RESEARCH
SERIES
NUMBER 147
JULY 2022

PROJECTIONS OF WORKFORCE REQUIREMENTS FOR PUBLIC ACUTE HOSPITALS IN IRELAND, 2019–2035

A REGIONAL ANALYSIS BASED ON THE HIPPOCRATES MODEL

CONOR KEEGAN, AOIFE BRICK, ABIÁN GARCÍA-RODRÍGUEZ AND LEONIE HILL

ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE

PROJECTIONS OF WORKFORCE REQUIREMENTS FOR PUBLIC ACUTE HOSPITALS IN IRELAND, 2019–2035

A REGIONAL ANALYSIS BASED ON THE HIPPOCRATES MODEL

Conor Keegan

Aoife Brick

Abián García-Rodríguez

Leonie Hill

July 2022

RESEARCH SERIES

NUMBER 147

Available to download from www.esri.ie

DOI: https://doi.org/10.26504/rs147

ABOUT THE ESRI

The mission of the Economic and Social Research Institute is to advance evidence-based policymaking that supports economic sustainability and social progress in Ireland. ESRI researchers apply the highest standards of academic excellence to challenges facing policymakers, focusing on 12 areas of critical importance to 21st century Ireland.

The Institute was founded in 1960 by a group of senior civil servants led by Dr T.K. Whitaker, who identified the need for independent and in-depth research analysis to provide a robust evidence base for policymaking in Ireland.

Since then, the Institute has remained committed to independent research and its work is free of any expressed ideology or political position. The Institute publishes all research reaching the appropriate academic standard, irrespective of its findings or who funds the research.

The quality of its research output is guaranteed by a rigorous peer review process. ESRI researchers are experts in their fields and are committed to producing work that meets the highest academic standards and practices.

The work of the Institute is disseminated widely in books, journal articles and reports. ESRI publications are available to download, free of charge, from its website. Additionally, ESRI staff communicate research findings at regular conferences and seminars.

The ESRI is a company limited by guarantee, answerable to its members and governed by a Council, comprising 14 members who represent a cross-section of ESRI members from academia, civil services, state agencies, businesses and civil society. The Institute receives an annual grant-in-aid from the Department of Public Expenditure and Reform to support the scientific and public interest elements of the Institute's activities; the grant accounted for an average of 30 per cent of the Institute's income over the lifetime of the last Research Strategy. The remaining funding comes from research programmes supported by government departments and agencies, public bodies and competitive research programmes.

Further information is available at www.esri.ie.

ABOUT THE AUTHORS

Conor Keegan is a Senior Research Officer at the ESRI and an Adjunct Associate Professor at Trinity College Dublin. Aoife Brick is a Research Officer at the ESRI and an Adjunct Assistant Professor at Trinity College Dublin. Leonie Hill is a Research Assistant at the ESRI. Abián García-Rodríguez was a Research Officer at the ESRI when contributing to this work.

ACKNOWLEDGEMENTS

Financial support for this research was provided by the Health Service Executive (HSE). The authors thank the members of the HSE Cross-Divisional Workforce Planning Steering Group which included input from the Department of Health Strategic Workforce Planning Unit. The authors particularly thank Dr Philippa Ryan Withero, Liz Roche, and Des Williams of the Strategic Workforce Planning and Intelligence Unit in the National Human Resources Directorate of the HSE for their assistance with this research project. The authors are also grateful to the many officials of the HSE including those in the National Health and Social Care Professions Office, Office of the Nursing and Midwifery Services Director, National Doctors Training and Planning, National Finance Division, and Business Intelligence Unit. In addition, the authors are grateful to staff of the Healthcare Pricing Office, National Treatment Purchase Fund, and many other providers of data who assisted this research. Contacts with policymakers, providers and stakeholders have contributed important context and understanding. The authors also acknowledge the contributions of colleagues at the ESRI. Valuable comments on the text and suggestions for revision were provided by three anonymous reviewers. We thank all those who provided contributions while acknowledging that the authors bear sole responsibility for the analyses and interpretations presented.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AP	Advanced practitioner
APD	Adjusted patient days
BIU	HSE Business Intelligence Unit
CHI	Children's Health Ireland
CHO	Community Healthcare Organisation
COPD	Chronic obstructive pulmonary disease
CS	Clinical specialist
CSO	Central Statistics Office
DIME	Doctors Integrated Management E-system
ED	Emergency Department
GDP	Gross domestic product
HCA	Healthcare assistant
HG	Hospital Group
HIPE	Hospital In-Patient Enquiry scheme
HPO	Healthcare Pricing Office
HSCA	Health and social care assistant
HSCPs	Health and social care professions
HSE	Health Service Executive
LOS	Length of stay
MHA	Moderate healthy ageing
NCHD	Non-consultant hospital doctor
NDTP	National Doctors Training and Planning unit
NHS	National Health Service - UK
NSP	HSE's National Service Plan
NTPF	National Treatment Purchase Fund
OECD	Organisation for Economic Cooperation and Development
OPD	Outpatient department
PET	Patient experience time
RHA	Regional Health Area
SD	Service demand scenario
SLT	Speech and language therapist
SYOA	Single year of age
TFR	Total fertility rate
ULHG	University of Limerick Hospital Group
UTI	Urinary tract infection
WHO	World Health Organization
WM	Workforce mix scenario
WTE	Whole-time equivalent

FOREWORD

This report was prepared by researchers at the Economic and Social Research Institute (ESRI) for the Strategic Workforce Planning and Intelligence Unit at the National Human Resources Directorate of the Health Service Executive. Published as an ESRI Research Series Report, it is the fourth report applying the Hippocrates Model of healthcare demand and expenditure. It analyses workforce demand in public acute hospitals and projects regional demand for the years from 2019 to 2035.

The Hippocrates Model was developed at the ESRI under the ESRI Research Programme in Healthcare Reform agreed between the ESRI and the Department of Health. The Hippocrates Model is a tool which can: inform health and social service planning in Ireland; inform financial planning for the healthcare system; inform planning for capacity, services and staffing; identify future demand pressures, and provide a framework in which to analyse the effects of potential system changes and reforms. The HSE-funded developments to Hippocrates required two important extensions to the model: regionalisation and the capability to project workforce demand. The project was overseen by the HSE Cross Division Workforce Planning Steering Group with input from the Department of Health Strategic Workforce Planning Unit.

The ESRI is responsible for the quality of this research, which has undergone peer review prior to publication. The report was prepared by Dr Conor Keegan, Dr Aoife Brick, Ms Leonie Hill and Dr Abián García-Rodríguez and reflects their expertise and views. The views expressed in this report are not necessarily those of other ESRI researchers, the HSE, the Minister for Health, Department of Health or those represented on the HSE Cross-Divisional Workforce Planning Steering Group.

July 2022

EXECUTIVE SUMMARY

INTRODUCTION

This is the fourth report to be published applying the ESRI's Hippocrates healthcare projection model. Previous analyses have applied Hippocrates to estimate baseline utilisation and expenditure for a range of health and social care services and to provide national projections of demand, capacity and expenditure. The analysis undertaken in this report, funded by the Health Service Executive, necessitated two important extensions to the Hippocrates model: extending it to project workforce requirements, and providing these projections at a regional level. We present regional workforce projections both in terms the current Hospital Group configuration and the new integrated Regional Health Areas.

Workforce projections are considered over the medium term, between 2019 and 2035, and for a selected set of staff categories directly involved in patient care: medical staff, nursing and midwifery staff, healthcare assistants and health and social care assistants, and five health and social care professions (dietitians, occupational therapists, physiotherapists, speech and language therapists, and social workers).

CONTEXT

Current government plans to substantially increase publicly funded healthcare staff over the coming years takes place in the context of acknowledged staff shortages and an Irish population that is expected to continue to see strong growth and ageing. Publication of this report also takes place at a time of ongoing implementation of Sláintecare, which seeks to deliver a single-tier integrated universal public healthcare system where access is based on need rather than ability to pay. While promoting a shift away from hospital-centred care, these reforms also acknowledge the importance of investment in acute system capacity and the alignment of hospital and community services through the development of six new Regional Health Areas. The Sláintecare programme recognises that strategic healthcare workforce planning will be a critical enabler of these reforms.

METHODS

Hippocrates is a macro-simulation projection model developed by the ESRI. The model is bottom-up in nature, with hospital-level workforce projections developed from a demand base in 2019. To inform the modelling approach, a review of the literature on the drivers of workforce demand and international health workforce planning models was undertaken as part of this report. Acknowledging the uncertainty surrounding key assumptions, and to facilitate comparison of

alternative drivers of workforce demand, several projection scenarios were developed. In total we specify five projection scenarios, three service demand scenarios and two workforce-mix scenarios.

The *service demand scenarios* vary assumptions in relation to projected hospital service demand without changing the mix of staff involved in delivering care. Demand for care is projected in line with regional demographic change and assumptions in relation to healthy ageing, waiting-list management, and assumed enhancement of community care delivery. Key to informing the service demand projections are ESRI county-level population projections which model future population change as a function of fertility, mortality, and international and internal migration. The *workforce-mix scenarios* then additionally examine how projected service demand might be delivered by alternative combinations of workforce through altering grade-mix (e.g. between staff nurses/midwives and healthcare assistants) and skill-mix distributions (e.g. the percentage of healthcare professions operating at advanced practice level).

The grade- and skill-mix assumptions modelled in this report have been chosen in agreement with relevant stakeholders and professions following online workshops and follow-up consultation. It is important to note that these assumptions are best described as informing 'what-if' scenarios, to facilitate greater depth and understanding in relation to projections, and do not reflect recommendations regarding implementation. For instance, a main assumption examines the impact of a move towards a 70 per cent staff nursing/midwifery to 30 per cent healthcare assistant grade-mix (70:30) at an overall hospital level in the context of an estimated national baseline mix of 76:24. However, additional analyses examine how sensitive whole-time equivalent (WTE) projections are to alternative grade-mix ratios. For example, current policy recommendations set out an 80:20 staff nursing/midwifery to healthcare assistant mix, but this relates only to general and specialist medical and surgical adult in-patient wards rather than the totality of the hospital setting.

The report does not forecast workforce but provides projections of workforce requirements based on clear assumptions in relation to the drivers of service demand and changes to workforce mix. It does not consider how workforce supply will be adjusted to meet projected demand requirements. It is also acknowledged that, due to data limitations, it was not possible to examine the extent to which the baseline levels of workforce supply (adjusted for agency and overtime) reflect best-practice staffing levels. Work is on-going within the HSE as part of this project to develop detailed best-practice staffing metrics, which will inform future analyses in this area.

FINDINGS

Overview

A key finding from this report is that workforce requirements for all staff categories examined are projected to increase substantially by 2035. Large projected increases in older age groups are identified as the dominant driver of underlying service demand and therefore workforce requirements. In this regard, particularly large relative increases in workforce requirements have been identified for health and social care professions (most notably occupational therapists and speech and language therapists) that are particularly required by older people in hospital.

Additional workforce will likely be required to contribute to waiting-list management, but we estimate much of this to be temporary in nature and required to address non-recurring backlogs for care that have arisen in recent years. Greater access to community care has the potential to offset some projected increased pressures on hospital workforce. As described in the report, however, assumptions modelled in relation to shifting activity to the community are conservative and reflect the mixed evidence in relation to care substitutability.

For nursing and midwifery and the health and social care professions, the application of respective grade-mix assumptions had the impact of offsetting some of the additional projected WTE requirements for these professions through increasing the proportion of care delivered by assistant grades. The impact of skill-mix assumptions increased projected requirements for nurses and midwives and health and social care professions operating at advanced practice and clinical specialist level, and for medical consultants.

While large increases in workforce requirements are projected across all Regional Health Areas and Hospital Groups, a consequence of these internal patterns of population change is that somewhat larger projected workforce requirements tend to arise in those Regional Health Areas and Hospital Groups located in the east of the country. Regional projected WTE growth is also sensitive to the application of modelled grade-mix scenarios and the extent to which base-year regional grade-mix ratios differ from modelled ratios.

Detailed findings

Tables ES.1 and ES.2 illustrate projected growth in WTE requirements for workforce categories, nationally and regionally.

TABLE ES.1 Workforce categories – WTE projection range, 2019–2035

	2019	Projected additional WTE across scenarios	
	WTE	2035 WTE (min–max)	Average annual growth (min %–max %)
Medical	8,403	2,575-3,236	1.7-2.1
Nursing and midwifery	22,964	5,726-8,868	1.4-2.1
Healthcare assistants and health and social care assistants	5,707	1,802-3,277	1.7-2.9
Healthcare assistants	5,630	1,765-3,102	1.7-2.8
Health and social care assistants	77	37-176	2.5-7.7
Health and social care professions			
Dietitians	357	119-166	1.8-2.4
Occupational therapists	315	169-214	2.7-3.3
Physiotherapists	938	372-494	2.1-2.7
Speech and language therapists	174	75-118	2.3-3.3
Social workers	303	105-148	1.9-2.5
National total	**39,160**	**12,418-15,491**	**1.7-2.1**

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4). No waiting-list or enhanced community care assumptions are modelled for health and social care assistants or health and social care professions.
Source: See section 4.4 for an overview of data sources.

- *Medical* WTEs were estimated at 8,403 in 2019. By 2035, WTE requirements are projected to increase by between 2,575 and 3,236 WTE, nationally. This represents an average annual growth rate of between 1.7 and 2.1 per cent. Across scenarios the highest projected regional average annual growth rate was recorded for Regional Health Areas A and B (2.2%) in the east of the country while the lowest rate was recorded for Area F (1.4%) in the west/north west.
- *Nursing and midwifery* was the single largest staff category, contributing an estimated 22,964 WTE to care delivery in public hospitals in 2019. By 2035, nursing and midwifery category WTE requirements are projected to increase by between 5,726 and 8,868 WTE, nationally. This represents an average annual growth rate of between 1.4 and 2.1 per cent. Across scenarios, the highest projected average annual growth rate was recorded for Regional Health Areas A and B (2.2%) while the lowest rate was recorded for Areas C, D and E (1.0%) in the south.

TABLE ES.2 Workforce categories – WTE projection range by Regional Health Area, 2019–2035

	Average annual growth (min % – max %)					
	Area A	Area B	Area C	Area D	Area E	Area F
Medical	1.8-2.2	1.8-2.2	1.7-2.1	1.6-2.0	1.5-1.8	1.4-1.8
Nursing and midwifery	1.5-2.2	1.9-2.2	1.0-2.1	1.0-2.0	1.5-1.8	1.0-1.8
Healthcare assistants and health and social care assistants	1.9-3.0	1.5-2.3	1.8-5.2	1.6-4.6	0.7-1.8	1.4-3.0
Health and social care professions						
Dietitians	2.0-2.6	2.0-2.6	1.9-2.5	1.6-2.2	1.4-2.0	1.4-2.0
Occupational therapists	3.0-3.4	2.9-3.5	2.5-3.4	2.0-3.0	1.9-2.9	2.6-2.9
Physiotherapists	2.3-2.8	2.2-2.9	2.0-2.7	1.7-2.4	2.0-2.2	2.1-2.4
Speech and language therapists	2.4-3.3	2.4-3.4	2.3-3.4	2.1-3.1	2.1-3.2	2.0-3.1
Social workers	2.0-2.6	2.0-2.7	2.0-2.6	0.9-1.5	0.9-1.6	2.1-2.8

Source: See section 4.4 for an overview of data sources.

- *Healthcare assistant and health and social care assistant* WTEs were estimated at 5,707 in 2019. By 2035, healthcare assistant WTE requirements are projected to increase by between 1,802 and 3,277 WTE, nationally. This represents an average annual growth rate of between 1.7 and 2.9 per cent. Across scenarios, the largest projected average annual growth rates were recorded for Regional Health Area C (5.2%) while the lowest rate was recorded for Area E (0.7%).
- *Staff nurses/midwives and HCAs – changing the grade-mix:* Baseline staff nurse/midwife and HCA was 76:24 in 2019. Projected staff nurse/midwife and HCA WTE requirements are sensitive to the grade-mix assumptions modelled. Nationally, under our main 70:30 staff nurse/midwife grade-mix assumption, we project an average annual increase in nursing WTE of 1.4% which rises to 2.8% under an 80:20 mix. For HCAs, we project an average annual increase in WTE requirements of 2.8% under a 70:30 mix, falling to 0.2% under an 80:20 mix.
- *Health and social care professions:* Physiotherapists (938 WTE) were the largest of the selected health and social care professions in 2019, followed by dietitians (357 WTE), occupational therapists (315 WTE), social workers (303 WTE), and speech and language therapists (174 WTE). Projected average annual growth rates for health and social care professions, most notably occupational therapists and speech and language therapists, were higher overall relative to other workforce categories examined. As with other workforce categories examined, larger projected WTE requirements overall were reported in Regional Health Areas located in the east of the country, reflecting underlying patterns of projected population change.

POLICY IMPLICATIONS

Workforce planning will be key to delivering Sláintecare reforms. Findings from this report raise important considerations for policymakers in terms of acute workforce investment, training and planning nationally and regionally over the coming years. The main findings of this report are that workforce requirements for all public acute staff categories examined are set to increase substantially over the coming years and across all current Hospital Groups and Regional Health Area configurations. Projected workforce requirements are primarily driven by the underlying projected demand for hospital care, itself a function of a projected growing and ageing population.

Policy developments, however, could both increase or lessen additional public hospital workforce requirements over the projection horizon. For example, while addressing waiting-list challenges will require a multi-faceted approach, additional public hospital workforce investment will likely represent part of the solution. On the other hand, increased access and investment in community services may help

reduce some additional demand and workforce pressures on the public hospital system. Where appropriate, it may also be possible to improve productivity through, for example, changing the mix of professional and assistant grades involved in care delivery.

While recent budgets have made provision for large increases in workforce supply to address current and future demand pressures, increasing future supply to the levels required will be a challenge for policymakers, given the recognised difficulties with health workforce recruitment and retention both nationally and internationally.

CHAPTER 1

Introduction

1.1 INTRODUCTION

In this report we provide projections of workforce demand for a selected set of professions in public acute hospitals in Ireland, between 2019 and 2035. These projections have been generated using the Hippocrates Model,[1] which was developed at the ESRI in a programme of research funded by the Department of Health.

This report marks the next phase in the development of the Hippocrates projection model. Previous analyses have applied the Hippocrates Model to estimate baseline utilisation and expenditure on a wide range of health and social care services and to provide medium-term projections of demand, capacity and expenditure. This report, funded by the Health Service Executive (HSE), expands the Hippocrates modelling framework in two important ways. First, informed by new ESRI COVID-19 adjusted regional demographic projections, we extend Hippocrates to project public acute hospital demand regionally, at a Hospital Group (HG) and Regional Health Area (RHA) level. These regional public acute hospital care demand projections are then used as a basis to develop projections of public acute hospital workforce demand to 2035 which is the focus of this report.

1.2 OBJECTIVES

The broad objectives of this report are to:

- provide estimates of workforce supply for a selected set of professions in Irish public acute hospitals in 2019;
- project demand requirements for Irish public acute hospital workforce both nationally and regionally to 2035; and
- examine the relative impact of service demand and workforce-mix drivers on projected workforce demand.

Future ESRI research will extend the model to develop projections of non-acute healthcare workforce.

[1] Hippocrates – Greek physician (born c. 460 – died c. 375 BC) regarded as the father of modern medicine. (www.britannica.com/biography/Hippocrates). Also, an acronym of Healthcare in Ireland model of effects of Population Projections, patterns Of CaRe and Ageing Trends on Expenditure and demand for Services.

1.3 BACKGROUND

Strategic workforce planning can be defined as a process of analysing an organisation's current and future workforce needs, identifying the gaps and implementing solutions to allow an organisation to deliver on its strategic plan (Department of Public Expenditure and Reform, 2020). In this regard, workforce planning attempts to understand what drives underlying demand for workforce as well as analysing future supply with the aim of addressing any future shortages or surpluses. The need to develop a robust evidence-based approach to workforce planning in the Irish health system has become a key policy priority in recent years.

The National Strategic Framework for Health and Social Care Workforce Planning, published in 2017, is the basis for health and social care workforce planning in Ireland (Department of Health, 2017). Underlying the framework is a recognition that planning must focus on current and future population health needs, ensuring the right skills and geographic distribution of workforce, and recognising a need to capture 'key strategic and operational developments including national health policies and strategies, agreed models of care, and other developments' (Department of Health, 2017, p.9). The framework outlines a five-step approach to strategic workforce planning under which step two relates to modelling and forecasting activities that act as necessary enablers for identifying and implementing policy solutions.

In terms of the framework's recognition of the need to keep pace with policy development, the need for robust strategic workforce planning comes at a time when Ireland seeks to implement the Sláintecare Reform Programme, an ambitious reform of the health and social care system over the next number of years. The Sláintecare programme seeks to introduce equitable access to a universal single-tier public healthcare system, where most care takes place in primary and social care settings. While promoting a shift away from a hospital-centred model of care, the programme recognises that additional measures – such as investment in hospital capacity, hospital waiting-time targets and a phased elimination of private care in public hospitals will also be needed (Government of Ireland, 2018). The programme has recognised that healthcare workforce planning will be a critical enabler of these reforms and has actioned the acceleration of the implementation of the National Strategic Framework to support Sláintecare implementation (Government of Ireland, 2018). These reforms, along with the development of new integrated RHAs, form key deliverables under the Sláintecare Implementation Strategy and Action Plan, 2021–2023 (Government of Ireland, 2021).

The focus of this report is on projecting demand for public acute hospital workforce over the period 2019–2035. The report does not consider how workforce supply

will be adjusted to meet projected demand requirements. Workforce supply-side modelling is currently being undertaken by the HSE, for the public health system, and the Department of Health for the wider health system with the support of the Directorate-General for Structural Reform Support (DG Reform) of the EU Commission under the auspices of their Technical Support Instrument.

1.3.1 The Irish hospital system

Public hospitals

Hospitals in Ireland may have statutory, voluntary and private (for profit) ownership. Statutory hospitals are owned and funded by the HSE. Voluntary hospitals have traditionally been established by religious or charitable organisations and receive large amounts of their funding from the State. Many major acute hospitals in Ireland are owned by voluntary organisations. For the purposes of this report, statutory and voluntary hospitals are collectively termed as public acute hospitals.

Most hospital care in Ireland is delivered in public hospitals. In 2019, there were 53 hospitals returning information to the national public acute hospital administrative dataset, the Hospital In-Patient Enquiry (HIPE) scheme. In 2019, HIPE recorded 1.1 million day patient discharges and 650,000 in-patient discharges (Healthcare Pricing Office, 2020). Both publicly and privately financed care is provided in public hospitals. Private patients in public hospitals represent about 20 per cent of activity. They are seen by their consultant on a private basis and are responsible for meeting both *per diem* rates and private consultant fees. Private care in public (and private) hospitals is largely financed through voluntary private health insurance. For non-consultant hospital staff, the same publicly funded staff resources are employed in delivering care to both publicly and privately financed patients.

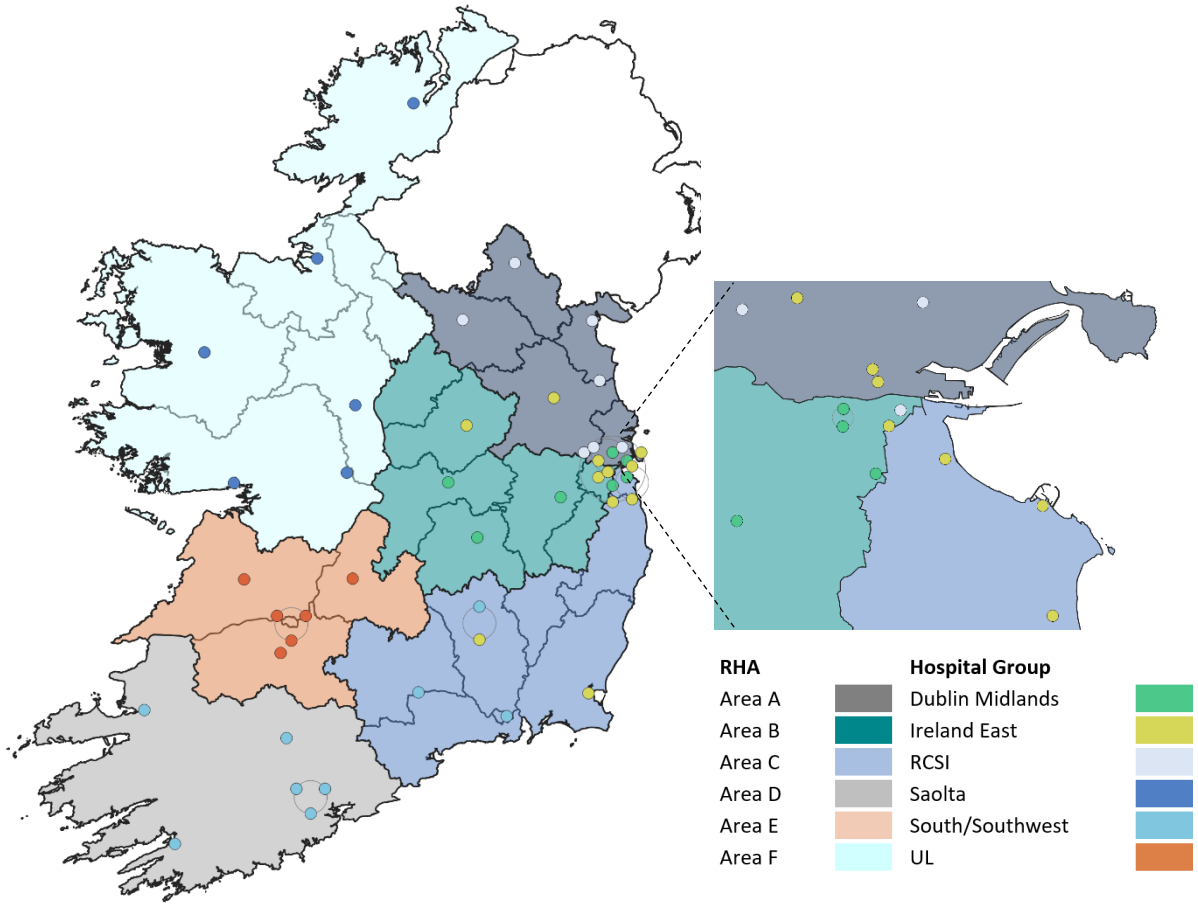
The delivery of public acute hospital services is currently organised around seven Hospital Groups (HGs): Dublin Midlands HG, Ireland East HG, RCSI HG, Saolta Hospital Group, South/Southwest HG, the University of Limerick HG and the Children's Health Ireland (CHI) Group. The creation of HGs in 2013 (Higgins, 2013) sought to correct the difficulty in relation to planning and financial accountability at regional level brought about by the abolition of the health boards and the establishment of the centralised HSE in 2004/2005 (Government of Ireland, 2019). The current organisation of acute services around these groups, however, creates issues in relation to population-based health planning. Specifically, HGs are not aligned with the nine geographical catchments for community care delivery, the Community Health Organisations (CHOs). In fact, HGs were developed in the

absence of any geographical boundaries or catchments on which to organise care delivery (Government of Ireland, 2019).

To address this problem and to allow for an integrated approach to service planning and care delivery, the Sláintecare Report called for the establishment of regional healthcare bodies, termed Regional Health Areas (RHAs). These will be based on the alignment of current HG and CHO structures, which are to be replaced.

Delivery of acute and non-acute services around the country is set to be organised around six RHAs, each with defined geographical boundaries (Figure 1.1). These boundaries are based on analysis of patient service use. In relation to acute services, these boundaries were informed by the extent to which hospitals in a region serve patients who live in that region (Government of Ireland, 2019).

FIGURE 1.1 Public acute hospitals by RHA and HG



Notes: Each dot on the map represents a hospital. The colour of the dot indicates the Hospital Group to which it belongs. The geographic areas shaded on the map represent the six RHAs. Hospitals will be aligned to the RHA in which they are located.
This analysis excludes the Children's Health Ireland hospitals (CHI Tallaght, CHI Crumlin and CHI Temple Street) and the National Rehabilitation Hospital (as it did not belong to a HG or RHA in 2019).

Private hospitals

There are 18 major private hospitals in Ireland, members of the Private Hospitals Association, providing acute and mental healthcare services. Traditionally, the information available in relation to activity and resourcing of private healthcare services in Ireland has been limited (Keegan et al., 2018b). However, recent analysis has shown the important contribution of private hospitals in delivering (mainly elective) hospital services, accounting for approximately 500,000 day patient and 110,000 in-patient cases in 2018 (Keegan et al., 2021). Yet, in contrast to the public hospital system, there is no centralised system for collecting administrative hospital activity and workforce data in private hospitals. Consequently, it has not been possible to (nationally or regionally) model projections of private hospital workforce demand as part of this report.

1.4 CONTEXT

Ireland faces a shortage of doctors and nurses. As described by the OECD/European Observatory on Health Systems and Policies (2021), in 2019 Ireland had 3.3 doctors per 1,000 population, the sixth lowest rate across EU countries. In comparison Ireland had 12.9 nurses per 1,000 population.[2] While this was above the EU average of 8.4 per 1,000, this number has been falling over the last 10 years, with many working on a part-time basis. In this context, Ireland relies heavily on doctors and nurses trained abroad, despite recording the highest number of medical graduates per capita among all EU countries. Once qualified, many of these graduates do not remain in the Irish system (OECD/European Observatory on Health Systems and Policies, 2021). Furthermore, Tyrrell et al. (2016) highlighted lower opportunities for career progression and training for non-EU doctors trained outside Ireland compared to those trained in Ireland.

Recently a strong focus has been directed towards recruitment in the Irish public healthcare workforce. Budget 2021, for example, made provision for an increase in public healthcare staff of approximately 16,000 WTE, as set out in the HSE National Service Plan of that year. While there was an immediate need to increase staffing levels as a consequence of the COVID-19 pandemic, there is also recognition of the need for a permanent increase in staffing levels to meet population healthcare needs into the future (Government of Ireland, 2020).

Plans to substantially increase healthcare posts on a permanent basis take place in the context of an Irish population that has experienced strong population growth and ageing historically and is expected to continue to do so over the medium term (Keegan et al., 2020). Recent, COVID-19 adjusted ESRI population projections

[2] However, the OECD recognises that Irish data returns include nurses working in management and educational roles that are not captured in the dataset for other countries which creates difficulties in relation to comparability.

estimate that the Irish population will increase from 4.9 million in 2019 to between 5.2 and 5.8 million by 2035. The population aged 65 and over is also expected to increase, from 1 in 7 now to 1 in 5 by 2035 (Walsh et al., 2021).

However, traditionally population growth has not been evenly distributed throughout the country. Between 1996 and 2016, the Mid-East region has experienced the highest population growth (averaging 2.2 per cent per annum) while the Mid-West region experienced the lowest growth (averaging 0.9 per cent per annum). ESRI analysis suggests that these patterns in regional population growth will continue (Bergin and García-Rodríguez, 2020).

Changes in the size and structure of the population will be important in driving healthcare demand (Keegan et al., 2020; Keegan et al., 2021; Walsh et al., 2021). As the delivery of healthcare is heavily service-orientated and labour-intensive (Keegan et al., 2020; Walsh et al., 2021), increased demand for healthcare services will also drive increased demand for healthcare staff.

The extent to which population growth and ageing may drive public acute hospital workforce both nationally and regionally is a topic which this report explores in detail. However, several other potential drivers of workforce requirements are also considered. For instance, allied to large population increases, years of under-investment in capacity and staff affected by the recession have created a situation whereby a substantial amount of demand for hospital services in the Irish system manifests as unmet demand. Recently, waiting-lists have been exacerbated by the COVID-19 pandemic (Brick and Keegan, 2020a; Walsh et al., 2020a) and the cyberattack on the HSE information systems. At the same time, the Sláintecare programme recognises that some care currently delivered in hospital settings could be more appropriately delivered in the community; this will have implications for workforce requirements both inside and outside of hospitals.

Workforce demand challenges arising from policy changes such as Sláintecare can be managed in several ways, including through integrating staff within and across professions to improve efficiency and the optimisation of the available skills, enabling professions to practise at the top of their professional licence. In this regard, recent policy documents (Health Service Executive, 2018; Department of Health, 2019; Health Service Executive, 2021; Morris and Smith, 2021), allied to additional insights and recommendations from consultation with a range of professional bodies and stakeholders, help inform assumptions applied in this report in relation to grade- and skill-mix. Particularly, many of the skill-mix assumptions developed in this report align with a key HSE priority area for action in 2022 – the enabling of a *sustainable clinical workforce*. While this is to be achieved in a number of ways, emphasis is placed on the need for staff professional

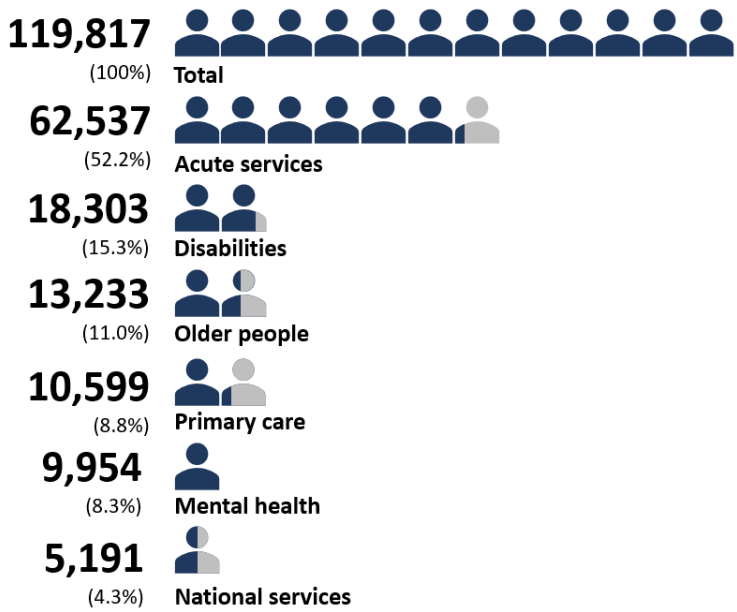
education and development, including the development of specialist and advanced practice for the nursing and midwifery and health and social care professions (HSCP) (Health Service Executive, 2022). Chapter 2 in this report provides a summary of current Irish workforce planning recommendations and policy.

1.5 MODEL SCOPE AND MODELLING APPROACH

The Hippocrates Model is designed to be broad in scope. To date the model has projected national demand and expenditure for a range of health and social care services. The focus of this report is on regional projections of workforce requirements for the public acute hospital sector.

This sector was chosen to operationalise the workforce modelling for a number of reasons. First, the acute system represents the largest area of HSE expenditure (Keegan et al., 2020), and the largest staff allocation, across all service areas (Figure 1.2). Second, in Hippocrates the ability to project workforce requirements is heavily reliant on access to detailed information on underlying use of services. For the public acute hospital system, these detailed data exist; they are collected and made available by the Healthcare Pricing Office (HPO). Outside the acute system, significant data gaps have been identified in relation to service use (Brick et al., 2020a; b; Henry et al., 2020; Walsh et al., 2021) and it is difficult to match available utilisation data with the quantum of workforce used to deliver services. Work is underway to address some of these data deficiencies in the expectation that Hippocrates will next be employed to project workforce requirements for selected non-acute care services.

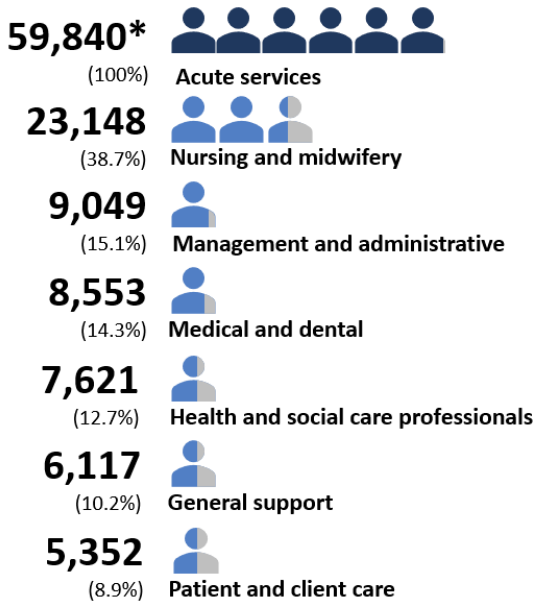
FIGURE 1.2 HSE workforce (WTE) by service area, 2019



Note: Excludes staff classified as being on a career break. Acute services include Ambulance Service.
Source: Health Service Personnel Census – December 2019.

Staff classified as working in *acute services* are categorised into six main *staff categories* (Figure 1.3): nursing and midwifery (38.7%), management and administrative (15.1%), medical and dental (14.3%), HSCPs (12.7%), general support (10.2%) and patient and client care (8.9%).

FIGURE 1.3 HSE workforce (WTE) acute services, 2019



Notes: * Includes all hospitals listed in Appendix A and the children's hospitals. Excludes staff classified as being on a career break, staff classified as acute hospital but not directly assigned to a hospital and ambulance service.

Source: Health Service Personnel Census – December 2019.

In this report we project workforce requirements for public acute hospitals that participated in the HIPE Scheme in 2019 (see Appendix A for a list of included hospitals). The analysis excludes projections for Children's Health Ireland. As CHI operates on an all-Ireland basis rather than as a regional service, demand for care (and workforce) within CHI is less likely be driven by regional demand patterns. As a consequence, the CHI hospitals sit outside the proposed RHAs (Government of Ireland, 2019).

This report projects workforce for a selection of staff categories and staff groups directly involved in patient care and whose future requirements will therefore be directly related to projected demand for care. These relate to medical, nursing and midwifery, select patient and client care – healthcare assistants (HCA) and select health and social care assistants (HSCA) – and five HSCPs (dietitians, occupational therapists, physiotherapists, speech and language therapists, and social workers).

Hippocrates is a macro-simulation model. Macro-simulation models or cell-based models represent a large and important class of component-based models, which group individuals into cells according to key attributes such as age and sex, and project from that basis (Astolfi et al., 2012). The model is bottom-up in nature,

projecting demand for care and workforce, separately. Demand for care is projected in line with regional demographic change and assumptions in relation to healthy ageing, unmet demand for hospital care, and assumed improvements in community care delivery. At the same time, adjustments are made to the relationship between activity and workforce within the model to consider the effects of changes in grade-mix and skill-mix distributions. As is reviewed in Chapter 2, this projection framework is in line with the more comprehensive demand-based healthcare workforce projection models applied internationally.

The Hippocrates Model is automated using IBM SPSS® and R statistical software, with subsidiary analysis undertaken in Microsoft Excel.

1.6 REPORT STRUCTURE

The remainder of the report is structured as follows: Chapter 2 provides the background to the analysis, including a review of the literature relating to workforce planning in Ireland and workforce planning demand modelling. Chapter 3 describes the methodology used to develop the regional population projections used in the analysis. Chapter 4 outlines the data sources and methods used to project workforce demand. Chapter 5 presents our findings while Chapter 6 summarises and concludes.

Key points

- This HSE-funded extension to Hippocrates represents two significant developments to the model – regionalisation and workforce demand modelling.
- The focus is on the public acute hospital system.
- Projections are provided for medical staff, nursing and midwifery staff, HCAs and HSCAs, and five HSCPs (dietitians, occupational therapists, physiotherapists, speech and language therapists, and social workers).

CHAPTER 2

Background

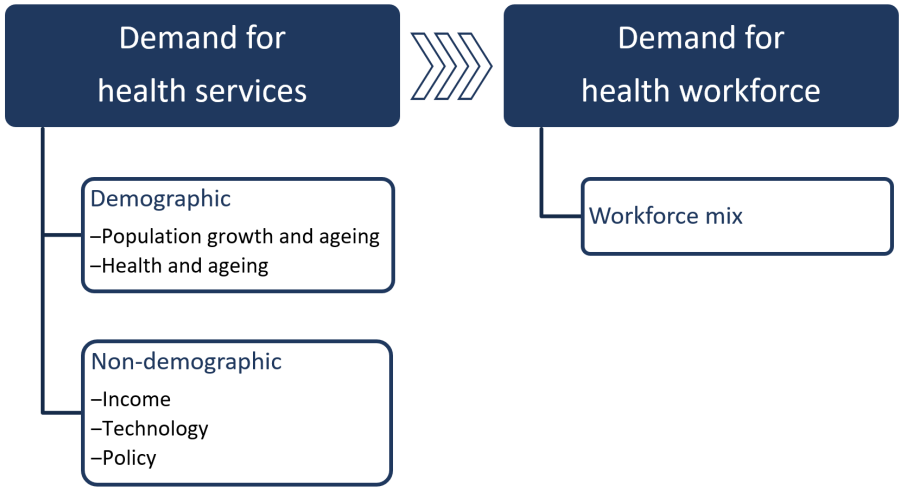
2.1 INTRODUCTION

This chapter provides the background and evidence that informs the development of the projection modelling framework described in detail in Chapters 3 and 4. While covered extensively in previous Hippocrates reports (Wren et al., 2017; Keegan et al., 2020; Walsh et al., 2021), we summarise evidence on the drivers of demand for health services that underlie the demand for health workforce. Selected Irish workforce planning policy as it pertains to the acute hospital system is also summarised as it provides the context in which many of the projection model scenarios were developed. Finally, we review the literature on workforce planning models particularly related to modelling workforce demand.

2.2 DRIVERS OF HEALTH WORKFORCE DEMAND

The drivers of health workforce demand are inextricably linked to those for health services demand. Summarised in the sections below and described in detail elsewhere (Wren et al., 2017; Keegan et al., 2020; Walsh et al., 2021), these include demographic drivers such as the relationships between population growth and ageing, health and ageing, and non-demographic drivers including income, technology and policy. When considering workforce demand, it is important to consider the potential impact of changes in delivery models (referred to as workforce mix in this report) (Ono et al., 2013) and, while not a direct driver, unmet service demand in the system (Segal and Bolton, 2009). Figure 2.1 illustrates the framework through which we examine the drivers of workforce demand.

FIGURE 2.1 Framework for workforce demand modelling



Source: Adapted from Ono et al. (2013).

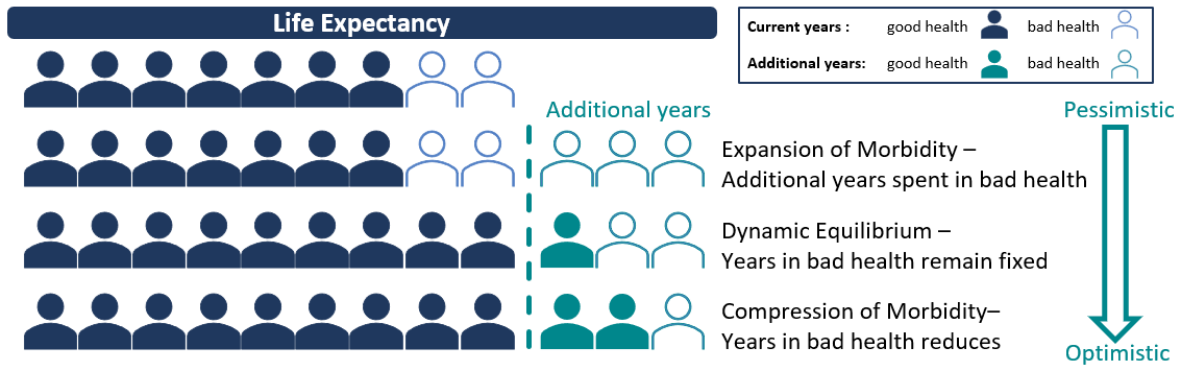
2.2.1 Demographic and non-demographic drivers

Changes to the drivers of health services demand will directly influence the demand for healthcare workforce. These drivers can usefully be considered as demographic and non-demographic.

Demographic drivers of health services demand include the relationship between population growth and ageing and health and ageing. The age and sex distributions of the population and how these change over time will influence the demand for health services. It has been shown that demand for health services is higher for children in the first year of life, during childbearing years for women, and among older adults (European Commission, 2015b; Brick and Keegan, 2020b). Therefore, any changes to the size or structure of the population can have substantive implications for health services demand.

As well as the growth and ageing of the population, the relationship between health (or morbidity) and ageing and the impact on health service demand is an important consideration. While an increase in life expectancy may suggest an increase in demand for health services, and consequently health workforce, this relationship is complex. Several hypotheses, described in detail elsewhere (Wren et al., 2017; Keegan et al., 2020), have been put forward. Illustrated in Figure 2.2, these hypotheses range from the more pessimistic *Expansion of Morbidity* (Przywara, 2010) whereby additional years are spent in bad health, *Dynamic Equilibrium* (Przywara, 2010) whereby additional years are largely spent in good health and years in bad health remain fixed, [3] to the most optimistic *Compression of Morbidity* (Fries, 1980) which suggests that as life expectancy increases the number of years spent in bad health reduces and is compressed to older ages. The uncertainty surrounding this relationship suggests that, when modelling future demand, several scenarios should be considered.

FIGURE 2.2 Health and ageing hypotheses



Source: Author illustration from Fries (1980) and Przywara (2010).

[3] Parallels can be drawn with the Proximity to Death hypothesis which suggests that proximity to death rather than ageing is the driver of demand (Wren et al., 2017).

Previous research has suggested that there are several *non-demographic* drivers of health service demand. Higher levels of national income have been linked to people demanding more health services (Charlesworth and Johnson, 2018). Technological change may also affect the demand for health services; however the effect can be difficult to measure. Technology may broaden the range of conditions that may be treated, thus increasing demand, but may also improve the effectiveness and productivity of service delivery (Socha-Dietrich, 2019), leaving the potential impact on health workforce demand unclear.

2.2.2 Other main drivers

Policy – changes to health service delivery models

Policy change relating to health service delivery is also a key driver of health workforce demand (Ono et al., 2013). Policy changes may alter how, where, or by whom services are delivered – again placing a range of demands on workforce. These can include requiring more staff to meet additional demand or a change in the mix of staff required to deliver services. For instance, National Clinical Programmes (NCPs), established in 2010, take an evidence-based approach to transforming how services are delivered, to improve and standardise patient care (Shaw, 2020). There are now 31 programmes, covering areas ranging from paediatrics and neonatology to sepsis and mental health. These programmes design models of care and clinical pathways, and many have developed national guidelines and strategies. [4]

Furthermore, each year, the HSE's National Service Plan (NSP) sets out the type and volume of health and personal social services to be provided, and estimated workforce requirements, in line with priorities set out by the Minister for Health and the longer-term policy agenda. [5] In recent years, the NSPs have considered how many of the key Sláintecare reforms are to be progressed.

The Sláintecare Report published in 2017 recommends extensive policy reform which includes shifting the focus of care delivery from a hospital-centric system to one in which there is greater emphasis on primary care (Houses of the Oireachtas Committee on the Future of Healthcare, 2017). Recommendations relating to the introduction of universal GP and primary care are likely to increase demand for healthcare and consequently increase demand for GPs and other professions in the primary and community care workforce. An increase in demand for GP services due to the reduction or elimination of GP fees has been found in several Irish studies (Nolan, 2008; Nolan and Smith, 2012; Connolly et al., 2018).

4 https://www.hse.ie/eng/about/who/cspd/about/

5 https://www.hse.ie/eng/services/news/media/pressrel/hse-2021-national-service-plan-published.html

However, the extent to which greater access to and investment in primary care may ultimately affect demand for acute care is unclear. National and international evidence in relation to care substitutability between acute and non-acute settings is mixed (Newhouse, 1993; Nolan, 2011; Anderson et al., 2012; Kolstad and Kowalski, 2012; Baicker et al., 2013; Kaestner and Lo Sasso, 2015; Walsh et al., 2019; The Health Foundation, 2021).

One perspective, however, is to consider the role of avoidable hospitalisations in current hospital care delivery. These relate to conditions where the need for secondary care is reduced or prevented by timely and appropriate ambulatory or primary care. International evidence reviews have highlighted associations between rates of avoidable hospitalisation and primary care accessibility and quality (Gibson et al., 2013; Rosano et al., 2013; van Loenen et al., 2014). In an Irish context, McDarby and Smyth (2019) and Keegan et al. (2020) have both identified a number of resource-intensive conditions currently treated in hospital for which evidence exists for appropriate treatment or prevention outside hospital. These should thus be considered as areas for priority primary care investment. Keegan et al. (2020) showed that, in 2018, the three most common avoidable hospital conditions [6] accounted for over 600,000 in-patient bed days amounting to over €400 million in expenditure (excluding any emergency department related costs).

Sláintecare has not only focused on the primary care system; there are also specific recommendations for the acute hospital system. For example, the Sláintecare Report outlined the aim to achieve and sustain waiting lists for public acute hospital services at 10 weeks for outpatients and 12 weeks for admitted care. These highly ambitious targets (Brick and Keegan, 2020a; Brick and Connolly, 2021) undoubtedly have implications for service and workforce demand. Brick and Keegan (2020a) estimated that to clear backlogs for care that have accumulated in recent years and reduce waiting times in line with these Sláintecare targets, relevant activity in public hospitals would have to increase by between 10 and 18 per cent (on 2018 levels) depending on the service (e.g. outpatient or admitted elective care). While much of the discourse has centred on the need to improve bed capacity to deliver this additional care within the public hospital system (Keegan et al., 2018a; PA Consulting, 2018), improving access to services will also require greater investment in workforce than would be implied by projecting current realised demand alone.

Workforce demand challenges arising from policy changes such as Sláintecare can be managed in several ways, including by integrating different categories of staff

[6] Influenza and pneumonia (vaccine-preventable), urinary tract infections (including pyelonephritis), and chronic obstructive pulmonary disease.

within and across professions to improve efficiency in service delivery. This can be achieved by changes to the grade and/or skill-mix (Ono et al., 2013).

In the literature, the terms grade-mix and skill-mix can be used somewhat interchangeably (Buchan and Dal Poz, 2002). In this work we follow the terminology used in the Taskforce on Staffing and Skill-mix for Nursing (2018). This may not align with the terminology used in the academic literature cited.

Grade-mix refers to the mix of individual grades in the workforce (Taskforce on Staffing and Skill Mix for Nursing, 2018). Sometimes referred to as vertical integration, it involves the transfer of tasks from one workforce group to another; for example, in the acute hospital setting, the transfer of tasks from staff nurses/midwives to healthcare assistants (HCA) or from health and social care professions (HSCP) to health and social care assistants (HSCA). [7]

Skill-mix refers to the mix of education, training, skills and experience within a professional group (Taskforce on Staffing and Skill Mix for Nursing, 2018). Sometimes referred to as horizontal integration, it refers to the proportion of staff operating at various levels within a profession; for example, in the acute hospital setting, the proportion of nursing/midwifery staff or HSCPs operating at clinical specialist or advanced practice level. [8]

Evidence on the effectiveness of grade- and skill-mix policy changes is mixed. In relation to nursing and HCAs, a Cochrane review (Butler et al., 2019) published in 2019 and examining studies up to 2017, examined evidence on whether changes to hospital nurse staffing improved seven outcome measures. The authors concluded that there is currently insufficient evidence to draw definitive conclusions. The changes considered included the introduction of clinical nurse specialists or advanced nurse practitioners and the introduction of HCAs. Recent papers have found higher nursing mix to be associated with lower odds of mortality and lower odds of poor outcomes being reported (Aiken et al., 2017; Griffiths et al., 2019). However, a recent Irish study also found a lack of high-quality evidence on the impact of grade-mix across nursing and HCAs (Drennan et al., 2018). With regard to skill-mix, Brady et al. (2020) have shown a positive impact on patient experience from the introduction of a 'critical mass' of advanced nurse practitioners and have highlighted the potential for such roles in managing chronic illness. A systematic review by Htay and Whitehead (2021) also showed evidence

7 "Health Care Assistant is an unregistered healthcare worker, providing patient care under the direct guidance and supervision of a registered nurse" Taskforce on Staffing and Skill Mix for Nursing (2018).

8 Clinical nurse/midwifery specialists are those with clinical expertise within a specific clinical area or condition while advanced nurse/midwife practitioners are those who focus on managing whole episodes of clinical care. https://healthservice.hse.ie/about-us/onmsd/advanced-and-specialist-practice/advanced-specialist-practice.html

of the positive impact of advanced nurse practitioners on clinical and service-related outcomes (e.g. patient satisfaction, waiting times, control of chronic disease, and cost effectiveness). Fennelly et al. (2018) have shown the benefit of advanced practice physiotherapy-led triage in reducing onward referrals to consultants.

2.3 IRISH WORKFORCE PLANNING POLICY

The National Strategic Framework for Health and Social Care Workforce Planning, published in 2017, is the basis for strategic workforce planning in Ireland (Department of Health, 2017). The framework, the result of the work of a cross-sectoral steering group [9] tasked with its development, sets out proposals for workforce planning policy in Ireland based on best international evidence and stakeholder engagement. The framework builds on work published in a number of previous reports undertaken in the Irish context in the recent past (Department of Health, 2017, Table 5.10, p.73-74). The report ultimately outlined a five-step approach to workforce planning in Ireland: internal and external environment analysis, assessment of demand and supply, identification of human resource and policy solutions, planning and implementation of solutions, and the monitoring and evaluation of outcomes. Underlying the framework is a recognition that planning must focus on current and future population health needs, ensuring the right skills and geographic distribution of workforce, and a need to capture 'key strategic and operational developments including national health policies and strategies, agreed models of care, and other developments' (Department of Health, 2017, p9). In addition, it is highlighted that national self-sufficiency is the ideal objective in the supply of health workers and should be planned for in alignment with the WHO Global Code of Practice on the International Recruitment of Health Personnel.

In parallel and after the publication of the strategic framework in 2017, several profession-specific reports related to workforce planning in acute hospital settings have been published and are summarised in Table 2.1.

TABLE 2.1 Summary of selected Irish workforce planning reports published since 2018

Author (year)	Report	Key points
Taskforce on Staffing and Skill Mix for Nursing (2018)	Framework for safe nurse staffing and skill-mix in general and specialist medical and surgical care settings in adult hospitals in Ireland 2018	- Development of evidence-based nurse staffing and skill-mix ranges framework with phased implementation - Ward-level assessment of staff profiles and requirements based on acuity/dependency in conjunction with the calculation of nursing hours per patient day - Recommends a nurse/HCA grade-mix of 80:20 for medical and surgical wards, not all settings across hospitals. Once safe nurse staffing levels have been met and subject to the

[9] Included officials from the Departments of Education and Skills, Public Expenditure and Reform, Children and Youth Affairs, Justice and Equality, and Business, Enterprise and Innovation, as well as representatives of the HSE, Tusla, the HEA, SOLAS and regulatory bodies.

Author (year)	Report	Key points
		availability of Irish evidence consider shifting toward 'the international norm' 75:25 into the future as roles develop.
Health Service Executive (2018)	Review of role and function of health care assistants	- Recommended a standardised definition of the HCA role and proposed a minimum training level requirement for the role - Identified scope for development of the role across different service areas, for example older persons services - Recommended career progression opportunities - Restated the 80:20 nursing:HCA grade-mix recommended by the nursing taskforce within general medical and surgical wards
Department of Health (2019)	A policy on the development of graduate to advanced nursing and midwifery practice	- Recommended maintenance of a 2% target[a] for advanced practitioners in the nursing/midwifery workforce. Advanced practitioners should have appropriate authority to facilitate full episodes of care. - Deployment should meet service needs. - Requirement for clear education pathways. - Importance of service impact evaluation is stressed.
Morris and Smith (2021)	Demand for medical consultants and specialists to 2028 and the training pipeline to meet demand – A high-level stakeholder informed analysis	- Estimates a 53% increase in demand for acute hospital consultants and specialists to 2028. - Reiterates a desired ratio of 1.2 non-consultant hospital doctors (NCHD) per consultant to reduce the reliance on NCHDs. - Proposes a reduction in the number of non-training doctors. - Highlights the importance of retaining Irish graduates
Health Service Executive (2021)	HSCP deliver: a strategic guidance framework for health & social care professions 2021-2026	A strategic framework with the aim of achieving the collective potential of the health and social care professions. The impacts HSCPs can make when working to full potential are outlined along with commitments at national and local level to achieve them. Supports required to deliver these impacts include the inclusion of HSCPs in clinical design, planning and leadership, enabling and creating opportunities for HSCPs to meet their full potential in the system, ensuring career development and progression opportunities and the development and improvement of access to research, metrics and technology.
Taskforce on Staffing and Skill Mix for Nursing (2022)	Framework for safe nurse staffing and skill mix in adult emergency care settings in Ireland 2022	This report sets out the key information to assist services in determining safe nurse staffing and skill mix in emergency care settings. The report sets out a number of recommendations in relation to staffing numbers, profile, and mix including: - The nurse: HCA skill mix ratio for EDs is 85:15 once a safe nurse staffing level exists. - All ED settings should have a minimum of one HCA 24/7, which must be considered when applying the recommended skill mix. - Nurses in ED settings should have access to relevant continuing professional development to facilitate workforce development

Note: a During the lifetime of this project the Office of the Chief Nursing Officer in the Department of Health noted that the Minister for Health increased the target to 4% by 2035.

A taskforce, established by the Office of the Chief Nursing Officer in the Department of Health, comprising key stakeholders to the profession including the Office of the Nursing and Midwifery Services Director in the HSE leads an evidence-informed programme of work to develop frameworks to support the determination of safe nurse staffing and skill-mix in a range of major specialities. The *Framework for Safe Nurse Staffing and Skill-Mix in General and Specialist*

Medical and Surgical Care Settings in Adult Hospitals in Ireland was published in 2018 and a programme of work to implement this has commenced in the HSE. The second phase of the work the *Framework for Safe Nurse Staffing and Skill Mix in Adult Emergency Care Settings in Ireland* was published in 2022.

Medical workforce planning in Ireland is undertaken as part of the role of the National Doctors Training and Planning unit in the HSE. Using their own model developed in 2014, 'A Stepwise Approach' predicts the medical workforce requirements (at specialist or grouped levels) over a defined period of time, taking account of future population projections, and societal and health service changes (NDTP, 2014). Data from these analyses are used to inform postgraduate medical training and consultant appointment requirements for the country. This is a dynamic programme of work that is constantly modified as information is updated.

Workforce planning for the 26 HSCPs within the remit of their national office is predominantly undertaken at service level as part of the annual service planning process. The national HSCP Office has committed to *'work with relevant stakeholders to address HSCP workforce issues through supporting implementation of the Health Services People Strategy 2019-2024'* (Health Service Executive, 2021, p.29) as capacity and capability within the team develops.

2.4 A REVIEW OF HEALTH WORKFORCE PLANNING MODELS

This section will review approaches adopted in the literature to workforce planning modelling. Workforce planning aims to achieve a balance between the supply and demand for different categories of workers into the future (Ono et al., 2013). In this regard, workforce planning attempts to understand what drives underlying demand for workforce as well as analysing future supply with the aim of addressing any future shortages or surpluses. Given the scope of the analysis set out in this report, this section will concentrate on reviewing approaches to modelling workforce demand requirements.

This section draws considerably from a review into health workforce planning models in the OECD undertaken by Ono et al. (2013); more recent additional literature is also included where it has been identified. As shown in Table 2.2, at least five different approaches to modelling workforce demand can be identified; they consider (i) changing population size, (ii) current utilisation, (iii) changing utilisation patterns, (iv) changing delivery models (workforce mix), and (v) economic growth (Ono et al., 2013). [10] These are described below.

[10] As described by Ono et al. (2013), a sixth approach includes labour productivity growth assumptions which may help improve the balance of healthcare demand and supply. However, this approach is discounted due to the often arbitrary assumptions in relation to the evolution of projected productivity growth.

TABLE 2.2 Summary of workforce planning models literature review

	Models including
Population size	35/35
Current utilisation	26/35
Changing utilisation and unmet need	20/35
Changes in health service delivery (workforce mix)	13/35
GDP/ HCE growth	6/35

Notes: See Appendix B for further details on the literature reviewed.

2.4.1 Approaches to modelling workforce demand

Population size

All workforce planning models account for how changes in population size might affect future demand for health services and thus healthcare workforce requirements (see Table 2.1). In the most basic models, this is the only factor considered, with projections based on simple workforce personnel-to-population ratios (Segal and Bolton, 2009). These models have the advantage of being based on data that is readily accessible and known with a fairly high degree of certainty (Ono et al., 2013). Consequently, the administrative burden of population-only-based models is relatively small.

However, as these models do not consider how utilisation of care may vary by age and sex, they cannot account for how changes in the population age structure may affect future service demand and workforce requirements. In the face of a projected ageing population, this ratio-to-population approach is likely to underestimate demand and workforce requirements for many services.

Current service utilisation patterns

Given the limitations with the ratio-to-population approach just described, most workforce planning models project demand for healthcare services by combining information on healthcare service utilisation rates by age and sex with projected changes in the size and structure of the population. As demand for healthcare services can vary across the age and sex distribution, for example see Wren et al. (2017), changes in population structure can have a significant bearing on projected healthcare demand. This approach is employed by Teljeur et al. (2010) in an analysis of GP workforce planning in Ireland. The annual frequency of GP visit rates by age and sex was estimated from survey data. GP demand was then projected by combining age- and sex-specific visiting rates with population projections. These projections of healthcare demand can then be converted to workforce through specifying a workforce-to-utilisation ratio.

Changing service utilisation patterns

Projecting workforce demand based on assumed constant age- and sex-specific utilisation rates, however, fails to consider other factors that may affect utilisation rates through a projection horizon and thus demand for health services and workforce.

In this context, utilisation profiles are often varied to capture changes in population health status or epidemiology. In some instances, models may incorporate historical evidence on age- and sex-specific trends in relation to the incidence or prevalence of disease as a basis for projecting these trends into the future. These approaches, however, require access to detailed morbidity data and often require expert input where the future directions of trends may be uncertain (Ono et al., 2013). For example, a forecasting model applied in the Netherlands has incorporated potential changes in disease incidence and prevalence which may affect demand for workers into the future. Annual Dutch health statistics inform this modelling, but actual changes to be modelled are determined by experts (Van Greuningen et al., 2012). In Australia, a simulation model developed to improve planning of the GP workforce also incorporated information on incidence and prevalence of disease and injury groups as part of its projections (Laurence and Karnon, 2016).

Alternatively, other models draw on broader healthy ageing hypotheses that consider the future relationship between population ageing and healthcare use. These healthy ageing hypotheses, as drivers of morbidity, have been discussed in section 2.2.1. In modelling terms, the application of healthy ageing assumptions has been used extensively by the European Commission as part of its EU ageing healthcare projection exercises (European Commission, 2008; 2011; 2014; 2017) and as part of the Hippocrates projection framework (Wren et al., 2017; Keegan et al., 2018a; Keegan et al., 2020; Keegan et al., 2021; Walsh et al., 2021). In short, the approach involves adjusting age- and sex-specific per capita healthcare expenditure profiles in relation to projected changes in life expectancy between a base-year and the projection year. The strength of the shift specified determines the healthy ageing hypothesis modelled. A more detailed description of this modelling approach is described in Chapter 4.

Other models relax the assumption that current utilisation of health services reflects acceptable levels of use and therefore allow for the possibility that using current utilisation as a basis for projecting future service requirements may not be appropriate (Ono et al., 2013). These models tend to adjust baseline utilisation profiles to account for additional unmet care needs not reflected in current utilisation. For example, Simkin et al. (2021) describe a workforce planning tool for Australia that incorporated measures of primary care unmet healthcare need that

was included in the calculation of estimated service requirements. Similarly, the National Doctors Training and Planning Report into demand for medical consultants and specialists in Ireland captured unmet demand (as per waiting lists) in developing projected demand estimates for certain specialties (Morris and Smith, 2021). The Hippocrates model has previously employed a detailed approach to estimating unmet demand [11] for public hospital appointments and treatment. Informed by queuing theory, the model estimates, at an aggregate level, the additional service requirements required to reduce backlogs for elective hospital waiting and maintain waiting times at target thresholds into the future (Brick and Keegan, 2020a). Chapter 4 provides detail on how the approach is applied in this analysis.

Changing the workforce mix

As described in section 2.2.2, an additional factor that will affect demand for healthcare workforce is changes to the workforce mix. In this regard, Ono et al. (2013) suggest that most workforce planning models still centre on a 'silo' approach and look at projections for each profession in isolation. However, Kinsella and Kiersey (2016) report that most countries are now attempting to incorporate some element of a multi-profession integrated approach into their workforce planning models. The benefit of examining workforce planning from an integrated perspective is that it allows for analysis of the impact of creating new roles and responsibilities for different providers and potentially to consider how workforce may be allocated in a more productive way.

Workforce integration, in this context, can be horizontal or vertical in nature (Ono et al., 2013). Horizontal integration focuses on interactions between different specialties within the same occupational group (for example, skill-mix between registered nurses and clinical nurse specialists or between hospital doctors and GPs). Vertical integration, on the other hand, focuses on interactions across different occupational groups (e.g., grade-mix between staff nurses and HCAs or HSCPs and HSCAs).

In terms of horizontal integration, the most frequent approach has been to examine the impact of improved primary care delivery on the requirements for different categories of doctors. For example, a health workforce planning model in Switzerland found that the introduction of a gatekeeping system could potentially increase doctor consultations by 2 per cent over the projection period relative to a status quo scenario. This overall net increase comprised a 5 per cent increase in GP consultations combined with a reduction in specialist consultations. Model assumptions were informed by international randomised trial evidence

[11] The model estimates unmet demand for healthcare based on waiting-list information. It is not possible to capture any broader unmet need for hospital care outside those captured on waiting lists.

(Seematter-Bagnoud et al., 2008, as cited in Ono et al., 2013). A workforce planning model in the Netherlands also estimated that assumed horizontal integration could have increased demand for GPs by 5 per cent between 2009 and 2019 (Van Greuningen et al., 2012). In this study, model assumptions were based on expert opinion and (where available) empirical data.

The Hippocrates model has previously examined how reductions in the rate of avoidable hospitalisations (that is conditions where the need for secondary care is reduced or prevented by timely and appropriate ambulatory or primary care) under assumed improvements in primary care access and investment may affect public acute hospital service demand and bed capacity projections (Keegan et al., 2018a; Keegan et al., 2020). Chapter 4 describes how this approach is refined and extended in the context of this report.

Regarding vertical integration, the workforce modelling in Switzerland examined the possible effect of greater task-sharing between physicians and advanced practice nurses which suggested that it might reduce the number of doctor consultations in primary care by 10 per cent. Under this scenario the number of GP consultations were projected to increase by 2 per cent between 2005 and 2030 versus 13 per cent under the status quo scenario (Seematter-Bagnoud et al., 2008, as cited in Ono et al., 2013). In Van Greuningen et al. (2012), developments regarding vertical substitution in the Netherlands, informed by expert opinion, were estimated to decrease demand for GPs by 6 per cent between 2009 and 2019.

Economic growth

As described above there is evidence to support a relationship between national income (usually measured in gross domestic product per capita) and the level and growth in healthcare expenditures across countries. However, as noted by Ono et al. (2013), few workforce planning models tend to model projected economic growth as a driver of workforce demand (see Table 2.2). One explanation for this may relate to the fact that, while much research has been undertaken to understand income elasticity of demand at a national or international health system level, fewer studies have considered the relationship between income and demand at a service-specific level (for example, an acute or community level). Moreover, any evidence that does exist tends to be inconsistent (Keegan et al., 2020). Additionally, income elasticity of demand as an underlying factor that leads to rising expectations for quality of care may be captured under other assumptions such as reforms to expand service provision or reduce waiting-list backlogs for care (Charlesworth and Johnson, 2018).

2.4.2 Other considerations

In reviewing the literature on healthcare workforce planning models, a few other relevant considerations were identified, which are briefly discussed here.

Geographic distribution

Most models focus their projections and, as a result, their recommendations at a national level. Few models focus on assessing the underlying differences in patterns of demand (both service and workforce) geographically and how these patterns may change into the future (Ono et al., 2013). Ono et al. (2013) note that a proper assessment of workforce planning needs to assess the geographic distribution of workforce and how this might change over time under different sets of assumptions.

Modelling challenges and development

Developing workforce planning models over a medium-term horizon is a difficult task, with many challenges. Kinsella and Kiersey (2016) describe data availability as a major determinant of model performance, and necessary data often contain significant gaps and lags. Ono et al. (2013) note that projections are fundamentally based on a set of assumptions about the evolution of key drivers of workforce. The evolution of these assumptions can be subject to many uncertainties, particularly assumptions that underlie projected health service demand, which can make workforce demand modelling more challenging than workforce supply modelling.

With this in mind, both Kinsella and Kiersey (2016) and Ono et al. (2013) describe the need for workforce planning modelling to be an iterative process. Most countries begin workforce planning models with a focus on medical professions, followed by nursing and midwifery, and then adding additional healthcare professions (Kinsella and Kiersey, 2016). Moreover, models and assumptions require regular assessment and updating in light of changing circumstances, new or better data availability, or the introduction of new policies.

2.5 SUMMARY

This chapter has reviewed evidence in relation to the drivers of health workforce demand, recent Irish workforce planning policy, and approaches to health workforce demand modelling. The material reviewed in this chapter is key to informing the modelling framework, assumptions, and projection scenarios, developed and discussed in Chapter 4.

Key points

- Workforce demand is influenced by several factors including demographic and non-demographic drivers of service demand as well as changes to how services are delivered (i.e. workforce mix).
- Internationally, workforce demand modelling can vary significantly in terms of its sophistication, ranging from models that consider how population growth alone may affect workforce demand to models that explicitly account for changing workforce delivery and care utilisation patterns.
- The National Strategic Framework for Health and Social Care Workforce Planning identifies the need for workforce planning to be aligned to current and future population health needs, but there is also clear recognition that workforce planning needs to also capture advances in strategy and policy.
- When examining grade- and skill-mix we follow the terminology used in the Taskforce on Staffing and Skill-mix for Nursing (2018) which states that *grade-mix* refers to the mix of individual grades in the workforce while *skill-mix* refers to the mix of education, training, skills and experience in a profession.

CHAPTER 3

Demographics

3.1 INTRODUCTION

This chapter describes the methodology for developing regional population projections used in this report, including underlying assumptions, and provides an overview of the demographic projection scenarios considered in this report. The projections are developed using the ESRI's Regional Demographic Model described in Bergin and García-Rodríguez (2020). The demographic assumptions underpinning the projections are taken from Walsh et al. (2021) and therefore include the effect of the COVID-19 pandemic on mortality rates and the assumed short- to medium-term effect on net international migration. Furthermore, in line with previous Hippocrates modelling, three scenarios are considered (Wren et al., 2017; Keegan et al., 2020; Walsh et al., 2021): Low, Central and High population growth.

3.2 METHODOLOGY

This section provides a summary of the functioning of the ESRI's Regional Demographic Model; a more detailed description can be found in Bergin and García-Rodríguez (2020). The model is a version of the demographic model described in Wren et al. (2017) augmented to account for the regional distribution of international migration and the movement of population between counties in Ireland. Consequently, the Regional Demographic Model is based on the cohort-component method, the methodology most frequently applied by national statistical offices (for example, the Central Statistics Office in Ireland, the Office for National Statistics in the United Kingdom) and international organisations (the United Nations). A detailed snapshot of the population is used as a starting point; in this case population by single year of age (SYOA) and sex taken from the 2016 Census. This snapshot is then projected forward according to assumptions, based on historical data and an analysis of current trends, regarding the main components of population change: fertility, mortality and net international migration. To produce projections at county level, the Regional Demographic Model also accounts for potential differences in fertility between counties, the regional distribution of net international migration and internal movements of population. The main contribution of the Regional Demographic Model is on internal migration. Instead of simply assuming a pattern of internal migration into the future, the model estimates a pattern based on an analysis of previous movements and their relationship to underlying economic conditions, such as wages or house prices, at county level.

3.3 DEMOGRAPHIC ASSUMPTIONS

The main demographic assumptions for the population scenarios at the national level are summarized in Table 3.1. The assumptions are in line with those in Walsh et al. (2021), where they are explained in detail.

TABLE 3.1 Summary of main assumptions for population scenarios

2020 projections	Central scenario	High population scenario	Low population scenario
Mortality			
Mortality rates assumed to decrease with gains in life expectancy at birth from 80.5 (84.5) years for males (females) in 2019 to:	83.5 (86.5) years for males (females) in 2035	83.8 (86.7) years for males (females) in 2035	83.2 (86.2) years for males (females) in 2035
Migration			
Net immigration over the projection horizon:	Declining from 2019 level of +33,700 to +5,000 until 2022 and then constant at +10,000 p.a. over long term	Declining from 2019 level of +33,700 to between +15,000 and +20,000 until 2022 and then constant at +25,000 p.a. thereafter	Declining from 2019 level of +33,700 to between –5,000 and zero net migration until 2022 and then constant at 5,000 p.a. thereafter
Fertility			
Total fertility rate:	Unchanged from 2019 rate of 1.72	Rises from 2019 rate to 1.96 by 2026 and remains constant thereafter	Declines from 2019 to 1.6 by 2035

Source: Walsh et al. (2021).

Connected to the national projections, further assumptions are needed for each of the different components of population change to create regional projections. For mortality, following the latest CSO regional projections (Central Statistics Office, 2019), no differences in mortality rates by SYOA or sex between counties are assumed, given the relatively small number of deaths in some counties for specific ages, combined with the relatively small impact of regional differentials in the number of deaths.

For fertility, Table 3.2 shows county-level total fertility rates (TFR [12]) over time, illustrating that there is substantial variation in fertility rates across counties. For example, in 2016 while the national total fertility rate was 1.81, the rate ranged from 1.64 in Dublin to 2.28 in Longford. Furthermore, the table shows that these differences in fertility rates across counties persist over time, so that individual counties tend to consistently have either high or low fertility rates. Consequently, county-level TFRs are projected in line with the national projections but adjusted proportionally according to their average difference to the national level over the 1996–2016 period. So, for example, if a county registered TFRs 10 per cent higher

[12] The TFR represents the theoretical average number of children who would be born alive to a woman during her lifetime if she were to pass through her childbearing years (ages 15–49) conforming to the age specific fertility rates of a given year. https://www.cso.ie/en/releasesandpublications/ep/p-plfp/populationandlabourforceprojections2017-2051/appendix2-conceptsanddefinitions/

on average for the period of analysis than the national level, then we project their TFRs in the future to be 10 per cent higher than the national projection.

TABLE 3.2 Fertility rates by county, 1996 to 2016

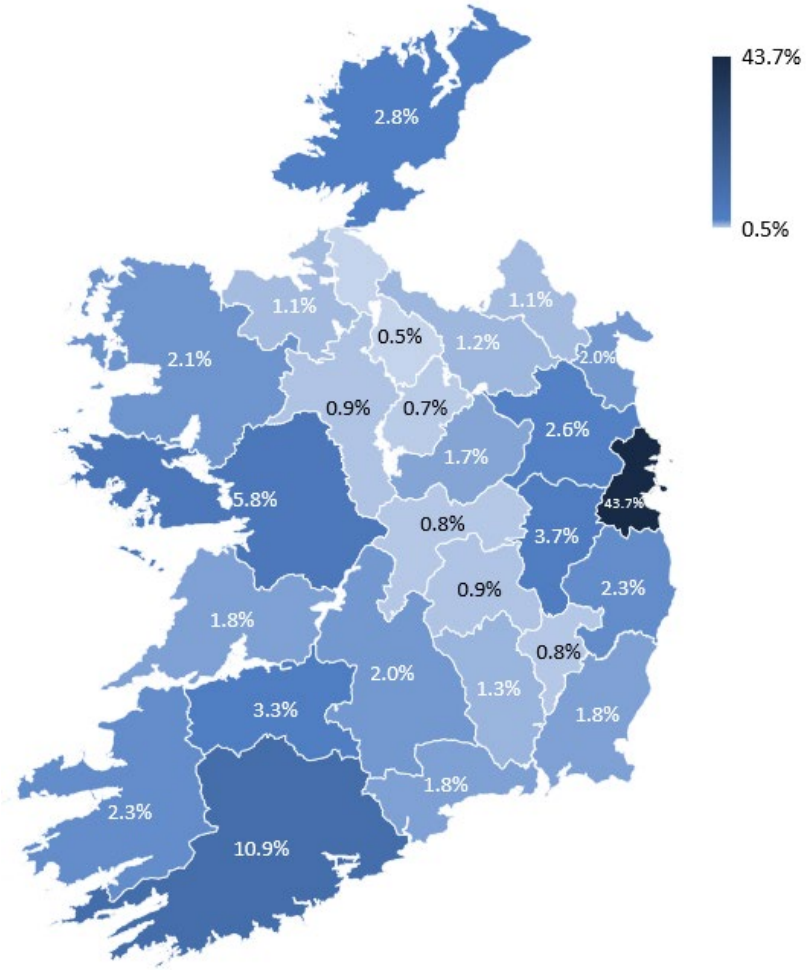
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Dublin	1.71	1.75	1.78	1.76	1.74	1.78	1.77	1.81	1.77	1.72	1.73	1.82	1.83	1.84	1.89	1.90	1.90	1.84	1.76	1.69	1.64
Kerry	1.90	1.96	1.91	1.84	1.84	1.88	1.95	1.84	1.90	1.81	1.93	2.05	2.00	2.10	1.87	2.01	1.93	1.84	1.78	1.75	1.81
Monaghan	1.96	1.88	1.91	1.96	1.77	1.71	1.86	1.81	1.75	1.87	1.80	1.95	2.03	1.94	2.03	2.01	2.00	2.03	1.94	1.96	1.93
Kilkenny	1.86	1.93	1.92	1.83	1.91	1.99	1.97	1.96	1.90	1.85	1.87	1.94	2.07	2.04	2.08	2.03	2.02	1.94	1.91	1.78	1.72
Sligo	1.94	1.92	2.02	1.84	1.84	1.88	1.82	1.85	1.81	1.72	2.01	2.04	2.08	2.12	1.99	2.01	2.21	2.04	1.87	1.84	1.83
Cork	1.89	1.94	1.99	1.83	1.85	1.88	1.95	1.90	1.90	1.88	1.96	2.01	2.07	2.10	2.08	2.02	1.99	1.95	1.87	1.88	1.75
Galway	1.89	2.01	2.07	2.02	2.03	2.10	1.96	1.94	1.93	1.87	1.86	1.96	2.07	1.96	2.01	1.96	2.01	1.96	1.85	1.81	1.83
Donegal	2.05	2.11	2.05	2.10	1.95	2.03	2.00	2.02	1.89	1.91	1.95	1.98	2.00	2.07	1.94	1.96	1.97	1.87	1.78	1.91	1.93
Limerick	2.05	2.08	2.06	1.93	1.87	1.81	1.87	1.95	1.86	1.81	1.94	2.04	2.11	2.16	2.13	2.09	2.00	1.97	1.94	1.97	1.89
Roscommon	1.82	1.90	1.93	1.77	1.68	1.82	1.95	1.89	1.98	2.06	2.01	2.04	2.27	2.27	2.28	2.02	2.10	2.21	1.99	1.92	1.93
Louth	1.88	1.99	2.03	2.05	2.10	2.30	2.06	1.92	1.92	1.83	1.97	1.93	2.04	1.94	2.00	1.99	2.09	2.24	1.98	2.05	1.99
Waterford	1.99	1.94	1.90	1.92	1.93	2.09	2.21	2.09	2.06	1.97	2.18	2.18	2.27	2.15	2.14	2.15	2.04	2.09	2.06	1.99	1.97
Offaly	2.10	2.07	2.22	1.98	1.85	2.13	2.23	2.08	2.12	2.02	2.09	2.09	2.14	2.15	2.06	2.23	2.09	1.98	2.18	1.94	1.98
Mayo	2.11	2.12	2.15	2.09	2.09	2.09	2.01	2.00	1.93	2.00	2.10	2.25	2.21	2.10	2.15	2.13	2.17	2.19	2.06	1.99	2.02
Tipperary	2.09	2.15	1.94	1.99	2.02	1.98	1.97	2.04	2.04	2.11	2.04	2.26	2.26	2.34	2.22	2.17	2.04	2.14	2.04	2.09	2.05
Wicklow	2.01	1.96	2.00	2.03	2.02	2.03	2.16	2.07	2.09	1.92	2.21	2.28	2.32	2.30	2.35	2.18	2.19	2.13	2.05	2.02	1.96
Clare	2.01	2.16	2.08	2.27	2.08	2.19	2.34	2.26	2.16	2.10	2.16	2.15	2.18	2.28	2.03	2.08	2.08	1.89	1.88	2.03	1.96
Laois	2.00	2.07	2.10	2.06	2.04	2.15	2.26	2.30	2.30	2.04	2.11	2.37	2.42	2.50	2.50	2.12	2.03	1.94	1.95	1.96	1.84
Westmeath	2.13	2.14	2.11	2.26	2.29	2.33	2.19	2.17	2.14	2.10	2.22	2.13	2.16	2.17	2.16	2.11	2.11	2.14	2.15	2.00	2.03
Kildare	2.09	2.14	2.18	2.07	2.27	2.31	2.34	2.23	2.20	2.00	2.16	2.31	2.29	2.32	2.29	2.16	2.11	2.02	2.02	1.97	1.93
Leitrim	2.09	2.05	2.10	2.20	2.02	1.92	2.29	2.26	2.25	2.21	2.17	2.45	2.50	2.38	2.27	2.15	2.15	2.23	2.00	2.11	2.17
Meath	1.98	2.05	1.99	2.04	2.09	2.35	2.20	2.33	2.28	2.22	2.16	2.41	2.39	2.35	2.39	2.33	2.14	2.21	2.08	1.99	1.99
Wexford	2.10	2.16	2.19	2.24	2.09	2.21	2.21	2.34	2.27	2.20	2.26	2.29	2.44	2.29	2.18	2.20	2.17	2.05	2.13	2.05	1.95
Carlow	2.06	1.84	2.16	1.98	2.22	2.24	2.40	2.33	2.14	2.16	2.21	2.47	2.59	2.36	2.35	2.38	2.30	2.09	2.32	2.02	1.90
Cavan	2.18	2.44	2.21	2.34	2.10	2.14	2.19	2.09	2.16	2.14	2.29	2.33	2.60	2.52	2.49	2.38	2.29	2.22	2.08	2.09	2.12
Longford	2.26	2.27	2.31	2.20	2.20	2.35	2.73	2.50	2.24	2.24	2.42	2.38	2.78	2.77	2.58	2.31	2.33	2.32	2.16	2.23	2.28

Min Median Max

Source: CSO and Department of Health.

For international migration, the net flows are distributed among counties according to their historical averages, as shown in Figure 3.1. Using data from the Census 2011 and 2016, we can see that international migrants tend to settle in the main population centres and particularly in Dublin. In terms of age, most international migrants are of prime working age with around 47 per cent between the ages of 20 and 30 and a further 27 per cent between 31 and 45. For the projection period, we keep constant both the county distribution of international migrants and their age profile.

FIGURE 3.1 International net migration distribution by county



Notes: The figures indicate the average of the 2011 and 2016 county distributions.
Source: CSO, Census data.

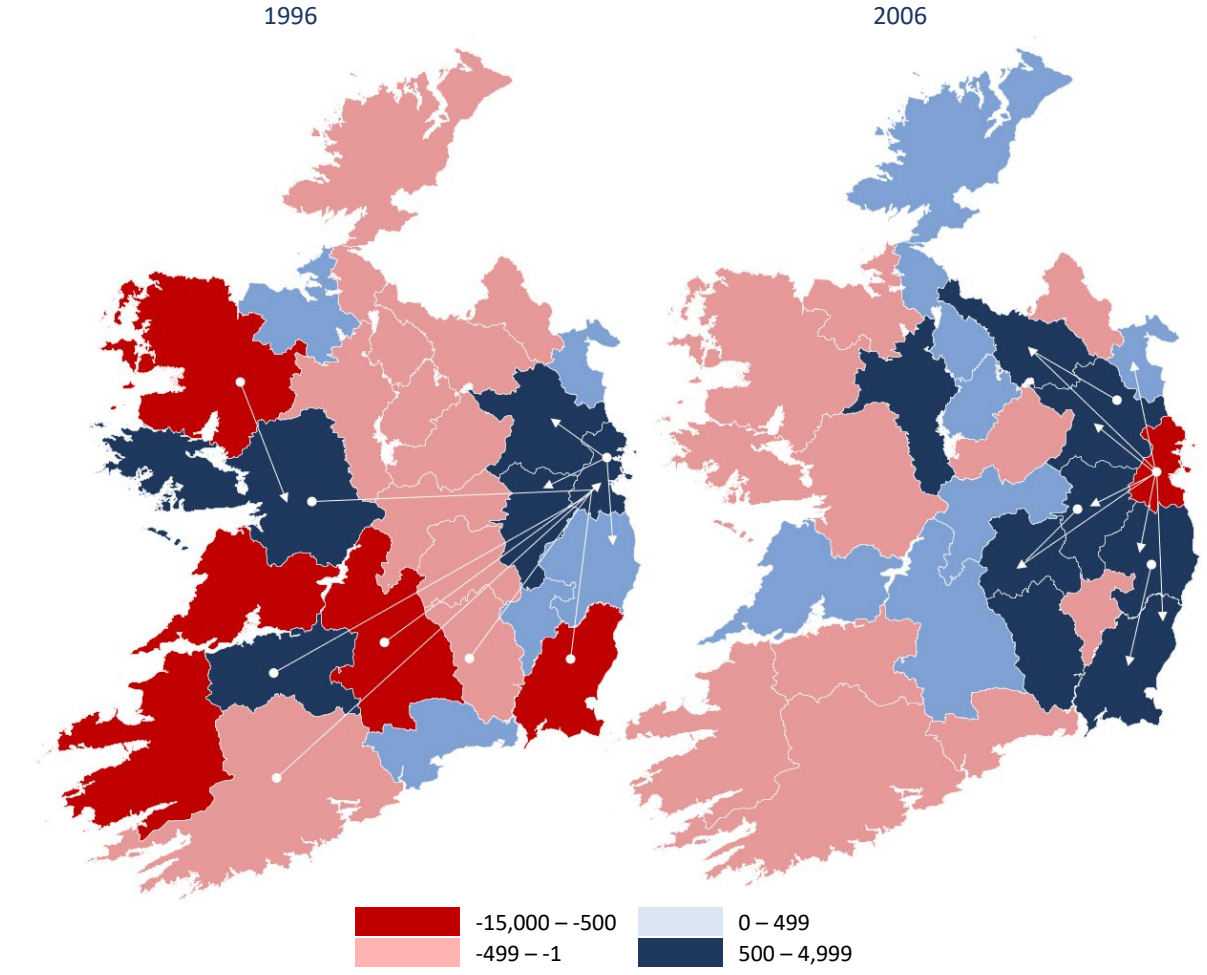
3.4 INTERNAL MIGRATION

The final element of a regional demographic model is internal migration; that is, how the population moves between the different sub-national units of the model – in this case, the counties. Understanding the determinants of internal migration is crucial given the instability in the population flows between regions in the last 30 years for Ireland. We can observe the evolution of intercounty population movements using Census data; as respondents are asked for current residence and residence one year previously, so we can approximate how many people moved from one county to another in a given year. This reveals two very different internal migration patterns for the Census years of 1991, 1996 and 2011 compared to the Census years 2002, 2006 and 2016.

Figure 3.2 shows the patterns observed in the years 1996 and 2006, which provide representative examples of the two different internal migration patterns for those years. Counties are shaded by the sign and magnitude of net internal migration registered for that year: counties in blue had positive internal migration for that

year, receiving more population from other counties than the population that left to reside in another county, with the opposite interpretation for the counties shaded in red. In addition, the map shows the top ten net internal migration flows for the two years, indicated by the arrows on the map. The difference between the patterns is evident. In 1996, the major net gainers were the main population centres and the Greater Dublin Area. The largest internal migration flows were from the main cities to Dublin and from Dublin to the counties contiguous to Dublin. The CSO describes this pattern as the Dublin Inflow scenario. In contrast, in 2006 Dublin registered significant net internal outflows, with 10,000 more people leaving to reside in some other county than people moving to Dublin from other counties. The top ten net flows are flows out of Dublin, with the population moving to counties which are either contiguous to Dublin or are connected to Dublin via motorway. This scenario is named Dublin Outflow by the CSO.

FIGURE 3.2 Net internal migration and top ten intercounty net flows



Source: Bergin and García-Rodríguez (2020).

The analysis of the flow patterns demonstrates that movements in and out of Dublin are the key element in determining the overall internal migration scenario. In turn, these movements are consistent with differences in regional economic developments in Dublin compared to the rest of the country, particularly on the

housing market. Therefore, we produce projections for internal migration by combining estimation results from a model of migration flows between counties with projections for the underlying economic determinants of internal migration. Using data from the 2011 and 2016 Censuses, the flows between counties are modelled as a function of four key variables: the distance in kilometres between the counties, if the counties are contiguous, house prices in the origin county and the differences in labour market conditions between the counties. [13]

In addition to the estimation results, we need projections for the counties' underlying economic conditions: house prices, disposable incomes and unemployment rates. For the unemployment rate, a national projection is created out of the *Economic Outlook* (Bergin et al., 2016) and county projections are adjusted in line with the national projections, while maintaining county-level differences that are apparent over time. Similarly for county incomes, a national projection is created from the *Economic Outlook* and then county incomes are projected following the national figures, but with a small adjustment in the growth rates to take account of the differences in growth rates in the years for which we have county incomes data (2000 to 2016). Finally, house price projections are created combining recent estimates of disposable income-house price elasticities (Kostarakos et al., forthcoming) and the projections for regional disposable incomes.

The result of this exercise is a projection for internal movements in Ireland representing a mild Dublin Outflow scenario. The main contribution of the ESRI's Regional Demographic Model is that this pattern is based on underlying economic conditions, whereas other regional projections had to rely on assuming a future pattern of internal movements. In the Regional Demographic Model, changes in future economic conditions would result in changes in the pattern of internal flows and a different regional distribution.

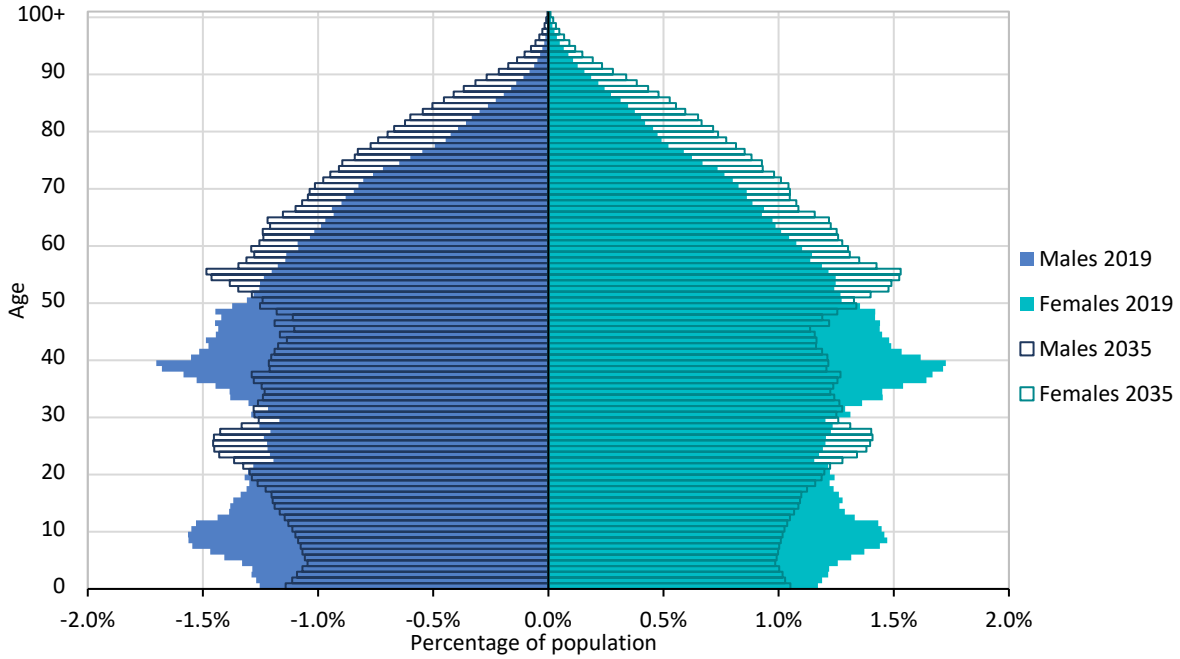
3.5 REGIONAL DEMOGRAPHIC PROJECTIONS

In the Central scenario, national population is expected to increase by close to 500,000 people between 2019 and 2035, for a total population of around 5.444 million people in 2035. These figures imply an average annual population growth for the period of 0.61 per cent. For the other two scenarios considered, in the High population scenario the population figure by 2035 would be of 5.804 million, for an implied average annual growth of 1.04 per cent, whereas in the Low population scenario the figures would be 5.308 million people and average annual growth of 0.48 per cent, respectively.

[13] The technical details can be found in Bergin and García-Rodríguez (2020).

As our demographic model produces projections by SYOA, we can also examine the projected age composition of the population at a more granular level. Figure 3.3 shows population age pyramids that illustrate the ageing of the population over the projection horizon. To ensure comparability (as counties have different population sizes), the pyramids are presented as percentages of total county population for each year of age. The figure allows us to see the ageing of the population, with the two peaks in the 2019 population at around ages 5–10 and 35–40 years shifting up the pyramid by 2035. By 2035, the numbers in the older age groups (in the higher part of the pyramid) are much higher and, given the relatively flat projection for fertility, the overall pyramid is more top-heavy: the population over 65 years of age is projected to increase from 700,000 in 2019 to 1.1 million in 2035. The number aged 85 years and older is projected to more than double, going from 75,000 in 2019 to 165,000 in 2035.

FIGURE 3.3 Population age pyramid, Central projection scenario: national 2019–2035 (% of population)



Source: Authors' calculations based on CSO, Census data.

Table 3.3 shows the projections for the three scenarios at county level. Eastern and Midlands counties are expected to experience the highest average annual growth over the period 2019–2035. These counties, including Carlow, Meath, Laois, Kildare and Offaly, are projected to grow by between 0.7 and 1.3 per cent per annum. Dublin is expected to continue to be the county with the highest population share, although the area surrounding Dublin registers the faster population growth. Population growth is expected to be about average in the southern counties, with a bit more intensity across the south coast. Finally, the projection results suggest that the slowest-growing counties will continue to be in the northern and western regions, showing signs of an ageing population, with County Mayo as the slowest-growing county.

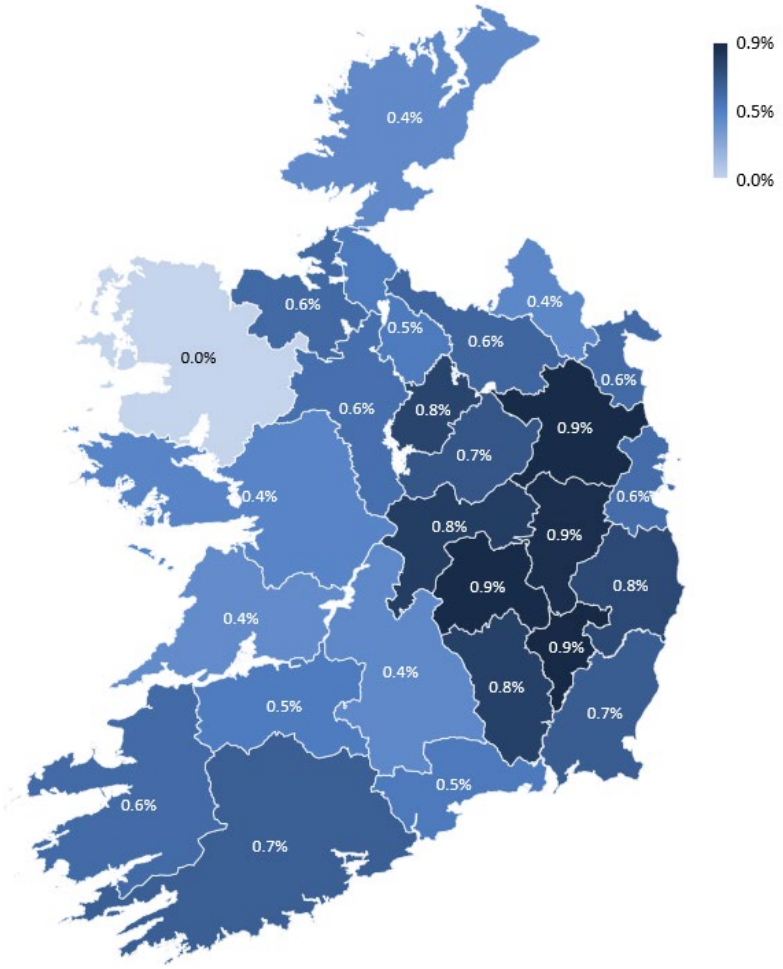
TABLE 3.3 Population projections, annual growth rates and population shares by scenario, 2035

County	Population ('000)			Average annual growth (%), 2019-2035			Population share 2035 (% of total)		
	Low	Central	High	Low	Central	High	Low	Central	High
Carlow	67	68	72	0.9	0.9	1.3	1.3	1.3	1.2
Cavan	85	86	93	0.5	0.6	1.0	1.6	1.6	1.6
Clare	127	130	139	0.3	0.4	0.8	2.4	2.4	2.4
Cork	610	622	664	0.5	0.7	1.1	11.5	11.5	11.4
Donegal	170	173	185	0.3	0.4	0.8	3.2	3.2	3.2
Dublin	1,500	1,541	1,675	0.4	0.6	1.1	28.3	28.4	28.9
Galway	279	284	303	0.3	0.4	0.8	5.3	5.2	5.2
Kerry	164	167	178	0.5	0.6	1.0	3.1	3.1	3.1
Kildare	264	269	286	0.8	0.9	1.3	5.0	5.0	4.9
Kilkenny	113	115	121	0.7	0.8	1.1	2.1	2.1	2.1
Laois	100	102	109	0.8	0.9	1.3	1.9	1.9	1.9
Leitrim	35	35	38	0.4	0.5	0.9	0.7	0.7	0.7
Limerick	213	217	232	0.4	0.5	0.9	4.0	4.0	4.0
Longford	47	48	51	0.7	0.8	1.2	0.9	0.9	0.9
Louth	143	146	155	0.5	0.6	1.0	2.7	2.7	2.7
Mayo	129	132	141	-0.1	0.0	0.4	2.4	2.4	2.4
Meath	231	235	251	0.8	0.9	1.3	4.4	4.3	4.3
Monaghan	66	67	72	0.3	0.4	0.8	1.2	1.2	1.2
Offaly	90	92	98	0.7	0.8	1.2	1.7	1.7	1.7
Roscommon	71	72	77	0.4	0.6	1.0	1.3	1.3	1.3
Sligo	72	74	79	0.5	0.6	1.0	1.4	1.4	1.4
Tipperary	171	174	187	0.3	0.4	0.8	3.2	3.2	3.2
Waterford	127	129	135	0.4	0.5	0.8	2.4	2.4	2.3
Westmeath	101	103	109	0.6	0.7	1.1	1.9	1.9	1.9
Wexford	168	171	179	0.6	0.7	1.0	3.2	3.1	3.1
Wicklow	163	166	177	0.7	0.8	1.2	3.1	3.1	3.1
State	**5,308**	**5,417**	**5,804**	**0.5**	**0.6**	**1.0**	**100**	**100**	**100**

Source: Authors' calculations.

The higher average annual growth in the Eastern and Midland regions of the country is clearly visible in Figure 3.4 which presents projections from the Central scenario.

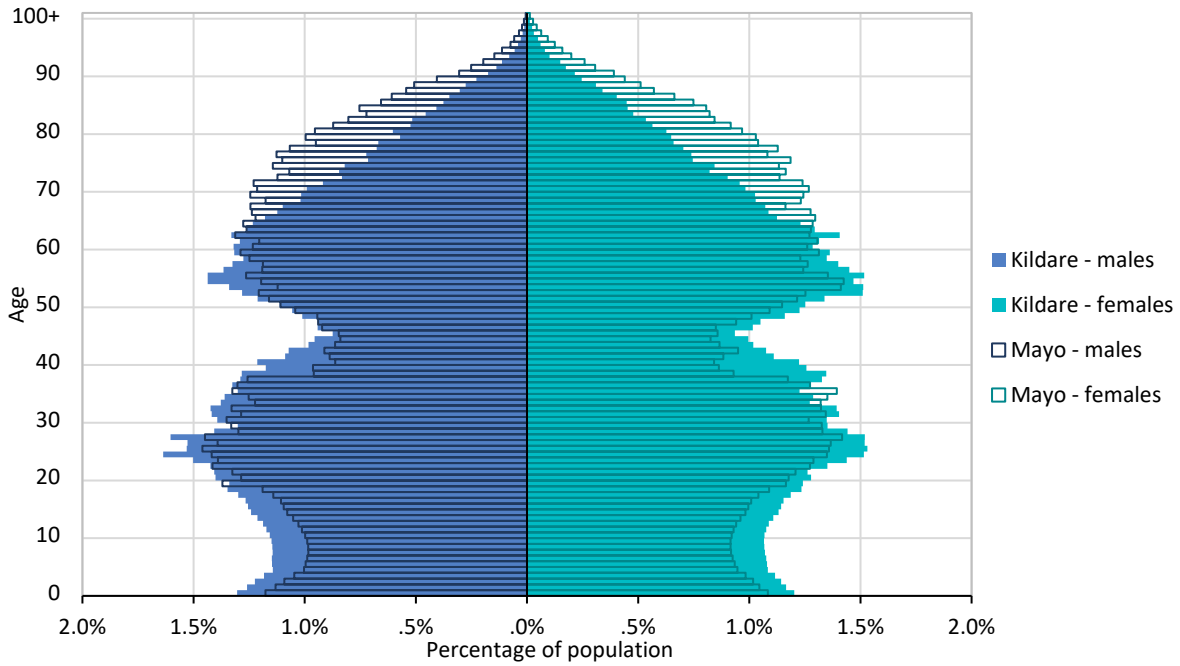
FIGURE 3.4 Average annual change in population by county (Central scenario), 2019–2035



Source: Authors' calculations based on CSO, Census data.

Similar to the national results, the projections at county level are produced by single year of age, allowing us to observe the ageing of the population and the impact on individual counties. For example, Figure 3.5 shows the population pyramids for Kildare and Mayo, counties with, on average, among the youngest and the oldest populations respectively. Despite having a similar overall profile there are clear differences, with Mayo having an older and more rapidly ageing population. In 2035, the share of population over the age of 65 is projected to be 25.9 per cent in Mayo compared to 18.3 per cent in Kildare.

FIGURE 3.5 Population age pyramid: Kildare and Mayo, 2035 (% of population)



Source: Authors' calculations based on CSO, Census data.

3.6 SUMMARY

This section provided an overview of the demographic scenarios used in the report. The demographic projections are created with the ESRI's Regional Demographic Model. This model combines projections of the main demographic trends, based on their historical evolution, with a novel treatment of internal migration, depending on underlying economic conditions at county level, to produce detailed demographic projections.

Key points

- At the national level, the population is expected to increase by close to 500,000 people between 2019 and 2035, for a total population of around 5.444 million people in 2035 in the Central scenario. That figure would be 5.308 and 5.804 million people for the Low and High population scenarios.
- The projections show the importance of international migration in determining the future path of the population figures.
- At the regional level, the Eastern and Midlands region are projected to register faster population growth, in particular the counties surrounding Dublin. The projection results also suggest that the slowest-growing region will continue to be the Northern and Western region, showing signs of an ageing population.

CHAPTER 4

Hippocrates projection methods and data

4.1 INTRODUCTION

This chapter presents the methods used to estimate baseline hospital activity profiles, which underlie the workforce projections, and describes the Hippocrates projection methodology in detail. The workforce projection scenarios are outlined, and an overview of the data sources employed in the analysis is provided.

4.2 OVERVIEW OF PROJECTION METHODOLOGY

The Hippocrates model is a type of component-based healthcare projection model known as a macro-simulation or cell-based model. These models involve grouping individuals into cells according to key attributes, typically age and sex. At a fundamental level, healthcare demand (expenditure) is projected by multiplying activity rates (average expenditures) for the goods and services in question by projected population (Astolfi et al., 2012).

Most models of this type tend to be top-down in nature, projecting on aggregate demand or expenditure. Hippocrates, in contrast, belongs to a smaller class of model that projects from a service-level, bottom-up perspective. While bottom-up models tend to be considerably more data-intensive, they allow for more flexibility and a wider range of applications (Keegan et al., 2020).

Previously, Hippocrates has employed these methods to project demand and expenditure for health and social care services and acute hospital bed capacity (Wren et al., 2017; Keegan et al., 2018a; Keegan et al., 2020; Keegan et al., 2021; Walsh et al., 2021).

In this report, the Hippocrates projection methodology has been expanded in two main ways. First, we extend Hippocrates to project hospital demand regionally, informed by ESRI county-level demographic projections (as described in Chapter 3). Second, these regional service demand projections are used as a basis for developing projections of hospital workforce requirements at both a Hospital Group (HG) and Regional Health Area (RHA) level.

Whole-time equivalents (WTEs) are the measure of HSE staff workforce reported in this analysis and the underlying data are sourced from the Health Service Personnel Census for December 2019. WTEs are a comparable measure of staff resource which incorporate adjustments for different patterns in part- and full-

time working. A WTE is calculated on the basis of the number of hours worked in a period divided by the standard number of working hours (for the grade) worked over that period. [14] The WTE calculation excludes any overtime (hours worked in excess of contracted hours) and therefore a WTE for an individual cannot exceed one.

In this analysis we consider WTE information for four main *staff categories* as defined by the Health Service Personnel Census; medical (including dental [15]), nursing and midwifery, select health and social care professions (HSCPs), and select patient and client care. Each *staff category* is further disaggregated into *staff group* (see Table 4.1). For HSCPs the analysis is limited to five professions: dietitians, occupational therapists, physiotherapists, speech and language therapists, and social workers. Analysis of other HSCP groups was not possible due to lack of corresponding activity data reported in HIPE. For patient and client care, the analysis is limited to healthcare assistants (including attendants and aides) (HCAs) and health and social care assistants (HSCAs). In Appendix C we also present baseline headcounts which capture the number of staff employed, regardless of the number of hours worked by each staff, for the main staff categories.

TABLE 4.1 Staff categories and staff groups included in the analysis

Staff category	Staff group
Medical	All groups – consultants; NCHDs training, NCHDs non-training; medical/dental other
Nursing and midwifery	All groups –nurse/midwife specialists & advanced nurse/ midwife practitioners; staff nurse/staff midwives; nursing/midwifery other
Patient and client care	Selected groups – healthcare assistants – healthcare assistants and attendant/aide and health and social care assistants
Health and social care professions	Selected groups – dietitians, occupational therapists, physiotherapists, speech and language therapists, social workers

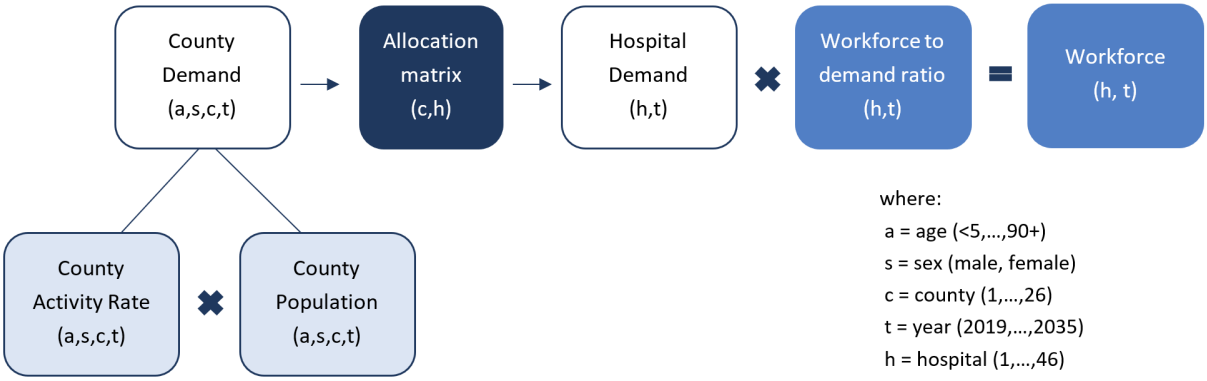
Source: Health Service Personnel Census.

14 WTE data included in this analysis exclude employees currently classified as on a *career break*.

15 As dentists comprise <0.5 per cent of the WTEs in this category for public acute hospitals, the category is referred to as *medical* throughout the remainder of the report

Figure 4.1 outlines the steps involved in developing Hippocrates from a demand base to project workforce requirements. The following sections describe each step of the projection process in detail.

FIGURE 4.1 Hippocrates model development – diagrammatic representation



Source: Authors' representation.

4.2.1 Developing county-level activity rate profiles for 2019

Activity profiles for medical, nursing and midwifery and HCA – adjusted patient days

The first step involved in developing regional workforce projections is to estimate county-level age- and sex-specific activity rate profiles for 2019. In previous analyses we derived activity rate profiles for each of the four main forms of hospital activity undertaken in public acute hospitals in Ireland – emergency department (ED) attendances, outpatient department (OPD) attendances, day patient discharges, and in-patient discharges – as a basis for demand projections (Wren et al., 2017; Brick and Keegan, 2020b; Keegan et al., 2020). However, a key aspect of projecting workforce is the ability to align base-year activity with the corresponding workforce resource used to deliver that activity (see section 4.2.4). Currently, Health Service Personnel Census data cannot be aligned to each of these individual service-level areas. For example, while we know the total number of nursing and midwifery WTEs in each hospital, we do not know how many of those WTEs are allocated to, for example, the ED. Therefore, we first need to develop an aggregate measure of total hospital activity (i.e. incorporating ED and OPD attendances and admitted care) to match with the available hospital-level workforce data. To do this we develop a measure of *adjusted patient days* (APDs) that converts ED and OPD attendances to bed days, weighted in terms of estimated relative resource use.

Using HPO Speciality Costing data, the hospital-specific weights are calculated as a ratio of the unit cost of an ED or OPD attendance to the unit cost of an in-patient bed day. The mean weighting for an ED attendance in 2019 across all hospitals was 0.33 and for OPD attendances was 0.19. For these services, the vast majority of the

cost of care delivery is pay (Keegan et al., 2020, p.70). For day-patient care, a large component of the cost of care delivery relates to drugs (Keegan et al., 2020, p.70) and therefore specialty costing data may not represent a useful basis to inform weighting for this particular service. We thus impose a weighting of 0.5 on day patient discharges (and same-day in-patients), reflecting the approach applied by the HPO (Healthcare Pricing Office, 2019).

For ED and OPD attendances, while we know the hospital attended in currently available data, the county of residence of the patient is not reported. We allocate this (weighted) care to counties based on patterns of activity flow from hospital to counties [16] (e.g. the proportion of activity in St. James's hospital accounted for by patients from Co. Meath) identified in the HIPE dataset in 2019. For day and in-patient discharges, patient county of residence is reported. These county-level age- and sex-specific APD profiles are then converted to rates by dividing by corresponding age- and sex-specific county population volumes.

This approach also allows us to account for the varying age- and sex-specific distributions of hospital activity under one composite measure. This will be important in terms of properly reflecting the impact of projected population growth and changing age structure on projected demand for hospital services, and ultimately projected hospital workforce requirements. Related approaches have been adopted in other settings where difficulties exist in matching particular hospital activity data to staffing data because staffing data capture personnel working across all hospital services (Spetz et al., 2008; Cleverley and Cleverley, 2011; Bai and Anderson, 2016)

Activity profiles for HSCP and HSCA – adjusted discharges

For HSCPs it is not possible to calculate total hospital APDs specific to the type of care undertaken by these staff categories, due to incomplete data on ED and OPD service use. We thus estimate age- and sex-specific activity profiles for each category of HSCP included in the analysis based on available, albeit limited, admitted care data only.

For each HIPE discharge record, diagnosis (one principal and up to 29 additional) and procedure (up to 20) codes are recorded based on the medical record or chart. If a patient receives an intervention by a HSCP during their hospital stay, a procedure code from the procedure block 1916 (generalised allied health interventions) is assigned (National Centre for Classification in Health, 2013a).

[16] For the ED county allocations, we apply the HIPE hospital profiles for emergency in-patient discharges. For OPD attendances we apply the HIPE hospital profile for elective discharges (excluding dialysis, chemotherapy and radiotherapy).

According to the clinical coding guidelines (0032), a code is assigned only once for each staff category regardless of the number of interventions during the stay (National Centre for Classification in Health, 2013b). The age- and sex-specific profiles are based on the number of discharges with an intervention flag for each of the five HSCP categories under consideration; for example, the number of discharges with the procedure code for physiotherapy intervention (1916 – 95550-02). These profiles are also used for the associated HSCA grades.

Table 4.2 summarises the activity profiles used for each workforce category included in the analysis.

TABLE 4.2 Activity profiles by workforce category

Category	Activity profile	
	Adjusted patient day[a]	Adjusted discharges[b]
Medical	✓	
Nursing and midwifery	✓	
HCA and HSCA	✓	
HSCP		✓
Dietitians		✓
Occupational therapists		✓
Physiotherapists		✓
Speech and language therapists		✓
Social workers		✓

Notes: a ED attendances (weighted), OPD attendances (weighted), day patient discharges (weighted), and in-patient bed days.
b Day patient discharges (weighted) and in-patient discharges.
Source: Authors' representation.

4.2.2 Projecting county activity rates to 2035

Once baseline age- and sex-specific activity rate profiles have been generated the next step is to develop activity rate profiles for each projection year (j), out to 2035. In this analysis we adjust these profiles through the projection horizon in a number of ways, described below.

Adjusting activity rates to account for healthy ageing

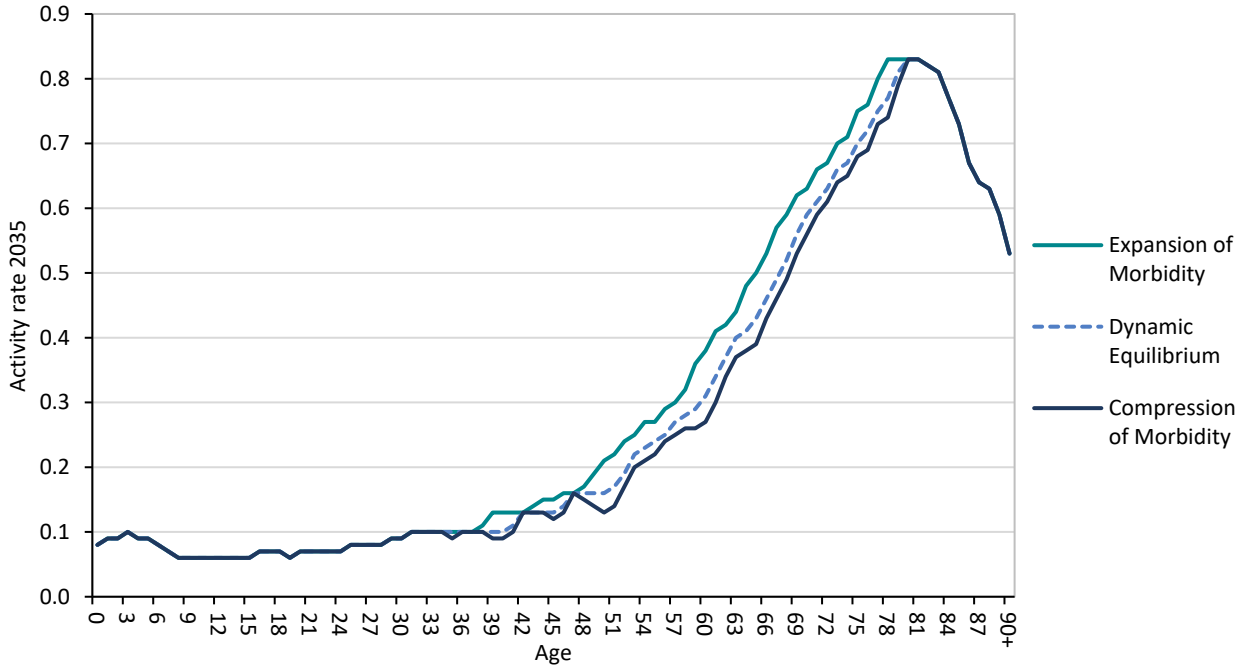
Healthy ageing adjustments are made to account for the fact that, as life expectancy increases, not all additional life years may be spent in bad health (Wren et al., 2017). To simulate these effects, we shift age- and sex-specific activity curves to the right in proportion to projected life expectancy change. This is based on an approach adopted from the European Commission (European Commission, 2011; 2014; 2017) and previously applied in a number of Hippocrates projection analyses (Wren et al., 2017; Keegan et al., 2018a; Keegan et al., 2020; Walsh et al., 2021). [17] The strength of the activity shift applied describes the healthy ageing effect to be

[17] See section 3.3.5 in Wren et al. (2017) for a technical explanation of these activity rate shifts.

modelled. Several healthy ageing hypotheses are identified in the literature, and these are discussed in Chapter 2.

The most pessimistic effect is to assume no healthy ageing, known as the *Expansion of Morbidity* hypothesis. This assumes that all additional life years are spent in bad health and is implicitly modelled where age and sex-specific activity rate profiles are kept constant over the projection horizon. The more optimistic *Dynamic Equilibrium* hypothesis assumes that, for every one-year increase in life expectancy, the relevant age-specific activity rate profile shifts back one age year. This assumes, for example, that if life expectancy increases by one year between 2019 and 2035, the care demanded by an 80-year-old in 2035 will be the same as the care demand by a 79-year-old in the base-year, 2019. The approach is illustrated graphically in Figure 4.2. Hippocrates models two additional healthy ageing scenarios. The even more optimistic *Compression of Morbidity* hypothesis is modelled as gains in health exceeding gains in life expectancy by 150 per cent. A *Moderate Healthy Ageing* assumption is also modelled to incorporate additional nuance into the health ageing projections. While not based in any underlying hypothesis, it models gains in health set at 50 per cent of the gain in life expectancy.

FIGURE 4.2 Illustrative example of the impact of healthy ageing shifts on activity rate distribution in 2035



Source: Authors' representation.

Adjusting activity rates to model enhanced community care delivery

Under this assumption we model the potential impact on acute care demand related to enhanced access and investment in community care. This is done through gradually reducing the rate of avoidable hospitalisations through the projection horizon to 2035. As described in Chapter 2, avoidable hospitalisations relate to conditions for which hospitalisation can be considered avoidable through timely and effective utilisation of non-acute care. These rates are often used as a marker of primary care quality (Gibson et al., 2013; Rosano et al., 2013). [18] In line with previous analyses, only emergency in-patient discharges from public hospitals are considered (Ansari et al., 2012; Sheridan et al., 2012).

In Ireland, the three most common avoidable hospitalisations recorded relate to vaccine-preventable influenza and pneumonia, Chronic Obstructive Pulmonary Disease and urinary tract infections (including pyelonephritis). While these three conditions account for the majority of avoidable hospitalisations recorded, [19] there is also an established evidence base for treatment or prevention (in the case of influenza and pneumonia) outside of the acute hospital setting (McDarby and Smyth, 2019; OECD, 2019).

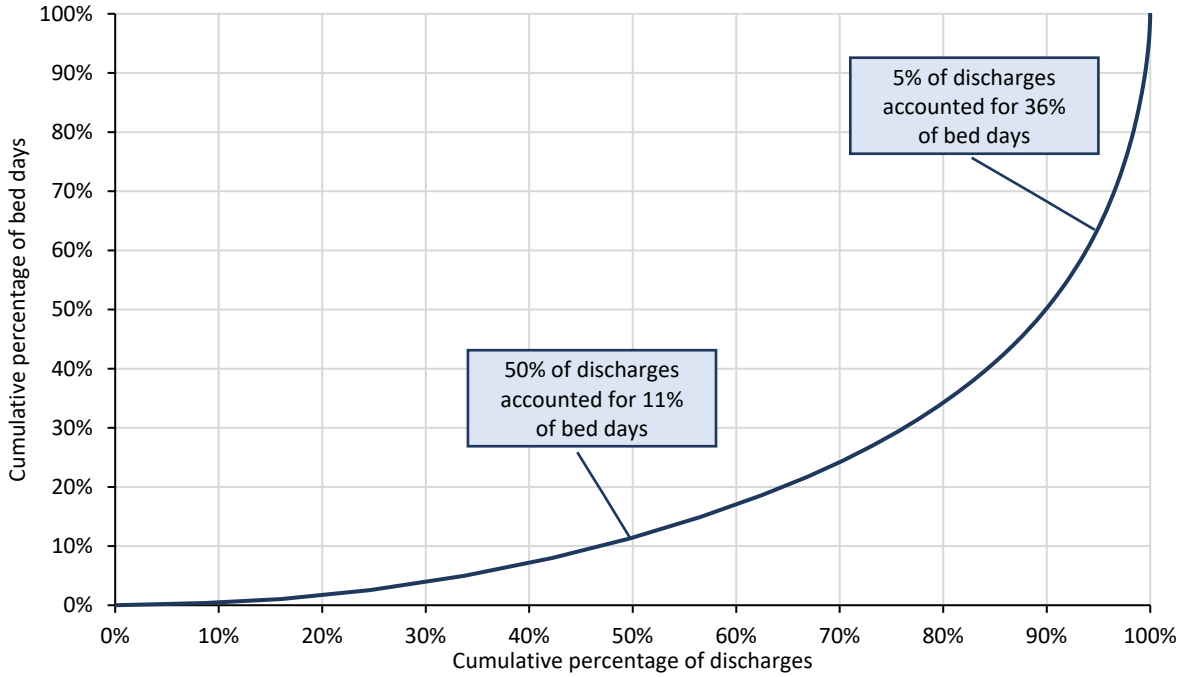
In Keegan et al. (2020), under our main modelling scenario, we assumed a 33 per cent reduction in (complexity-adjusted) avoidable discharges for these conditions by 2035. In this current analysis our measure of activity relates to bed days rather than hospitalisations. However, a large number of bed days tend to be recorded by a relatively small group of patients. Figure 4.3 shows that just 5 per cent of discharges accounted for 36 per cent of bed days for the three selected conditions in 2019. Therefore, in practice, a 33 per cent reduction in hospitalisations will likely result in a smaller proportionate reduction in bed days. To reflect this, we assume that the avoidable bed days associated with a 33 per cent reduction in discharges equals the median length of stay for avoidable discharges multiplied by the number of avoidable discharges to be removed. This corresponds to approximately a 15 per cent reduction in bed days. To incorporate the effect of population change on demand, bed days associated with all avoidable discharges are converted into a rate and (from 2022 onwards) linearly reduced through the projection horizon converging on a 15 per cent reduction by 2035. This reduction is applied across all age and sex groups.

---

[18] Avoidable hospitalisations are defined in accordance with Australia's National Healthcare Agreement indicator PI 18–Selected potentially preventable hospitalisations (Australian Institute on Health and Welfare, 2020) and refined in line with McDarby and Smyth (2019). See Keegan et al. (2020) for more details.

[19] For example, in 2018 together these three conditions accounted for 54.2 per cent of unweighted and 70.7 per cent of complexity-weighted avoidable hospitalisations recorded (Keegan et al., 2020).

FIGURE 4.3 Cumulative distribution of emergency in-patient discharges and bed days for selected avoidable hospitalisations, 2019



Notes: Vaccine-preventable influenza and pneumonia, Chronic Obstructive Pulmonary Disease, and urinary tract infections (including pyelonephritis).
Source: HIPE, 2019.

Adjusting activity rates to model improvements in waiting-list management

Based on methods applied in previous Hippocrates work and described in detail elsewhere (Brick and Keegan, 2020a; Keegan et al., 2020) we estimate the number of APDs required to clear OPD, day and in-patient waiting-list backlogs and maintain waiting times at 12 weeks. [20, 21] The main assumption in the model applies an OPD conversion rate of 33.3 per cent – that is, 33.3 per cent of OPD first-time attendances will 'convert' into day or in-patient treatment. We also assume that it will take 10 years to clear the backlog. [22] The calculations are undertaken at a national (not regional or specialty) level and the estimated APDs are allocated to hospitals based on the most recent published data on the hospital distribution of patients waiting more than 12 weeks (March 2021).

This method represents a high-level approach to estimation of the additional WTE required to reduce backlogs and maintain lower waiting times. In projecting WTE we assume a constant ratio between additional activity and additional WTE requirements for various staff categories. In reality, backlogs for certain procedures may be related to undersupply of particular staff categories (e.g.,

[20] At the time the analysis was undertaken the most recent data supplied by the NTPF were up to and including September 2021.
[21] Sláintecare sets a 10-week waiting-time target for OPD appointments. However, the data available for analysis at the time of writing allowed us to model a 12-week target for all services.
[22] See Appendix D for an alternative calculation in which we assume the backlog will be reduced over 7 years with a 20 per cent OPD conversion rate.

certain consultant specialities). In other instances, waiting lists may be more a function of lack of theatre space or limited bed capacity rather than available workforce. The workforce implications of this approach also necessarily assume that waiting lists will be largely managed over the medium term through expanding public hospital capacity rather than through purchasing of private capacity. A more detailed examination of the relationship between workforce supply and unmet demand was outside the scope of this analysis.

4.2.3 Projecting demand for care to 2035

Demand for care is then projected for each county, by multiplying annual age- and sex-specific activity rate profiles by annual age- and sex-specific projected population volumes.

Projected county-level demand for care in each projection year is then mapped to hospitals, using a matrix which captures the probability of a hospital discharge in 2019 from each county being treated in each hospital. Appendix E provides a detailed description of this allocation matrix.

4.2.4 Converting projected demand to workforce requirements

Hospital-specific workforce-to-activity ratios are calculated for each staff category and relevant staff group in 2019. Table 4.3 presents public acute hospital WTEs by staff category and HG in 2019, as recorded by the Health Service Personnel Census in December 2019.

TABLE 4.3 Public acute hospital WTEs by staff category and hospital group, 2019

	2019	Hospital Group					
		Dublin Midlands	Ireland East	RCSI	Saolta	South/ Southwest	UL
Medical	8,064	1,384	1,753	1,390	1,451	1,532	553
Nursing and midwifery	21,811	3,992	4,604	3,727	3,617	4,215	1,656
HCA and HSCA	5,047	1,167	949	913	799	642	577
HSCP							
Dietitians	345	94	78	57	37	62	17
Occupational therapists	306	68	68	61	56	45	8
Physiotherapists	913	160	229	169	141	162	52
Speech and language therapists	169	39	35	42	16	33	5
Social workers	292	79	70	73	26	33	11

Notes: Excludes CHI Tallaght, CHI Temple Street and CHI Crumlin, and staff classified as on a career break.
For a list of the hospitals included in the analysis see Appendix A.
Source: Health Service Personnel Census – December 2019.

However, the Health Service Personnel Census WTE figures (Table 4.3) do not account for overtime and the impact of agency staff. In calculating 2019 ratios we adjust the base (December) 2019 WTE figures to account for these factors. This is

done to ensure that workforce to activity ratios more meaningfully reflect the underlying workforce available to deliver care in 2019.

These adjustments (outlined in Table 4.4) were estimated by the HSE [23] specifically for use in this analysis and are applied across all hospitals in the HG and across all grades in the staff category. While it is not ideal to apply the adjustments to all grades, the available data do not currently allow for a more nuanced approach. These ratios represent the best available estimate of the WTE available to deliver the care and do not reflect a judgement on the ideal ratio or best-practice staffing. [24]

It should also be noted that the medical category includes an adjustment for agency only. For the purpose of this project it was recommended by HSE NDTP that medical overtime should be excluded from the medical workforce projections as NCHDs are required to work overtime in the form of on-call hours to cover out-of-hours emergency services and also work an amount of unrostered overtime in line with service demands. Employing additional NCHDs will not substitute the overtime hours worked without significant changes to how services are delivered.

The higher percentage agency/overtime adjustment in the HCA staff group may reflect the 'enhanced care' [25] requirements of some patients in hospital and/or the availability of this grade in the labour market when a registered professional may not be available.

TABLE 4.4 Workforce overtime and agency adjustments

	Hospital Group (%)					
	Dublin Midlands	Ireland East	RCSI	Saolta	South/ Southwest	UL
Medical[a]	5.2	2.4	3.3	5.2	3.3	9.6
Nursing and midwifery	5.5	8.3	8.2	1.7	3.4	2.4
HCA and HSCA	3.1	4.4	3.4	1.9	3.4	9.5
HSCP	19.1	12.3	12.1	10.7	13.6	14.9

Note: a Includes an agency adjustment only.
Source: Personal communication, HSE 2021.

23 The WTE adjustment is estimated by converting the expenditure on agency and overtime in 2019 to derived WTE based on the agency and overtime hourly payment rate. Personal communication, 25 February 2022.

24 It is acknowledged that the use of agency and overtime hours provided would have been used to cover vacant posts and to replace various absences (e.g. annual leave, sick leave) where supply is available. It is also known that most staff categories and organisations do not have additional WTE to accommodate staff on leave; particularly frontline staff working over the 24-hour period.

25 Enhanced care refers to the need for additional or extraordinary care, beyond what is provided for within average daily staffing levels for patients who are disorientated, have altered cognition or behaviour or a non-acute mental illness. It involves allocating a specific member of staff to a patient or group of patients with responsibility for continuous awareness of their whereabouts and care needs through ongoing observation.

Keeping these WTE to activity ratios constant, workforce is then projected in line with underlying demand growth, providing a hospital-level WTE projection. Hospital-level projected workforce is then aggregated to HG level and RHA level.

4.2.5 Adjusting workforce mix

Maintaining a constant workforce-to-activity ratio assumes that the workforce input per unit of activity remains constant over the course of the projection horizon, implicitly assuming no change to the workforce mix. However, as described in Chapter 2, an important driver of projected workforce requirements may be changes to the workforce mix. In this analysis, we consider two key adjustments to workforce-to-activity ratios to capture the potential impact of changes to workforce grade- and skill-mix, on projected workforce requirements.

The grade- and skill-mix assumptions modelled in this report have been chosen in agreement with relevant stakeholders and professional groups following online workshops and follow-up consultation. The development of these assumptions incorporated an appraisal of relevant policy, research evidence, international benchmarks, input by experts from national offices for various staff categories and the professional judgement of experienced managers across the professions. Separate workshops were held with a variety of internal and external stakeholders for the following staff categories incorporated in the project: medical, [26] nursing and midwifery, [27] and health and social care professions. [28] Final assumptions were agreed by the HSE Cross Divisional Workforce Planning Steering Group. [29] However, it should be noted that these are best described as 'what if' scenarios and do not reflect current policy, nor are they recommendations for implementation. Their intention is best described as one that facilitates greater depth to the analysis of the projections, taking account of 'what if' future developments in education/training/skills/roles that may occur.

Irish evidence does not currently exist to allow consideration of how workforce-to-activity ratios could be additionally adjusted at hospital level to reasonably capture the impacts of best-practice staffing levels on baseline and projected WTE. However, a body of work is currently being undertaken by the HSE, as part of this project, to develop this evidence for an additional scenario (to be published in a separate paper).

---

26 Office of the National Doctors Training and Planning (HSE), Strategic Workforce Planning and Intelligence (SWP&I) team (HSE) +/- ESRI/project group.

27 Office of the Nursing and Midwifery Services Director (HSE), Group Chief Directors of Nursing, CNO (DoH) and SWP&I team (HSE).

28 National Health and Social Care Professions Office, SWP&I team, WFP team (Department of Health) +/- ESRI/project group.

29 HSE governance for the project - (ESRI and Department of Health attend this group for the duration of this project).

Grade-mix

Grade-mix baseline, 2019

Table 4.5 presents the grade-mix baseline by RHA and HG in 2019. The grade-mix assumptions examined are the ratio of staff nurse/midwife to HCA, occupational therapists to occupational therapy assistants, and physiotherapists to physiotherapy assistants. While the ratios vary by RHA and HG, the overall ratio of staff nurses/midwives to HCA was 76:24, for occupational therapists to occupational therapy assistants it was 93:7, and for physiotherapists to physiotherapy assistants it was 94:6.

TABLE 4.5 Grade-mix baseline by hospital group, 2019

	Staff nurses/midwives: HCA	Occupational therapists [a]: occupational therapy assistants	Physiotherapists[a]: physiotherapy assistants
Regional Health Area			
Area A	75 : 25	88 : 12	94 : 6
Area B	70 : 30	95 : 5	98 : 2
Area C	83 : 17	98 : 2	97 : 3
Area D	82 : 18	100 : 0	97 : 3
Area E	68 : 32	100 : 0	88: 12
Area F	78 : 22	90 : 10	88 : 12
Hospital Group			
Dublin Midlands	71 : 29	94 : 6	98 : 2
Ireland East	78 : 22	94 : 6	98 : 2
RCSI	75 : 25	87 : 13	92 : 8
Saolta	78 : 22	90 : 10	88 : 12
South/Southwest	83 : 17	100 : 0	95 : 5
UL	68 : 32	100 : 0	88 : 12
National total	**76 : 24**	**93 : 7**	**94 : 6**

Notes: a Excludes clinical specialist grades.
Source: Health Service Personnel Census – December 2019.

Grade-mix assumptions

Table 4.6 provides details in relation to the grade-mix assumptions modelled in this analysis, by staff category. All grade-mix assumptions are modelled to be introduced in 2026 and remain in place for the length of the projection horizon (to 2035). This scenario is proposed as work is underway within the HSE to implement the recommendations of a national review of the role of the HCA which may see their role develop over the timeline of the projections.

TABLE 4.6 Grade-mix assumptions

Staff	Assumption	Timeframe
Nursing and midwifery	Main: Staff nurse/midwife to HCA mix of 70:30 Alternative: Staff nurse/midwife to HCA mix of 80:20 Staff nurse/midwife to HCA mix of 75:25	Apply from 2026
HSCP		
Occupational therapists; physiotherapists; speech and language therapists	Therapists to HSCA mix of 90:10	Apply from 2026
Dietitians; social workers	Dietitian/social worker to HSCA mix of 95:5	Apply from 2026

Source: Authors' representation.

Nursing and midwifery and healthcare assistants

As shown in Table 4.5, the overall national staff nurse/midwife to HCA grade-mix in 2019 was 76:24. The main grade-mix assumption models the impact of the introduction of a greater concentration of HCAs in the delivery of care nationally (70:30) over the medium term, acknowledging the wider roles of HCAs employed in nursing and midwifery services across hospitals, such as in enhanced care teams. Relative to the main grade-mix assumption, alternative assumptions illustrate the impact on projected workforce of incrementally increasing the ratio of nursing and midwifery to HCAs. For example, current policy recommendations set out an 80:20 staff nurse/midwife to HCA mix, but this relates only to general and specialist medical and surgical adult in-patient wards rather than the totality of the hospital setting.

Health and social care professions and health and social care assistants

For occupational therapists, physiotherapists, and speech and language therapists, we apply a therapy profession to HSCA grade-mix of 90:10. For dietitians and social workers we apply a profession to HSCA grade-mix of 95:5. We apply a higher profession to HSCA mix for dietitians and social workers as these grades are not yet established. In 2019, WTEs related to HSCA grades for occupational therapists, physiotherapists, and speech and language therapists were captured in public acute hospitals. [30, 31]

Skill-mix

Skill-mix baseline, 2019

Table 4.7 presents the skill-mix baseline by RHA and HG for 2019. In 2019, 3.8 per cent of nursing staff were at the clinical specialist grade and a further 1.5 per cent at the advanced practitioner grade. For the HSCP grades, the proportion of clinical

[30] While 1 WTE for speech and language therapist assistant was recorded in the data for 2019, for modelling purposes this is ignored.

[31] There were no recorded HSCAs supporting dietitians and social workers in the 2019 Health Service Personnel Census although the development of such roles in some hospitals has been piloted (personnel communication – HSE, 29 April 2022).

specialists varied from 3.3 per cent of occupational therapists to 10.1 per cent of physiotherapists. In 2019 there were no HSCP staff categorised as advanced practice. There was substantial variation in the proportion of clinical specialists across the RHAs/HGs. For example, for physiotherapists 5.0 per cent of those in Area C were classified as clinical specialists compared to 13.6 per cent in Area B, while 8.4 per cent of those in Ireland East were classified as clinical specialists compared with 14.7 per cent across Dublin Midlands hospitals.

TABLE 4.7 Skill-mix baseline by RHA and HG, 2019

	Medical		Nursing and midwifery		Dietitians	Occupational therapists	Physio-therapists	Speech and language therapists
	NCHD training: Consultant	NCHD non-training: Consultant	Clinical specialist %	Advanced Practitioner %	Clinical specialist %	Clinical specialist %	Clinical specialist %	Clinical specialist %
Regional Health Area								
Area A	1.2 : 1	0.9 : 1	3.8	1.7	5.9	4.8	12.4	13.2
Area B	1.2 : 1	0.8 : 1	3.6	1.5	7.0	6.7	13.6	6.3
Area C	1.2 : 1	1.0 : 1	4.8	1.4	3.3	2.0	5.0	3.8
Area D	1.2 : 1	1.0 : 1	2.6	0.5	5.5	0.0	9.5	3.9
Area E	1.3 : 1	1.1 : 1	3.3	1.3	2.9	0.0	8.6	0.0
Area F	1.1 : 1	1.0 : 1	4.0	2.1	0.0	0.0	8.7	0.0
Hospital Group								
Dublin Midlands	1.2 : 1	0.8 : 1	3.6	1.6	7.4	7.1	14.7	6.7
Ireland East	1.3 : 1	0.9 : 1	5.1	1.6	6.2	1.4	8.4	10.6
RCSI	1.2 : 1	0.9 : 1	3.3	1.7	3.5	5.8	10.1	11.0
Saolta	1.1 : 1	1.0 : 1	4.0	2.1	0.0	0.0	8.7	0.0
South/Southwest	1.1 : 1	1.0 : 1	2.9	0.6	4.3	2.0	9.8	3.0
UL	1.3 : 1	1.1 : 1	3.3	1.3	2.9	0.0	8.6	0.0
National total	**1.2 : 1**	**0.9 : 1**	**3.8**	**1.5**	**4.9**	**3.3**	**10.1**	**7.0**

Source: Health Service Personnel Census – December 2019.

Skill-mix assumptions

Table 4.8 provides details in relation to the skill-mix assumptions modelled in this analysis by staff category. In cases where the 2019 base-year proportion of clinical specialist at a hospital level exceeds the respective 5 and 7 per cent modelled skill-mixes, no change is made to the underlying percentages.

TABLE 4.8 Skill-mix assumptions by staff category

Staff	Assumptions		Timeframe
Medical	NCHD in training:Consultant	1.1:1	Reduced in intervals from 2020 to 2035
	NCHD non-training:Consultant	0.4:1	
Nursing and midwifery	Clinical specialist	7%	Applied from 2020
	Advanced practitioner	4%	2020-2024 = 3%; 2025-2035 = 4%
HSCP	Clinical specialist	7%	2023-2024 = 5%, 2025-2035 = 7%
	Advanced practitioner	4%	2023-2024 = 2%, 2025-2035 = 4%

Source: Authors' representation.

Medical

The skill-mix assumptions modelled for the medical category, provided by the HSE National Doctors Training and Planning (NDTP) unit, have the overarching aim of reducing reliance on NCHDs, both training and non-training, relative to the consultants. The assumption is modelled from 2020, and reduces, in intervals, the WTE of NCHDs in training to 1.1 for every consultant WTE by 2035 and to 0.4 WTE per consultant WTE for non-training NCHDs by 2035.

Nursing and midwifery

For the nursing and midwifery staff category, we model two skill-mix assumptions. One assumption models 7 per cent of the nursing and midwifery workforce being employed at clinical specialist grade. This assumption is modelled from 2020 and remains in place for the entire projection horizon (to 2035).

The other assumption models 4 per cent of the nursing and midwifery workforce being employed at advanced practitioner grade. This assumption is also modelled from 2020, initially with this grade group representing 3 per cent of the nursing and midwifery workforce, rising to 4 per cent in 2025 and remaining at that level to 2035.

Health and social care professions

For included HSCPs we model two skill-mix assumptions. The first assumption models 7 per cent of the HSCPs, respectively, employed at clinical specialist level. The assumption is modelled to be introduced in 2023, initially with clinical specialist representing 5 per cent of the respective professional workforce, rising to 7 per cent in 2025 and remaining at that level to 2035. All professions had staff employed at clinical specialist level in 2019, apart from social workers. [32]

The second assumption models 4 per cent of the HSCPs employed at advanced practitioner level. This assumption is modelled to be introduced in 2023, initially with this grade group representing 2 per cent of the respective professional workforce, rising to 4 per cent in 2025 and remaining at that level to 2035. Currently, the advanced practitioner grade does not exist for HSCPs and is created within the model as the skill-mix assumption is applied.

[32] Clinical specialist is not a grade used in the social work profession currently.

4.3 WORKFORCE PROJECTION SCENARIOS

Rather than projecting the effect of each demand and workforce driver in isolation, we adopt the approach taken in previous Hippocrates projection reports (Wren et al., 2017; Keegan et al., 2018a; Keegan et al., 2020; Keegan et al., 2021; Walsh et al., 2021) and many other healthcare projection exercises (Wanless, 2002; Blanco-Moreno et al., 2013; de la Maisonneuve and Martins Oliveira, 2015; Charlesworth and Johnson, 2018; Lorenzoni et al., 2019) and develop a range of projection scenarios that group assumptions together in a consistent manner. The projection scenarios applied in this report are presented in Table 4.9. For all categories of workforce we apply a set of service demand and workforce-mix scenarios.

TABLE 4.9 Projection assumptions and scenarios

		Service demand scenarios			Workforce-mix scenarios	
		1	2	3	1	2
Service demand assumptions	Population growth and age structure	Central	Central	Central	Central	Central
	Waiting-list management	-	Yes	Yes	Yes	Yes
	Healthy ageing	-	-	MHA	MHA	MHA
	Enhanced community care	-	-	Yes	Yes	Yes
Workforce-mix assumptions	Grade-mix	-	-	-	Yes	Yes
	Skill-mix	-	-	-	-	Yes

Note: Waiting-list management and enhanced community care assumptions apply to only medical, nursing and midwifery, and HCA staff categories.

Source: Authors' representation.

Service demand scenarios

Three service demand scenarios are specified. Each service demand scenario varies assumptions in relation to projected acute care demand requirements, holding workforce to demand ratios constant through the projection horizon. The first service demand scenario is a comparator scenario, projecting workforce based purely on projected changes in the size and structure of the population from our Central population projection scenario (see Chapter 3). The second service demand scenario additionally models the projected workforce requirements potentially required to contribute to improvements in waiting-list management (which is a key dimension of Sláintecare reform). The final service demand scenario additionally assumes that pressure on projected workforce requirements in hospitals could be mitigated in two ways. First, we assume not all additional life years over the projection horizon will be spent in bad health. A review of sectoral health ageing evidence in Wren et al. (2017) supports the application of healthy ageing effects in relation to acute care demand. Informed by this evidence, previous Hippocrates projection exercises have favoured modelling Moderate Healthy Ageing and Dynamic Equilibrium health ageing effects in relation to acute care demand (Wren et al., 2017; Keegan et al., 2018a; Keegan et al., 2020; Keegan et al., 2021). In this report we apply a Moderate Healthy Ageing effect as part of our scenario analysis in Chapter 5. Secondly, in line with current Sláintecare reforms, we examine the

impacts of a reorientation of care to the community (through reducing the rate of avoidable hospitalisations). Our main service demand assumptions are then subject to sensitivity analysis in section 6.4.

Workforce-mix scenarios

Building on the final service demand scenario, additional workforce-mix scenarios are specified. The workforce-mix scenarios model changes to grade-mix and then additionally skill-mix for respective workforce categories, as presented in Tables 4.6 and 4.8.

4.4 OVERVIEW OF DATA SOURCES

Workforce: The Health Service Personnel Census (December for each year) is the main source of data on the numbers of staff working in public acute hospitals. The terminology used to categorise staff in this analysis arises from that used in the Census. The NDTP provided NCHD training and non-training breakdowns by hospital as recorded on their Doctors Integrated Management E-system (DIME). These NCHD training and non-training breakdowns were then applied to the NCHD WTE data recorded in the Health Service Personnel Census. The data are supplemented with estimates relating to overtime and agency used in the base-year which were also provided by the HSE.

Population: ESRI population projections inform the analysis and are discussed in detail in Chapter 3.

ED attendances: The main source of data on ED attendances for this analysis is the Patient Experience Time 2019 (PET) dataset managed by the HSE Acute Business Intelligence Unit (BIU). [33]

OPD attendances: No single dataset captures the totality of activity undertaken in outpatient departments in Irish public hospitals. For this analysis we use the number of OPD attendances in 2019 reported as part of the specialty costing returns, and for hospitals outside the Activity Based Funding system we supplement with the number of attendances reported to Acute BIU. Due to the lack of detailed patient profiles in these datasets, we use waiting-list data from the National Treatment Purchase Fund (NTPF), activity data from the Hospital In-Patient Enquiry (HIPE) Scheme, and OPD attendances in NHS England to estimate an age- and sex-profile for attendances (NHS Digital, 2019).

[33] Emergency presentations to maternity units/hospitals are not included in these figures. Number of attendances to one hospital not reported to the PET are taken from the figures returned to HPO speciality costing.

Day and in-patient discharges and bed days: The HIPE scheme, managed by the HPO, is an information system which records administrative and clinical data on deaths in and discharges from public acute hospitals in Ireland. The following analysis uses data on discharges between 1 January 2019 and 31 December 2019. Variables from HIPE used to establish the Hippocrates Model projection baseline are hospital, age, sex, patient type (day, in-patient), admission type, length of stay (LOS) in days, patient county of residence, and diagnosis flags for avoidable hospitalisations and procedure flags for HSCPs (see section 4.2.1).

Waiting-list management: the National Treatment Purchase Fund has provided both aggregate (up to and including September 2021) and micro data (June 2020) to allow for the analysis of waiting lists. The data have enabled the estimation of bed days and ultimately the associated workforce required to clear backlogs and maintain a 12-week waiting time at a point in time. [34] Full details of this method can be found in Brick and Keegan (2020a).

[34] Sláintecare sets a 10-week waiting time target for OPD appointments. However, the data available for analysis at the time of writing allowed us to model a 12-week target for all services.

4.5 SUMMARY

This chapter provided a detailed description of the projection methods applied in the analysis in this report. The development of the projection methods was informed by a review of the evidence on the drivers of healthcare workforce demand and their application to workforce planning modelling (reviewed in Chapter 2). The chapter outlined the approach to calculating base-year hospital activity profiles, regionalisation of the model, and the assumptions underlying the service demand and workforce-mix projection scenarios to be applied in Chapter 5. The chapter also provided an overview of the data sources employed for the analysis and the baseline workforce and utilisation profiles for 2019.

Key points

- Activity rate profiles are developed at county level for all services.
  - Medical, nursing and midwifery and HCA profiles are based on adjusted patient days. This is a composite measure of hospital activity based on weighted OPD, ED attendances and day patient discharges, and in-patient bed days
  - HSCP and HSCA profiles are based on weighted day patient discharges and in-patient discharges only.
- County-level activity rates are adjusted to account for healthy ageing, enhanced community care delivery and waiting-list management.
- Demand for care is projected for each county, by multiplying annual age- and sex-specific activity rate profiles by projected population volumes.
- Projected county-level demand in each projection year is mapped to hospitals.
- WTE to activity ratios are calculated following the adjustment of 2019 WTE, where appropriate, for agency and overtime recorded in 2019.
- Keeping WTE to activity ratios constant, workforce is projected in line with underlying demand growth.
- Additional grade- and skill-mix assumptions are also applied under two workforce-mix scenarios.
- Hospital-level projected workforce is aggregated to HG and RHA levels.

CHAPTER 5

Findings

5.1 INTRODUCTION

This chapter presents findings for projected public acute hospital workforce to 2035. The acute staff categories examined are medical, nursing and midwifery, healthcare assistants (HCAs) and health and social care assistants (HSCAs), and a selection of health and social care professions (HSCPs) (dietitians, physiotherapists, occupational therapists, speech and language therapists, and social workers). Base-year and projected whole-time equivalent (WTE) requirements are measured in terms of WTE and are presented both nationally and regionally. At staff category level, findings are presented for both Hospital Groups (HGs) and Regional Health Areas (RHAs) (see Figure 1.1). Corresponding regional projections at a more disaggregated staff group level are presented in Appendix F.

As described in Chapter 4 we project workforce requirements under five scenarios (see Table 4.9): three service demand (SD) scenarios and two workforce-mix (WM) scenarios. The SD scenarios consider projected workforce requirements maintaining baseline WTE-to-activity ratios while the WM scenarios build on the SD scenarios and additionally model the impact of how changes to grade-mix (Table 4.6) and skill-mix (Table 4.8) could impact on the workforce mix used to deliver the projected demand for services. Base-year WTE reported in the Health Service Personnel Census is adjusted to reflect the contribution of overtime and agency to care delivery at a regional staff category level. Therefore, the base-year adjusted WTE from which our projections start is a best estimate of the WTE that delivered services in 2019.

Section 5.2 provides an overview of activity rates in the base-year 2019 by staff category and county of residence while the remainder of the chapter presents projections of WTE requirements by staff category, staff group and grade group.

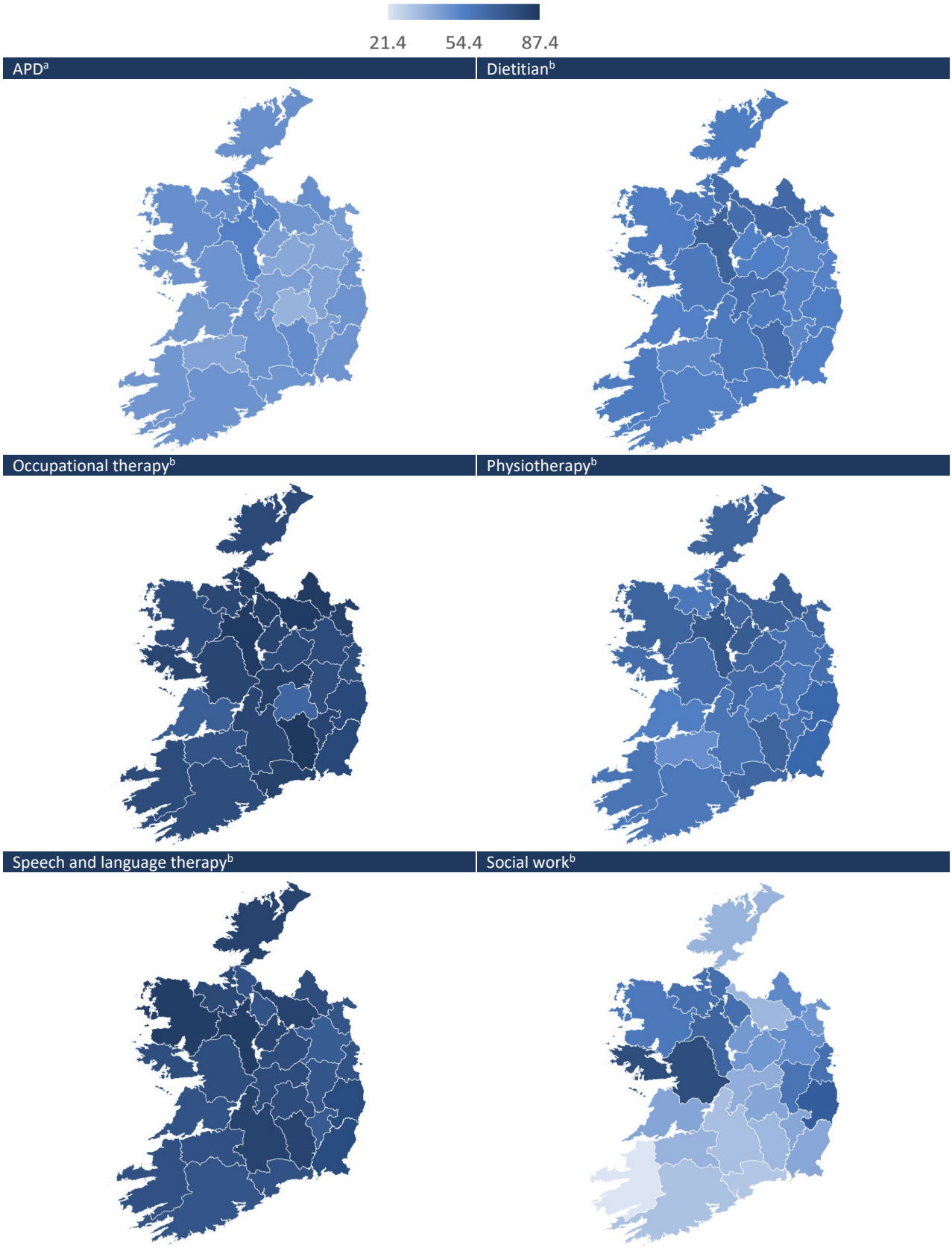
5.2 ACTIVITY BASELINE, 2019

County-level activity profiles, on which the workforce projections are based, have been developed for 2019 (see section 4.2.1). For medical, nursing and midwifery, and HCAs this APD profile is based on an aggregation of weighted emergency department and outpatient department attendances, weighted day patient discharges and in-patient bed days. The number of APDs nationally in 2019 was 5.37 million or 1,093 per 1,000 population. The activity profile for HSCAs and HSCPs is based on weighted day patient discharges and in-patient discharges to whom the professionals were recorded as having provided a service. This ranged from

approximately 28,000 (6 per 1,000 population) for social workers and speech and language therapists to 140,000 (28 per 1,000 population) for physiotherapists. Figure E.1 in Appendix E provides detail on how activity rates vary by county and activity type.

Figure 5.1 provides detail on how the proportion of activity attributable to those aged 65 years and older varies by county of residence and activity type, in 2019. The proportion of activity attributable to older ages was relatively similar across counties within each activity type. The exception to this was social work where large variation is evident in the proportion of activity attributable to those aged 65 and over across counties (ranging from 77% in Galway to 21% in Kerry). All estimated activity rates reported a high level of activity attributable to older ages, with occupational therapists (80% at a national level) and speech and language therapists (76% at a national level) tending to have the highest proportion. APDs recorded the lowest proportion (47% at a national level).

FIGURE 5.1 Proportion of activity 65+ years by county of residence, 2019



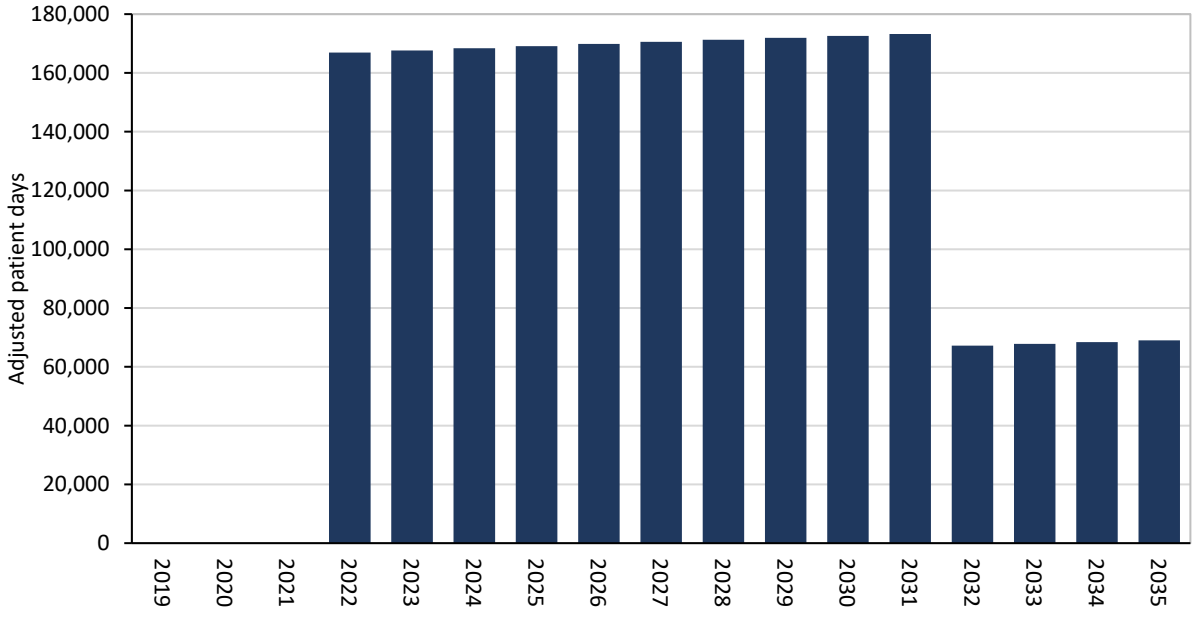
Notes: Includes CHI (CHI Tallaght, CHI Temple Street and CHI Crumlin) for completeness.
a ED attendances (weighted), OPD attendances (weighted), day patient discharges (weighted), and in-patient bed days.
b Day patient discharges (weighted) and in-patient discharges.
Sources: Author calculations based on 2019 data provided by HPO, BIU Acute and ESRI population projections.

5.3 WAITING-LIST MANAGEMENT – A CLOSER LOOK

We include an assumption in relation to the potential workforce implications of addressing waiting lists (through improved waiting-list management – see section 4.2.2) in projection scenarios SD 2 and SD 3 and WM 1 and WM 2. This section considers this assumption in more detail prior to introducing the workforce projections, as activity (and consequently WTE) implications have a strong temporal dimension that is not fully reflected when WTE requirements are expressed over the entire projection period. As described in Chapter 4, there are two components to this assumption. The first relates to addressing an accumulated, non-recurring, backlog of cases over the 10-year period 2022–2031. As shown in Figure 5.2, this has by far the greatest impact on projected service demand requirements. In total, across professions, an average of 170,000 additional APDs are estimated to be required to reduce current waiting-list backlogs over the 10-year period 2022-2031. [35, 36]

The second component reflects the additional recurring activity required to maintain waiting times at target levels (12 weeks). Once the backlog has been cleared, the recurring additional APDs required to maintain lower waiting times are estimated at 68,000 (on average) from 2032 onwards.

FIGURE 5.2 Waiting-list management – additional adjusted patient day requirements with 10-year backlog reduction and 33% OPD conversion rate, 2019–2035



Notes: Waiting-lists pressure are assumed to begin to be addressed from 2022.
See Appendix D for an alternative calculation in which we assume the backlog will be reduced over 7 years with a 20 per cent OPD conversion rate.

Source: See section 4.4 for an overview of data sources.

35 See Appendix D for an alternative calculation in which we assume the backlog will be reduced over 7 years with a 20 per cent OPD conversion rate.

36 See section 5.2 for context. It is important to note that, as we do not have service-level workforce data, the conversion of APDs to workforce is an approximation based on hospital level figures. For waiting list management, the impact on consultants, for example, could be greater than estimated due to the high number on OPD waiting lists.

5.4 PROJECTIONS BY STAFF CATEGORY – OVERVIEW

Table 5.1 provides base-year adjusted WTE estimates and projected WTE requirements by scenario for selected staff categories between 2019 and 2035. In 2019, across these selected categories we estimate a total of 39,160 WTE. Nursing and midwifery accounted for the largest share of total WTE (59%) followed by medical (21%), HCAs (15%) and finally the selected HSCPs (5%).

Across these selected staff categories, in total, we project requirements for between an additional 12,418 and 15,491 WTE by 2035, corresponding to an average annual increase of between 1.7 and 2.1 per cent over the period.

For the medical staff category, we project requirements for between an additional 2,575 and 3,236 WTE by 2035, which corresponds to projected average annual growth across scenarios of between 1.7 and 2.1 per cent. For nursing and midwifery, we project requirements for between an additional 5,726 and 8,868 WTE by 2035, or projected average annual growth across scenarios of between 1.4 and 2.1 per cent.

For HCAs and HSCAs, projected average annual growth ranged between 1.7 and 2.9 per cent over the period. This corresponds to projected increased WTE requirements of between 1,802 and 3,277 by 2035. The higher projected additional WTE projected under WM 1 largely reflects the assumed convergence to a 70:30 staff nurse/midwife to HCA grade-mix beginning in 2026.

Overall, the largest projected additional percentage increases in WTE requirements are reported for HSCPs. This reflects the application of profession-specific age- and sex-based service utilisation profiles on which WTE projections are based. As described above (see Figure 5.1), HSCP utilisation profiles tend to record higher relative service use at older ages and are therefore particularly sensitive to changes in population age structure. Speech and language therapists and occupational therapists recorded the highest average annual growth rates across these professions, ranging from 2.3 to 3.3 per cent average annual growth.

TABLE 5.1 Workforce categories – WTE projections by scenario, 2019–2035

	2019[a]	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	1[b]	1	2	3	1[b]
Medical	8,403	3,199	3,236	2,575	2,575	2.0	2.1	1.7	1.7
Nursing and midwifery	22,964	8,763	8,868	7,063	5,726	2.0	2.1	1.7	1.4
HCA and HSCA	5,707	2,220	2,247	1,802	3,277	2.1	2.1	1.7	2.9
HSCP									
Dietitians	357	166	166	143	119	2.4	2.4	2.1	1.8
Occupational therapists	315	214	214	183	169	3.3	3.3	2.9	2.7
Physiotherapists	938	494	494	425	372	2.7	2.7	2.4	2.1
Speech and language therapists	174	118	118	101	75	3.3	3.3	2.9	2.3
Social workers	303	148	148	127	105	2.5	2.5	2.2	1.9
National total	**39,160**	**15,321**	**15,491**	**12,418**	**12,418**	**2.1**	**2.1**	**1.7**	**1.7**

Note: Waiting-list management and enhanced community care assumptions apply only to medical, nursing and midwifery, and HCA staff categories.

a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).

b At staff category level, projections for WM 1 and WM 2 are identical.

Source: See section 4.4 for an overview of data sources.

5.5 MEDICAL

As shown in Table 5.2, of total medical WTE in 2019, 37.7 per cent related to NCHDs in training, 31.7 per cent to consultants, 29.9 per cent to non-training NCHDs and 0.7 per cent to the medical (other) category.

To keep pace with projected service demand under our first three scenarios, we project a requirement for between an additional 817 and 1,028 consultant WTE; 973 and 1,226 NCHD in training WTE; 766 and 959 non-training NCHD WTE; and 18 to 23 medical other WTE, by 2035.

However, changes to the underlying skill-mix associated with delivery of this care (WM 2) have a strong impact on projected WTE requirements across medical staff groups. Based on scenario WM 2, to reduce the ratio of NCHD in training:consultant to 1.1:1 and the ratio of NCHD non-training:consultant to 0.4:1, from current levels, would require an average annual increase in consultant WTE of 3.1 per cent. Under this scenario, this equates to 1,695 projected additional consultant WTE, by 2035.

The application of this skill-mix distribution would also have implications for the projected WTE requirements for training and non-training NCHDs. Under this scenario (WM 2), projected average annual growth in training NCHD requirements would increase by 2.6 per cent, while projected average annual requirements for non-training NCHDs would fall by 2.3 per cent.

TABLE 5.2 Medical – WTE projections by scenarios, 2019-2035

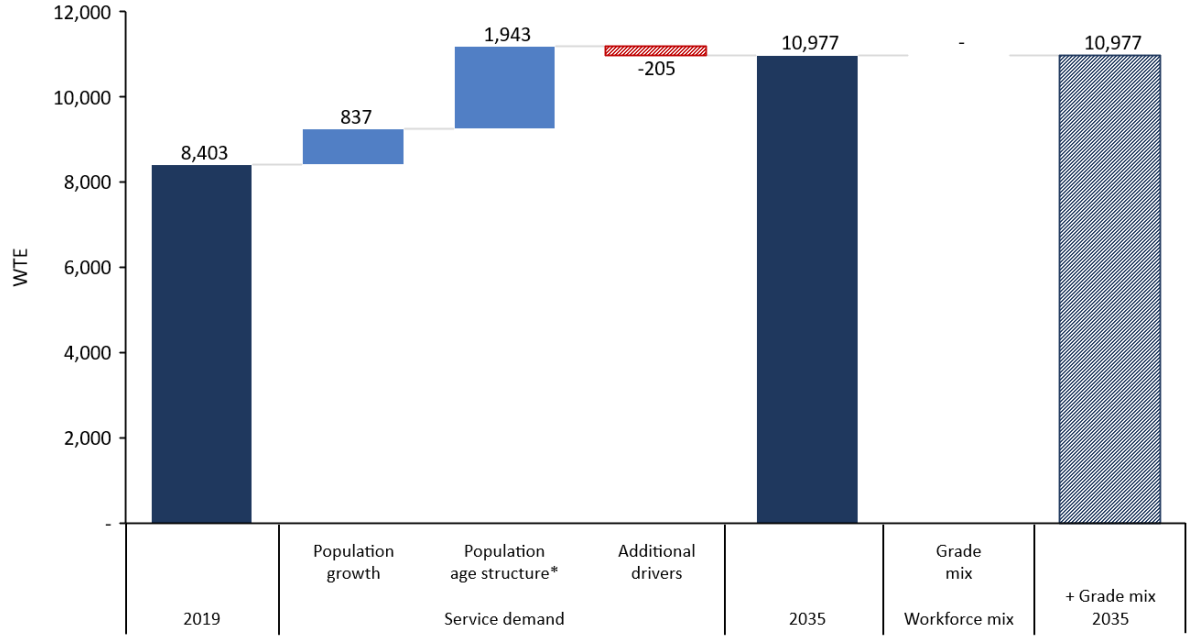
	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	2	1	2	3	2
Consultants	2,665	1,016	1,028	817	1,695	2.0	2.1	1.7	3.1
NCHD – training	3,168	1,212	1,226	973	1,628	2.0	2.1	1.7	2.6
NCHD – non-training	2,511	948	959	766	-767	2.0	2.0	1.7	-2.3
Medical other	59	23	23	18	18	2.1	2.1	1.7	1.7
National total	**8,403**	**3,199**	**3,236**	**2,575**	**2,575**	**2.0**	**2.1**	**1.7**	**1.7**

Notes: a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
b No grade-mix assumption is modelled for the medical staff group.
See Appendix F for HG and RHA level results by grade.
Source: See section 4.4 for an overview of data sources.

Figure 5.3 decomposes projected growth in total medical WTE by 2035 into its constituent drivers. As shown, the largest contributor to projected medical WTE requirements over the period relates to demographic change, particularly the changing age structure of the population. Even accounting for healthy ageing effects, an additional 1,943 medical WTE will be required to meet the demands of population ageing.

The additional service demand drivers model the combined effect of the impact of waiting-list management and enhanced community care assumptions (through an assumed reduction in avoidable hospitalisations) on projected workforce. While waiting-list management places increased pressure on activity (see Figure 5.2) and consequently workforce, the greater medium-term impact of the enhanced community care assumptions leads to an overall net reduction in additional projected medical WTE requirements of 8.0 per cent, equating to 205 WTE, by 2035.

FIGURE 5.3 Medical – decomposition of projected WTE requirements for *WM 1*, 2019–2035



Notes: * Incorporates a healthy ageing effect.
No grade-mix assumption is modelled for the medical staff group.
Source: See section 4.4 for an overview of data sources.

Table 5.3 presents baseline and projected medical WTE disaggregated by RHA and HG. In 2019, Area A and Ireland East HG recorded the largest estimated medical workforce at 2,072 WTE and 1,795 WTE, respectively. In contrast, Area E and ULHG (incorporating the same set of hospitals) recorded the fewest WTE (606).

Variation in projected additional WTE requirements across regions is predominantly driven by variation in patterns of underlying population change. Reflecting assumed higher population growth in the Eastern and Midlands regions, the largest projected growth in medical WTE requirements is concentrated in RHAs A, B, and C. Similarly, the projected growth in WTE requirements is greatest in Dublin Midlands, Ireland East, and RCSI HGs. Staff group projections at the level of RHA/HG are reported in Appendix F.

TABLE 5.3 Medical – WTE projections by scenarios and RHA/HG, 2019–2035

	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	2	1	2	3	2
Regional Health Area									
AREA A	2,072	857	865	687	687	2.2	2.2	1.8	1.8
AREA B	1,606	674	680	547	547	2.2	2.2	1.8	1.8
AREA C	1,492	582	589	469	469	2.1	2.1	1.7	1.7
AREA D	1,100	395	401	321	321	1.9	2.0	1.6	1.6
AREA E	606	193	196	158	158	1.7	1.8	1.5	1.5
AREA F	1,527	497	505	394	394	1.8	1.8	1.4	1.4
Hospital Group									
Dublin Midlands	1,456	618	623	500	500	2.2	2.3	1.9	1.9
Ireland East	1,795	737	744	594	594	2.2	2.2	1.8	1.8
RCSI	1,436	590	594	472	472	2.2	2.2	1.8	1.8
Saolta	1,527	497	505	394	394	1.8	1.8	1.4	1.4
South/Southwest	1,583	564	572	458	458	1.9	1.9	1.6	1.6
UL Hospitals	606	193	196	158	158	1.7	1.8	1.5	1.5
National total	**8,403**	**3,199**	**3,236**	**2,575**	**2,575**	**2.0**	**2.1**	**1.7**	**1.7**

Notes: a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
b No grade-mix assumption is modelled for the medical staff group.
See Appendix F for HG and RHA level results by grade.
Source: See section 4.4 for an overview of data sources.

5.6 NURSING AND MIDWIFERY

As shown in Table 5.4, of total estimated nursing and midwifery WTE employed in care delivery in 2019, the vast majority (72.4%) is related to staff nurse/midwife WTE followed by nurse/midwife (other) [37] WTE (22.4%). In 2019, it is estimated that clinical specialist (CS) and AP grades accounted for, respectively, 3.8 and 1.5 per cent of total nursing and midwifery WTE employed in the delivery of care.

Assuming that current grade- and skill-mix ratios remain in place (SD 1, SD 2 and SD 3), we project a requirement for between an additional 5,094 and 6,397 staff nurse/midwife WTE; 1,595 and 2,001 nurse/midwife (other) WTE; 268 and 337 CS WTE; and 105 and 132 AP WTE, by 2035. This represents an average annual increase over the period of between 1.7 and 2.1 per cent.

The grade-mix assumption modelled in the WM 1 scenario assumes a staff nurse/midwife to HCA ratio of 70:30. This reduces the projected additional WTE requirements for staff nurses/midwives to 3,757 or an average annual increase of 1.3 per cent (and 1.4 per cent for total nursing/midwifery). The additional skill-mix assumptions modelled in the final scenario, WM 2, take WM 1 as a starting point and assume 7 per cent of total nursing/midwifery at CS level from 2020 and 4 per cent at AP level from 2025 (3% in 2020–2024). This represents an average annual increase in CS of 5.4 per cent and in AP of 8.0 per cent over the period.

37 This category is comprised mainly of managerial grades but also includes student nurses/midwives.

TABLE 5.4 Nursing and midwifery – WTE projections by scenarios, 2019-2035

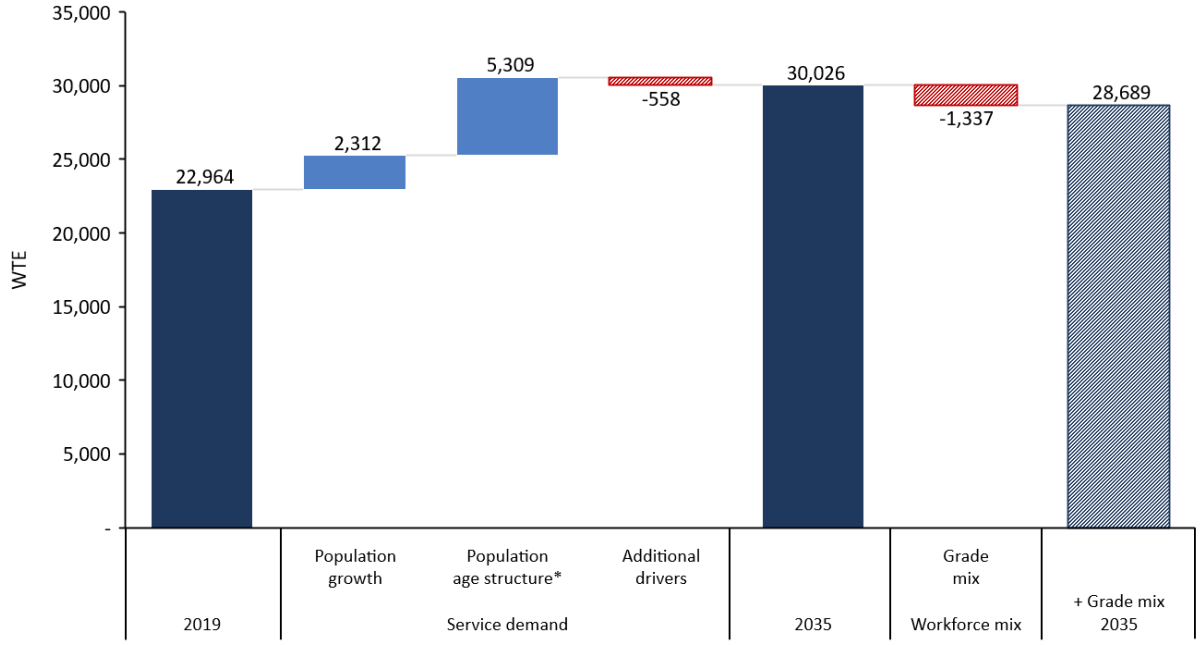
	2019	Projected additional WTE – 2035					Average annual increase 2019–2035 (%)				
		Service demand			Workforce mix		Service demand			Workforce mix	
	WTE	1	2	3	1	2	1	2	3	1	2
Advanced practitioners	336	131	132	105	105	811	2.1	2.1	1.7	1.7	8.0
Clinical specialists	866	333	337	268	268	1,142	2.1	2.1	1.7	1.7	5.4
Staff nurses/midwives	16,617	6,321	6,397	5,094	3,757	2,572	2.0	2.1	1.7	1.3	0.9
Nurses/midwives other[a]	5,144	1,978	2,001	1,595	1,595	1,201	2.1	2.1	1.7	1.7	1.3
National total	**22,964**	**8,763**	**8,868**	**7,063**	**5,726**	**5,726**	**2.0**	**2.1**	**1.7**	**1.4**	**1.4**

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
a Predominantly managerial grades but also includes student nurses.
See Appendix F for HG and RHA level results by grade.
Source: See section 4.4 for an overview of data sources.

Figure 5.4 decomposes projected growth in the nursing and midwifery WTE by 2035 into its constituent drivers. As with medical WTE, the largest contributor to projected requirements relates to demographic change, particularly the changing age structure of the population. Even accounting for healthy ageing effects, an additional 5,309 WTE will be required to meet the demands of population ageing.

The combined impact of the waiting-list management and enhanced community care assumptions are reported as additional drivers in Figure 5.4. While waiting-list management places increased pressure on activity (see Figure 5.2) and consequently workforce, the greater medium-term impact of the enhanced community care assumptions leads to a net reduction in additional projected medical WTE requirements by 558 WTE, by 2035. A change in grade-mix between staff nurses/midwives and HCAs has the effect of reducing the additional nursing/midwifery WTE required by 1,337.

FIGURE 5.4 Nursing and midwifery – decomposition of projected WTE requirements for *WM 1*, 2019–2035



Notes: * Incorporates a healthy ageing effect.
Source: See section 4.4 for an overview of data sources.

Table 5.5 presents baseline and projected nursing and midwifery WTE disaggregated by RHA and HG. In 2019, Area A and Ireland East HG recorded the largest estimated WTE at 5,760 and 4,987, respectively. In contrast, Area E/UL HG recorded the fewest at 1,695.

Variation in projected additional WTE requirements across regions is predominantly driven by variation in patterns of underlying population change. Reflecting assumed higher population growth in the Eastern and Midlands regions, the largest projected growth in nursing and midwifery WTE requirements (WM 2) is concentrated in RHAs A, B, and C and the Dublin Midlands, Ireland East, and RCSI HGs.

TABLE 5.5 Nursing and midwifery – WTE projections by scenarios and RHA/HG, 2019–2035

	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	1/2	1	2	3	1/2
Regional Health Area									
AREA A	5,760	2,376	2,398	1,907	1,578	2.2	2.2	1.8	1.5
AREA B	4,566	1,922	1,940	1,560	1,723	2.2	2.2	1.9	2.0
AREA C	4,107	1,603	1,619	1,289	730	2.1	2.1	1.7	1.0
AREA D	3,157	1,133	1,151	921	519	1.9	2.0	1.6	1.0
AREA E	1,695	537	548	440	542	1.7	1.8	1.5	1.7
AREA F	3,679	1,191	1,212	945	632	1.8	1.8	1.4	1.0
Hospital Group									
Dublin Midlands	4,210	1,789	1,805	1,449	1,551	2.2	2.3	1.9	2.0
Ireland East	4,987	2,042	2,062	1,643	1,214	2.2	2.2	1.8	1.4
RCSI	4,034	1,653	1,667	1,326	1,130	2.2	2.2	1.8	1.6
Saolta	3,679	1,191	1,212	945	632	1.8	1.8	1.4	1.0
South/Southwest	4,358	1,551	1,575	1,260	656	1.9	1.9	1.6	0.9
UL Hospitals	1,695	537	548	440	542	1.7	1.8	1.5	1.7
National total	**22,964**	**8,763**	**8,868**	**7,063**	**5,726**	**2.0**	**2.1**	**1.7**	**1.4**

Notes: a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
See Appendix F for HG and RHA level results by grade.
Source: See section 4.4 for an overview of data sources.

5.7 HEALTHCARE/HEALTH AND SOCIAL CARE ASSISTANTS

In 2019, there was an estimated 5,707 HCA and HSCA WTE, of which 5,630 (98.6%) were HCA and just 77 (1.4%) were HSCA (Table 5.6). There were no speech and language therapist, dietitian or social worker assistants employed in that year.

Assuming that current grade-mix ratios [38] remain in place (SD scenarios one to three), we project a requirement for between an additional 1,765 and 2,204 HCA WTE or average annual growth of between 1.7 and 2.1 per cent. For HSCAs, overall we project requirements for an additional 38 to 44 WTE or average annual increases of between 2.5 and 2.8 per cent.

The grade-mix assumption (WM 1) modelled assumes a staff nurse/midwife to HCA ratio of 70:30, an occupational therapist/physiotherapist/speech and language therapist to HSCA ratio of 90:10, and a dietitian/social worker to HSCA ratio of 95:5. Based on WM 1 assumptions, this increases the projected additional WTE requirements for HCA to 3,102, or an average annual increase of 2.8 per cent. For HSCA, this increases the projected additional overall WTE to 176 WTE, or an average annual increase of 7.7 per cent.

38 No skill-mix assumption is modelled for the included grades.

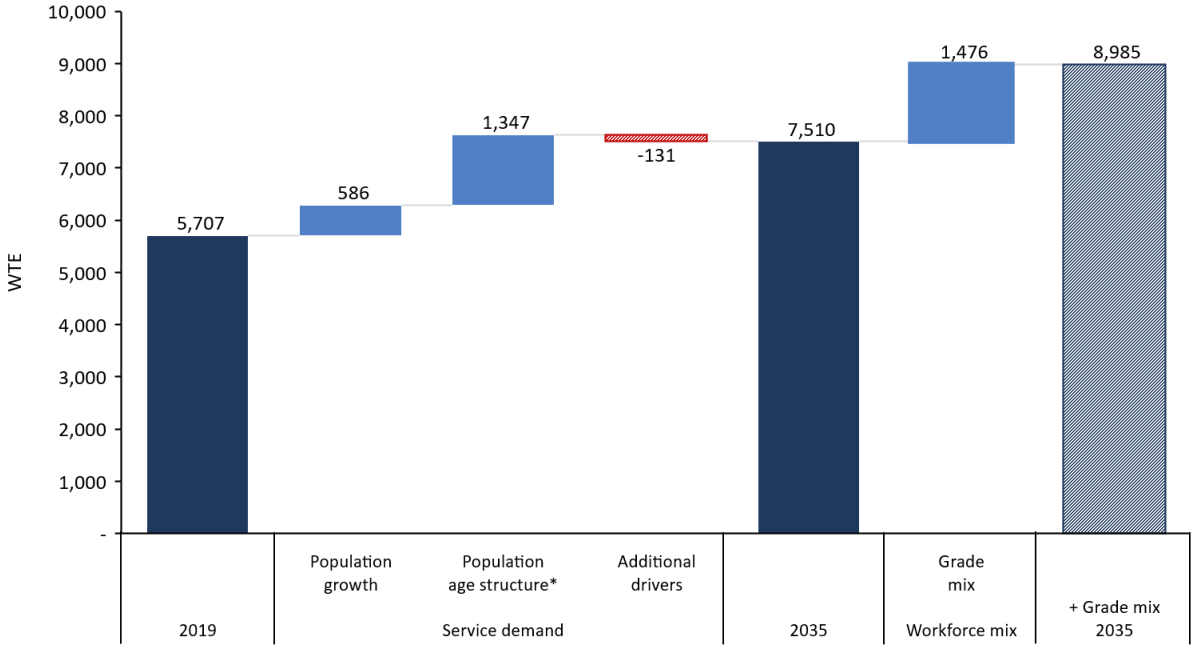
TABLE 5.6 HCA and HSCA – WTE projections by scenarios, 2019–2035

	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	1	1	2	3	1
HCA	5,630	2,176	2,204	1,765	3,102	2.1	2.1	1.7	2.8
HSCA									
Dietitian assistants	-	-	-	-	24	-	-	-	-
Occupational therapy assistants	23	16	16	14	29	3.4	3.4	3.0	5.2
Physiotherapy assistants	54	27	27	23	76	2.6	2.6	2.3	5.6
Speech and language therapy assistants	-	-	-	-	26	-	-	-	-
Social work assistants	-	-	-	-	21	-	-	-	-
National total	**5,707**	**2,220**	**2,247**	**1,802**	**3,277**	**2.1**	**2.1**	**1.7**	**2.9**

Notes: Waiting-list management and enhanced community care assumptions apply only to HCA staff.
a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
b No skill-mix assumption is modelled for the included grades.
See Appendix F for HG and RHA level results by grade.
Source: See section 4.4 for an overview of data sources.

Figure 5.5 decomposes projected growth in the HCA and HSCA WTE by 2035 (WM 1) into its constituent drivers. The largest contributor to projected requirements again relates to demographic change (growth and ageing), accounting for an additional 1,933 WTEs by 2035. The combined impact of the waiting-list management and enhanced community care assumptions are reported as additional drivers in Figure 5.5. Overall, the net effect of these assumptions is to reduce projected additional WTE by 131 by 2035. A change in grade-mix in favour of greater HCA and HSCA care delivery has the effect of considerably increasing, by 1,476 WTE, the additional WTE requirements by 2035.

FIGURE 5.5 HCA and HSCA – decomposition of projected WTE requirements for *WM 1*, 2019–2035



Notes: * Incorporates a healthy ageing effect.
Waiting-list management and enhanced community care assumptions apply only to HCA staff.
Source: See section 4.4 for an overview of data sources.

Table 5.7 presents baseline and projected HCA and HSCA WTE disaggregated by RHA and HG. In 2019, Area B and Dublin Midlands HG recorded the largest estimated WTE at 1,564 and 1,386, respectively. In contrast, Area D and ULHG recorded the fewest at 563 and 660 respectively.

Variation in projected additional WTE requirements across regions is driven by variation in patterns of underlying population change, and particularly the baseline ratios of nurses/midwives to HCAs (regions with baseline grade-mix ratios further away from the modelled 70:30 mix will display stronger harmonisation effects). The largest projected growth in HCA and HSCA WTE requirements (WM 1) is concentrated in RHA C (5.2% average annual growth) and the South/Southwest (5.0% average annual growth) HG. This area/group had the highest baseline ratios of staff nurses/midwives to HCAs, at 83:17, in 2019. This contrasts with Area E/UL HG which had a baseline ratio of 68:32 in 2019 and a projected 73 additional WTE (WM 1) by 2035 or 0.7 per cent average annual growth.

TABLE 5.7 HCA and HSCA – WTE projections by scenarios and RHA/HG, 2019–2035

	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	1	1	2	3	1
Regional Health Area									
AREA A	1,401	591	598	478	841	2.2	2.2	1.9	3.0
AREA B	1,564	671	677	551	431	2.3	2.3	1.9	1.5
AREA C	642	256	258	206	800	2.1	2.1	1.8	5.2
AREA D	563	205	209	167	593	2.0	2.0	1.6	4.6
AREA E	660	212	216	173	73	1.8	1.8	1.5	0.7
AREA F	877	284	289	226	540	1.8	1.8	1.4	3.0
Hospital Group									
Dublin Midlands	1,386	604	610	496	432	2.3	2.3	1.9	1.7
Ireland East	1,045	437	441	355	830	2.2	2.2	1.8	3.7
RCSI	1,016	421	426	340	557	2.2	2.2	1.8	2.8
Saolta	877	284	289	226	540	1.8	1.8	1.4	3.0
South/Southwest	723	261	265	212	845	1.9	2.0	1.6	5.0
UL Hospitals	660	212	216	173	73	1.8	1.8	1.5	0.7
National total	**5,707**	**2,220**	**2,247**	**1,802**	**3,277**	**2.1**	**2.1**	**1.7**	**2.9**

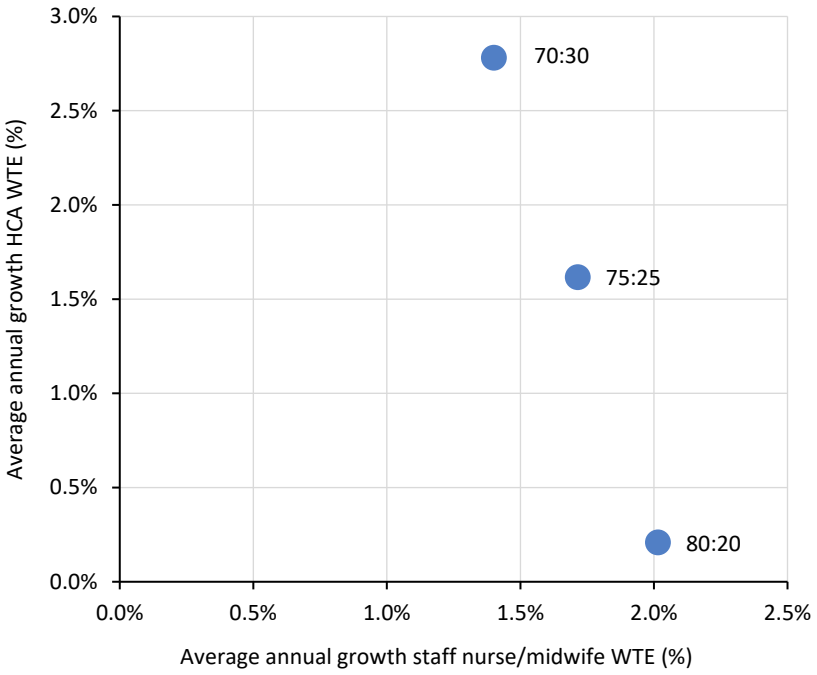
Notes: Waiting-list management and enhanced community care assumptions apply only to HCA staff.
a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
b No skill-mix assumption is modelled for the healthcare assistant staff.
See Appendix F for HG and RHA level results by grade.
Source: See section 4.4 for an overview of data sources.

5.8 STAFF NURSES/MIDWIVES AND HEALTHCARE ASSISTANTS – CHANGING THE GRADE-MIX

As described in section 4.2.5, while a staff nurse/midwife to HCA grade-mix of 70:30 reflects our main modelling assumption it should be viewed as a 'what if' scenario rather than a policy or recommendation for implementation. The impact on projected WTE requirements of alternative grade-mix assumptions between these groups is also worth considering. In this regard, Figure 5.6 presents projected average annual WTE growth (2019–2035) for staff nurses/midwives and HCAs under the main and alternative grade-mix assumptions.

Under our main assumption of a 70:30 staff nurse/midwife to HCA grade-mix, projected average annual growth for staff nurse/midwives (1.4%) and HCAs (2.8%) is consistent with what is presented under scenario WM 2 in sections 5.6 and 5.7. Assuming an alternative 75:25 grade-mix (under WM 2), this increases average annual growth in projected staff nurse/midwives WTE to 1.7 per cent, while projected average annual growth in HCAs falls to 1.6 per cent. Under an 80:20 mix, projected average annual growth in staff nurse/midwife WTE increases further to 2.0 per cent while projected average annual growth in HCA WTE is 0.2 per cent. As shown, projected HCA WTE requirements are particularly sensitive to alternative assumptions in relation to staff nurse/midwife to HCA grade-mix.

FIGURE 5.6 Projected average annual WTE growth (2019–2035) for staff nurses/midwives and HCAs under alternative grade-mix assumptions



	Average annual growth (%)	
	Staff nurses/ midwives	HCAs
70:30	1.4%	2.8%
75:25	1.7%	1.6%
80:20	2.0%	0.2%

5.9 HEALTH AND SOCIAL CARE PROFESSIONS

Table 5.8 presents the estimated baseline and projected WTE requirements for the five selected HSCPs by grade group. For each of the professions, the grade of advanced practitioner (AP) did not exist in 2019; its introduction is modelled as part of the skill-mix scenario (WM 2). For clinical specialist (CS) the grade is established for all but one of the professions (social worker). The highest proportion of CS is in the physiotherapy profession, with 10.2 per cent of the total WTE at that grade in 2019.

Assuming that current grade and skill-mix ratios remain in place (SD scenarios one to three) [39] we project a requirement for between an additional 143 and 166 dietitian WTE; 183 and 214 occupational therapist WTE; 425 and 494 physiotherapist WTE; 101 and 118 speech and language therapist WTE; and between 127 and 148 social worker WTE by 2035. This represents an average annual increase over the period of between 2.1 and 3.3 per cent.

The grade-mix assumption modelled in the WM 1 scenario assumes a therapist to assistant ratio of 90:10 for occupational therapists, physiotherapists and speech and language therapists, and a ratio of 95:5 for dietitians and social workers. This reduces the projected additional WTE requirements for all professions and implies average annual growth of between 1.8 and 2.7 per cent. The additional skill-mix

[39] Note that, due to the nature of the underlying activity profiles, no enhanced community care assumption is modelled for HSCP grades.

assumptions modelled in the final scenario, WM 2, take WM 1 as a starting point and assume 5 per cent of total WTE at CS level and 2 per cent at AP level from 2023, increasing to 7 per cent and 4 per cent respectively from 2025. This represents an average annual increase in CS WTE of between 3.3 and 8.4 per cent and in overall AP WTE requirements of between 10 and 53 WTE.

TABLE 5.8 HSCP – WTE projections by scenarios, 2019–2035

	2019[a]	Projected additional WTE – 2035					Average annual increase 2019–2035 (%)				
		Service demand			Workforce mix		Service demand			Workforce mix	
	WTE	1	2	3	1	2	1	2	3	1	2
Dietitians	**357**	**166**	**166**	**143**	**119**	**119**	**2.4**	**2.4**	**2.1**	**1.8**	**1.8**
Advanced practitioners	-	-	-	-	-	19	-	-	-	-	-
Clinical specialists	18	8	8	7	7	24	2.4	2.4	2.1	2.1	5.5
Other	339	158	158	136	112	76	2.4	2.4	2.1	1.8	1.3
Occupational therapists	**315**	**214**	**214**	**183**	**169**	**169**	**3.3**	**3.3**	**2.9**	**2.7**	**2.7**
Advanced practitioners	-	-	-	-	-	19	-	-	-	-	-
Clinical specialists	11	7	7	6	6	28	3.3	3.3	2.9	2.9	8.4
Other	304	206	206	177	162	122	3.3	3.3	2.9	2.7	2.1
Physiotherapists	**938**	**494**	**494**	**425**	**372**	**372**	**2.7**	**2.7**	**2.4**	**2.1**	**2.1**
Advanced practitioners	-	-	-	-	-	52	-	-	-	-	-
Clinical specialists	96	50	50	43	43	66	2.7	2.7	2.4	2.4	3.3
Other	843	444	444	382	329	254	2.7	2.7	2.4	2.1	1.7
Speech and language therapists	**174**	**118**	**118**	**101**	**75**	**75**	**3.3**	**3.3**	**2.9**	**2.3**	**2.3**
Advanced practitioners	-	-	-	-	-	10	-	-	-	-	-
Clinical specialists	12	8	8	7	7	15	3.3	3.3	2.9	2.9	5.2
Other	161	110	110	94	68	50	3.3	3.3	2.9	2.2	1.7
Social workers	**303**	**148**	**148**	**127**	**105**	**105**	**2.5**	**2.5**	**2.2**	**1.9**	**1.9**
Advanced practitioners	-	-	-	-	-	16	-	-	-	-	-
Clinical specialists	-	-	-	-	-	29	-	-	-	-	-
Other	303	148	148	127	105	60	2.5	2.5	2.2	1.9	1.1

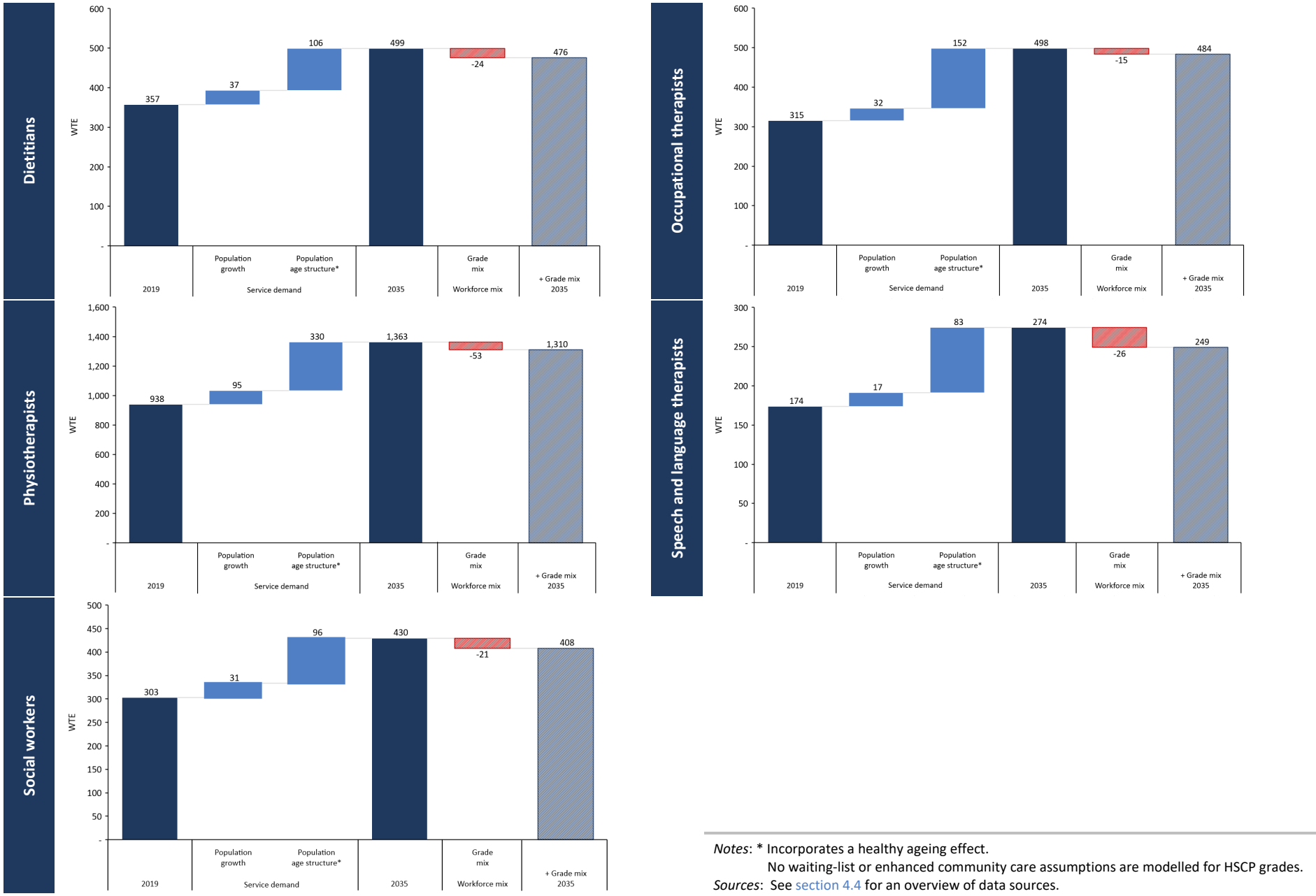
Notes: No waiting-list or enhanced community care assumptions are modelled for HSCP grades.
For each of the professions, the grade of AP did not exist in 2019 and its introduction is modelled as part of the skill-mix scenario (WM 2). Similarly for social workers, there was no clinical specialist grade in 2019 and its introduction is modelled as part of WM 2.

a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
See Appendix F for HG and RHA level results by grade.

Source: See section 4.4 for an overview of data sources.

Figure 5.7 decomposes projected growth in WTE for each of the selected HSCPs by 2035 into its constituent drivers. The largest contributor to projected WTE requirements for each profession relates to demographic change, particularly the changing age structure of the population. Even accounting for healthy ageing effects, between 83 and 330 additional WTE will be required to meet the demands of population ageing, depending on profession. A change in grade-mix between therapists and assistants has the effect of reducing the therapy WTE required by between 15 and 54 WTE by 2035, depending on profession.

FIGURE 5.7 HSCP – decomposition of projected WTE requirements for *WM 1*, 2019–2035



Notes: * Incorporates a healthy ageing effect.
No waiting-list or enhanced community care assumptions are modelled for HSCP grades.
Sources: See section 4.4 for an overview of data sources.

Table 5.9 presents baseline and projected total HSCP WTE disaggregated by RHA and HG. More detailed profession-specific RHA and HG disaggregations are presented in Appendix F. In 2019, Area A and Ireland East HG recorded the largest estimated WTE for all selected HSCPs (607 and 501 WTE respectively). In contrast, Area E/ULHG recorded the fewest WTE for all selected HSCPs at 101 WTE.

As with the other staff categories examined in this report, variation in underlying patterns of population change has a significant bearing on projected WTE requirements across scenarios, with projected growth rates higher in those RHAs and HGs located in the east of the country. Across most RHAs and HGs, the impact of the respective HSCP grade-mix assumptions (WM 1/2) has the effect of reducing projected overall HSCP WTE requirements relative to scenario SD 3. However, the relative impact of these grade-mix assumptions on projected HSCP WTE requirements will be influenced by differences in base-year regional mixes of professions to assistant for each of the HSCPs (regions with baseline grade-mix ratios further from away from modelled grade-mix will display stronger harmonisation effects; see Appendix F, Table F.4).

TABLE 5.9 HSCP (total[a]) – WTE projections by scenario and RHA/HG, 2019–2035

	2019[b]	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3[c]	1/2	1	2	3	1/2
Regional Health Area									
Area A	607	354	354	305	270	2.9	2.9	2.6	2.3
Area B	480	286	286	247	204	3.0	3.0	2.6	2.2
Area C	351	197	197	169	134	2.8	2.8	2.5	2.0
Area D	266	123	123	105	81	2.4	2.4	2.1	1.7
Area E	101	43	43	36	34	2.2	2.2	1.9	1.8
Area F	282	138	138	117	117	2.5	2.5	2.2	2.2
Hospital Group									
Dublin Midlands	454	270	270	233	194	3.0	3.0	2.6	2.2
Ireland East	501	290	290	250	203	2.9	2.9	2.6	2.2
RCSI	403	236	236	203	182	2.9	2.9	2.6	2.4
Saolta	282	138	138	117	117	2.5	2.5	2.2	2.2
South/Southwest	346	164	164	139	110	2.4	2.4	2.1	1.7
UL Hospitals	101	43	43	36	34	2.2	2.2	1.9	1.8
National total	**2,087**	**1,140**	**1,140**	**979**	**840**	**2.8**	**2.8**	**2.4**	**2.1**

Notes: No waiting-list or enhanced community care assumptions are modelled for HSCP grades.
a Aggregation of dietitian, occupational therapist, physiotherapy, speech and language therapist, social worker professions.
b 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
See Appendix F for HG and RHA level results for each profession.
Source: See section 4.4 for an overview of data sources.

5.10 SUMMARY

This chapter provided baseline estimates and projected WTE for medical, nursing and midwifery, HCA and HSCA, and five HSCPs (physiotherapists, dietitians, occupational therapists, speech and language therapists, and social workers) under a range of different scenarios. A more comprehensive review of the findings of this chapter is presented in Chapter 6, along with a sensitivity analysis, a description of the study limitations, and a discussion of implications for policy.

Key points

- The WTE requirements for all workforce categories considered are projected to increase substantially by 2035.
- These increases are largely driven by increases in the underlying population and, in particular, changes in the age structure.
- Percentage increases are projected to be relatively higher for HSCPs, given the concentration of activity in the older age categories.
- Regional variation in projected requirements is also observed, with relatively higher increases in Eastern regions again largely driven by population change.
- Projected workforce requirements can be sensitive to assumptions in relation to grade- and skill-mix.

CHAPTER 6

Summary and conclusions

6.1 INTRODUCTION

This is the fourth ESRI Research Series Report to be published that applies the ESRI's Hippocrates healthcare projection model. Previous analyses have applied the model to estimate baseline utilisation and expenditure for a range of health and social care services and to provide projections of demand, capacity and expenditure. This current analysis, funded by the Health Service Executive (HSE), marks a significant development for Hippocrates, with the modelling framework extended in two important ways. First, informed by new ESRI COVID-adjusted regional demographic projections, we extend Hippocrates to project public acute hospital demand regionally, at a Hospital Group (HG) and Regional Health Area (RHA) level. These regional hospital demand projections are then used as a basis to develop projections of public acute hospital workforce demand to 2035, which is the focus of this report.

The model is bottom-up in nature, with hospital-level workforce projections developed from a demand base in 2019. To inform this modelling, a review of the international literature on the drivers of workforce demand and health workforce planning models, was undertaken (Chapter 2). Several projection scenarios were developed as part of this report to acknowledge the uncertainty surrounding key assumptions, and to facilitate comparison of alternative drivers.[40] In total, we specify five projection scenarios; three service demand scenarios and two workforce-mix scenarios.

The service demand scenarios vary assumptions in relation to projected acute hospital service demand requirements, holding workforce to demand ratios constant through the projection horizon. At the most fundamental level, demand for public acute hospital care is modelled based on projected (COVID-adjusted) regional demographic change and assumptions on the relationship between projected life-year gains and healthcare use. We also apply additional policy-relevant demand assumptions that reflect key dimensions of the ongoing Sláintecare reforms (Houses of the Oireachtas Committee on the Future of Healthcare, 2017). Waiting-list management assumptions, at a broad level, estimate the additional workforce potentially required (based on the underlying additional activity requirements) to contribute to clearance of existing outpatient department (OPD) and admitted patient waiting-list backlogs and sustain shorter waiting times (12 weeks) into the future. At the same time, we also consider the

[40] See Chapter 3 for a description of the underlying regional demographic projection scenarios, while a detailed description of the projection scenarios is included in Chapter 4.

potential workforce implications of greater access to and investment in community care. This is modelled through the reduction in the rates of three common and resource intensive avoidable hospitalisations – vaccine-preventable influenza and pneumonia, chronic obstructive pulmonary disease (COPD), and urinary tract infection (including pyelonephritis) (UTI) – for which an established evidence base exists for treatment or prevention outside of hospital.

The workforce-mix scenarios build on the service demand scenarios and vary assumptions in relation to underlying grade-mix and staff-mix ratios. The development of these assumptions incorporated an appraisal of relevant policy, research evidence, international benchmarks, input from experts from national offices for various staff categories and the professional judgement of experienced managers across the professions who work in acute services.

In considering the findings in this chapter and Chapter 5, it is important to note that we model projections, not forecasts, of public acute hospital workforce requirements. Projected workforce requirements are based on underlying assumptions in relation to the evolution of service demand and the application of changes to workforce mix. Over the short term, workforce provision may vary from year to year due to unanticipated shocks (for example, the impact of COVID-19 on staffing levels and allocation), political decisions on budgetary allocation of resources, and labour market conditions. In the following sections we provide a summary of the main findings by drivers of workforce demand and by staff category. Also, in this chapter, additional analyses are presented that demonstrate the sensitivity of our projections to changes in key assumptions.

6.2 SUMMARY: DRIVERS OF WORKFORCE DEMAND

6.2.1 Population growth and ageing

A key finding from this report is that whole-time equivalent (WTE) requirements for all workforce categories examined are projected to increase substantially by 2035. As highlighted by decomposition analyses undertaken in Chapter 5, the overall biggest driver of these projected workforce requirements is large projected increases in the underlying size and changes in the structure of the Irish population. These changes then drive projected demand for hospital services. As described in previous analyses (Wren et al., 2017; Keegan et al., 2018a), net inward migration has contributed to large population growth in Ireland relative to other European countries in recent decades, and continued population growth is projected into the future. Under our main demographic modelling scenario, the Irish population is projected to increase by close to 500,000 people by 2035, bringing the total population to around 5.4 million. However, particularly important in terms of driving future demand for public acute hospital services, and therefore workforce requirements, are large projected increases in older population cohorts who tend

to use hospital services more intensively. Over the projection horizon, the population over 65 years of age is projected to increase from 700,000 in 2019 to 1.1 million in 2035. The number aged 85 years and older is projected to more than double, going from 75,000 in 2019 to 165,000 in 2035. These large projected increases in older ages mean that population ageing remains the dominant driver of healthcare demand despite assumptions that reduce age-specific utilisation rates through the projection horizon in line with Moderate Healthy Ageing assumptions. In this context, large projected growth in WTE requirements recorded for HSCPs (in particular occupational therapists and speech and language therapists) reflect the fact that care delivery incorporating these professions, as modelled, tend to be particularly required by older people.

While population change has been dramatic in Ireland in recent decades, this population growth has not been evenly distributed throughout the country. Between 1996 and 2016, the Mid-East region experienced the highest population growth (averaging 2.2% per annum) while the Mid-West region experienced the lowest (averaging 0.9% per annum). The projected regional distribution of international migration and the movement of population between counties in Ireland suggest that these trends will broadly continue. Modelled based on patterns of previous movements and their relationship to underlying economic conditions (e.g. county-level wage and house prices dynamics), findings suggest that the Eastern and Midlands regions will register faster population growth, in particular the counties surrounding Dublin. Counties such as Meath and Kildare are projected to have average annual growth of 0.9 per cent per annum compared to counties such as Mayo at 0.0 per cent and Galway at 0.4 per cent per annum. While large increases in workforce requirements are projected across all RHAs and HGs, a consequence of these internal patterns of population change is that somewhat larger projected workforce requirements tend to arise in those RHAs and HGs located in the east of the country.

6.2.2 Additional service demand drivers

Chapter 5 also provides detail on the additional drivers of service demand. As shown in Figure 5.2, addressing waiting lists has a strong temporal dimension, with the majority of additional activity required to address waiting-list backlogs modelled over the 10-year period 2022–2031. Once these backlogs have been addressed, the additional recurring activity required to be delivered to maintain waiting times at 12-week levels is estimated to be relatively small. Additionally, the impact of assumed greater access to care in the community through a reduction in avoidable hospitalisations, is modelled. Decomposition analyses conducted in Chapter 5 show the net of effect of these additional service demand drivers on projected WTE. Overall, while waiting-list management places increased pressure on activity (and consequently workforce), the greater medium-term impact of the

enhanced community care assumptions leads to a net reduction in additional projected WTE across the largest workforce categories (medical, nursing, and HCA/HSCA). This has the effect of (modestly) offsetting some of the projected increased pressures on hospital workforce resulting from demographic change and improved waiting-list management.

6.2.3 Workforce mix

Finally, the grade- and skill-mix assumptions that were applied examined how projected hospital demand could potentially be delivered by alternative combinations of workforce. In interpreting these findings, however, it is important to emphasise that the intention is to facilitate greater understanding of potential future developments in relation to education/training/skills/roles that might occur. These projections are therefore best considered as 'what if' scenarios and largely do not reflect current policy nor recommendations for implementation.

For nursing/midwifery and the HSCP categories, the application of respective grade-mix assumptions had the impact of offsetting some of the additional projected WTE requirements for these professional groups through increasing the delivery mix by assistant grades. [41] The effect of grade-mix adjustments on the relative re-distribution of WTE between professional and assistant grades at a regional level was strongly influenced by the base-year regional grade-mix, which varied considerably. The subsequent skill-mix scenario modelled the effect of redistributing staff within staff categories. The impact of skill-mix assumptions varied across professions but increased projected requirements for nurses/midwives and HSCPs operating at clinical specialist (CS) and advanced practitioner (AP) level, and for consultants in the medical category.

6.3 SUMMARY: WORKFORCE CATEGORY

6.3.1 Medical

As shown in Table 6.1, medical WTE was estimated at 8,403 in 2019. Between 2019 and 2035, medical category WTE requirements are projected to increase by between 2,575 and 3,236 WTE, nationally. This represents an average annual growth rate of between 1.7 and 2.1 per cent.

As shown in Figure 6.1, across scenarios the highest projected regional average annual growth rate was recorded for RHA Area A and B (2.2%) while the lowest rate was recorded for Area F (1.4%). [42]

[41] Chapter 5 Figure 5.6 illustrates the impact on WTE of applying alternative staff nurse/midwife to HCA grade-mix ratios to projections.

[42] As no grade-mix assumptions are applied to medical category variation in projected workforce demand at a national and regional level is driven entirely by variation in projected service demand.

Within the medical category (see Chapter 5), the scenarios that vary skill-mix assumptions reflect the aim of reducing reliance on NCHDs, particularly non-training NCHDs, relative to consultants in the delivery of care (see Table 4.7). The application of these assumptions under scenario SD 2 increased additional consultant WTE requirements to 1,695 (relative to 817 WTE under SD 3) and additional NCHD training WTE requirements to 1,628 (relative to 973 WTE under SD 3) by 2035. These increases were compensated through a large net reduction in the number of non-training NCHD WTE, projected at 767 fewer WTE in 2035 relative to 2019.

6.3.2 Nursing and midwifery

As shown in Table 6.1, nursing/midwifery was the single largest staff category contributing an estimated 22,964 WTE to care delivery in public hospitals in 2019. Between 2019 and 2035, nursing/midwifery WTE requirements are projected to increase by between 5,726 and 8,868 WTE nationally. This represents an average annual growth rate of between 1.4 and 2.1 per cent. The lower end of this range corresponds to the application of a modelled reduction in the staff nurse/midwife:HCA grade-mix from 76:24 to 70:30 at a national level. [43]

Regionally, as shown in Figure 6.1, across scenarios the largest projected average annual growth rate was recorded for RHA Area A and B (2.2%) while the lowest rate was recorded for Area C, D, and F (1.0%). The large variability in minimum projected average annual growth rates regionally (compared to medical) reflects the fact that the application of the 70:30 staff nurse/midwife:HCA grade-mix has varying effects on projected nursing/midwifery WTE requirements due to differences in underlying regional staff nurse/midwife:HCA grade-mix distributions in the base-year, 2019.

In the nursing/midwifery category (see Chapter 5), the application of skill-mix adjustments to increase the percentage of nurses/midwives operating at clinical specialist and advanced practice level to 7 and 4 per cent, respectively, had a significant impact on projected WTE requirements for these grades. Under this scenario (WM 2), an additional 1,142 clinical specialist WTE would be required, representing an average annual growth rate of 5.4 per cent. In comparison, an additional 811 advanced nurse practitioners would be required by 2035, representing an average annual growth rate of 8.0 per cent.

[43] As shown in Chapter 5 Figure 5.6, alternatively assuming a staff nurse/midwife to HCA grade-mix of 75:25 (80:20) increases average annual growth in projected nurse/midwife WTE to 1.7 (2.0) per cent.

6.3.3 Healthcare/health and social care assistants

As shown in Table 6.1, HCA/HSCA WTE was estimated at 5,707 in 2019. Between 2019 and 2035, HCA/HSCA WTE requirements are projected to increase by between 1,802 and 3,277 WTE nationally. This represents an average annual growth rate of between 1.7 and 2.9 per cent. The higher end of this projected range corresponds to the application of a modelled increase in the intensity of care delivery by HCA and HSCA grades under our grade-mix assumptions. [44]

Regionally, as shown in Figure 6.1, across scenarios the largest projected average annual growth rates were recorded for RHA Area C (5.2%) and D (4.6%) while the lowest rate was recorded for Area E (0.7%). The large projected WTE requirements recorded in Area C and D are primarily a consequence of high baseline ratios of staff nurse/midwife:HCA in these regions prior to application of grade-mix adjustments.

6.3.4 Health and social care professions

As shown in Table 6.1, physiotherapists (938 WTE) accounted for the largest of the selected HSCPs followed by dietitians (357 WTE), occupational therapists (315 WTE), social workers (303 WTE), and speech and language therapists (174 WTE). Projected average annual growth rates for HSCPs, most notably occupational therapists and speech and language therapists, were higher overall relative to other workforce categories examined. This reflects the relatively high utilisation in older age of care provided by these professions (see Figure 5.1). As with nursing and midwifery, minimum projection growth rates reflect the application of profession-specific grade-mix assumptions that increase the intensity of care delivery by assistant grades.

[44] As shown in Chapter 5 Figure 5.6, alternatively assuming a staff nurse/midwife to HCA grade-mix of 75:25 (80:20) reduces average annual growth in projected HCA WTE to 1.6 (0.2) per cent. No additional changes are made to HSCP to HSCA grade-mix as part of this analysis.

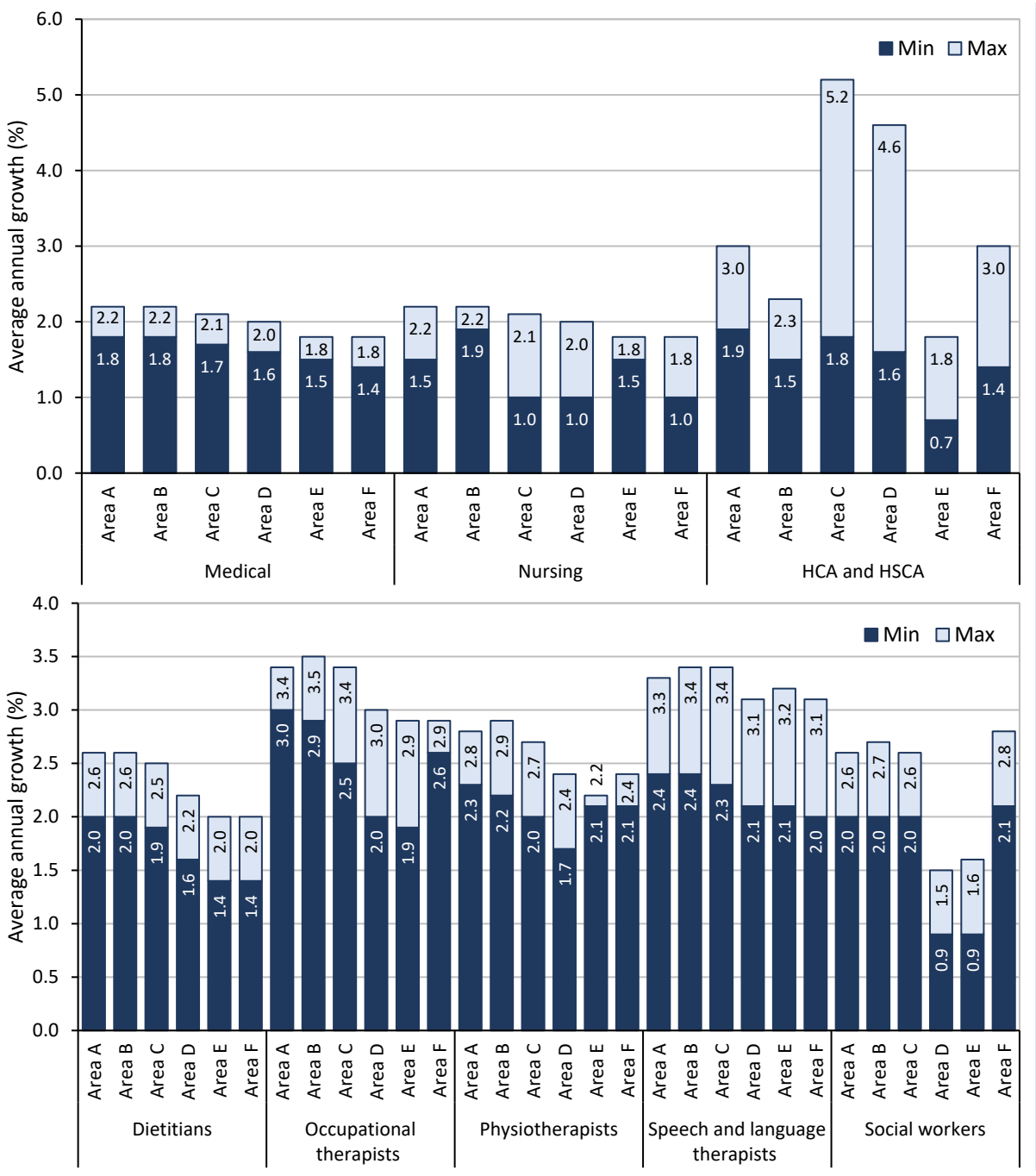
TABLE 6.1 Workforce categories – WTE projection range, 2019–2035

	2019	Projected additional WTE across scenarios	
	WTE	WTE (min–max)	Average annual growth (min %–max %)
Medical	8,403	2,575-3,236	1.7-2.1
Nursing and midwifery	22,964	5,726-8,868	1.4-2.1
HCA and HSCA	5,707	1,802-3,277	1.7-2.9
HCA	5,630	1,765-3,102	1.7-2.8
HSCA	77	37-176	2.5-7.7
HSCP			
Dietitians	357	119-166	1.8-2.4
Occupational therapists	315	169-214	2.7-3.3
Physiotherapists	938	372-494	2.1-2.7
Speech and language therapists	174	75-118	2.3-3.3
Social workers	303	105-148	1.9-2.5
National total	**39,160**	**12,418-15,491**	**1.7-2.1**

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
No waiting-list or enhanced community care assumptions are modelled for HSCA or HSCP grades.
Source: See section 4.4 for an overview of data sources.

As with other workforce categories examined, larger projected WTE requirements overall were reported in RHAs located in the east of the country (see Figure 6.1) reflecting underlying patterns of projected population change. Minimum projected regional growth rates for HSCPs will also be influenced by the extent to which base-year grade-mix ratios differ from modelled ratios.

FIGURE 6.1 Workforce categories – WTE projection range by RHA, 2019–2035



Note: No waiting-list or enhanced community care assumptions are modelled for HSCA or HSCP grades.
Source: See section 4.4 for an overview of data sources.

6.4 SENSITIVITY ANALYSIS

Table 6.2 presents projected WTE in 2035 arising from assuming only our Central population assumption as a driver of demand growth (i.e. SD 1) and examines the percentage change in WTE if key service demand assumptions are then altered independently of other assumptions. [45]

[45] We do not model varying assumptions in relation to waiting-list management in the main sensitivity analysis. However, in Appendix D we illustrate the impact on service demand (adjusted patient days) of a 7-year backlog reduction period with a 20 per cent OPD conversion rate.

The sensitivity of changes to service demand assumptions will be related to the underlying shape of the activity rate distribution. As described in Chapter 4, workforce projections for medical, nursing and HCA grades are based on the same underlying composite (adjusted-patient day) hospital utilisation profile; projected WTE for these staff categories thus displays the same relative sensitivity to changes in underlying assumptions. [46] In contrast, underlying demand for HSCP services is modelled based on profession-specific admitted care utilisation profiles (see section 4.2.1).

Table 6.2 demonstrates that, in general, variations in projected WTE requirements are most sensitive to the assumptions we adopt regarding healthy ageing. Our comparator central population projection implicitly assumes an expansion of morbidity, meaning that age-specific utilisation rates remain unchanged through the projection horizon which, as populations age, translates into greater illness and disability in the population. The Moderate Healthy Ageing assumption applied as part of our projection scenarios in Chapter 5 has the effect of reducing projected WTE, relative to no assumed healthy ageing, by between 3.6 and 5.9 per cent by 2035 across workforce categories and groups. More optimistic healthy ageing effects in the form of, respectively, Dynamic Equilibrium and Compression of Morbidity show, as expected, even greater relative projected WTE reductions.

Notably, the impact of healthy ageing assumptions on projected WTE is greatest for HSCPs, particularly occupational therapists and speech and language therapists. For example, relative to no assumed healthy ageing, the application of Moderate Healthy Ageing for speech and language therapists is projected to reduce projected WTE requirements in 2035 by 5.9 per cent. The corresponding reduction for medical staff, nursing staff and HCA/HSCAs is 3.6 per cent. This reflects the fact that a relatively high proportion of care provided by these professions is concentrated in older age groups, and therefore projected demand (and consequently WTE requirements) is particularly sensitive to assumptions on life expectancy change and healthcare use.

Uncertainty exists in terms of how acute workforce requirements may respond to enhanced community care services; therefore it is important to subject this underlying assumption to sensitivity testing. Under our main assumption applied in Chapter 5, we consider the impact on projected WTE of a 15 per cent reduction in bed days associated with the three most common and resource-intensive avoidable hospitalisations by 2035: vaccine-preventable influenza and pneumonia, COPD and UTI. However, as shown in Table 6.2, for applicable staff categories, the

[46] HSCAs make up a very small proportion of the overall healthcare assistant WTE, their WTE is projected based on relevant HSCP activity profiles not the overall composite adjusted patient day profiles. However, they represent such a small number of WTE that their effect on the sensitivity analysis is negligible.

relative impact of varying assumptions in relation to bed day reduction has a relatively small impact on projected WTE by 2035. This reflects the fact that this assumption acts only on in-patient bed day demand (and associated emergency department (ED) attendance) rather than the total hospital utilisation profile and, ultimately, what we consider reasonable parameter values to apply to the projections.

A final sensitivity undertaken in Table 6.2 examines the impact on projected WTE of replacing the main profession-specific weighted discharge profiles that underlie our HSCP projections with alternative weighted bed-day profiles. This examines how sensitive our projections are to the choice of underlying activity profiles rather than varying a service demand assumption. As described in section 4.2.1, derivation of HSCP profiles due to data constraints was subject to uncertainty. For dietitians (4.9%), physiotherapists (5.4%), and social workers (6.7%), applying respective weighted bed day profiles had the effect of increasing projected WTE in 2035 relative to corresponding weighted discharge profiles. For occupational therapists and speech and language therapists, less variation in projected 2035 WTE was observed. This reflects the fact that the age- and sex-specific weighted discharge and bed-day profiles for these professions in 2019 were very similar.

TABLE 6.2 Sensitivity analysis – effect on projected WTE of varying key service demand assumptions

		Medical	Nursing	HCA/ HSCA	Health and social care professions				
					Dietitians	Occupational therapists	Physio-therapists	Speech and language therapists	Social workers
Projected 2035 WTE based on central population growth only		11,601	31,726	7,927	523	529	1,432	292	451
Assumption		Percentage effect on 2035 WTE of changing one assumption (%)							
Population	Low	-1.6	-1.6	-1.6	-1.5	-1.1	-1.2	-1.2	-1.7
	High	4.7	4.7	4.7	4.6	3.6	3.9	4.0	5.0
Healthy ageing	MHA	-3.6	-3.6	-3.6	-4.5	-5.7	-4.8	-5.9	-4.7
	DE	-7.2	-7.2	-7.2	-9.0	-11.5	-9.6	-11.9	-9.5
	CM	-10.8	-10.8	-10.8	-13.5	-17.2	-14.4	-17.8	-14.2
Enhanced community care (% avoidable hospitalisation bed day rate reduction by 2035)	10%	-1.4	-1.4	-2.9	-	-	-	-	-
	15%	-2.1	-2.1	-3.5	-	-	-	-	-
	25%	-3.5	-3.5	-4.9	-	-	-	-	-
HSCP weighted bed days		-	-	0.1	4.9	0.2	5.4	-0.7	6.7

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
No enhanced community care assumption is modelled for HSCP grades.
Source: See section 4.4 for an overview of data sources.

6.5 LIMITATIONS

The modelling in this analysis was subject to some limitations. One limitation relates to the inability to align data on workforce and utilisation for various forms of public acute hospital care (e.g. ED care, OPD care, day and in-patient care). This restricted our ability to develop setting specific assumptions and projections (e.g., projected ED nursing requirements). Consequently, WTE projections for the largest staff categories are informed by underlying service demand growth at hospital level based on the development of an age- and sex-based adjusted patient day (APD) utilisation profile.

For HSCPs, however, it was not possible to derive total hospital APDs specific to the type of care undertaken by these staff categories, due to incomplete data on ED and OPD service use. Consequently, WTE projections for HSCPs are based on available, but limited, admitted care discharge data only. The extent to which these admitted care profiles are reflective of total use of hospital services is unknown. In addition, these discharge-based profiles do not reflect the intensity of use during an admission.

The scope of this analysis meant that it was not possible to incorporate projections for all staff grade groups and grades within the staff categories considered in this report. For example, it was outside the scope of this analysis to examine projected consultant WTE at a specialist level. While it is within the ability of Hippocrates to model these requirements, such an analysis would require a separate focused examination to understand specialist-level patient profiles and variation in waiting lists for individual specialties. The requirement to model activity predominantly in terms of APDs (described above) also restricts our ability to consider whether particular staff categories would have a greater impact on reducing the size of particular lists (e.g. consultant WTE may be particularly important in terms of addressing OPD waiting lists).

Finally, in projecting WTE requirements over the medium term, an important consideration relates to whether the current base staffing levels represent an adequate foundation for projections and to the extent that this may differ across staff categories and regions. While it was possible to adjust base-year workforce personnel data to account for the contribution of overtime and agency in care delivery in 2019, both regionally and by staff category, this does not tell us the extent to which current ‘adjusted’ supply reflects ‘best practice’ staffing levels. Developing and examining assumptions in relation to best-practice staffing-to-demand levels was an original intention of this report. Unfortunately, an agreed, comprehensive set of indicators specific to the Irish public acute hospital setting was not available in time for publication. Work is on-going within the HSE to

develop detailed best-practice staffing ratios which may inform future analyses in this area.

6.6 POLICY IMPLICATIONS, REFLECTIONS, AND CONCLUSIONS

Publication of this report takes place in the context of ongoing implementation of the Sláintecare programme, which seeks to deliver a single-tier integrated universal public healthcare system, with access to care based on need and not ability to pay. While promoting a shift away from hospital-centred care, the programme acknowledges the need to invest in acute system capacity and to reduce waiting times for acute services. Moreover, key to delivering on the Sláintecare vision of integrated service delivery is alignment of hospital and community services through the development of six RHAs. As described in Chapter 1, the Sláintecare programme has recognised that healthcare workforce planning will be a critical enabler of these reforms.

In this context, findings from this report raise important considerations for policymakers in terms of acute workforce investment, workforce planning and training both nationally and regionally over the coming years. The main findings of this report are that workforce requirements for all public acute staff categories examined are set to increase substantially over the coming years and across all current HGs and proposed RHA configurations. Projected workforce requirements are primarily driven by the underlying projected demand for hospital care, itself a function of a projected growing and ageing population. Demand for hospital-based HSCPs, particularly occupational therapists and speech and language therapists, may be particularly sensitive to large projected increases in older age cohorts over the next number of years. Similarly, while all HGs and RHAs are set to experience increased workforce demand, projected patterns in regional population growth suggest higher relative increases in workforce demand in eastern regions.

Using current hospital activity levels as a basis for projecting hospital workforce, however, would ignore large backlogs for care that have developed in recent times. These backlogs have arisen from a chronic under-investment in capacity and workforce over a number of years, and have been exacerbated more recently by the impact of the COVID-19 pandemic and the cyberattack on HSE information systems. Findings from this report suggest that while additional workforce will be required to deliver the necessary additional activity to address waiting lists, most of this extra activity will be non-recurring (i.e. temporary) and required to clear backlogs that have arisen. Once these backlogs have been cleared, the additional recurring activity (and associated workforce) to maintain target waiting times is relatively modest.

The projections provided in this report assume that this additional care is to be delivered through expansion of public hospital capacity. However, should capacity continue to be purchased from the private hospital system, the projected public workforce requirements would be lower. Additionally, it was outside the scope of the analysis to consider specialty requirements of those waiting and how that might affect the ability of hospitals to deal with backlogs. If backlogs are concentrated in certain specialities, they make take longer to clear as targeted recruitment may be required.

As acknowledged in this report, however, addressing waiting-list issues will require a multi-faceted approach as, in reality, backlogs for care are also related to factors such as bed shortages and a lack of theatre space and not just staffing requirements. However, the mix of staffing may also be important. For instance, there is evidence to show that expanding the role of allied healthcare professions can reduce waiting lists (Ryan et al., 2016; Mutsekwa et al., 2019) while recent Irish evidence has shown that the introduction of an AP physiotherapy-led triage service for musculoskeletal disorders reduced the number of onward consultant referrals, thus reducing waiting lists and waiting times (Fennelly et al., 2018).

While a strong focus has been placed on addressing acknowledged shortages in the Irish healthcare workforce in recent Budgets, increasing future supply to meet these demand pressures will be a challenge, given recognised difficulties with health workforce recruitment and retention nationally and internationally (Humphries et al., 2009; European Commission, 2015a; Brugha et al., 2021). It was outside the scope of this report to consider how supply can best be adjusted to meet these large projected pressures on acute workforce, but the report does offer some insights in terms of the potential to manage projected hospital demand and its delivery.

In this regard, a key element of Sláintecare relates to shifting the focus of care delivery from a hospital-centric model to one with greater access to care delivery in the community, which may have knock-on effects for additional acute workforce requirements. As modelled, an enhancement of community care services could help offset a material amount of projected additional workforce requirements, although this represents a relatively small offsetting effect relative to the projected impact of population ageing on workforce requirements. However, our assumptions are subject to uncertainty. As described in Chapter 2, while greater access to community care can be expected to increase demand for these services and their workforce, national and international evidence on the substitutability of community and acute care is mixed. This makes it challenging to model the likely impact of enhanced community care services on acute hospital demand and workforce. The method adopted in this report is to focus on resource-intensive

potentially avoidable hospitalisations for which evidence exists for treatment and prevention in the community. We believe that this offers a conceptually useful, albeit potentially conservative, approach to considering this problem. However, should greater substitutability of care be achievable, this could lead to greater mitigation of acute hospital demand (and potentially) workforce pressures than presented in this report. [47] Facilitation of greater levels of community care would also clearly have implications for additional community staffing and resourcing which was not considered in this report. However, it is planned that future analysis using Hippocrates will consider the projected workforce requirements in the community.

Moreover, this report modelled a number of grade- and skill-mix assumptions developed in consultation with key system stakeholders and policymakers. These assumptions illustrate the scope that may exist to manage projected service demand challenges through integrating different categories of acute workforce within and across staff groups to improve efficiency and quality of service delivery. Changes to grade-mix may help to manage projected demand pressures through increasing the role of assistant grades in care delivery. Changes to skill-mix may help address the recognised need to reorientate acute workforce delivery to reduce reliance on NCHDs and increase the share of nursing and HSCPs operating at advanced practice and clinical specialist level. However, the application of these assumptions was applied broadly across regions, and a notable finding from this analysis was that base-year regional grade- and skill-mix distributions differed significantly. In considering the implications of grade- and skill-mix changes, policymakers should bear in mind that there may be legitimate clinical, structural or supply-side reasons that explain this underlying variation. Policy in relation to Irish workforce planning could potentially benefit from further research in this area.

47 For example, although Ireland reports a relatively low average length of hospital stay internationally, there is evidence to show that areas with higher per capita home care supply are associated with lower average length of hospital stay, the results driven by impacts on those with the longest length of stay (Walsh et al., 2020b).

APPENDIX A

Acute public hospitals

TABLE A.1 Hospitals included in the analysis by RHA, HG and county

Regional Health Area	Hospital Group	County
AREA A		
Cappagh National Orthopaedic Hospital	Ireland East	Dublin
Mater Misericordiae University Hospital	Ireland East	Dublin
Our Lady's Hospital	Ireland East	Meath
Beaumont Hospital	RCSI	Dublin
Cavan General Hospital	RCSI	Cavan
Connolly Hospital Blanchardstown – includes CHI Connolly	RCSI	Dublin
Louth County Hospital	RCSI	Louth
Monaghan Hospital	RCSI	Monaghan
Our Lady of Lourdes Hospital	RCSI	Louth
Rotunda Hospital	RCSI	Dublin
AREA B		
Coombe Women & Infants University Hospital	Dublin Midlands	Dublin
Midland Regional Hospital, Portlaoise	Dublin Midlands	Laois
Midland Regional Hospital, Tullamore	Dublin Midlands	Offaly
Naas General Hospital	Dublin Midlands	Kildare
St. James's Hospital	Dublin Midlands	Dublin
St. Luke's Regional Oncology Network – includes St. Luke's Radiation Oncology Network centres located in Beaumont and St. James's Hospitals	Dublin Midlands	Dublin
Tallaght Hospital	Dublin Midlands	Dublin
Midland Regional Hospital, Mullingar	Ireland East	Westmeath
AREA C		
National Maternity Hospital	Ireland East	Dublin
Royal Victoria Eye and Ear Hospital	Ireland East	Dublin
St. Columcille's Hospital	Ireland East	Dublin
St. Luke's General Hospital	Ireland East	Kilkenny
St. Michael's Hospital	Ireland East	Dublin
St. Vincent's University Hospital	Ireland East	Dublin
Wexford General Hospital	Ireland East	Wexford
Kilcreene Orthopaedic Hospital	South/Southwest	Kilkenny
South Tipperary General Hospital	South/Southwest	Tipperary
University Hospital Waterford	South/Southwest	Waterford
AREA D		
Bantry General Hospital	South/Southwest	Cork
Cork University Hospital – includes Cork University Maternity Hospital	South/Southwest	Cork
Mallow General Hospital	South/Southwest	Cork
Mercy University Hospital	South/Southwest	Cork
South Infirmary Victoria University Hospital	South/Southwest	Cork
University Hospital Kerry	South/Southwest	Kerry
AREA E		
Croom Orthopaedic Hospital	UL	Limerick
St. John's Hospital	UL	Limerick
UL Hospitals, Ennis	UL	Clare
UL Hospitals, Nenagh	UL	Tipperary
University Hospital Limerick	UL	Limerick
University Maternity Hospital Limerick	UL	Limerick
AREA F		
Galway University Hospitals	Saolta	Galway
Letterkenny University Hospital	Saolta	Donegal
Mayo University Hospital	Saolta	Mayo
Portiuncula Hospital	Saolta	Galway
Roscommon County Hospital	Saolta	Roscommon
Sligo University Hospital	Saolta	Sligo

Notes: The National Rehabilitation Hospital was not part of a HG or RHA at the time the analysis was conducted so has been excluded. Other hospitals participating in HIPE that are also excluded are Peamount Hospital, Incorporated Orthopaedic Hospital, St. Finbarr's Hospital, CHI at Tallaght, Crumlin and Temple Street.

APPENDIX B

Workforce planning models: literature

The search for relevant peer-reviewed journal articles, reports, books, and government documents was conducted online, predominantly through Google Scholar and PubMed. The following search terms, among others, were used to locate relevant literature (including grey): workforce planning, workforce planning models, healthcare workforce, evaluation healthcare workforce planning. A central source was Ono et al. (2013).

TABLE B.1 Workforce planning models

County	Author (year)	Population size	Population structure		Changes in health service delivery	GDP/Health-care expend-iture growth
			Current utilisation	Changing utilisation & unmet need		
Australia	Health Workforce Australia (2014)	x	x		x	x
	Crettenden et al. (2014)	x	x		x	
	Health Workforce Australia (2012)	x	x			
	McDonnell et al. (2010)	x	x	x	x	
	Maynard (2006)	x	x	x	x	
Belgium	SPF SPSCAE (2009)[a]	x	x			
Canada	Murphy et al. (2012)	x		x		
	Singh et al. (2010)	x		x		
	Tomblin et al. (2009)[a]	x		x		
	Gupta and Basu (2007)[a]	x	x			
	Birch et al. (2007)	x	x	x		
Chile	World Bank and Ministry of Health (2010)[a]	x				
Denmark	National Board of Health (2010)[a]	x	x			
Finland	Ministry of Employment and the Economy, Ministry of Education and Culture (2011)[a]	x	x	x		x
France	Hanhijoki et al. (2009)[a]	x				
	Barlet and Marbot (2011)[a]	x				
Germany	Federal Joint Committee (2012)[a]	x	x			
	Maier and Afentakis (2010)[a]	x	x	x		
Ireland	Health Service Executive (2020)	x	x	x	x	
	Morris and Smith (2021)	x	x	x	x	
	Behan et al. (2009)[a]	x				
Israel	Ministry of Health (2010)[a]	x	x			x
Italy	Ministry of Health (Annual)[a]	x				
Japan	Expert Panel on Projection of Supply and Demand for Nurses (2010)[a]	x	x			
	National Commission on Social Security (2008)[a]	x	x		x	
	Hasegawa (2006)[a]	x	x	x		
Korea	Oh (2011)[a]	x		x		
Netherlands	Advisory Committee on Medical Manpower Planning (2010)	x	x	x	x	
Norway	Roksvaag and Texmon (2012)[a]	x	x	x	x	x
Switzerland	Ruedin et al. (2009)[a]	x	x	x	x	
	Seematter-Bagnoud et al. (2008)[a]	x	x	x	x	
UK	Anderson et al. (2021)	x	x	x	x	x
	Centre for Workforce Intelligence (2013)	x	x	x	x	
	Centre for Workforce Intelligence (2012)	x	x	x		x
US	The Cecil G. Sheps Center for Health Services Research (2012)	x	x	x		

Notes: a As cited in Ono et al. (2013).

APPENDIX C

Workforce trends

Table C.1 presents total public acute hospital WTE by staff category in 2015 and 2019, and the WTE rate per 100,000 population. The children's hospitals are included in the calculation to allow for a more accurate rate calculation.

TABLE C.1 Public acute hospital workforce (WTEs) by staff category per 100,000 population, 2015–2019

	2015		2019		Average annual growth 2015–2019 (%)	
	WTE	WTE per 100,000	WTE	WTE per 100,000	WTE	WTE per 100,000
General support	5,747	122	6,117	124	1.6	0.5
Health and social care professions	6,737	143	7,621	155	3.1	2.0
Management and administrative	7,995	170	9,049	184	3.1	2.0
Medical	7,235	154	8,553	174	4.3	3.2
Nursing and midwifery	20,409	433	23,148	471	3.2	2.1
Patient and client care	4,411	94	5,352	109	5.0	3.8
National total	**52,534**	**1,115**	**59,840**	**1,217**	**3.3**	**2.2**

Notes: Includes all hospitals listed in Appendix A and the children's hospitals to allow for more accurate population calculations.
Excludes staff classified as being on a career break, staff classified as acute hospital but not directly assigned to a hospital and ambulance service.
Source: Health Service Personnel Census – December 2015 and 2019 and ESRI population estimates.

Table C.2 presents the workforce by headcount and WTEs for each staff category under consideration in the analysis between 2015 and the base-year for the projections 2019, while Table C.3 disaggregates by HG.

TABLE C.2 Public acute hospital workforce by staff category, headcount and WTE, 2015–2019

	2015		2019		Average annual growth 2015–2019 (%)	
	Headcount	WTE	Headcount	WTE	Headcount	WTE
Medical	7,179	6,843	8,428	8,064	4.1	4.2
Nursing and midwifery	22,507	19,244	25,102	21,811	2.8	3.2
HCA and HSCA	4,656	4,138	5,597	5,047	4.7	5.1
HSCP						
Dietitians	326	289	398	345	5.1	4.6
Occupational therapists	285	264	332	306	3.9	3.8
Physiotherapists	888	793	1,041	913	4.1	3.6
Speech and language therapists	163	144	190	169	3.9	4.1
Social workers	270	244	317	292	4.1	4.6
National total	**36,274**	**31,958**	**41,405**	**36,945**	**3.4**	**3.7**

Notes: Excludes CHI Tallaght, CHI Temple Street and CHI Crumlin. For a list of the hospitals included in the analysis see Appendix A.
Excludes staff classified as on a career break.
These figures are taken directly from the Health Service Personnel Census and do not include an adjustment for agency and overtime.
Source: Health Service Personnel Census – December 2015 and 2019 and ESRI population estimates

TABLE C.3 Public acute hospital workforce (WTEs) by staff category and HG, 2015–2019

	2015	2019	Average annual growth 2015–2019
	WTE	WTE	%
Medical	**6,843**	**8,064**	**4.2**
Dublin Midlands	1,199	1,384	3.6
Ireland East	1,499	1,753	4.0
RCSI	1,158	1,390	4.7
Saolta	1,212	1,451	4.6
South/Southwest	1,346	1,532	3.3
UL	430	553	6.5
Nursing and midwifery	**19,244**	**21,811**	**3.2**
Dublin Midlands	3,557	3,992	2.9
Ireland East	4,112	4,604	2.9
RCSI	3,044	3,727	5.2
Saolta	3,278	3,617	2.5
South/Southwest	3,829	4,215	2.4
UL	1,424	1,656	3.9
HCA/HSCA	**4,138**	**5,047**	**5.1**
Dublin Midlands	1,078	1,167	2.0
Ireland East	852	949	2.7
RCSI	662	913	8.4
Saolta	661	799	4.9
South/Southwest	475	642	7.8
UL	410	577	8.9
Dietitians	**289**	**345**	**4.6**
Dublin Midlands	81	94	3.7
Ireland East	57	78	8.1
RCSI	53	57	1.6
Saolta	35	37	1.5
South/Southwest	49	62	5.9
UL	13	17	8.0
Occupational Therapists	**264**	**306**	**3.8**
Dublin Midlands	58	68	4.2
Ireland East	65	68	1.4
RCSI	56	61	1.9
Saolta	45	56	5.3
South/Southwest	37	45	4.9
UL	2	8	34.2
Physiotherapists	**793**	**913**	**3.6**
Dublin Midlands	150	160	1.6
Ireland East	182	229	5.9
RCSI	148	169	3.3
Saolta	129	141	2.2
South/Southwest	138	162	4.1
UL	46	52	3.1
Speech and Language Therapists	**144**	**169**	**4.1**
Dublin Midlands	36	39	4.9
Ireland East	29	35	7.9
RCSI	37	42	3.8
Saolta	14	16	8.3
South/Southwest	26	33	9.8
UL	3	5	25.5
Social workers	**244**	**292**	**4.6**
Dublin Midlands	70	79	3.2
Ireland East	56	70	5.9
RCSI	65	73	2.9
Saolta	23	26	3.9
South/Southwest	25	33	6.4
UL	6	11	10.4

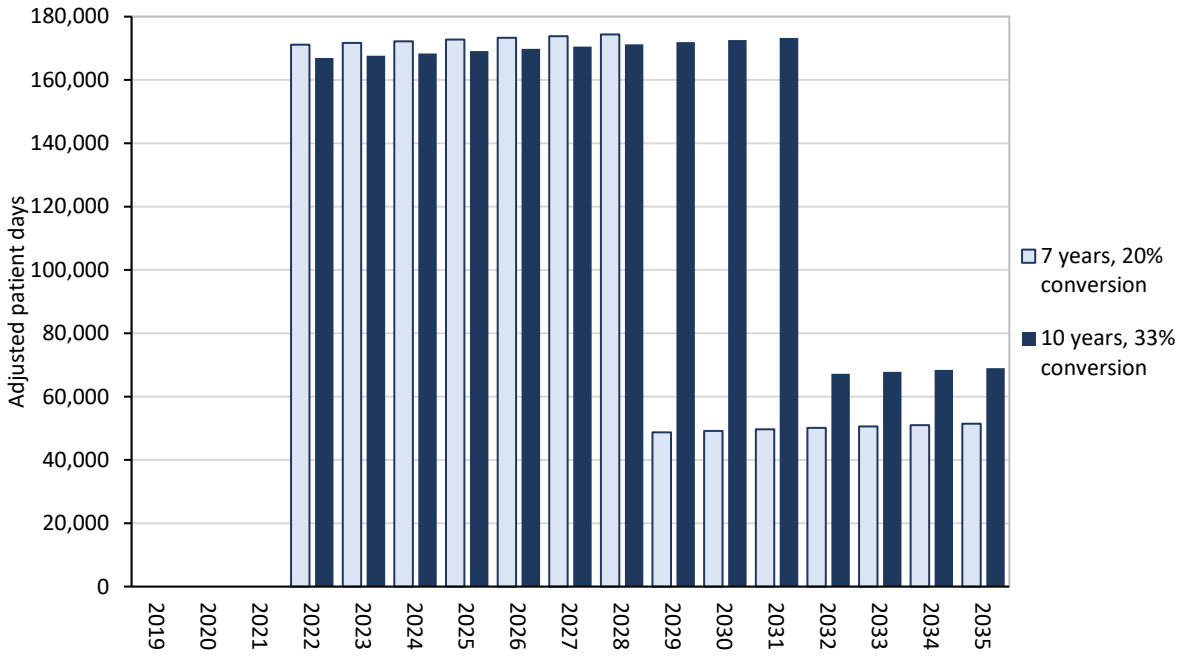
Source: Health Service Personnel Census – December 2015 and 2019.

APPENDIX D

Waiting-list management

The main waiting-list assumption in the report assumes that the backlog of cases on the waiting list is gradually reduced over a 10-year period, after which waiting times will be maintained at 12 weeks going forward by planning for additional service demand. It also assumes an OPD conversion rate, or the number of first-time OPD attendances 'converting' to day or in-patient cases, of 33.3 per cent. Figure D.1 illustrates an alternative assumption under which the backlog reduction takes place over 7 years with a lower OPD conversion rate of 20 per cent.

FIGURE D.1 Waiting-list management – additional adjusted patient day requirements



Notes: Waiting-list pressures are assumed to begin to be addressed from 2022.
Source: See section 4.4 for an overview of data sources.

APPENDIX E

Adjusted patient days

TABLE E.1 Adjusted patient days – county to RHA distribution matrix, 2019

	Regional Health Area						CHI
	Area A	Area B	Area C	Area D	Area E	Area F	
Carlow	4.6	13.4	78.6	0.4	0.2	0.1	2.7
Cavan	91.1	4.9	1.3	0.0	0.0	1.3	1.4
Clare	1.6	1.7	0.7	1.7	82.3	10.7	1.3
Cork	0.7	0.7	0.5	95.7	1.0	0.1	1.4
Donegal	2.8	3.1	1.1	0.0	0.0	91.9	1.1
Dublin	44.4	32.0	18.3	0.1	0.0	0.1	5.1
Galway	1.3	1.1	0.5	0.0	0.3	95.7	1.0
Kerry	0.9	1.0	0.5	93.6	2.1	0.2	1.6
Kildare	16.3	73.0	5.0	0.1	0.1	0.2	5.3
Kilkenny	2.9	5.8	88.3	1.1	0.1	0.0	1.8
Laois	3.7	87.9	5.0	0.2	0.5	0.3	2.4
Leitrim	15.8	10.3	1.4	0.0	0.0	70.4	2.0
Limerick	1.3	1.4	0.7	6.3	88.0	0.7	1.5
Longford	14.1	73.9	2.9	0.0	0.0	6.6	2.5
Louth	91.9	4.3	1.3	0.0	0.0	0.1	2.3
Mayo	1.7	1.0	1.1	0.0	0.1	95.1	1.0
Meath	82.4	10.5	3.4	0.0	0.0	0.2	3.5
Monaghan	90.0	5.8	1.8	0.0	0.0	0.2	2.1
Offaly	3.3	84.1	2.8	0.1	1.0	7.2	1.6
Roscommon	2.6	7.0	1.2	0.0	0.1	88.1	1.0
Sligo	1.6	2.0	0.7	0.0	0.0	94.8	0.9
Tipperary	2.3	6.2	56.8	5.8	25.9	1.5	1.5
Waterford	1.4	2.4	86.2	8.7	0.1	0.1	1.2
Westmeath	6.7	70.1	3.0	0.0	0.0	18.4	1.7
Wexford	3.1	5.6	88.7	0.7	0.0	0.1	1.8
Wicklow	3.5	18.8	72.6	0.1	0.0	0.1	4.9

Notes: Includes a category for CHI (CHI Tallaght, CHI Temple Street and CHI Crumlin) for completeness.
Day patients and same-day in-patients classified as 0.5 bed days.
For a list of the hospitals included in the analysis see Appendix A.
Source: Author calculations from HIPE, 2019.

TABLE E.2 Adjusted patient days – county to HG distribution matrix, 2019

	Hospital Group						
	Dublin Midlands	Ireland East	RCSI	Saolta	South/ Southwest	UL	CHI
Carlow	13.4	66.5	2.2	0.1	14.9	0.2	2.7
Cavan	4.6	12.6	80.0	1.3	0.1	0.0	1.4
Clare	1.6	1.4	0.9	10.7	1.7	82.3	1.3
Cork	0.7	0.6	0.3	0.1	96.0	1.0	1.4
Donegal	3.1	2.2	1.6	91.9	0.1	0.0	1.1
Dublin	31.9	34.9	27.8	0.1	0.1	0.0	5.1
Galway	1.1	0.8	0.9	95.7	0.1	0.3	1.0
Kerry	1.0	1.1	0.3	0.2	93.7	2.1	1.6
Kildare	72.4	8.5	13.3	0.2	0.3	0.1	5.3
Kilkenny	5.8	60.0	1.7	0.0	30.5	0.1	1.8
Laois	87.7	6.1	2.2	0.3	0.8	0.5	2.4
Leitrim	6.7	7.5	13.3	70.4	0.0	0.0	2.0
Limerick	1.4	1.1	0.7	0.7	6.6	88.0	1.5
Longford	21.5	60.2	9.1	6.6	0.1	0.0	2.5
Louth	4.3	8.6	84.7	0.1	0.0	0.0	2.3
Mayo	1.0	1.8	1.0	95.1	0.0	0.1	1.0

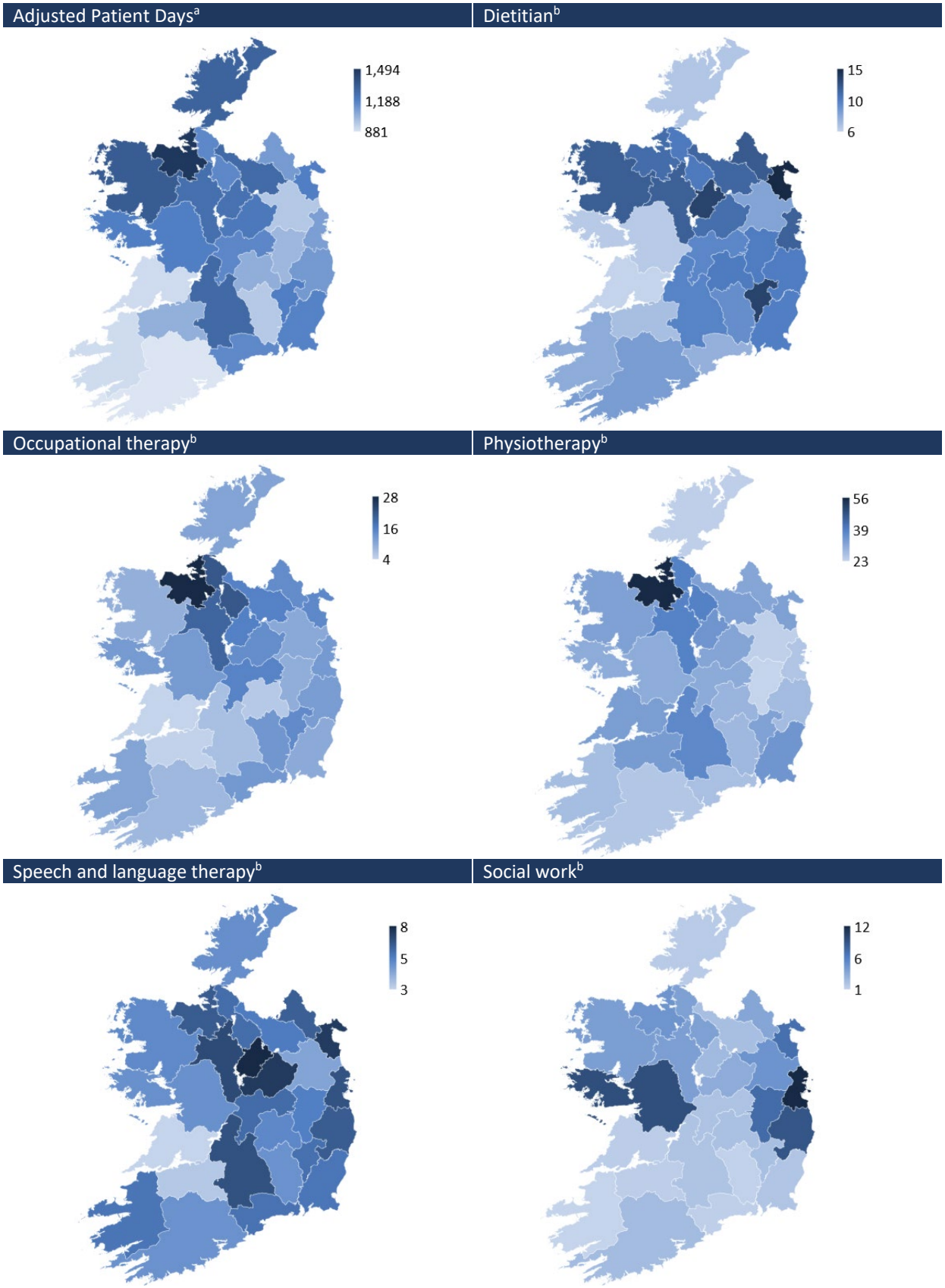
	Hospital Group						
	Dublin Midlands	Ireland East	RCSI	Saolta	South/ Southwest	UL	CHI
Meath	7.7	41.1	47.5	0.2	0.0	0.0	3.5
Monaghan	5.7	10.5	81.4	0.2	0.0	0.0	2.1
Offaly	77.5	10.7	1.9	7.2	0.1	1.0	1.6
Roscommon	4.2	4.9	1.5	88.1	0.2	0.1	1.0
Sligo	2.0	1.3	0.9	94.8	0.1	0.0	0.9
Tipperary	6.1	4.6	1.0	1.5	59.4	25.9	1.5
Waterford	2.4	2.3	0.6	0.1	93.4	0.1	1.2
Westmeath	30.9	45.8	3.1	18.4	0.1	0.0	1.7
Wexford	5.6	68.9	1.5	0.1	22.1	0.0	1.8
Wicklow	18.7	74.3	1.6	0.1	0.3	0.0	4.9

Notes: Includes a category for CHI (CHI Tallaght, CHI Temple Street and CHI Crumlin) for completeness.
Day patients and same-day in-patients classified as 0.5 bed days.
For a list of the hospitals included in the analysis see Appendix A.
Source: Author calculations from HIPE, 2019.

County-level activity profiles, on which the workforce projections are based, have been developed for 2019. For medical, nursing and midwifery, and HCA, this adjusted patient day profile is based on an aggregation of weighted ED and OPD attendances, weighted day patient discharges and in-patient bed days (see section 4.2.1). Figure E.1 illustrates the variation in the adjusted patient day rate per 1,000 population by county. In 2019 the rate was highest in the west (Mayo 1,335 and Sligo 1,494) and lowest in the southwest (Cork 881 and Kerry 909).

For the remaining professions, separate activity profiles were generated for each of the HSCPs included in the analysis. These profiles are based on service use by day and in-patient discharges during their hospital admission. Figure E.1 presents weighted discharges per 1,000 population by county. We see that the level and county distribution of the utilisation varies by service. Physiotherapy and occupational therapy are the most intensively used services. These profiles are also applied to the associated HSCAs.

FIGURE E.1 County of residence activity rate per 1,000 population, 2019



Notes: Includes CHI (CHI Tallaght, CHI Temple Street and CHI Crumlin) for completeness.
a ED attendances (weighted), OPD attendances (weighted), day patient discharges (weighted), and in-patient bed days.
b Day patient discharges (weighted) and in-patient discharges.
Source: Author calculations based on data provided by HPO, BIU Acute and ESRI population estimates.

APPENDIX F

Projected WTE requirements by grade group and grade

TABLE F.1 Medical – WTE projections by scenarios and RHA/HG, 2019–2035

	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	2	1	2	3	2
Consultants	**2,665**	**1,016**	**1,028**	**817**	**1,695**	**2.0**	**2.1**	**1.7**	**3.1**
Regional Health Area									
AREA A	671	276	279	221	427	2.2	2.2	1.8	3.1
AREA B	523	219	221	177	334	2.2	2.2	1.8	3.1
AREA C	459	180	182	145	314	2.1	2.1	1.7	3.3
AREA D	346	125	126	101	219	1.9	2.0	1.6	3.1
AREA E	181	58	59	47	124	1.7	1.8	1.5	3.3
AREA F	486	159	162	126	277	1.8	1.8	1.5	2.9
Hospital Group									
Dublin Midlands	488	206	208	166	291	2.2	2.2	1.8	3.0
Ireland East	552	226	229	182	390	2.2	2.2	1.8	3.4
RCSI	465	191	193	153	295	2.2	2.2	1.8	3.1
Saolta	486	159	162	126	277	1.8	1.8	1.5	2.9
South/Southwest	494	177	179	143	318	1.9	2.0	1.6	3.2
UL Hospitals	181	58	59	47	124	1.7	1.8	1.5	3.3
NCHD – training	**3,168**	**1,212**	**1,226**	**973**	**1,628**	**2.0**	**2.1**	**1.7**	**2.6**
Regional Health Area									
AREA A	816	337	340	269	391	2.2	2.2	1.8	2.5
AREA B	638	268	270	216	304	2.2	2.2	1.8	2.5
AREA C	548	215	217	173	302	2.1	2.1	1.7	2.8
AREA D	398	144	146	117	223	1.9	2.0	1.6	2.8
AREA E	233	74	75	60	103	1.7	1.8	1.4	2.3
AREA F	534	174	177	138	305	1.8	1.8	1.4	2.9
Hospital Group									
Dublin Midlands	592	251	253	202	264	2.2	2.2	1.9	2.3
Ireland East	701	287	290	230	334	2.2	2.2	1.8	2.5
RCSI	545	225	226	180	291	2.2	2.2	1.8	2.7
Saolta	534	174	177	138	305	1.8	1.8	1.4	2.9
South/Southwest	562	201	204	163	331	1.9	2.0	1.6	2.9
UL Hospitals	233	74	75	60	103	1.7	1.8	1.4	2.3
NCHD – non-training	**2,511**	**948**	**959**	**766**	**-767**	**2.0**	**2.0**	**1.7**	**-2.3**
Regional Health Area									
AREA A	574	240	242	193	-135	2.2	2.2	1.8	-1.7
AREA B	436	184	186	151	-94	2.2	2.2	1.9	-1.5
AREA C	463	179	181	144	-154	2.1	2.1	1.7	-2.5
AREA D	349	124	126	101	-123	1.9	1.9	1.6	-2.7
AREA E	192	61	62	50	-70	1.7	1.8	1.5	-2.8
AREA F	496	160	163	127	-191	1.8	1.8	1.4	-3.0
Hospital Group									
Dublin Midlands	368	159	160	129	-57	2.3	2.3	1.9	-1.0
Ireland East	516	213	215	173	-139	2.2	2.2	1.8	-1.9
RCSI	420	172	173	138	-116	2.2	2.2	1.8	-2.0
Saolta	496	160	163	127	-191	1.8	1.8	1.4	-3.0
South/Southwest	518	183	185	148	-193	1.9	1.9	1.6	-2.9
UL Hospitals	192	61	62	50	-70	1.7	1.8	1.5	-2.8
Medical other	**59**	**23**	**23**	**18**	**18**	**2.1**	**2.1**	**1.7**	**1.7**

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
a RHA and HG categories are too small to disaggregate.
Source: See section 4.4 for an overview of data sources.

TABLE F.2 Nursing and midwifery – WTE projections by scenarios and RHA/HG, 2019–2035

	2019	Projected additional WTE – 2035					Average annual increase 2019–2035 (%)				
		Service demand			Workforce mix		Service demand			Workforce mix	
	WTE	1	2	3	1	2	1	2	3	1	2
Advanced practitioner	**336**	**131**	**132**	**105**	**105**	**811**	**2.1**	**2.1**	**1.7**	**1.7**	**8.0**
Regional Health Area											
Area A	99	41	41	33	33	195	2.2	2.2	1.8	1.8	7.0
Area B	66	29	29	24	24	185	2.3	2.3	1.9	1.9	8.7
Area C	56	23	23	18	18	137	2.1	2.2	1.8	1.8	8.0
Area D	16	6	6	5	5	131	1.9	1.9	1.6	1.6	14.7
Area E	22	7	7	6	6	67	1.7	1.8	1.5	1.5	9.0
Area F	76	25	26	20	20	97	1.8	1.8	1.5	1.5	5.3
Hospital Group											
Dublin Midlands	65	29	29	23	23	165	2.3	2.3	1.9	1.9	8.2
Ireland East	79	32	33	26	26	169	2.2	2.2	1.8	1.8	7.4
RCSI	68	28	29	23	23	138	2.2	2.2	1.8	1.8	7.1
Saolta	76	25	26	20	20	97	1.8	1.8	1.5	1.5	5.3
South/Southwest	26	9	9	7	7	175	1.9	1.9	1.6	1.6	13.8
UL Hospitals	22	7	7	6	6	67	1.7	1.8	1.5	1.5	9.0
Clinical specialist	**866**	**333**	**337**	**268**	**268**	**1,142**	**2.1**	**2.1**	**1.7**	**1.7**	**5.4**
Regional Health Area											
Area A	221	91	92	73	73	293	2.2	2.2	1.8	1.8	5.4
Area B	163	69	69	56	56	277	2.2	2.2	1.9	1.9	6.4
Area C	200	79	80	63	63	139	2.1	2.1	1.7	1.7	3.4
Area D	81	29	30	24	24	176	1.9	2.0	1.6	1.6	7.5
Area E	55	18	18	14	14	101	1.7	1.8	1.5	1.5	6.7
Area F	146	47	48	38	38	156	1.8	1.8	1.4	1.4	4.6
Hospital Group											
Dublin Midlands	150	64	64	52	52	253	2.2	2.3	1.9	1.9	6.4
Ireland East	254	104	106	84	84	180	2.2	2.2	1.8	1.8	3.4
RCSI	135	55	56	44	44	227	2.2	2.2	1.8	1.8	6.4
Saolta	146	47	48	38	38	156	1.8	1.8	1.4	1.4	4.6
South/Southwest	126	45	45	36	36	225	1.9	1.9	1.6	1.6	6.6
UL Hospitals	55	18	18	14	14	101	1.7	1.8	1.5	1.5	6.7
Staff nurse/midwife	**16,617**	**6,321**	**6,397**	**5,094**	**3,757**	**2,572**	**2.0**	**2.1**	**1.7**	**1.3**	**0.9**
Regional Health Area											
Area A	4,046	1,670	1,686	1,341	1,013	734	2.2	2.2	1.8	1.4	1.0
Area B	3,251	1,368	1,380	1,110	1,273	984	2.2	2.2	1.9	2.1	1.7
Area C	2,909	1,135	1,147	913	354	214	2.1	2.1	1.7	0.7	0.4
Area D	2,345	841	854	684	282	76	1.9	2.0	1.6	0.7	0.2
Area E	1,255	398	406	326	428	312	1.7	1.8	1.5	1.9	1.4
Area F	2,810	909	924	721	407	252	1.8	1.8	1.4	0.8	0.5
Hospital Group											
Dublin Midlands	2,991	1,270	1,282	1,029	1,131	872	2.2	2.3	1.9	2.0	1.6
Ireland East	3,506	1,436	1,451	1,156	727	551	2.2	2.2	1.8	1.2	0.9
RCSI	2,821	1,158	1,168	929	733	518	2.2	2.2	1.8	1.5	1.1
Saolta	2,810	909	924	721	407	252	1.8	1.8	1.4	0.8	0.5
South/Southwest	3,233	1,150	1,168	934	331	67	1.9	1.9	1.6	0.6	0.1
UL Hospitals	1,255	398	406	326	428	312	1.7	1.8	1.5	1.9	1.4
Nurse/midwife (other)	**5,144**	**1,978**	**2,001**	**1,595**	**1,595**	**1,201**	**2.1**	**2.1**	**1.7**	**1.7**	**1.3**
Regional Health Area											
Area A	1,394	573	579	460	460	356	2.2	2.2	1.8	1.8	1.4
Area B	1,085	457	461	371	371	278	2.2	2.2	1.9	1.9	1.4
Area C	942	367	370	295	295	240	2.1	2.1	1.7	1.7	1.4
Area D	715	257	261	209	209	137	1.9	2.0	1.6	1.6	1.1
Area E	362	115	117	94	94	62	1.7	1.8	1.5	1.5	1.0
Area F	646	210	214	167	167	128	1.8	1.8	1.4	1.4	1.1

	2019	Projected additional WTE – 2035					Average annual increase 2019–2035 (%)				
		Service demand			Workforce mix		Service demand			Workforce mix	
	WTE	1	2	3	1	2	1	2	3	1	2
Hospital Group											
Dublin Midlands	1,004	426	430	345	345	261	2.2	2.3	1.9	1.9	1.5
Ireland East	1,148	469	473	377	377	313	2.2	2.2	1.8	1.8	1.5
RCSI	1,010	411	415	329	329	248	2.2	2.2	1.8	1.8	1.4
Saolta	646	210	214	167	167	128	1.8	1.8	1.4	1.4	1.1
South/Southwest	974	347	353	282	282	189	1.9	2.0	1.6	1.6	1.1
UL Hospitals	362	115	117	94	94	62	1.7	1.8	1.5	1.5	1.0

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
Source: See section 4.4 for an overview of data sources.

TABLE F.3 HCA and HSCA – WTE projections by scenarios and RHA/HG, 2019–2035

	2019	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2	3	1	1	2	3	1
HCA	**5,630**	**2,176**	**2,204**	**1,765**	**3,102**	**2.1**	**2.1**	**1.7**	**2.8**
Regional Health Area									
Area A	1,376	575	581	464	792	2.2	2.2	1.8	2.9
Area B	1,556	666	672	546	383	2.3	2.3	1.9	1.4
Area C	637	253	255	203	762	2.1	2.1	1.7	5.0
Area D	558	203	206	165	567	2.0	2.0	1.6	4.5
Area E	653	208	213	171	68	1.7	1.8	1.5	0.6
Area F	850	272	276	215	529	1.7	1.8	1.4	3.1
Hospital Group									
Dublin Midlands	1,378	599	604	491	389	2.3	2.3	1.9	1.6
Ireland East	1,036	431	435	349	779	2.2	2.2	1.8	3.6
RCSI	998	410	414	330	526	2.2	2.2	1.8	2.7
Saolta	850	272	276	215	529	1.7	1.8	1.4	3.1
South/Southwest	715	257	261	209	812	1.9	2.0	1.6	4.9
UL Hospitals	653	208	213	171	68	1.7	1.8	1.5	0.6
HSCA total	**77**	**43**	**43**	**37**	**176**	**2.8**	**2.8**	**2.5**	**7.7**
Regional Health Area									
Area A	25	16	16	14	49	3.2	3.2	2.8	7.0
Area B	8	6	6	5	47	3.4	3.4	3.0	12.8
Area C	6	3	3	3	38	2.8	2.8	2.5	13.4
Area D	5	2	2	2	26	2.4	2.4	2.1	12.6
Area E	7	3	3	3	5	2.3	2.3	2.0	3.1
Area F	26	13	13	11	11	2.5	2.5	2.2	2.2
Hospital Group									
Dublin Midlands	8	6	6	5	44	3.4	3.4	3.0	12.3
Ireland East	10	6	6	5	52	3.2	3.2	2.8	12.3
RCSI	18	12	12	10	32	3.1	3.1	2.8	6.5
Saolta	26	13	13	11	11	2.5	2.5	2.2	2.2
South/Southwest	8	4	4	3	33	2.5	2.5	2.2	10.7
UL Hospitals	7	3	3	3	5	2.3	2.3	2.0	3.1

Notes: 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
Waiting-list management and enhanced community care assumptions apply only to HCA staff.
a HSCA categories are too small to disaggregate.
Source: See section 4.4 for an overview of data sources.

TABLE F.4 HSCPs – WTE projections by scenario and RHA/hospital group, 2019–2035

	2019[a]	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2[b]	3	1/2	1	2	3	1/2
Dietitians	**357**	**166**	**166**	**143**	**119**	**2.4**	**2.4**	**2.1**	**1.8**
Regional Health Area									
Area A	84	42	42	36	30	2.6	2.6	2.3	2.0
Area B	103	52	52	45	38	2.6	2.6	2.3	2.0
Area C	63	30	30	26	22	2.5	2.5	2.2	1.9
Area D	50	21	21	18	14	2.2	2.2	1.9	1.6
Area E	19	7	7	6	5	2.0	2.0	1.7	1.4
Area F	38	14	14	12	10	2.0	2.0	1.7	1.4
Hospital Group									
Dublin Midlands	97	50	50	43	36	2.6	2.6	2.3	2.0
Ireland East	81	40	40	34	29	2.5	2.5	2.2	1.9
RCSI	58	29	29	25	21	2.6	2.6	2.3	2.0
Saolta	38	14	14	12	10	2.0	2.0	1.7	1.4
South/Southwest	64	26	26	22	18	2.2	2.2	1.9	1.6
UL Hospitals	19	7	7	6	5	2.0	2.0	1.7	1.4
Occupational therapists	**315**	**214**	**214**	**183**	**169**	**3.3**	**3.3**	**2.9**	**2.7**
Regional Health Area									
Area A	96	68	68	59	60	3.4	3.4	3.0	3.1
Area B	74	54	54	47	42	3.5	3.5	3.1	2.9
Area C	46	33	33	28	22	3.4	3.4	3.0	2.5
Area D	33	20	20	17	12	3.0	3.0	2.7	2.0
Area E	8	5	5	4	3	2.9	2.9	2.5	1.9
Area F	57	34	34	28	29	2.9	2.9	2.6	2.6
Hospital Group									
Dublin Midlands	70	51	51	44	40	3.5	3.5	3.1	2.9
Ireland East	71	51	51	44	40	3.4	3.4	3.0	2.8
RCSI	61	44	44	38	39	3.4	3.4	3.0	3.1
Saolta	57	34	34	28	29	2.9	2.9	2.6	2.6
South/Southwest	47	29	29	25	18	3.1	3.1	2.7	2.1
UL Hospitals	8	5	5	4	3	2.9	2.9	2.5	1.9
Physiotherapists	**938**	**494**	**494**	**425**	**372**	**2.7**	**2.7**	**2.4**	**2.1**
Regional Health Area									
Area A	261	148	148	128	113	2.8	2.8	2.5	2.3
Area B	178	105	105	91	73	2.9	2.9	2.6	2.2
Area C	172	93	93	80	63	2.7	2.7	2.4	2.0
Area D	126	58	58	49	39	2.4	2.4	2.1	1.7
Area E	57	24	24	21	23	2.2	2.2	2.0	2.1
Area F	144	65	65	55	62	2.4	2.4	2.1	2.3
Hospital Group									
Dublin Midlands	165	97	97	85	68	2.9	2.9	2.6	2.2
Ireland East	239	134	134	116	90	2.8	2.8	2.5	2.0
RCSI	166	94	94	82	74	2.9	2.9	2.5	2.3
Saolta	144	65	65	55	62	2.4	2.4	2.1	2.3
South/Southwest	168	78	78	67	56	2.4	2.4	2.1	1.8
UL Hospitals	57	24	24	21	23	2.2	2.2	2.0	2.1
Speech and language therapists	**174**	**118**	**118**	**101**	**75**	**3.3**	**3.3**	**2.9**	**2.3**
Regional Health Area									
Area A	56	39	39	33	25	3.3	3.3	2.9	2.4
Area B	43	31	31	26	20	3.4	3.4	3.0	2.4
Area C	27	19	19	16	12	3.4	3.4	3.0	2.3
Area D	26	16	16	14	10	3.1	3.1	2.7	2.1
Area E	5	3	3	3	2	3.2	3.2	2.8	2.1
Area F	16	10	10	9	6	3.1	3.1	2.7	2.0

	2019[a]	Projected additional WTE – 2035				Average annual increase 2019–2035 (%)			
		Service demand			Workforce mix	Service demand			Workforce mix
	WTE	1	2[b]	3	1/2	1	2	3	1/2
Hospital Group									
Dublin Midlands	40	28	28	24	18	3.4	3.4	3.0	2.4
Ireland East	36	26	26	22	17	3.4	3.4	3.0	2.4
RCSI	42	29	29	25	19	3.3	3.3	3.0	2.4
Saolta	16	10	10	9	6	3.1	3.1	2.7	2.0
South/Southwest	34	21	21	18	13	3.1	3.1	2.7	2.0
UL Hospitals	5	3	3	3	2	3.2	3.2	2.8	2.1
Social workers	**303**	**148**	**148**	**127**	**105**	**2.5**	**2.5**	**2.2**	**1.9**
Regional Health Area									
Area A	110	57	57	49	41	2.6	2.6	2.3	2.0
Area B	82	43	43	37	31	2.7	2.7	2.4	2.0
Area C	42	22	22	19	16	2.6	2.6	2.3	2.0
Area D	30	8	8	7	5	1.5	1.5	1.3	0.9
Area E	12	3	3	3	2	1.6	1.6	1.2	0.9
Area F	27	15	15	12	10	2.8	2.8	2.4	2.1
Hospital Group									
Dublin Midlands	82	43	43	37	31	2.7	2.7	2.4	2.0
Ireland East	73	39	39	33	28	2.7	2.7	2.4	2.1
RCSI	75	39	39	34	28	2.6	2.6	2.3	2.0
Saolta	27	15	15	12	10	2.8	2.8	2.4	2.1
South/Southwest	34	9	9	7	5	1.5	1.5	1.3	0.9
UL Hospitals	12	3	3	3	2	1.6	1.6	1.2	0.9

Notes: a 2019 WTE adjusted to account for the contribution of overtime and agency (see section 4.2.4).
b No waiting-list or enhanced community care assumptions are modelled for HSCP grades.
Source: See section 4.4 for an overview of data sources.

REFERENCES

Advisory Committee on Medical Manpower Planning (2010). The 2010 Recommendations for Medical Specialist Training. Capaciteitsorgaan, The Netherlands. https://capaciteitsorgaan.nl/app/uploads/2016/01/2010_Recommendations-for-medical-spec-training_Netherlands.pdf.

Aiken, L.H., D. Sloane, P. Griffiths, A.M. Rafferty, L. Bruyneel, M. McHugh, C.B. Maier, T. Moreno-Casbas, J.E. Ball, D. Ausserhofer and W. Sermeus (2017). 'Nursing skill mix in European hospitals: cross-sectional study of the association with mortality, patient ratings, and quality of care'. BMJ Quality & Safety 26(7): 559-568. 10.1136/bmjqs-2016-005567.

Anderson, M., C. Dobkin and T. Gross (2012). 'The Effect of Health Insurance Coverage on the Use of Medical Services'. American Economic Journal: Economic Policy 4(1): 1-27.

Anderson, M., C. O'Neill, J.M. Clark, A. Street, M. Woods, C. Johnston-Webber, A. Charlesworth, M. Whyte, M. Foster and A. Majeed (2021). 'Securing a sustainable and fit-for-purpose UK health and care workforce'. The Lancet 397(10288): 1992-2011.

Ansari, Z., S.I. Haider, H. Ansari, T. de Gooyer and C. Sindall (2012). 'Patient characteristics associated with hospitalisations for ambulatory care sensitive conditions in Victoria, Australia'. BMC Health Serv Res 12: 475. https://doi.org/10.1186/1472-6963-12-475.

Astolfi, R., L. Lorenzoni and J. Oderkirk (2012). 'Informing policy makers about future health spending: a comparative analysis of forecasting methods in OECD countries'. Health Policy 107(1): 1-10. https://doi.org/10.1016/j.healthpol.2012.05.001.

Australian Institute on Health and Welfare (2020). National Healthcare Agreement: PI 18– Selected potentially preventable hospitalisations, 2019. Retrieved 29 July, 2020, https://meteor.aihw.gov.au/content/index.phtml/itemId/698904.

Bai, G. and G.F. Anderson (2016). 'A More Detailed Understanding Of Factors Associated With Hospital Profitability'. Health Aff (Millwood) 35(5): 889-897. https://doi.org/10.1377/hlthaff.2015.1193.

Baicker, K., S.L. Taubman, H.L. Allen, M. Bernstein, J.H. Gruber, J.P. Newhouse, E.C. Schneider, B.J. Wright, A.M. Zaslavsky, A.N. Finkelstein and G. Oregon Health Study (2013). 'The Oregon experiment--effects of Medicaid on clinical outcomes'. N Engl J Med 368(18): 1713-1722. https://doi.org/10.1056/NEJMsa1212321.

Bergin, A. and A. García-Rodríguez (2020). Regional Demographics and Structural Housing Demand at a County Level. Research Series Number 111. Economic and Social Research Institute, Dublin.

Bergin, A., A. García-Rodríguez, N. McInerney and E. Morgenroth (2016). Baseline: Methodology, Assumptions and Projections. Ireland's Economic Outlook. Dublin: Economic and Social Research Institute.

Birch, S., G. Kephart, G. Tomblin-Murphy, L. O'Brien-Pallas, R. Alder and A. MacKenzie (2007). 'Human resources planning and the production of health: a needs-based analytical framework'. Canadian Public Policy 33(Supplement 1): S1-S16.

Blanco-Moreno, A., R.M. Urbanos-Garrido and I.J. Thuissard-Vasallo (2013). 'Public healthcare expenditure in Spain: measuring the impact of driving factors'. Health Policy 111(1): 34-42. https://doi.org/10.1016/j.healthpol.2013.03.012.

Brady, A., J. Drennan, N. Elliott, S. Fleming, L. Daly, J. Varley, E. Savage, J. Hegarty, E. Lehane, P. Cotter, S. Rogerson, D. O'Reilly and D. Bryant-Lukosius (2020). Evaluation of the impact of implementing a draft policy to develop advanced nurse practitioners (cANPs/RANPs) to meet health service needs. Trinity College Dublin and University College Cork. https://healthservice.hse.ie/filelibrary/onmsd/final-evaluation-report-on-the-impact-of-implementing-the-draft-policy-on-graduate-specialist-and-advanced-nursing-practice.pdf.

Brick, A. and S. Connolly (2021). 'Waiting Times for Publicly Funded Hospital Treatment: How does Ireland Measure Up?'. Economic and Social Review 52(1): 41-52.

Brick, A. and C. Keegan (2020a). Paying more to wait less: Estimating the cost of reducing Ireland's public hospital waiting lists. Working Paper Series Number 688. Economic and Social Research Institute, Dublin, https://www.esri.ie/system/files/publications/WP688_0.pdf.

Brick, A. and C. Keegan (2020b). Utilisation of Public Acute Hospital Services in Ireland - Baseline Analysis for the Hippocrates Model. Survey and Statistical Report Series

Number 100. Economic and Social Research Institute Dublin. https://doi.org/10.26504/sustat100.

Brick, A., C. Keegan and M.A. Wren (2020a). Utilisation of Specialist Disability Services in Ireland - Baseline Analysis for the Hippocrates Model. Survey and Statistical Report Series Number 89. Economic and Social Research Institute Dublin. https://doi.org/10.26504/sustat89.

Brick, A., C. Keegan and M.A. Wren (2020b). Utilisation of Specialist Mental Health Services in Ireland - Baseline Analysis for the Hippocrates Model. Survey and Statistical Report Series Number 90. Economic and Social Research Institute Dublin. https://doi.org/10.26504/sustat90.

Brugha, R., N. Clarke, L. Hendrick and J. Sweeney (2021). 'Doctor Retention: A Cross-sectional Study of How Ireland Has Been Losing the Battle'. International Journal of Health Policy and Management 10(6): 299-309. 10.34172/ijhpm.2020.54.

Buchan, J. and M.R. Dal Poz (2002). 'Skill mix in the health care workforce: reviewing the evidence'. Bull World Health Organ 80(7): 575-580.

Butler, M., T.J. Schultz, P. Halligan, A. Sheridan, L. Kinsman, T. Rotter, J. Beaumier, R.G. Kelly and J. Drennan (2019). 'Hospital nurse-staffing models and patient-and staff-related outcomes'. Cochrane Database of Systematic Reviews(4).

Central Statistics Office (2019). Regional Population Projections 2017-2036. Central Statistics Office, Dublin.

Centre for Workforce Intelligence (2012). A Strategic Review of the Future Healthcare Workforce: Informing Medical and Dental Student Intakes. Centre for Workforce Intelligence, United Kingdom. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/507390/CfWI_healthcare_workforce_medical_and_dental_student_intakes.pdf.

Centre for Workforce Intelligence (2013). Future Nursing Workforce Projections—Starting the Discussion. Centre for Workforce Intelligence, United Kingdom. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/507491/CfWI_Future_nursing_workforce_projections_acc.pdf

Charlesworth, A. and P. Johnson, Eds. (2018). Securing the future: funding health and social care to the 2030s. London, England, The Institute for Fiscal Studies.

Cleverley, W.O. and J.O. Cleverley (2011). 'A better way to measure volume--and benchmark costs'. Healthc Financ Manage 65(3): 78-82, 84, 86.

Connolly, S., A. Nolan, B. Walsh and M. Wren (2018). 'Universal GP Care in Ireland: Potential Cost Implications'. Econ Soc Rev 49(1): 93-91.99, https://www.esr.ie/article/view/871.

Crettenden, I.F., M.V. McCarty, B.J. Fenech, T. Heywood, M.C. Taitz and S. Tudman (2014). 'How evidence-based workforce planning in Australia is informing policy development in the retention and distribution of the health workforce'. Human Resources for Health 12(1): 1-13.

de la Maisonneuve, C. and J. Martins Oliveira (2015). The future of health and long-term care spending. OECD Journal: Economic Studies. OECD. https://dx.doi.org/10.1787/eco_studies-2014-5jz0v44s66nw.

Department of Health (2017). Working Together for Health: A National Strategic Framework for Health and Social Care Workforce Planning. Department of Health, Dublin.

Department of Health (2019). A Policy on the Development of Graduate to Advanced Nursing and Midwifery Practice. Department of Health, Dublin. https://assets.gov.ie/19260/f49c5ea1a19843b0aae20151aeaf694d.pdf.

Department of Public Expenditure and Reform (2020). Our Public Services 2020: Strategic Workforce Planning Guide. Department of Public Expenditure and Reform, Dublin. https://www.ops.gov.ie/app/uploads/2020/12/OPS2020-Strategic-Workforce-Planning-Guide.pdf.

Drennan, J., J. Hegarty, E. Savage, N. Brady, C. Prendergast, V. Howson, A. Murphy and K. Spilsbury (2018). Provision of the Evidence to Inform the Future Education, Role and Function of Health Care Assistants in Ireland. University College Cork. https://www.hse.ie/eng/staff/resources/hrstrategiesreports/health-care-assistant-literature-review-2018.pdf.

European Commission (2008). The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies. European Commission, Brussels https://ec.europa.eu/economy_finance/publications/pages/publication13782_en.pdf.

European Commission (2011). The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies. European Commission, Brussels.

European Commission (2014). The 2015 Ageing Report: Underlying Assumptions and Projection Methodologies. European Commission, Brussels. https://doi.org/10.2765/76255.

European Commission (2015a). Recruitment and Retention of the Health Workforce in Europe. European Commission, Brussels. http://www.sedda.ie/news&events/2015 Jul - Sept/2015_healthworkforce_recruitment_retention.pdf.

European Commission (2015b). The 2015 Ageing Report: Economic and budgetary projections for the 28 EU Member States (2013-2060). European Commission, Brussels. https://doi.org/10.2765/877631.

European Commission (2017). The 2018 Ageing Report: Underlying Assumptions and Projection Methodologies. European Commission, Brussels https://doi.org/10.2765/286359.

Fennelly, O., C. Blake, O. FitzGerald, R. Breen, J. Ashton, A. Brennan, A. Caffrey, F. Desmeules and C. Cunningham (2018). 'Advanced practice physiotherapy-led triage in Irish orthopaedic and rheumatology services: national data audit'. BMC Musculoskeletal Disorders 19(1): 181. https://doi.org/10.1186/s12891-018-2106-7.

Fries, J.F. (1980). 'Aging, natural death, and the compression of morbidity'. N Engl J Med 303(3): 130-135. https://doi.org/10.1056/NEJM198007173030304.

Gibson, O.R., L. Segal and R.A. McDermott (2013). 'A systematic review of evidence on the association between hospitalisation for chronic disease related ambulatory care sensitive conditions and primary health care resourcing'. BMC Health Serv Res 13: 336. https://doi.org/10.1186/1472-6963-13-336.

Government of Ireland (2018). Sláintecare Implementation Strategy, Dublin. https://assets.gov.ie/9914/3b6c2faf7ba34bb1a0e854cfa3f9b5ea.pdf.

Government of Ireland (2019). Minister for Health confirms restructuring of health services and delivers key Sláintecare commitment. Retrieved 22 June, 2021, https://www.gov.ie/en/press-release/95394a-minister-for-health-confirms-restructuring-of-health-services-and-de/.

Government of Ireland (2020). Expenditure Report 2021 Part II – Expenditure Allocations 2021. Government of Ireland, Dublin. http://budget.gov.ie/Budgets/2021/Documents/Budget/Part II -Expenditure Allocations 2021.pdf.

Government of Ireland (2021). Sláintecare Implementation Strategy and Action Plan 2021-2023, Dublin, Ireland. https://www.gov.ie/ga/foilsiuchan/6996b-slaintecare-implementation-strategy-and-action-plan-2021-2023/.

Griffiths, P., A. Maruotti, A. Recio Saucedo, O.C. Redfern, J.E. Ball, J. Briggs, C. Dall'Ora, P.E. Schmidt and G.B. Smith (2019). 'Nurse staffing, nursing assistants and hospital mortality: retrospective longitudinal cohort study'. BMJ Quality & Safety 28(8): 609-617. https://doi.org/10.1136/bmjqs-2018-008043.

Health Service Executive (2018). Review of Role and Function of Health Care Assistants.

Health Service Executive (2020). Intensive Care Medicine Workforce Plan. National Doctors Training and Planning. HSE, Dublin, Ireland. https://www.hse.ie/eng/staff/leadership-education-development/met/plan/specialty-specific-reviews/icm-workforce-plan-2020-final-report.pdf.

Health Service Executive (2021). HSCP Deliver: A Strategic Guidance Framework for Health & Social Care Professions 2021-2026. HSE, Dublin. https://www.hse.ie/eng/about/who/cspd/health-and-social-care-professionals/hscp-strategic-framework/hscp-deliver-a-strategic-guidance-framework-for-hscp-2021-2026.pdf.

Health Service Executive (2022). National Service Plan 2022. Health Service Executive, Dublin, https://www.hse.ie/eng/services/publications/serviceplans/hse-national-service-plan-2022.pdf.

Health Workforce Australia (2012). Health workforce 2025: Doctors, nurses and midwives. Adelaide, Health Workforce Australia.

Health Workforce Australia (2014). Australia's future health workforce-Nurses overview report. Health Workforce Australia, Adelaide. https://www.health.gov.au/sites/

default/files/documents/2021/03/nurses-australia-s-future-health-workforce-reports-overview-report.pdf.

Healthcare Pricing Office (2019). Activity in Acute Public Hospitals in Ireland Annual Report, 2018. Health Service Executive, Dublin, http://www.hpo.ie/latest_hipe_nprs_reports/HIPE_2018/HIPE_Report_2018.pdf.

Healthcare Pricing Office (2020). Activity in Acute Public Hospitals in Ireland Annual Report, 2019. Health Service Executive, Dublin, http://hpo.ie/latest_hipe_nprs_reports/HIPE_2019/HIPE_Report_2019.pdf.

Henry, E., A. Brick and C. Keegan (2020). Utilisation of Dental and Optical Services in Ireland - Baseline Analysis for the Hippocrates Model. Survey and Statistical Report Series Number 99. Economic and Social Research Institute Dublin. https://doi.org/10.26504/sustat99.

Higgins, J.R. (2013). The Establishment of Hospital Groups as a transition to Independent Hospital Trusts Department of Health, Dublin, http://health.gov.ie/wp-content/uploads/2014/03/IndHospTrusts.pdf.

Houses of the Oireachtas Committee on the Future of Healthcare (2017). Sláintecare Report. Houses of the Oireachtas, Dublin. http://www.oireachtas.ie/parliament/media/committees/futureofhealthcare/Oireachtas-Committee-on-the-Future-of-Healthcare-Slaintecare-Report-300517.pdf.

Htay, M. and D. Whitehead (2021). 'The effectiveness of the role of advanced nurse practitioners compared to physician-led or usual care: A systematic review'. International Journal of Nursing Studies Advances 3: 100034. https://doi.org/10.1016/j.ijnsa.2021.100034.

Humphries, N., R. Brugha and H. McGee (2009). '"I won't be staying here for long": a qualitative study on the retention of migrant nurses in Ireland'. Human Resources for Health 7(1): 68. 10.1186/1478-4491-7-68.

Kaestner, R. and A.T. Lo Sasso (2015). 'Does seeing the doctor more often keep you out of the hospital?'. J Health Econ 39: 259-272. https://doi.org/10.1016/j.jhealeco.2014.08.003.

Keegan, C., A. Brick, A. Bergin, M.-A. Wren, E. Henry and R. Whyte (2020). Projections of Expenditure for Public Hospitals in Ireland, 2018-2035, Based on the Hippocrates Model. ESRI Research Series Report 117. ESRI, Dublin. https://doi.org/10.26504/rs117.

Keegan, C., A. Brick, E. Henry and A. Bergin (2021). 'Projected private hospital expenditure in Ireland, 2018-2035: What role for demographics, cost, and Sláintecare?'. Int J Health Plann Manage. https://doi.org/10.1002/hpm.3381.

Keegan, C., A. Brick, B. Walsh, A. Bergin, J. Eighan and M. Wren (2018a). 'How many beds? Capacity implications of hospital care demand projections in the Irish hospital system, 2015-2030'. The International Journal of Health Planning and Management 34(1). https://doi.org/10.1002/hpm.2673.

Keegan, C., S. Connolly and M.-A. Wren (2018b). 'Measuring healthcare expenditure: different methods, different results'. Irish Journal of Medical Science (1971 -) 187(1): 13-23. https://doi.org/10.1007/s11845-017-1623-y.

Kinsella, S. and R. Kiersey (2016). Health Workforce Planning Models, Tools and Processes in Five Countries: An Evidence Review. Health Research Board, Dublin.

Kolstad, J.T. and A.E. Kowalski (2012). 'The Impact of Health Care Reform on Hospital and Preventive Care: Evidence from Massachusetts'. J Public Econ 96(11-12): 909-929. https://doi.org/10.1016/j.jpubeco.2012.07.003.

Kostarakos, I., C. O'Toole and A. Garcia Rodriguez (forthcoming). Testing the Determinants of County House Prices in Ireland.

Laurence, C.O. and J. Karnon (2016). 'Improving the planning of the GP workforce in Australia: a simulation model incorporating work transitions, health need and service usage'. Hum Resour Health 14: 13. https://doi.org/10.1186/s12960-016-0110-2.

Lorenzoni, L., A. Marino, D. Morgan and C. James (2019). Health Spending Projections to 2030: New results based on a revised OECD methodology. OECD Health Working Paper No. 110. OECD, Paris.

Maynard, A. (2006). 'Medical Workforce Planning: Some Forecasting Challenges'. Australian Economic Review 39(3): 323-329. https://doi.org/10.1111/j.1467-8462.2006.00422.x.

McDarby, G. and B. Smyth (2019). 'Identifying priorities for primary care investment in Ireland through a population-based analysis of avoidable hospital admissions for ambulatory care sensitive conditions (ACSC)'. BMJ Open 9(11): e028744. https://doi.org/10.1136/bmjopen-2018-028744.

McDonnell, G., D. Lyell, K. Masnick, I. Asangansi and J. Dewdney (2010). 'Linking clinical workforce skill mix planning to health and health care dynamics'. Human Resources for Health.

Morris, R. and M. Smith (2021). Demand for medical consultants and specialists to 2028 and the training pipeline to meet demand: A high level stakeholder informed analysis. National Doctor Training Programme, Health Service Executive, https://www.hse.ie/eng/staff/leadership-education-development/met/plan/demand-for-medical-consultants-and-specialists-to-2028.pdf.

Murphy, G.T., S. Birch, A. MacKenzie, R. Alder, L. Lethbridge and L. Little (2012). 'Eliminating the shortage of registered nurses in Canada: an exercise in applied needs-based planning'. Health Policy 105(2-3): 192-202. https://doi.org/10.1016/j.healthpol.2011.11.009.

Mutsekwa, R.N., R. Canavan, A. Whitfield, A. Spencer and R.L. Angus (2019). 'Dietitian first gastroenterology clinic: an initiative to reduce wait lists and wait times for gastroenterology outpatients in a tertiary hospital service'. Frontline Gastroenterology 10(3): 229. https://doi.org/10.1136/flgastro-2018-101063.

National Centre for Classification in Health (2013a). Volume 3: ACHI Tabular List of Procedures. The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM). Sydney: National Centre for Classification in Health.

National Centre for Classification in Health (2013b). Volume 5: Australian Coding Standards for ICD-10-AM. The International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Australian Modification (ICD-10-AM). Sydney: National Centre for Classification in Health.

NDTP (2014). NDTP Medical Workforce Planning Ireland: A Stepwise Approach. Health Service Executive, Dublin, https://www.hse.ie/eng/staff/leadership-education-development/met/plan/medical workforce planning ireland a step wise approach.pdf.

Newhouse, J.P. (1993). Free for All? Lessons from the Rand Health Insurance Experiment. Cambridge, MA, Harvard University Press.

NHS Digital (2019). Hospital Episode Statistics for England. Outpatient statistics, 2018-19. Health and Social Care Information Centre, https://digital.nhs.uk/data-and-information/publications/statistical/hospital-outpatient-activity/2018-19.

Nolan, A. (2008). 'Evaluating the impact of eligibility for free care on the use of general practitioner (GP) services: A difference-in-difference matching approach'. Soc Sci Med 67(7): 1164-1172. https://doi.org/10.10.1016/j.socscimed.2008.06.021.

Nolan, A. (2011). 'An extension in eligibility for free primary care and avoidable hospitalisations: a natural experiment'. Soc Sci Med 73(7): 978-985. https://doi.org/10.1016/j.socscimed.2011.06.057.

Nolan, A. and S. Smith (2012). 'The effect of differential eligibility for free GP services on GP utilisation in Ireland'. Soc Sci Med 74(10): 1644-1651. https://doi.org/10.1016/j.socscimed.2012.02.007.

OECD (2019). Health at a Glance 2019: OECD Indicators. OECD Publishing, Paris. https://doi.org/10.1787/4dd50c09-en.

OECD/European Observatory on Health Systems and Policies (2021). Ireland: Country Health Profile 2021. State of Health in the EU, OECD Publishing Paris/European Observatory on Health Systems and Policies, Brussels.

Ono, T., G. Lafortune and M. Schoenstein (2013). Health workforce planning in OECD countries: a review of 26 projection models from 18 countries. OECD, Paris. OECD Health Working Papers No. 62, https://doi.org/10.1787/18152015.

PA Consulting (2018). Health Service Capacity Review 2018. Department of Health, Dublin, Ireland.

Przywara, B. (2010). Projecting future health care expenditure at European level: drivers, methodology and main results. European Commission, Brussels, http://ec.europa.eu/economy_finance/publications/economic_paper/2010/pdf/ecp417_en.pdf.

Rosano, A., C.A. Loha, R. Falvo, J. van der Zee, W. Ricciardi, G. Guasticchi and A.G. de Belvis (2013). 'The relationship between avoidable hospitalization and accessibility to primary care: a systematic review'. Eur J Public Health 23(3): 356-360. https://doi.org/10.1093/eurpub/cks053.

Ryan, D., F. Pelly and E. Purcell (2016). 'The activities of a dietitian-led gastroenterology clinic using extended scope of practice'. BMC Health Services Research 16(1): 604. https://doi.org/10.1186/s12913-016-1845-0.

Segal, L. and T. Bolton (2009). 'Issues facing the future health care workforce: the importance of demand modelling'. Aust New Zealand Health Policy 6: 12. https://doi.org/10.1186/1743-8462-6-12.

Shaw, G. (2020). 'National clinical programmes in the Republic of Ireland: a qualitative study of acute hospitals'. Journal of Research in Nursing 25(5): 421-440. 10.1177/1744987119893014.

Sheridan, A., F. Howell and D. Bedford (2012). 'Hospitalisations and costs relating to ambulatory care sensitive conditions in Ireland'. Ir J Med Sci 181(4): 527-533. https://doi.org/10.1007/s11845-012-0810-0.

Simkin, S., C. Chamberland-Rowe and I.L. Bourgeault (2021). 'An integrated primary care workforce planning toolkit at the regional level (part 2): quantitative tools compiled for decision-makers in Toronto, Canada'. Human Resources for Health 19(1): 86. https://doi.org/10.1186/s12960-021-00595-y.

Singh, D.L., H , B. Kralj, E. Newman, J. Goodyear, D. Hellyer and J. Tepper (2010). Ontario Population Needs-Based Physician Simulation Model. Ministry of Health and Long-Term Care and the Ontario Medical Association.

Socha-Dietrich, K. (2019). Engaging and transforming the health workforce. Health in the 21st Century. OECD.

Spetz, J., N. Donaldson, C. Aydin and D.S. Brown (2008). 'How many nurses per patient? Measurements of nurse staffing in health services research'. Health services research 43(5 Pt 1): 1674-1692. https://doi.org/10.1111/j.1475-6773.2008.00850.x.

Taskforce on Staffing and Skill Mix for Nursing (2018). Framework for Safe Nurse Staffing and Skill Mix in General and Specialist Medical and Surgical Care Settings in Adult Hospitals in Ireland 2018: Final Report and Recommendations by the Taskforce on Staffing and Skill Mix for Nursing. Department of Health, Dublin, https://assets.gov.ie/10054/14bb1eb59fc04bfb9fb9bffd9d2ee352.pdf.

Taskforce on Staffing and Skill Mix for Nursing (2022). Framework for Safe Nurse Staffing and Skill Mix in Adult Emergency Care Settings in Ireland 2022: Final Report and Recommendations by the Taskforce on Staffing and Skill Mix for Nursing. Department of Health, Dublin, https://assets.gov.ie/226687/1a13b01a-83a3-4c06-875f-010189be1e22.pdf.

Teljeur, C., S. Thomas, F.D. O'Kelly and T. O'Dowd (2010). 'General practitioner workforce planning: assessment of four policy directions'. BMC Health Serv Res 10: 148. https://doi.org/10.1186/1472-6963-10-148.

The Cecil G. Sheps Center for Health Services Research (2012). Developing an Open-Source Model for Projecting Physician Shortages in the United States. University of North Carolina. University of North Carolina, Chapel Hill, North Carolina.

The Health Foundation (2021). Have integrated care programmes reduced emergency admissions? Lessons for Integrated Care Systems (ICSs). 2022, https://www.health.org.uk/publications/long-reads/have-integrated-care-programmes-reduced-emergency-admissions.

Tyrrell, E., C. Keegan, N. Humphries, S. McAleese, S. Thomas, C. Normand and R. Brugha (2016). 'Predictors of career progression and obstacles and opportunities for non-EU hospital doctors to undertake postgraduate training in Ireland'. Hum Resour Health 14(Suppl 1): 23. https://doi.org/10.1186/s12960-016-0120-0.

Van Greuningen, M., R.S. Batenburg and L.F. Van der Velden (2012). 'Ten years of health workforce planning in the Netherlands: a tentative evaluation of GP planning as an example'. Hum Resour Health 10: 21. https://doi.org/10.1186/1478-4491-10-21.

van Loenen, T., M.J. van den Berg, G.P. Westert and M.J. Faber (2014). 'Organizational aspects of primary care related to avoidable hospitalization: a systematic review'. Fam Pract 31(5): 502-516. https://doi.org/10.1093/fampra/cmu053.

Walsh, B., C. Keegan, A. Brick, S. Connolly, A. Bergin, M.-A. Wren, S. Lyons, L. Hill and S. Smith (2021). Projections of Expenditure for Primary, Community and Long-term Care in Ireland 2019–2035, Based on the Hippocrates Model. ESRI Research Series 126. Economic and Social Research Institute, Dublin. https://doi.org/10.26504/rs126.

Walsh, B., C. Keegan, A. Brick and S. Lyons (2020a). How is Ireland's healthcare system coping with coronavirus? Retrieved 22 October, 2020, https://www.coronavirusandtheeconomy.com/question/how-irelands-healthcare-system-coping-coronavirus.

Walsh, B., S. Lyons, S. Smith, M.A. Wren, J. Eighan and E. Morgenroth (2020b). 'Does formal home care reduce inpatient length of stay?'. Health Econ. https://doi.org/10.1002/hec.4158.

Walsh, B., A. Nolan, A. Brick and C. Keegan (2019). 'Did the expansion of free GP care impact demand for Emergency Department attendances? A difference-in-differences analysis'. Soc Sci Med 222: 101-111. https://doi.org/10.1016/j.socscimed.2018.12.029.

Wanless, D. (2002). Securing our Future Health: Taking a Long-Term View. HM Treasury Office of Budget Responsibility, London, http://www.yearofcare.co.uk/sites/default/files/images/Wanless.pdf.

Wren, M.A., C. Keegan, B. Walsh, A. Bergin, J. Eighan, A. Brick, S. Connolly, D. Watson and J. Banks (2017). Projections of Demand for Healthcare in Ireland, 2015-2030. First Report from the Hippocrates Model. ESRI Research Series No. 67. Economic and Social Research Institute Dublin.

Whitaker Patrons and Corporate Members

The ESRI plays a leading role in producing independent research which allows policymakers in Ireland to better understand the economic and social landscape which shapes Ireland. One goal of the ESRI is to ensure that the Institute has a strong revenue stream to fund valuable, independent social and economic research initiatives that will have a long-term impact on Irish society. In 2021, we launched a compelling new membership programme with two categories of membership:

1) Whitaker Patron and
2) Corporate Membership

We would like to acknowledge the following organisations and thank them for their valuable support:

WHITAKER PATRONS

EirGrid
ICON
Davy
ESB
Intel
Microsoft
Kingspan
Meta

CORPORATE MEMBERSHIP

Musgrave Group
OHM Group (Jaguar)
Tesco
Enterprise Ireland
Matheson
PwC
ABP Food Group
KPMG
Ibec
DCC
Department of Transport
FBD Insurance
Department of Further and Higher Education, Research, Innovation and Science
IDA Ireland
Irish Water
Greencoat Capital
Malin
Fáilte Ireland
SIPTU
Bord Gáis Energy
Department of Agriculture, Food and the Marine
Irish Farmers' Association
Irish Life
National Treasury Management Agency
Department of Foreign Affairs

Whitaker Square,
Sir John Rogerson's Quay,
Dublin 2
Telephone **+353 1 863 2000**
Email **admin@esri.ie**
Web **www.esri.ie**
Twitter **@ESRIDublin**

ESRI ECONOMIC & SOCIAL RESEARCH INSTITUTE