828	2.44
2027	148,010	4,330	152,341	95,975	2.52
2028	154,504	4,546	159,050	100,201	2.60
2029	161,002	4,763	165,765	104,432	2.68
2030	167,540	4,983	172,523	108,689	2.76

Source: Original calculations for this publication.
a. The projected number of Saudi nurses employed by the Ministry of Health and other public sector employers.
b. The projected number of Saudi nurses employed in the private sector.
c. The total projected supply of Saudi nurses in the health workforce in Saudi Arabia.
d. The supply of nurses incorporating the productivity of health workers.

Table 4A.15 presents the projected supply of Saudi nurses (including diploma, bachelor, and advanced nurses) from 2020 to 2030. Assuming no policy change, by 2030, Saudi Arabia will have approximately 172, 523 nurses with 108,689 full-time equivalent employees, which translates to 2.76 nurses per 1,000 population.

NOTES

1. OECD 2020, Doctors (indicator) (accessed May 8, 2020), doi:10.1787/4355e1ec-en; OECD 2020, Nurses (indicator) (accessed May 8, 2020), doi:10.1787/283e64de-en.
2. Missing regional population data points between any two real data points were linearly interpolated. The following regions had missing regional population data in 2012: Al-Ahsa, Bisha, Hafr Al-Batin, Jeddah, Qunfudhah, Qurayyat, and Ta'if.

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5 Projecting the Labor Market Demand for Nurses and Physicians in Saudi Arabia

TRACY KUO LIN, MOHAMMED ALLUHIDAN, HUSSAH ALGHODAIER, NABIHA TASHKANDI, CHRISTOPHER H. HERBST, AND JENNY X. LIU

KEY MESSAGES

- Labor market demand can be understood as the amount of financing available to absorb health workers in the health sector by employers.
- Overall labor market demand for physicians and nurses (including nurses with diplomas, bachelor's degrees, and advanced degrees—referred to as *diploma, bachelor,* and *advanced nurses*) will increase steadily from 2020 to 2030 if trends in government spending continue as projected.
- In 2030, the overall number of health workers demanded and that which the Saudi labor market can absorb will be at a level similar to that of other upper-middle-income and high-income countries.
- When removing diploma nurses from the nursing cadre, given that they do not perform nursing tasks according to international job classification standards, the total number of nurses the labor market can afford may be lower than estimated.
- The public sector demand for physicians and nurses will increase from 5.93 per 1,000 population in 2020 to 6.02 per 1,000 population in 2030.

BACKGROUND

This chapter presents projections of future labor market demand for physicians and nurses in Saudi Arabia. Incorporating health worker labor market demand-side considerations facilitates health workforce planning that accounts for the

size health workforce the country can afford to employ in the future. Labor market demand for health workers should not be confused with need-based demand for health workers, presented in chapter 3. Instead, it can be understood as the amount of financing available to absorb health workers in the health labor market by employers.

Labor market demand can be defined as the willingness of health care service providers, such as government or private sector providers, to recruit and absorb health workers into the health labor market. This willingness depends on the financial resources available to government and private sector providers to recruit and employ health workers. In the public sector, financial resources are linked to the budget allocated to the wage bill, which in turn is linked to levels of government health expenditures. In the private sector, the budget available to recruit workers is linked to the population demand for private health care and the willingness of the population to pay for health care services, the delivery of which requires health workers. The main notion of labor market demand for health workers is that health workforce purchasers, whether public or private, can recruit only as many health workers as they can afford (that is, for which they have the budget) (Bruckner, Liu, and Scheffler 2016). High levels of labor market demand for health workers mean that more health workers can be recruited (or fewer numbers of workers at higher wages), and low levels of labor market demand for health workers mean that fewer health workers can be recruited (or greater numbers at lower wages).

Identifying how many health workers can be absorbed by the public sector in 2030 by modeling future health labor market demand is critical for government planning purposes in Saudi Arabia. A situation in which health labor market supply is greater than government health labor market demand would mean that the health workers who want to work in the health labor market exceed the public finances to recruit and employ them. Policy solutions would then consider reducing labor market supply (production output), increasing public labor market demand, or both. Public labor market demand can be increased by either increasing the public sector budget and wage bill allocation, or by increasing the role and capacity of the private sector to deliver services and thus recruit and absorb health workers. Such a policy decision is linked largely to equity considerations as well as to the number of health workers required to address key health needs under the health labor market need perspective (as presented in chapter 3).

The remainder of this chapter is organized as follows: The next section provides a brief overview of the methodology used to project labor market demand for physicians and nurses; a more extensive explanation is provided in annex 5A. The following section summarizes the projected overall health labor market demand for the physician and nurse workforce in Saudi Arabia, assuming no changes in health worker wages, productivity, or technology. These projections reflect the total number of workers that could be absorbed in a baseline status quo scenario for Saudi Arabia. In addition, an estimate of public sector health labor market demand (that is, what would happen to government labor market demand without any policy intervention) is presented and compared and contrasted with overall demand in Saudi Arabia. The next section then conducts a sensitivity check and compares the baseline estimates with a different future economic condition. The final section provides concluding remarks for the chapter.

OVERVIEW OF METHODS FOR PROJECTING LABOR MARKET DEMAND

An economic model was used to project the total number of physicians and nurses (both foreign and Saudi) that the health labor market may demand (that is, that can be recruited and absorbed based on sufficient budget) as a result of anticipated future patterns of aggregate spending. Drawing on past correlations of economic drivers and physician and nursing densities, the model predicts the future densities of nurses and physicians, assuming the wage bill remains the same. Although wages are a key determinant of the quantity of labor employed, wage growth is held constant to assess the independent effects of aggregate spending patterns. Health labor markets are often characterized by wage rigidities, especially where government employers dominate and follow civil service schedules or where other professional bodies may influence these negotiations. The model thus relies on the availability of robust economic indicators of spending that correlate with health worker densities. Such an approach could also be used to predict overall labor demand in all sectors; however, using the outcomes of physician and nurse densities focuses the resulting predictions on only the labor market demand for health workers. Although expenditure on health is considered to be the ideal indicator for health labor market demand, past studies have relied on proxy indicators—such as gross domestic product (GDP) or national income (Cooper, Getzen, and Laud 2003; Getzen 1990; Newhouse 1977)—because of the lack of available data.

From the available subnational economic data in Saudi Arabia, per capita total government expenditures and Ministry of Health (MOH) expenditures on health were identified as the main predictors in the demand model. Information on private sector spending was not available, which is a notable limitation of this analysis, especially in light of the fact that the outcomes predicted—physician and nurse densities—reflect total health workers employed by both the public and the private sectors. However, the MOH accounts for the largest share (65 percent) of government health expenditure in Saudi Arabia (World Bank 2018), employing 75 percent of health workers in the public sector (see chapter 4), and thus is a principal component of labor market demand for health workers. Higher expenditures for health reflect direct spending on health service provision, of which labor is the largest component (Liu et al. 2016), as recognized by the model. Total government expenditures per capita is also included as an additional measure reflecting the general trajectory of public sector investment across all spending categories, which equates to 39 percent of GDP in Saudi Arabia in 2016 (World Bank 2018; WHO Global Health Expenditure Database, https://apps.who.int/nha/database/Select/Indicators/en). Higher total government expenditures reflect a larger spending envelope within which health is a key expenditure category (and within that labor). In an economy in which government spending dominates the market and is the largest driver of overall economic spending, predictions for both public and private sector workers using only public spending data may yield little bias. This bias may further be plausible if patterns in private sector spending are unlikely to change. In fact, trends in private health expenditures as a percentage of total health expenditures were relatively stable between 2000 and 2016, fluctuating between 27 percent and 38 percent (World Bank 2020); see table 5A.2 for more details. Thus, assuming

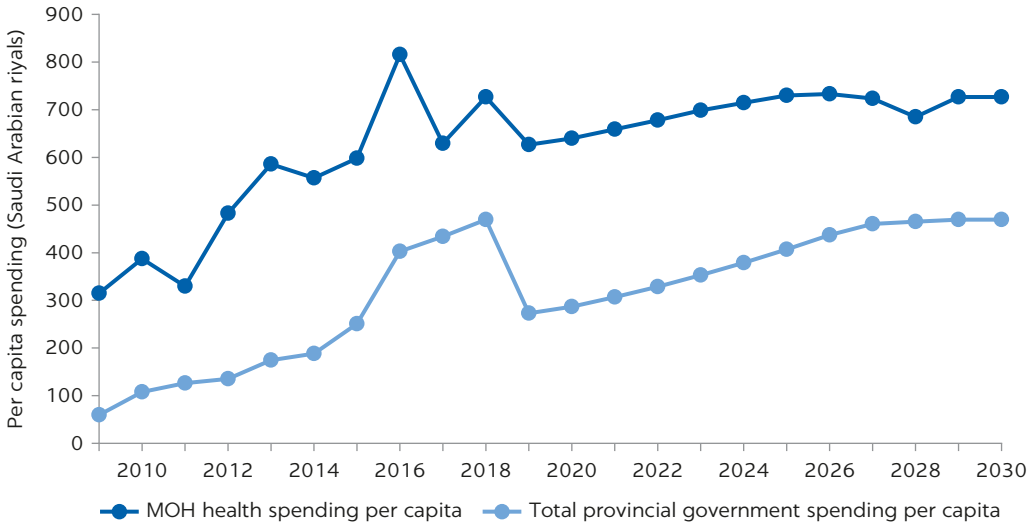
these private sector spending trends continue under the status quo baseline scenario, this economic model using only government spending data may adequately predict total market demand for physicians and nurses in Saudi Arabia. Additional details on past studies and methods for developing this model are presented in annex 5A.

Future densities of total physicians and nurses were estimated separately using lagged values of per capita total government expenditures across all sectors and MOH health expenditures. The projection methodology first followed a stepwise approach to identify the optimal correlation of lagged government expenditures, in total and for health, from 2009 to 2018 that most strongly relates to the historical density of physicians and nurses per 1,000 population. Lagged economic variables ensure the direction of causality and allow time for these factors to work through the economy to affect the labor market. Then, based on the estimated effects of economic predictor variables (using the optimal correlation structure) and their forecasted values, the future density of physicians and nurses that will be demanded in the labor market in each province in Saudi Arabia by 2030 was predicted. See annex 5A, equations (5.1) and (5.2), for model specifications. Future estimated values of both public spending drivers (see figure 5.1) were used to estimate the density of physicians and nurses in each province-year from 2020 to 2030. The density for each cadre in each province-year was multiplied by the estimated future province population to calculate the number of health workers demanded per province. Provincial estimates were then summed by year to calculate national labor market demand for physicians and nurses from 2020 to 2030.

Additional steps were taken to project the overall number of health workers in the entire public sector, including MOH and non-MOH employers, and to more precisely capture the number of health workers the Saudi government can afford in the future. Because yearly data on the number of all public sector

FIGURE 5.1

Historical (2009–18) and projected (2019–30) per capita total government expenditures and MOH health expenditures, 2009–30



Sources: Historical data estimates calculated from Ministry of Finance (2018) projected data are original calculations for this publication.
Note: MOH = Ministry of Health.

workers were not available at the regional level, national-level data on the number of public sector health workers in the MOH and outside the MOH were used to project overall demand for public sector health workers. The national percentages of physicians and nurses working for the MOH out of total public sector workers (MOH and non-MOH) were projected into the future. These projections were then used to calculate the estimated national number of public sector workers, including all public sector employers, from 2020 to 2030.

The demand model projections thus reflect the total estimated physicians and nurses (in both the public sector and the private sector) under a baseline scenario using continuing trends in MOH health expenditures per capita and total government spending per capita. This approach implicitly assumes that trends in private sector spending will continue, even though this is not explicitly included in the model parameters. A summary of the projections is presented in table 5.1. The projections of labor demand further assume that there will be no changes in wages, skills mix, tasks, and productivity for health workers, health systems, or technology in the future. In reality, differentials in the wages and productivity of different health workers will affect the numbers of workers demanded—fewer workers may be needed at higher levels of productivity to deliver the same amount of services (all else being equal) and thus command a higher salary. However, these factors are often fixed in the short term (for example, with civil service compensation schedules) and may require large-scale implementation (for example, of technologies that enhance productivity) to effect macroeconomic change. Substitution across different types of workers—such as between physicians and nurses, Saudi and foreign workers, nurses with a diploma and those with a bachelor's or advanced degree—is not captured in this model and may be better examined under a budget impact analysis or a constrained optimization approach for the production of health services. Considering economic trends, this chapter presents a simulated scenario for labor market demand in which future health expenditures are expected to follow overall predicted trends in the rate of GDP growth as an alternative sensitivity check under different assumptions of spending growth that reflect the total economy, including private spending.

To enable comparison with the projection of overall health labor market demand in Saudi Arabia, additional estimates were conducted to estimate public sector–specific demand. As discussed, yearly data on the number of total public sector workers at the regional level were not available; therefore, additional

TABLE 5.1 Projection summary

SECTOR	HISTORICAL DATA	METHODOLOGY	PROJECTED VALUES
Public sector, MOH	MOH physicians and nurses	MOH health expenditure and total government expenditure are used as predictors for physician and nurse densities	(1) Labor market demand for physicians in Saudi Arabia (entire public and private sector), from 2020 to 2030 (2) Labor market demand for nurses in Saudi Arabia (entire public and private sector), from 2020 to 2030
Public sector, non-MOH	Percentage of non-MOH health workers out of total public sector health workers	Historical data are used to predict the percentage of non-MOH health workers out of total public sector health workers in the future	
Private sector	Private sector physicians and nurses	MOH health expenditure and total government expenditure are used as predictors for physician and nurse densities	

Source: World Bank.
Note: MOH = Ministry of Health.

steps were required to project percentages of MOH physicians and nurses out of total public sector physicians and nurses to calculate overall demand in Saudi Arabia. Given data limitations, the same predictors in the projection for overall health labor market demand were used to separately project public sector health labor market demand (excluding the private sector but including workers employed by non-MOH employers). As expected, because the predictors are the same for overall health labor market demand and public sector–specific health labor market demand, the two projected trends yielded parallel trajectories—with public sector–specific demand projecting a lower number. Although repeated use of the predictors was required by data limitations, the resulting projection may reflect accurate health labor market demand in a baseline scenario with no policy intervention. See *Step 5: Calculating public sector health labor market demand for physicians and nurses in Saudi Arabia* in annex 5A for estimation steps.

PROJECTED LABOR MARKET DEMAND

This section presents projected labor market demand (referred to simply as *demand*) for physicians and nurses from 2020 to 2030.

Overall demand for all physicians in the health worker labor market in Saudi Arabia is projected to increase steadily, assuming trends in MOH health spending and total government spending continue. Figure 5.2 illustrates the projections for the number of physicians (both Saudi and foreign) that may be absorbed into the health worker labor market. The health worker labor market was projected to demand 2.99 physicians per 1,000 population, or 104,145 physicians, in 2020. By 2030, it is projected that 3.05 physicians per 1,000 population, or 120,099 physicians, will be demanded by the health labor market. This projection reflects an increase of 15.3 percent, which translates to 0.06 physicians per 1,000, or 15,954 physicians.

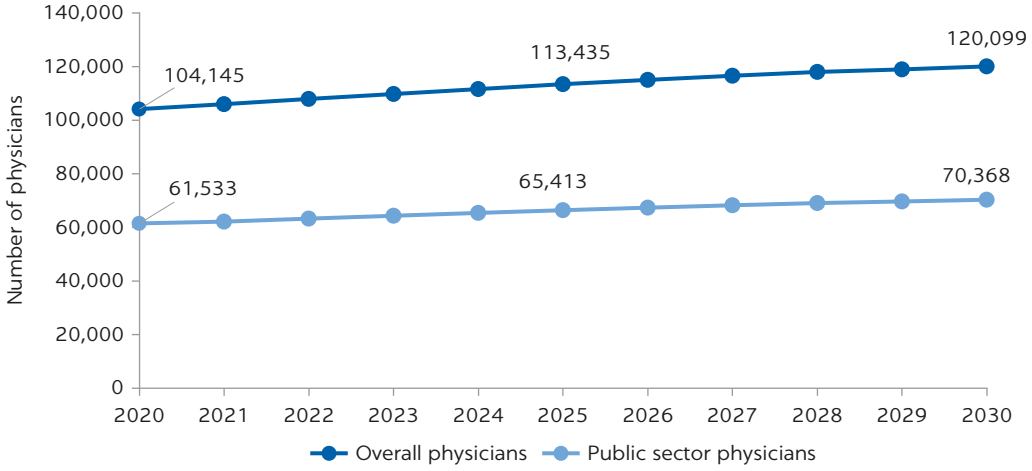
Similarly, public sector demand for physicians in the health worker labor market is estimated to increase steadily, assuming the trends in MOH health spending and total government spending continue (figure 5.2). Following the projections of overall demand in Saudi Arabia, the estimated public sector demand includes both Saudi and foreign physicians. In contrast to overall demand, assuming no policy change, public sector demand was estimated to be 1.77 physicians per 1,000 population, or 61,533 physicians, in 2020. By 2030, it is estimated that public sector demand will be 1.79 physicians per 1,000 population, or 70,368 physicians. As such, in 2030, public sector demand is estimated to account for approximately 59 percent (70,368 out of 120,099) of overall demand in Saudi Arabia.

The projections indicate that overall demand for nurses in the health worker labor market will increase steadily, assuming trends in MOH health spending and total government spending continue (figure 5.3). In 2020, 5.83 nurses per 1,000 population, or 203,040 nurses, were projected to be demanded in the health worker labor market. By 2030, this demand is projected to grow to 6.01 nurses per 1,000 population or 236,415 nurses. This projection reflects an increase of 16 percent, which translates to 0.18 workers per 1,000 or 33,375 nurses.

Following a similar pattern, it is estimated that public sector demand for nurses will increase steadily from 2020 to 2030 (figure 5.3). In 2020, 4.17 nurses

FIGURE 5.2

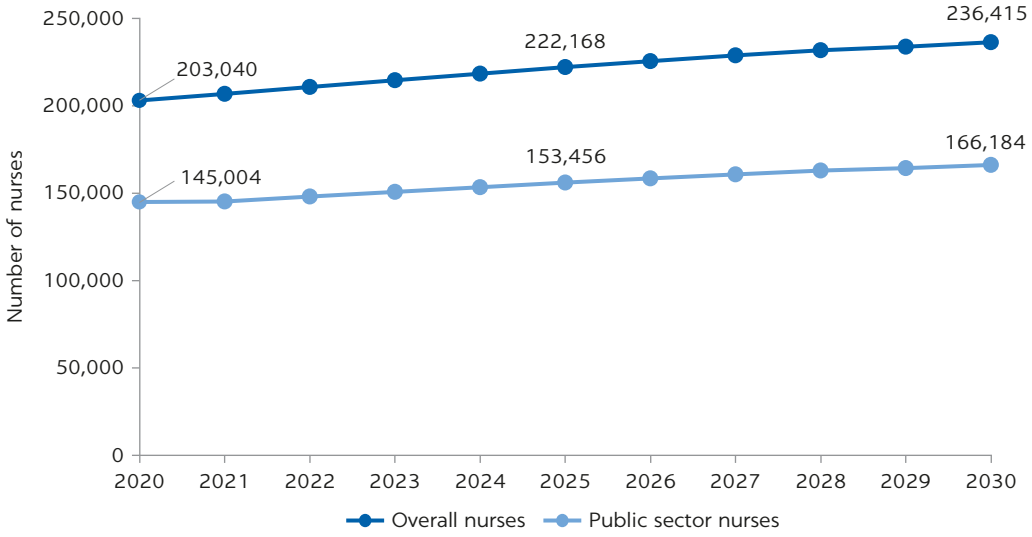
Projected number of physicians that can be absorbed in Saudi Arabia overall and in the public sector alone, 2020–30



Source: Original figure for this publication.

FIGURE 5.3

Projected number of nurses that can be absorbed in Saudi Arabia overall and in the public sector alone, 2020–30



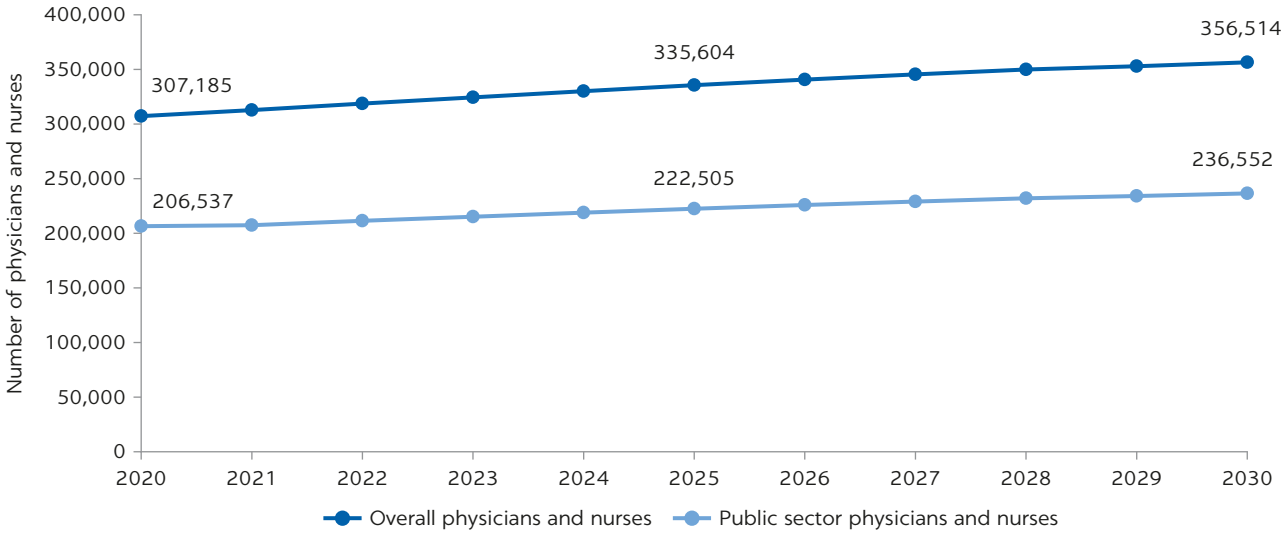
Source: Original figure for this publication.

per 1,000 population or 145,004 nurses were estimated to be demanded by the public sector alone. By 2030, 4.23 nurses per 1,000 population or 166,184 nurses are estimated to be demanded. In 2030, public sector demand for nurses is estimated to account for approximately 70 percent (166,184 out of 236,415) of the overall demand for nurses in Saudi Arabia.

These projections include all subcategories of nurses, which may overestimate the number of nurses—as defined by international standards for the nursing professional scope of work—that Saudi Arabia may be able to afford. Diploma

FIGURE 5.4

Projected number of physicians and nurses that can be absorbed in Saudi Arabia, 2020–30



Source: Original figure for this publication.

nurses, who are included in the nurse category, do not have a standard job description, function more like medical assistants in some cases, and are paid less than bachelor and advanced nurses. Thus, the number of bachelor and advanced nurses that the health labor market may be able to employ may actually be much lower. Scenario analyses in later chapters provide estimates for separate subcategories of nurses.

Overall demand for physicians and nurses in the health worker labor market will increase steadily and will be at a level similar to that of other upper-middle-income and high-income countries. By 2030, 356,514 physicians and nurses, or 9.07 physicians and nurses per 1,000 population, are projected to be demanded (figure 5.4), increasing by 0.25 physicians and nurses per 1,000 population from 2020; this is an increase of 16 percent.

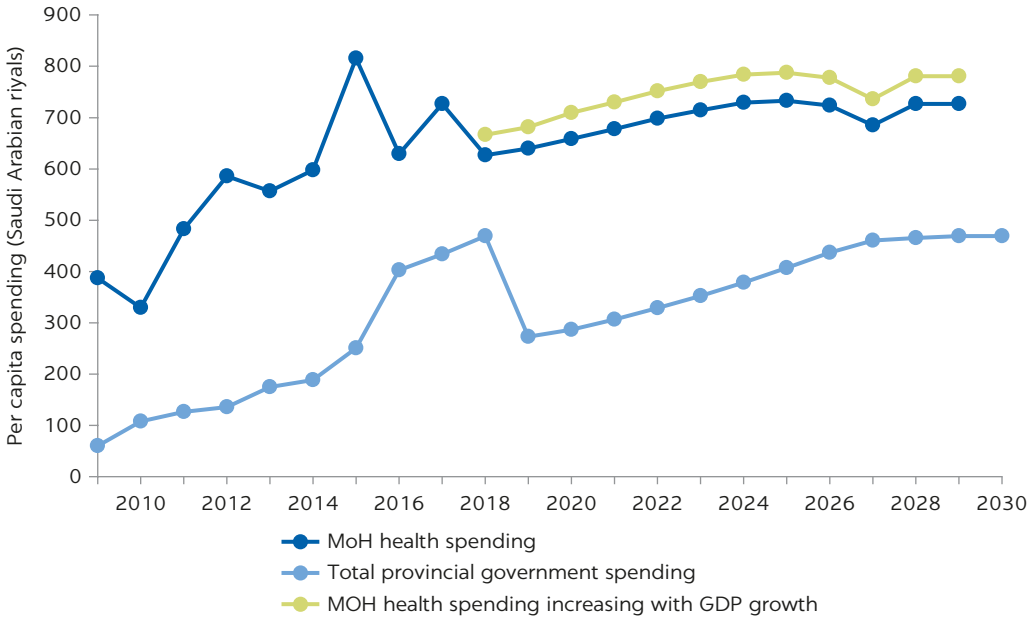
Public sector demand for physicians and nurses in combination is estimated to follow a pattern similar to overall demand for physicians and nurses in Saudi Arabia. In 2020, the public sector was estimated to demand 5.93 physicians and nurses per 1,000 population. By 2030, the public sector is estimated to demand 6.02 physicians and nurses per 1,000 population. Public sector demand is estimated to account for approximately 66 percent (236,552 out of 356,244) of overall demand for physicians and nurses in Saudi Arabia.

SENSITIVITY ANALYSIS OF OVERALL DEMAND IN THE HEALTH WORKER LABOR MARKET IN SAUDI ARABIA

This section presents projected health labor market demand for physicians and nurses assuming health expenditures increase at the same rate as GDP per capita, illustrated in figure 5.5; projected GDP per capita does not include the ongoing and uncertain impact of the COVID-19 (coronavirus) pandemic on

FIGURE 5.5

Historical (2009–18) and projected (2019–30) predictors for the economic model, 2009–30



Source: Original figure for this publication.
Note: MOH = Ministry of Health.

the economy. This alternative projection, using a different possible future spending pattern, provides a point of comparison for how sensitive estimates of health worker demand may be. Compared with the baseline model, future MOH health expenditures trending with anticipated overall GDP growth yields a 6–8 percent higher level of MOH health expenditure.

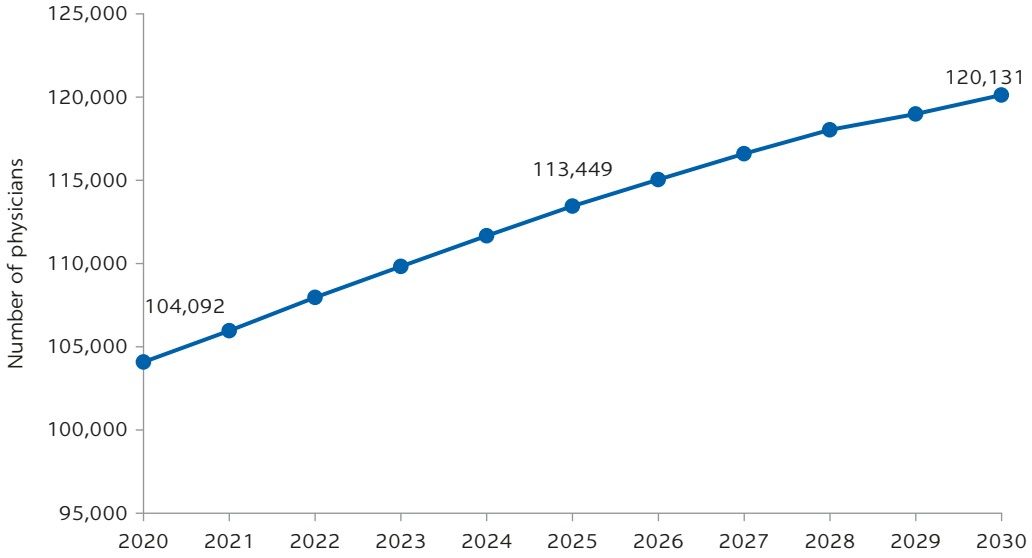
This alternative scenario of future MOH health spending suggests that overall demand for physicians in the health worker labor market will be nearly identical to the baseline projection and similarly increase steadily, but initially at a slightly slower rate than the baseline projection. The projections for physicians are provided in figure 5.6.

The alternative scenario indicates that overall labor market demand for nurses will be nearly identical to the baseline projection and increase steadily, but at a slower rate than the baseline projection (figure 5.7). Again, the projections include all subcategories of nurses, which may overestimate Saudi Arabia's ability to afford nurses as defined by international standards.

The alternative scenario—assuming health expenditure changes with the GDP growth rate—projects a similar pattern of increase in labor market demand for physicians and nurses, with slightly fewer workers compared with the baseline. The difference in the number of workers is illustrated in figure 5.8. The changes in the number of workers are not significant enough to change the density of workers per 1,000 population.

FIGURE 5.6

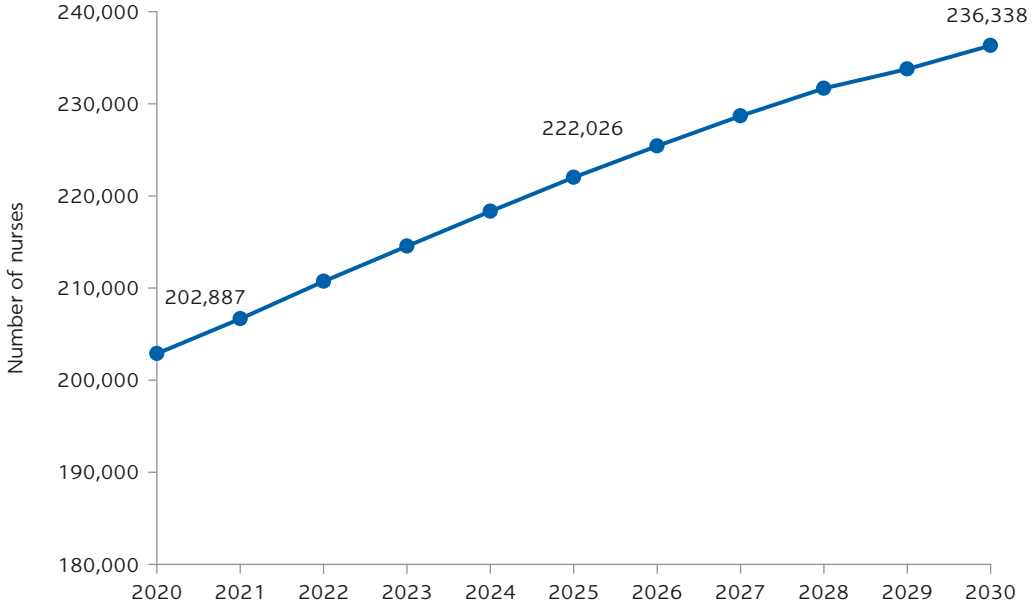
Projected number of physicians that can be absorbed in Saudi Arabia (alternative scenario, assuming MOH health spending changes with GDP growth rate), 2020–30



Source: Original figure for this publication.
Note: MOH = Ministry of Health.

FIGURE 5.7

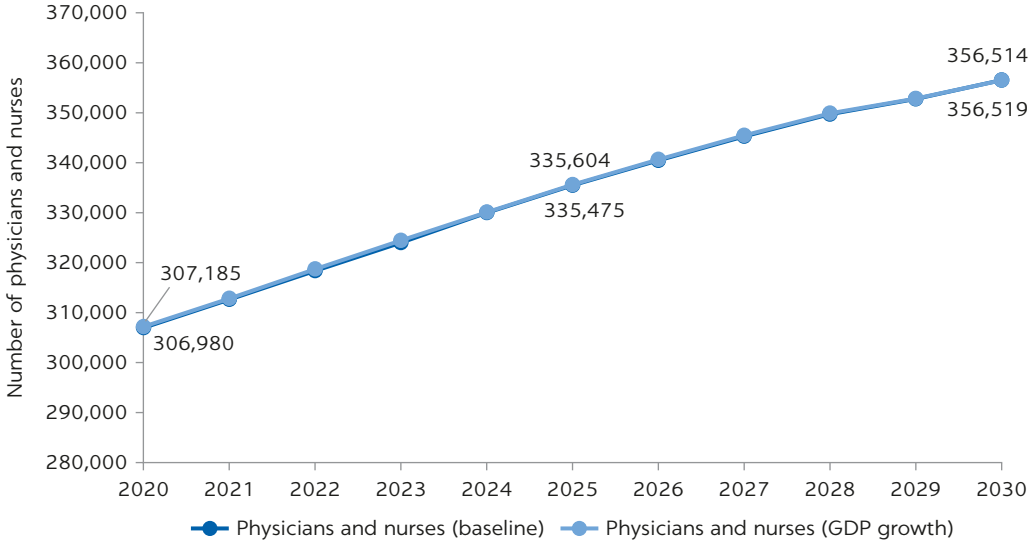
Projected number of nurses that can be absorbed in Saudi Arabia (alternative scenario, assuming MOH health spending changes with GDP growth rate), 2020–30



Source: Original figure for this publication.
Note: MOH = Ministry of Health.

FIGURE 5.8

Projected number of physicians and nurses, GDP growth scenario compared with baseline, 2020–30



Source: Original figure for this publication.

CONCLUSION

Both overall demand for physicians and nurses (including those with diplomas and those with bachelor's and advanced degrees) in Saudi Arabia (demanded by all employers in the public and private sectors) and public sector–only demand for physicians and nurses in the health worker labor market will increase steadily. Overall demand for health workers in Saudi Arabia will be at a level similar to that of other upper-middle-income and high-income countries (Liu et al. 2016). By 2030, public sector demand for physicians is estimated to account for approximately 59 percent of overall demand for physicians in Saudi Arabia. Public sector demand for nurses is estimated to account for approximately 70 percent of overall demand for nurses in Saudi Arabia. Assuming the trends continue, public sector demand for physicians and nurses is estimated to account for 66 percent of overall demand for physicians and nurses in Saudi Arabia.

Sensitivity analysis that alternatively assumed future growth in MOH health spending trends with anticipated GDP growth yielded very similar estimates. Although labor market demand for nurses is projected to increase from 2020 to 2030, the projection includes all subcategories of nurses. Diploma nurses, however, do not have a standard job description and may perform tasks that are more similar to medical assistants. Given that there is a distinction between the common scope of work of bachelor and advanced nurses, who receive higher wages, and diploma nurses, who receive lower wages, it is important to note that the number of nurses (who perform tasks according to the international standard) that can be afforded by the health worker labor market may be lower than projected in this chapter.

The projections included in this chapter use an economic model that draws on past trends between economic drivers (that is, MOH health expenditure and total government expenditure) and physician and nurse densities to predict

future densities. The model assumes the wage bill, skill mix, provider tasks, productivity, health system organization, and technology remain unchanged. As noted, limitations for this analysis include the unavailability of data on non-MOH public sector and private sector health expenditures. Nevertheless, the MOH accounts for the largest share of government health expenditure in Saudi Arabia and employs the majority of health workers in the public sector; therefore, the MOH is a principal component of labor market demand for health workers in Saudi Arabia. In addition, total government expenditure per capita is included to capture the general trajectory of public sector investment across all spending categories. In an economy in which government spending dominates the market and private health expenditure has been relatively stable over the past 16 years, using only public spending data may adequately predict total market demand for physicians and nurses in Saudi Arabia. Furthermore, national-level data on the number of public sector health workers within the MOH and outside the MOH were used to project overall demand for public sector workers.

Some of these assumptions are relaxed and simulated scenarios are explored in chapter 7. The labor market demand for physicians and nurses under a different wage bill and increased health expenditure are evaluated.

ANNEX 5A: LABOR MARKET DEMAND PROJECTION

The economic model to project future demand for physicians and nurses in Saudi Arabia was built on previous methods used for projecting physician demand (Bruckner, Liu, and Scheffler 2016; Liu et al. 2016). Drawing on past trends between the correlation of economic drivers and physician and nurse densities, the model predicts the future densities of nurses and physicians, assuming the wage bill remains the same. Data sources used for the projections are presented in table 5A.1. Regional data used for this analysis were available for the numbers of physicians and nurses working for the MOH in the public sector and working for all employers in the private sector. Regional data did not include information on physicians and nurses working for non-MOH employers in the public sector; these data were available only at the national level. Regional data, which are collected at a lower administrative level than provincial data, were aggregated at the province level so the projection could be conducted at a province level for consistency.[1] Provincial MOH health expenditure and total government expenditure were divided by provincial population to calculate MOH health expenditure per capita and total government expenditure per capita, respectively, to ensure comparability across provinces with different population sizes. The variable was calculated by dividing MOH health expenditure for each province-year by the population for the respective province-year.

The economic factors used to project labor market demand for health workers in Saudi Arabia were driven primarily by the availability of suitable data at the subnational (that is, province) level:

- MOH health expenditures per capita: Higher spending on health is directly associated with increased provision of health services, of which labor is the largest component.
- Total government expenditure per capita: The variable is included as a proxy for the amount of government expenditure on health. As such, it is expected that higher total government expenditure will increase health care utilization

TABLE 5A.1 Data sources used for the economic model

INDICATOR	UNIT	YEARS	SOURCE
Number of physicians and nurses (MOH and private sector)	Regional	2007–18	MOH 2019
Number of physicians and nurses in the public sector, by MOH and non-MOH	National	2007–18	MOH 2019
Population	Regional	2007–18	MOH 2019
Future estimated population	National	2019–30	UN DESA, Population Division 2019
MOH health expenditure	Provincial	2009–16	MOF BOOST data 2018
Total government expenditure	Provincial	2009–16	MOF BOOST data 2018
Estimated future GDP PPP	National	2019–30	World Bank[a]

Source: World Bank, based on Source column.
Note: GDP = gross domestic product; MOF = Ministry of Finance; MOH = Ministry of Health; PPP = purchasing power parity.
a. The GDP estimate for 2030 was prepared by Patrick Eozenou (Health Economist, World Bank) for Ly et al. (2017).

and yield higher demand for health workers per capita. This variable was calculated by dividing total government expenditure for each province-year by the population for the respective province-year.

Information on private sector spending was not available, which is a notable limitation of this analysis, especially in light of the fact that the outcomes predicted—physician and nurse densities—reflect total health workers employed by both the public and the private sectors. In an economy in which government spending dominates the market and is the largest driver of overall economic spending, predictions for both public and private sector workers using only public spending data may result in a small bias. This bias may be even more negligible if patterns in private sector spending are unlikely to change. In fact, as indicated in table 5A.2, trends in private health expenditures as a percentage of total health expenditures were relatively stable between 2000 and 2016, fluctuating between 27 percent and 38 percent (World Bank 2020). Thus, assuming these private sector spending trends continue under the status quo baseline scenario, the economic model using only government spending data may adequately predict total market demand for physicians and nurses in Saudi Arabia.

The projection methodology adopted the stepwise approach described below.

Step 1. Determining the economic drivers

Although health expenditure is considered to be a more ideal indicator for demand, because of a lack of data, previous studies on demand for health workers have relied on proxy indicators. Studies have shown that indicators of GDP or national income are the best predictors of health expenditures, of which labor is the principal component (Cooper, Getzen, and Laud 2003; Getzen 1990; Newhouse 1977). The model for global health worker labor market demand by Liu et al. (2017) similarly uses per capita indicators of GDP (Liu et al. 2016), but also includes household out-of-pocket health expenditures as a proxy

TABLE 5A.2 Private health expenditure as a share of total health expenditure, 2000–16

YEAR	PRIVATE HEALTH EXPENDITURE TO TOTAL HEALTH EXPENDITURE (%)
2000	27.948
2001	27.460
2002	27.686
2003	27.626
2004	28.520
2005	27.505
2006	27.018
2007	29.613
2008	36.405
2009	35.013
2010	38.067
2011	32.931
2012	31.717
2013	30.406
2014	28.631
2015	31.526
2016	33.289

Source: World Bank DataBank, Saudi Arabia data, updated May 20, 2020, https://data.worldbank.org/country/saudi-arabia?view=chart.

measure of the generosity of health insurance coverage, as well as the size of the population age 65 or older as an indicator of the demographic effect of population aging and ensuing demand for health care services utilized at older ages (Cooper et al. 2002).

Using historical data on physician and nurse densities, health expenditure per capita, and total government expenditure per capita, the relationship between the economic drivers and health worker densities was estimated using a generalized linear model. All variables were transformed into logs. To avoid endogeneity, health expenditure per capita and total government expenditure were lagged up to three years to allow time for such factors to work through the economy and affect the labor market, as other authors have done in previous projection exercises (Getzen 1990; Scheffler et al. 2008). A stepwise approach was used to select the specific combination of year lags that maximize the predictive power of each variable. Lagged variables that achieve a minimum 1 percent level of significance after repeated iterations were kept within the model, resulting in the following optimal model for physicians and nurses, respectively:

$$\ln(\text{MOH \& private sector } \textit{physicians per 1,000 population}_{pt}) = \alpha_0 + \alpha_1 \times \ln(\textit{health expenditure per capita}_{pt-1}) \alpha_2 \times \ln(\textit{total government expenditure per capita}_{it-4}) + \mu_p + \xi_{pt} \quad (5.1)$$

$$\ln(\text{MOH \& private sector } \textit{nurses per 1,000 population}_{pt}) = \beta_0 + \beta_1 \times \ln(\textit{health expenditure per capita}_{pt-1}) + \beta_2 \times \ln(\textit{total government expenditure per capita}_{it-4}) + \mu_p + \xi_{pt} \quad (5.2)$$

where μ_p represents a vector of province fixed effects, ξ_{pt} is the disturbance term, and β coefficients are unknown parameters to be estimated from the model. Province fixed effects μ_p were included to account for time-invariant unobservable heterogeneity (that is, not captured by available data) across provinces (for example, average distance to closest hospital).

Although specification testing showed that the optimal model for physicians included only one economic predictor but the model for nurses included two predictors, the final predictive model used both health expenditures and total government expenditures, each lagged one year, for several reasons. First, using both predictors ensured that the models used to predict both physicians and nurses rest on the same theoretical assumptions regarding economic drivers. Second, comparison of the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) showed that including both economic predictor variables produced nearly the same test statistic value (see table 5A.3) as the model using only one predictor variable (as in equation (5.1)). Third, because the nursing cadre is larger than that for physicians in Saudi Arabia, the model projections for nurses will have a larger substantive impact on resource mobilization. Model 1 in table 5A.3 includes the coefficients for physicians per 1,000 population using both predictor variables. The results indicate that a 1 percent increase in health expenditure per capita is associated with about a 16 percent increase in physicians per 1,000 population; a 1 percent increase in total government expenditure is associated with a 3 percent increase in physicians per 1,000 population. Model 2 in table 5A.3 presents the results for nurses per 1,000 population using two predictors (equation (5.2)). The results indicate that a 1 percent increase in health expenditure per capita is associated with about a 13 percent increase in nurses per 1,000 population, and a 1 percent increase in total government expenditure is associated with about a 7 percent increase in nurses per 1,000 population.

TABLE 5A.3 Model 1 fit, using historical data

	(1)	(2)
VARIABLE	**LN(MOH & PRIVATE SECTOR *PHYSICIANS PER 1,000 POPULATION*)**	**LN(MOH & PRIVATE SECTOR *NURSES PER 1,000 POPULATION*)**
ln(health expenditure per capita)$_{t-1}$	0.146***	0.129**
	(0.0482)	(0.0551)
ln(total government expenditure per capita)	0.0305	0.0653***
	(0.0213)	(0.0244)
Constant	−0.141	0.409
	(0.241)	(0.275)
AIC	−1.476291	−1.206426
BIC	−484.5306	−484.1554
Observations	117	117

Source: Original calculations for this publication.
Note: AIC = Akaike information criterion; BIC = Bayesian information criterion; MOH = Ministry of Health..
** $p < .05$ *** $p < .001$

Step 2. Projecting the future value of predictors

Future values of health expenditure are needed as input parameters for the demand model projections to predict future values of physicians per 1,000 population and nurses per 1,000 population. To project future values of health expenditure per capita, seven different models were tested:

1. For each province *p*, a moving average for 12 prior periods without weights was estimated:

$$health\ expenditure_{pt} = \frac{1}{12}\sum_{x=1}^{11} health\ expenditure_{p,t-x} \tag{5.3}$$

A total of 12 previous periods was chosen to maximize the number of prior year observations possible to base projections on (for example, the projection for 2030 needs at least 12 lags to use prior information from 2018).

2. For each province *p*, a moving average for 10 prior periods with weights was estimated, with the more distant observations receiving progressively smaller weights:

$$health\ expenditure_{pt} = \frac{1}{10}\sum_{x=1}^{10}\left(10-x\right) health\ expenditure_{p,t-x} \tag{5.4}$$

3. For each province *p*, double-exponential smoothing over 10 prior periods was applied:

$$S_{pt}^{[2]} = \alpha S_{pt} + (1-\alpha) S_{p,t-1}^{[2]}, \tag{5.5}$$

where $S_{pt}^{[2]}$ is the smoothed original series from $S_{pt} = \alpha X_{pt} + (1-\alpha) S_{p,t-1}$, and α is the smoothing parameter estimated by minimizing the in-sample sum-of-squared predicted errors; X_{pt} is the original series.

4. For each province *p*, the following regression was applied, where β represents the yearly difference in health expenditure over the previous year, and ε_{pt} is a random error term:

$$health\ expenditure_{pt} = \alpha + \beta Year\ trend_{pt} + \varepsilon_{pt} \tag{5.6}$$

5. For each province *p*, the following regression, which additionally accounts for nonlinearities in the time trend of health spending, was estimated:

$$health\ expenditure_{pt} = \alpha + \beta_1 Year\ trend_{pt} + \beta_2 (Year\ trend_{pt})^2 + \varepsilon_{pt} \tag{5.7}$$

6. For all provinces *p*, the following pooled regression, which includes province fixed effects (γ_p) as well as a flexible time trend, was estimated:

$$health\ expenditure_{pt} = \alpha_c + \beta_1 Year\ trend_{pt} + \beta_2 (Year\ trend_{pt})^2 + \gamma_{pt} + \varepsilon_{pt} \tag{5.8}$$

7. This model uses the same regression as equation 5.3 but corrects for autoregressive serial correlation.

Each model specification was first estimated using the initialization data set (2009 to 2015), using the lag structure from equations (5.1) and (5.2). The estimated parameters were then applied to the data set to obtain predicted values for 2009 through 2018. These predicted values were then compared with actual data

from 2009 to 2018. To assess the fit of each model, the mean square root of the squared error is again calculated in equation (5.9); the results are displayed in table 5A.4 for each of the models tested.

$$Mean\ error\ = \frac{1}{PT}\sum\sqrt{(\widehat{health\ spending}_{pt} - health\ spending_{pt})^2} \qquad (5.9)$$

Models 3 and 6 (table 5A.4) were found to have the smallest prediction error. Moreover, the mean of the predictions from Models 3 and 6 were evaluated to see if prediction accuracy was improved (Makridakis, Wheelwright, and Hyndman 1998). To further improve prediction accuracy, the optimal method (which minimizes the square root of the squared error) for each province was identified for inclusion (instead of relying on one method for all provinces). For example, Model 3 may minimize prediction errors in province A, but Model 6 may minimize prediction errors in province B. Rather than force one method on all provinces uniformly, the optimal model selection was allowed to be province–specific. The results from this approach indicated that Model 3 generated the smallest errors across all provinces; therefore, Model 3 was used for all provinces.

The same steps were used for predicting future values of both health spending per capita and total government spending per capita. Table 5A.5 displays the mean errors associated with the models tested for predicting total spending per capita. Model 3 was the method found to have the smallest prediction error.

Step 3. Calculating future labor market demand for physicians and nurses

The predicted values for health expenditure per capita and total government expenditure per capita were then used as inputs into the overall demand model (equation (5.2)) along with estimated coefficients (table 5A.3) to estimate the density of physicians and nurses in each province-year from 2020 to 2030. Predicted values of logged physician and nurse densities from this model were then transformed with an antilog and multiplied by a correction factor ($e^{\sigma^2/2}$) to account for the skewed distribution. The density for each cadre in each province-year was multiplied by the province population to calculate labor market demand for health workers in the province. The provincial demand was

TABLE 5A.4 Mean errors for health spending per capita projection models

MODEL	N = P × T	MEAN	STANDARD DEVIATION
1	117	46,038.29	96,127.89
2	117	38,526.09	84,861.62
3	**130**	**12,095.64**	**30,076.51**
4	130	73,775.19	99,767.52
5	130	73,336.20	97,681.25
6	**130**	**15,855.27**	**36,518.44**
7	130	23,363.77	58,253.15

Source: Original calculations for this publication.
Note: **Bold** indicates smallest prediction errors. N = number; P = province; T = time period (year).

TABLE 5A.5 Mean errors for total spending per capita projection models

MODEL	N = P × T	MEAN	STANDARD DEVIATION
1	117	25,321.35	37,006.60
2	117	19,959.16	28,690.76
3	**130**	**1,551.467**	**3,558.455**
4	130	32,036.45	41,569.14
5	130	31,875.68	42,551.93
6	130	4,135.892	6,013.235
7	130	8,129.914	13,696.85

Source: Original calculations for this publication.
Note: **Bold** indicates smallest prediction error. N = number; P = province; T = time period (year).

then summed by year to calculate national labor market demand for physicians and nurses from 2020 to 2030.

Step 4. Calculating overall health labor market demand for physicians and nurses in Saudi Arabia

Additional steps were taken to project the total number of public sector workers, incorporating the supply of physicians and nurses in the public sector but who were not employed by the MOH. Because yearly data at the province level were not available, national-level data on the number of public sector health workers in the MOH and outside the MOH were used. The national percentages of physicians and nurses working for the MOH out of total public sector workers were projected into the future. The projected percentages of MOH physicians and nurses out of total public sector physicians and nurses were then used to calculate the estimated national number of health workers, including all public sector employers, from 2020 to 2030 (table 5A.6).

Step 5. Calculating public sector health labor market demand for physicians and nurses in Saudi Arabia

To allow for comparison with the projection of overall health labor market demand in Saudi Arabia, additional estimations were conducted to project public sector–specific demand. Although past literature (Liu et al. 2016) uses demand predictors that capture economywide spending, the analysis here is limited to data on MOH and government spending only; no private sector demand-side predictors were available in Saudi Arabia. Thus, government-specific spending data are accompanied by historical data for MOH workers only (excluding health workers in the public sector who were employed by non-MOH employers). As such, the predictions for overall health labor market demand in Saudi Arabia were being driven entirely by trends in public sector spending. The same predictors were used to predict the demand for MOH workers when estimating public sector–specific demand for workers. As expected, overall health labor market demand and public sector–specific labor market demand yielded parallel lines, with public sector–specific demand projecting a lower number. This is a statistical product of the data limitations. Without any indicators of private sector growth, this assumption is necessary. Nevertheless,

TABLE 5A.6 Projected labor market demand for physicians and nurses, 2020–30

	PHYSICIANS		NURSES		PHYSICIANS AND NURSES	
YEAR	NUMBER	DENSITY PER 1,000 POPULATION	NUMBER	DENSITY PER 1,000 POPULATION	NUMBER	DENSITY PER 1,000 POPULATION
2020	104,145	2.99	203,040	5.83	307,185	8.82
2021	106,010	3.00	206,819	5.85	312,830	8.85
2022	107,936	3.01	210,779	5.88	318,716	8.89
2023	109,806	3.02	214,632	5.91	324,438	8.93
2024	111,649	3.03	218,447	5.94	330,096	8.97
2025	113,435	3.05	222,168	5.96	335,604	9.01
2026	115,054	3.05	225,586	5.99	340,640	9.04
2027	116,602	3.06	228,858	6.00	345,460	9.06
2028	118,040	3.06	231,856	6.02	349,896	9.08
2029	118,975	3.06	233,868	6.01	352,843	9.06
2030	120,099	3.05	236,415	6.01	356,514	9.07

Source: Original calculations for this publication.

TABLE 5A.7 Model fit, using historical data

	(1)	(2)
VARIABLE	LN(MOH *PHYSICIANS PER 1,000 POPULATION*)	LN(MOH *NURSES PER 1,000 POPULATION*)
ln(health expenditure per capita)$_{t-1}$	0.123*** (0.0428)	0.107** (0.0538)
ln(total government expenditure per capita)	0.0316* (0.018)	0.0654*** (0.0238)
Constant	−0.129 (0.214)	0.498 (0.269)
AIC	−1.712543	−1.252813
BIC	−484.7854	−484.2273
Observations	117	117

Source: Original calculations for this publication.
Note: AIC = Akaike information criterion; BIC = Bayesian information criterion; MOH = Ministry of Health.
* $p < .10$ ** $p < .05$ *** $p < .001$

this projection may adequately reflect health labor market demand in a baseline scenario with no policy intervention.

Following the methodology outlined for projecting overall health labor market demand in Saudi Arabia, the same steps were used to estimate public sector demand for health workers. Model fit is presented in table 5A.7.

To estimate public sector–specific demand for health workers, the projected national number of MOH physicians and MOH nurses was used as the numerator and the percentages of MOH workers out of total public sector workers (generated in step 4 of this annex) were used as the denominator. Table 5A.8 provides the estimated public sector health labor market demand for physicians and nurses.

Step 6. Calculating projected numbers of physicians and nurses (GDP growth rate scenario)

A sensitivity analysis was conducted assuming health expenditure increases with the estimated GDP growth rate. The projected numbers are presented in table 5A.9.

TABLE 5A.8 Projected public sector labor market demand for physicians and nurses, 2020–30

	PHYSICIANS		NURSES		PHYSICIANS AND NURSES	
YEAR	NUMBER	DENSITY PER 1,000 POPULATION	NUMBER	DENSITY PER 1,000 POPULATION	NUMBER	DENSITY PER 1,000 POPULATION
2020	61,533	2.99	145,004	4.17	206,537	5.93
2021	62,182	3.00	145,271	4.11	207,454	5.87
2022	63,287	3.01	148,059	4.13	211,346	5.90
2023	64,358	3.02	150,772	4.15	215,130	5.92
2024	65,413	3.03	153,456	4.17	218,869	5.95
2025	66,435	3.05	156,070	4.19	222,505	5.97
2026	67,373	3.05	158,487	4.21	225,860	5.99
2027	68,275	3.06	160,808	4.22	229,083	6.01
2028	69,118	3.06	162,937	4.23	232,055	6.02
2029	69,698	3.06	164,357	4.22	234,055	6.01
2030	70,368	3.05	166,184	4.23	236,552	6.02

Source: Original calculations for this publication.

TABLE 5A.9 Projected labor market demand for physicians and nurses, assuming health expenditure increases with GDP growth rate, 2020–30

	PHYSICIANS		NURSES		PHYSICIANS AND NURSES	
YEAR	NUMBER	DENSITY PER 1,000 POPULATION	NUMBER	DENSITY PER 1,000 POPULATION	NUMBER	DENSITY PER 1,000 POPULATION
2020	104,092	2.99	202,887	5.83	306,980	8.82
2021	105,968	3.00	206,669	5.85	312,637	8.85
2022	107,968	3.01	210,728	5.88	318,381	8.89
2023	109,831	3.02	214,550	5.91	324,000	8.93
2024	111,668	3.03	218,332	5.93	330,000	8.97
2025	113,449	3.05	222,026	5.96	335,475	9.01
2026	115,052	3.05	225,414	5.98	340,466	9.03
2027	116,600	3.06	228,683	6.00	345,283	9.06
2028	118,038	3.06	231,678	6.01	349,716	9.08
2029	118,992	3.06	233,777	6.00	352,768	9.06
2030	120,131	3.06	236,338	6.01	356,519	9.07

Source: Original calculations for this publication.

NOTE

1. The region Al-Bahah is coded as Al Bahah province. The regions Al-Jouf and Qurayyat are grouped into Al-Jouf province. The regions Aseer and Bisha are grouped into Asir province. The regions Eastern, Al-Ahsa, and Hafr Al-Batin are grouped into Eastern province. The region Ha'il is coded as Ha'il province. The region Jazan is coded as Jazan province. The regions Mekkah, Jeddah, Qunfudhah, and Ta'if are coded as Mekkah province. The region Madinah is coded as Medinah province. The Northern region is coded as Northern province. The region Qaseem is coded as Qaseem province. The region Riyadh is coded as Riyadh province. The region Tabouk is coded as Tabouk province.

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6 The Projected Gaps between Need and Health Labor Market Supply and Demand

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KEY MESSAGES

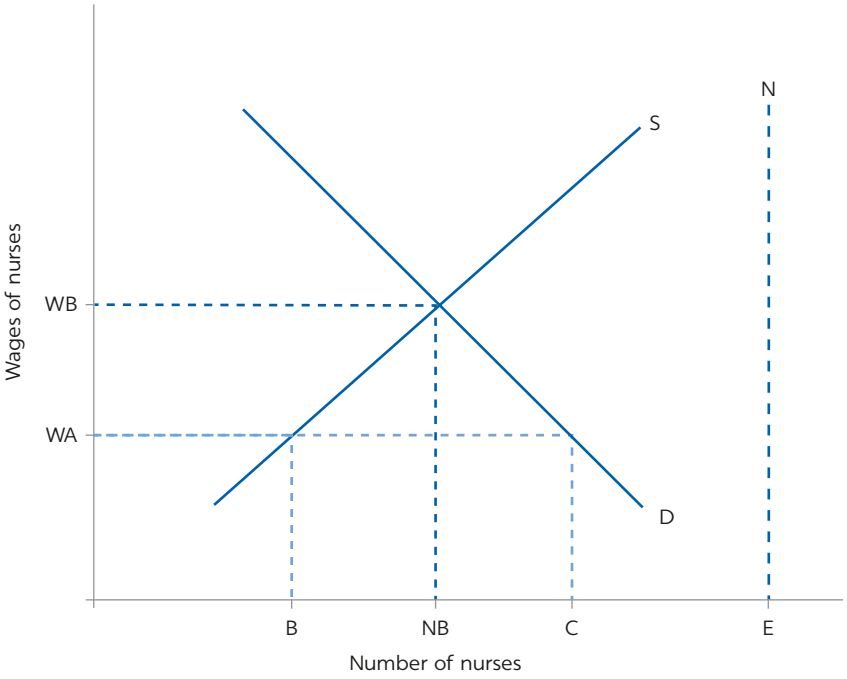
- Nationally, by 2030, there will be a sufficient number of Saudi physicians to meet need-based demand in the country, but there will be a need-based shortage of Saudi nurses, assuming no policy change.
- There will be a critical gap in the number of Saudi bachelor and advanced nurses through 2030, for which there are both insufficient numbers of patient care nurses to meet population health care needs (a need-based shortage) and to fill all positions despite available finances (a labor market demand–based shortage).
- Shortages of both Saudi physicians and nurses in the labor market, given anticipated demand to employ health workers, are estimated to persist through 2030, assuming no policy change.
- The demand-based shortage in the public sector will be substantial—estimated to be more than four health workers per 1,000 persons in 2030, or 167,933 physicians and nurses.

BACKGROUND

With future projections of health worker need, demand, and supply, the estimated shortages or surpluses of health workers can be identified. At a conceptual level, a shortage of workers results when the demand or need exceeds the supply in the health worker labor market. Figure 6.1 is a static depiction of a labor market for nurses. Traditional labor economic analyses assume that, in well-functioning labor markets, disequilibrium (that is, an imbalance between demand and supply) is short-lived. A core assumption is that the wage rate is

FIGURE 6.1

Static model of the labor market for nurses



Source: Reproduced from Bruckner, Liu, and Scheffler (2016), figure 3.5.
Note: The diagram depicts the labor market for nurses. WB is the equilibrium wage that matches the demand (D) and supply (S) of nurses. As the wage falls to WA, demand will exceed supply and there will be a shortage of workers equal to C – B. N represents the number of nurses needed, E measures health care needs, and NB is the number of nurses employed at the equilibrium wage WB.

flexible and freely adjusts the incentives to both employers and health workers to influence their employment behavior and preferences such that equilibrium is restored. However, countries face a binding constraint on the amount of financing available to employ more health workers. In this market, a shortage results according to a demand-based model when the wage rate is equal to (WA) and the quantity demanded (C) exceeds the quantity supplied (B). Additionally, the estimated number of workers needed (E) exceeds any number of workers supplied; hence, a need-based shortage results.

Following the conceptual framework, projected annual health worker need, demand, and supply are compared to determine workforce gaps, if any, in Saudi Arabia from 2020 to 2030. In previous chapters, the overall need (chapter 3), supply (chapter 4), and demand (chapter 5) are projected at a baseline status quo situation *without* any new policy intervention or country-specific characteristics; these projections (summarized in table 6.1) rely on historical trends and assume that these trends continue into the future. Subtracting supply from need-based health worker volume yields the need-based shortage (or surplus). Similarly, subtracting supply from demand-based health worker volume yields the demand-based shortage (or surplus).

To better capture particular characteristics of the Saudi health workforce, this chapter makes the following additional adjustments to the baseline estimates:

- Adjusts the projected supply upward to include non-MOH public sector workers (previously excluded from baseline estimates in chapter 4)

TABLE 6.1 Summary of baseline projections from chapters 3, 4, and 5

CHAPTER	TYPE OF PROJECTION	ASSUMPTIONS
3. Need-based demand	• Estimates of the size of the health workforce driven by the prevalence of priority health conditions of a population • Estimates of the number of physicians and nurses required to meet the epidemiological need of the population[a]	• Health workforce responds only to *true* illness, rather than to economic factors. • A DALY multiplier of 5 is used to establish the baseline burden of disease. • Plausible target coverage rates are based on the literature. • No policy interventions (for example, task-shifting and education campaigns) are included.
4. Labor market supply	• Estimates the number of health workers available to be employed by the MOH in the public sector and by all employers in the private sector	• Historical trends (including output and attrition) continue into the future.
5. Labor market demand	• Reflects the total estimated physicians and nurses that can be afforded by all employers (public and private sectors) • Estimates the number of health workers that can be afforded by the public sector (including MOH and non-MOH employers but excluding private sector employers) • Uses the association of historical trends in MOH health expenditure per capita and total government spending per capita with health worker density to estimate future demand in the health worker labor market	• Historical trends of predictors (MOH health expenditures per capita and total government spending per capita) continue. • Historical association between health workers demanded (per 1,000 population) and economic predictors continues. • Labor market demand projections are driven by public sector spending.

Source: World Bank.
Note: DALY = disability-adjusted life year; MOH = Ministry of Health.
a. The epidemiological need is calculated with target coverage informed by the National Transformation Program.

- Accounts for the relative lower productivity of public sector as well as private sector Saudi health workers
- Delineates between bachelor and advanced nurses and diploma nurses by excluding diploma nurses from the overall projected supply of nurses, facilitating an examination of bachelor and advanced nurses separately from diploma nurses, whose scope of work is similar to that of health technicians in many cases

Together, these adjustments are in alignment with the strategic goals outlined in the National Transformation Program (NTP) for health workforce Saudization and ensure there will be adequate Saudi health workers with the necessary skills to meet the needs and demand of the health system. The adjusted baseline health labor market supply and demand and need-based demand projections that align with the NTP will allow for the calculation of health workforce gaps that are more informative for health workforce planning in Saudi Arabia. The adjusted baseline projections presented in this chapter are later used to simulate health workforce gaps under different policies in chapter 7.

As such, this analysis focuses on the gaps between the supply of Saudi physicians (generalists and specialists) and Saudi nurses (including only bachelor and advanced nurses) and need-based demand and labor market demand. The estimated supply of health workers under the baseline assumptions presented in chapter 4 are adjusted to reflect full-time equivalent (FTE) numbers of Saudi physicians and nurses in all health sectors (both public and private). This adjusted supply is then more comparable to estimated demand for physicians and nurses in the health worker labor market (including both public and private

sector employers). The need-based demand for physicians and for nurses is the baseline projection from chapter 3, estimated using the standard target coverage rate. However, all projections, even after adjusting for these country-specific characteristics, still assume no policy change; scenarios reflecting different policy changes are examined in chapter 7.

The remainder of this chapter is organized as follows: The next section presents additional supply estimates adjusted for specific data limitations (that is, it incorporates overall public sector supply, worker productivity, and adjusted nurse supply to exclude diploma nurses). The section after that presents the estimated gaps in the physician, nurse, and total health workforces that may occur in Saudi Arabia. The concluding section summarizes the implications for the projected gaps, assuming no policy intervention, in relation to the strategic goals of the NTP.

ADJUSTED BASELINE LABOR MARKET SUPPLY PROJECTIONS

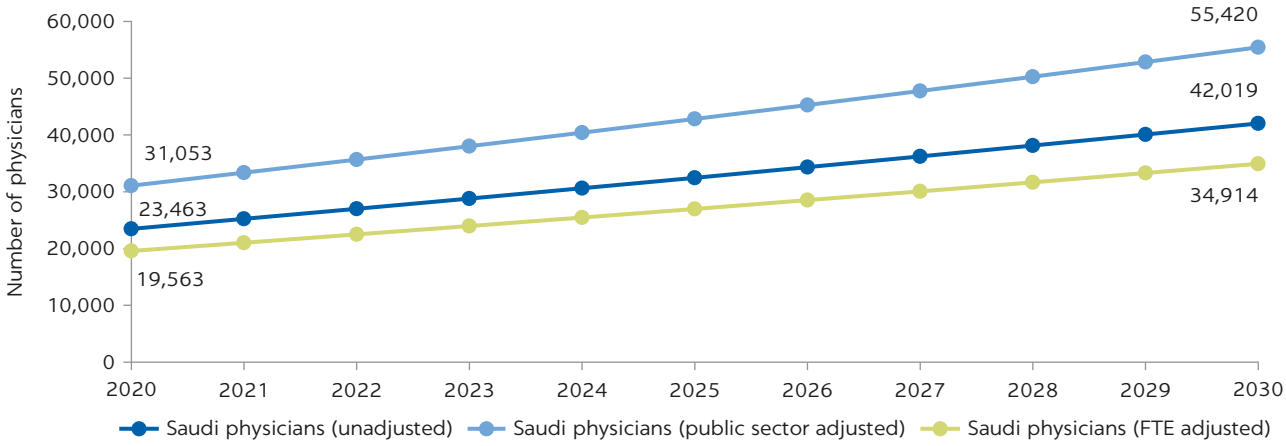
To address data limitations and align the projections with the strategic goals outlined in the NTP, baseline supply estimates were adjusted upward to capture workers from non-MOH public sector employers. The projected supply of Saudi health workers was first adjusted to incorporate non-MOH Saudi health workers in the public sector. In chapter 4, projections are made for the number of health workers employed by the MOH in the public sector and by all employers in the private sector; public sector workers employed outside the MOH are excluded. Additional analytical steps were taken to estimate the supply of non-MOH public sector workers by projecting public sector non-MOH workers as a percentage of all public sector workers (MOH and non-MOH; see table 6A.1 in annex 6A) and adding them to the total supply of health workers in Saudi Arabia.

As illustrated in figure 6.2, once the number of Saudi physicians employed by non-MOH employers was included to account for the overall number of public sector physicians, the number of public sector Saudi physicians increased by approximately 32 percent (from 42,019 to 55,420 in 2030). Similarly, figure 6.3 shows that once the nurses employed by non-MOH employers were included, the overall number of public sector nurses also increased by approximately 26 percent (from 129,008 to 162,119 in 2030). Note that, because data on non-MOH health workers are available only at the national level, these supply projections could not be further stratified by gender and facility type.

Then, the estimated number of health workers was further converted to FTEs to adjust for the relative productivity of public sector workers compared with their private sector counterparts. Using a five-hour workday (9 am to 3 pm, including a one-hour lunch) as compared to a full eight-hour workday, 63 percent (five hours divided by eight hours) maximum productivity was estimated for public sector workers (62 percent were of Saudi origin in 2018, projected to be 57 percent in 2030). In other words, the projected number of public sector workers was multiplied by 63 percent to generate the FTE supply of health workers in the public sector. After accounting for non-MOH public sector workers and the lower productivity of public sector workers, the resulting adjusted FTE supply of health workers better approximates the baseline status quo health workforce *without* any new policy intervention.

FIGURE 6.2

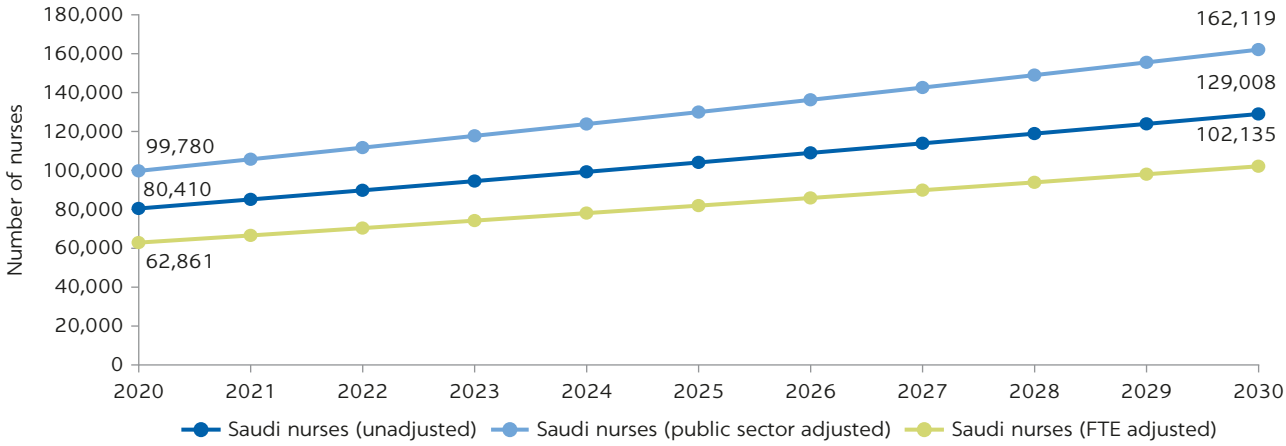
Projected number of Saudi physicians, adjusted versus unadjusted supply, 2020–30



Source: Original calculations for this publication.
Note: The ***unadjusted supply*** is the baseline supply of physicians from chapter 4, which does not include either (1) physicians employed by non-MOH employers or (2) the relative productivity of physicians. FTE = full-time equivalent; MOH = Ministry of Health.

FIGURE 6.3

Projected number of Saudi nurses, adjusted versus unadjusted supply, 2020–30



Source: Original calculations for this publication.
Note: The ***unadjusted supply*** is the baseline supply of nurses (including diploma, bachelor, and advanced nurses) from chapter 4, which does not include either (1) nurses employed by non-MOH employers or (2) the relative productivity of nurses. FTE = full-time equivalent; MOH = Ministry of Health.

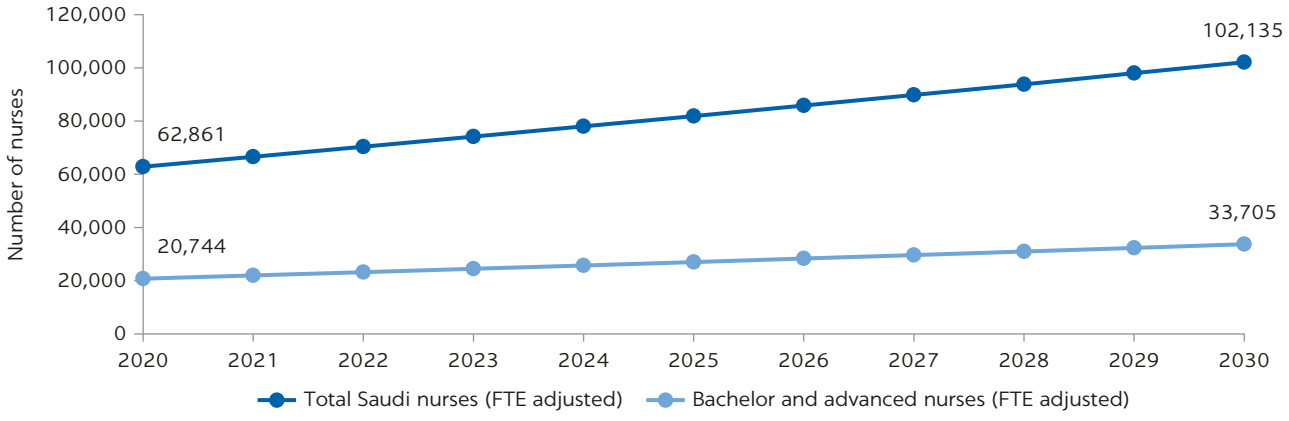
The supply of Saudi physicians is unequivocally lower when considering productivity adjustments that reflect current work schedules in Saudi Arabia (figure 6.2). If all public sector Saudi physician work hours were in line with international standards of an eight-hour workday, then 42,019 Saudi physicians, or 1.07 Saudi physicians per 1,000 population, are projected to be available by 2030. However, when accounting for Saudi physicians' lower relative productivity in both the public sector and the private sector and converting the total number of physicians in both sectors to FTEs, the 2030 total supply of Saudi physicians drops to just 34,914, or 0.89 Saudi physicians per 1,000 population. Annex 6A details the calculation of this adjustment for FTE productivity. Table 6A.2 presents the estimated numbers from 2020 to 2030.

Similarly, the projected supply of Saudi nurses in both the public sector and the private sector is lower when adjusting for their relative productivity estimated using work hours (figure 6.3). If all public sector Saudi nurses worked an eight-hour workday, then 129,008 Saudi nurses, or 3.28 Saudi nurses per 1,000 population, are projected to be available by 2030. However, when accounting for Saudi nurses' fewer work hours (that is, five hours per day) in both the public sector and the private sector and converting the total public sector nurse number to FTEs, the supply of nurses by 2030 is projected to be 102,135. This number translates to 2.60 Saudi nurses per 1,000 population. Annex 6A details the calculation for this adjustment and table 6A.3 presents the estimated numbers from 2020 to 2030.

For nurses, the data and projections were additionally adjusted downward to exclude diploma nurses, whose scope of work is similar to that of health technicians in many cases. In contrast, bachelor and advanced nurses, who are more involved in patient care, are better aligned with international classifications for the nursing profession. The data on nurses from the MOH combines diploma, bachelor, and advanced nurses into one group, and the baseline projections of nurse supply presented in chapter 3 reflect this aggregate definition. However, this categorization likely reflects an overestimation of the true supply of nurses who perform patient care duties according to international standard definitions for the nursing profession. Approximately 67 percent of all nurses (from 2018 cross-sectional data; see SHC 2017-2018 Balanced Distribution Data Set) were diploma nurses. As such, the projections going forward in this report exclude these diploma nurses (figure 6.4). Note that data on physicians incorporate both generalists and specialists, the classifications for which are similar to international professional standards; the data also include a small portion of dentists. The physician data and classification obviated the need for any additional adjustments for worker numbers. All projected Saudi physician and nurse supply estimates presented in this chapter from this point forward reflect productivity-adjusted FTEs of Saudi physicians and bachelor and advanced nurses (excluding diploma nurses) in both the public and private sectors.

FIGURE 6.4

Projected number of Saudi nurses: All categories of nurses versus bachelor and advanced nurses only, 2020–30



Source: Original calculations for this publication.
Note: The FTE-adjusted supply of nurses includes nurses employed by the private sector and the public sector. FTE = full-time equivalent.

GAPS IN THE PHYSICIAN AND NURSE WORKFORCES

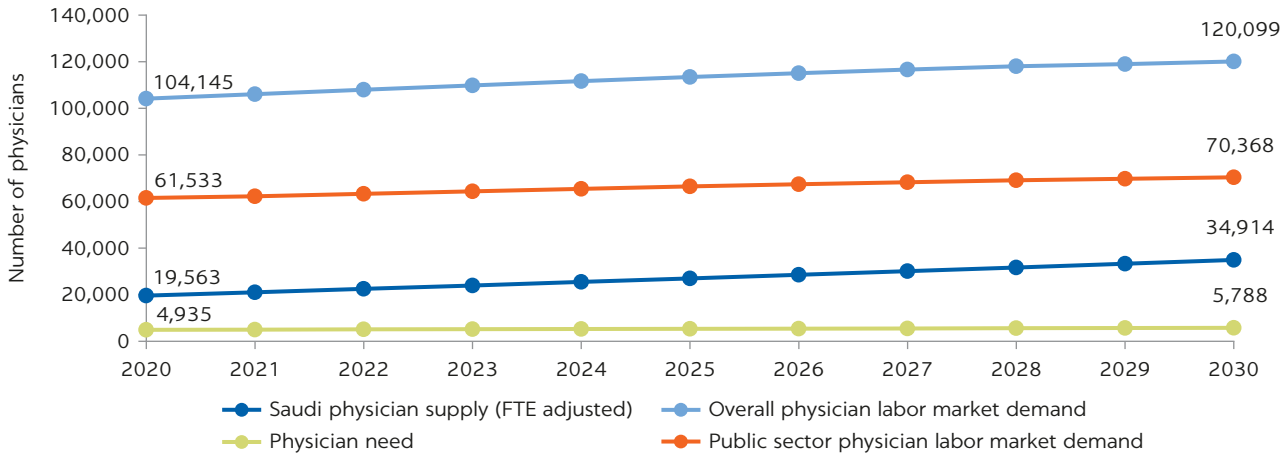
After adjustments (for non-MOH public sector workers, productivity of Saudi workers, and excluding diploma nurses), the gaps in the health workforce were determined. With no policy intervention, there will be a sufficient number of Saudi physicians to meet the epidemiological need but a shortage of Saudi physicians to meet demand[1]—both overall and within the public sector—in the Saudi health worker labor market through 2030. The physician workforce gaps in Saudi Arabia from 2020 to 2030 are illustrated in figure 6.5, and the respective numbers are presented in table 6A.4. With no policy change, the estimated overall health labor market demand shortage of Saudi physicians is expected to fluctuate between 84,582 and 86,541 during the period from 2020 to 2030. Focusing on public sector health labor market demand, the shortage is expected to be 41,969 Saudi physicians in 2020, but decreasing to 35,454 in 2030.

With no policy intervention, there will be a need-based shortage and a health labor market demand-based shortage of Saudi bachelor and advanced nurses from 2020 through 2030. Figure 6.6 illustrates the projected Saudi nurse supply and demand from 2020 to 2030; respective numbers are presented in table 6A.5. With the model adjustments made in this chapter, there is still a consistent and substantial need-based shortage of nurses. In 2020, there is a need-based shortage of 38,310 Saudi nurses, decreasing to a shortage of 35,694 nurses in 2030.

The estimated overall health labor market demand-based shortage of Saudi nurses is expected to be substantial and increasing, from an estimated shortage of 182,295 in 2020 to 202,711 in 2030, assuming no policy change. Although the gap between the supply of Saudi nurses and estimated need-based demand is much larger than the gap between supply and health labor market demand, it is important to note that although labor market supply projections excluded diploma nurses, labor market demand for nurses includes all nurses (diploma, bachelor, and advanced). As such, labor market demand for nurses may be overestimated, given that diploma nurses receive lower wages than bachelor and advanced nurses.

FIGURE 6.5

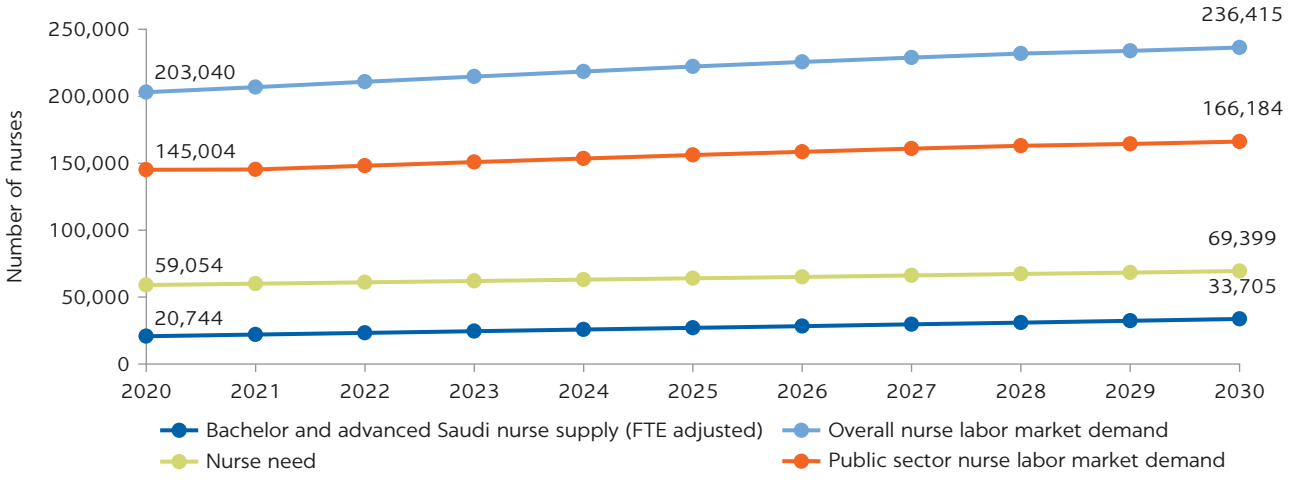
Projected Saudi physician need, supply, and demand, 2020–30



Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

FIGURE 6.6

Projected Saudi bachelor and advanced nurse need, supply, and demand, 2020–30



Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

A similar pattern of shortages of Saudi nurses is expected when examining only public sector labor demand for nurses. Assuming no policy change, there will be an estimated shortage of 124,260 nurses in the public sector in 2020. This public sector demand shortage of Saudi nurses is expected to increase to 132,479 in 2030.

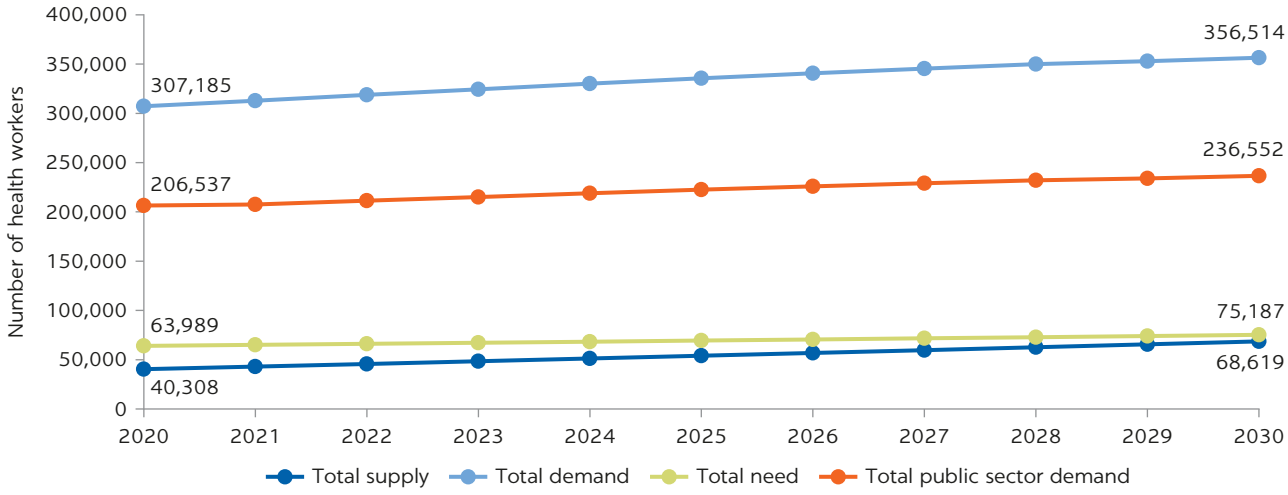
For physicians and nurses together, there will be a need-based shortage and a persistent demand-based shortage—both overall and within the public sector—in Saudi Arabia between 2020 and 2030. Figure 6.7 illustrates the projections for the Saudi health workforce; see table 6A.6 for more details. Assuming no policy change, in 2020 there is an estimated need-based shortage of 23,682 workers, or 0.68 workers per 1,000 population. This gap between the Saudi supply of health workers and need-based demand, however, is expected to become smaller; by 2030 it is expected that there will be a need-based shortage of only 6,568 health workers, or 0.17 workers per 1,000 population, assuming no policy change.

Although the health labor market demand-based shortage of health workers will continue, the gap between labor market demand for workers and supply of workers in terms of density (per 1,000 population) is projected to narrow between 2020 and 2030. In 2020, there is an estimated shortage of 266,877, or 7.67 workers per 1,000 population. By 2030, the estimated shortage of physicians and nurses is 287,896 or 7.32 per 1,000 population. The gap between labor market demand and supply is therefore projected to narrow by 0.35 per 1,000 population.

Focusing only on the public sector, the demand-based shortage, assuming no policy change, is estimated to narrow between 2020 and 2030. The shortfall of workers to meet demand in the public sector is expected to fluctuate between 164,464 and 169,433 workers from 2020 to 2030. However, the estimated density gap is expected to narrow by 0.50 health workers per 1,000 population, from 4.77 workers in 2020 to 4.27 workers in 2030.

FIGURE 6.7

Projected health worker need, supply, and demand, 2020–30



Source: Original calculations for this publication.

CONCLUSION

This chapter adjusts baseline projections from chapter 3 for several Saudi-specific characteristics—incorporating non-MOH public sector workers, adjusting for the relative productivity of public sector workers, and focusing only on patient care nurse subcategories (bachelor and advanced degrees)—to better assess the anticipated gaps in the Saudi health workforce. Although the estimated supply of health workers was adjusted upward to include workers employed in the non-MOH public sector, total worker numbers were adjusted downward after (1) converting public sector workers to FTEs to account for their five-hour workday,[2] and (2) excluding diploma nurses from the nursing projections.

Still assuming no policy change, the net effect of these different adjustments indicates that there will be both a need-based shortage and a labor market demand–based shortage overall (including in both the public sector and the private sector) as well as a shortage within just the public sector (including MOH and non-MOH employers) of Saudi health workers from 2020 to 2030. The need-based shortage is driven largely by a shortage in the supply of Saudi nurses. It is estimated that there will be a sufficient number of Saudi physicians to meet need-based demand for physicians. The overall labor market demand shortage and the public sector–only demand shortage are estimated to persist for both the physician and nurse cadres, assuming no policy change. Although the public sector health labor market demand-based shortage is lower absolutely than the overall health labor market demand-based shortage, the public sector demand-based shortage is nevertheless more than four health workers per 1,000 population in 2030, or 167,933 health workers. The adjusted baseline projections and gap analyses presented in this chapter are further evaluated in chapter 7 under different policy intervention simulations.

Potential policy interventions targeting the supply of Saudi physicians should consider to what extent it is necessary to increase the supply of Saudi physicians to meet labor market demand. The projected supply of Saudi physicians is already sufficient to meet health care needs from 2020 to 2030 without policy intervention. Even though Saudi Arabia is projected to be able to afford more physicians, it may be useful to evaluate current resource allocations and ensure efficient use of existing health system resources.

Given the Saudization goals, the most critical gap is in the number of bachelor and advanced Saudi nurses, of which there are both need-based and demand-based shortages. These shortages imply that there are both insufficient FTE numbers of patient care nurses to meet population needs for health service delivery and an inability to employ such nurses. In contrast, there are many diploma nurses; this subset of nurses may be well-positioned for further training through bridge programs that provide continuing education to diploma nurses and for mobilization into patient care nursing positions in the near future. The bridge programs can be implemented along with standardization of the licensing exam for nurses. Most nations have one licensing exam for nurses regardless of the exam taker's qualification—a diploma or bachelor's or advanced degree. In Saudi Arabia there are two types of exams, with the exam for diploma nurses to qualify as health technicians being cheaper and easier than the exam for diploma nurses to qualify as nurse specialists. Therefore, many choose to take the cheaper and easier exam. With additional training and with standardization of the licensing exam, Saudi Arabia can increase the number of nurses with the ability and qualifications to provide patient care.

ANNEX 6A: ADJUSTED PROJECTIONS AND GAP ANALYSIS

Adjustment and incorporating non-MOH workers in the public sector

Additional steps were taken to project the total number of public sector workers, incorporating the supply of physicians and nurses who work in the public sector but who are not employed by the MOH. Because yearly data on the number of total public sector workers at the regional level are not available, national-level data on the number of public sector health workers in the MOH and outside the MOH were used. The national percentages of physicians and nurses working for the MOH out of total public sector health workers were projected into the future, as presented in table 6A.1. The projected percentages of MOH physicians and nurses out of total public sector physicians and nurses were then used to calculate the estimated national number of public sector workers, including all public sector employers, from 2020 to 2030. Table 6A.2 includes the projected number of Saudi physicians, and table 6A.3 includes the projected supply of Saudi nurses.

Incorporating relative productivity

To capture the status quo health workforce supply and allow for comparison with estimated changes in the supply of health workers associated with policy interventions, the projection additionally incorporates relative worker productivity. The projection adjusts for relative productivity of Saudi workers using a

five-hour workday (9 am to 3 pm, including a one-hour lunch) as compared with a full eight-hour workday. The status quo productivity was estimated to be 63 percent (five hours divided by eight hours) of maximum productivity. The projected supply was multiplied by 63 percent to generate the status quo health workforce supply. The projection includes all Saudi workers in the public sector and the private sector. The FTE supply of physicians is presented in table 6A.2, and the FTE supply of nurses is presented in table 6A.3.

TABLE 6A.1 Projected percentage of MOH health workers out of total public sector health workers, 2020–30

YEAR	PERCENTAGE OF MOH WORKERS
2020	73.3
2021	73.3
2022	73.4
2023	73.4
2024	73.5
2025	73.5
2026	73.5
2027	73.6
2028	73.6
2029	73.5
2030	73.5

Source: Original calculations for this publication.
Note: MOH = Ministry of Health.

TABLE 6A.2 Projected number and density of Saudi physicians, adjusted and unadjusted supply, 2020–30

	UNADJUSTED SUPPLY		ADJUSTED SUPPLY			
			ALL SECTORS		FTE SUPPLY	
YEAR	NUMBER OF SAUDI PHYSICIANS	SAUDI PHYSICIANS PER 1,000 POPULATION	NUMBER OF SAUDI PHYSICIANS	SAUDI PHYSICIANS PER 1,000 POPULATION	NUMBER OF SAUDI PHYSICIANS	SAUDI PHYSICIANS PER 1,000 POPULATION
2020	23,463	0.67	31,053	0.89	19,563	0.56
2021	25,213	0.71	33,351	0.94	21,011	0.59
2022	26,987	0.75	35,671	1.00	22,473	0.63
2023	28,785	0.79	38,021	1.05	23,953	0.66
2024	30,608	0.83	40,401	1.10	25,452	0.69
2025	32,454	0.87	42,811	1.15	26,971	0.72
2026	34,324	0.91	45,258	1.20	28,513	0.76
2027	36,217	0.95	47,736	1.25	30,074	0.79
2028	38,132	0.99	50,250	1.30	31,657	0.82
2029	40,067	1.03	52,841	1.36	33,290	0.86
2030	42,019	1.07	55,420	1.41	34,914	0.89

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

TABLE 6A.3 Projected number and density of Saudi nurses, adjusted and unadjusted supply (including diploma nurses), 2020–30

	UNADJUSTED SUPPLY		ADJUSTED SUPPLY			
			ALL SECTORS		FTE SUPPLY	
YEAR	NUMBER OF SAUDI NURSES	SAUDI NURSES PER 1,000 POPULATION	NUMBER OF SAUDI NURSES	SAUDI NURSES PER 1,000 POPULATION	NUMBER OF SAUDI NURSES	SAUDI NURSES PER 1,000 POPULATION
2020	80,410	2.31	99,780	2.87	62,861	1.81
2021	85,045	2.41	105,719	2.99	66,603	1.88
2022	89,740	2.50	111,709	3.12	70,376	1.96
2023	94,481	2.60	117,750	3.24	74,183	2.04
2024	99,273	2.70	123,843	3.37	78,021	2.12
2025	104,111	2.80	130,005	3.49	81,903	2.20
2026	109,000	2.89	136,246	3.62	85,835	2.28
2027	113,938	2.99	142,552	3.74	89,808	2.36
2028	118,925	3.09	148,941	3.87	93,833	2.44
2029	123,948	3.18	155,565	4.00	98,006	2.52
2030	129,008	3.28	162,119	4.12	102,135	2.60

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

Calculating gaps

Table 6A.4 presents the gaps between supply of and labor market demand and need-based demand for Saudi physicians. The difference is calculated as follows:

$$\textit{Need-Based Shortage or Surplus} = \textit{Supply Projection} - \textit{Need-Based Projection Labor Market Demand Shortage or Surplus} = \textit{Supply Projection} - \textit{Need-Based Projection} \quad (6.1)$$

Table 6A.5 presents the gaps between supply of and labor market demand and need-based demand for Saudi nurses.

Total workforce projection

Table 6A.6 presents total Saudi health worker supply contrasted with need-based demand, overall labor market demand, and public sector–specific demand.

TABLE 6A.4 Projections and gaps for the physician workforce, 2020–30

YEAR	SAUDI PHYSICIAN SUPPLY[a]	NEED-BASED DEMAND		OVERALL LABOR MARKET DEMAND		PUBLIC SECTOR LABOR MARKET DEMAND	
		NUMBER	SURPLUS (SHORTAGE)	NUMBER	SURPLUS (SHORTAGE)	NUMBER	SURPLUS (SHORTAGE)
2020	19,563	4,935	14,628	104,145	(84,582)	61,533	(41,969)
2021	21,011	5,015	15,996	106,010	(84,999)	62,182	(41,171)
2022	22,473	5,096	17,377	107,936	(85,464)	63,287	(40,814)
2023	23,953	5,178	18,775	109,806	(85,853)	64,358	(40,405)
2024	25,452	5,261	20,192	111,649	(86,197)	65,413	(39,961)
2025	26,971	5,346	21,625	113,435	(86,464)	66,435	(39,464)
2026	28,513	5,432	23,081	115,054	(86,541)	67,373	(38,860)
2027	30,074	5,520	24,553	116,602	(86,528)	68,275	(38,201)
2028	31,657	5,611	26,046	118,040	(86,383)	69,118	(37,461)
2029	33,290	5,700	27,590	118,975	(85,685)	69,698	(36,408)
2030	34,914	5,788	29,126	120,099	(85,185)	70,368	(35,454)

Source: Original calculations for this publication.
a. Saudi physician supply indicates the supply after adjustments to account for full-time equivalent supply of physicians in both the public sector and the private sector.

TABLE 6A.5 Projections and gaps for the nurse workforce, 2020–30

YEAR	SAUDI NURSE SUPPLY[a]	NEED-BASED DEMAND		OVERALL LABOR MARKET DEMAND		PUBLIC SECTOR LABOR MARKET DEMAND	
		NUMBER	SURPLUS (SHORTAGE)	NUMBER	SURPLUS (SHORTAGE)	NUMBER	SURPLUS (SHORTAGE)
2020	20,744	59,054	(38,310)	203,040	(182,295)	145,004	(124,260)
2021	21,979	60,026	(38,047)	206,819	(184,840)	145,271	(123,292)
2022	23,224	61,002	(37,778)	210,779	(187,555)	148,059	(124,835)
2023	24,480	61,991	(37,511)	214,632	(190,152)	150,772	(126,292)
2024	25,747	62,998	(37,251)	218,447	(192,700)	153,456	(127,709)
2025	27,028	64,031	(37,003)	222,168	(195,140)	156,070	(129,042)
2026	28,326	65,071	(36,745)	225,586	(197,261)	158,487	(130,161)
2027	29,636	66,147	(36,510)	228,858	(199,222)	160,808	(131,172)
2028	30,965	67,245	(36,280)	231,856	(200,892)	162,937	(131,972)
2029	32,342	68,331	(35,989)	233,868	(201,526)	164,357	(132,015)
2030	33,705	69,399	(35,694)	236,415	(202,711)	166,184	(132,479)

Source: Original calculations for this publication.
a. Saudi nurse supply indicates the supply after adjustments to account for full-time equivalent supply of bachelor and advanced nurses in both the public sector and the private sector.

TABLE 6A.6 Status quo projections and gaps for the health workforce, 2020–30

YEAR	SAUDI HEALTH WORKER SUPPLY	NEED-BASED DEMAND			OVERALL LABOR MARKET DEMAND			PUBLIC SECTOR LABOR MARKET DEMAND		
		NUMBER	SURPLUS (SHORTAGE)	GAP PER 1,000 POPULATION	NUMBER	SURPLUS (SHORTAGE)	GAP PER 1,000 POPULATION	NUMBER	SURPLUS (SHORTAGE)	GAP PER 1,000 POPULATION
2020	40,308	63,989	(23,682)	(0.68)	307,185	(266,877)	(7.67)	206,537	(166,229)	(4.77)
2021	42,990	65,042	(22,052)	(0.62)	312,830	(269,840)	(7.64)	207,454	(164,464)	(4.65)
2022	45,697	66,098	(20,401)	(0.57)	318,716	(273,019)	(7.62)	211,346	(165,649)	(4.62)
2023	48,433	67,169	(18,735)	(0.52)	324,438	(276,004)	(7.60)	215,130	(166,697)	(4.59)
2024	51,199	68,259	(17,059)	(0.46)	330,096	(278,896)	(7.58)	218,869	(167,670)	(4.56)
2025	53,999	69,377	(15,378)	(0.41)	335,604	(281,604)	(7.56)	222,505	(168,506)	(4.52)
2026	56,838	70,502	(13,664)	(0.36)	340,640	(283,802)	(7.53)	225,860	(169,022)	(4.48)
2027	59,710	71,667	(11,957)	(0.31)	345,460	(285,750)	(7.50)	229,083	(169,372)	(4.44)
2028	62,622	72,856	(10,234)	(0.27)	349,896	(287,274)	(7.46)	232,055	(169,433)	(4.40)
2029	65,632	74,031	(8,399)	(0.22)	352,843	(287,211)	(7.38)	234,055	(168,423)	(4.33)
2030	68,619	75,187	(6,568)	(0.17)	356,514	(287,896)	(7.32)	236,552	(167,933)	(4.27)

Source: Original calculations for this publication.

NOTES

1. NTP demand is also captured in the epidemiological model.
2. The 5-hour workday refers to the number of working hours per working day instead of the number of shifts.

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7 The Effect of Simulated Policy Scenarios on Saudi Nurse and Physician Workforce Gaps in 2030

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KEY MESSAGES

- Simulation results suggest that labor market demand–based shortages of physicians and nurses will continue even after considering different policies to increase supply, such as increasing work hours, increasing Saudization of the workforce, increasing retirement age, and providing continuing education for diploma nurses.
- Provision of continuing education to train diploma nurses (for example, through bridge programs) to perform more advanced patient care tasks may reduce the need-based shortage of bachelor and advanced nurses.
- To reduce both the overall and public sector–specific labor market demand shortage for bachelor and advanced nurses, bridge programs will need to be implemented in conjunction with other policies to augment their supply to meet demand.
- Most policy scenarios show that, through 2030, there will be a need-based *surplus* of Saudi physicians, but a need-based *shortage* of Saudi bachelor and advanced nurses, suggesting that task-sharing may not be the most appropriate or meaningful policy intervention to reduce workforce gaps.

BACKGROUND

The projections and analyses presented in this report until now represent a status quo baseline perspective that assumes that there will be no policy intervention and that historical trends in health workforce dynamics will continue into the future. Need-based estimates generated in chapter 3 consider various public health conditions and establish the baseline need-based demand for physicians and nurses from an epidemiological standpoint. When need-based estimates are compared with projected supply (chapter 4) under a conservative assumption of

continuing trends, there is a shortage of Saudi physicians and nurses (although the shortage declines from 23,682 in 2020 to 6,568 in 2030) despite sufficient overall numbers to deliver all needed health services when including foreign workers. However, health labor market demand projections (chapter 5) that consider the number of workers the country can employ (in both the public and the private sectors) hint at potential shortages by 2030. Further analysis of the potential gap in Saudi health workers (chapter 6) highlights a persistent demand-based shortage of Saudi physicians and both a labor market–demand shortage and a need-based shortage of bachelor and advanced Saudi nurses.

This chapter relaxes some of these assumptions and simulates the effect of a range of alternative scenarios on estimated health workforce gaps. All simulations for physicians take as their starting point the final, fully adjusted baseline estimates described in chapter 6 (and summarized in table 7.1) that account for Saudi health workers employed by all employers in both the public sector and the private sector and also account for workers' relative productivity. When relevant to the policy intervention, simulations for nurses include diploma nurses. Most simulations examine different supply-side changes, including quantifying the effect of increased work hours, increased workforce Saudization, and increased retirement age. The influences of increased target coverage of health services (as a result of behavior change education campaigns, for example) and of task-sharing between physicians and nurses are also examined under the need-based perspective. Comparative statistics are used to quantify the independent effect of each policy intervention in reducing shortages. The magnitude of different policy options can then be compared side by side to understand their relative effects. These simulations serve as an exercise for isolating and considering the individual impacts of potential policy interventions; they cannot compare multiple interventions simultaneously. However, policy interventions in the real world do not

TABLE 7.1 Summary of baseline projections from chapter 6

PERSPECTIVE	TYPE OF PROJECTION	ASSUMPTIONS
Need-based demand	• Estimates the size of the health workforce driven by the prevalence of priority health conditions in the population • Estimates the number of physicians and nurses required to deliver services for meeting the epidemiological need of the population[a]	• Health workforce responds only to *true* illness, rather than to economic factors. • A DALY multiplier of 5 is used to convert disease burden from six priority diseases into the baseline burden of all disease conditions in Saudi Arabia. • Plausible target service coverage levels are based on the literature. • No policy interventions (for example, task-sharing and education campaigns) are used.
Labor market supply	• Estimates the number of health workers available to be employed by the public sector (MOH and non-MOH employers) and by all employers in the private sectors	• Historical trends (including output, attrition) continue into the future. • Relative productivity of 63 percent based on working hours is used to establish baseline productivity of Saudi workers. • Excludes diploma nurses from the nurse cadre when applicable to specific policy intervention.
Labor market demand	• Reflects the total estimated physicians and nurses (diploma, bachelor, and advanced) that can be afforded by all employers (public and private sectors) • Estimates the number of health workers that can be afforded by the public sector (including MOH and non-MOH employers but excluding private sector employers)	• Historical trends of predictors (MOH health expenditures per capita and total government spending per capita) continue. • Historical association between health workers demanded (per 1,000 population) and economic predictors continues. • Labor market demand projections driven by public sector spending. • Uses the association of historical trends in MOH health expenditure per capita and total government spending per capita with health worker density to estimate future demand in the health worker labor market.

Source: World Bank.
Note: DALY = disability-adjusted life year; MOH = Ministry of Health.
a. National Transformation Program considerations are included in the need-based calculation when considering treatment coverage for priority diseases.

TABLE 7.2 Summary of simulated scenarios

PERSPECTIVE	SIMULATED SCENARIOS	DESCRIPTION
Labor market supply	Increasing working hours to increase FTE supply of workers	Baseline productivity of 63 percent (5-hour workday) is compared with 80 percent productivity (6.5-hour workday) and 100 percent productivity (8-hour workday).
	Increasing workforce Saudization to increase the supply of Saudi health workers	Scenarios compare baseline supply of Saudi health workers with 75 percent workforce Saudization and 100 percent workforce Saudization.
	Improving retention of health workers through increased retirement age	Scenarios compare baseline supply of Saudi health workers with supply if retirement age is increased by 5 years and by 10 years.
	Providing continuing education to train diploma nurses to perform more advanced tasks	Baseline supply of nurses is compared with 20 percent and 40 percent of diploma nurses receiving continuing education.
Need-based demand	Increasing service coverage	Baseline need-based demand is compared with demand when there is a 10 percent increase in service coverage.
	Task-sharing	Baseline demand for workers is compared with demand when there is 30 percent and 50 percent task-sharing between physicians and nurses.

Source: World Bank.
Note: FTE = full-time equivalent.

happen in a vacuum and are often implemented jointly as a result of policy deliberations (considered in chapter 8). As such, these simulations do not generate a precise health workforce gap on an absolute level, but instead present an overview of the potential effects of policy interventions on health workforce gaps.

The remainder of this chapter is organized as follows: The following four sections present simulated scenarios based on varying supply-side factors that are aligned with the National Transformation Program (NTP) and may help achieve its strategic goals; these factors include increasing working hours for health workers, levels of workforce Saudization, retirement age, and continuing education for diploma nurses, respectively. The scenarios are summarized in table 7.2 The next section discusses the different need-based conditions and their impacts on need-based demand surpluses and shortages, including increased target health service coverage rates and task-sharing from physicians to nurses. The subsequent section discusses available public sector financial resources and considers how different allocation strategies may reduce need-based demand shortages. The final section summarizes the implications for the projected gaps under these different scenarios.

THE EFFECT OF INCREASING WORKING HOURS

The ability to serve more patients or attend to more visits with the same number of health workers, which reflects higher productivity (as outlined in chapter 1), may contribute to reducing health labor market demand shortages and need-based demand shortages of health workers. In chapter 1, because of data limitations, the analysis of the association between the number of health workers and the number of patients served was inconclusive. Chapter 6 accounts for worker productivity by incorporating Saudi health worker working hours (that is, five hours per day) into the estimated supply of Saudi workers and adjusting estimated worker numbers to their full-time equivalent (FTE).

This section explores the potential effect on shortages of increasing health worker working hours. Compared with the adjusted baseline scenario that

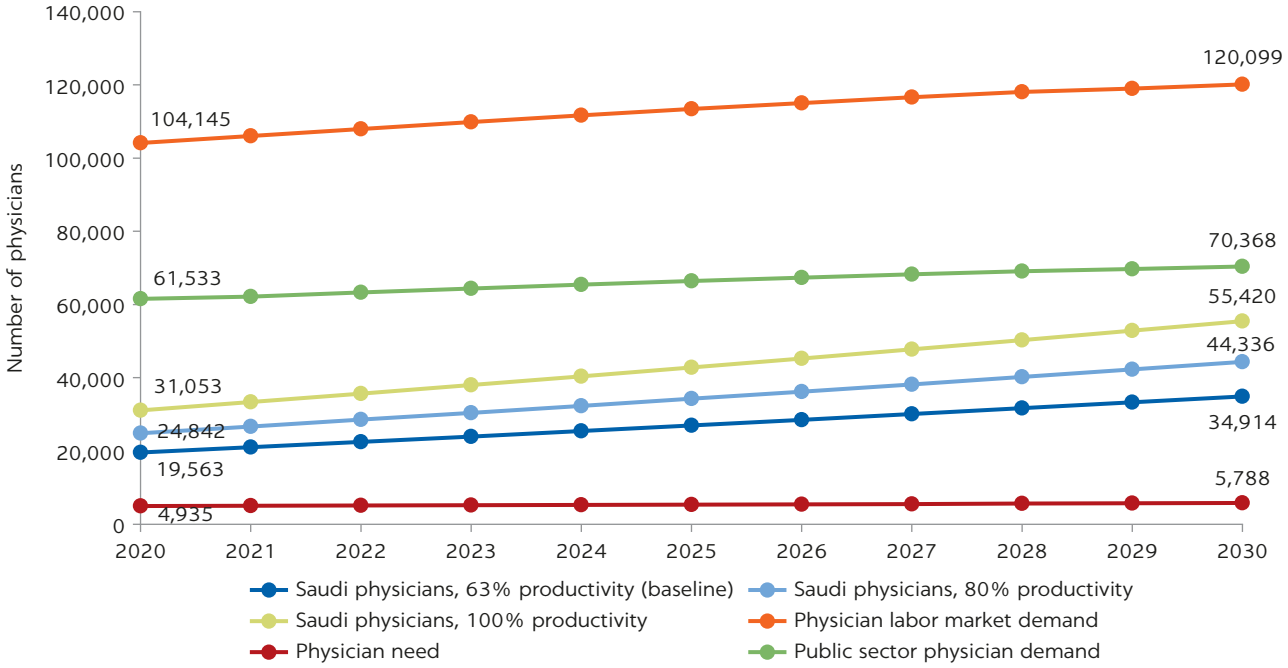
reflects the current five-hour workday (that is, 63 percent productivity), alternative scenarios of a six-and-a-half-hour workday (that is, 80 percent productivity) and an eight-hour workday (100 percent productivity) are examined as potential ways to increase the supply of labor available to deliver health services.

If work hours are increased from five to a full eight hours per day, the labor market demand shortage of Saudi physicians in 2030 would be reduced by 24 percent (from 85,185 to 64,680). Figure 7.1 illustrates that, at 63 percent productivity (five hours per day) under the baseline scenario (no policy intervention), the FTE supply of Saudi physicians is estimated to be 34,914 in 2030 (see table 7A.1 in the annex for additional details). However, if work hours increased to six-and-a-half hours per day to achieve 80 percent productivity, the FTE supply of physicians increases (by 9,422) to 44,336 in 2030. Correspondingly, the supply of Saudi physicians would increase further, by 11,084, above the 2030 baseline estimate if Saudi physicians' work hours increase from 80 percent to 100 percent. At 100 percent productivity (an eight-hour workday), there will be 55,420 full-time working Saudi physicians in 2030. This number exceeds need-based demand for workers by 49,631 physicians. However, at 100 percent relative productivity, it is expected that there will still be a labor market demand shortage of 64,680 Saudi physicians in 2030. Hence, increasing to eight work hours per day only closes the gap in overall labor market demand by 24 percent. When examining only the public sector, at 100 percent relative productivity, the demand-based shortage is only 14,948 (a 58 percent reduction from a shortage of 35,454 at 63 percent productivity).

If work hours for Saudi nurses (excluding diploma nurses) are increased from five hours to a full eight-hour workday, the labor market demand shortage will shrink by 10 percent (from 202,710 to 182,916) and the need-based demand

FIGURE 7.1

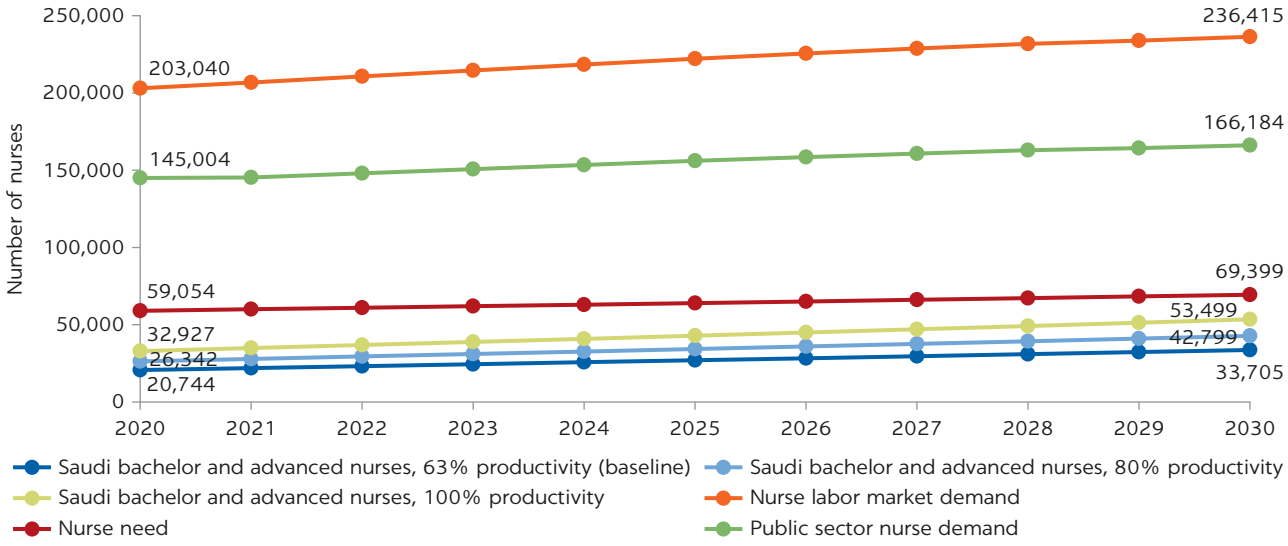
Supply of Saudi physicians under different relative productivity scenarios, 2020–30



Source: Original calculations for this publication.

FIGURE 7.2

Supply of Saudi nurses under different relative productivity scenarios, 2020–30



Source: Original calculations for this publication.
Note: Saudi diploma nurses are excluded from the supply and need projections (and only included in the labor market demand projections) because they function more like medical assistants and technicians according to international standards. Only bachelor and advanced nurses who can complete nursing tasks and fulfill epidemiological needs are included to align the analysis and appropriately determine the gap for nurses.

shortage will decrease by 55 percent (from 35,694 to 15,900) in 2030. Under the baseline scenario with a five-hour workday, the FTE supply of Saudi bachelor and advanced nurses is estimated to be 33,705 in 2030 (figure 7.2). If the workday were increased to six-and-a-half hours (that is, 80 percent productivity), the FTE supply of nurses (bachelor and advanced) is estimated to increase (by 9,094) to 42,799 Saudi nurses in 2030, and by another 10,700 nurses if hours are further increased to eight per day. At 100 percent productivity, the FTE supply of bachelor and advanced Saudi nurses is estimated to be 53,499 in 2030. However, it is estimated that there will still be an overall health labor market demand shortage of 182,916 nurses, a public sector labor market demand shortage of 112,684 nurses, and a need-based demand shortage of 15,900 nurses.

It is important to note that trends for labor market demand for nurses include all nurses (bachelor, advanced, and diploma), which may overestimate total nursing demand because diploma nurses receive lower wages than bachelor and advanced nurses.

THE IMPACT OF INCREASING WORKFORCE SAUDIZATION

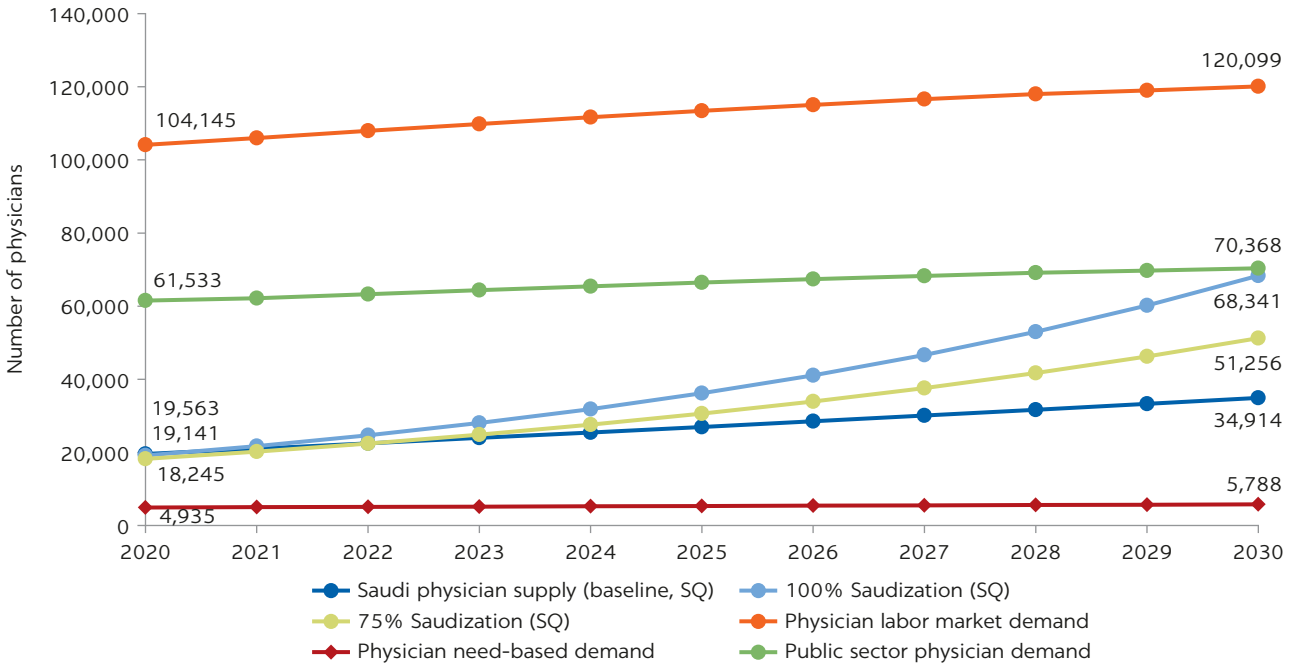
Following the NTP's strategic goal of workforce Saudization, growth in the supply of Saudi workers to achieve 75 percent and 100 percent workforce Saudization by 2030 was simulated. These simulations first assume that the number of workers (both Saudi and foreign) will follow historical trends and continue to grow. Next, using the adjusted baseline estimates for the FTE supply of Saudi workers, the yearly rates of growth in health worker density required to achieve the Saudization goals of 75 percent and 100 percent by 2030 were calculated and then converted to the yearly density of workers per 1,000 population.

Yearly growth in the number of Saudi physicians must increase from 7 percent to 23 percent to achieve 100 percent Saudization by 2030. If the composition of the physician workforce were to reach 75 percent Saudization by 2030, it is estimated that there would be 16,342 more Saudi physicians in 2030, for a total of 51,256 Saudi physicians. If 100 percent Saudization of the physician workforce were achieved, an additional 33,427 Saudi physicians (above the 2030 baseline estimate of 34,914) would be available in 2030, for a total of 68,341 Saudi physicians (figure 7.3). There will still be an overall (public and private sectors combined) labor market demand-based shortage even at 100 percent Saudization; however, the public sector–specific labor market demand shortage will be reduced from 35,454 (at baseline) to 2,027 physicians. In contrast, workforce Saudization of 100 percent is estimated to increase the surplus of physicians above what is required to meet epidemiological needs from an excess of 14,206 (in 2020 under baseline conditions) to an excess of 62,553 physicians (in 2030 with 100 percent Saudization).

Yearly growth in bachelor and advanced Saudi nurses must increase from 6 percent to 20 percent to achieve 100 percent Saudization by 2030, which will reduce the overall labor market demand shortage by 64 percent, reduce the public sector demand-based shortage by 99 percent, and turn the need-based shortage of 35,694 nurses into a surplus of 94,854 nurses in 2030 (figure 7.4) (see table 7A.4 for more details). At 100 percent Saudization in 2030, the 2030 FTE supply of Saudi nurses will increase by 130,548 workers (from a total of 33,705 under the baseline scenario to 164,253). At this level of Saudization, the need-based shortage will be eliminated by 2022 and reach a need-based surplus of 94,854 nurses in 2030. However, in 2030, there will still be a demand-based shortage of 72,162 Saudi nurses overall and of 1,931 Saudi nurses within the public sector; when

FIGURE 7.3

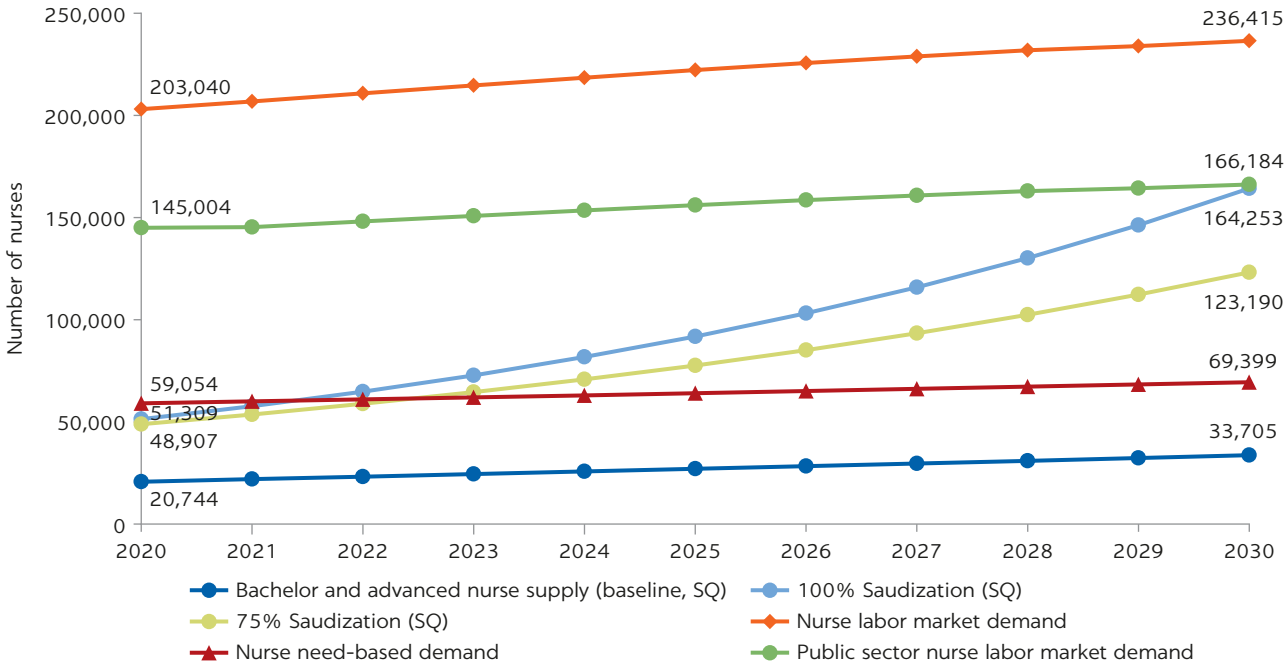
Physician workforce Saudization scenarios, 2020–30



Source: Original calculations for this publication.
Note: SQ = status quo.

FIGURE 7.4

Nurse workforce Saudization scenarios, 2020–30



Source: Original calculations for this publication.
Note: Saudi diploma nurses are excluded from the analysis because they function more like medical assistants and technicians under international standards. Only bachelor and advanced nurses who can complete nursing tasks and fulfill epidemiological needs are included to align the analysis and appropriately determine the gap for nurses. SQ = status quo.

considering only the demand for bachelor and advanced nurses (excluding the demand for diploma nurses, who receive comparatively lower wages), the shortage may be eliminated.

INCREASING RETENTION THROUGH DELAYED RETIREMENT

One approach to increasing the supply of health workers is through better retention. Although various strategies can be used to encourage workers to remain in the workforce (for example, increased salary and compensation, career development training, programs to improve workplace satisfaction, flexibility in working hours), this section explores the direct effect of a policy to increase the retirement age. The consequence of such a policy is effectively to keep a percentage of workers in active patient care who would otherwise retire and exit the workforce. Saudi Arabia has seen an increase in its older population; those older than age 60 will increase from 3 percent of the population in 2010 to 10 percent in 2035 (Khoja et al. 2018). Therefore, delaying retirement may contribute both to workforce Saudization goals (increasing the proportion of workers who are Saudi) and to increasing the total number of Saudi workers in the health workforce.

Two alternative retirement policies were examined: (1) increasing the retirement age by 5 years (age 64 instead of 60 for men; age 59 instead of 55 for women), and (2) increasing the retirement age by 10 years (age 69 for men; age 64 for women). The adjusted baseline supply of Saudi health workers (employed by all

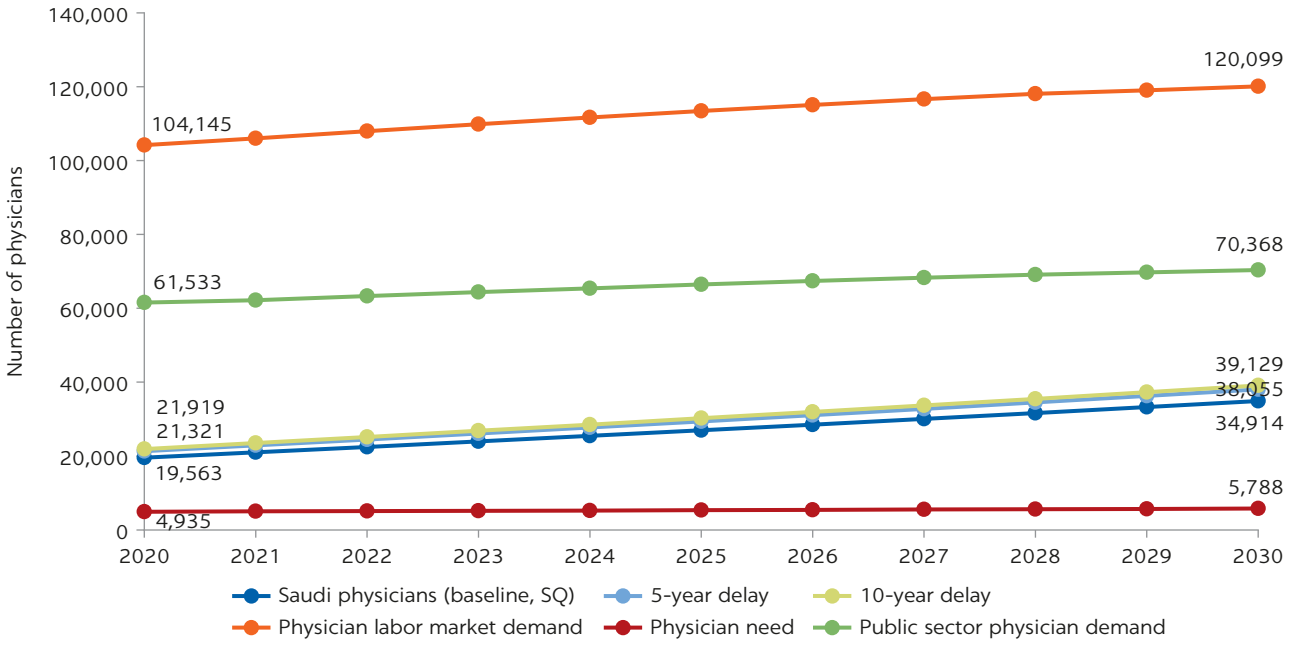
employers in both the public sector and the private sector) and the population pyramid for Saudi Arabia are used to calculate the percentage of individuals in the delayed retirement category out of the total health workforce. The percentage of individuals in the delayed retirement category is then used to calculate the number of additional workers made available for patient care. Note that in August 2019, the retirement age was modified to 60 for both men and women; however, the baseline data used for projection and analysis are from the period before implementation of the new retirement age. The simulated scenarios are therefore structured for comparison with the previous retirement ages in Saudi Arabia.

Simulations show that delaying retirement by 10 years would reduce the overall and public sector–specific health labor market demand-based shortage of Saudi physicians by 5 percent (from 85,185 to 80,970) and 12 percent (from 35,454 to 31,239), respectively (figure 7.5). Compared with the baseline supply estimates reflecting the current retirement age, delaying retirement by 5 years and 10 years is projected to add 3,141 and 4,215 FTE Saudi physicians to the workforce in 2030, respectively (see table 7A.5 for additional details). Thus, increasing the retirement age by 10 years will still yield an overall health labor market demand shortage of 82,226 Saudi physicians in 2020, which will only decrease to 80,971 Saudi physicians by 2030. Similarly, within the public sector, increasing the retirement age by 10 years will lead to a demand shortage of 39,614 in 2020 and 31,239 in 2030. Delaying retirement by 10 years will still yield a need-based demand surplus—about 33,340 Saudi physicians in 2030, which is an additional 4,214 Saudi physicians compared with the need-based demand surplus at baseline (29,126 physicians).

Simulations indicate that delaying retirement by 10 years will reduce the need- and demand-based shortages of bachelor and advanced Saudi nurses by 21 percent (from 35,694 to 28,196) and 4 percent (from 202,710 to 195,212),

FIGURE 7.5

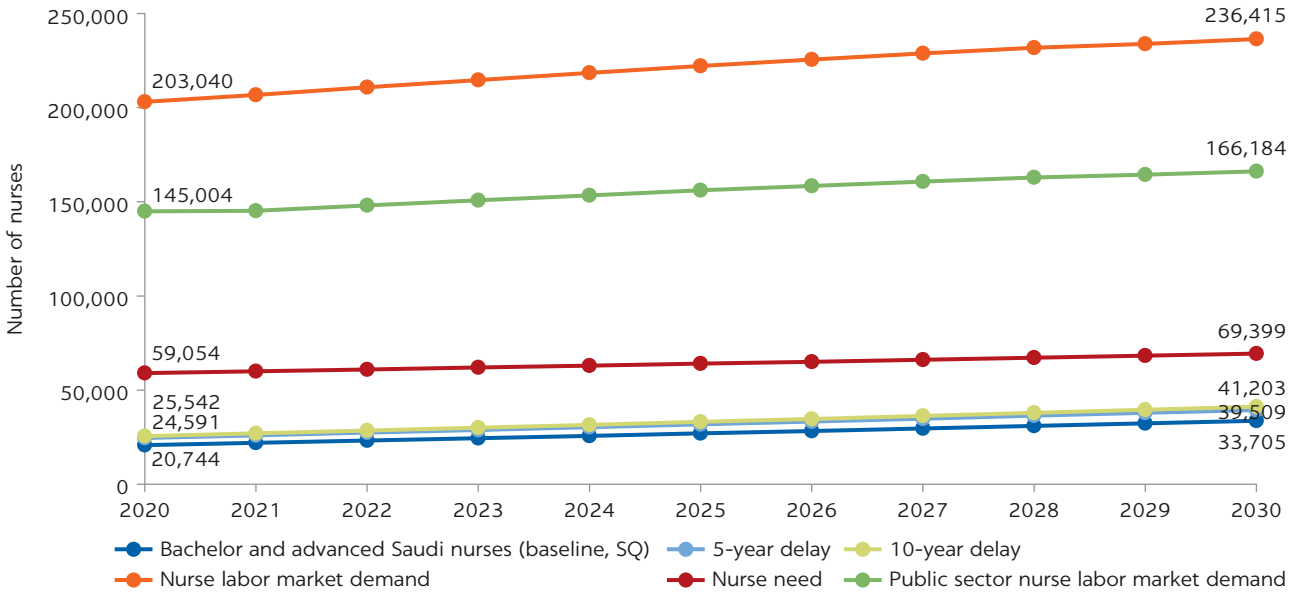
Physician delayed retirement scenarios, 2020–30



Source: Original calculations for this publication.
Note: SQ = status quo.

FIGURE 7.6

Nurse delayed retirement scenarios, 2020–30



Source: Original calculations for this publication.
Note: Saudi diploma nurses are excluded from the analysis because they function more like medical assistants and technicians under international standards. Only bachelor and advanced nurses who can complete nursing tasks and fulfill epidemiological needs are included to align the analysis and appropriately determine the gap for nurses. SQ = status quo.

respectively (figure 7.6). Compared with baseline supply estimates using the current retirement age, delaying retirement for 5 years and 10 years is projected to add 5,804 and 7,498 FTE Saudi nurses to the workforce in 2030, respectively; see table 7A.6 for additional details. However, even with the additional nurses generated by increasing the retirement age by 10 years, it is estimated that there will still be a need-based shortage of 28,196 Saudi nurses. Simultaneously, it is estimated that there will be an overall health labor market demand shortage of 195,212 and a public sector–specific labor market demand shortage of 124,981 Saudi nurses in 2030. Thus, delaying retirement will do little to stem the anticipated persistent need- and demand-based shortages of bachelor and advanced Saudi nurses.

CONTINUING EDUCATION TO TRAIN DIPLOMA NURSES IN PERFORMING NURSING TASKS

Another approach to increasing the supply of health workers is through modifying the education pipeline. One strategy that specifically targets the nurse cadre, and has been used by Saudi Arabia, is the implementation of *bridge programs*. Bridge programs provide additional training to develop diploma nurses—who function more like medical assistants—into nurses who can complete patient care tasks. This section explores the direct effect of implementing bridge programs in Saudi Arabia, which is expected to increase the supply of Saudi nurses who can perform patient care tasks.

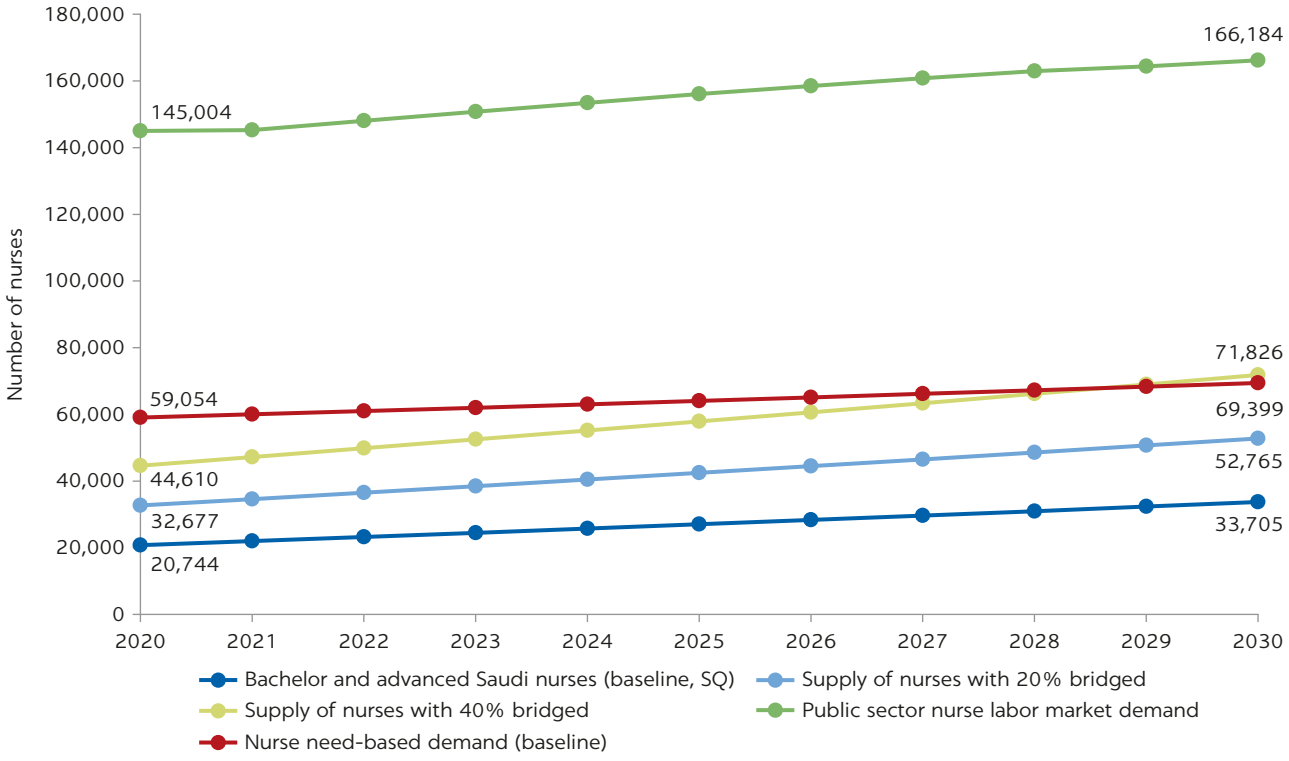
These simulations first assume that the number of Saudi bachelor and advanced nurses, as well as diploma nurses, will follow historical trends and

continue to grow. Next, using the adjusted baseline estimates for the FTE supply of Saudi nurses, two alternate scenarios are examined. In the first scenario, 20 percent of diploma nurses are assumed to receive continuing education and are trained to perform nursing tasks. In the second scenario, 40 percent of diploma nurses are assumed to be trained to perform nursing tasks. The estimated number of diploma nurses who can perform nursing tasks is then added to the yearly supply of Saudi bachelor and advanced nurses to generate the simulated supply of nurses with the implementation of bridge programs (see table 7A.7 for additional details).

Simulations show that, with 40 percent of diploma nurses being trained to perform nursing tasks, the need-based demand shortage for nurses will be eliminated by 2028 (figure 7.7). In the scenario in which 20 percent of diploma nurses are trained, the supply of FTE Saudi nurses who can perform nursing tasks is estimated to be 52,765 in 2030. And, in the scenario in which 40 percent of diploma nurses receive continued training, the estimated supply of FTE Saudi nurses who can perform nursing tasks is 71,826 in 2030. The 20 percent scenario is projected to add 19,060 nurses to the baseline estimate, but under this scenario a need-based shortage of 16,634 nurses is expected to persist in 2030. The 40 percent scenario is projected to add 38,121 nurses to the baseline estimate, generating a need-based surplus of 2,427 FTE nurses. However, in both scenarios, the public sector–specific labor market demand is expected to persist; with 20 percent and 40 percent of diploma nurses receiving continuing education, it is estimated that there would be labor market demand shortages of 113,418 and 94,359 FTE Saudi nurses, respectively.

FIGURE 7.7

Nurse bridge program scenarios, 2020–30



Source: Original calculations for this publication.
Note: The scenario projects the resulting supply of bachelor and advanced nurses after diploma nurses are trained through a bridge program to complete patient care tasks. Saudi diploma nurses are excluded from the analysis. SQ = status quo.

CONDITIONS AFFECTING THE EPIDEMIOLOGICAL NEED FOR PHYSICIANS AND NURSES

This section considers interventions that may lead to changes in need-based demand and their impact on the health workforce gap. Thus far, this chapter has explored supply-side changes that may affect health labor market demand and need-based demand shortages and surpluses—holding epidemiological need for physicians and nurses at baseline and assuming no related policy interventions. However, public health policies such as education campaigns can quickly and effectively increase the number of individuals who will seek treatment and thus increase the need for physicians and nurses. Similarly, health policies that lead to changes in service delivery models and to reassignment of provider tasks may shift the relative need for physicians and nurses.

To examine the effects of changes in population health coverage goals and health service delivery models, two alternative scenarios are examined:

- *Service coverage for all health conditions is increased by 10 percentage points.* This assumes that individuals will be more motivated to seek care as a result of health education.
- *A total of 30 percent of tasks can be "shared" between physicians and nurses.* Baseline staffing ratios assume physicians and nurses perform 1.7 percent and 98.3 percent of tasks in outpatient settings, and 10 percent and 90 percent of tasks in inpatient settings. The 30 percent scenario assumes 30 percent of physician tasks are shared with nurses, so physicians perform approximately 1.2 percent of tasks in outpatient settings and 7 percent of tasks in inpatient settings. See table 3.4 in chapter 3 for more details.

Increased service coverage

It is estimated that an absolute increase of 10 percent in service coverage for all health conditions would increase the 2030 need-based demand for physicians by 21 percent, or 1,201 physicians (figure 7.8). The need-based demand for physicians increases from 5,788 under baseline assumptions to 6,989 physicians for higher coverage levels. Compared with the estimated 2030 supply of 34,914 Saudi physicians (FTEs), the 2030 need-based surplus of Saudi physicians will decrease by 4 percent, to 27,925. Thus, even without supply-side policy interventions, there will be sufficient Saudi physicians to meet increased health care coverage of essential needs.

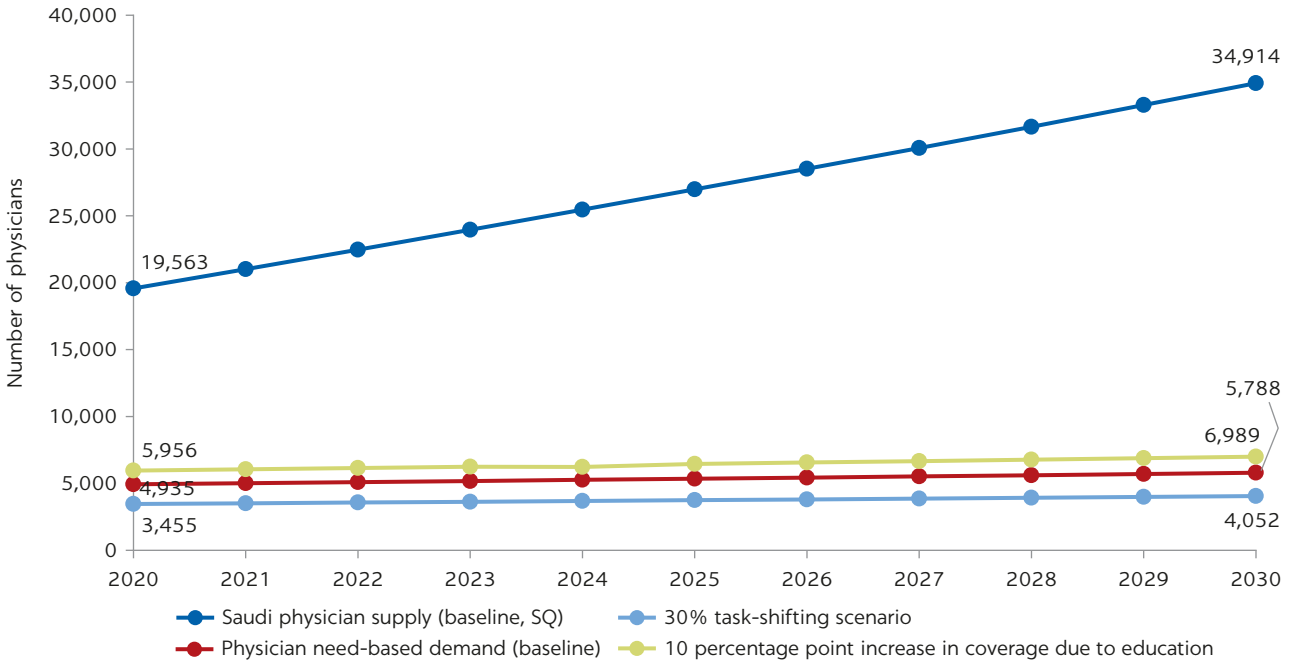
Increasing service coverage[1] for all health conditions by 10 percentage points would increase the 2030 need-based demand for bachelor and advanced nurses by approximately 25 percent, or 17,013 nurses. Under this scenario, there will be a 48 percent (from 35,694 to 52,707) increase in the need-based shortage of bachelor and advanced nurses. As such, the baseline, status quo FTE supply of bachelor and advanced Saudi nurses will be insufficient to meet the need-based demand for nurses (figure 7.9).

Task-sharing

With 30 percent of physicians' tasks shifted to nurses, the 2030 need-based surplus of Saudi physicians will decrease by 6 percent, but the need-based shortage of nurses will increase by 5 percent. Although the estimated 2030 need for

FIGURE 7.8

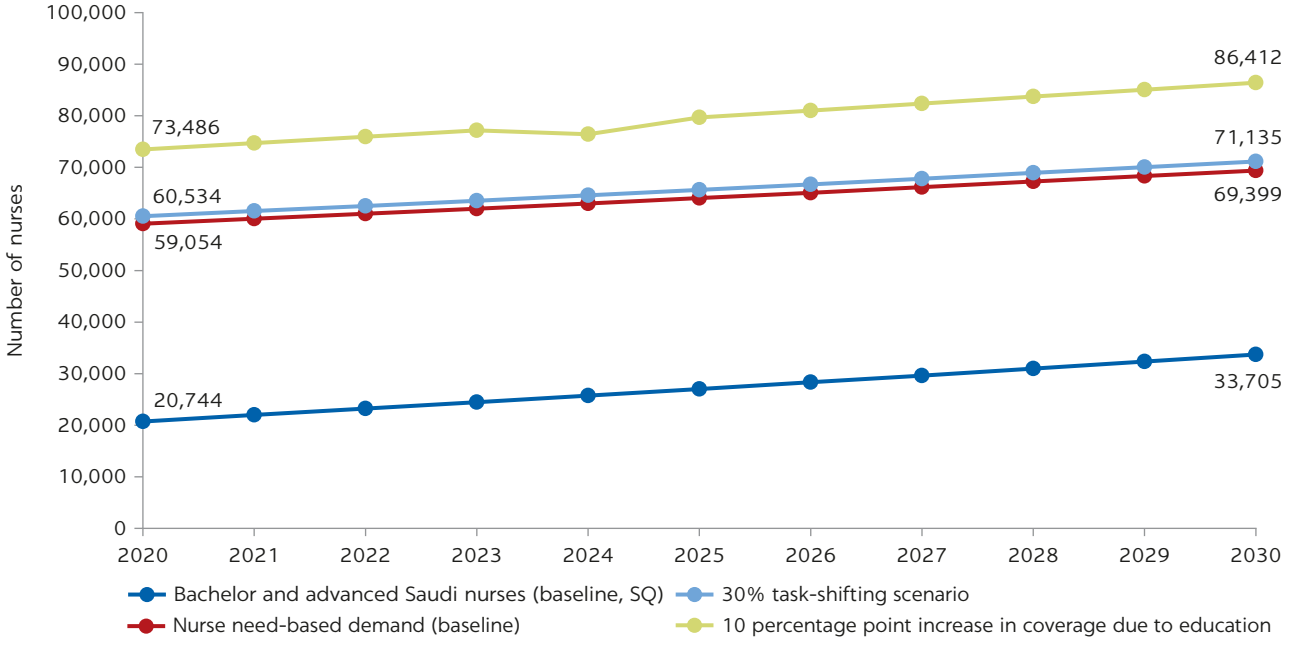
Physician need-based scenarios, 2020–30



Source: Original calculations for this publication.
Note: SQ = status quo.

FIGURE 7.9

Nurse need-based scenarios, 2020–30



Source: Original calculations for this publication.
Note: Saudi diploma nurses are excluded from the analysis because they function more like medical assistants and technicians under international standards. Only bachelor and advanced nurses who can complete nursing tasks and fulfill epidemiological needs are included to align the analysis and appropriately determine the gap for nurses. SQ = status quo.

physicians will decline from 5,788 to 4,052 (a 30 percent reduction), there will still be an overall surplus of 30,862 Saudi physicians in 2030 (figure 7.8). In contrast, the need for nurses will increase by 3 percent, from 69,399 to 71,135 in 2030, adding to the need-based shortage of 37,430 Saudi nurses (figure 7.9).

RESOURCE ALLOCATION STRATEGIES TO MINIMIZE NEED-BASED GAPS

To inform health workforce planning in Saudi Arabia, this section considers the Saudi public sector financial resources for health workers' salaries and examines the impact of reallocating resources on reducing need-based demand shortages. Specifically, the effects of reallocating financial resources used for worker salaries across cadres is considered: for cadres with more workers than needed (a surplus), resources going toward salaries can be redirected toward increasing the supply of other cadres that have shortages. For example, resources for surplus workers could be reallocated to training programs for task-sharing between cadres. It is important to note that, for policy makers, reallocated resources do not have to be earmarked for worker compensation; the scenarios presented here using estimated salary amounts are used to illustrate the principle of resource reallocation in a tangible way. The findings illustrate how the public sector in Saudi Arabia can prioritize reducing projected need-based gaps with existing resources.

The different simulated supply and need scenarios are summarized in table 7.2 and the resulting need-based surpluses and shortages are summarized in table 7.3. Among the six scenarios considered, four scenarios yield a need-based surplus of physicians but a need-based shortage of nurses:[2]

- Increase work hours
- Increase retirement age
- Increase service coverage by 10 percentage points
- Sharing 30 percent of physician tasks with nurses

The effect of reallocating salary support resources from one cadre to another is examined for these four scenarios. To calculate available financial resources for workers' salaries, average public sector physician and nurse salaries were estimated using the Saudi public sector salary scale (see table 7A.8 for details). The additional numbers of nurses gained from redirecting salary resources from surplus physicians are presented in the columns under public sector financial resources in table 7.3.

In these scenarios, reallocating salary resources from surplus physicians to employing more nurses is estimated to substantially reduce the need-based demand shortage of nurses in Saudi Arabia. With the need-based demand surplus of 49,631 physicians but a shortage of 15,900 bachelor and advanced nurses under an eight-hour workday scenario, the public sector could hire an additional 70,783 nurses, fully eliminating the nursing shortage and resulting in a surplus of 54,883 nurses. Similarly, in the scenario with an increased retirement age, reallocating resources from surplus physicians could support 47,549 nurses, and reallocating resources from surplus physicians in the task-sharing scenario could support 44,015 nurses, fully eliminating projected nursing shortages. The only scenario in which reallocating salary resources would not eliminate the need-based nursing shortage is increased service coverage:

TABLE 7.3 Impact of salary resource reallocation on need-based shortage or surplus

AREA OF IMPACT	SCENARIO	NEED-BASED SURPLUS (SHORTAGE)		PUBLIC SECTOR FINANCIAL RESOURCES	
		PHYSICIANS	NURSES	NUMBER OF NURSES (REALLOCATING PHYSICIAN SALARIES TO NURSES)	DIFFERENCE IN NURSES (COMPARED WITH NEED-BASED DEMAND)
Supply	Increase work hours from 5 to 8	49,631	(15,900)	70,783	54,883
	100% workforce Saudization	62,553	94,854	n.a.	n.a.
	Delay retirement by 10 years	33,340	(28,196)	47,549	19,353
	Provide bridge program (40 percent of diploma nurses)	n.a.	(2,427)	n.a.	n.a.
Need	Increase service coverage by 10 percent	27,925	(52,707)	39,826	(12,881)
	Share 30 percent of physician tasks with nurses	30,862	(37,430)	44,015	6,585

Source: Original calculations for this publication.
Note: n.a. = not applicable.

resources can be reallocated to hire 39,826 more nurses, but a need-based shortage of 12,881 nurses remains.

CONCLUSION

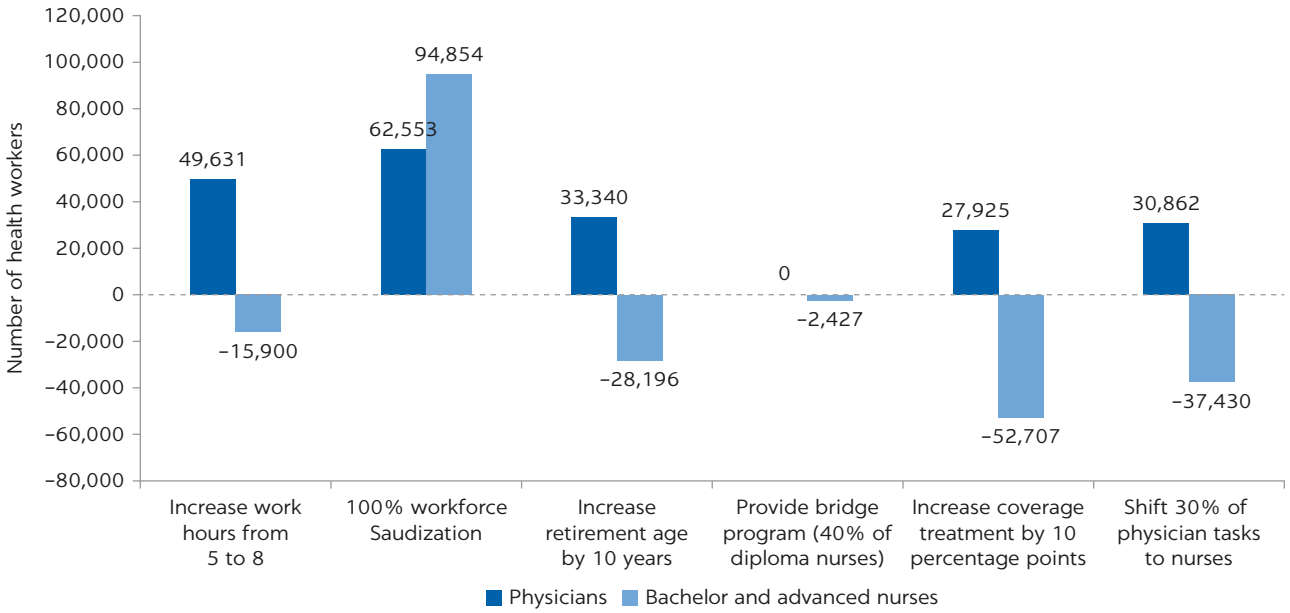
This chapter simulates health workforce scenarios to evaluate how potential supply, need, and demand factors influence predicted workforce gaps for Saudi health workers. Supply-side policy interventions include increasing work hours, increasing Saudization, increasing the retirement age, and providing continuing education for diploma nurses. Changes in service delivery coverage levels and model of care are examined for the epidemiological need for health workers. The impact of resource reallocation is considered for scenarios in which need-based surpluses and shortages are projected to exist simultaneously for different worker cadres.

Simulation results suggest that labor market demand shortages of physicians and nurses will continue. In most scenarios, a need-based surplus of Saudi physicians remains, but so does a need-based shortage of bachelor and advanced Saudi nurses through 2030. Figure 7.10 summarizes the net effect of these different simulated actions on the resulting need-based demand gaps (see table 7A.9 for more details). Figure 7.11 summarizes the net effect of the simulated supply-side actions on the resulting labor market demand gaps.

The results from the simulated scenarios suggest that task-sharing may not be the most appropriate or meaningful policy intervention to reduce workforce gaps because there is simultaneously a persistent need-based demand surplus of Saudi physicians and a need-based demand shortage of bachelor and advanced Saudi nurses. Given the large need-based demand surplus of physicians, it is worthwhile considering whether it may be cost-saving to task-share between nurses and junior physicians—with junior physicians sharing and carrying out some tasks that are generally performed by nurses. Or it may be relevant to consider complementary measures to increase Saudi nursing supply overall.

FIGURE 7.10

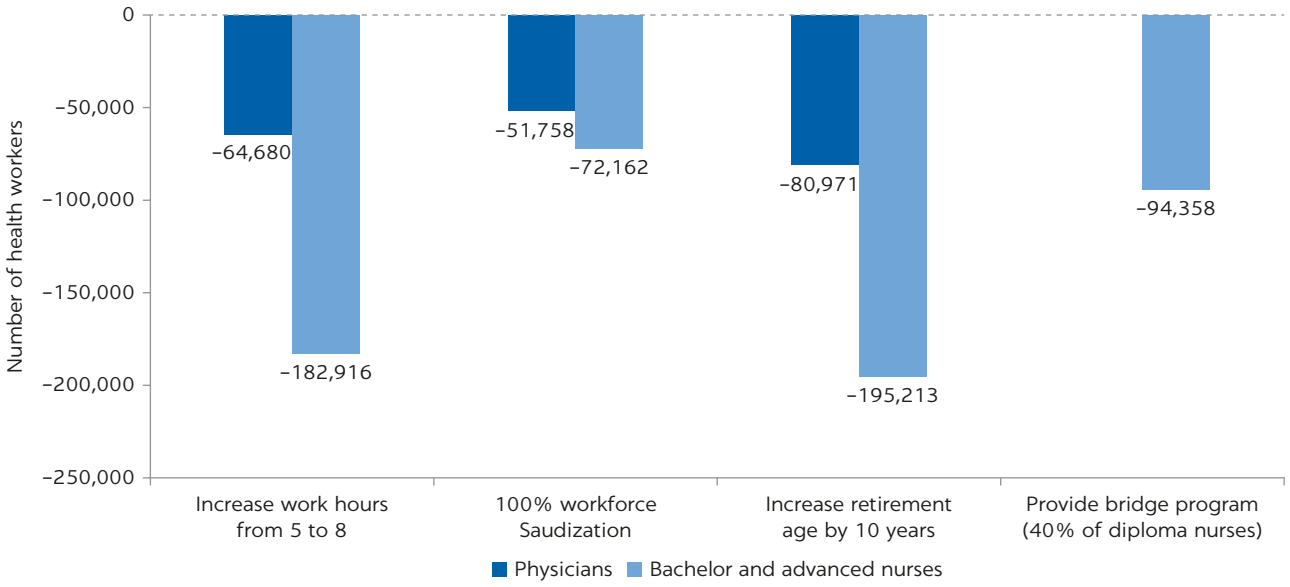
Need-based shortages and surpluses in simulated scenarios



Source: Original calculations for this publication.

FIGURE 7.11

Labor market demand shortages and surpluses in simulated scenarios



Source: Original calculations for this publication.

Workforce Saudization may be one of the more meaningful steps to reduce the critical gap between the supply of bachelor and advanced Saudi nurses, need-based demand, and health labor market demand. The need-based shortage of bachelor and advanced nurses is persistent across all potential need-based scenarios considered in this report, as well as across a range of productivity and retirement scenarios. The one supply-side intervention that

leads to a need-based demand surplus in Saudi nurses is workforce Saudization. Thus, workforce Saudization may be a cornerstone policy intervention for meeting the strategic goals outlined in the NTP. Although Saudization significantly increases the number of Saudi health workers and reduces need-based demand shortages in the health workforce, it will not fully alleviate health labor market demand shortages. Ultimately, it will be necessary to implement a combination of interventions to mitigate shortages in the health workforce in Saudi Arabia. This chapter only simulates one policy scenario at a time. Implementing multiple policies concurrently, such as increasing working hours and delaying retirement, may effectively ameliorate shortages in the health workforce.

For the nurse cadre specifically, the provision of continuing education to train diploma nurses to perform patient care tasks may reduce the need-based demand shortage for bachelor and advanced nurses. The findings suggest that relaunching the bridge programs may be useful for reducing the shortage of nurses in Saudi Arabia. However, by itself, training diploma nurses to perform patient care may not be sufficient to reduce both the overall and public sector–specific labor market demand shortage of bachelor and advanced nurses. Bridge programs will need to be implemented in conjunction with other policies to successfully eliminate the labor market demand shortage of nurses.

Among the simulated scenarios, reallocating salary support resources from surplus physicians to hiring more nurses may help eliminate the nursing shortage in Saudi Arabia. Although the exercise is conducted by assuming direct transfer of salaries from one cadre to another, the resource does not have to be earmarked for salary support and can be used in other ways to increase the supply of workers and minimize the demand shortage.

The analyses presented here show that there will be critical workforce gaps, especially for the bachelor and advanced Saudi nurse workforce; however, these analyses come with several caveats. For the scenarios simulating supply-side changes, it is assumed that the number of working hours directly translates to workers' relative productivity. This assumption neglects efficiency factors that may be relevant to the number of patients each provider can care for during each working day. Saudization scenarios assume that the historical trends in the workforce (for both Saudi and foreign workers) continue, but Saudi workers are assumed to increasingly replace foreign workers in numbers; in actuality, the supply pipeline for health workers is more complicated than simple replacements. The delayed retirement scenario assumes that the retained health workers will work the same position with the same productivity as all other health workers, when in reality more senior health workers may carry out tasks that differ significantly from those carried out by mid-level and junior-level health workers. For the need-based changes, it is assumed that the existence of an education campaign will increase the target coverage rate, and providers' tasks can simply be shared with no additional human or physical resources needed to facilitate the task-sharing. None of these scenarios discusses how the policies will be implemented but merely assumes that a policy is in place; these scenarios serve to illustrate the potential impact of each of these policies. Further details on policy solutions are discussed in chapter 8.

ANNEX 7A: SIMULATED SCENARIOS

Simulated scenarios for relative productivity

To capture status quo health workforce supply and allow for comparison with estimated changes in the supply of health workers associated with policy interventions, the projection additionally incorporates relative worker productivity. The projection adjusts for the relative productivity of Saudi workers using a five-hour workday (9 am to 3 pm, including a one-hour lunch) as compared with a full eight-hour workday. The status quo productivity was estimated to be 63 percent (five hours divided by eight hours) of maximum productivity. The projected supply was multiplied by 63 percent to generate the status quo health workforce supply. Simulated scenarios evaluate the impact on workforce supply of 80 percent relative productivity (six-and-a-half hours divided by eight hours) and 100 percent (a full eight hours). The projection includes all Saudi workers in the public sector and the private sector. The FTE supply of physicians under different scenarios is presented in table 7A.1, and the FTE supply of nurses under different scenarios is presented in table 7A.2.

TABLE 7A.1 FTE supply of Saudi physicians (including generalists and specialists) with varying productivity, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	63% RELATIVE PRODUCTIVITY	80% RELATIVE PRODUCTIVITY	100% RELATIVE PRODUCTIVITY
2020	19,563	24,842	31,053
2021	21,011	26,681	33,351
2022	22,473	28,537	35,671
2023	23,953	30,417	38,021
2024	25,452	32,320	40,401
2025	26,971	34,249	42,811
2026	28,513	36,207	45,258
2027	30,074	38,189	47,736
2028	31,657	40,200	50,250
2029	33,290	42,273	52,841
2030	34,914	44,336	55,420

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

TABLE 7A.2 FTE supply of Saudi nurses (including bachelor and advanced nurses) with varying productivity, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	63% RELATIVE PRODUCTIVITY	80% RELATIVE PRODUCTIVITY	100% RELATIVE PRODUCTIVITY
2020	20,744	26,342	32,927
2021	21,979	27,910	34,887
2022	23,224	29,491	36,864
2023	24,480	31,086	38,858
2024	25,747	32,695	40,868
2025	27,028	34,321	42,902
2026	28,326	35,969	44,961
2027	29,636	37,634	47,042
2028	30,965	39,320	49,150
2029	32,342	41,069	51,337
2030	33,705	42,799	53,499

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

Workforce Saudization

Following the NTP's strategic goal of workforce Saudization, the supply of Saudi workers needed to achieve 75 percent and 100 percent workforce Saudization by 2030 was simulated and is presented in tables 7A.3 and 7A.4.

TABLE 7A.3 FTE supply of Saudi physicians (including generalists and specialists) with simulated changes in Saudization, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	0% SAUDIZATION	75% SAUDIZATION	100% SAUDIZATION
2020	19,563	18,245	19,141
2021	21,011	20,230	21,739
2022	22,473	22,432	24,689
2023	23,953	24,873	28,040
2024	25,452	27,579	31,846
2025	26,971	30,580	36,168
2026	28,513	33,908	41,077
2027	30,074	37,598	46,652
2028	31,657	41,689	52,983
2029	33,290	46,226	60,174
2030	34,914	51,256	68,341

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

TABLE 7A.4 FTE supply of Saudi nurses (bachelor and advanced nurses only) with simulated changes in Saudization, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	0% SAUDIZATION	75% SAUDIZATION	100% SAUDIZATION
2020	20,744	48,907	51,309
2021	21,979	53,640	57,640
2022	23,224	58,832	64,753
2023	24,480	64,525	72,743
2024	25,747	70,770	81,719
2025	27,028	77,620	91,802
2026	28,326	85,132	103,130
2027	29,636	93,371	115,856
2028	30,965	102,408	130,151
2029	32,342	112,319	146,211
2030	33,705	123,190	164,253

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

Retention through delayed retirement

Scenarios for delayed retirement for health workers were considered. The supply of Saudi workers under scenarios of a 5-year delay in retirement and a 10-year delay in retirement were simulated and are presented in tables 7A.5 and 7A.6.

TABLE 7A.5 FTE supply of Saudi physicians (including generalists and specialists) with delays in retirement, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	NO DELAY IN RETIREMENT	5-YEAR DELAY IN RETIREMENT	10-YEAR DELAY IN RETIREMENT
2020	19,563	21,321	21,919
2021	21,011	22,898	23,541
2022	22,473	24,492	25,179
2023	23,953	26,105	26,838
2024	25,452	27,739	28,518
2025	26,971	29,395	30,221
2026	28,513	31,076	31,950
2027	30,074	32,778	33,700
2028	31,657	34,504	35,476
2029	33,290	36,284	37,307
2030	34,914	38,055	39,129

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

TABLE 7A.6 FTE supply of Saudi nurses (bachelor and advanced nurses only) with delays in retirement, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	NO DELAY IN RETIREMENT	5-YEAR DELAY IN RETIREMENT	10-YEAR DELAY IN RETIREMENT
2020	20,744	24,591	25,542
2021	21,979	26,009	27,025
2022	23,224	27,444	28,528
2023	24,480	28,893	30,046
2024	25,747	30,358	31,583
2025	27,028	31,841	33,139
2026	28,326	33,339	34,712
2027	29,636	34,855	36,306
2028	30,965	36,402	37,931
2029	32,342	37,950	39,561
2030	33,705	39,509	41,203

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

TABLE 7A.7 FTE supply of Saudi nurses (including bachelor and advanced nurses and bridged diploma nurses) with provision of bridging program, 2020–30

	BASELINE	SIMULATED SCENARIOS	
YEAR	NO BRIDGE PROGRAM (ONLY BACHELOR AND ADVANCED NURSES)	20% OF DIPLOMA NURSES RECEIVE CONTINUING EDUCATION (ALL NURSES)	40% OF DIPLOMA NURSES RECEIVE CONTINUING EDUCATION (ALL NURSES)
2020	20,744	32,677	44,610
2021	21,979	34,592	47,205
2022	23,224	36,527	49,831
2023	24,480	38,480	52,481
2024	25,747	40,452	55,158
2025	27,028	42,445	57,861
2026	28,326	44,460	60,595
2027	29,636	46,497	63,357
2028	30,965	48,557	66,149
2029	32,342	50,663	68,985
2030	33,705	52,765	71,826

Source: Original calculations for this publication.
Note: FTE = full-time equivalent.

The average salary of public sector physicians and the average salary of public sector nurses presented in table 7A.8 were estimated using the following assumptions:

- The ranges of physician and nurse wages are assumed to be the same for both Saudi and foreign physicians in the public sector.
- The health worker wage bill is from 2018 and is assumed to remain unchanged into the future.

TABLE 7A.8 Average physician and nurse wage bills and overall public sector wage costs

CADRE	MINIMUM MONTHLY SALARY (SRIs)	MAXIMUM MONTHLY SALARY (SRIs)	AVERAGE MONTHLY SALARY (SRIs)	NUMBER OF HEALTH WORKERS IN THE PUBLIC SECTOR, 2018	TOTAL ESTIMATED MONTHLY COST IN 2018 (SRIs)	ESTIMATED RESOURCES FOR WAGE BILL IN 2030[a] (SRIs)
Physicians	14,950[b]	39,040[b]	26,995	65,455	1,766,957,725	2,828,956,247
Nurses	10,400[c]	27,455[d]	18,928	46,378	875,949,984	1,402,424,146
Total						4,231,380,393

Source: Original calculations for this publication.
Note: SRIs = Saudi Arabian riyals.
a. Assumes the wage bill increases with the average annual GDP growth rate of 1.04 percent.
b. Data are taken from MOH (2013).
c. Minimum: 8,000 SRIs per month + 30% benefits = 10,400 SRIs per month.
d. Maximum: 21,119 SRIs per month + 30% benefits = 27,455 SRIs per month.

In scenarios in which there is one cadre in surplus, the surplus number of workers is multiplied by the average salary to determine the additional resources that can be reallocated to the other cadre. The estimated numbers are presented in table 7A.9.

TABLE 7A.9 Summary of the net effects of simulated scenarios compared with baseline model estimates, 2030

AREA OF IMPACT	SCENARIO	CHANGE IN FULL-TIME EQUIVALENT WORKERS	NEED-BASED SURPLUS (SHORTAGE)[a]		DEMAND-BASED SURPLUS (SHORTAGE)[a, b]	
			PHYSICIANS	NURSES	PHYSICIANS	NURSES
Supply	Increase work hours from 5 to 8	20,506 physicians 19,794 nurses	49,631	(15,900)	(64,680)	(182,916)
	100% workforce Saudization	33,427 physicians 130,548 nurses	62,553	94,854	(51,758)	(72,162)
	Delay retirement by 10 years	4,215 physicians 7,498 nurses	33,340	(28,196)	(80,971)	(195,213)
Need	Increase service coverage by 10%	1,201 physicians 17,013 nurses	27,925	(52,707)	(85,185)[b]	(202,710)[b]
	Shift 30% of physician tasks to nurses	(1,736) physicians 1,736 nurses	30,862	(37,430)	(85,185)[b]	(202,710)[b]

Source: Original calculations for this publication.
a. Baseline gaps.
b. Demand-based gaps are not affected by need-based policy; the number presented here is the baseline demand gap.

NOTES

1. Reminder: Target coverage rates were determined on the basis of the severity of the health condition, the ability to detect cases, and the probability that patients with the condition will seek care. Chapter 3 discusses this in further detail.
2. No estimations are provided for the 100 percent Saudization scenario, where there is a surplus of workers in both cadres. Similarly, no estimations are provided for continuing education for nurses because the policy intervention does not affect the number of physicians.

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8 Priority Interventions to Address Labor Market Supply and Demand Challenges in Saudi Arabia

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KEY MESSAGES

- To address estimated health worker shortfalls on the supply side and on the labor market demand and financing side, this chapter proposes a set of key priority interventions for physicians and nurses, and for Saudi nationals only.
- A key policy priority is to increase the number of bachelor and advanced nurses, ensure greater gender balance, and steer a greater proportion of health worker supply toward primary care services, rural areas, and private sector employers.
- On the demand side, generating greater efficiencies from existing resources is critical, as is considering shifting a larger proportion of financing to the general population and the private sector.
- Concurrent interventions are needed to ensure that poorer segments of the population are protected, which is where the majority of public resources should probably be directed.

BACKGROUND

Previous chapters reveal that with no policy change, by 2030 labor market demand for and supply of Saudi physicians and nurses (when including diploma nurses) will exceed what is needed to meet basic health needs. In fact, the projected numbers of physicians and nurses would be far more than required to supply the basket of basic services necessary to address priority health conditions (as defined in chapter 3) in Saudi Arabia. This projection, however, reflects

the fact that people want many health services other than basic necessities (for example, cosmetic-, elective-, wellness-, and aging-related services), all of which drive population demand and thus the supply of health workers. In addition, labor market demand (available financing to recruit and employ workers in the sector as a whole) is shown to exceed the projected supply of physicians and nurses even if 100 percent Saudization is achieved (that is, if all foreign workers are replaced by Saudi workers), or the retirement age of health workers is increased. This reflects substantial absorptive financing capacity in both the public and the private sectors (not public sector financing only), driven again by population demand for workforce supply (Saudi and non-Saudi) to meet requirements beyond the basic services needed to address priority health conditions in Saudi Arabia.

What the chapters show, however, is that when including bachelor and advanced Saudi nurses only, a shortage is projected in 2030 in relation to the basic package of needs. More specifically, chapter 7 shows that there will be a need-based shortage of 35,694 Saudi bachelor and advanced nurses by 2030 if nothing changes. This shortage is further shown to persist under different scenarios: at 100 percent productivity, there will be a need-based shortage of 15,900 bachelor and advanced Saudi nurses; at 100 percent Saudization, there will be a need-based shortage of 28,747 bachelor and advanced Saudi nurses. These values indicate that, without any policy changes, and if the trend continues as it has, by 2030 Saudi Arabia will not have enough Saudi nurses, in the traditional sense (that is, nurses with a bachelor's or advanced degree), to meet the epidemiological and health needs of its population. With no policy to scale up the supply of bachelor and advanced nurses (discussed below), gaps would have to continue to be filled by Saudi diploma nurses or foreign nurses.

Furthermore, the chapters show that for both Saudi physicians and Saudi nurses the projected supply will not be balanced by gender, sector (public versus private), level of care (primary versus hospital). Unless policies are developed to steer supply otherwise, the growth of female physicians and male nurses, and their potential in the labor market, would decline and remain untapped. Most of the growth of Saudi physicians and nurses would be at the hospital level, would be in urban areas, and would be in the Ministry of Health (MOH) sector. The fact that most of the growth would be in the MOH sector could have a negative impact on public sector labor market demand. Labor market demand projections take into account overall fiscal space linked to the recruitment of physicians and nurses: with the majority of health worker supply projected to flow into MOH employment (rather than into the private sector), this means that the MOH will continue to bear the brunt of the wage bill for health workers, which does not align well with efforts to spread the risk and diversify funding. Table 8.1 summarizes some of the findings from the previous chapters.

This chapter proposes some key policy interventions on both the supply side and the demand side that can help ensure the Saudi physician and nurse workforce in 2030 meets all needs and demand. The aim of this chapter is to be selective, not extensive—a more comprehensive discussion on the solutions to address physician and nursing challenges is available elsewhere (Alluhidan et al. 2020; Alluhidan et al., forthcoming). Instead, the aim here is to focus on a number of selected, high-level priority interventions, especially scaling up Saudi bachelor and advanced nurses, thus ensuring a more balanced future distribution of physicians and nurses by gender, care level, geographic location, and sector as well

TABLE 8.1 Summary of findings on labor market supply and labor market demand

	DIMENSION	PHYSICIANS	NURSES
Labor market supply	Availability	• The modeling shows that the projected number of Saudi physicians will exceed those needed in 2030, even with 100 percent Saudization replacement.	• There will be a shortage of nurses in relation to needs, even with 100 percent Saudization.
	Gender balance	• With no policy change, the number of Saudi female physicians will grow, but the number of male physicians will grow faster. • Increases in employment in the private sector are largely driven by the female labor force. Currently more males work in the private sector, but in the future more females will be employed by the private sector.	• With no policy change, the number of female nurses will grow rapidly, whereas the number of male nurses will remain relatively constant. • Although it remains low, the number of Saudi female nurses in the private sector will more than double (the number of male nurses will increase by less).
	Sector distribution	• Most of the physician supply increase will be absorbed by the MOH, with increased employment in the private sector. • Increased employment in the private sector will largely be driven by female physicians, which is contrary to the current situation.	• Most of the increase in nurses will be in the MOH sector, with a very small increase in the private sector.
	Geographic distribution	• The geographic distribution of the workforce is critical since most physicians will still be located in urban areas.	• Although this could not be modeled, chapter 1 on the current distribution shows that nurses remain highly unevenly distributed across rural and urban areas, especially when considering only bachelor and advanced nurses.
	Level distribution	• Although the number of primary care physicians will grow, the majority of growth in the supply of physicians will remain at the hospital level.	• With no policy change, the increase in nurses will be mainly in hospitals, with a decrease occurring at the primary level.
Labor market demand	General financing to absorb employment	• On the physician demand side, modeling shows that the projected financing to absorb physicians in the private and non-MOH public sectors will be more than enough, even with 100 percent Saudization. The demand in the MOH sector is likely to be much less than in the other sectors.	• On the nursing demand side, modeling shows that the projected financing to absorb nurses will be more than enough, even with 100 percent Saudization. • Modeling also shows that as we increase productivity and Saudization and increase retirement age, there will still be enough financing to absorb nurses.
	MOH labor market demand	• The finding that much of the growth in the supply of physicians would end up in the MOH sector (and very little in the private sector) may well put pressure on the MOH wage bill.	• The finding that much of the growth in the supply of nurses would end up in the MOH sector (and very little in the private sector) means that the MOH will continue to bear the brunt of the wage bill for health workers.

Source: World Bank.
Note: MOH = Ministry of Health.

as generating greater value for money for existing public sector funds. The interventions discussed cover both education and labor market solutions, highlighting the importance of health planners working in close collaboration with the education (and financing) sectors during the development and implementation of the interventions.

SELECTED PRIORITY SUPPLY-SIDE INTERVENTIONS

This section discusses some of the supply-side interventions that should be prioritized to ensure that the projected Saudi workforce meets needs for their availability and distribution across gender, sector, and care level

(primary versus hospital). The interventions focus solely on a select number of key priority solutions for Saudi nurses and Saudi physicians (rather than all solutions) in light of government ambitions to work toward Saudization.

Scale up aggregate supply

A key policy priority is to scale up the number of bachelor and advanced nurses. The availability of Saudi physicians will be more than sufficient to meet basic health needs, but not so for Saudi bachelor and advanced nurses. The scale up of bachelor and advanced nurses needs to be prioritized, and within that, five strategies could be prioritized: (1) scaling up training capability (specifically clinical sites) to increase production, (2) increasing reliance on private schools for production, (3) using a bridge program to help existing diploma nurses become bachelor or advanced nurses, (4) increasing the productivity of nurses already in the labor market, and (5) considering optional delayed retirement. Although the immediate need is to scale up Saudi bachelor and advanced nurses, strategies 1, 2, 4, and 5 could be relevant for scaling up the number of physicians as well.

Scale up clinical sites

One of the main bottlenecks in training more Saudi health workers and increasing the aggregate supply is the lack of clinical sites at which health workers can conduct their practical training. This limitation applies to training of both physicians and nurses. Hands-on training with direct access to patients and participation in patient care (including experience with physical exams, diagnosis, treatment plan development, and procedures) is essential for creating confident health workers who can efficiently deliver high-quality care. This clinical site shortage affects both preservice education (nursing and medical school, and so on) and postgraduate training (physician residencies and fellowships; and nursing certificates, master's degrees, and doctoral programs).

This shortage of clinical sites exists in Saudi Arabia (and in most other countries) because health workers' clinical practica have traditionally taken place almost exclusively in public academic or referral hospitals. This practice ensures that students are able to see large numbers of complex patients and have access to highly skilled instructors. However, as more countries move toward self-sufficiency in training health workers, the number of public academic hospitals is becoming insufficient to teach the increased number of students. In addition, a low student-to-patient ratio is desired so that students can interact with and examine the patients and be actively involved in their care. Therefore, clinical sites need to be expanded both to private hospitals and to all levels of the public health system, including primary care.

To ensure high-quality clinical practica in these new clinical sites, a number of measures need to be taken. These measures include ensuring that clinical sites have a legal education mandate, ensuring this education right is communicated in patient rights and responsibility documentation, ensuring case-based teaching and mentoring, designing standardized clinical practice curricula, ensuring availability of methods to document the clinical experience, and ensuring availability of transportation and accommodation. Box 8.1 provides details on each of these dimensions.

BOX 8.1

Key dimensions to consider in scaling up clinical site capacity

Education mandate. All public health facilities and all private health facilities of a certain size or referral level or level of technical advancement (for example, having a magnetic resonance imaging scanner) could be legally required to accept health profession students. Private facilities that do not wish to participate in health worker education could pay a reasonable per bed fee each year. This fee would go toward scholarships for health profession students.

Patient rights and responsibilities. In all health facilities that have students, when patients arrive and register at the facility, they should be provided with a copy of their patient rights and responsibilities. The rights and responsibilities would explain that the facility is a teaching facility, that teaching is an essential part of its work, and that it is the responsibility of the patient to help in the education of the next generation of health workers. The rights and responsibilities will explain that in extreme cases patients can request not to be seen by students or by male students, but this is expected to be a rare exception.

Case-based teaching. To ensure that the nursing and physician staff at the new teaching sites are able to teach and mentor the students properly, Saudi Arabia could train them in case-based teaching (often called *bedside teaching*) and clinical mentoring.

Clinical practica curricula. Because students traditionally receive some lectures during clinical practica, Saudi Arabia can ease the transition for new clinical sites by providing curricula and lecture materials. For some topics, the government may want to provide interactive webinars or taped lectures, which will be especially helpful in clinical sites that have large numbers of patients but few specialists.

Documentation of clinical experience. To ensure that each student sees a sufficient volume and diversity of patients and has sufficient opportunity for hands-on experience (including procedures such as suturing and lumbar punctures, and so on), there need to be agreed-on metrics for each program and a common methodology for documenting the experience. This documentation can be as simple as a paper booklet in which the student records cases and the supervising health worker signs, or it can be in the form of more sophisticated apps or websites.

Transportation and accommodation. As students start learning in sites outside of public academic centers, many of these sites will be a great distance from the medical or nursing school. Schools should then be obliged to provide transportation when the distance is commutable from the base school. If the clinical site is too far away to commute to, the school should provide free or affordable housing near the clinical site.

Saudi preclinical faculty. A shortage of preclinical faculty (biochemistry, anatomy, physiology, and so on) in Saudi Arabia hinders the expansion of both public and private health professional education. This shortage occurs mainly because preclinical faculty are not able to supplement their income with higher-paid clinical work the way clinical faculty can. Saudi preclinical faculty can be increased by creating tailored pipeline programs and improving the salaries and career paths of preclinical positions.

Increase role of private schools in production

The government is unlikely to have sufficient funding to open the number of new medical schools, nursing schools, and other health professional schools for Saudi Arabia to become self-sufficient in training health workers. Therefore, while ensuring accreditation standards and monitoring performance and quality, the government will need to provide incentives to the private sector to expand existing private schools and to open new ones. These incentives can come in a variety of forms, including land, student financing, matching funds, social impact bonds, removal of administrative burdens, and reliance on pedagogic and administrative public goods. Box 8.2 provides more detail.

BOX 8.2

Key dimensions to consider in scaling up the role of private schools

Accreditation and quality management. Any private sector institution would be required to meet standardized accreditation requirements if it is to operate, and monitoring should occur regularly to ensure that these requirements are enforced.

Land. The government can offer private investors free or below–market rate land for sale or lease to set up schools. Or the government can give schools access to government-owned or government-contracted buildings to house schools.

Student financing. Rather than finance schools directly, Saudi Arabia can finance schools indirectly by providing scholarships or loans to students at accredited private schools.

Low-interest rate loans or matching funds. Saudi Arabia can provide matching grant funds or below–market rate loans to encourage the opening and expansion of private schools.

Social impact bonds. To de-risk private sector investment as well as to ensure that the government only pays for results, the government can issue social impact bonds that pay investors an agreed-on amount upon the successful graduation of a certain number of health workers.

Removing administrative burdens. To facilitate the opening of more private schools, Saudi Arabia could remove some of the administrative barriers to the founding of schools. This can be accomplished through an analysis of the accreditation process to identify steps that do not add real value but instead burden the process of opening a school.

Pedagogic public goods. Many schools have outdated curricula and it can cost upward of $500,000 to update a curriculum. Rather than have multiple schools in Saudi Arabia reinvent the wheel, Saudi Arabia can provide curricula and teaching materials (lecture notes, demonstration notes, PowerPoint slides, handouts, reading lists, and so on) for free.

Public management goods. Health professional schools can be complex institutions, and one of the challenges of starting and expanding them is the management software (student tracking, classroom scheduling, clinical practica scheduling, and so on) and standard operating procedures necessary to efficiently run a school. Saudi Arabia can make such public goods available to all private health schools to reduce the cost and time required to start the schools and increase the likelihood of their success. In addition, Saudi Arabia can facilitate the establishment of networks of school administrators to share best practices—for example, networks of admissions officers, networks of deans, and so on.

Use bridge programs and continuing education

The existing diploma nurse workforce should be provided with work-friendly bridging training to transform these workers into bachelor nurses. The goal of bridging programs is to allow existing diploma nurses to upgrade their training and to enter clinical practice in as short a time as possible. The scenario projections in chapter 7 show that 35,866 diploma nurses would need to be trained to become bachelor nurses (if no other intervention to increase supply is implemented) so that the overall number of Saudi nurses would meet need-based demand in 2030. Standardized bridging programs are needed to allow diploma nurses to pursue part-time training alongside their current work responsibilities. Currently, no such opportunities exist for nurses in Saudi Arabia—to carry out bridging training or any postgraduate training—and a nurse has to exit the nursing profession completely to take up training opportunities, which makes it difficult to pursue such training. Offering part-time bridging programs in Saudi Arabia that can be undertaken alongside current work and, most important, that focus on clinical training elements (that is, that

are not only theory driven) will also provide an opportunity for the private sector (with public scholarships provided to those with financial difficulties), if adequately regulated and accredited.

Similarly, work-friendly continuing professional development opportunities should be in place to offer existing nurses opportunities to progress toward becoming advanced practice nurses and earn additional certifications, master's degrees, or doctor of nursing practice (DNP) or PhD degrees.

Increase productivity

The results from the scenario modeling show that supply can be increased substantially by increasing the overall productivity of workers. If existing health workers are more productive—increasing the quality and efficiency of their work—then fewer overall workers will be needed. The productivity of Saudi health workers can be increased through a variety of mechanisms. Productivity can be improved by ensuring that health workers receive competency-based education that ensures they have the practical skills (in addition to the theoretical knowledge) to do their jobs. The faculty and pedagogy in preservice education can be improved through regulatory support and other mechanisms in both the public and private sectors. The most profound change needed to increase health worker productivity is to improve team design. This change includes adding junior fellows (specialty physicians with shortened fellowships that prepare them to care for the most common and straightforward conditions in the specialty) and midlevel providers (advanced practice nurses, physician's assistants, diploma nurses, and so on) to the team, and task-shifting or repurposing. Furthermore, more health care assistants can be added to the nursing team. Adding these new team members will enable task-sharing and allow physicians to focus on the most complex patients and the most complex tasks, in addition to matching the reorientation toward primary care. Also, the workflow of health workers can be analyzed and modified to increase efficiency. For example, unnecessary steps in the hospital admission process can be eliminated and the usability of electronic medical records can be improved. As another example, clinical pathways can be added, which have been shown to improve outcomes and decrease length of stay, enabling health teams to care for more patients more cost-effectively. Finally, the management of health teams can be improved, with increased management autonomy and accountability. Such measures would include carefully designed pay-for-performance schemes and other mechanisms, which would include productivity indicators as key performance measures.

Delay retirement

An optional delayed retirement policy can increase the number of years workers stay in the health labor market and thus address shortages on the supply side. The previous chapters show that increasing the work interval by 10 years can reduce the shortage in the Saudi health workforce in 2030 by 3,849 physicians and 5,336 bachelor and advanced nurses. Delayed retirement could possibly be introduced as an optional policy, but it would need to go hand in hand with a careful assessment of the impact on pension benefits and thus the overall cost to the government or private sector.

Increase gender balance of supply

Saudi Arabia has made great strides in gender equality in recent years. However, progress can still be made in reducing the gender imbalance in the Saudi health labor market. Specifically, more women can be encouraged to pursue careers in medicine and more men can be encouraged to pursue careers in nursing, while taking into account patient preferences for the gender of their provider. The supply-side modeling in chapter 4 shows that, with no policy intervention, the vast majority of physicians would remain male and the majority of nurses would remain female in 2030. To move toward a gender balance, interventions could include (1) creating pipeline programs and women-only medical schools to generate female interest in the medical profession early on, (2) creating more family-friendly working conditions, (3) expanding telemedicine opportunities, and (4) using strategies to increase male nursing.

Create pipeline programs and women-only medical schools

Women can be encouraged to pursue careers in medicine through pipeline programs that reach down to the middle-school level to encourage women to pursue medical fields. Such programs would expose young girls to medical science and to female physician role models. Such programs are particularly important in rural and conservative areas, where girls may not think about pursuing a career in medicine. The expansion of women-only medical schools may also help create a pipeline for female physicians. Overall, women's educational attainment in Saudi Arabia (as in much of the Arab world) is already very high—many have completed secondary school and go on to university, so there is already a large pool of highly educated women who can immediately mobilize to go into medicine.

Create more family-friendly working conditions

In addition, medical careers can be made more family friendly by improving the work-life balance. Such measures can include allowing part-time work, decreasing shift length, changing the team design so that nighttime and weekend coverage is not as burdensome, and starting mentoring programs. Better maternity leave will also help retain female physicians once they have started a family. It is important to note that improving work-life balance will benefit men as well as women and will decrease burnout and increase labor market retention.

Expand telemedicine opportunities

Telemedicine has already been introduced in Saudi Arabia through Vision 2030, and the COVID-19 (coronavirus) outbreak is accelerating its expansion. Increased telemedicine opportunities throughout all aspects of care (prevention, primary care, urgent care, chronic disease management, specialty care, and rehabilitation) will provide even more opportunities to female physicians so they do not need to leave their homes or enter the home of the patient.

Use strategies to increase male nursing

Men can be encouraged to enter the nursing field in much the same way that women can be encouraged to enter the physician field. Nursing pipeline programs and mentorship programs for men can be created. The programs can initially focus on specialty areas in which other countries have had success in bringing more men into the profession, including emergency nursing, military

nursing, intensive care, and advanced practice nursing. The initial focus on recruiting male nurses into specialty areas should be implemented with careful consideration to not crowd out female nurses already in these specialty areas. Moreover, as the nursing field positions itself with disciplines that are historically more male-oriented (for example, biological sciences), more men will be attracted to the field.

Increase supply to primary care

Saudi Arabia has shortages across many types of health workers; however, the shortage is most acute in primary care and in certain physician specialties such as psychiatry and geriatrics. The modeling in chapter 4 shows that, with no intervention, a large portion of the supply of physicians and nurses is ending up at the hospital level. Because primary care is seen as one of the most cost-effective service levels to meet needs, this is a problem. The primary care shortage can be addressed by (1) creating special tracks and scholarships for primary care, (2) increasing postgraduate education for primary specialties, (3) linking mandatory service to licensure qualification, and (4) increasing incentives for primary care.

Create special tracks and scholarships for primary care

The number of Saudi physicians available to work at the primary care level can be increased by increasing the number of general and family practitioners who graduate. Saudi Arabia needs to substantially increase the number of family medicine training places, both for the shorter "practical" training and the longer academic training. Government scholarships, moreover, could give preference to generalist or family practitioner education. A key priority should also be to expand the one-year training programs required after medical school to practice independently. It is especially crucial to set up these new training programs in underserved regions and underserved communities, perhaps with requirements to serve in these communities afterward.

Increase postgraduate education for primary care specialties

To address the shortage of physicians in primary care specialties, postgraduate education for primary care specialties should be increased. Postgraduate faculty need to be expanded through pipeline programs and pedagogy training. In addition, efforts need to ensure that postgraduate seats are filled as they are created, including by ensuring that sponsors (public and private) release nurses for postgraduate training. Overall, a national strategy needs to be developed, which must include determining which postgraduate education specialties are highest priority, standardizing the length of postgraduate education programs, standardizing their regulation, creating instructor pipelines, and providing opportunities for nurses to take up postgraduate education.

Link mandatory service to licensure qualification

Another strategy could be to institute a one-year primary care service requirement to qualify for licensure. The idea behind this mandatory primary care year is twofold: (1) it helps temporarily staff hard-to-fill positions, and (2) some physicians who originally were not attracted to primary care or to rural or underserved areas may discover that they like it and choose to continue. For example, Colombia requires one year of "social service" in rural areas, research, public health, or special populations (for example, orphan children) before a license is

given (WHO 2017). Steps would need to be taken, however, to avoid potential pitfalls if neighboring countries are willing to hire their physicians with a medical degree alone.

Increase incentives for primary care

If the number of applicants for primary care–relevant positions is not adequate, the incentives need to be improved. These improvements can either be short-term incentives linked to the fellowship (for example, improved fellowship pay, benefits, working conditions) or long-term incentives linked to pay, benefits, working conditions, and career advancement for practical and academic family practitioners. Close attention should be paid to the market aspects of students' decisions regarding which fellowships to apply for and accept.

Increase supply to rural areas

Chapter 1 shows that the vast majority of the physician and nursing workforce is located in urban areas. Currently rural areas are staffed mainly by expatriates. The shortage of Saudi nurses in more remote locations is driven largely by poor living and working conditions, which are particularly pronounced for nurses who do not come from remote areas and are not used to the conditions. Saudization will require gradually replacing these expatriates with Saudi nationals. A number of priority interventions should be considered to increase the rural supply of Saudi nationals, mainly (1) rural education pipelines, (2) hub-and-spoke models, (3) rural bonding schemes, (4) rural career pathways, and (5) telemedicine adoption and expansion.

Consider rural education pipelines

Saudi Arabia should create rural education pipelines to train health workers who will stay and practice in rural areas and meet the needs of rural populations. Such pipelines are programs that have the stated goal of recruiting students from rural areas and training them in rural areas—with the agreement that, upon graduation, the health workers will commit to serving those communities for a specified period. Rural pipelines can be created by establishing schools in rural areas, focusing the intake of students on rural candidates, ensuring curricula and practical training are adequately geared to addressing rural-specific challenges, and helping students obtain jobs in rural areas.

Consider hub-and-spoke models

Another option, closely linked to the rural education model, is to take existing medical and nursing schools and create a *hub-and-spoke model* in which the hubs are the existing schools located near large academic referral hospitals and the spokes are satellite campuses located in or next to rural district hospitals. The hub and spokes are connected to one another by high-speed internet, enabling videoconferencing and e-learning. Through the hub-and-spoke model, no new schools need be formed, and rural students can have either all or most of their education in rural settings.

Consider rural bonding schemes

One of the most successful ways to place health workers in rural communities is to bond them with scholarships that require a certain number of years of return service. These bonding scholarships have been used successfully in Asia,

Australia, Europe, and North America. In exchange for paying for all or a certain percentage of a health worker's education, the health worker agrees to work in an underserved community for an agreed-on number of years. If necessary, these contracts can have buy-out clauses that enable the health worker to be released from the contract by paying back the investment that was made in them. The contracts could include a menu of scholarships with different levels of support and number of years to pay back.

Consider rural career pathways

Many countries that strive to retain health workers in rural communities see a pattern in which new graduates work for a few years in rural communities but then leave to seek further training or career advancement. To encourage health workers to continue to work in rural areas, Saudi Arabia must create rural career pathways. Such pathways give rural physicians and nurses preferred admission to postgraduate education or enable them to pursue postgraduate education while living and working in rural communities. In addition, more advanced posts—such as senior clinical posts and management positions—need to be created in rural areas so that high-performing rural workers can use their more advanced skills.

Adopt and expand the use of telemedicine

For communities too remote or too small for health workers to be placed permanently, a number of solutions are available. One is for health workers to periodically visit the community to care for people with chronic diseases and diagnose and treat nonurgent conditions. Another is to expand Saudi Arabia's already-successful telemedicine programs. The Saudi Telemedicine Unit of Excellence and existing telemedicine programs, such as the Telemedicine Centre in King Faisal Specialist Hospital, can work to create programs that cover medical homes and primary care as well as acute and episodic care.

Increase supply into the private sector

Currently, most Saudi health workers are employed by the public sector, especially the MOH. Other government institutions, such as the National Guard and the Ministry of Defense, employ Saudi health workers; however, health workers rarely move from one ministry to another. The private health sector does employ some Saudi health workers, mainly specialty physicians who are moonlighting from their public sector jobs (Algaith et al., forthcoming). Except for these specialty physicians, the private health sector in Saudi Arabia is seen as a less desirable employment sector because it offers lower wages and less job security. Of course, these are perceptions by Saudi workers: private employers might actually be paying according to actual productivity, with the public sector paying higher salaries for less productivity. In any case, with no intervention, minimal growth in the supply of health workers in the private sector by 2030 highlights a lost opportunity to better leverage private financing resources and diversify the fiscal responsibility of absorbing health workers into the public sector. A substantial portion of the labor market demand in 2030—the fiscal space needed to absorb workers—seems to sit outside the MOH or even the public sector in general. To make the private sector more attractive to Saudi health workers, robust regulation of the private sector will be key to its effective scale up, with an emphasis on aligning population health priorities and protecting profit-maximizing interests.

Maximize oversight of working conditions and standards

There must be proper regulatory oversight of the private sector to ensure that standards are upheld—quality standards as well as wage standards—and the private sector should be included in Saudi Arabia's unified minimum wage scales.

SELECTED PRIORITY LABOR MARKET DEMAND INTERVENTIONS

This section discusses some of the main labor market demand-side interventions that should be prioritized in the future. The projections find that overall labor market demand (that is, financing) far exceeds the amounts needed to absorb the projected growth in Saudi physicians and nurses and is likely sufficient to absorb all health workers when 100 percent Saudization is considered or the retirement age is raised. Projected labor market demand reflects combined public and private sector labor market demand and the demand for both Saudi and non-Saudi nationals. These workforce dynamics explain why the modeled numbers far exceed the labor market demand needed from an epidemiological standpoint. What is clear is that the fiscal space for a particular submarket, such as the MOH only, may be substantially lower. In fact, the back-of-the-envelope calculation for MOH labor market demand has shown it to be much lower than overall labor market demand. In addition, with the majority of the Saudi nurse and physician supply expected to be flowing into MOH facilities, maximizing the efficiency of existing resources and freeing resources for investing in workforce development (such as the solutions outlined in this chapter) are critical for Saudi Arabia, and particularly the MOH, if it wants to maximize the number of physicians and nurses that can be absorbed.

Increase the efficiency of existing resources

Increasing the efficiency of existing resources going toward the wage bill can open up more financing and thus labor market demand—in the MOH as well as other sectors—for investments in the health workforce more broadly. A number of different interventions should be considered, several of which are already being implemented, including (1) reforming service delivery with a focus on results and greater accountability, and (2) decentralizing financing and autonomy from national- to subnational-level structures.

Reform accountability and pay for results

Currently, the majority of the budget for health worker education and wages comes from Saudi central government revenue. In the Vision 2030 plan, and the reform currently being implemented, Saudi Arabia intends to "corporatize" MOH facilities into accountable care organizations (ACOs). The ACOs will initially be allocated budgets in accordance with historical budgets; these budgets will increasingly be allocated based on each ACO's performance as measured against a set of key performance indicators focused on quality and efficiency. Such mechanisms can also help with negotiating prices and services, enhancing and ensuring quality of care, and encouraging healthy behavior (Dey and Bach 2019).

Decentralize funding

The ongoing model of reform toward ACOs within the health sector clusters—the integrated network of health care providers under one administrative structure—will ensure that more autonomy over financing and hiring and firing will also be given to the subnational level. The reform will allow health care to become the responsibility of each cluster (each ACO) and will allow health care budgets to be shifted to such clusters. In general, lower levels of government (such as clusters, as opposed to the central government) can forge closer relationships with the population and be more responsive to their needs. The ACOs can free up resources for targeted and needed recruitment, thus increasing labor market demand.

Shift financing partly to the public

Currently, the Saudi central government acts as the de facto health insurer for most Saudis. This arrangement may not be sustainable in the future, and copayments or private health insurance considerations for some populations or services could be explored. The public sector may want to focus on insuring only those services that meet health priorities, that emphasize prevention, or that have a public health angle, and may want to predominantly cover lower-income individuals.

Scale up private health insurance

By shifting some services or Saudi income groups to a private or parastatal insurance model, the benefits of health insurance functions can be widened and better realized. These insurance models include risk pooling and financial protection from some catastrophic events. As with any insurance considerations, particular attention should be paid to poorer segments of the population who may need continued government subsidies to pay for select services.

Expand the private sector

Currently, most health care in Saudi Arabia is provided by the public sector. This model has limitations because it places full responsibility for investing in health care on the government and, at the same time, government health care is generally recognized as having management inefficiencies. A number of interventions could be considered, including shifting some of the financing of education and service provision to the private sector, with simultaneous measures to address equity concerns. Expanding the private sector is a particularly important recommendation given the huge difference observed in previous chapters between the epidemiological need and labor market demand from the public and private sectors.

Expand private professional schools

The private sector can be encouraged to invest in opening and expanding private health professional schools and private postgraduate education programs. Saudi Arabia can provide incentives for this private sector investment through the provision of land grants, tax incentives, matching funds, advance contracts, and more flexible regulatory mandates. For private schools, Saudi Arabia can agree to provide public scholarships to qualified students at accredited private schools in good standing.

Provide incentives to private providers

Saudi Arabia can encourage national, regional, and global private health care providers to invest in creating and expanding health care infrastructure and services. These private sector investment opportunities exist not just in acute care provision, but, as the population of Saudi Arabia ages, increasingly in prevention, chronic disease management, and long-term care.

CONCLUSION

This chapter reflects on the findings of the previous chapters and includes a set of key priority interventions to address potential shortcomings on both the supply side and on the labor market demand and financing side. The chapter focuses on interventions for physicians and nurses, and on Saudi nationals only. It discusses a select number of priority interventions relevant to some of the findings of the previous chapters. An in-depth account of different policy solutions can be obtained elsewhere (Alluhidan et al. 2020; Alluhidan et al., forthcoming). In line with the findings in previous chapters, key policy priorities are to increase the number of bachelor and advanced nurses, ensure greater gender balance, and steer a greater proportion of supply toward the primary care level, rural areas, and the private sector. On the demand side, generating greater efficiencies from existing resources and considering shifting a larger proportion of financing to the general population and the private sector are critical. Concurrent interventions are needed to ensure that poorer segments of the population are protected, which is where the majority of public resources should most likely be directed.

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Strengthening the health workforce in Saudi Arabia is central to ongoing reform efforts in the country and to the changing business priorities in the health sector and beyond. Saudi Arabia's Vision 2030 aims to increase the size and performance of the Saudi health workforce to meet changing population needs and to achieve ambitious social and economic targets and goals. This book presents rigorous, empirical, and quantitative evidence to support national-level strategic planning efforts on human resources for health in Saudi Arabia.

The book, a collaborative effort between the Saudi Health Council and the World Bank, is a first to anticipate and quantify projected future labor market imbalances of nurses and physicians in Saudi Arabia and to identify solutions to close those gaps. Drawing on the latest principles and modeling techniques in epidemiology and economics, the book forecasts future imbalances between epidemiological need and labor market supply and demand. It culminates in a set of policy recommendations to improve the availability, distribution, and performance of Saudi nurses and physicians. The book is expected to be of interest to health workforce planners and health systems researchers working in Saudi Arabia and beyond.

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