

Keegan, Conor et al.

Research Report

Projections of expenditure for public hospitals in Ireland, 2018-2035, based on the Hippocrates Model

Research Series, No. 117

Provided in Cooperation with:

The Economic and Social Research Institute (ESRI), Dublin

Suggested Citation: Keegan, Conor et al. (2020) : Projections of expenditure for public hospitals in Ireland, 2018-2035, based on the Hippocrates Model, Research Series, No. 117, The Economic and Social Research Institute (ESRI), Dublin, <https://doi.org/10.26504/rs117>

This Version is available at:

<https://hdl.handle.net/10419/249094>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

RESEARCH
SERIES
NUMBER 117
December
2020

PROJECTIONS OF EXPENDITURE FOR PUBLIC HOSPITALS IN IRELAND, 2018–2035, BASED ON THE HIPPOCRATES MODEL

CONOR KEEGAN, AOIFE BRICK, ADELE BERGIN,
MAEV-ANN WREN, EDWARD HENRY AND RICHARD WHYTE



PROJECTIONS OF EXPENDITURE FOR PUBLIC HOSPITALS IN IRELAND, 2018–2035, BASED ON THE HIPPOCRATES MODEL

Conor Keegan

Aoife Brick

Adele Bergin

Maev-Ann Wren

Edward Henry

Richard Whyte

December 2020

RESEARCH SERIES

NUMBER 117

Available to download from www.esri.ie

© The Economic and Social Research Institute and the Minister for Health

DOI: <https://doi.org/10.26504/rs117>



This Open Access work is licensed under a Creative Commons Attribution 4.0 International License (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited

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 and Aoife Brick are Research Officers at the ESRI and Adjunct Assistant Professors at Trinity College Dublin. Adele Bergin is an Associate Research Professor at the ESRI, an Adjunct Professor at Trinity College Dublin and a Research Fellow at IZA Bonn. Maev-Ann Wren is a Senior Research Officer at the ESRI and an Adjunct Associate Professor at Trinity College Dublin. Edward Henry and Richard Whyte were Research Assistants at the ESRI when contributing to this work.

ACKNOWLEDGEMENTS

Financial support for this research was provided by the Department of Health. The authors thank the members of the Steering Group of the ESRI Research Programme in Healthcare Reform for their support, input and encouragement. The authors particularly thank Teresa Maguire and Tiago McCarthy of the Department of Health for their assistance with this research project. In addition, staff at the Healthcare Pricing Office have provided substantial assistance in the provision and interpretation of the acute hospital expenditure data which formed the basis of the analysis in the report. The authors are also grateful to the many officials of the Department of Health, Health Service Executive, National Treatment Purchase Fund, Health Research Board, Central Statistics Office and many other providers of data who have assisted this research. Contacts with policymakers, providers and stakeholders have contributed important context and understanding to this research. 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.

This report has been accepted for publication by the Institute, which does not itself take institutional policy positions. All ESRI Research Series reports are peer-reviewed prior to publication. The authors are solely responsible for the content and the views expressed.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS.....	VI
GLOSSARY OF TERMS.....	VII
FOREWORD	VIII
EXECUTIVE SUMMARY	IX
CHAPTER 1 INTRODUCTION	1
1.1 Introduction	1
1.2 Objectives.....	2
1.3 Overview of the Irish hospital system.....	3
1.4 Considering Covid-19	5
1.5 Model scope and modelling approach.....	8
1.6 Expenditure in Irish acute hospitals, 2018	10
1.7 Structure of the report.....	11
CHAPTER 2 BACKGROUND	12
2.1 Introduction	12
2.2 Review of the literature on the drivers of healthcare expenditure	12
2.3 Modelling methods for healthcare expenditure projection	18
2.4 Substitutability of care and avoidable hospitalisations	26
2.5 International comparison of acute care expenditure	28
2.6 Summary	31
CHAPTER 3 MACROECONOMIC AND DEMOGRAPHIC SCENARIOS	32
3.1 Introduction	32
3.2 Macroeconomic projection scenarios.....	32
3.3 Demographic projection scenarios	40
3.4 Summary	51
CHAPTER 4 HIPPOCRATES PROJECTION METHODS AND DATA	52
4.1 Introduction	52
4.2 Projection methodology.....	52
4.3 Expenditure projection scenarios	62
4.4 Overview of data sources.....	65
4.5 Summary	67
CHAPTER 5 FINDINGS: PUBLIC ACUTE HOSPITAL EXPENDITURES BY SERVICE	68
5.1 Introduction	68
5.2 Findings – unit costs.....	69
5.3 Findings – baseline expenditure – attendances.....	72
5.4 Findings – baseline expenditure – discharges.....	75
5.5 Findings – expenditure projections.....	82
5.6 Summary	95
CHAPTER 6 FINDINGS: PROJECTED AGGREGATE PUBLIC ACUTE HOSPITAL EXPENDITURE	98
6.1 Introduction	98
6.2 Findings – aggregate gross expenditure	99
6.3 Findings – aggregate gross expenditure projections	101
6.4 Summary	108
CHAPTER 7 FINDINGS: PUBLIC ACUTE PSYCHIATRIC IN-PATIENT SERVICES EXPENDITURE	111
7.1 Introduction	111
7.2 Findings – bed day cost.....	111
7.3 Findings – baseline expenditure	112

7.4	Findings – expenditure projections.....	113
7.5	Summary	115
CHAPTER 8	SUMMARY AND CONCLUSION	117
8.1	Introduction	117
8.2	Summary and discussion of findings on baseline and projected acute expenditure by service ..	120
8.3	Sensitivity analysis.....	127
8.4	Limitations.....	130
8.5	Policy implications, reflections, and conclusions	131
APPENDIX A	AVOIDABLE HOSPITALISATIONS	134
APPENDIX B	PUBLIC ACUTE PSYCHIATRIC IN-PATIENT SERVICE UTILISATION, 2018–2035.....	138
APPENDIX C	SHORT-TERM EXPENDITURE ADJUSTMENTS – ASSUMPTIONS AND ANALYSIS	142
APPENDIX D	PROJECTED EXPENDITURES – AVERAGE GROWTH RATES 2018–2035	146
APPENDIX E	WAITING LIST MANAGEMENT.....	147

LIST OF TABLES

TABLE 2.1	Hypotheses on gains in longevity and health status	15
TABLE 2.2	Recent income elasticity estimates	16
TABLE 3.1	Summary of macroeconomic projections for the Recovery and Delayed Recovery scenarios	38
TABLE 3.2	Summary of main assumptions for population scenarios and comparison with 2017 projections	41
TABLE 3.3	Comparison between new 2020 and previous 2017 projections of growth in various cohorts 2016–2030	49
TABLE 3.4	Summary of population scenarios	50
TABLE 4.1	Key drivers of expenditure included in Hippocrates	52
TABLE 4.2	Breakdown of HSE acute care clinical expenditures, 2015–2018	59
TABLE 4.3	Projection scenario assumptions	64
TABLE 4.4	Principal data sources for baseline expenditure analysis – summary	67
TABLE 5.1	Unit cost by service, 2015–2018	69
TABLE 5.2	Projection scenario assumptions	82
TABLE 5.3	ED – projected real and nominal expenditure growth by projection scenario, 2018–2035	83
TABLE 5.4	OPD– projected real and nominal expenditure growth by projection scenario, 2018–2035	86
TABLE 5.5	Day patient and in-patient – projected real and nominal expenditure growth by public/private status and projection scenario, 2018–2035	90
TABLE 5.6	Elective and emergency in-patients (excl. maternity) – projected real and nominal expenditure growth by projection scenario and public/private status, 2018-2035.....	91
TABLE 6.1	Public acute hospital gross expenditure, 2018	100
TABLE 6.2	Progress projection scenario – assumptions.....	102
TABLE 6.3	Public acute hospital gross expenditure – sex-specific real and nominal growth rates by projection scenario, 2018–2035	103
TABLE 6.4	Public acute hospital gross expenditure – nominal average annual growth rates by projection scenario, 2013–2035	104
TABLE 7.1	Projection scenario assumptions	113
TABLE 7.2	Psychiatric in-patient – projected real and nominal expenditure growth by projection scenario, 2018-2035	114
TABLE 8.1	Public acute hospital and acute psychiatric hospital expenditure – 2018 baseline and 2035 low- and high-pressure projections by service	124
TABLE 8.2	Public acute hospital gross expenditure – nominal and real average annual growth rates, and average annual growth rates per capita, by projection scenario.....	126
TABLE 8.3	Sensitivity analysis – effect on projected expenditure for main services of varying key assumptions and productivity effects	129
TABLE A.1	Avoidable hospitalisations – diagnosis codes, unweighted and complexity-weighted discharges, 2018	134
TABLE B.1	HSE and HSE-funded acute adult psychiatric in-patient units by Community Healthcare Organisation	138
TABLE B.2	Psychiatric in-patient – projected bed day demand by projection scenario, 2018 and 2035.....	141
TABLE C.1	Summary of new expenditure measures in the health service, 2021.....	143
TABLE C.2	Public acute hospital gross expenditure – nominal average annual growth rates by projection scenario and incorporating short-term assumed expenditure and budgetary adjustments	145
TABLE D.1	Public acute and psychiatric in-patient gross expenditure – real and nominal average annual growth rates by projection scenario, 2018–2035	146
TABLE E.1	Projected activity and nominal expenditure required to clear backlogs (2021–2025) and sustain elective waiting times at <12 weeks for OPD, day patient, and in-patient care	147

LIST OF FIGURES

FIGURE 1.2	Expenditure in Irish public acute hospitals and adult psychiatric in-patient units/hospitals, 2018	10
FIGURE 2.1	Conceptual model of the determinants of healthcare expenditure	13
FIGURE 2.2	Basic conceptual representation of macro-simulation projection modelling	19
FIGURE 2.3	Public in-patient C&R expenditure, 2017	30
FIGURE 3.1	Monthly unemployment rate, 2005 M01–2020 M07	34
FIGURE 3.2	Sectoral GDP: percentage change in 2020 Q1&Q2 relative to 2019 Q1&Q2	35
FIGURE 3.3	Period life expectancy at birth, 2020 compared to 2017 projections	42
FIGURE 3.4	Period life expectancy at age 65, 2020 compared to 2017 projections	43
FIGURE 3.5	Total fertility rate	46
FIGURE 3.6	Total population – Central, High Population Growth and Low Population Growth scenarios	47
FIGURE 3.7	Total population – new 2020 and previous 2017 projections	48
FIGURE 3.8	Central scenario – population pyramids for 2018 and 2035	50
FIGURE 4.1	Hippocrates Model – diagrammatic representation	53
FIGURE 4.2	Illustrative example of the impact of healthy ageing shifts on activity rate distribution in 2035	54
FIGURE 4.3	Avoidable hospitalisations: unweighted and complexity-weighted emergency in-patient discharges by avoidable hospitalisation condition, 2018	56
FIGURE 4.4	Illustrative example of the impact of avoidable hospital rate reductions, for various values of β , on the activity rate distribution in 2035	57
FIGURE 5.1	Total unit cost by category and service, 2018	70
FIGURE 5.2	Contributors to unit cost changes, 2015–2018	71
FIGURE 5.3	Pay unit cost by category and service, 2018	72
FIGURE 5.4	ED– age- and sex-specific expenditure and expenditure per capita, 2018	73
FIGURE 5.5	OPD – age- and sex-specific expenditure and expenditure per capita, 2018	74
FIGURE 5.6	Day patients (excl. maternity) – age- and sex-specific complexity-weighted expenditure and expenditure per capita, 2018	75
FIGURE 5.7	Day patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by public/private status, 2018	76
FIGURE 5.8	In-patients (excl. maternity) – age- and sex-specific complexity-weighted expenditure and expenditure per capita, 2018	77
FIGURE 5.9	In-patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by public/private status, 2018	78
FIGURE 5.10	Elective and emergency in-patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by admission type, 2018	79
FIGURE 5.11	Elective and emergency in-patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by admission type and public/private status, 2018	79
FIGURE 5.12	AMAU/ASAU only (excl. maternity) – age- and sex-specific complexity-weighted expenditure and expenditure per capita, 2018	80
FIGURE 5.13	Maternity patients – age-specific complexity-weighted expenditure and expenditure per capita by patient type and public/private status, 2018	81
FIGURE 5.14	ED – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035	84
FIGURE 5.15	ED – expenditure by age and projection scenario, 2018 and projected 2035 (nominal)	85
FIGURE 5.16	OPD – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035	87
FIGURE 5.17	OPD – expenditure by age and projection scenario, 2018 and projected 2035 (nominal)	88
FIGURE 5.18	Day patient – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035	92

FIGURE 5.19	In-patient – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035	93
FIGURE 5.20	Day patient and in-patient – expenditure by age and projection scenario, 2018 and projected 2035 (nominal)	94
FIGURE 6.1	Public acute hospital gross expenditure – age and sex-specific profiles, 2018	101
FIGURE 6.2	Public acute hospital gross expenditure – service category and projection scenario, 2018 and 2035 (nominal)	105
FIGURE 6.3	Public acute hospital gross expenditure – growth decomposition by projection scenario, 2018–2035 (nominal)	107
FIGURE 6.4	Public acute hospital gross expenditure – projections by age and projection scenario, 2018 and 2035 (nominal)	108
FIGURE 7.1	Psychiatric in-patient – cost per bed day by category, 2015–2018	111
FIGURE 7.2	Psychiatric in-patient – age- and sex-specific expenditure and expenditure per capita, 2018....	112
FIGURE 7.3	Psychiatric in-patient – decomposition of projected nominal expenditure growth, 2018-2035, by projection scenario	114
FIGURE 7.4	Psychiatric in-patient – projected nominal expenditure by age and projection scenario, 2018 and 2035	115
FIGURE A.1	Avoidable hospitalisations – age- specific unweighted and complexity-weighted discharges, 2018	135
FIGURE A.2	Avoidable hospitalisations – age- and sex-specific complexity-weighted discharges and discharge rates per 1,000 population, 2018.....	136
FIGURE A.3	Avoidable hospitalisations – age- and sex-specific expenditure, 2018.....	137
FIGURE B.1	Psychiatric in-patient – episodes and bed days and episode and bed day rates per 1,000 population, 2015–2018.....	139
FIGURE B.2	Psychiatric in-patient – age- and sex-specific in-patient episodes and bed days and episode and bed day rates per 1,000 population, 2018	140
FIGURE B.3	Psychiatric in-patient – age-specific projected bed day demand by projection scenario, 2018 and 2035	141
FIGURE C.1	Projected expenditure growth under the central and central-adjusted scenarios, 2018-2035 ..	144

ABBREVIATIONS AND ACRONYMS

ABF	Activity-based Funding
ACSC	Ambulatory care sensitive conditions
ADX	Additional diagnosis
AMAU	Acute medical assessment unit
ASAU	Acute surgical assessment unit
CHO	Community Healthcare Organisation
COPD	Chronic obstructive pulmonary disease
COSMO	COre Structural MOdel of the Irish economy
COVID-19	Coronavirus disease
CSO	Central Statistics Office
ED	Emergency Department
ESRI	Economic and Social Research Institute
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GNI	Gross National Income
GNP	Gross National Product
HCE	Healthcare expenditure
HIPE	Hospital In-patient Enquiry scheme
HIPPOCRATES	<i>Healthcare in Ireland model of the effects of Population Projections, Patterns Of CaRe and Ageing Trends on Expenditure and Demand for Services</i>
HIQA	Health Information and Quality Authority
HPO	Healthcare Pricing Office
HRB	Health Research Board
HSE	Health Service Executive
ICD	International Classification of Diseases
ICT	Information and communications technology
IED	Income elasticity of demand
MIU	Minor Injury Unit
NACE	European industrial activity classification
NHS	National Health Service
NIESR	National Institute of Economic and Social Research
NPIRS	National Psychiatric Inpatient Reporting Scheme
NTPF	National Treatment Purchase Fund
OECD	Organisation for Economic Co-operation and Development
OOP	Out-of-pocket
OPD	Outpatient Department
PHI	Private health insurance
PPE	Personal protective equipment
PUP	Pandemic unemployment payment
PPP	Purchasing power parity
SHA	System of Health Accounts
SYOA	Single year of age
TFR	Total fertility rate

GLOSSARY OF TERMS

Hospital Data Terms	
Attendance	An attendance in this report is a single visit to an emergency or outpatient department.
Discharge	The Hospital In-Patient Enquiry (HIPE) scheme collects activity data at the discharge level. A discharge record is created when a patient is discharged from (or dies in) a public hospital. At present, in the absence of the rollout of a unique patient identifier, it is not possible to follow activity at the patient level (that is, attribute multiple discharges to the same patient) across hospitals.
Day patient	A day patient is admitted to hospital for treatment on an elective (rather than an emergency) basis and is discharged alive, as scheduled, on the same day. Births are excluded.
In-patient	An in-patient is admitted to hospital for treatment or investigation on an elective (arranged in advance) or emergency (unforeseen and urgent) basis.
Elective in-patient	The patient's condition permits adequate time to schedule the availability of suitable services; an elective admission can be delayed without substantial risk to the health of the individual.
Emergency in-patient	The patient requires immediate care and treatment as a result of a severe, life-threatening or potentially disabling condition. Generally, the patient is admitted through the emergency department or acute medical/surgical assessment unit. In this report, those admitted to and discharged from the AMAU/ASAU are examined separately.
AMAU/ASAU only	The patient is admitted as an emergency to the acute medical/surgical assessment unit and is discharged from there.
Maternity discharges	Maternity discharges are those who were admitted in relation to their obstetrical experience (from conception to six weeks post-delivery). Maternity discharges capture both delivery and non-delivery episodes of care. All delivery episodes of care are classified as in-patients and, for maternity discharges, there is no distinction between elective and emergency in-patients.
Public/private status	Public or private status relates to whether the hospital patient saw their consultant on a private or public basis. It does not relate to the type of bed occupied nor is it an indicator of possession of private health insurance.
In-patient bed day	In the analysis of the adult acute psychiatric in-patients, each overnight stay reflects one in-patient bed day.
Other	
GDP	GDP measures the total output of the economy in a period i.e. the value of work done by employees, companies and self-employed persons.
GNI*	GNI* is designed to be a supplementary measure of the level of the Irish economy and excludes globalisation effects related to highly mobile economic activities that disproportionately affect the measurement of the size of the Irish economy.

FOREWORD

This report was prepared by researchers at the Economic and Social Research Institute (ESRI) for the ESRI Research Programme in Healthcare Reform, which is funded by the Department of Health. The report is published as an ESRI Research Series Report and is the second report applying the Hippocrates Model of healthcare demand and expenditure which has been developed at the ESRI. This report analyses expenditure on public acute hospital and psychiatric in-patient services and projects expenditure for these services for the years from 2018 to 2035.

The ESRI Research Programme in Healthcare Reform was agreed between the Economic and Social Research Institute (ESRI) and the Department of Health in July 2014. The broad objectives of the programme are to apply economic analysis to explore issues in relation to health services, health expenditure and population health, in order to inform the development of health policy and the Government's healthcare reform agenda. The programme is overseen by a Steering Group comprising nominees of the ESRI and the Department of Health, which agrees its annual work programme. The Steering Group agreed in 2015 that this programme would include the development of a projection model of healthcare demand and expenditure, and work on developing the model began in that year. The objectives of the development of the Hippocrates Model are to supply a tool which will: 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 ESRI is responsible for the quality of this research, which has undergone national and international peer review prior to publication. This report was prepared by Dr Conor Keegan, Dr Aoife Brick, Dr Adele Bergin, Dr Maev-Ann Wren, Mr Edward Henry, and Mr Richard Whyte and reflects their expertise and views. The views expressed in this report are not necessarily those of other ESRI researchers, the Minister for Health, Department of Health or organisations represented on the Steering Group.

December 2020

EXECUTIVE SUMMARY

INTRODUCTION

This is the second report to be published applying the Hippocrates projection model of Irish healthcare demand and expenditure, developed at the ESRI in a programme of research funded by the Department of Health. Previous analyses have applied the Hippocrates Model to estimate baseline utilisation of healthcare services in Ireland and to provide projections of demand and capacity. This analysis extends the Hippocrates Model to provide baseline estimates of expenditure in 2018 for public acute hospitals and psychiatric in-patient services in Ireland, and to project expenditures for these services to 2035.

OBJECTIVES

The Hippocrates Model has been developed as a tool to: inform health and social care capacity and services planning in Ireland, inform financial planning for the healthcare system, and identify future demand and expenditure pressures.

The broad objectives of this report are to:

- provide comprehensive estimates of current expenditure on public acute hospital and adult acute psychiatric in-patient services in Ireland;
- examine the relative impact of demographic and non-demographic factors on projected expenditure;
- provide a projection framework, and analysis, that considers the impact of Covid-19 on projected expenditure in the short and medium term;
- provide a framework, and analysis, to consider the effects of potential system change and reform; and
- inform hospital service, staffing, and financial planning.

CONTEXT

The base year for analysis in this report is 2018, with expenditures projected to 2035. From 2020 onwards, however, the outbreak of the Covid-19 pandemic needs to be considered both in terms of the short-term impacts on acute care expenditures and the medium-term impact on drivers of expenditure.

Before the onset of Covid-19 the Irish public hospital system was already operating under pressure from high population growth and ageing, and as a result of system cuts to bed capacity in the preceding decades. The onset of Covid-19 highlighted these acute capacity deficits. The immediate budgetary response in 2020 has been to increase public healthcare funding dramatically, with priorities given to changes

in the model of care delivery in line with the cross-party Sláintecare policy objectives, addressing these known capacity deficits, and tackling waiting lists. In line with recent policy responses, in this report we consider the impact of these short-term expenditure shocks, and develop a framework to examine the potential impact of models of care change and improved waiting-list management on acute care expenditures over time.

Previous analysis by Wren et al. (2017) showed that Ireland’s rapid projected population growth, unusual in a European context, and population ageing will increase demand for all forms of health and social care in the coming years. While these broad trends are set to continue, using the ESRI’s demographic model we adjust assumptions to reflect existing and emerging trends in the data. Most notably, assumptions on future net migration, a key driver of overall population change in Ireland, are refined over the short term (travel restrictions, uncertainty, lower confidence) and medium term (weaker economic conditions) in response to the potential disruption of Covid-19.

In recent times Ireland’s healthcare expenditure has been considered as among the highest in the OECD. While cross-country comparison of healthcare expenditure is challenging, recent analysis has shown that Ireland’s apparent high ranking in an international context is driven by relatively high prices for healthcare delivery, particularly salaries, rather than due to the volume of care delivered. This high cost of healthcare delivery is a function of a high wage/cost economy. Importantly, in this analysis we model the projected cost of hospital care delivery separately to the demand for care. The evolution of pay and non-pay costs are informed by modelling of the Irish economy as it recovers from the impact of Covid-19, undertaken using the ESRI’s macro-econometric model COSMO.

METHODS

Hippocrates has been developed as 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. The model is bottom-up in nature, with service-level expenditure projections modelled from a demand and cost base in 2018. We project expenditure for four primary public acute hospital services in this report: emergency department attendances, outpatient department attendances, and day patient and in-patient discharges. We also project expenditure for public acute adult psychiatric in-patient services.

The bottom-up service-level approach to expenditure estimation has also facilitated the generation of the most comprehensive age and sex-specific profiles

of public acute hospital expenditure in Ireland developed to date. These profiles have in turn formed the foundation for a recent Department of Health submission, for the first time, of Irish age-cost profiles to the European Commission to inform their Ageing Reports. Up until now, Ireland was only one of three countries unable to submit age-cost profiles to the European Commission for this purpose.

The first step is to estimate activity rates in 2018 from analysis of current use of services by age (single-year-of-age for most services) and sex (see Brick and Keegan, 2020a). Demand is projected by multiplying activity rates by projected population. Population projections by single-year-of-age and sex to 2035 are provided by the ESRI's demographic model based on assumptions in relation to fertility, mortality and net migration. Separately, the unit cost of delivering care in 2018 is estimated and disaggregated into pay and non-pay components. The ESRI's COSMO model provides government sector earnings and wider inflation projections that inform projected trajectories in this analysis of pay and non-pay hospital costs. For day and in-patient services, we project the cost of drugs separately informed by historic unit cost growth. Importantly, in this regard, the report does not forecast expenditure; rather it provides projections of expenditure requirements based on clear assumptions in relation to the evolution of these key drivers of demand and cost.

Since any projection exercise must address uncertainty, alternative projection scenarios are developed for each service analysed, and sensitivity analyses are undertaken to test the sensitivity of our projections to changes in key assumptions. The alternative expenditure projection scenarios vary assumptions related to population change, healthy ageing, and pay and non-pay cost drivers. Assumptions are grouped to provide projections of expenditure under low-pressure, central, and high-pressure expenditure scenarios. We also define a 'progress' scenario where we examine the effect on total public acute expenditure of addressing important dimensions of the Sláintecare reforms, such as waiting-list management and enhanced primary care, which appear subject to a renewed commitment in the recent Budget.

SUMMARY OVERVIEW OF FINDINGS

Public acute hospital expenditure

- Public acute hospital gross expenditure was €5,907m in 2018.
- In 2018, expenditure per capita is estimated at €1,169 for males and €1,253 for females.
- Reducing current waiting-list backlogs and maintaining waiting times is estimated to require an additional €212m on average per annum between 2021 and 2025.
- In nominal terms, we project gross expenditure requirements of between €10,761m and €14,363m by 2035, or between 3.6 and 5.4 per cent expenditure growth on average per annum.
- When the effect of pay and non-pay cost increases is removed, we project a real (or volume) increase in expenditure requirements of between 1.2 and 1.7 per cent on average per annum.
- Pay cost is the largest single driver of expenditure growth, projected to account for between €2,040m and €4,061m of additional expenditure requirements by 2035.

Emergency department attendances

- In 2018, public emergency department expenditure is estimated at €418.6m based on 1.4m recorded attendances.
- In nominal terms, we project gross expenditure requirements of between €679m and €876m by 2035.
- In real (or volume) terms, when the effect of pay and non-pay cost increases is removed, we project expenditure requirements of between €468m and €496m by 2035.

Outpatient department attendances

- In 2018, public outpatient expenditure is estimated at €676.4m based on 4.0m recorded attendances.
- In nominal terms, we project gross expenditure requirements of between €1,105m and €1,404m by 2035.
- In real (or volume) terms, when the effect of pay and non-pay cost increases is removed, we project expenditure requirements of between €759m and €799m by 2035.

Day-patient discharges

- In 2018, expenditure on day-patient discharges from public acute hospitals is estimated at €919.5m in 2018, based on 1.0m recorded discharges.
- In 2018, we estimate 17 per cent of expenditure went on treating private discharges.
- In nominal terms, we project gross expenditure requirements of between €1,766m and €2,397m by 2035.
- In real (or volume) terms, when the effect of pay and non-pay cost increases is removed, we project expenditure requirements of between €1,110m and €1,201m by 2035.

In-patient discharges

- In 2018, expenditure on in-patient discharges from public acute hospitals is estimated at €3,220.5m based on 0.6m recorded discharges.
- In 2018, we estimate 18 per cent of expenditure went on treating private discharges.
- In nominal terms, we project gross expenditure requirements of between €5,985m and €8,050m by 2035.
- In real (or volume) terms, when the effect of pay and non-pay cost increases is removed, we project expenditure requirements of between €4,029m and €4,446m by 2035.

Public acute psychiatric hospital expenditure

- In 2018, expenditure on in-patient care in adult public acute hospitals/units is estimated at €179.3m based on 0.4m recorded bed days.
- In nominal terms, we project expenditure requirements of between €303m and €395m by 2035.
- In real (or volume) terms, when the effect of pay and non-pay cost increases is removed, we project expenditure requirements of between €209m and €223m by 2035.

POLICY IMPLICATIONS

The main finding of this report is that, due to a combination of a growing and ageing population and increasing costs of care delivery, expenditure on all main categories of public acute and psychiatric in-patient services will be required to increase substantially by 2035.

The main driver of this increased expenditure is the future expected cost of care delivery, particularly pay-related cost. Trends and policy in relation to public-sector pay will therefore be an important driver of public hospital expenditure. Policies aimed at improving productivity of care delivery such as investment in information and communication technology, changes to staff-mix, and better management, may be considered as some ways of offsetting these increased costs.

Projected population growth and ageing will also require investment in workforce and bed capacity to meet growing demand for public hospital care. In recent times, under-investment in acute care capacity has led to a constraint on the volume of public acute care delivery. These acknowledged capacity deficits, underscored by the effects of the Covid-19 pandemic, have resulted in larger and longer waiting lists to access public acute care. Additional expenditure will be required over time to address these waiting-list backlogs and sustain lower waiting times into the future. However, when considering the sustainability of future expenditure requirements, it is important to view these increases in the context of growing national income which will contribute to the tax base necessary to finance future care needs.

In parallel, however, changes in models of care, as proposed under the cross-party Sláintecare report in 2017, may help mitigate some of these increased demand and expenditure pressures on the public hospital system. In this analysis we show that it is possible to offset the increased expenditure associated with improved waiting-list management through shifting certain appropriate care, currently delivered in public hospitals, to the community over time. The model will be extended to consider non-acute expenditure projections, including the effects of models of care change, in future work.

CHAPTER 1

Introduction

1.1 INTRODUCTION

In this report we provide healthcare expenditure base year estimates for 2018 and projections to 2035 for public acute hospitals and public acute adult psychiatric hospitals. These projections have been generated using the Hippocrates Model, which was developed at the ESRI in a programme of research funded by the Department of Health. Baseline demand profiles underlying these expenditure projections have been published separately in the ESRI's *Survey and Statistical Reports Series* (Brick and Keegan, 2020a).

This report marks the next phase in the development of the Hippocrates projection model of Irish healthcare demand and expenditure.¹ Previously, the model has provided base year estimates and projections of healthcare demand for a wide range of Irish health and social care services for the years 2015–2030 (Wren et al., 2017) and provided projections of hospital bed capacity (Keegan et al., 2018a). Future ESRI research will extend the model to develop baseline estimates and projections of non-acute healthcare expenditures.

Healthcare projection models have been used in several countries and in a variety of ways. Such models assist policymakers to identify future demand pressures and to inform financial planning as well as planning for services and staffing. The original development of this model to project demand for health and social care services was an unprecedented undertaking for Ireland and was ambitious even in an international context. While many models project at aggregate levels, Hippocrates was developed from a bottom-up perspective, building a service-level picture of demand across health and social care services, and incorporating measures of unmet need or demand in projecting demand.

The modelling framework has been extended to cost public acute hospital and public acute adult psychiatric hospital activity in 2018. This facilitates the generation of a service-level picture of expenditure in 2018 and projections of these expenditures to 2035, based on identified demographic and non-demographic drivers. The development of the model required detailed analysis of service unit costs in 2018. This is the first time detailed unit costs and baseline expenditure profiles for a range of acute services have been published for Ireland.

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.

While the base year for these projections is 2018, the Covid-19 pandemic in 2020 can be expected to significantly alter trajectories of hospital expenditures over the short to medium term. We have adjusted our analysis to reflect these changes where possible. In particular, updates were made to key ESRI demographic and macroeconomic projections that inform our demand and unit cost projections. We also account for the recent impact of Covid-19 when examining the projected expenditure implications of clearing large existing backlogs for elective hospital care over the next number of years.

The next section outlines the objectives of the model and this report. Section 1.3 provides an overview of the Irish hospital system while Section 1.4 considers Covid-19 in the context of this modelling. Section 1.5 gives an overview of the model scope and modelling approach. Section 1.6 presents a summary of the report's findings on baseline expenditure for Irish public acute hospitals and public acute adult psychiatric hospitals. Section 1.7 outlines this report's structure.

1.2 OBJECTIVES

The Hippocrates Model has been developed as a tool to: inform health and social capacity and services planning in Ireland; inform financial planning for the healthcare system; and identify future demand and expenditure pressures. Previous applications of the Hippocrates Model examined questions of demand and capacity: how population growth and ageing affect demand for health and social care services; what is the extent of unmet need for care; and what are the bed capacity implications of projected demand for hospital care (Keegan et al., 2018a; Wren et al., 2017).

Building on the existing modelling framework, the objectives of this report are to:

- provide comprehensive estimates of current expenditure on public acute hospital and adult acute psychiatric in-patient services in Ireland;
- examine the relative impact of demographic and non-demographic factors on projected expenditure;
- provide a projection framework, and analysis, that considers the impact of Covid-19 on projected expenditure in the short and medium term;
- provide a framework, and analysis, to consider the effects of potential system change and reform; and
- inform hospital service, staffing, and financial planning.

Future research under the ESRI Research Programme in Healthcare Reform will provide base year estimates and projections of non-acute health and social care

services. The model is expected to be further extended to develop detailed analyses of staffing requirements and to develop demand and expenditure projections by region.

1.3 OVERVIEW OF THE IRISH HOSPITAL SYSTEM

The Irish hospital system is situated within a complex healthcare system, which has a mixture of public and private delivery and financing and many eligibility categories governing access to care. The Department of Health provides strategic leadership for the Irish healthcare system, ensuring that government policies are translated into actions and are effectively implemented (Department of Health, 2016). The Health Service Executive (HSE), established in 2005, manages the operation of the Irish health service, replacing the former regionally based health boards. The Health Information and Quality Authority (HIQA) is an independent authority established in 2007 to promote and monitor quality and safety in Irish health and social care services. The National Treatment Purchase Fund (NTPF) was established in 2004; its main responsibilities are: to arrange the provision of hospital treatment as required; to collect, collate and validate information on persons waiting for public hospital treatment; and to agree pricing arrangements with private and voluntary nursing homes under the Nursing Homes Support Scheme.

1.3.1 Ownership

Hospitals in Ireland may have non-voluntary, voluntary, and private (for profit) ownership. Non-voluntary hospitals are owned and directly funded by the HSE. Voluntary hospitals, usually established by religious organisations or charities, receive large amounts of their funding from the State, while retaining quasi-independence from the HSE. Many major acute hospitals are owned by voluntary organisations. In this report, non-voluntary and voluntary hospitals are collectively referred to as public acute hospitals. Privately financed acute care is provided in both public and private hospitals. All care in public acute hospitals is considered in this report regardless of whether it is publicly or privately financed.

In this report we analyse activity and expenditure in 51 of the 53 public hospitals that participated in the Hospital In-Patient Enquiry (HIPE) scheme in 2018.² Public hospitals in Ireland may differ in the care they provide, for example, three children's hospitals offer care to children and younger people only; four standalone maternity hospitals offer largely maternity and neonatal care.³ This report presents

² Two long-term-care hospitals are excluded from the analysis. See Brick and Keegan (2020a) for full list of included hospitals.

³ A small number of hospitals offer specialised services such as for eye and ear conditions, orthopaedic or rehabilitation services. Although included in the analysis in this report, some of these hospitals would not be considered 'acute' in the sense of offering emergency care. However, due to their inclusion for historical reasons in the HIPE dataset and not in other service registers, we analyse their activity within the acute hospital grouping.

findings for four primary forms of public acute hospital activity: emergency department (ED) and outpatient (OPD) attendances, day patient and in-patient discharges.

In addition, to the above outlined services the report also presents findings on public acute psychiatric hospitals/units. This activity was not included in the analysis in Wren et al. (2017) but a subsequent report analysed utilisation of mental health services in Ireland in 2018 (Brick et al., 2020a). In this current report we focus specifically on in-patient activity and expenditure in the 29 HSE/HSE-funded public acute adult psychiatric hospitals and co-located units.

1.3.2 Eligibility and access

Public acute hospitals are funded by a combination of government financing allocated through the HSE, by payments from private health insurers for private patient care, and by out-of-pocket (OOP) payment of charges. A minority of the Irish population qualifies for free public hospital care, receiving medical cards which are allocated on grounds of low income, or older age and low income combined. Medical cards give access to all forms of care including public hospital care without charge, except for a charge for prescribed medications.

The proportion of the population covered by medical cards fluctuates depending on the relationships between changing eligibility criteria, income thresholds and the income distribution. Between 2010 and 2019, the proportion of the population covered by medical cards fluctuated from a high of 40 per cent in 2012 to a low, largely due to rising incomes, of 32 per cent in 2019 (Department of Health, 2019a; Health Service Executive, 2020a). Non-medical cardholders must pay public hospital in-patient bed charges and self-referred ED attendance charges.

Although all residents are eligible for free or subsidised public hospital care, private hospital services such as private or semi-private accommodation and consultant-delivered care (purchased by private fee payment), are available in public and private hospitals for those who are willing to pay significant OOP charges, but are more typically financed by private health insurance (PHI). In 2019, 46 per cent of the population purchased PHI (Health Insurance Authority, 2020), which is largely intended to ensure timely access to care, whether in public or private hospitals (Wren and Connolly, 2016).

Although a nominally common waiting system was introduced in 2009, privately insured patients' faster routes of access to initial consultations in hospital consultants' private rooms and to diagnostic tests, ensure that they gain faster access to public hospital elective care while public patients can experience long waits (Department of Health, 2016; Tussing and Wren, 2006). Additionally,

privately insured or paying patients can access the private hospital sector, which expanded rapidly in the early 2000s supported by government subsidies (Tussing and Wren, 2006). A recent study which examined the impact of insurance status on waiting times for hospital-based services found no evidence that the introduction of the common waiting list reduced the differential in waiting times between those with and without PHI (Whyte et al., 2020). A review group found in 2019 that, while it was difficult to quantify the extent to which private patients might access treatment more quickly in public hospitals, there was anecdotal evidence that this was the case at least in some instances (Independent Review Group, 2019).

1.3.3 Sláintecare

In 2016 an all-party parliamentary committee (Houses of the Oireachtas Committee on the Future of Healthcare, 2017) was established with the aim of achieving a single long-term vision for healthcare and the direction of health policy in Ireland. The committee concluded that the health system must be re-orientated to ensure equitable access to a universal single-tier system, and that most care takes place in primary and social care settings. While promoting a shift away from a hospital-centred model of care, the committee recognised that additional measures such as significant investment in hospital capacity, hospital waiting-time guarantees and a phased elimination of private care in public hospitals would also be needed (Houses of the Oireachtas Committee on the Future of Healthcare, 2017). Although the report received cross-party support and was an important milestone in the development of Irish health policy, it lacked clarity on how the critical issue of universality should be defined and, although some costings were published, they were not comprehensive (Connolly and Wren, 2019).

In January 2019, the Department of Health published a Sláintecare Action Plan 2019, which stopped short of commitments to introducing universal healthcare by progressive expansion of access and changes to eligibility (Department of Health, 2019b). The plan stated: “Sláintecare proposes providing universal services at no or low cost to the patient/service user. We will plan how, when and in what order of priority this could be done and make proposals to government for consideration” (Department of Health, 2019b: 6).

1.4 CONSIDERING COVID-19

In this report, 2018 is the base year for analysis of activity and unit costs. Data from 2018 are used as a basis to project Ireland’s hospital expenditure to 2035. However, the outbreak of the Covid-19 pandemic in Ireland has already influenced Irish public healthcare expenditure allocations and will likely have longer-term implications for drivers of demand and cost.

As described in Walsh et al. (2020a), Covid-19 has shone a light on the insufficient hospital capacity in Ireland that was evident prior to Covid-19 (Keegan et al., 2018a). Before the onset of the pandemic, Ireland already had a public bed occupancy rate averaging 95 per cent, the highest in the OECD (OECD, 2019a). This most recently can be traced back to the 2008 financial crisis, which resulted in large reductions in public healthcare expenditure and the stock of public hospital beds (Mercille, 2018). Related to this acute capacity shortage, the decision was made in the early stages of the pandemic to cancel all but essential elective hospital services and to secure additional capacity through effectively nationalising the private hospitals temporarily (Walsh et al., 2020a).

While this private hospital capacity was ultimately not fully required to manage the additional Covid-19 burden, the numbers waiting for elective treatment have continued to grow. In October 2020, there were 613,000 on the OPD waiting list, 105,000 on the day-patient treatment list, and 24,000 on the in-patient treatment list. Almost 42 per cent of those waiting for an OPD appointment had been waiting for more than 12 months, while, of those waiting for day and in-patient treatment, 16 per cent and 30 per cent, respectively, had been waiting for more than 12 months.⁴

It was in this context and in preparation for subsequent Covid-19 waves that, in September 2020, the HSE announced an ambitious ‘Winter Plan’ plan to increase the country’s healthcare capacity and workforce, and to reconfigure care towards the community (Health Service Executive, 2020b). Supporting this plan, on 13 October 2020, the Government announced a record health budget of €22.1 billion for 2021, including €1.8 billion in direct Covid-related supports (Government of Ireland, 2020). Within the overall funding allocations, and consistent with the Winter Plan objectives, it appears that funding priorities relate to changing the model of care delivery in line with Sláintecare objectives, addressing known capacity deficits, and tackling waiting lists (Government of Ireland, 2020). In this report, we adjust our analysis where relevant to consider this expenditure shock on projections of gross public acute hospital expenditure.

Longer term, however, future expenditure requirements will be shaped by underlying demand and unit-cost drivers. In this context, the Covid-19 pandemic may also have implications related to the demand for, and the cost of delivering, acute hospital services relevant for modelling trends in expenditures over the medium term. To account for these effects, we adjust our projections in several ways.

⁴ Figures for October 2020, personal communication, NTPF, 16 November 2020.

Importantly, we have updated and revised our demographic projection scenarios. As described in Wren et al. (2017), Ireland's demographic structure has traditionally been somewhat unusual compared to other Western European countries, experiencing unusually high population growth⁵ driven by net inward migration. The population has also experienced strong population ageing, albeit from a relatively young base. While these broad trends are likely to continue, we have adjusted our assumptions to reflect emerging trends. In particular, net international migration has been adjusted downwards over the short to medium term because of the effects of Covid-19 and the downturn in the macroeconomy. In addition, the population estimates for 2020 have been adjusted to take account of deaths from Covid-19.

Following Wren et al. (2017), this report also places considerable emphasis on measuring and modelling unmet demand (long waiting times) for care in Irish public hospitals. In this report, however, we have refined our methods in line with an approach developed by Findlay (2017). This approach allows us for the first time, to estimate the activity and expenditure required, over the next number of years, to achieve and sustain public hospital waiting lists at, or close to, the Sláintecare targets of up to 12 weeks. As discussed above, Covid-19 has contributed to increasingly larger and longer waiting lists. To ensure that we capture this Covid-19 impact, we incorporate into our analysis the most recent information on numbers waiting for hospital care as of October 2020.

Recent findings by Wren and Fitzpatrick (2020) have shown that Ireland ranks below the EU-15 average in terms of the volume of public health and hospital care consumed per capita. However, Ireland ranks relatively high in terms of total healthcare expenditure as a proportion of national income. This dichotomy may reflect relatively high prices for healthcare delivery in Ireland, characterised by a high-wage/high-cost economy. Healthcare salaries, the largest component cost of healthcare delivery, are particularly affected by Ireland's status as a high-wage, high-cost economy. When projecting nominal expenditures in the present analysis, Hippocrates models pay and non-pay components of costs separately. Trends in pay and non-pay (non-drug) costs are informed by the ESRI's macro-econometric model COSMO. These costs are modelled based on two COSMO scenarios for economic recovery following the Covid-19 pandemic; a *Recovery* scenario and a *Delayed Recovery* scenario. Pay is modelled based on assumptions related to trends in government sector average earnings growth over the projection horizon, linked to pay growth in the wider economy. Non-pay (non-drug) costs growth reflects trends in projected inflation (linked to a personal consumption deflator). Where applicable, we model the drug cost component of acute care delivery in line

⁵ For instance, Ireland's population increased by 31 per cent (1,136m) in the twenty years 1996 to 2016. This compares to average population growth in the EU28 of 6 per cent over the same period (Wren et al., 2017).

with historic trends, which has seen strong growth in recent years reflecting the innovative and high-tech nature of many of these drugs (e.g. oncology).

1.5 MODEL SCOPE AND MODELLING APPROACH

The Hippocrates Model has been designed to be broad in scope. The Wren et al. (2017) report included all health and social care services (acute hospital, primary, community and long-term care) and public and private services (including private hospitals and privately purchased GP visits, home help hours and other non-acute care services). However, scope and data constraints led us to divide the projections of healthcare expenditure into separate analyses. This report focuses on the public acute care sector due to the greater availability of data on activity and costs with which to develop baseline expenditure estimates and projections. Information on the unit costs of many non-acute services is currently lacking, and filling this gap will require particular attention as part of a non-acute expenditure analysis. The acute care system also represents an obvious choice for initial focus given that acute care expenditures represent the single largest area of HSE expenditure. In 2018, acute services accounted for 34 per cent of the HSE's total gross non-capital vote allocation of €16.3 billion (Department of Health, 2019a). As described in Section 1.2, future analysis will develop baseline estimates and projections of expenditure for non-acute healthcare services.

Hippocrates has been developed as 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. The model is bottom-up in nature; expenditure projections are developed from a demand and cost base in 2018. We model demand projections primarily based on projected demographic change and assumptions on the relationship between life year gains and healthcare use. Projected demand for respective services is then costed through modelling, assumed trends in pay, drug and other non-pay costs.

Since any projection exercise must address uncertainty, alternative projection scenarios are developed for each service analysed, and sensitivity analyses are undertaken to test the sensitivity of our projections to changes in key assumptions. The alternative expenditure projection scenarios vary assumptions related to population change, healthy ageing, and pay and non-pay cost drivers. Assumptions are grouped to provide projections of expenditure under low-pressure, central and high-pressure expenditure scenarios.

We also define a 'progress' scenario where we examine the effect on total public acute expenditure of addressing important dimensions of the Sláintecare reforms,

such as waiting-list management and enhanced community care, which appear subject to a renewed commitment in the recent Budget.

The costs modelled in this analysis reflect the ‘fully absorbed’ costs of treatments for specific services. This means they reflect all treatment and care costs (e.g. pay, drugs, theatre costs) as well as running costs (e.g. heating and lighting) associated with the delivery of care, but exclusive of capital and depreciation. This analysis does not consider projections of capital expenditure, which would require separate detailed treatment. The report also does not consider baseline expenditure estimates and projections of expenditure on acute care in private hospitals. We expect this to form the basis of a future report on private hospital expenditure projections. Relatedly, the analysis does not consider the impact of the proposed removal of private activity from public hospitals on projected expenditures (Independent Review Group, 2019). This would require a separate detailed examination and specification of assumptions which are outside the scope of this analysis. Were the proposals to be implemented, however, it is likely that much of the projected private activity and expenditure would remain in the public acute hospital system, with funding of this activity becoming the responsibility of the Exchequer (Independent Review Group, 2019; Keegan et al., 2018b).

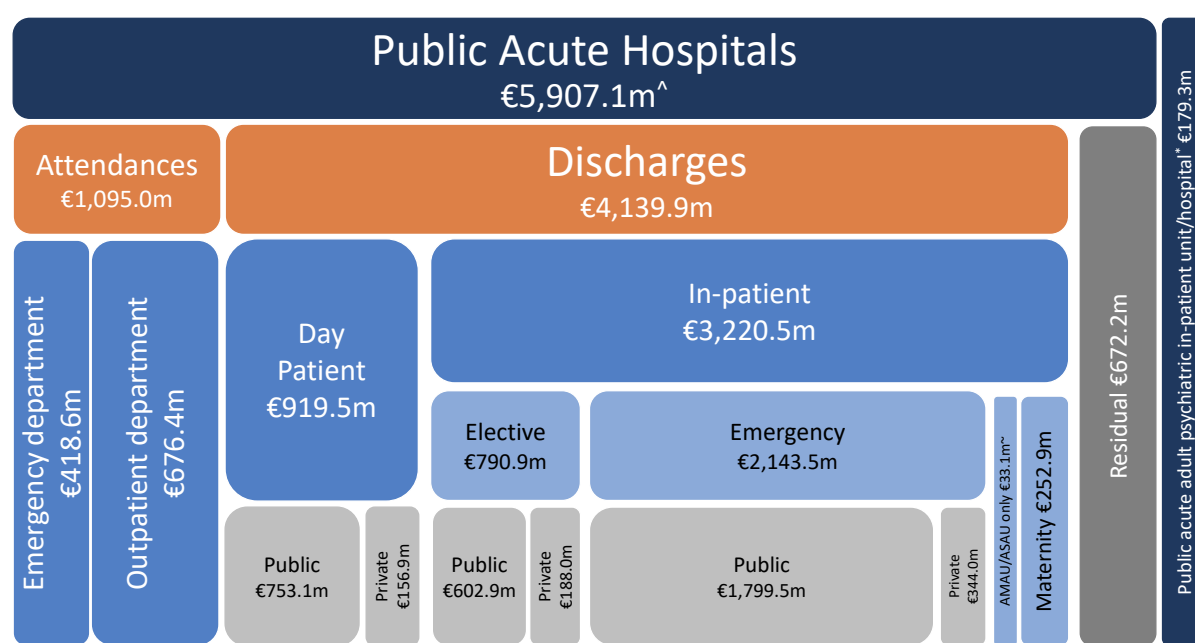
The model is automated using SPSS software, with subsidiary analysis undertaken in Microsoft Excel.

1.6 EXPENDITURE IN IRISH ACUTE HOSPITALS, 2018

The development of projections required, first, a detailed picture of the expenditure on services provided in Irish public acute hospitals and public acute adult psychiatric units in 2018. Figure 1.2 outlines the main expenditure categories presented in this report.

Overall, HSE gross expenditure on public acute hospitals was €5,907.1m in 2018.⁶ An estimated €4,139.9m of this expenditure related to admitted care, consisting of €919.5m on day-patient (incl. maternity) discharges and €3,220.5m on in-patient discharges. The vast majority of in-patient expenditure related to emergency care (€2,143.5m) followed by elective care (€790.9m), maternity care (€252.9m) and those admitted to and discharges from AMAU/ASAUs (€33.1m). Across day-patient and in-patient services, most expenditure related to treatment of public (as opposed to private) discharges. For instance, 84.0 per cent of in-patient emergency expenditure was on public discharges, with similar proportions recorded across the other categories of admitted care.

FIGURE 1.2 Expenditure in Irish public acute hospitals and adult psychiatric in-patient units/hospitals, 2018



Note: [^] This figure relates to HSE Consolidated Financial Intelligence data on end-year 2018 gross expenditure on Acute Hospitals.
[~] In HIPE AMAU/ASAU only discharges are categorised as emergency in-patients. In this analysis we considered them separately.
^{*} This figure is an estimate provided by the HSE to the CSO as part of the System of Health Accounts submission.
Source: Authors' representation.

⁶ This figure relates to HSE Consolidated Financial Intelligence data on end-year 2018 gross expenditure on Acute Hospitals. The data were provided through personal communication with HSE Acute Finance.

Expenditure on OPD and ED attendances accounted for an additional €676.4m and €418.6m, respectively. Total expenditure on day-patient, in-patient, OPD and ED captured a combined €5,234.9m of acute expenditure, or 88.6 per cent of recorded gross HSE expenditure on acute hospitals in 2018.⁷ Finally, expenditure on acute adult psychiatric in-patient units/hospitals amounted to €179.3m in 2018.⁸ This service is funded separately through the HSE Mental Health Budget.

1.7 STRUCTURE OF THE REPORT

The remainder of the report is structured as follows:

- Chapter 2 reviews the international evidence on the drivers of healthcare expenditure, reviews how these drivers have previously been modelled in similar projection exercises; and compares Irish health and hospital expenditure internationally.
- Chapter 3 describes the macroeconomic and demographic scenarios that feed into the hospital expenditure projection scenarios.
- Chapter 4 presents the Hippocrates modelling methodology, expenditure projection scenarios, and data sources.
- Chapter 5 to 7 present findings for our baseline analysis of expenditures and projections.
 - Chapter 5 – Public acute hospital expenditures by service
 - Chapter 6 – Projected aggregate public acute hospital expenditure
 - Chapter 7 – Public acute adult psychiatric in-patient services expenditure
- Finally, Chapter 8 concludes by summarising and discussing the findings presented in the report.

⁷ It is difficult to fully reconcile the residual amount of €672.2m not captured by our expenditure categories. However, a large proportion (€300m) is related to hospital costs incurred in relation to external services (e.g. hospital laboratory testing for primary healthcare providers). We also do not capture approximately €100m in activity related to Minor Injury Units (MIU) and other non-casemix hospital activity. We do not capture the cost of services outsourced by hospitals as the activity and costs are not captured in HIPE or specialty costing. We are also missing some OPD expenditure incurred outside the 40 Activity-based Funding (ABF) hospitals.

⁸ This figure is an estimate provided by the HSE to the CSO as part of the System of Health Accounts submission. The data were provided through personal communication with the HSE National Finance Division.

CHAPTER 2

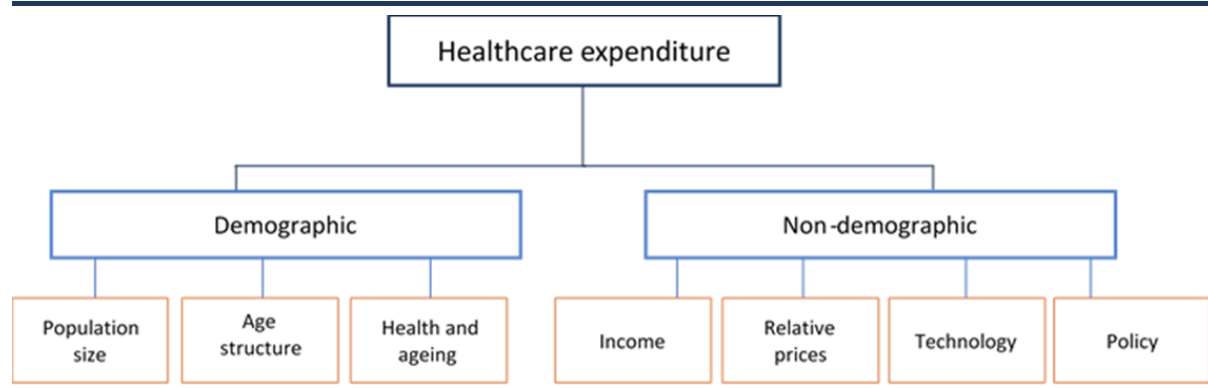
Background

2.1 INTRODUCTION

This chapter provides the background and evidence that informs the development of the projection modelling framework described in Chapters 3 and 4. A number of strands of literature are reviewed and discussed. As outlined in Chapter 1, Hippocrates can be classed as a macro-simulation model, a class of component-based models, which group individuals into cells according to key attributes such as age and sex, and project from that basis. The path of projected expenditure is then informed by assumptions related to the drivers of healthcare expenditure. In this chapter, we review the literature on the demographic and non-demographic drivers of healthcare expenditure as well as the methodological approaches adopted to include these drivers in component-based projection models. While evidence on the drivers of healthcare expenditure tend to be presented at a system or aggregate level, where evidence exists on specific determinants of hospital-based expenditure, it is highlighted. We also discuss evidence on the substitutability of care and avoidable hospitalisations. The chapter concludes by considering Irish hospital expenditure in an international context, along with the relative contribution of volume and cost to reported expenditure.

2.2 REVIEW OF THE LITERATURE ON THE DRIVERS OF HEALTHCARE EXPENDITURE

Figure 2.1 provides a conceptual breakdown of the drivers of healthcare expenditure. Traditionally, these drivers have been disaggregated into demographic and non-demographic components. Demographic drivers relate broadly to the size and structure of the population along with the relationship of health to ageing. Non-demographic drivers capture all other determinants of healthcare expenditure. They can broadly be classified into income, relative price effects, technological advancements and policy measures (Marino et al., 2017).

FIGURE 2.1 Conceptual model of the determinants of healthcare expenditure

Sources: Adapted from de la Maisonneuve and Martins Oliveira (2015); Marino et al. (2017)

2.2.1 Demographic drivers

Population size and structure

The number of people in a given population will affect total expenditure on healthcare goods and services through influencing demand. In a similar way, the structure of the population may also drive healthcare expenditure. For instance, the demand for healthcare is higher in the first years of life, during maternity years for women, and at older ages (European Commission, 2015). A growing population will influence total healthcare expenditure but not per capita expenditures, while an ageing population may increase overall per capita expenditure as older individuals tend to use more care.⁹

Health and ageing

While older individuals tend to consume more healthcare resources, the relationship between population ageing and healthcare use is complex. Efforts to understand this relationship have generated several competing hypotheses. On the one hand it has been suggested that, as life expectancy increases, individuals spend most of those extra years in bad health. This is referred to as the ‘Expansion of Morbidity’ hypothesis (Przywara, 2010). This is often characterised as a ‘failure of success’ whereby new treatments prolong life as opposed to improving its quality. Other authors have argued the opposite: that, as life expectancy increases, morbidity is compressed to older ages – the ‘Compression of Morbidity’ hypothesis (Fries, 2002). Under this hypothesis, healthier lifestyles result in a decrease in the number of years lived in poor health or with a disability. A final hypothesis put forward is that increases in life expectancy are largely spent in good health (total life expectancy and healthy life expectancy grow at the same rate). This has been referred to as the ‘Dynamic Equilibrium’ hypothesis (Przywara, 2010). While healthy ageing hypotheses concern how morbidity may evolve with increasing life expectancy, other authors suggest that healthcare expenditure is driven largely, or

⁹ In this context, it is worth noting that Ireland has experienced accelerated improvements in mortality rates in recent years compared to other EU-15 countries. Large reductions in mortality have been observed for diseases of the circulatory system and respiratory system, especially among older people (Eighan et al., 2020).

even solely, by changing mortality rates (Zweifel et al., 1999). This assumes that what is important for healthcare expenditure is not ageing but rather proximity to death.^{10,11} Parallels can be drawn between the Dynamic Equilibrium healthy ageing assumption that assumes postponement in morbidity to older ages and the Proximity to Death hypothesis (Wren et al., 2017).

An abundance of research has taken place on examining how healthy ageing may affect healthcare demand and expenditure, much of it at a sectoral level. In Wren et al. (2017), a review of this evidence was conducted. As it relates to acute hospital care, studies are broadly in agreement that ‘proximity to death’, rather than age, is a key driver of acute care demand and expenditure. For instance, evidence from Switzerland (Werblow et al., 2007; Zweifel et al., 1999), the United States (Lubitz et al., 2003; Yang et al., 2003), the Netherlands (Polder et al., 2006) and England (Seshamani and Gray, 2004) finds that proximity to death can be considered the main driver of hospital expenditure. Additionally, where age and proximity to death are both captured in healthcare expenditure modelling, age becomes an insignificant factor (de Meijer et al., 2011). Importantly, other studies have shown that, for less severe chronic conditions (suitable for management in primary care), age is still a significant predictor of expenditure. However, for severe conditions (such as cancer) closeness to death remains the key driver of expenditure (Wong et al., 2011). Most recently, Costa-Font and Vilaplana-Prieto (2020) indicate that estimates of the effect of ageing on healthcare utilisation are attenuated (for hospital admissions, length of stay, home care and nursing home care) or become completely insignificant (outpatient care) when alternative explanations of an ageing effect, such as proximity to death and the influence of comorbidities, are accounted for.

Overall, however, demographic drivers have been shown to account for relatively little of historic increases in healthcare expenditure (de la Maisonneuve and Martins Oliveira, 2015). The impact of non-demographic drivers is seen as more important in explaining per capita expenditure growth (de la Maisonneuve and Martins Oliveira, 2015; Xu et al., 2011). These non-demographic drivers are discussed in the next section.

¹⁰ It is important to note that morbidity and mortality are inter-related concepts in that some disease may result in death (Colombier and Weber, 2011). In Wren et al. (2017) parallels were drawn between the Dynamic Equilibrium healthy ageing hypothesis, which assumes postponement in morbidity to older ages, and the Proximity to Death hypothesis.

¹¹ For a detailed review of the healthy ageing hypotheses, see Wren et al. (2017).

TABLE 2.1 Hypotheses on gains in longevity and health status

Hypothesis	Healthy life expectancy	Mechanisms assumed
Expansion of Morbidity (Gruenberg, 1977)	Gains in longevity accompanied by additional years with chronic disease	Incidence of disease unchanged, medical progress will successfully improve survival probabilities for several chronic diseases requiring life-long treatment, hence increasing the prevalence of chronic disease.
Compression of Morbidity (Fries, 1980)	Both disease and disease-free years increasing more than gains in longevity	Healthier lifestyles will decrease and/or postpone the incidence of disease until later ages, while there is a defined upper limit for life extension, hence decreasing the prevalence of both chronic disease and disability.
Dynamic Equilibrium (Manton, 1982)	Gains in longevity accompanied by additional years without disability, not necessarily without chronic disease but disease with less severe progress due to new medical treatments.	Incidence of disease unchanged, medical progress will successfully improve survival probabilities while reducing the severity of the disease, hence increasing the prevalence of chronic disease but decreasing disability.

Source: Lindgren (2016).

2.2.2 Non-demographic drivers

Income

National income (usually measured in GDP per capita) has been identified as an important factor in explaining differences across countries in the level and growth of total healthcare expenditure (Xu et al., 2011). Income growth and healthcare expenditure tend to be positively related. As incomes rise, individuals tend to demand more, better-quality, healthcare-related goods and services (Charlesworth and Johnson, 2018).

The relationship of income to healthcare expenditure is generally understood in terms of income elasticity of demand (IED). IED measures the percentage change in healthcare spending relative to percentage change in income. Empirically, the effect of real income growth on healthcare expenditure has been subject to much debate, and the precise value of income elasticity remains uncertain (de la Maisonnette and Martins Oliveira, 2015). Early studies tended to report high income elasticities of demand, much greater than unity (Martin et al., 2011). For instance, the first seminal work in this area by Joseph Newhouse found income elasticities of between 1.15 to 1.31 for 13 OECD countries using data from 1970 (Newhouse, 1977). Income elasticities above (below) one indicate that healthcare is a luxury (necessity) good in which demand increases more (less) than proportionately as income rises. However, as longitudinal data became available and econometric specifications improved, estimates of income elasticity were revised downwards (Baltagi et al., 2017; Martin et al., 2011; Xu et al., 2011). For instance, Baltagi et al. (2017) find income elasticity for Western European countries to be much lower than one, supporting the idea that healthcare is a necessity as opposed to a luxury in these countries. Table 2.2 provides additional recent estimates of income elasticities for OECD countries from published literature.

TABLE 2.2 Recent income elasticity estimates

Study	Time span	Income elasticity
Moscone and Tosetti (2010)	1980-2004	0.36-0.90
Baltagi and Moscone (2010)	1971-2004	0.44-0.89
Dormont et al. (2010)	1970-2002	0.75-1.59
Chakroun (2010)	1975-2003	Below 1
Acemoglu et al. (2013)	1960-2005	0.7

Source: Adapted from supplementary material provided by Baltagi et al. (2017).

Previous research has focused predominantly on the relationship between income and aggregate healthcare expenditure; only a handful of studies have examined whether IED differs at a service level. Acemoglu et al. (2013), for example, exploiting the variation in oil price shocks, found IED of hospital expenditures to be less than one. In contrast, Barati and Fariditavana (2018) found that most healthcare services in the United States, including hospital services, reported IEDs greater than one.¹² Dental care was the only service to report an IED less than unity. Further evidence from Iran has indicated that in-patient care is a necessity good yet reported income elasticities more than twice that of GP visits and specialist visits (Zare et al., 2013).

Despite the relationship between healthcare expenditure and income still being subject to some uncertainty, the combination of demographic and income effects still fails to account for a large part of total growth in public healthcare expenditure across countries in the past (de la Maisonneuve and Martins Oliveira, 2015). Relative price effects, technological progress and the underlying health policies and institutions are considered the more likely candidates to explain this residual growth (de la Maisonneuve and Martins Oliveira, 2015). They are considered in turn below.

Relative prices

Relative price effects relate to the fact that prices for healthcare tend to rise at a greater rate than non-medical prices. An explanation of this observed trend is contained in Baumol's theory of cost disease (Hartwig, 2008). This theory posits that, because healthcare is labour-intensive, productivity in healthcare tends to be lower than in other sectors. However, as wages in low-productivity sectors must keep up with wages in high-productivity sectors, prices for health services will tend to rise faster than other prices (Baltagi and Moscone, 2010). Baumol's theory can be tested in several ways. For instance, one implication of the theory is that variation in the relative price of medical care (vis-à-vis other prices in the economy) explains variation in healthcare expenditure. However, early studies that used a variable capturing the relative price of medical care as an explanatory variable

¹² This includes hospital care, nursing care facilities, home health care, residential and personal care, and public health activity.

determining healthcare expenditure reported mixed results (Hartwig, 2008; Marino et al., 2017). Medical care prices may, however, not be a useful measure to test the Baumol effect. For example, medical prices may face an upward bias as they do not account for quality adjustments (Hartwig, 2011). Based on such concerns, Hartwig (2008) proposed an alternative Baumol variable, which measures the ratio of wages in healthcare to productivity gains in the general economy (Marino et al., 2017). A coefficient of 1 would indicate that productivity gains in the general economy cause a directly proportional increase in wages in the healthcare sector. Empirically, studies that have used this variable find evidence in favour of Baumol's theory, with an average effect of 0.6 (Marino et al., 2017). This suggests that wages in the healthcare sector rise by about 60 per cent of the productivity gains captured in the general economy.

Technological progress

Technology has been considered an important driver of health expenditure since the seminal work by Newhouse (Newhouse, 1992). Technological progress may affect healthcare expenditure in several ways. For instance, the positive relationship between technological change and health expenditure may be understood by the adoption of new technologies broadening the range of conditions that are treatable, thereby increasing demand. These new technologies (for instance, new oncology drugs, MRI scanners) may, at least initially, be considered to increase costs of care. Measuring technologies' impact on healthcare expenditure traditionally proved difficult. Often the impact of technology is estimated in a residual manner after other drivers of healthcare expenditure have been accounted for (Marino et al., 2017). Previously, measures such as medical equipment availability and use (Baker and Wheeler, 1998) and healthcare R&D spending (Okunad and Murthy, 2002) have been examined. Previous estimates suggest that medical technology has had a large positive effect on healthcare expenditure, explaining between 27 and 48 per cent of health expenditure growth in the US since 1960 (Smith et al., 2009).

Policy

One limitation of the residual method is that it captures all unexplained non-demographic drivers of healthcare expenditure, not just technology (although this is assumed to be the largest component). Health system characteristics (including health financing, provider payment mechanisms and service provision) are also considered important candidates to account for unexplained healthcare expenditure growth once other factors have been considered. Some evidence exists to show that, in OECD countries, the higher the publicly financed share of healthcare expenditure, the lower is per capita healthcare expenditure (Gerdtham, 1992; Gerdtham et al., 1992a; Gerdtham et al., 1992b). Gerdtham et al. (1992a) showed that an increase in the fraction of public financing by 10 per cent was associated with 5 per cent lower healthcare expenditure. Greater control of

healthcare providers in publicly financed systems has been advanced as an explanation of these results (Przywara, 2010). Other studies, however, have contradicted these findings (Bech et al., 2011; Christiansen et al., 2006; Leu, 1986).

A small number of studies have also examined the role of healthcare financing mechanisms as a determinant of healthcare expenditure. Overall healthcare expenditure has been observed to be higher in systems with social health insurance designs as opposed to tax-financed systems. Gerdtham et al. (1998) found that countries that used primary care as a gatekeeping function had approximately 18 per cent lower healthcare expenditure than those without gatekeeping. However, in an analysis by Barros (1998), the existence of gatekeeping was not found to explain health expenditure growth over time and across OECD countries. Recently, de la Maisonneuve et al. (2017) showed that, while differences in public healthcare expenditure across countries can be largely explained by demographic and economic factors (around 71%), cross-country variation in measures of the impact of policies and institutions explained most of the remaining difference. In summary, health system characteristics do seem to play a part in determining healthcare expenditure, but traditionally the literature has offered potentially conflicting results regarding the relative importance of different characteristics.

2.3 MODELLING METHODS FOR HEALTHCARE EXPENDITURE PROJECTION

The literature identified on healthcare expenditure projection methodologies characterises three broad modelling approaches: macro-level, component-based and micro-simulation. Classification is based primarily on the level of data disaggregation inherent in the approach.¹³ Macro-level models, most appropriate for short-term forecasting, focus on modelling broad aggregates. On the other hand, micro-simulation models focus on individuals as the unit of analysis rather than focusing on aggregated values (Przywara, 2010). These data-intensive models are used primarily to simulate individual behavioural responses to policies yet to be implemented (Zucchelli et al., 2012).

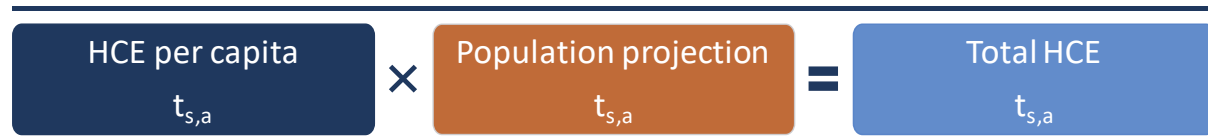
Component-based models, in contrast, represent a large variety of models that analyse expenditures by various components (e.g. financing agent, goods and services, groups or individuals). An important sub-class of component-based models is known as macro-simulation or cell-based models. These involve grouping individuals into cells according to key attributes, usually age and sex. Typically, they focus on expenditure projection, with each age (a) and sex (s) cell associated with an average healthcare expenditure (i.e. healthcare expenditure per capita) for goods and services in question. At its most basic level, healthcare expenditure is

¹³ See Wren et al. (2017) for a detailed review of these alternative modelling methods.

then projected by multiplying these average expenditures by the projected number of individuals included in each cell in each projection year (t) (Astolfi et al., 2012) (see Figure 2.2).

Macro-simulation models are flexible, are operational in the face of data constraints and, importantly from a stakeholder perspective, provide a transparent and intuitive approach to modelling future healthcare demand and expenditure (Wren et al., 2017). Macro-simulation modelling is thus a popular modelling framework, adopted internationally (Astolfi et al., 2012).

FIGURE 2.2 Basic conceptual representation of macro-simulation projection modelling



Source: Authors' representation.

2.3.1 Top-down versus bottom-up projection models

Many component-based projection models tend to be top-down in nature and provide aggregate projections on total or public healthcare expenditure (Astolfi et al., 2012). As noted by Charlesworth and Johnson (2018), these models tend to project on the main drivers of healthcare expenditure described in the literature (see Section 2.2): demographic factors, income effects, and other cost pressures. Large econometric analyses often provide parameter estimates for many of these drivers which are subsequently incorporated into projections. There are several examples of top-down projection model exercises. For instance, the European Commission's biennial EU Ageing Reports model *inter alia* healthcare expenditure projections for each member state (and Norway) using (mostly) country specific aggregate age cost profiles (European Commission, 2009a; 2012a; 2015; 2017). Colombier and Weber (2011) employ top-down macro-simulation modelling to examine the importance of ageing as a driver of future healthcare expenditure using Swiss data. Top-down macro-simulation models have also been recently employed to examine potential trends in future healthcare expenditure for Spain (Blanco-Moreno et al., 2013) and the United Kingdom (Licchetta Mirko and Michal Stelmach, 2016).

An alternative approach is to model projected healthcare expenditure from the 'bottom up'. Bottom-up models consider many of the same drivers of health spending but do so based on detailed information on the components of expenditure, demand and cost, for various services and their usage by different types of people (Charlesworth and Johnson, 2018). These types of models are less common than top-down models, given the greater associated data burden. However, the bottom-up approach incorporates more flexibility and a wider range

of applications. Bottom-up models capture differing patterns of demand and component cost requirements of service provision that exist across sectors. This modelling helps highlight not only areas where expenditure pressures are projected to be particularly strong, but also the relative contribution of demand and cost in explaining projected expenditure pressures.

Two notable examples of bottom-up healthcare projection modelling are Wanless (2002) and Charlesworth and Johnson (2018). Wanless (2002) provided an early example of bottom-up sectoral modelling in his review of the long-term trends affecting health services in the UK as far as 2022–2023. Most data were disaggregated by five-year age groups (births, 0-4, ..., 95+) and sex, with activity and cost assumptions modelled separately. The review provided a breakdown by several activity types, such as in-patient admissions, GP visits, screening, health promotion and stays in residential homes. Total health spending was projected to increase from 7.7 per cent (2002–2003) to between 10.6 and 12.5 per cent of GDP (2022–2023), depending on the modelling scenario.

Updating the Wanless (2002) analysis in 2018, Charlesworth and Johnson (2018) reported projections of UK healthcare expenditure to 2033/2034. Similarly to Wanless (2002), the report approached projections from a bottom-up perspective, modelling demand and cost components separately for a range of UK healthcare services. Under the scenarios modelled, UK healthcare expenditure was projected to increase as a share of GDP from 7.3 per cent in 2018–19 to 8.9 per cent or 9.9 per cent in 2033–34.

In an Irish context, the Irish Fiscal Advisory Council has also adopted bottom-up methods to health spending projections as part of wider analyses of the expenditure pressures facing the public sector over both the short (Irish Fiscal Advisory Council, 2018) and longer term (Irish Fiscal Advisory Council, 2020). Demand for services changes in line with demographics and income while adjustments to prices capture changes in the cost of delivering public services (Irish Fiscal Advisory Council, 2020). Under current policies, the Council projects that public health spending would rise from 8.3 per cent to 13 per cent of GNI* by 2050. Full implementation of Sláintecare would be expected to add 1.1 percentage points of GNI* to government spending by 2030, rising, against the background of increased cost pressures, to 1.2 percentage points by 2050.¹⁴

¹⁴ Modified GNI (GNI*) is an indicator designed to exclude globalisation effects that disproportionately affect the measurement of the size of the Irish economy. GNI is adjusted for 'retained earnings of firms that have re-domiciled to Ireland; the depreciation of foreign-owned intellectual property assets located in Ireland; and the depreciation of aircraft owned by aircraft-leasing companies' (Department of Finance, 2018).

2.3.2 Modelling the drivers of healthcare expenditure

For the most straightforward projections, expenditure profiles can be kept constant through the entire projection horizon, implying that all change in healthcare expenditure over the projection period is driven solely by changes in the size and structure of the population. However, this may represent a somewhat unrealistic assumption given that many factors, both demographic and non-demographic, can influence the projected path of future healthcare expenditure (see Section 2.2). This section reviews approaches adopted to incorporate drivers of healthcare expenditure, highlighting variations between top-down and bottom-up approaches where relevant.

Demographic drivers

Given that uncertainty may exist in terms of the future path of population growth and ageing, a standard adjustment to component-based modelling is to examine alternative assumptions relating to demographic change (European Commission, 2011; 2014; 2017). Failure, however, to incorporate effects of improved health status as populations age could lead to systematic over-estimation of future healthcare demand and expenditure requirements. Therefore, many projection models incorporate assumptions related to healthy ageing through the projection horizon. A common approach to incorporating healthy ageing effects is that used by the European Commission (European Commission, 2008; 2011; 2014; 2017). In simple terms, this involves adjusting baseline age and sex-specific per capita healthcare expenditure profiles in relation to changes in life expectancy between the base year and the projection year. This is under the assumption that per capita expenditure profiles act as a proxy for age-related morbidity profiles. The strength of the shift specified will determine the healthy ageing hypothesis modelled. This healthy ageing approach was also adopted in previous Hippocrates projections (Keegan et al., 2018a; Wren et al., 2017)¹⁵ and is incorporated in the projection analysis in this report (see Chapter 4).

The effects of health and ageing can also be analysed through incorporating death-related costs into projections. Death-related cost adjustments reflect the fact that a large share of total healthcare expenditure is concentrated in the final years of an individual's life (i.e. 'proximity to death' effect). In a projection context, as mortality rates at relatively younger ages decline and a smaller share of each age cohort is in its terminal phase of life, constant expenditure profiles may therefore overestimate projections of healthcare expenditure (European Commission, 2015).

Death-related costs are incorporated into macro-simulation projections through splitting the population, by age and sex, into survivor and decedent sub-groups in the base year. This split is achieved using age and sex-specific mortality rates (i.e.

¹⁵ In Wren et al. (2017) and Keegan et al. (2018a), these shifts were applied to demand rather than expenditure profiles.

the probability of dying). Each sub-group is then assigned a different expenditure profile; that being an adjustment to the ‘normal’ expenditure profile by the ratio to which decedent costs differ from survivor costs. Death-related cost projections will therefore differ from non-death-related cost projections as age and sex-specific mortality rates change through the projection horizon (Colombier and Weber, 2011; European Commission, 2014).¹⁶

It is important to note that the ability to incorporate death-related costs effects into projection modelling is heavily influenced by data availability. For instance, the European Commission was able to analyse death-related cost projections for only a subset of countries that were able to return requisite information on death-related costs by age (European Commission, 2015; 2018). Similarly, Blanco-Moreno et al. (2013), due to the lack of information on decedent and survivor cost profiles, estimated death-related costs through incorporating information available on palliative care costs. In this current report, data limitations mean it is not possible to explicitly incorporate the impact of death-related costs in the analysis.

Non-demographic drivers

Adjustments to capture the effect of non-demographic drivers of expenditure in top-down projection models often involve shifts to expenditure curves to variously model the impact of relative prices, income elasticity effects, and technology and other residual drivers of expenditure. In many cases, a convergence factor is also applied so that the effect of these drivers dissipates as the projection horizon approaches. While bottom-up models incorporate many of the same non-demographic drivers, the approach to modelling their impacts is often more nuanced.

Income

A standard approach in top-down projection exercises is to increase healthcare expenditure in line with projected changes to real GDP per capita. For instance, the Office for Budget Responsibility in the UK applies an elasticity of 1, which assumes that increases in income are accompanied by the same proportionate increase in healthcare expenditure (Licchetta Mirko and Stelmach Michal, 2018). In contrast, in its last Ageing Report, the European Commission applied an IED of 1.1 in 2016, initially assuming healthcare to be a luxury good, but converging towards 1 by 2070 (European Commission, 2017). Other studies have also applied an IED of 1.1 (Blanco-Moreno et al., 2013; Colombier and Weber, 2011). Based on the review of evidence on income elasticities in OECD countries (see Table 2.2), it may be more

¹⁶ Further refinements to this assumption can then take place through changing the age-specific ratio of survivor-to-decedent expenditures through the projection horizon (known as the k-ratio) (European Commission, 2014). The European Commission outlines an approach to link changes in the k-ratio to changes in life expectancy (European Commission, 2014; 2017).

reasonable to assume an IED less than 1 when modelling healthcare expenditure projections. This is the approach adopted by the OECD in recent analyses, primarily modelling IED between 0.7 and 0.85 (de la Maisonneuve and Martins Oliveira, 2015; Lorenzoni et al., 2019).

Bottom-up sectoral healthcare projection models tend not to explicitly model income elasticity parameters. This may in part be due to the fact that, at a health service level, less empirical evidence exists on the relationship between healthcare demand and income, and the evidence that does exist lacks consistency (see Section 2.2). Moreover, bottom-up models may inherently account for the impact of income on healthcare expenditure in other ways, and to explicitly model IED would be to double-count income as a driver of healthcare expenditure. For instance, Charlesworth and Johnson (2018) characterise the IED as the underlying factor that leads to rising expectations for quality and range of care provided under their ‘modernised’ projection scenario. This includes, for example, modelling an increase in the numbers of people with a mental health condition who receive NHS care and increasing emergency and elective care provision to meet targets and reduce backlogs (Charlesworth and Johnson, 2018).

Relative prices

As described in Section 2.2.2, a theoretical and empirical explanation for rising healthcare prices relates to wages in the healthcare sector being tied to productivity improvements in the wider economy (i.e. Baumol’s cost disease). Reflecting this idea, the European Commission Ageing Reports examine the impact on healthcare expenditure of unit costs evolving in line with changes in labour productivity (i.e. GDP per hours worked) (European Commission, 2011; 2014; 2017). Colombier and Weber (2011) and de la Maisonneuve and Martins Oliveira (2015) assume that per capita long-term care expenditures rise in line with productivity increases in the wider economy (but do not apply these assumptions to projections of per capita healthcare expenditure). Recently, Lorenzoni et al. (2019), based on panel regression methods, estimated a differential in productivity growth between the total economy and the health sector, and used this as a basis for incorporating a Baumol effect into health spending projections to 2030 for all OECD member countries.

An advantage of bottom-up projection models is that the unit costs of care can be modelled directly, including offsetting adjustments for healthcare-specific productivity improvements. For instance, Wanless (2002) models increases in hospital and community health services’ pay of 4.9 per cent a year in nominal terms through the projection horizon. While this pay growth assumption is common across all scenarios, offsetting assumed productivity improvements are varied between 0.75 and 3 per cent per year. Charlesworth and Johnson (2018) adopt a similar approach. Under their ‘status quo’ scenario, real annual wages grow by

between 1.7 and 1.9 per cent per annum between 2018 and 2033/34, with productivity growth of 0.8 per year assumed, matching historical long-run healthcare productivity growth. Under their more optimistic ‘modernised’ scenario, wage growth of between 1.9 to 3.0 per cent per year over the period is offset with higher assumed productivity growth of between 0.8 and 1.4 per cent per year over the period. Comparable methods have also been adopted in bottom-up modelling of long-term care and dementia (Wittenberg et al., 2018; Wittenberg et al., 2020). These analyses assume that the unit costs of care, such as the cost of an hour’s home care, rise in line with assumptions for rises in average earnings. Specific to Ireland, the Fiscal Council has recently modelled public pay growth to rise in line with economy-wide wage growth (between 2.0 and 2.7 per cent per annum to 2050) under long-term projections of public finances (including healthcare) (Irish Fiscal Advisory Council, 2020).

Modelling other non-demographic drivers

Residual estimation

Directly measuring the effect of important non-demographic drivers on healthcare can be challenging given that it is often difficult to find reliable proxies to measure their impact. In this context, many top-down macro-simulation projection exercises estimate a residual coefficient (measured by a time trend) to capture the effect of these non-demographic factors and project expenditures based on this estimated value (Marino et al., 2017).

For instance, the European Commission examines a ‘non-demographic determinants’ scenario whereby the residual approach is adopted to identify the aggregate impact of non-demographic factors (including income) on healthcare determinants. Country-specific non-demographic cost estimates are defined as the excess growth in real per capita healthcare expenditure over the growth in real per capita GDP, after controlling for demographic factors. Results are expressed in terms of an elasticity, with the weighted median of country-specific estimates (1.4) applied to projections in the base year, converging toward 1 by 2070 (European Commission, 2017).

However, where income effects are specifically controlled for, much of this unexplained residual is assumed to capture the impact of technology. Dybczak and Przywara (2010) adopt this residual approach through regressing healthcare expenditure on both demography and income and allowing the coefficient on a time trend to correspond to the impact of technology and other unexplained non-demographic factors. Their findings suggest that these factors increase healthcare expenditure by an additional 2 percentage points per year on average across countries. This estimate is then used as a basis to project forward the impact of

technology to 2060 (with the impact of technology linearly converging to zero by 2060).

A criticism of the residual approach associated with top-down macro-simulation projection exercises is that residual estimation for technology, as noted by Marino et al. (2017), also takes other effects into account, and thus it has been traditionally difficult to provide plausible estimates for the impact of policies and institutions which have been identified as a potential important driver of healthcare expenditure (see Section 2.2.2). With that in mind, de la Maisonneuve and Martins Oliveira (2015) separate out the impact of technology (through a proxy approach) and attempt to better quantify the effect that policies and institutions may have on healthcare expenditure growth. The authors estimate that 0.8 percentage points of residual growth can be explained by the combined impact of relative prices and a technology effect (proxied by the relative pace of patent creation in the health sector relative to the rest of the economy on average in OECD countries). An additional 0.9 percentage points of growth is captured through a time trend coefficient which the authors attribute to the impact of changes in policies and institutions. The authors then project healthcare expenditure to 2060 using a combined expenditure growth effect of 1.7 per cent per year (0.8% + 0.9%).

Additional approaches

As noted, most projection models that incorporate technology as a residual are top-down in nature. As a bottom-up sectoral analysis, however, Charlesworth and Johnson (2018) adopt a more focused approach to modelling the effect of technology. Specifically, technology's impact on healthcare expenditure is measured through a 5.5 per cent real-terms annual increase in hospital drug unit costs. This is based on trends in total costs of hospital drug prescribing, removing activity growth. The large increase in hospital drug costs is assumed to capture the impact of hospitals as the setting for the introduction of newer, more innovative technologies (Charlesworth and Johnson, 2018). In an Irish context, a similar approach has recently been adopted by the Fiscal Council as part of its long-term projections of healthcare spending (among other public services). Under its projection approach, prices for medicines and medical devices (included as part of non-pay health expenditure) are assumed to rise faster than household consumer goods (although the size of this effect is not reported) (Irish Fiscal Advisory Council, 2020).

Within a health system, a wide range of services can be provided to a population; an additional benefit of bottom-up sectoral modelling is that this framework allows for greater flexibility in testing scenarios around changing patterns of service provision. For instance, Wanless (2002) under his most optimistic scenario, models a 2 per cent switch of activity from GPs to pharmacists along with a reduction in outpatient (OPD) attendances among 450,000 people using self-care. Additional

reductions in demand for hospital and GP services are also modelled to simulate changes in health promotion and health behaviour. Charlesworth and Johnson (2018) apply their bottom-up model to examine the impact of improved health system standards on projected expenditure. As noted previously, this includes modelling an increase in mental health treatment prevalence and increasing emergency and elective care provision to meet targets and reduce backlogs. For instance, following an approach developed by Findlay (2017), planned in-patient activity is increased over and above the growth requirements attributable to changing population and chronic conditions, to avoid increased waiting times for care. Wren et al. (2017) also estimated service-specific measures of unmet need or demand across the Irish healthcare system and incorporated them into demand projections. This report will refine that approach, in line with the Findlay (2017) methodology, to estimate projected costs of removing backlogs, and maintaining waiting times for OPD and admitted elective care at manageable levels.

2.4 SUBSTITUTABILITY OF CARE AND AVOIDABLE HOSPITALISATIONS

As described in Section 2.3.2, a benefit of bottom-up sectoral modelling is that it allows greater flexibility for testing scenarios around changing patterns of care provision relative to more aggregate approaches. In this regard, a key recommendation of Sláintecare (see Chapter 1) is to strengthen the primary care system and shift appropriate care away from the acute system. While it can be difficult to quantify the impact of this substitution towards the primary care system, the change in rate of hospitalisation for conditions where the need for secondary care is reduced, by timely and appropriate ambulatory or primary care, is regularly employed in the literature to evaluate interventions aimed at improving primary care accessibility and quality (Gibson et al., 2013; Rosano et al., 2013; van Loenen et al., 2014). These conditions are collectively referred to as ambulatory care-sensitive conditions (ACSC) or avoidable hospitalisations. This section reviews the evidence in relation to primary care strength and avoidable hospital admissions as a basis for modelling in Chapter 4 the potential effect of a better-resourced primary care system of acute care spending.

Avoidable hospitalisations are those that, through appropriate preventative health interventions as well as early and ongoing disease management, might have been prevented (Australian Commission on Safety and Quality in Healthcare, 2017). This description notes a key distinction between hospitalisations deemed to be ‘necessary’ and those designated as ‘unnecessary’. They differ in that avoidable hospitalisations incorporate those that could have been treated more appropriately in a primary setting (e.g. hypertension) and thus could be classified as ‘unnecessary’, in addition to conditions which could have been prevented by timely access to primary care but which are ‘necessary’ once the condition has progressed (e.g. influenza) (Nolan, 2011).

Understanding how primary care design may affect rates of avoidable hospitalisation is not straightforward. The research in this area is mainly observational in nature, and this relationship is subject to multiple potentially confounding factors. Indeed, it has been argued that sociodemographic and health characteristics rather than primary care are, in fact, the major drivers of avoidable hospitalisation (Falster et al., 2015). That said, several systematic reviews have identified an association between primary care design and rates of avoidable hospitalisation. For example Rosano et al. (2013) concluded that a majority of studies examined reported the expected inverse relationship between avoidable hospitalisations and accessibility (measured in terms of physician supply) to primary care. Another review, conducted by van Loenen et al. (2014), confirmed sufficient primary-care physician supply to be associated with lower risks of avoidable hospitalisations across countries, disease and study populations. In addition, continuity of relationships between patients and GPs also resulted in fewer hospital admissions. However, evidence on the positive effects of other organisational aspects to primary care delivery, such as specific disease management programmes, is still lacking.

Some Irish-specific evidence also exists regarding the relationship of primary care access and rates of avoidable hospitalisation. Nolan (2011), applying quasi-experimental difference-in-difference analysis, examined the impact of the extension of free GP care to those aged 70 and over in 2001 on rates of avoidable hospitalisations. Relative to a comparator group (those under 70), no significant effect on avoidable hospitalisations was identified. One explanation offered is that other 'non-financial' barriers (such as personal mobility, transport and information) may be more important barriers to access for older populations.

Sexton and Bedford (2016), considering HIPE discharges related to only chronic obstructive pulmonary disease (COPD) and diabetes complications, examined the effect of primary care provision (proxied using GP supply) as well as deprivation on county-specific age-standardised rates of adult emergency in-patient discharges in 2011. They reported a national rate of 337.5 per 100,000 for COPD discharges and 108.1 per 100,000 in relation to diabetes complications. Significant differences in rates were observed across counties. The authors also report a negative correlation between the rate of discharges for both conditions and the level of GP supply. As a practical example, the authors estimate that, if Ireland had a national discharge rate for COPD and diabetes similar to Galway (which at the time had levels of deprivation and medical-card coverage consistent with national averages, but relatively high levels of GP supply) this would translate into approximately 1,500 fewer COPD discharges and 780 fewer discharges related to diabetes complications annually. The authors support the view that improvements in primary care resourcing have the potential to reduce avoidable hospitalisation

rates but caution that the complex system of entitlements particular to Ireland may mediate the effect in unforeseen ways.

Recently, McDarby and Smyth (2019) identified three main conditions accounting for a large proportion of potentially avoidable public acute hospital utilisation in 2016. Just over half of all recorded avoidable hospitalisations related to respiratory conditions: vaccine-preventable influenza and pneumonia, and COPD. Vaccine-preventable Influenza and pneumonia accounted for 39.0 per cent of bed days, and COPD for 14.5 per cent of bed days, associated with avoidable hospitalisations, respectively. The third most frequently diagnosed condition, pyelonephritis, represented 13.8 per cent of bed days associated with avoidable hospitalisation. Rates for these conditions were concentrated in older ages. The authors recommend prioritisation in primary care investment related to integrated care programmes for respiratory avoidable hospitalisations, while there was also evidence to support targeting community-based pulmonary rehabilitation, including pneumococcal and influenza vaccination programmes, in order to reduce the burden of infection and hospitalisations.

2.5 INTERNATIONAL COMPARISON OF ACUTE CARE EXPENDITURE

The Irish healthcare system is predominantly government-financed (74%), with out-of-pocket (OOP) payments contributing 12 per cent to overall financing and private health insurance (PHI) contributing 14 per cent in 2018 (Central Statistics Office, 2020a). Total public and private current Irish healthcare expenditure was €22.5 billion in 2018 (Central Statistics Office, 2020a). The public acute hospital sector in Ireland receives the largest component of public healthcare funding, accounting for 34 per cent of non-capital HSE expenditure in 2019 (Department of Health, 2019a). Analysis of profound pressures on healthcare delivery from recent and projected rapid population growth and ageing informed new targets for expanded public hospital capacity in the 2018 National Development Plan (Government of Ireland, 2018a; PA Consulting, 2018; Wren et al., 2017).

Ranking Irish hospital care expenditure for international comparative purposes has been found to be challenging for a number of reasons (Wren and Fitzpatrick, 2020). The typical measure used for such comparisons is healthcare as a percentage of GDP, but GDP is an over-stated measure of national income in Ireland due to the accounting methods of the large multinational sector (Fitzgerald, 2018). Thus, Wren and Fitzpatrick (2020) substituted GNI* for GDP in cross-country comparisons of public hospital expenditure as a percentage of national income.¹⁷ While healthcare expenditure as a share of national income is a commonly used

¹⁷ The GNI* measure was substituted for GDP as the preferred measure of national income for Ireland because GDP overstates income remaining with Irish residents due to the effects of multinational activity and globalisation on Irish national accounting measures.

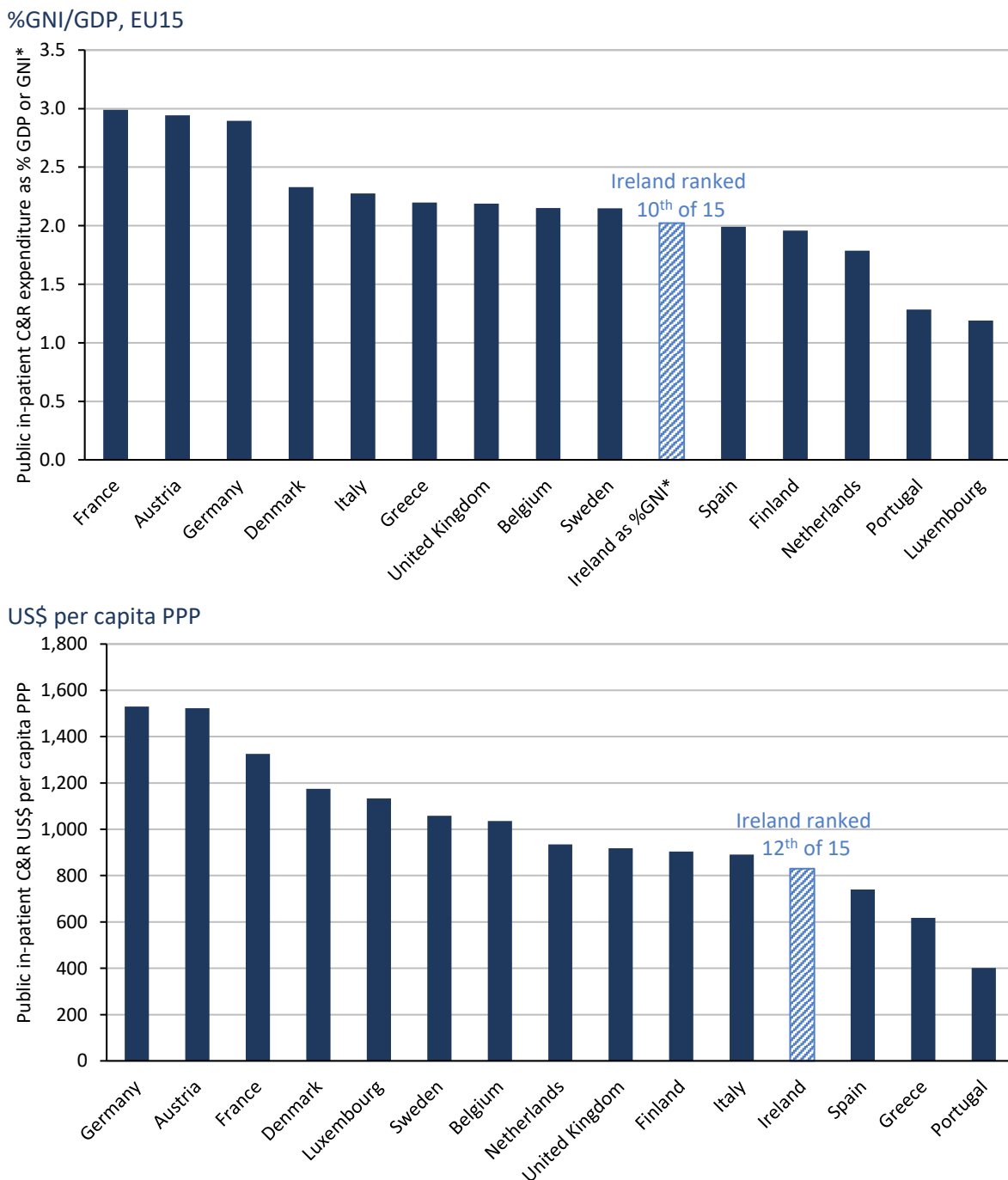
metric in international comparisons, it includes both price and volume components and does not adjust for population size. Wren and Fitzpatrick (2020) therefore further examined healthcare expenditure per capita, adjusted for purchasing power parity, which is designed as a measure of the volume of healthcare services supplied. This change in measure has a substantial effect on the ranking of Irish healthcare expenditure (HCE). Irish public HCE as a share of national income, for instance, ranked 5th in the EU15 in 2017, whereas Irish public healthcare per capita with adjustment for relative prices ranked 9th (Wren and Fitzpatrick, 2020).

A further challenge in comparing hospital care expenditures across countries is that definitions and categories of hospital expenditure in OECD Health Statistics, the data source for these comparisons, do not align exactly with the definitions traditionally used for public hospital programme spending in Ireland. OECD data for hospital care are accounted for under the functional categories of Curative and Rehabilitative (C&R) Care. In the Irish data returned to the OECD, these two functional categories are not accounted for separately. Aggregate C&R expenditure does not equate to hospital expenditure, including for instance some expenditure on services that are home-based, some provided in residential long-term care settings, and some provided in the community by primary care providers. Thus, it is necessary to analyse OECD data at a quite disaggregated level in order to reach an accounting category that equates to expenditure on hospital services. At this disaggregated level, however, there is the further limitation that hospital expenditure is not separately reported for publicly and privately financed services (Wren and Fitzpatrick, 2020). In OECD data, public and private definitions refer to the source of financing, whether government (public) or private health insurance or out-of-pocket (private). The OECD does not categorise expenditure by provider ownership, whereas this report focuses on the provider category of public and voluntary hospital services, whether financed by government or privately by PHI or OOP.

In relation to hospital care, Wren and Fitzpatrick (2020) found that Irish public inpatient C&R expenditure per capita with adjustment for relative prices ranked 12th in the EU15 in 2017, while private inpatient C&R expenditure per capita ranked 1st. However, this was not purely a comparison of public expenditure on hospital in-patient services since over one-tenth of Irish inpatient C&R expenditure funds services provided in residential long-term care settings. When Irish HCE per capita on inpatient C&R provided by hospitals is compared, combining publicly and privately financed services, Irish expenditure ranked 7th in the EU15 and was 3 per cent below the EU15 mean. In contrast, Irish day C&R expenditure on services provided by hospitals ranked 1st in the EU15.

Building on the analysis by Wren and Fitzpatrick (2020), in Figure 2.3, we examine Irish public inpatient C&R expenditure as a share of national income, which we find to rank 10th in the EU15. This compares to the Wren and Fitzpatrick (2020) finding that Irish public in-patient C&R expenditure per capita, with adjustment for relative prices, ranks 12th in the EU15 (Figure 2.3). Relatively high prices in Ireland inflate in-patient expenditure as a share of national income and, when this relative price effect is removed, the volume of inpatient C&R services supplied ranks relatively lower.

FIGURE 2.3 Public in-patient C&R expenditure, 2017



Source: OECD (2019b).

2.6 SUMMARY

This chapter has reviewed and discussed the background and the evidence that informs the approach taken to applying the Hippocrates Model to project healthcare expenditure in this report. Hippocrates has been developed as a macro-simulation model. As described in this chapter, macro-simulation models or cell-based models represent a large and important class of component-based models. These models are flexible, are operational in the face of data constraints and, importantly from a stakeholder perspective, provide a transparent and intuitive approach to healthcare projection modelling. While many component-based models are top-down in nature, Hippocrates has been developed from a bottom-up service-level perspective, modelling demand and cost separately. Bottom-up models tend to be less common, given greater data requirements, yet allow for a wider range of applications. While top-down and bottom-up projection models account for many of the same drivers of healthcare expenditure, the approach to incorporating these drivers can differ. As described, demographic and non-demographic factors both contribute to healthcare expenditure growth over time, but, as later chapters will also demonstrate, non-demographic factors tend to dominate. As reviewed in this chapter, Ireland's apparent high healthcare expenditure internationally appears to be driven by high prices for healthcare delivery in Ireland, particularly salaries, and be influenced by Ireland's status as a high-wage, high-cost economy.

The next chapter describes the generation of key demographic and non-demographic (macroeconomic) projection scenarios that feed into Hippocrates. Chapter 4 then provides detail on the Hippocrates projection methodology, the scenarios underlying the expenditure projections, and an overview of data sources.

CHAPTER 3

Macroeconomic and demographic scenarios

3.1 INTRODUCTION

This chapter details the macroeconomic and demographic projection scenarios developed and applied in this report, which form the basis for understanding projected expenditure trends in Chapters 5 to 7. Relative to Wren et al. (2017), the demographic projections have been updated and revised in light of the potential impact of Covid-19, while two alternative Covid-19 economic recovery scenarios form the basis of the macroeconomic projections. We discuss, in turn, the assumptions used to develop the macroeconomic and demographic scenarios applied in this report. These projections, developed through the ESRI's COSMO and demographic projection models, are later grouped into expenditure scenarios in Chapter 4. The macroeconomic scenarios provide a basis for modelling the non-demographic drivers (e.g. pay) of healthcare expenditure, while the demographic scenarios provide a basis for modelling the demographic drivers (e.g. population size and ageing), as discussed in Chapter 2.

3.2 MACROECONOMIC PROJECTION SCENARIOS

This section describes macroeconomic projections from 2018 to 2035 that are used in this report to develop healthcare expenditure projections. Future economic growth, demographic change and population ageing have important implications for healthcare spending and the long-run sustainability of the public finances. The projections are generated using the ESRI's macro-econometric model COSMO (**CO**re **Str**uctural **MO**del of the Irish Economy). Owing to the uncertainty about the duration of the economic impact of Covid-19, the economic outlook is highly uncertain. As a result, we consider two alternative macroeconomic scenarios termed *Recovery* and *Delayed Recovery*. Our approach is to simulate the economic shock(s) associated with Covid-19 and to model two potential recovery paths for the economy. This section briefly outlines the current macroeconomic context, and describes the methodology and assumptions underpinning the two scenarios. Finally, the scenarios are presented, where an emphasis is placed on the key macroeconomic aggregates that are subsequently used as inputs into the Hippocrates Model for projecting expenditure.

3.2.1 Macroeconomic context

There is broad consensus that the Irish economy has the capacity to grow at around 3–3.5 per cent per annum (in real terms) over the medium to long term.¹⁸ This, referred to as the potential growth rate of the economy, reflects the level of growth that is sustainable (without causing inflationary pressures) over the longer term.

However, the Covid-19 pandemic has triggered a global and domestic economic shock. While the pandemic is a public health shock that is having adverse economic impacts, it is not a traditional economic shock. As a result, the path of the economy is highly uncertain, especially over the short term. It depends on factors that are not easily predictable such as the stringency and duration of existing and new public health containment measures, the success of these measures in controlling the virus, the effectiveness of treatments and vaccines, and the behavioural response of consumers and firms as more normal activity resumes. The severity of containment measures has been unprecedented owing to the highly contagious nature of the virus, and means that much of the literature on the economic impact of pandemics may only provide lower-end estimates. Furthermore, relative to other European countries, Ireland had one of the most severe and longest periods of lockdown, as measured by the newly developed Oxford Stringency Index (Hale et al., 2020).¹⁹ At the same time, there has been an unprecedented level of government intervention in terms of transfers and income supports, extra spending in health and other business and household support programmes. This will help dampen the negative economic effects of the public health crisis but will also have direct negative implications for the public finances.

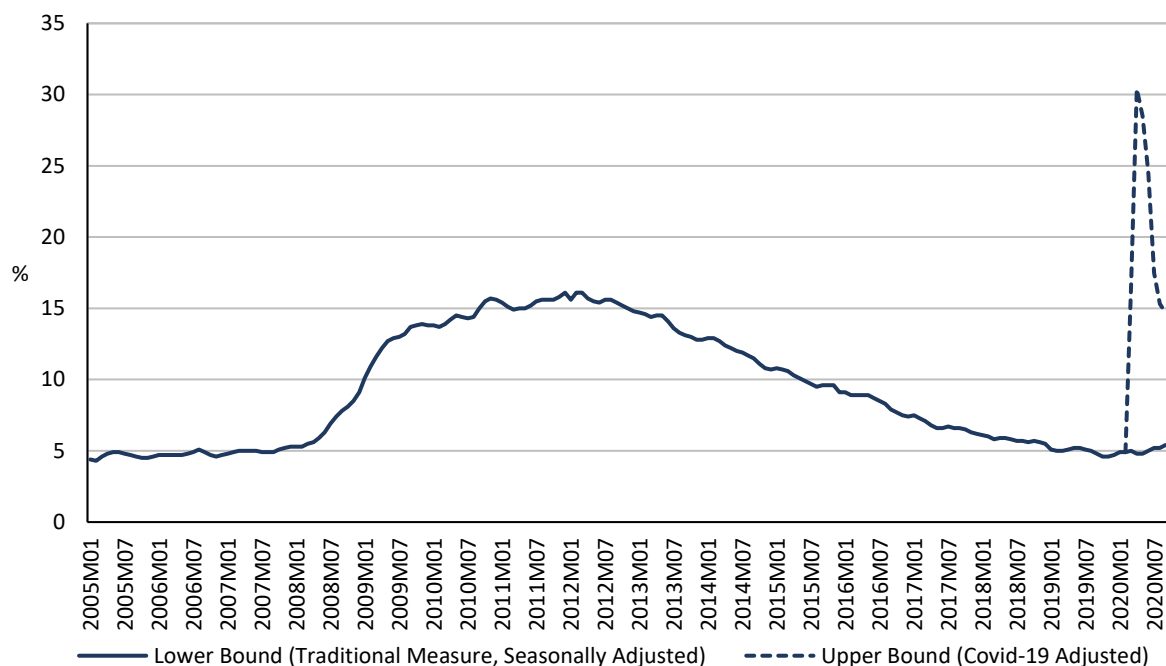
The strictest restrictions were in place in Ireland in the second quarter of 2020. Many sectors were effectively either closed or activity was severely limited before restrictions were eased in June and July. The macroeconomic effects of the virus are arguably most noticeable in terms of the labour-market impacts. Figure 3.1 shows the monthly unemployment rate and the Covid-19 adjusted unemployment rate (Pandemic Unemployment Payment recipients are classified as unemployed).²⁰ The graph shows that, prior to the pandemic, the unemployment rate was around 5 per cent, a rate consistent with full employment (a level of employment such that there is no cyclical unemployment). The rate rose sharply in March and peaked in April at just over 30 per cent, while it has been falling since then as the economy gradually opened up and stood at 14.7 per cent in September.

¹⁸ See, for example, Bergin et al. (2016) and Department of Finance (2019).

¹⁹ See O'Toole (2020) for a comparison in this index across countries over time.

²⁰ In addition, over 300,000 workers are being financially supported by the Employment Wage Subsidy Scheme. These workers are not classified as unemployed. The scheme is currently scheduled to run until spring 2021. Some of these workers may become unemployed.

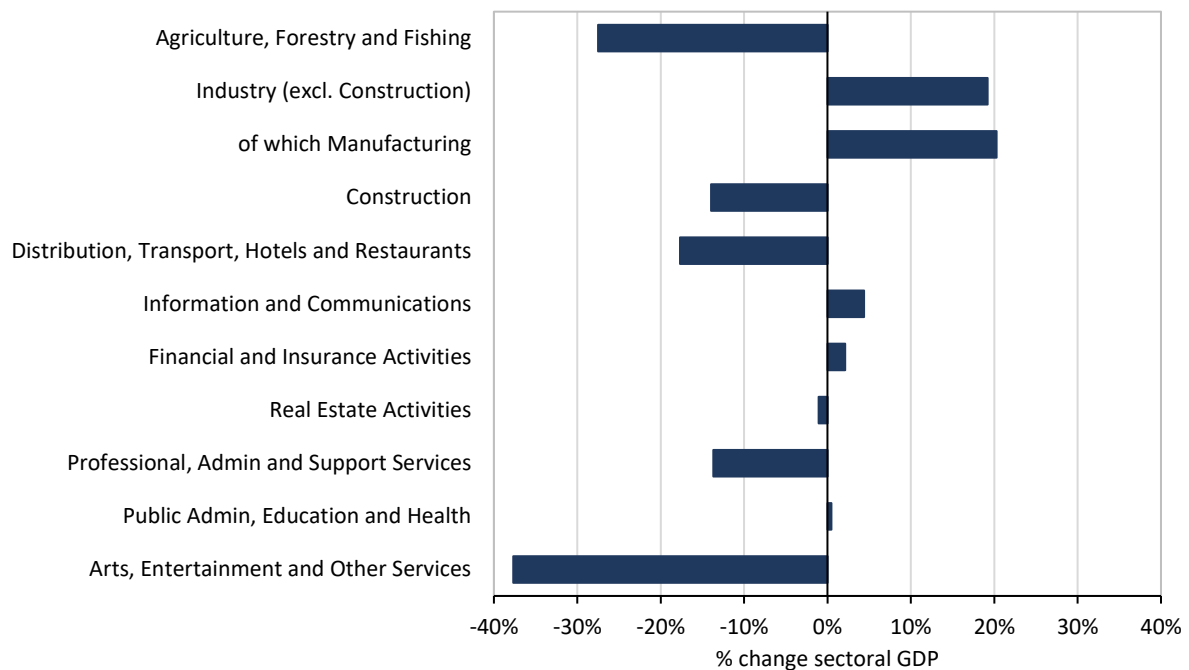
FIGURE 3.1 Monthly unemployment rate, 2005 M01–2020 M07



Notes: The unemployment rates are expressed as a percentage of the labour force aged 15–74. The Covid-19 adjusted monthly unemployment rate is based on the share of the labour force that were not working due to unemployment or were out of work due to Covid-19 and receiving the Pandemic Unemployment Payment (PUP). If all PUP recipients were classified as unemployed, the adjusted measure provides an upper bound of the monthly unemployment rate.

Source: CSO, *Monthly Unemployment*, available at: <https://www.cso.ie/en/releasesandpublications/er/mue/monthlyunemploymentseptember2020/>

Most domestic and international analysis, up to roughly the end of August 2020, had expected the containment measures to severely affect growth in the short term. For example, looking across the short-term projections of the ESRI (May), the Central Bank (July) and the Department of Finance (April), real GDP was expected to fall in the region of 9 to 20 per cent in 2020. However, recent data reveal that, while the economy has suffered a massive domestic shock affecting key aggregates such as consumption, significant parts of the traded or export sector have been relatively much less affected. As a result, the most recent short-term projections are much more benign, and, while real GDP is expected to fall in 2020, the extent of the fall is much less than what had been anticipated. In October, the ESRI, Central Bank and Department of Finance (Central Bank of Ireland, 2020; Department of Finance, 2020; McQuinn et al., 2020) each published new short-term projections, which show that the fall in GDP is now expected to be in the range of 0.4 to 2.5 per cent in 2020. Figure 3.2 shows the change in sectoral GDP in the first six months of 2020 relative to the same period last year. What is striking from the graph is the uneven performance across sectors, with export-orientated sectors such as Manufacturing, Information & Communications and Financial & Insurance activities all reporting positive growth over the period, while non-traded sectors which are more reliant on domestic demand, and which experienced the strictest restrictions, saw the largest falls in output.

FIGURE 3.2 Sectoral GDP: percentage change in 2020 Q1&Q2 relative to 2019 Q1&Q2

Notes: The data are shown by NACE Rev 2 A10 sectors as is the convention in National Accounts. The data are in constant basic prices. Overall real GDP growth was 0.3% in the first six months of 2020 compared to the same period in 2019.

Source: CSO Quarterly National Accounts Quarter 2 2020. Available at: <https://www.cso.ie/en/releasesandpublications/er/na/quarterlynationalaccountsquarter22020/>

Previous research has shown that the export orientation of the Irish economy and the sectoral structure of Irish exports, in particular the concentration in pharmaceutical and medical devices, helped to dampen the worst effects of the financial crisis and was a significant contributor to the recovery (see, for example, (Barry and Bergin, 2019; McQuinn and Varthalitis, 2018)). It appears that these features are also playing a key role in alleviating the most negative effects of the Covid-19 pandemic at a macroeconomic level (O'Toole, 2020). The outlook for 2021 and beyond remains uncertain. The timing and speed of any recovery is difficult to evaluate because of the extraordinary nature of the shock and the various unknown factors mentioned earlier.

3.2.2 Methodology and assumptions

The macroeconomic scenarios presented in the report are developed using our macroeconomic model COSMO. This section provides a brief description of the key features of the model, and describes the two scenarios and the main underlying assumptions.

A brief description of COSMO

COSMO is a structural macroeconomic model of the Irish economy which models the behaviour of the economy in a small open-economy framework. It has a theoretically founded structure with econometrically estimated parameters and

dynamics. It is designed to be used for medium-term economic projections and policy analysis.

The key mechanisms of the model are summarised below.²¹

COSMO initially focuses on the supply-side (output side) of the economy, and then examines the expenditure (demand side) and income consequences. A multi-sectoral model, it distinguishes between the traded sector, the non-traded sector and the government sector.²² The disaggregation reflects the differences between firms/agents operating within the three sectors. There is an underlying production function for each sector that ultimately drives medium-term growth in the economy. Output in the traded sector is driven by global demand for Irish exports and cost competitiveness. The non-traded sector is reliant on domestic demand. The government sector is policy-driven and includes the treatment of borrowing and debt accumulation.

Demand is disaggregated along standard national accounting lines (household consumption, public consumption, investment, exports and imports). Households make consumption decisions based on the current income and holdings of wealth. They also supply labour, with the supply of labour dependent on after-tax wages and migration, as well as demographic assumptions. The labour market is open and migration is influenced by conditions in alternative labour markets. Firms employ labour and make investment decisions, with their factor demands derived from the underlying production functions. Wages are determined in a bargaining model and influenced by the factors that affect the supply and demand for labour – e.g. prices, taxes. The government sector raises taxes, transfers income to households, employs labour and invests in capital. Any deficit accumulates onto the government debt stock, and interest must be paid on this debt.

Key assumptions underpinning the scenarios

COSMO has previously been used to develop medium-term projections for the Irish economy (Bergin et al., 2016). The exercise here has the same focus but the projections for the shorter term are developed by imposing various shocks on the model, intended to replicate the initial economic shocks associated with Covid-19.²³

²¹ This section draws on Bergin et al. (2017), which contains a full description of the mechanisms and behaviour of the model.

²² Sectors are defined based on the Supply and Use Input-Output Tables from the CSO. A sector is defined as traded if at least 50 per cent of total final uses (excluding change in stocks) is exported. The aggregate government sector comprises those sectors in which at least 50 per cent of total final uses (excluding changes in stocks) is used by the government as consumption. The non-traded sector comprises the remaining sectors. The traded sector comprises Manufacturing, Information and Communications, Finance and Insurance activities, and Professional, admin and support services; the government sector comprises Public Administration, Education and Health, and the remaining sectors are classified as non-traded.

²³ This analysis draws from Bergin et al. (2020).

The approach taken is to define the main channels through which the pandemic is affecting the economy, to calibrate the size of these shocks using recent data and research, and to develop two alternative paths/scenarios over the short and medium term. The main channels through which the pandemic and associated public health measures are negatively affecting the economy relate to production, employment, consumption, investment, and a weaker global environment. At the same time, government measures – including income supports, extra spending in health, and household and business support measures – should help dampen the most negative economic effects of the public health crisis.

CSO data for the first two quarters of 2020 from the *Quarterly National Accounts* is used to calibrate the shocks to consumption and output in the non-traded sector, while the *Labour Force Survey* and *Monthly Unemployment* are used to calibrate the shocks to employment. Recent research from the National Institute of Economic and Social Research in the UK (Hurst et al., 2020) on the possible international economic impact of the coronavirus, using its global multi-country model NiGEM, is used to provide the assumptions relevant for the traded sector. Additional shocks to investment are also considered to take account of the uncertainty facing firms and the fact that many firms have delayed investment decisions. These shocks are implemented into COSMO for the first half of 2020; however, the extent and pace of any recovery beyond that time is unclear. Both scenarios assume that the most severe macroeconomic impacts will have been in the first three quarters of 2020.

The *Recovery* scenario assumes some rebound in non-traded employment and output in the second half of 2020 and then a relatively rapid return to where the economy would have been (in the absence of the pandemic) by 2023 Q4. It also assumes that there will be a rebound in consumption in the second half of 2020. Furthermore, as the export sector has held up reasonably well so far in response to the pandemic, the shock to world demand for Irish exports in this scenario is scaled back.

The *Delayed Recovery* scenario assumes that the recovery in non-traded employment and output is delayed until the end of 2024. It also assumes that world demand for Irish exports remains weak until the end of 2023, and that consumption and investment are slower to recover from the initial shocks. This scenario also incorporates some scarring effects, whereby some of the losses in employment and output in the non-traded sector are considered to be permanent. This permanent loss of output and employment is difficult to calibrate; it is thus assumed to be 5 per cent. However, depending on the behavioural responses by consumers and firms, this loss could be larger.

3.2.3 Macroeconomic scenarios

This section describes the projections for key macroeconomic aggregates from the *Recovery* and *Delayed Recovery* scenarios. Table 3.1 summarises the macroeconomic projections for both scenarios averaged over various time periods out to 2035. Projections of the pay component of unit costs in this analysis are based on (average) projected government-sector, nominal average wage growth from these scenarios. Projections of the non-pay (non-drug) component of unit costs in this analysis are based on the projected inflation rate from these scenarios. For a full description of how these parameters are incorporated into the expenditure modelling, and the variations to growth applied, see Section 4.3.

TABLE 3.1 Summary of macroeconomic projections for the Recovery and Delayed Recovery scenarios

Averaged over:	2019-2020	2021-2025	2026-2030	2031-2035	Overall
<i>Recovery scenario</i>					
GDP, constant prices, % growth	0.4	5.8	3.4	3.3	3.7
GNP, constant prices, % growth	0.7	6.8	4.0	4.3	4.5
GDP, current prices, % growth	3.4	7.5	5.3	5.1	5.7
GNP, current prices, % growth	1.8	9.1	6.7	6.5	6.8
Government sector, nominal average wage % growth	2.5	2.5	2.5	2.5	2.5
Inflation rate, % ^a	1.8	1.1	2.0	1.6	1.6
<i>Delayed Recovery scenario</i>					
GDP, constant prices, % growth	-0.9	5.8	3.6	3.5	3.7
GNP, constant prices, % growth	-0.3	8.3	4.2	4.3	4.9
GDP, current prices, % growth	2.2	6.7	5.6	5.4	5.5
GNP, current prices, % growth	0.5	8.5	7.1	6.8	6.7
Government sector, nominal average wage % growth	2.2	2.2	2.2	2.2	2.2
Inflation rate, % ^a	1.8	0.5	2.0	1.7	1.4

Note: a The inflation rate in COSMO is the deflator on personal consumption and so it is a broader measure of price pressures than the traditional consumer price index which considers price changes in a specific basket of goods. Over time the two measures tend to track each other quite closely. The GDP deflator is often used as well in these types of analyses. In Ireland, as a small open economy, the GDP deflator is influenced by other prices including those for exports, which are not directly relevant for the analysis in this report.

Source: Projections from COSMO model.

The table shows that growth, measured in terms of gross domestic product (GDP) or gross national product (GNP), is severely curtailed in the short term, and this is largely driven by the effects of Covid-19 on the economy, with the effects being larger in the *Delayed Recovery* scenario as the economy is expected to recover at a slower pace. The largest losses occur in the non-traded sector, driven by the severe impact on consumption caused by the public health restrictions and the slowdown in investment. As mentioned earlier, the relatively strong performance of the traded sector helps mitigate the losses, but not by enough to stop the economy from registering negative growth for the 2019–20 period in the *Delayed Recovery* scenario.

Over the 2021–25 period, the economy recovers as the effects of the pandemic wane. In the *Recovery* scenario, output returns to baseline (where it otherwise would have been, in the absence of the pandemic) by the middle of 2023. In the *Delayed Recovery* scenario, output largely recovers after another two years. Despite the size of the initial shock, the economy grows over the medium term, even in the more pessimistic scenario. In terms of wage growth, we assume that nominal wages in the government sector experience average annual growth of 2.5 per cent per annum over the period in the *Recovery* scenario and 2.2 per cent per annum in the *Delayed Recovery* scenario.²⁴ These are policy modelling assumptions that reflect the long-run model projection for wages in the sector, which are ultimately linked to wage developments in other sectors of the economy. Over the short run, wage developments in the sector are difficult to project. For example, recent data show that wage growth has held up quite well so far in the pandemic. For example, average weekly earnings (seasonally adjusted) grew by 4.7 per cent on an annual basis in the first two quarters of 2020 (which includes the period when the strictest public health restrictions were in place) and by 3.3 per cent in the human health and social work sector.²⁵ The ESRI's Autumn 2020 *Quarterly Economic Commentary* makes a similar point in its analysis of the public finances, which shows that, despite the unprecedented increase in unemployment, income tax receipts for the first nine months of the year were only 1.9 per cent below where they were in the previous year. However, at some point, the deterioration in the public finances may lead to downwards pressure on wages in the government sector. As the outlook for the economy is uncertain and because of the importance of these projections for aspects of healthcare spending, the report also considers a public sector 'pay freeze' sensitivity in Section 8.3.

Over the more medium term, there is some internal adjustment in the economy in terms of lower price growth to help guide the economy back towards potential output. This has a positive effect on competitiveness in the traded sector and more generally on labour demand and output in the economy. Beyond 2025, the economy grows at or around its potential rate. In the *Recovery* scenario, the improvement in competitiveness helps the economy move above where it otherwise would have been (had there been no pandemic); in the *Delayed Recovery* scenario, the economic scarring, caused by factors such as firm closures, keeps the economy close to but below where it otherwise would have been (had there been no pandemic).

²⁴ In COSMO, government-sector wages are modelled at an aggregate level. Although the model does not explicitly differentiate between different components of the wage bill, including increments, the projections are consistent with long-run historical wage developments in the health sector. For example, Eurostat data show that nominal average annual wage growth in the health sector was 2.6 per cent between 1995 and 2019.

²⁵ CSO (2020), Earnings Hours and Employments Costs Survey Q2 2020.

3.3 DEMOGRAPHIC PROJECTION SCENARIOS

This section describes new population projection scenarios which have been developed for the latest version of the Hippocrates Model. Three population scenarios were examined in Wren et al. (2017). A main Central scenario was based on trends in the data and linked to medium-term projections for the Irish economy, and, given the uncertainty inherent in any projection exercise, the report also considered High Population Growth and Low Population Growth scenarios.

Since the publication of that report, new and revised data are available which have been incorporated into this version of the demographic model. Furthermore, some of the assumptions have been adjusted to reflect existing and emerging trends in the data. In particular, net international migration has been adjusted downwards over the short to medium term because of the effects of Covid-19, and the population estimates for 2020 have been adjusted to take account of deaths from Covid-19. The section below outlines the main assumptions and presents the updated population scenarios. It also describes key differences in assumptions and in overall scenario projections from those in Wren et al. (2017).

3.3.1 Assumptions

A cohort component methodology is used to generate population projections. This method begins with a base year population²⁶ and projects the population by sex and single year of age for each year over the projection horizon according to assumptions on the components of population change (fertility, mortality and net international migration).²⁷ This section outlines the main assumptions on mortality, fertility and migration that are required to generate demographic projections, before describing each assumption in more detail.

Table 3.2 outlines the main assumptions for each demographic scenario and provides the comparable assumptions for the previous scenarios in Wren et al. (2017).²⁸ At a broad level, the main differences between the two sets of scenarios are:

- 1) Improvements in life expectancy have been more muted than expected in recent years. This has contributed to an assumption of continued improvements in life expectancy over the projection horizon but at a slightly lower rate of improvement than in the previous projections.

²⁶ The base year in the projections is 2016 as this is the latest year for which complete detailed data are available. Census data by sex and single year of age are used on the *de facto* (i.e. all persons present on Census night) population for the base population. The base year in Hippocrates has been updated to 2018, so the assumptions guiding each of the demographic scenarios only diverge from 2019 on.

²⁷ See Wren et al. (2017) for a complete description of the methodology.

²⁸ The projection horizon has been extended to 2035 in the new projections.

- 2) Net immigration has accelerated in recent years in line with the recent strong relative performance of the Irish economy, and has been closer to the levels in the High Population Growth scenario in Wren et al. (2017). Incorporating this data means that population estimates for the most recent years are higher than the previous projections. However, the public health crisis is likely to reduce net migration below where it otherwise would have been. It is likely that travel restrictions, uncertainty about the evolution of the pandemic and lower confidence may result in net migration being significantly lower, at least in the short term. Medium-term projections for migration have been adjusted in line with somewhat lower growth and weaker economic conditions.²⁹
- 3) Recent data show a decline in the overall fertility rate compared with the previous projections. This will affect both the near-term projections, and has led to a downward adjustment in overall fertility rates across the three projection scenarios.

TABLE 3.2 Summary of main assumptions for population scenarios and comparison with 2017 projections

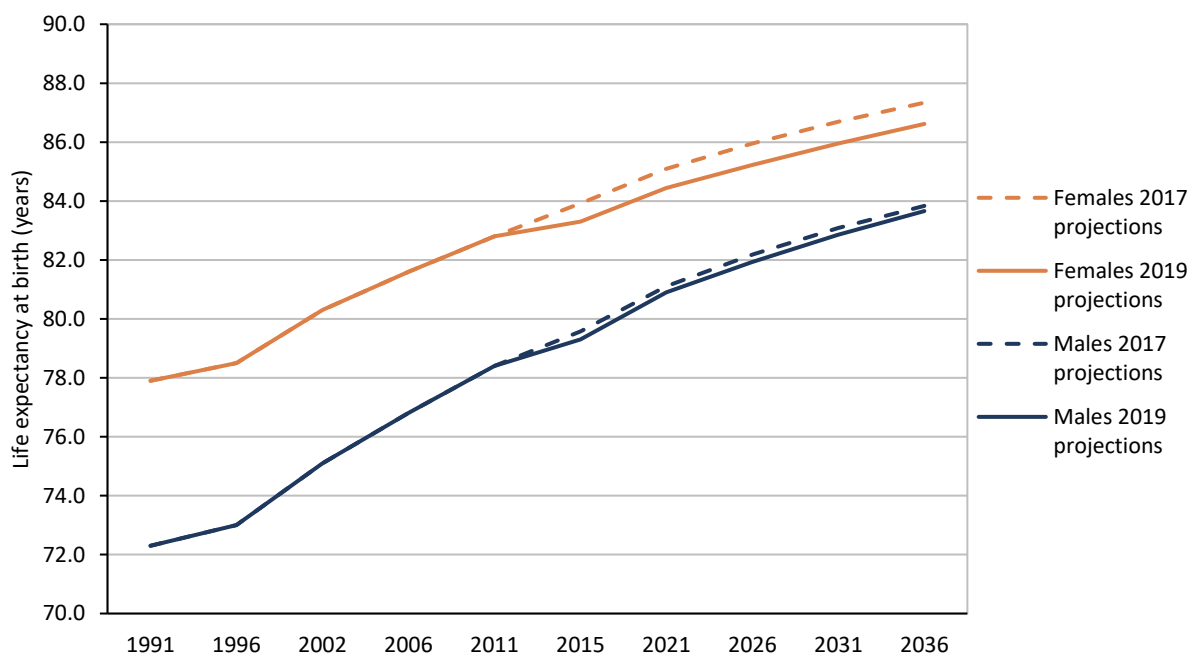
2020 Projections	Central scenario	High Population scenario	Low Population scenario
Mortality			
Mortality rates assumed to decrease with gains in life expectancy at birth from 79.5 years for males and 83.4 years for females in 2015 to:	82.7 years for males and 85.8 years for females in 2030 and 83.5 years for males and 86.5 years for females in 2035	83.0 years for males and 86.1 years for females in 2030 and 83.8 years for males and 86.7 years for females in 2035	82.4 years for males and 85.6 years for females in 2030 and 83.2 years for males and 86.2 years for 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. thereafter	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 of 1.72 to 1.96 by 2026 and remains constant thereafter	Declines from 2019 rate of 1.72 to 1.62 by 2030 and to 1.6 by 2035
Wren et al. (2017)	Central scenario	High Population scenario	Low Population scenario
Mortality			
Mortality rates assumed to decrease with gains in life expectancy at birth from 78.4 years for males and 82.9 years for females in 2011 to:	82.9 years for males and 86.5 years for females 2030	83.2 years for males and 86.8 years for females in 2030	82.6 years for males and 86.3 years for females in 2030
Migration			
Net immigration over the projection horizon:	Averaging 9,000 p.a. to 2021 and 13,000 p.a. thereafter	Averaging 39,000 p.a. to 2021 and 28,000 p.a. thereafter	Averaging 1,000 p.a. to 2021 and 12,000 p.a. thereafter
Fertility			
Total fertility rate:	Unchanged from 2015 rate of 1.94	Rises to 2.1 by 2021 and constant thereafter	Declines to 1.8 by 2021 and to 1.58 by 2030

²⁹ Lower migration in the future could also have implications for migrant labour supply of healthcare workers, which in turn could have implications for healthcare expenditure.

Life expectancy

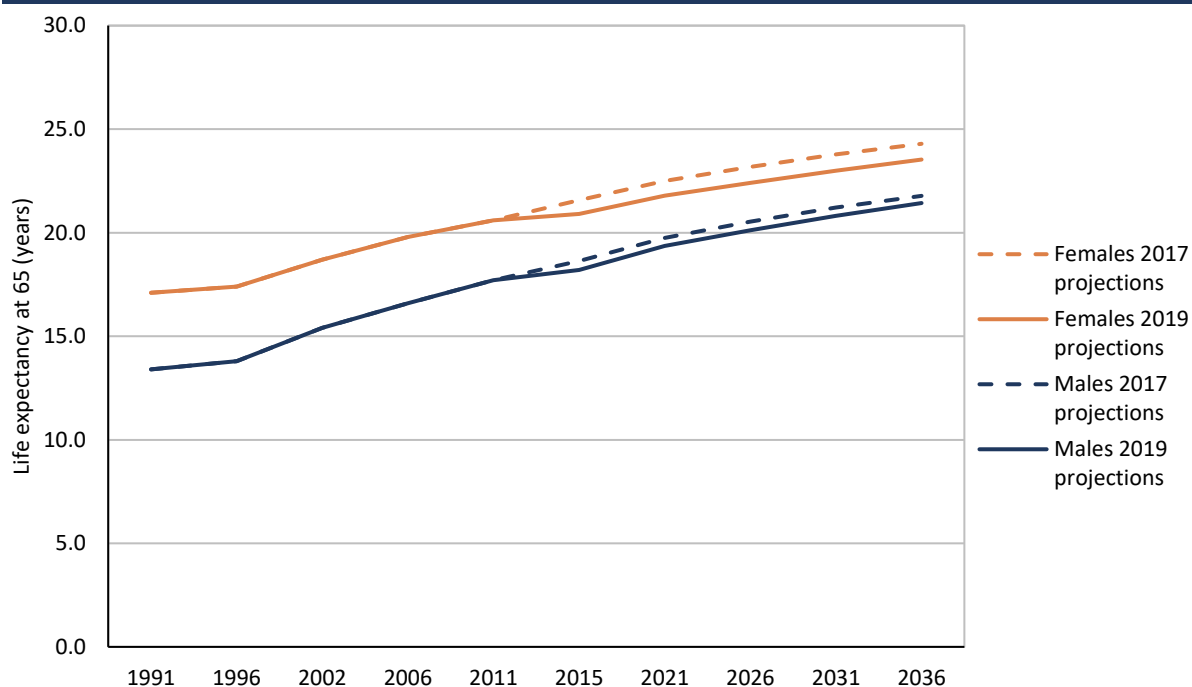
The period expectation of life at birth is the average number of years a newborn would live for, based on prevailing mortality rates for that year, and is shown in Figure 3.3 for males and females. While the data show continued improvements in life expectancy over time, the data for the most recent years reveal a slight slowdown in the rate of improvement.

FIGURE 3.3 Period life expectancy at birth, 2020 compared to 2017 projections



Sources: Central Statistics Office (2013; 2018b).

This slowdown in the rate of improvement is more pronounced for females than for males, and is evident across the age distribution (see Figure 3.4 which shows life expectancy for males and females at age 65). It is difficult to assess the reasons for the recent slowdown in life expectancy improvements, which have been observed generally in the Western world, as changes over time tend to be driven by a range of economic, social, institutional and health factors (Preston et al., 2018; Whelan and Naqvi, 2019).

FIGURE 3.4 Period life expectancy at age 65, 2020 compared to 2017 projections

Sources: Central Statistics Office (2013; 2018b).

The mortality assumptions developed for the recent CSO population projections are followed (Central Statistics Office, 2018b) while Wren et al. (2017) adopted the mortality assumptions from the previous CSO projections (Central Statistics Office, 2013). The recent projections (Central Statistics Office, 2018b) show a continued improvement in life expectancy, although at a slower pace than in previous projections. To generate the projections, a ‘targeting’ method is adopted where it is assumed that short-term rates of improvement in mortality (by sex and single year of age) will gradually converge to long-term rates of improvement (by sex and single year of age) by a target year (assumed to be the 25th year of the projections).³⁰ The short-term rates of improvement in mortality rates for males and females up to the age of 90 are 2.5 per cent and 2.0 per cent per annum respectively. These short-term rates of improvement are assumed to decline linearly over a 25-year period to a long-term rate of 1.5 per cent per annum for males and females. It is assumed there are no mortality improvements from the age of 100 years. For those aged between 90 and 100, the rate of improvement in each year is generated by interpolating between the assumed rate of improvement at 90 years and 100 years. The key difference with the previous set of projections is that the short-term rates of improvement in mortality rates are lower; previously they were 3 per cent per annum for males and 2.5 per cent per annum for females up to the age of 90 (Central Statistics Office, 2013). Furthermore, for 2020, mortality rates have been adjusted to take account of deaths from Covid-19, as this would not have been incorporated into the recent projections (Central Statistics Office, 2018b). This adjustment is only made for 2020, so implicitly assumes that

³⁰ See Whelan (2008) for a complete discussion of the methodology.

although the virus may be present for some time, the number of deaths associated with COVID-19 will not significantly rise in the coming years.³¹

Overall, these assumptions imply a projected increase in life expectancy at birth for males from 79.3 in 2015 to 83.5 years in 2035 and for females from 83.3 in 2015 to 86.5 years in 2035. It is the lower rate of improvement in the near-term current mortality rates that leads to the slower pace of improvement than in the previous projections. Two alternative scenarios for life expectancy are also considered. In the High Population Growth scenario, an additional three percentage points are added to both the short and long-term rates of mortality improvements for both males and females for all ages up to 90. In the Low Population scenario, an additional three percentage points is subtracted from both the short and long-term rates of mortality improvements for both males and females for all ages up to 90. The assumptions for the older ages are generated in the same way as described above. Compared to the Central scenario, male (female) life expectancy at birth is higher by 0.27 years (0.22 years) in 2035 in the High Population scenario and male (female) life expectancy at birth is lower by 0.30 years (0.27 years) in 2035 in the Low Population scenario.

Net international migration

International migration has long played a key role in driving both overall population change and the age structure of the population in Ireland. Migrants tend to be of prime working age; for example, over the 10-year period ending in 2019 over 80 per cent of net migration was in the 15 to 44 year-old age group. This helps to lower the age structure of the population and to reduce dependency rates. Migration flows in and out of Ireland are very volatile, and depend on both domestic and international economic conditions. Following the recovery of the Irish economy from the Great Recession, net immigration turned positive in 2015 and net inflows have been increasing since then. The latest CSO estimates of net international migration for 2017, 2018 and 2019 are +19,800, +34,000 and +33,700 respectively (Central Statistics Office, 2019). This compares to a twenty-year average of approximately +21,400 per annum for the preceding period, showing recent flows have been above the historical average. Our assumptions on net migration begin in 2020, and migration is distributed by gender and single year of age on the basis of historical weights. The overarching assumptions are:

³¹ Specifically, for 2020, the mortality projections by single year of age from CSO (2018) are adjusted downwards to reflect the number of laboratory confirmed COVID-19 deaths. This data is from the HPSC CIDR database and was extracted in mid-June when there was 1,449 deaths of confirmed cases at that point. The adjustment was made as the starting population for 2021 is the population in 2020 and if the projection in the near term is wrong or not adjusted for COVID-19, this can carry through to the projections over the medium term.

Central Scenario: Net immigration declines linearly from 2019 level of +33,700 to +5,000 until 2022 and to remain constant at 10,000 per annum thereafter. The lower projection in the near term reflects the potential impact of Covid-19. While the public health crisis has precipitated a massive global and domestic economic shock, it may not necessarily affect relative economic conditions between Ireland and the international economy. However, the global pandemic may result in economic factors being less important in influencing migration flows in the near term. The medium-term figure is based on updated projections from the *Economic Outlook* (Bergin et al., 2016) and is consistent with expected economic conditions in Ireland and abroad. Over the medium term, net migration is below its long-run average as growth rates between Ireland and the international economy begin to converge.

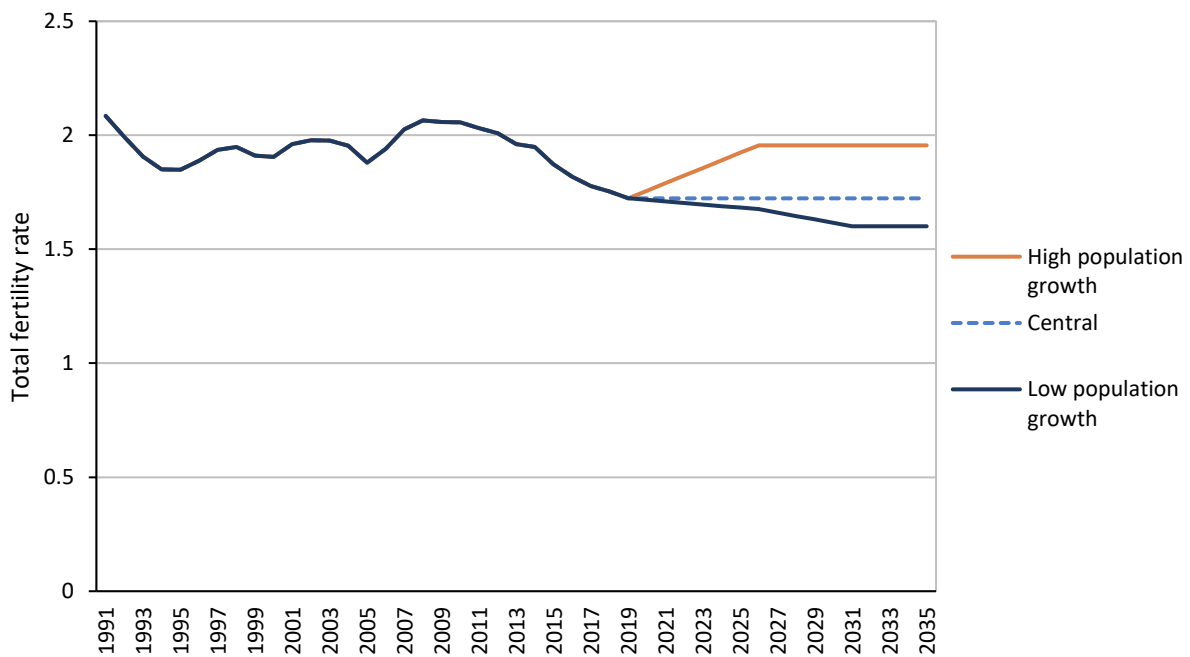
High Population Scenario: Net immigration continues at a high rate of 25,000 per annum over the long term. In the near term, net migration is assumed to decline to between 15,000 to 20,000 until 2022. This scenario is slightly below the assumptions from the previous projections and also below the M1 net inward migration from the recent CSO projections (CSO, 2018).

Low Population Scenario: Net migration turns negative in the short term (net emigration) of between –5,000 and zero until 2022 then remains constant at 5,000 per annum thereafter.

Fertility

The total fertility rate (TFR) (a measure of the number of children that a representative woman will have over her lifetime) has been broadly stable since the mid-1990s but has experienced a modest decline since the beginning of the last decade (see Figure 3.5).

FIGURE 3.5 Total fertility rate



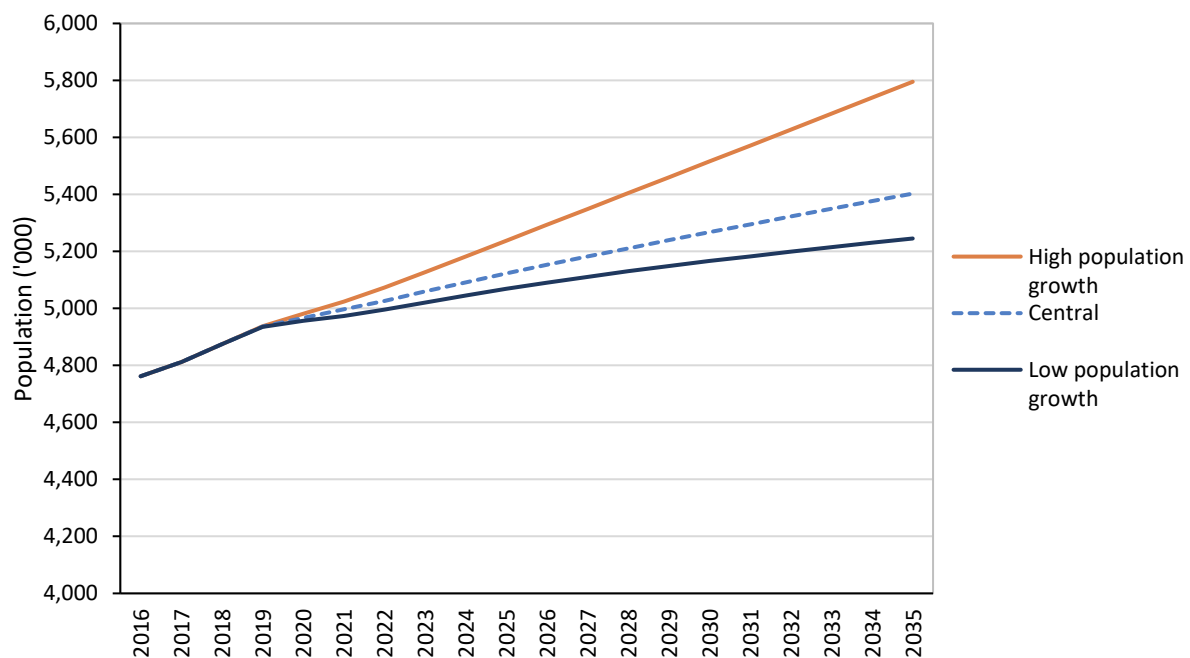
Source: CSO, Vital Statistics and ESRI projections.

For the Central scenario, it is assumed that the TFR will remain unchanged from the 2019 rate of 1.72 over the projection horizon. Some differences in fertility rates by age are allowed for: a modest increase in fertility rates for women in their thirties out to 2026 is assumed, and a further moderate decline for younger women out to 2026, while keeping the overall fertility rate unchanged. In the High Population scenario, the TFR is assumed to rise to 1.96 by 2026 and remains constant thereafter. This is below the replacement rate (the level of fertility at which a population exactly replaces itself from one generation to the next) of 2.1 children per woman, but marginally above the long-run average (over 1991 to 2018) of 1.94. In the Low Population scenario, the TFR is assumed to continue on the slight downwards trajectory observed in recent years, and then declines to 1.68 in 2026, 1.60 in 2031, and remains constant thereafter. The Central Scenario and Low Population Growth scenarios are broadly in line with the F1 and F2 scenarios respectively from the recent CSO projections (Central Statistics Office, 2018b).

3.3.2 Population scenarios

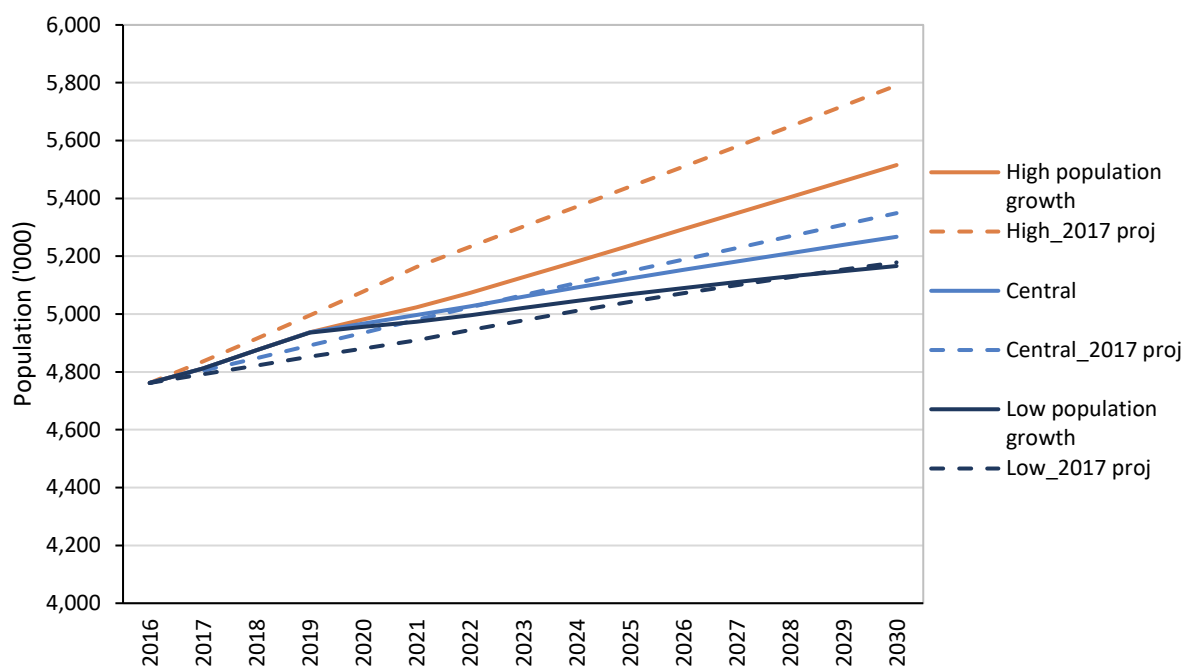
In this section the assumptions on mortality, migration and fertility are brought together for the three scenarios to generate the Central, High Population Growth and Low Population Growth scenarios. Figure 3.6 shows the total population in each of the three scenarios. Each scenario shows relatively strong total population growth over the projection horizon. In the Central scenario, between 2018 and 2035, the population will increase by 528,000, equivalent to average annual growth of just over 0.6 per cent, resulting in a total population of 5,403,000 in 2035. In the High (Low) Population Growth scenario, the total population will grow by 1.02 per cent (0.43%) on an average annual basis resulting in a total population of 5,795,000 (5,245,000) in the High (Low) Population Growth scenario in 2035.

FIGURE 3.6 Total population – Central, High Population Growth and Low Population Growth scenarios



Source: ESRI projections.

Figure 3.7 shows the evolution of the total population under the three scenarios out to 2030 with the three scenarios considered in Wren et al. (2017). While the two sets of scenarios are broadly consistent, the new projections have a slightly narrower range, largely driven by the refinements to the net migration assumptions. By 2030, the total population is around 80,000 lower in the Central scenario compared to the previous projections and 275,000 lower (12,000 lower) by 2030 in the High Population Growth (Low Population Growth) scenario.

FIGURE 3.7 Total population – new 2020 and previous 2017 projections

Source: ESRI projections and Wren et al. (2017).

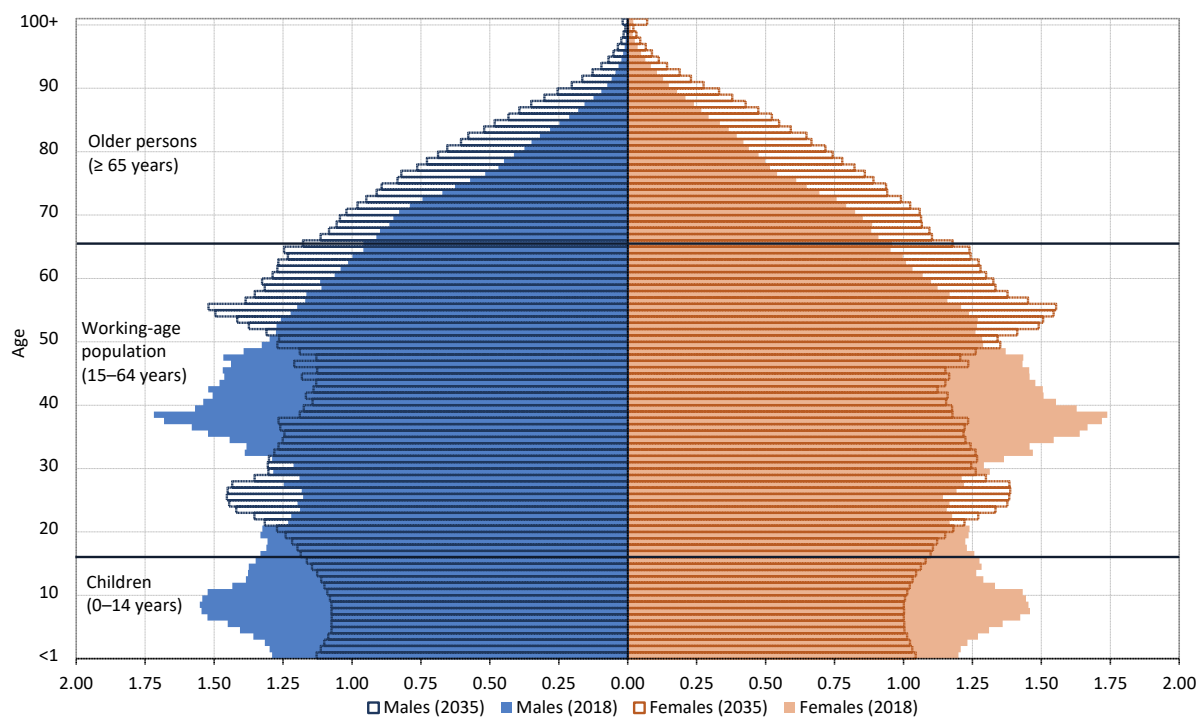
Table 3.3 shows the absolute change and percentage growth in the male and female populations for the Central scenario for the new projections and those from the previous scenarios in Wren et al. (2017). To ensure comparability between the scenarios, the table shows them over the same period, 2016 to 2030. These age cohorts are relevant for different aspects of healthcare services. While the overall absolute increase is somewhat smaller than in the previous projections, many of the trends for age cohorts are similar across both sets of projections, with the older age cohorts expected to experience the fastest growth over the period. The number of children (those aged <15) is projected to experience a sharper fall than in the previous set of projections. This is driven by a combination of a lower assumed overall fertility rate and lower net migration that will result in fewer females in some of the key childbearing age cohorts than was the case in the previous projections.

TABLE 3.3 Comparison between new 2020 and previous 2017 projections of growth in various cohorts 2016–2030

	Males		Females		Total	
	% Increase	Absolute Increase ('000)	% Increase	Absolute Increase ('000)	% Increase	Absolute Increase ('000)
Central Population Growth scenario 2016-2030, 2020 projections						
<15	-13	-68.4	-13	-65.2	-13	-133.6
15-64	10	153.4	10	155.7	10	309.0
65+	54	159.5	50	170.5	78	53.0
80+	99	57.9	65	58.3	78	116.2
85+	114	26.3	60	26.7	78	115.0
All Ages	10	244.5	11	260.9	11	505.4
Central Population Growth scenario 2015-2030, Wren et al. (2017)						
<15	-3	-13.2	-3	-16.0	-3	-29.1
15-64	9	133.6	9	149.0	9	282.5
65+	53	157.5	52	176.4	90	60.8
80+	101	58.8	71	64.1	83	122.8
85+	122	28.2	73	32.6	82	120.7
All Ages	12	277.9	13	309.4	12	587.2

Source: ESRI projections.

In addition to experiencing strong population growth, the age structure of the population will continue to change over time. Figure 3.8 shows population pyramids (which show the percentage of the population in each year of age) for 2018 and 2035. From the graph, the ageing of the population is readily apparent; 20 per cent of the population are over the age of 65 in 2035 compared to just 14 per cent in 2018. At the same time, the proportion of the population accounted for by children (0–14 years old) will become smaller over time as there will be relatively fewer women in the key childbearing age groups. In 2018, 21 per cent of the population were under the age of 15, while the comparable proportion in 2035 is 16 per cent. There is also a slight decline in the proportion of the population of working age, from 65 per cent in 2018 to 64 per cent in 2035.

FIGURE 3.8 Central scenario – population pyramids for 2018 and 2035

Source: ESRI projections.

Finally, Table 3.4 summarises both the total numbers and proportions in various age groups in 2018 and in 2035 for the three population scenarios. In each scenario, despite strong population growth, the ageing of the population is observable over time; the proportion of the population over the age of 65 rises steadily, while the proportion of the population under the age of 15 falls over time. The table also shows the young-age and old-age dependency ratios.³² The old-age dependency rate rises from 0.21 in 2018 to 0.32 in 2035 in both the Central and Low Population Growth scenarios, while it also increases strongly in the High Population Growth scenario, to 0.31 by 2035.

TABLE 3.4 Summary of population scenarios

	2018		Low Population 2035		Central 2035		High Population 2035	
	N ('000)	%	N ('000)	%	N ('000)	%	N ('000)	%
0-14	1,007	21	794	15	857	16	1,027	18
15-64	3,188	65	3,368	64	3,448	64	3,652	63
65+	680	14	1,083	21	1,097	20	1,117	19
Total	4,875	100	5,245	100	5,403	100	5,795	100
Young-age dependency ratio	0.32		0.24		0.25		0.28	
Old-age dependency ratio	0.21		0.32		0.32		0.31	

Source: ESRI Projections.

³² The young-age dependency ratio is the ratio of the number of young people at an age when they are normally economically inactive (under 15 years old) compared to the working-age population (those aged 15 to 64), while the old-age dependency ratio refers to the number of older people at an age when they are generally economically inactive (over 65 years old) compared to the working-age population.

3.4 SUMMARY

This chapter has provided a detailed description of the development of the macroeconomic and demographic scenarios applied in the remainder of the report to project hospital expenditure. Chapter 4 describes the projection methodology in detail and draws together the projection scenario assumptions presenting the eventual expenditure projection scenarios, while Chapters 5 to 7 present the findings from the analyses and projections.

CHAPTER 4

Hippocrates projection methods and data

4.1 INTRODUCTION

This chapter presents the methods used to estimate baseline healthcare expenditure profiles and describes the Hippocrates projection methodology in detail. The expenditure projection scenarios are outlined, and an overview of the data sources employed for the analysis is provided.

4.2 PROJECTION METHODOLOGY

As described in Chapter 2, most component-based models are top-down in nature, projecting on aggregate healthcare expenditure. In contrast, Hippocrates belongs to a smaller class of models that project from a bottom-up service or sectoral perspective; modelling demand and cost separately. While bottom-up models tend to be considerably more data-intensive, they allow for more flexibility and a wider range of applications. Top-down and bottom-up models consider many of the same demographic and non-demographic drivers of healthcare expenditure (these drivers were reviewed in details in Chapter 2). The key drivers of expenditure considered in this analysis are reported in Table 4.1.

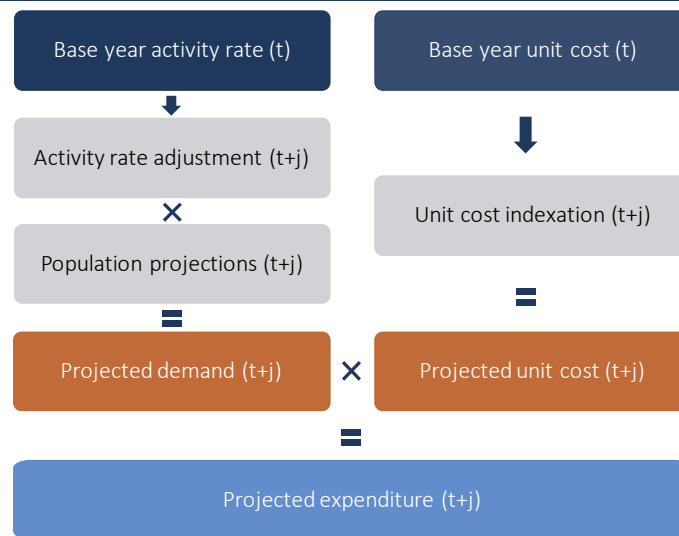
TABLE 4.1 Key drivers of expenditure included in Hippocrates

Demographic drivers	Non-demographic drivers
Population growth and ageing	Earnings growth
Healthy ageing	Drug cost growth
	Productivity

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

4.2.1 Develop activity rate profiles for 2018

The first step involved in developing Hippocrates expenditure projections is to develop base-year (t) age and sex activity profiles. The base year for this analysis is 2018. This involves grouping individuals into cohorts capturing age- and sex-specific activity rates for the service or sector under consideration (e.g. outpatient attendances, day-patient discharges). Activity rates are calculated by dividing age- and sex-specific activity volumes by corresponding age- and sex-specific populations in 2018.

FIGURE 4.1 Hippocrates Model – diagrammatic representation

Source: Authors' representation.

Ideally, where the data allow, age cohorts are disaggregated by single-year-of-age (SYOA). Where SYOA data are not available we use the most detailed level of age disaggregation available (e.g. 5-year age groups). The reasoning behind this is that the sensitivity of projections to changes in the age structure of the population reduces as the level of data aggregation (i.e. fewer age cohorts) increases. Aggregation has the consequence of understating the effect of increasing numbers of older people on healthcare demand and leads to understated demand projections (see Section 3.3.8, Wren et al. (2017)).

4.2.2 Project activity rates to 2035

The next step is to project age- and sex-specific activity rate profiles for each year (j) of the projection horizon. We adjust age- and sex-specific activity rates through the projection horizon in a number of ways, described below.

Adjusting activity rates to account for healthy ageing

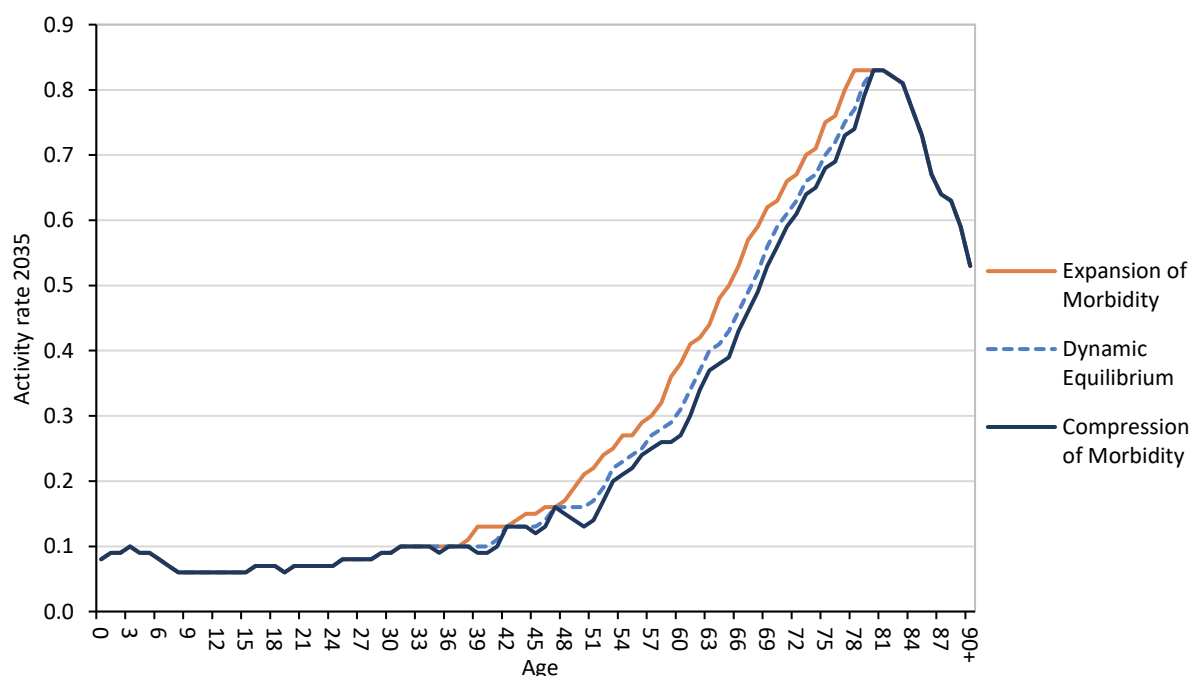
Healthy ageing adjustments are made to account for the fact that, as life expectancy increases, not all additional life years may be spent in bad health (Wren et al., 2017). To simulate these effects, we shift age- and sex-specific activity curves to the right in proportion to projected life-expectancy change. This is based on an approach adopted from the European Commission (European Commission, 2011; 2014; 2017) and previously applied in Wren et al. (2017).³³ The strength of the activity shift applied describes the healthy ageing effect to be modelled. Several healthy-ageing hypotheses are identified in the literature and these are discussed in Chapter 2.

³³ See Section 3.3.5, Wren et al. (2017) for a technical explanation of these activity rate shifts.

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 activity-rate profiles are kept constant over the projection horizon. A more optimistic hypothesis (*Dynamic Equilibrium*) is to assume 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 2018 and 2035, the care demanded by an 80-year-old in 2035 will be the same as that demanded by a 79-year-old in the base year, 2018. The approach is illustrated graphically in Figure 4.2.

Any assumption where activity rate shifts exceed gains in life-expectancy models the *Compression of Morbidity* hypothesis. However, the international literature offers little guidance on parameter values to assign when modelling *Compression of Morbidity*. In this report we follow the approach adopted in Wren et al. (2017) and model *Compression of Morbidity* as gains in health (as proxied by activity rate shifts) exceeding gains in life expectancy by 150 per cent. As in Wren et al. (2017) we also introduce an additional *Moderate Healthy Ageing* assumption so that gains in health are 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.

As with the approach adopted in Wren et al. (2017) activity rate shifts are only applied where activity rates, proxying morbidity, are increasing through the age distribution. Additionally, activity rates shifts are not applied to the entire age distribution as variation in activity rates at younger ages may be less reflective of

variation in morbidity (Blanco-Moreno et al., 2013). Activity rate shifts are therefore limited to those aged 35 and over (Figure 4.2).

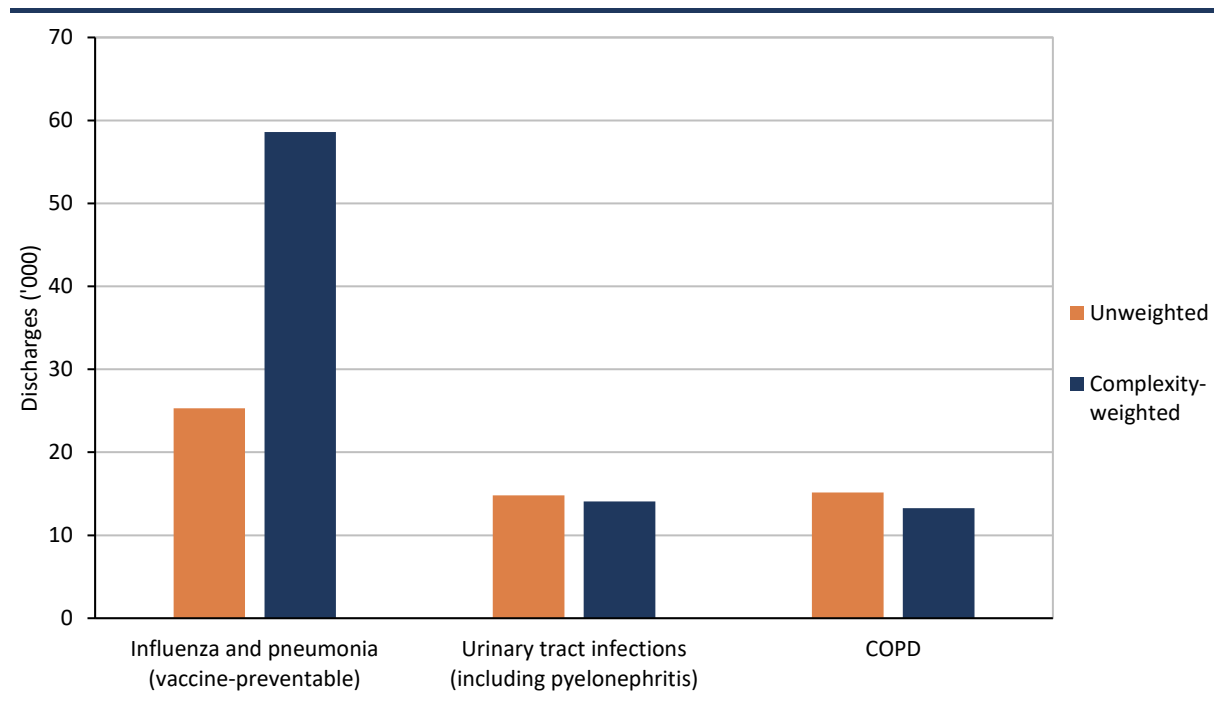
Adjusting activity rates to account for avoidable hospitalisations

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). This assumption reduces the rate of avoidable hospitalisations through the projection horizon to simulate the impact of improved access to and use of more appropriate non-acute care.

In this analysis, 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), who recently conducted a population-based analysis of avoidable hospitalisations tailored to the Irish setting.³⁴ In total, 21 avoidable hospitalisation conditions are identified. Cases are identified based on the presence of a principal diagnosis or, for some conditions, any diagnoses of the relevant conditions in the HIPE discharge record. Diagnoses are classified based on the ICD-10-AM, 8th edition, coding classification. In line with previous analyses, only emergency in-patient discharges from public hospitals are considered (Ansari et al., 2012; Sheridan et al., 2012).

In this analysis, we then adjust our baseline age-specific and sex-specific complexity-adjusted activity rates in 2018 by removing the identified hospital activity related to the three most frequent emergency in-patient (excl. maternity) avoidable hospitalisations (see Appendix A). These relate to vaccine-preventable influenza and pneumonia, Chronic Obstructive Pulmonary Disorder (COPD), and urinary tract infections (including pyelonephritis), which together account for 54.2 per cent of unweighted and 70.7 per cent of complexity-weighted avoidable hospitalisations recorded in 2018 (Figure 4.3). These are also the most frequent avoidable hospitalisations identified by McDarby and Smyth (2019). While these conditions account for the majority of avoidable hospitalisations recorded, 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, 2019a).

³⁴ See Appendix A for a list of the ICD-10-AM diagnosis codes employed in this analysis.

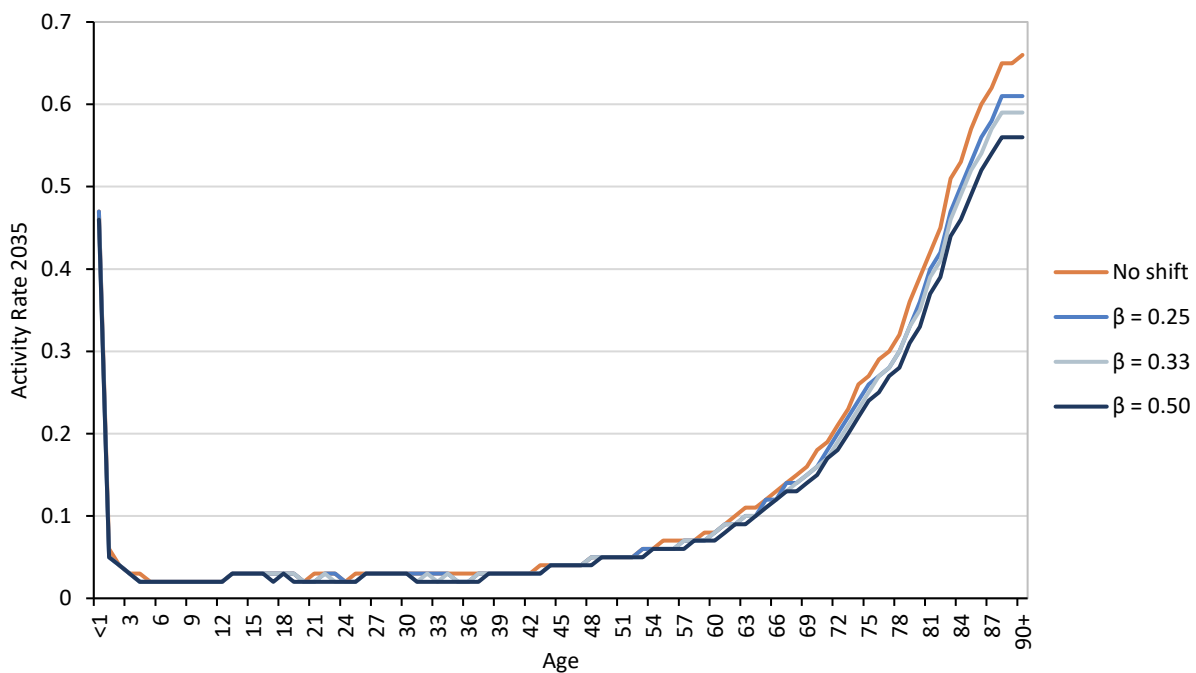
FIGURE 4.3 Avoidable hospitalisations: unweighted and complexity-weighted emergency in-patient discharges by avoidable hospitalisation condition, 2018

Source: HIPE, 2018.

A parameter in the model specifies the extent to which the avoidable hospitalisation rate is reduced. Setting this parameter to zero models no reduction in the rate of avoidable hospitalisations while setting the parameter to one would remove all hospitalisations classified as avoidable. Setting the parameter to one is not a reasonable assumption as all countries, regardless of the relative strength of their primary care systems, will record some level of avoidable hospitalisations (OECD, 2019a). As described in Chapter 2, the relationship between primary care strength and rate of avoidable hospitalisations is mixed, with causation and effect sizes difficult to identify. With that review in mind, for the main analysis, we assume this model parameter to linearly converge to a value of 0.33 by 2035. This implies that by 2035 improved investment in, and access to, effective primary care treatment will have reduced the overall rate of avoidable hospitalisations by 33 per cent relative to 2018.³⁵ This is a refinement of methods previously developed and described in Keegan et al. (2018a), The approach is illustrated graphically in Figure 4.4 (β represents the parameter under consideration).

³⁵ For context, a 33 per cent reduction would reduce Ireland's relatively high rate of COPD hospital admissions from 288 per 100,000 to 193 per 100,000, moving Ireland's relative ranking (all else equal) from 5th to 15th highest among 37 OECD countries (OECD, 2019a).

FIGURE 4.4 Illustrative example of the impact of avoidable hospital rate reductions, for various values of β , on the activity rate distribution in 2035



Source: Authors' representation.

We apply the convergence of this model parameter to 0.33 to all three selected conditions and across all age and sex groups. However, given the uncertainty around this choice of parameter, sensitivity analysis presented in Chapter 8 considers the effect of alternative parameter assumptions on healthcare expenditure projections. Appendix A provides an analysis of the level and distribution of avoidable hospitalisations in Ireland and further detail on the three selected conditions in 2018.

Adjusting activity rates to account for waiting-list management

The methodology employed to account for public acute hospital waiting lists in the model has changed since Wren et al. (2017).³⁶ It is based on a method developed for NHS waiting times analysis (Findlay, 2017) and applied by the Institute for Fiscal Studies and the Health Foundation (Charlesworth and Johnson, 2018) and the Health Foundation (Charlesworth et al., 2020). A non-recurring backlog of cases at a point in time is estimated along with an estimation of the recurring additional activity required to keep pace with demand and maintain waiting times at a manageable level (12 weeks). The estimated non-recurring backlog is assumed to be removed across five years of the projection horizon (2021–2025) along with the recurring additional activity required to keep waiting times to 12 weeks. These volumes are converted to rates to adjust activity in Hippocrates. This method is described in detail elsewhere (Brick and Keegan, 2020b).

³⁶ There are no data available on waiting times for public acute psychiatric in-patient hospitals/units (Brick et al., 2020a).

4.2.3 Project demand to 2035

Demand for care is then projected by multiplying yearly age- and sex-specific activity rate profiles with yearly age- and sex-specific projected population volumes. Age- and sex-specific population volumes for all years of analysis (2018–2035) are developed by the ESRI’s in-house cohort component model. A detailed description of the assumptions underlying the Low, Central and High Population Projection scenarios is provided in Chapter 3.

4.2.4 Develop unit costs for 2018

To develop base-year and projected healthcare expenditure, it is necessary to estimate the unit cost of the (projected) activity under consideration. A unit cost refers to the cost of delivering one unit of a particular service (e.g. OPD attendance). From the perspective of projection modelling it is important to also know the relative component shares of cost in the base year to allow for differential modelling of the growth rates of these components through the projection horizon.

For this analysis, we focus on two main components of unit costs: pay costs and non-pay costs. Pay costs relate to medical, nursing, and non-clinical staff costs required to deliver acute care. Non-pay costs are varied, and relate to elements such as drugs, laboratory equipment, and overheads. For projection purposes, where appropriate, non-pay costs for selected services are disaggregated into drug costs and ‘other’. This approach is discussed in more detail in Section 4.2.5. Such separation of unit costs for the purposes of projecting expenditure is similar to approaches adopted elsewhere (Barrett and Bergin, 2005; Charlesworth and Johnson, 2018; Irish Fiscal Advisory Council, 2018; 2020; Wanless, 2002; Wittenberg et al., 2018).

There is no internationally accepted gold standard for unit-cost estimation. Different approaches can influence the unit costs estimated (Mayer et al., 2020). In this analysis, where possible, we use a data-intensive bottom-up approach to cost estimation. Bottom-up unit costing identifies the different resources associated with the delivery of a service (e.g. salary costs, drug costs, other non-pay costs) and assigns a value to each (Curtis and Burns, 2019). For the majority of acute services under consideration in this report, detailed bottom-up costs exist, provided by the HPO. However, for certain services where bottom-up costing data are unavailable (i.e. specialist in-patient psychiatric services), we follow a top-down costing approach. Top-down costing involves calculating an overall unit cost of care by dividing total expenditure by units of activity (i.e. bed day).³⁷ Where such top-

³⁷ This approach does have benefits also, requiring less information than bottom-up costing, and it provides a straightforward way to aggregate back up to total recorded expenditures for a given service in a base year.

down costing is required, pay and non-pay shares are then applied to this total rather than estimated directly from the underlying data.

4.2.5 Project unit costs to 2035

The next step discusses the assumptions adopted in projecting unit costs of care through the projection horizon.

Pay costs

As described in Chapter 2, increases in healthcare expenditure are often explained by supply-side effects whereby remuneration in labour-intensive healthcare sectors (and less productive sectors more broadly) needs to keep pace with remuneration in the broader economy to support recruitment and retain workers. As described in Section 3.2, assumed pay cost trends in this analysis are based on projections of government-sector average wage growth, which is in turn linked to wages in other sectors of the economy. Over the period 2019 to 2035, nominal average annual government-sector wage growth is 2.5 per cent under the Recovery scenario and 2.2 per cent under the Delayed Recovery scenario.

Non-pay drug costs

We also pay special attention to the drug component of non-pay costs. Traditionally, the cost of providing drugs and medicines in public hospitals has increased at a faster rate than other non-pay cost components (Department of Health, 2017) and may be expected to do so into the future (Connors, 2017). As noted by Connors (2017), the number of new hospital drugs coming on stream over the coming years is expected to increase substantially, particularly in the area of oncology. Cancer is the therapeutic area expected to experience the largest expenditure growth of which approval for costly new drugs will be an important component. Table 4.2 shows trends in day and in-patient expenditure on drugs and medicines compared to spending on other non-pay costs in ABF hospitals between 2015 and 2018.

TABLE 4.2 Breakdown of HSE acute care clinical expenditures, 2015–2018

	Expenditure ('000)				2015-2018		Unit Cost
	2015	2016	2017	2018	Percentage change	Average annual percentage change	2015-2018
							Average annual percentage change
Drugs and medicines	297,883	324,463	335,545	357,070	19.9	6.2	5.2
Other non-pay	980,132	1,001,187	1,063,598	1,109,119	13.2	4.2	3.2

Source: HPO Specialty Costing

The overall growth rate for drugs and medicines over the 2015–2018 period (19.9%) exceeded the growth rate of other non-pay costs (13.2%). This translates into a compound annual growth rate for drugs and medicines of 6.2 per cent compared to 4.2 per cent for other non-pay costs. Adjusting for the change in activity over the period, the increase in the unit cost of drugs and medicines was 5.2 per cent per year. These higher unit-cost increases attributable to drugs and medicines are likely to have been driven by the new-technology attributes of many of these hospital drugs (Charlesworth and Johnson, 2018). Simulating this technology effect on future expenditures, and assuming the hospital cost of drugs and medicines rises in line with this recent experience, we assume that growth in drug unit costs will vary between 4.2 and 6.2 per cent per annum across scenarios (see Table 4.3). This represents a similar approach to that adopted by Charlesworth and Johnson (2018).³⁸ In contrast to the residual approach often applied in top-down projection exercises (see Chapter 2), this approach offers a direct way to simulate the supply-side effects of technology on hospital expenditure.

Other non-pay costs

We assume that all other non-pay costs will follow the trend in prices in the broader economy. This is a similar approach to that adopted in previous Irish healthcare expenditure projection analyses (Barrett and Bergin, 2005; Irish Fiscal Advisory Council, 2018). Over the period 2019 to 2035, the average annual inflation rate is expected to be 1.6 per cent under the *Recovery* scenario and 1.4 per cent under the *Delayed Recovery* scenario (see Chapter 3, Table 3.1). We add between 0.5 (low-pressure) and 1.0 (central and high-pressure) percentage points to these rates across scenarios to reflect assumed higher cost growth for elements of non-pay hospital cost (e.g. medical and surgical supplies, laboratory equipment, overheads) over the projection horizon.

4.2.6 Develop expenditure profiles for 2018 and project to 2035

For the base year 2018, we then combine activity profiles (Section 4.2.1) with unit costs (Section 4.2.4) to develop base year age- and sex-specific expenditure profiles. These base-year expenditure profiles are presented throughout Chapters 5 to 8. To project expenditure for each year, we multiply annual projections of demand (Section 4.2.3) by annual projections of unit costs (Section 4.2.5). For major categories of acute expenditure, we also decompose expenditure growth into its constituent drivers, applying methods described elsewhere (Ha et al., 2014; Wren et al., 2017).

³⁸ Charlesworth and Johnson (2018) project a 5.5 per cent real-terms annual increase in hospital drug unit costs based on historical expenditure data, removing activity growth.

4.2.7 Sensitivity analysis and productivity effects

In addition to examining a range of projection scenarios, we conduct a sensitivity analysis in Chapter 8 to demonstrate the sensitivity of projections to changes in our key assumptions. Additionally, as part of this analysis we examine the potential impact of improved productivity on projected expenditures. Productivity measures the relationship between input and outputs (Bojke et al., 2017). More productive systems can achieve a greater level of output (e.g. activity) with the same input (e.g. staff) or alternatively the same output for less input (Charlesworth and Johnson, 2018). As described in Chapter 2, healthcare tends to be less productive than other sectors, and the gap between pay growth and productivity growth is considered a key driver of healthcare expenditure. Future healthcare expenditure will be sensitive, therefore, to the trajectory of future productivity. The ability to increase productivity could play an important role in offsetting increases in the cost of delivering care.

Analysis by Burke et al. (2014) has suggested improved productivity between 2008 and 2012, with evidence of public hospitals doing ‘more with less’ despite less staff and funding (Whyte et al., 2020) in response to the economic crisis at the time. Burke et al. (2014) report poor hospital productivity growth from 2013 to 2014, while more recent analysis by Lawless (2018) and the Department of Health (2017) offer somewhat contradictory findings. These studies, however, do not measure productivity change directly, and no index currently exists in Ireland that captures in isolation acute or even healthcare system productivity trends over time. The CSO produces a productivity index related to Health and Human and Social Work (Central Statistics Office, 2020b).³⁹ However, as this index includes residential care and social work activity, it is unlikely to be representative of trends in acute care productivity.

Considering this weak evidence base on which to project acute care productivity, we test the effect of productivity on projected expenditure growth as part of our sensitivity analysis rather than incorporating it into our set of projection scenarios. We test this productivity effect by modelling a 1.0 and 1.5 per cent per annum downward adjustment to unit costs of care. This approach, and the modelled rate of productivity growth, is in line with previous analyses in the UK (Charlesworth and Johnson, 2018; Wanless, 2002).

³⁹ This is based on an aggregation of European Industrial Activity Classification (NACE) codes 86 (Human Health Activities), 87 (Residential Care Activities) and 88 (Social Work Activities without Accommodation). It was not possible to receive a more detailed breakdown from the CSO.

4.3 EXPENDITURE PROJECTION SCENARIOS

For the main analysis, rather than projecting the effect of each driver in isolation, we follow the approach taken in Wren et al. (2017) and many other healthcare projection exercises (Blanco-Moreno et al., 2013; Charlesworth and Johnson, 2018; de la Maisonneuve and Martins Oliveira, 2015; Lorenzoni et al., 2019; Wanless, 2002) of developing a range of projection scenarios that group drivers together in a consistent manner. Given the uncertainty inherent in any projection exercise such as this, this provides a basis for developing a projection range charting the likely course of future expenditures.

Projection scenarios used in this report are presented in Table 4.3. For all services we apply a set of low, central, and high expenditure scenarios. These scenarios vary in relation to assumptions on the future evolution of demand and cost of care. Variation in projected demand across these scenarios is influenced by assumptions in relation to population growth and ageing, and healthy ageing. Three alternative population projection scenarios are available to Hippocrates (low, central, and high) to examine how alternative assumptions on demographic change may affect projected demand. As described in Chapter 3, since the publication of Wren et al. (2017), new and revised data are available which are incorporated into this version of our demographic model. Furthermore, we have adjusted some of our assumptions to reflect existing and emerging trends in the data. In particular, we have adjusted downwards net international migration over the short to medium term because of the effects of Covid-19, and we have adjusted our population estimates for 2020 to take account of deaths from Covid-19. Additionally, in light of the Covid-19 pandemic we now place more weight on the low and central population projections. Previously, in Wren et al. (2017), projected economic circumstances favoured a focus on the central and high population projections.

Macroeconomic projections generated using the ESRI's macroeconometric model COSMO (described in detail in Chapter 3), provide a basis for modelling pay and non-pay (non-drug) costs in this analysis. Owing to the uncertainty about the duration of the economic impact of Covid-19, the economic outlook is highly uncertain. Therefore, two alternative macroeconomic scenarios, termed *Recovery* and *Delayed Recovery*, are considered. The *Recovery* scenario assumes some rebound in the second half of 2020 and a relatively rapid return to where the economy would have been (in the absence of the pandemic) by late 2023. The *Delayed Recovery* scenario assumes a delayed recovery until the end of 2024, with some permanent losses in employment and output. In this analysis, pay growth is linked to government-sector average wage growth (linked to wages in other sectors of the economy). Non-pay (non-drug) cost trends are informed by projected trends in inflation. More detail on the generation of these COSMO scenarios and the assumptions underlying them are described in Chapter 3. Drug cost trends are modelled in line with historical trends (see Section 4.2.5).

Central scenario

Under our central scenario, demand evolves in line with our central population growth scenario combined with moderate healthy ageing. Pay costs evolve in line with government-sector average wage growth from COSMO's *Recovery* scenario. Non-pay costs are indexed to a projected inflation rate from COSMO's *Recovery* scenario plus one percentage point per annum to reflect assumed higher growth of non-pay (non-drug) hospital costs above general inflation. Drug unit costs evolve in line with an historical annual growth rate of 5.2 per cent (see Section 4.2.5).

Low- and high-pressure scenarios

We then model what we term 'low' and 'high'-pressure projection scenarios. Given uncertainty in relation to the expected course of expenditure drivers, these scenarios examine trajectories where demand and cost drivers place relatively lesser or greater pressures on projected expenditures. Under the low-pressure scenario, demand evolves in line with lower projected population growth (defined by lower fertility rates and inward migration, and greater mortality) and more optimistic healthy ageing effects (Dynamic Equilibrium). Pay costs evolve in line with government-sector average wage growth from COSMO's *Delayed Recovery* scenario. Non-pay costs evolve in line with inflation from COSMO's *Delayed Recovery* scenario plus 0.5 percentage points per annum. Drug costs growth is assumed to be one percentage point per annum lower than under the central scenario.

In our high-pressure scenario, for public acute hospital care, we revert to our Central population growth assumption⁴⁰ and assume a pessimistic relationship between life-expectancy increase and acute care demand (i.e. expansion of morbidity hypothesis, which assumed all additional life years gained are spent in bad health). For psychiatric in-patient, we apply a high population growth assumption to provide more nuance to demand projections for this particular service as we consider that the application of healthy ageing effects are not appropriate for this service. For all acute and psychiatric services, pay and drug costs are assumed one percentage point per annum higher relative to the Central scenario. Non-pay costs evolve in line with inflation from COSMO's *Recovery* scenario plus one percentage point per annum.

Progress scenario

Finally, we also specify an additional scenario that examines the potential acute care expenditure implications of realising important dimensions of the original Sláintecare proposals (see Chapter 2) related to reorientation of care to the community (through reducing the rate of avoidable hospitalisation) and improved

⁴⁰ Sensitivity analysis in Chapter 8 analyses the effect of projected high population growth on all main services.

management of acute waiting lists. We term this our Progress scenario. All other assumptions on demand and cost reflect those specified under the central scenario, discussed above. The progress scenario applies to projections of aggregate public hospital expenditure only (see Chapter 6).

TABLE 4.3 Projection scenario assumptions

	Low pressure	Central	High pressure	Progress
Public Acute Hospital				
Demand assumptions				
Population growth and age structure	Low	Central	Central	Central
Healthy ageing	Dynamic Equilibrium	Moderate Healthy Ageing	None	Moderate Healthy Ageing
Avoidable hospitalisations	-	-	-	Linearly reduce rate of avoidable hospitalisations each year, converging to 33% reduction by 2035
Waiting-list management	-	-	-	Model additional non-recurring activity to reduce current backlog between 2021–2025; additional recurring activity to sustain 12-week waiting times
Cost assumptions				
Pay	COSMO <i>Delayed Recovery</i> – projected government-sector wage growth (2.2% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth +1 pct point p.a. (3.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)
Non-pay				
Drug cost	4.2% increase p.a.	5.2% increase p.a.	6.2% increase p.a.	5.2% increase p.a.
Other	COSMO <i>Delayed Recovery</i> – indexed to projected inflation rate + 0.5 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rate + 1 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rate + 1 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rate + 1 pct point p.a.
Psychiatric In-patient				
Demand assumptions				
Population growth and age structure	Low	Central		-
Healthy ageing	-	-		-
Cost assumptions				
Pay	COSMO <i>Delayed Recovery</i> – projected government-sector wage growth (2.2% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth +1 pct point p.a.	-
Non-pay	COSMO <i>Delayed Recovery</i> – indexed to projected inflation rate + 0.5 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rate + 1 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rate + 1 pct point p.a.	-

Source: Authors' representation.

4.4 OVERVIEW OF DATA SOURCES

In Wren et al. (2017), where possible disaggregated administrative data on service utilisation were applied in the analyses. As described in Wren et al. (2017), administrative data are collected by organisations, including government bodies, for administrative purposes (e.g. Hospital In-Patient Enquiry – HIPE). While these data are not primarily collected for research purposes, which can create challenges, their use is becoming more common. For the purposes of projecting healthcare demand and expenditure, access to administrative data is especially useful as the data are routinely collected; do not depend on self-reporting; and are often stringently audited. Additionally, they usually provide information on the full population of service users.⁴¹

Granular administrative data on public acute hospital services are available for this analysis. For example, in modelling projected demand for public acute hospital day and in-patient services, detailed discharge data collected by the Healthcare Pricing Office (HPO) in the HIPE scheme are used.⁴² Furthermore, specialty costing data collected by the HPO provided an estimate of total activity levels for emergency department (ED) and OPD attendances.^{43,44}

Data provided by the National Treatment Purchase Fund (NTPF) have allowed a detailed analysis of public patient waiting lists for OPD appointments, and day patient and in-patient treatment (Brick and Keegan, 2020b). The data have enabled the estimation of the activity and expenditure (excluding any associated capital costs) required to achieve a 12-week waiting time.

Data provided by the Health Research Board (HRB) National Psychiatric In-Patient Reporting System (NPIRS) enable the generation of specialist public acute in-patient psychiatric profiles for inclusion in the model.^{45,46} There is no overlap in the activity reported in HIPE and the activity reported in NPIRS. These psychiatric hospitals/units do not report their activity to HIPE and are not currently part of the ABF process, even when co-located. The expenditure data environment has proved very challenging in this area. There are currently no patient-level cost data available on acute public in-patient psychiatric episodes. In addition, the data

⁴¹ In Wren et al. (2017), where administrative data were not available, use was made of survey data. Application of survey data was particularly necessary for modelling non-acute healthcare demand where no appropriate administrative data on healthcare use were available.

⁴² HIPE is a health information system designed to collect clinical and administrative data on discharges from, and deaths in, public acute hospitals in Ireland.

⁴³ For a detailed explanation of the data and methods used to generate the baseline utilisation profiles see Brick and Keegan (2020a).

⁴⁴ We do not capture a small amount of OPD activity that takes place in non-Activity-based Funding (ABF) hospitals.

⁴⁵ For a detailed explanation of the data and methods used to generate the baseline utilisation profiles see Brick et al. (2020a).

⁴⁶ Unlike acute public hospitals, there are no waiting-list data available for acute adult in-patient psychiatric services see Brick et al. (2020a).

collected by the NPIRS, unlike HIPE data, have no complexity weighting. This meant that we had to estimate an average unit cost per bed day for 2018 using a top-down method. Data provided by the HSE as part of the annual System of Health Accounts submission are used to ascertain the total expenditure on acute HSE and HSE-funded adult psychiatric in-patient units.^{47,48,49,50} A cost per 2018 bed day is achieved by dividing the total expenditure in 2018 by the total number of bed days in 2018.

With the exception of in-patient psychiatric services, cost data for this analysis are sourced from speciality costing data captured by the HPO. Speciality cost returns are submitted by all hospitals funded through ABF (40 hospitals).⁵¹ Speciality costs refer to the costs associated with all patients of a consultant in a particular speciality (e.g., ‘all costs associated with the patients of cardiologist(s) should be allocated to the cardiology specialty’) (Healthcare Pricing Office, 2019b). In this process, costs are matched to the service that generates them (e.g. day patients) and are allocated to cost centres such as wards and departments. This process provides detailed breakdowns of pay, non-pay and overhead costs for each hospital through time. For the purposes of this analysis, HPO provided speciality costing returns aggregated across all hospitals for each year 2015, 2016, 2017, and 2018.

While the HPO specialty costing files have very detailed categories of costs (Healthcare Pricing Office, 2019b), for the purpose of the projections, and in consultation with the HPO, we aggregated these to three categories: pay, non-pay drugs and non-pay other.

- 1) Pay⁵² – includes pay for medical and dental, nursing and allied health professionals, administration, para-medical, catering, housekeeping, all other support services, and any pay overheads. Pay overheads include the proportion of the overhead from services such as radiology, pharmacy, laboratories etc., as determined by the HPO, attributable to pay.

⁴⁷ These are defined as acute adult in-patient units with a 24-hour medical presence and classified as approved centres by the Mental Health Commission under the Mental Health Act 2001.

⁴⁸ A list of the 29 included units can be found in Appendix B. These units account for 80 per cent of total acute psychiatric in-patient expenditure and 89 per cent of acute psychiatric in-patient bed days in 2018.

⁴⁹ For baseline utilisation profiles and projections of demand for the aggregated public acute adult psychiatric in-patient episodes included in the expenditure analysis, see Appendix B.

⁵⁰ HSE National Finance advised that the HSE’s current financial reporting system is aligned to Annual Financial Statements (i.e., Nursing pay, Drugs and Medicines etc.) and does not align to the services and sub-services in operation. To obtain a service view of Mental Health expenditure through the System of Health Accounts, high-level assumptions and allocations were required to be included in a manual calculation of this service breakdown. The Future Health Report (Department of Health, 2012) identified the financial and service information systems of the Health Service as not fit for purpose. To address this, over 200 legacy financial systems will be moved to a Single Integrated Financial and Procurement Management System (IFMS). This process is now underway, the IFMS project is currently in the detailed design phase. When the IFMS system is fully implemented, Mental Health will be able to report on a more accurate basis in relation to expenditure by service category. Personal communication, HSE National Finance, 8 October 2020.

⁵¹ See Brick and Keegan (2020a) for baseline utilisation profiles and a list of the hospitals included in the analysis.

⁵² Specialty costing does not include superannuation.

- 2) Non-pay drugs – captures costs of drugs and medicines.
- 3) Non-pay other – includes all other costs outside of pay and non-pay drugs. This includes such items as medical and surgical supplies, office equipment, transport, and maintenance. Non-pay overheads include the proportion of the overhead from services such as radiology, pharmacy, laboratories etc., as determined by the HPO, attributable to non-pay.

Table 4.4 lists the principal data sources employed in the baseline demand and expenditure analysis and in the analysis of waiting lists. Where possible, data have been analysed at the level of SYOA and sex, with the most disaggregated age breakdowns included where SYOA data are not available. The base year for this report is 2018. Where data from 2018 are not available or unsuitable, particularly in light of Covid-19, data from other time periods are used to supplement the analysis (this is clearly indicated in the report).

TABLE 4.4 Principal data sources for baseline expenditure analysis – summary

Service	Data	Provider	Year
Public acute hospitals		HPO	2018
ED	HPO Specialty Costing	HPO	2015–2018
OPD	HPO Specialty Costing	HPO	2015–2018
Day patient	HIPE	HPO	2015–2018
In-patient	HIPE	HPO	2015–2018
Waiting list	Waiting-list data for public patients – OPD, day and in-patient	NTPF	2018, 2020
	HIPE	HPO	2018
In-patient psychiatric (public acute adult)	<i>NPIRS</i> <i>CSO System of Health Accounts</i>	HRB HSE/CSO	2018

Note: See Brick and Keegan (2020a) for full description of the data used to establish baseline utilisation.

4.5 SUMMARY

This chapter provided a detailed description of the projection methods, applied in the analysis in this report. The development of projection methods was informed by a detailed review of the evidence on the drivers of healthcare expenditure and their application to component-based modelling, reviewed in Chapter 2. The chapter also outlined the final expenditure projection scenarios to be applied in Chapters 5 to 7 and provided an overview of the data sources employed for the analysis. Chapters 5 to 7 present the findings from the analyses and projections.

CHAPTER 5

Findings: Public acute hospital expenditure by service

5.1 INTRODUCTION

This chapter presents findings for projected public acute hospital expenditure at the service level to 2035. The services examined are public acute hospital outpatient (OPD) attendances, emergency department (ED) attendances, and day-patient and in-patient discharges. Maternity services are presented separately throughout. Expenditures are projected for three scenarios: low-pressure, central, and high-pressure. The three scenarios incorporate assumptions that place varying expenditure pressures on acute services to 2035. (Chapter 4 provided a detailed discussion on the development of, and assumptions underlying, these projection scenarios.)

Age- and sex-specific expenditure profiles for each service in 2018 provide the basis for projections in this chapter. These expenditure profiles, in turn, are generated from underlying age- and sex- specific activity rate profiles for 2018, combined with the average unit cost of delivering care. Underlying age- and sex- specific activity profiles for 2018 are reported and analysed separately in Brick and Keegan (2020a). The starting point for this chapter is an analysis of unit costs of care for each service. These unit costs reflect all the treatment and care costs as well as running costs associated with the delivery of care, but are exclusive of capital and depreciation. Baseline expenditures and projections presented in this chapter therefore relate to current expenditure. As described in Chapter 1, both public and private patients are treated in public acute hospitals. Baseline expenditures and projections for day-patient and in-patient expenditure in this chapter, unless stated, include both publicly and privately financed activity.

Section 5.2 presents an analysis of trends in unit costs of care between 2015 and 2018. Section 5.3 presents findings on baseline expenditure for public hospital ED and OPD attendances. Section 5.4 presents findings on baseline expenditure for public hospital day-patient and in-patient discharges. Section 5.5 presents findings for projected expenditure to 2035 for categories of care analysed in Section 5.3 and 5.4. Section 5.6 discusses and concludes.

5.2 FINDINGS – UNIT COSTS

Table 5.1 summarises the unit costs of services in public acute hospitals between 2015 and 2018.⁵³ The unit costs, provided by the HPO, have increased year-on-year for each service over the period. The average annual compound growth rate ranged from 3.1 per cent for an in-patient to 6.5 per cent for a day patient.

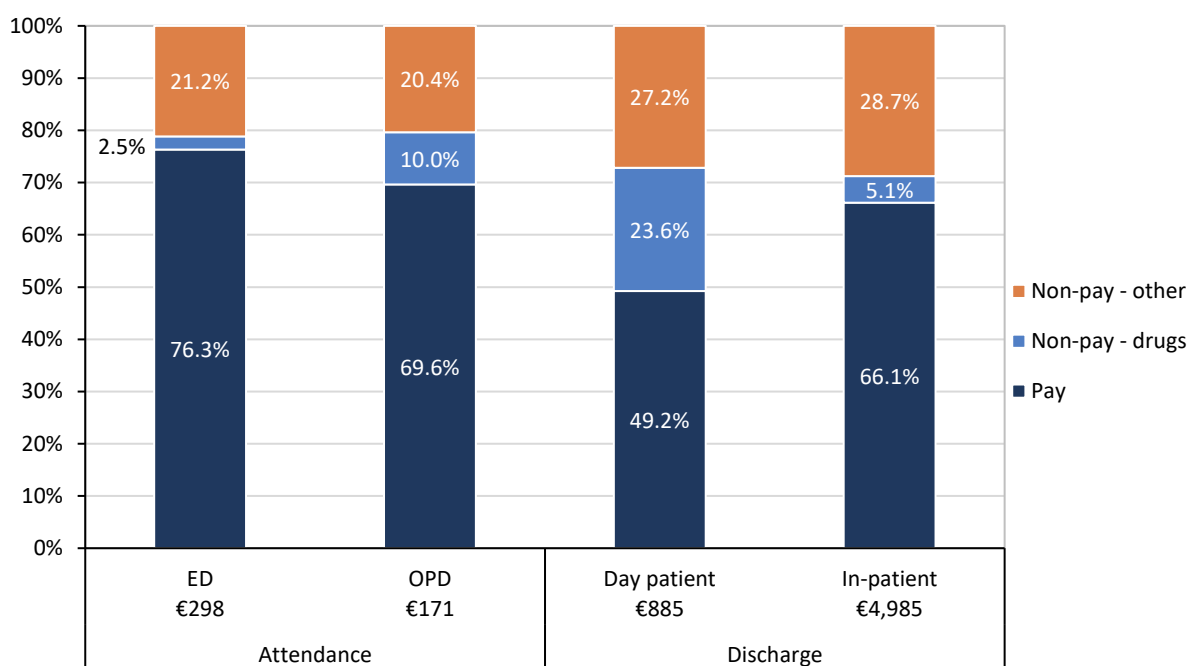
TABLE 5.1 Unit cost by service, 2015–2018

	ED attendance	OPD attendance	Day patient discharge	In-patient discharge
	€	€	€	€
2015	263	142	733	4,555
2016	270	156	754	4,602
2017	294	163	836	4,794
2018	298	171	885	4,985
Average annual growth 2015–2018	4.2%	6.2%	6.5%	3.1%

Source: HPO Specialty Costing, 2015–2018; HIPE, 2015–2018.

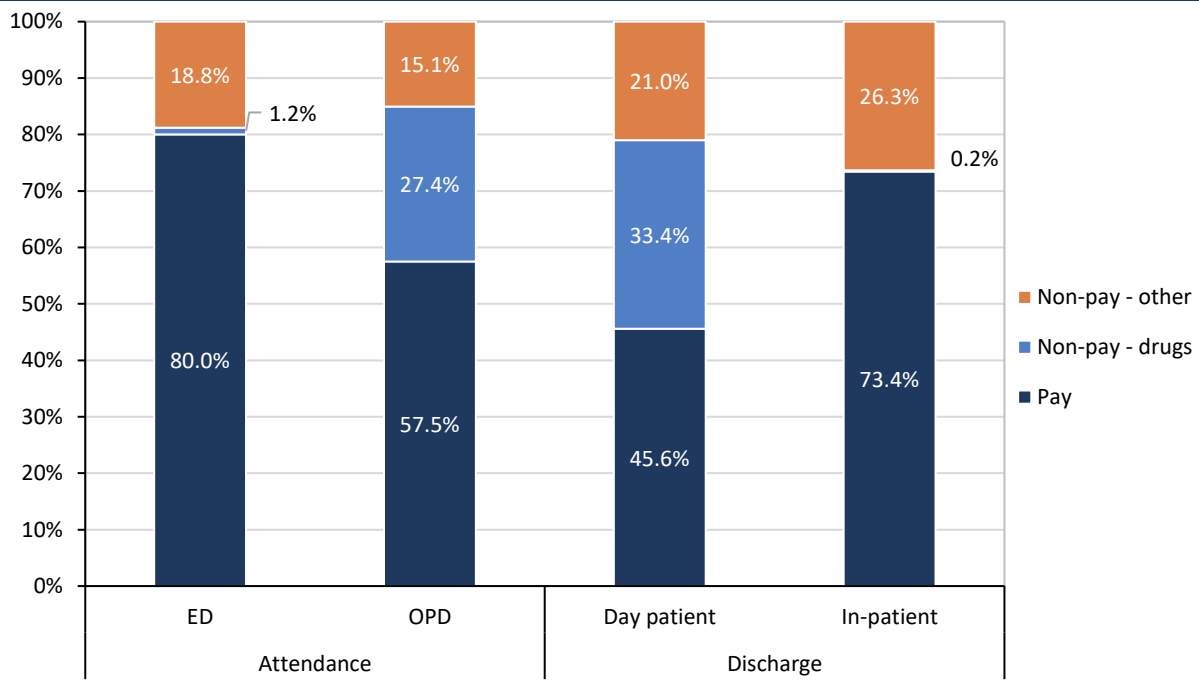
Data from the HPO allows for the unit cost of each service to be disaggregated into pay, non-pay drugs, and non-pay other components. Figure 5.1 shows, for 2018, the proportion of the unit cost for each service accounted for by each of pay, non-pay drugs, and non-pay other. Pay accounts for the highest proportion of the unit cost across all services, between 49.2 per cent for day-patient discharges and 76.3 per cent for ED attendances. Across all services, non-pay drugs contributed the highest proportion to the cost of a day-patient discharge in 2018 (23.6%).

⁵³ The unit cost of a day and in-patient discharge captures the overall average cost (across all patient types) of treating a single weighted unit of activity. The unit cost of treating a private patient will largely reflect the unit cost of treating a public patient, as the same staff and non-staff resources are applied in delivering care to both categories of patients. The only exception to this relates to the salaried consultant component of the unit cost which is part of the cost of providing public but not private care. The data available does not allow us to disentangle this cost component from our overall average base cost. Therefore, the private expenditure reported in this analysis is a closer reflection of the overall cost of treating private patients, which has a consultant pay component, rather than the direct cost to the hospital which for private patients does not include the consultant fee.

FIGURE 5.1 Total unit cost by category and service, 2018

Source: HPO Specialty Costing 2018; HIPE 2018.

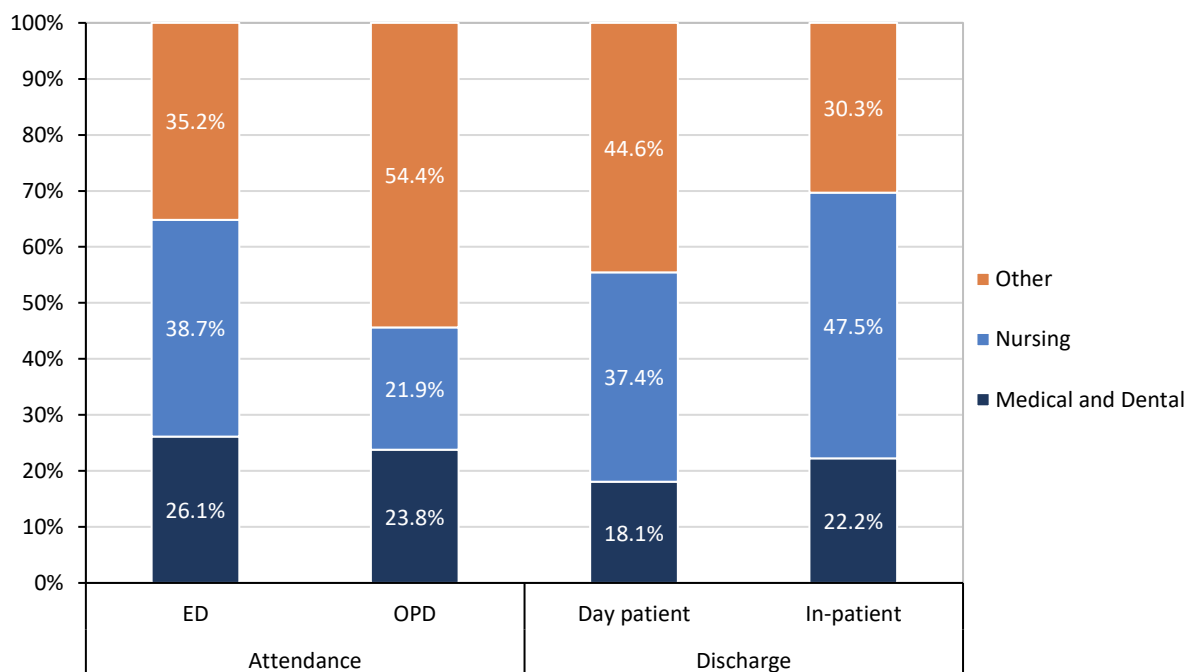
Figure 5.2 outlines the proportionate contribution of each component to the change in the unit cost of each service between 2015 and 2018. The biggest contributor to the change in the unit cost for each service between 2015 and 2018 was pay; contributing 80 per cent to the increase in the unit cost of an ED attendance, 73.4 per cent to in-patient discharge cost, 57.5 per cent to OPD attendance cost, and 45.6 per cent to day-patient discharge cost. Non-pay made a similar contribution across all services. Non-pay drugs only affected OPD and day patient unit costs, with one-quarter and one-third of the increase attributed to this category, respectively.

FIGURE 5.2 Contributors to unit cost changes, 2015–2018

Source: HPO Specialty Costing 2018; HIPE 2015-2018.

The HPO specialty costing data further disaggregate the pay category by medical and dental, nursing, and other (Figure 5.3).⁵⁴ Medical and dental contribute approximately one-quarter to the total pay cost of the four services, slightly less for day-patient discharges. Nursing contributes 47.5 per cent to the pay component of an in-patient discharge compared to 21.9 per cent for an OPD attendance. Other pay contributes 54.4 per cent to the pay component of an OPD attendance compared to 30.3 per for an in-patient discharge. Some of the areas contributing most to the other pay costs were, radiology for ED and OPD attendances, and anaesthetics for day and in-patient discharges.

⁵⁴ Other includes administration, para-medical, catering, housekeeping, maintenance, porters, and other support services. It also includes pay components of services such as radiology, laboratories, pharmacy, allied clinics, etc.

FIGURE 5.3 Pay unit cost by category and service, 2018

Note: Other includes administration, para-medical, catering, housekeeping, maintenance, porters, and other support services. It also includes pay components of services such as radiology, laboratories, pharmacy, allied clinics etc.

Source: HPO Specialty Costing 2018; HIPE, 2018.

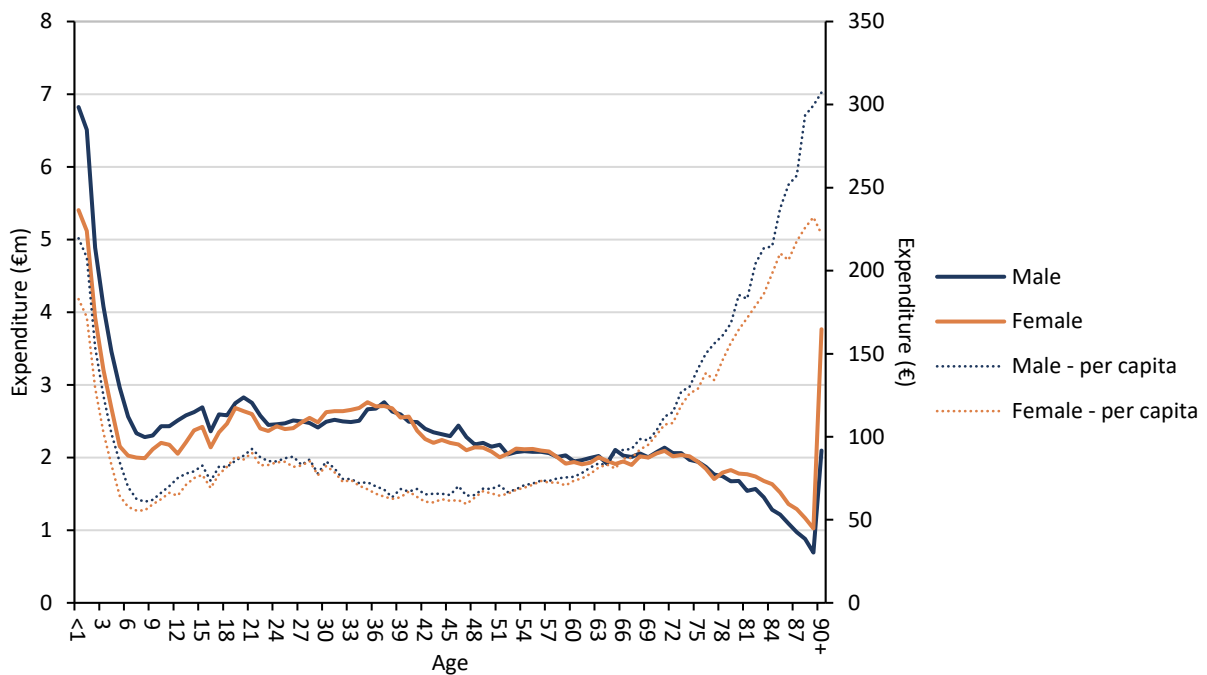
5.3 FINDINGS – BASELINE EXPENDITURE – ATTENDANCES

The following sections outline baseline expenditure profiles for ED and OPD attendances, and day and in-patient discharges in 2018.⁵⁵

5.3.1 Emergency department

Expenditure on ED attendances in public acute hospitals amounted to €418.6m in 2018. Figure 5.4 shows that age-specific expenditure was highest at the youngest ages (<4 years) and oldest ages (75 years and older), with similar patterns for males and females. Notably, while total expenditure decreases from 70 years, per capita expenditure continues to increase.

⁵⁵ See Brick and Keegan (2020a) for baseline utilisation analysis.

FIGURE 5.4 ED— age- and sex-specific expenditure and expenditure per capita, 2018

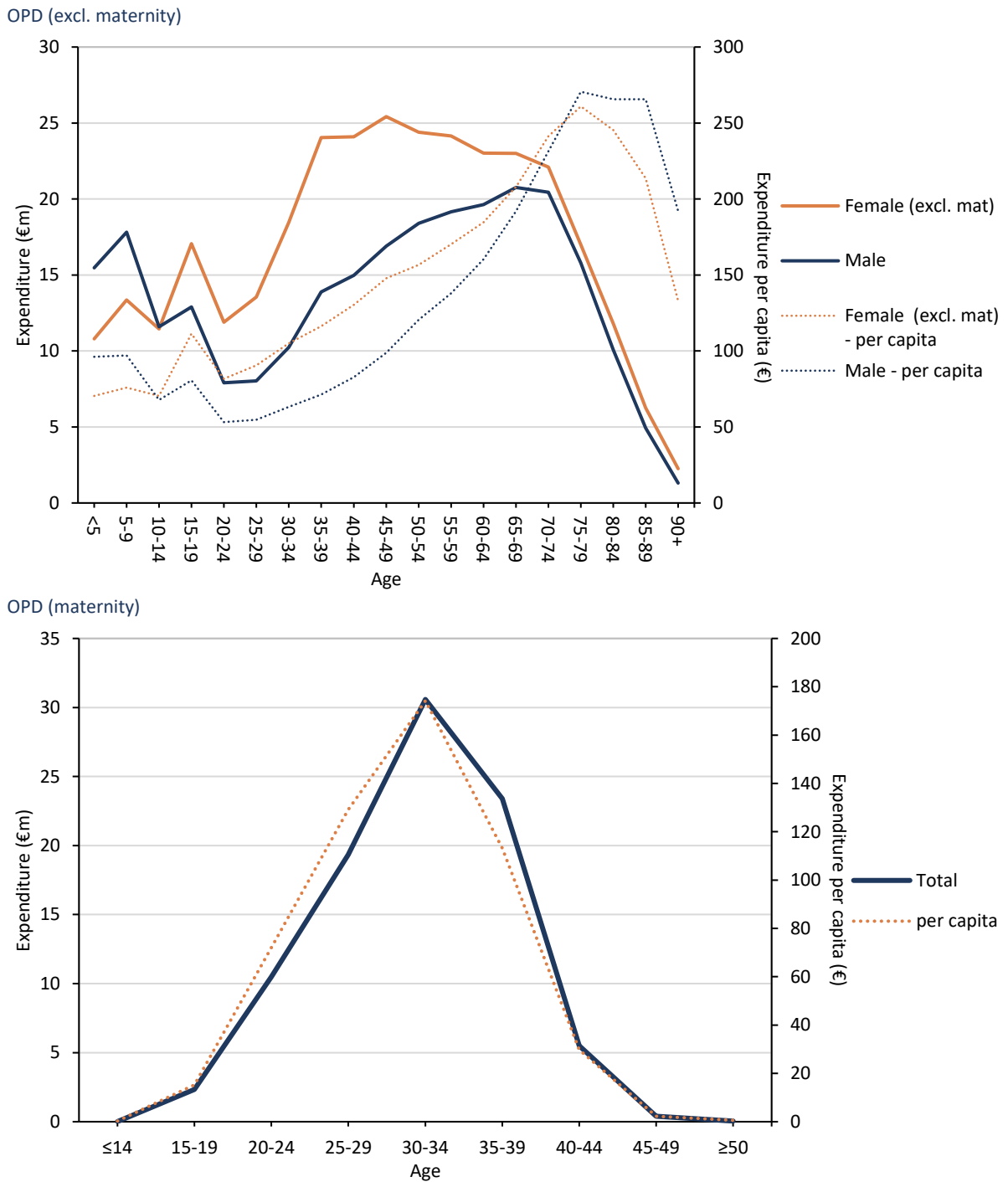
Source: HPO Specialty Costing, 2018; HSE Patient Experience Time, 2018; ESRI population data, 2018.

5.3.2 Outpatient department

Total expenditure on OPD attendances in 2018 was €676.3m. Figure 5.5 shows the estimated age- and sex-specific OPD expenditure for non-maternity (€584.3m) and maternity (€92m) in 2018.⁵⁶ With the exception of those under 15 years, expenditure is higher for females (excl. maternity) than males at all ages. There is a particularly high differential between 30 and 65 years. Total expenditure (excl. maternity) is highest for females at 45–49 years while for males it is highest at 65–69 years. Per capita expenditure is highest for males and females at 75–79 years. Estimated maternity OPD expenditure accounts for 13.6 per cent of total OPD expenditure. Both total and per capita expenditure peak at 30–34 years.

⁵⁶ See Brick and Keegan (2020a) for a full description of the methods for how age- and sex-specific profiles for OPD attendances were estimated.

FIGURE 5.5 OPD – age- and sex-specific expenditure and expenditure per capita, 2018



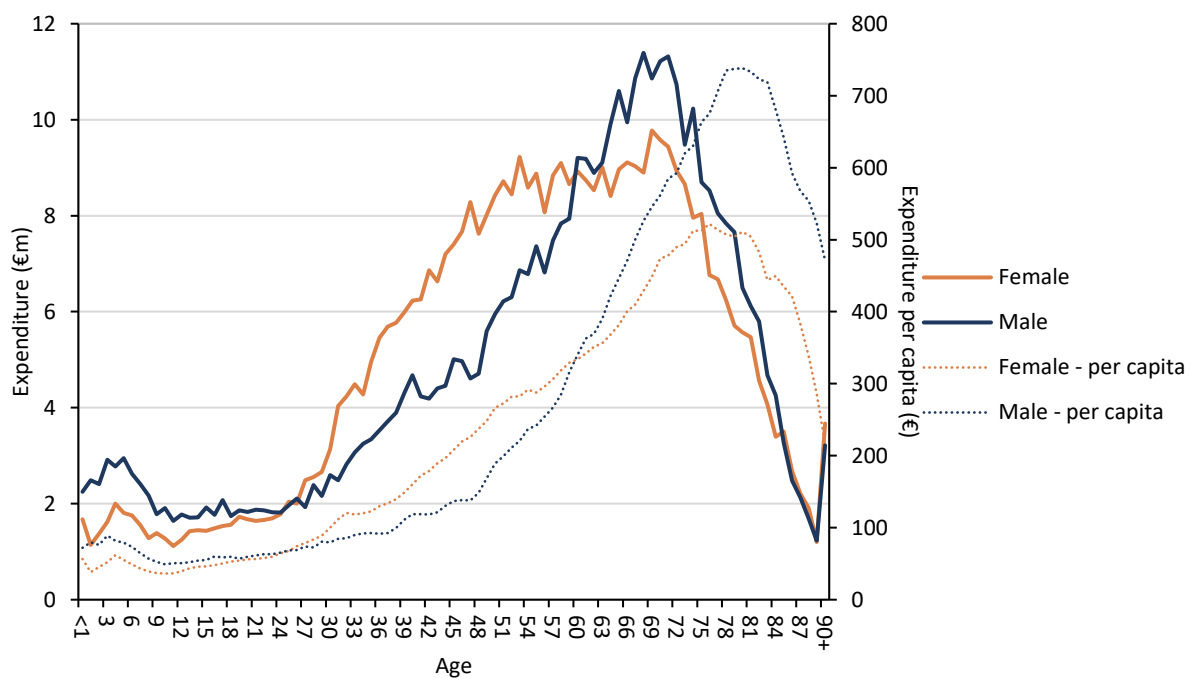
Source: HPO Specialty Costing, 2018; National Treatment Purchase Fund, 2018; NHS 2018-2019; ESRI population data, 2018.

5.4 FINDINGS – BASELINE EXPENDITURE – DISCHARGES

5.4.1 Day patients

Public acute hospital expenditure on day-patient (excl. maternity) discharges⁵⁷ amounted to €909.9m in 2018. Figure 5.6 shows the age- and sex-specific distribution of expenditure and expenditure per capita.⁵⁸ In 2018, 50.9 per cent of expenditure related to female discharges (€462.8m) and 49.1 per cent to male discharges (€447.1m). Expenditure peaked at 68 years for males and 69 years for females. While male expenditure is greater than female at the youngest and oldest ages, the opposite is the case for discharges aged 25–59 years, where female expenditure is substantially greater than male. Expenditure per capita follows a similar pattern but peaks at older ages (80 years for males and 76 years for females).

FIGURE 5.6 Day patients (excl. maternity) – age- and sex-specific complexity-weighted expenditure and expenditure per capita, 2018



Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

When total expenditure is disaggregated by the public/private status⁵⁹ of the patient, we see, as expected, that expenditure on public day-patient discharges (€753.1m – 82.8%) far exceeds that on private discharges (€156.9m – 17.2%)

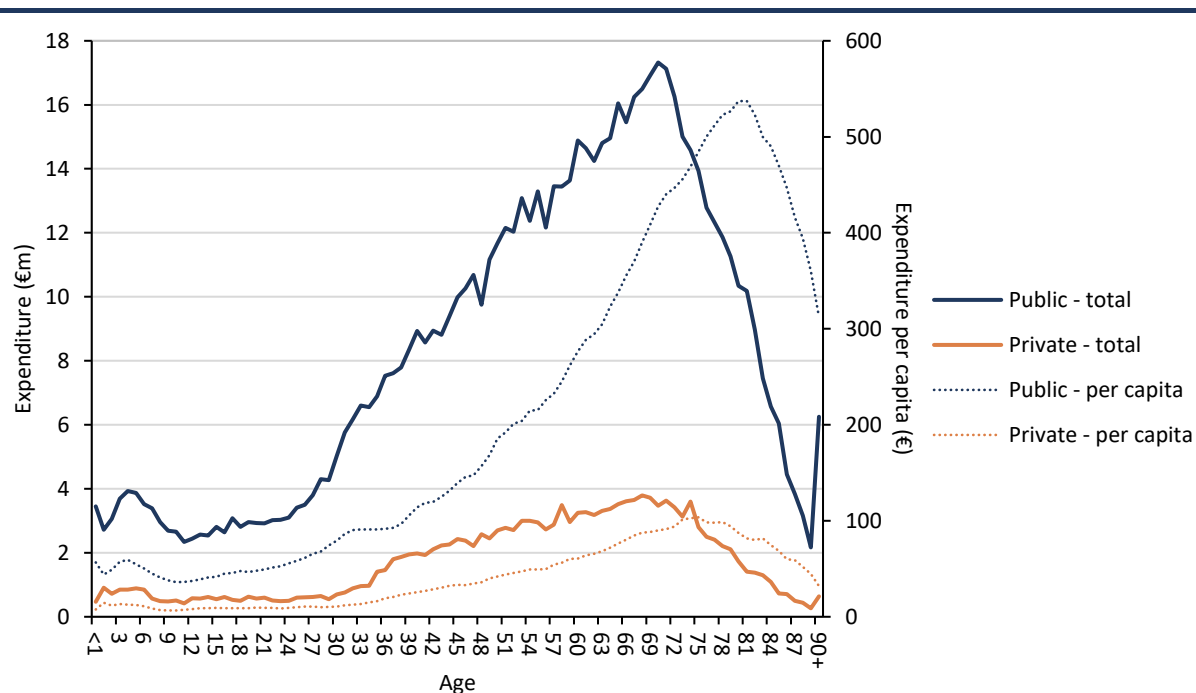
⁵⁷ 'Each HIPE discharge record represents one episode of care. Patients may be admitted to hospital more than once in any given time period with the same or different diagnoses. In the absence of a unique health identifier, therefore, the data reported to HIPE facilitate analysis of hospital discharge activity but do not permit analysis of certain parameters, such as the number of hospital encounters per patient; or estimate the incidence or prevalence of a particular disease' (Healthcare Pricing Office, 2019a, pg 7).

⁵⁸ Day patient profiles are complexity-weighted to account for relative intensity of resource use across the age distribution (Brick and Keegan, 2020a).

⁵⁹ 'Public/private status refers to whether the patient saw the consultant on a private or public basis. It does not relate to the type of bed occupied nor is it an indicator of private health insurance.' HPO (2019a), p 13.

(Figure 5.7). While the age-specific expenditure peaks at similar ages for public (70 years) and private (68 years) discharges, expenditure increases with age at a faster rate for public discharges. Per capita expenditure peaks at 81 years for public patients and 75 years for private patients.

FIGURE 5.7 Day patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by public/private status, 2018



Source: HIPE, 2018; HPO Specialty Costing, 2018.

5.4.2 In-patients

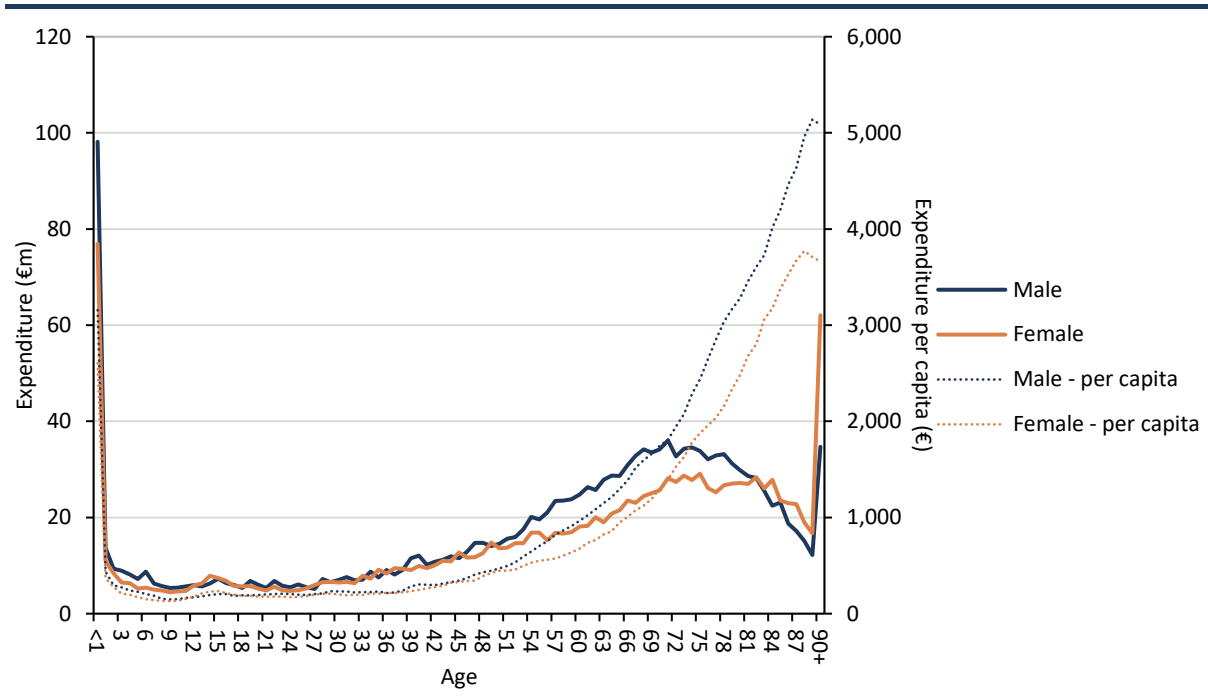
Total public acute hospital expenditure on in-patient (excl. maternity) discharges amounted to €2,967.5m in 2018. Figure 5.8 shows the age- and sex-specific distribution of expenditure and expenditure per capita.⁶⁰ In 2018, 53.2 per cent of expenditure related to males (€1,578.4m) and 46.8 per cent to females (€1,389.2m), with expenditure for both highest at youngest ages, particularly on those <1 year old.⁶¹ From one year to 30 years expenditure is relatively stable but from 30 years onwards expenditure increases with age. There is a second peak for males at 71 years and at 90+ years for females at which points expenditure decreases with age.

⁶⁰ In-patient profiles are complexity-weighted to account for relative intensity of resource use across the age distribution (see Brick and Keegan (2020a)).

⁶¹ This is related to both the relatively high volume and complexity of discharges in this age category. A large proportion of these in-patients are categorised as 'newborn' (51.2% of total in-patients and 54.3% of emergency in-patients). These are emergency in-patients aged between 0–27 days who are categorised as in-patients following delivery due to conditions such as being preterm, respiratory issues, neonatal jaundice, or observation for infection. Well newborn babies are not coded in Ireland and so do not appear as discharges in HIPE (Irish Coding Standard 1607).

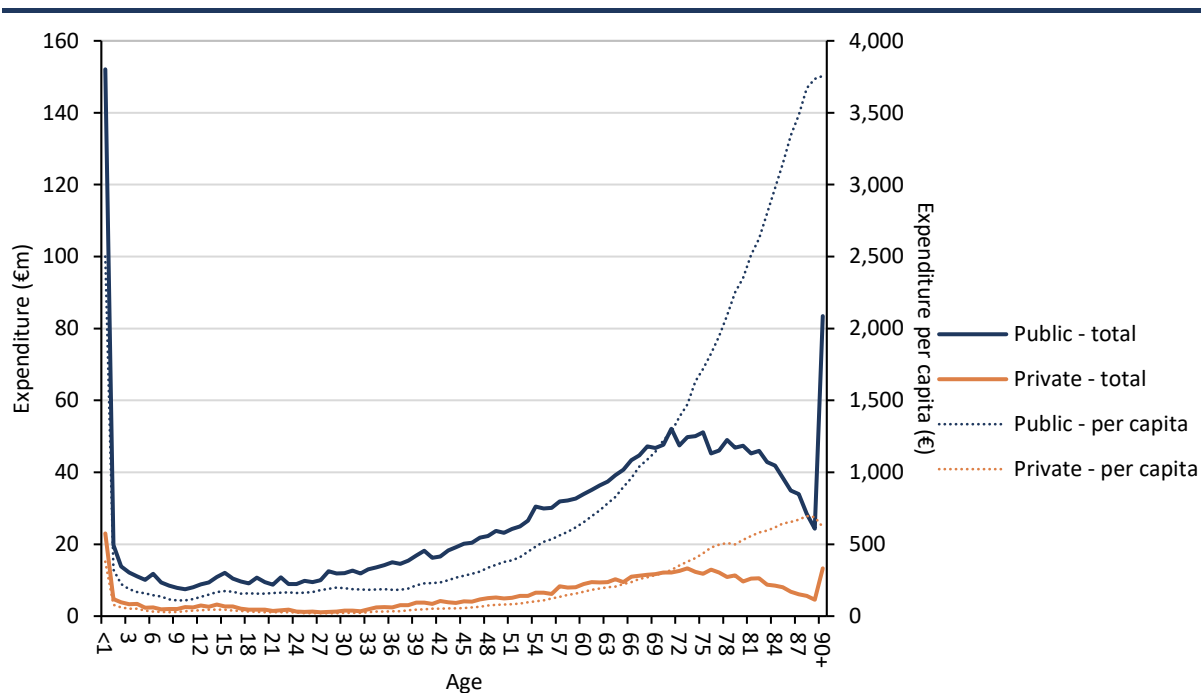
There is little difference in expenditure between male and female discharges at younger ages until approximately 55 years when expenditure on males becomes substantially greater than that on females. This remains the case until 80+ years, at which point female expenditure exceeds male expenditure. Expenditure per capita follows a similar pattern but, rather than decreasing in later years, it continues to increase.

FIGURE 5.8 In-patients (excl. maternity) – age- and sex-specific complexity-weighted expenditure and expenditure per capita, 2018



Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

In-patient (excl. maternity) expenditure is disaggregated by public/private status in Figure 5.9. Expenditure on public in-patients comprises 82.0 per cent (€2,433.1m) of total in-patient expenditure, with the remaining 18.0 per cent (€534.4m) on private in-patients. The age distribution of expenditure is similar for public and private patients, with the highest expenditure at the youngest and oldest ages. Expenditure per capita increases with age for both public and private in-patients but the differential between them increases substantially from approximately 50 years onwards.

FIGURE 5.9 In-patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by public/private status, 2018

Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

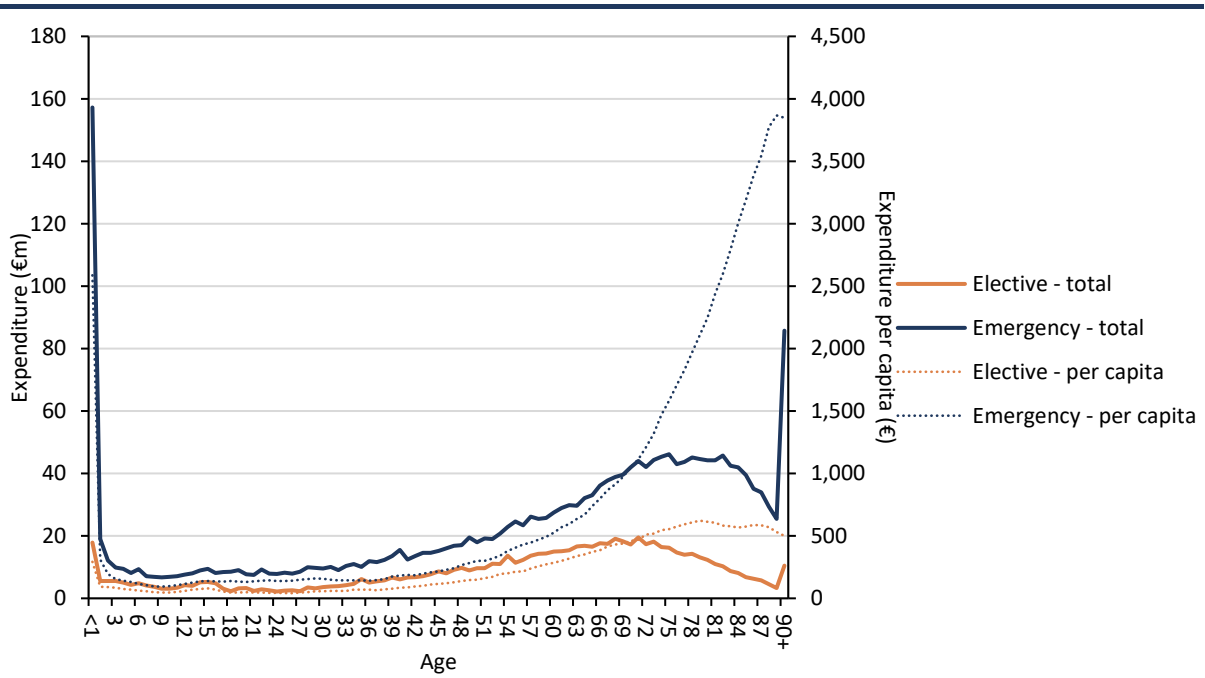
Elective and emergency in-patient

Figure 5.10 disaggregates expenditure by admission type,⁶² elective and emergency in-patient. Of total in-patient (excl. maternity and acute medical/surgical assessment units (AMAU/ASAU) only⁶³) expenditure, elective in-patient expenditure accounts for 26.7 per cent (€790.9m) and emergency in-patient expenditure for 72.2 per cent (€2,143.5m). For elective discharges, expenditure peaks at 71 years while for emergency discharges it peaks at <1 year. Expenditure per capita increases considerably more with age for emergency than elective discharges.

⁶² See Brick and Keegan (2020a) for a full description of the *admission type* disaggregation used in this analysis.

⁶³ Discharges from the 'AMAU/ASAU only' are recorded as emergency in-patients in HIPE. They are admitted as an emergency to the AMAU/ASAU and are discharged from there; 92 per cent have a LOS of 0.5 days.

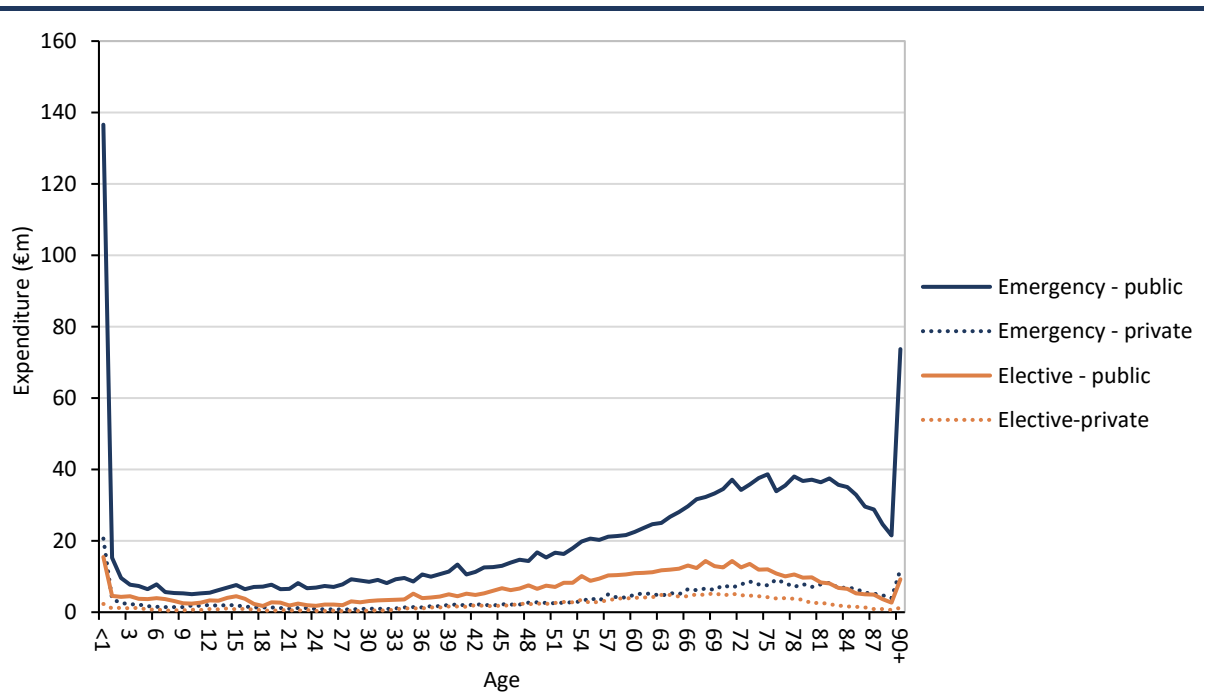
FIGURE 5.10 Elective and emergency in-patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by admission type, 2018



Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

Figure 5.11 shows age-specific in-patient (excl. maternity) expenditure disaggregated by admission status (elective and emergency) and public/private status. The pattern of expenditure across the age distribution is similar for public and private discharges.

FIGURE 5.11 Elective and emergency in-patients (excl. maternity) – age-specific complexity-weighted expenditure and expenditure per capita by admission type and public/private status, 2018

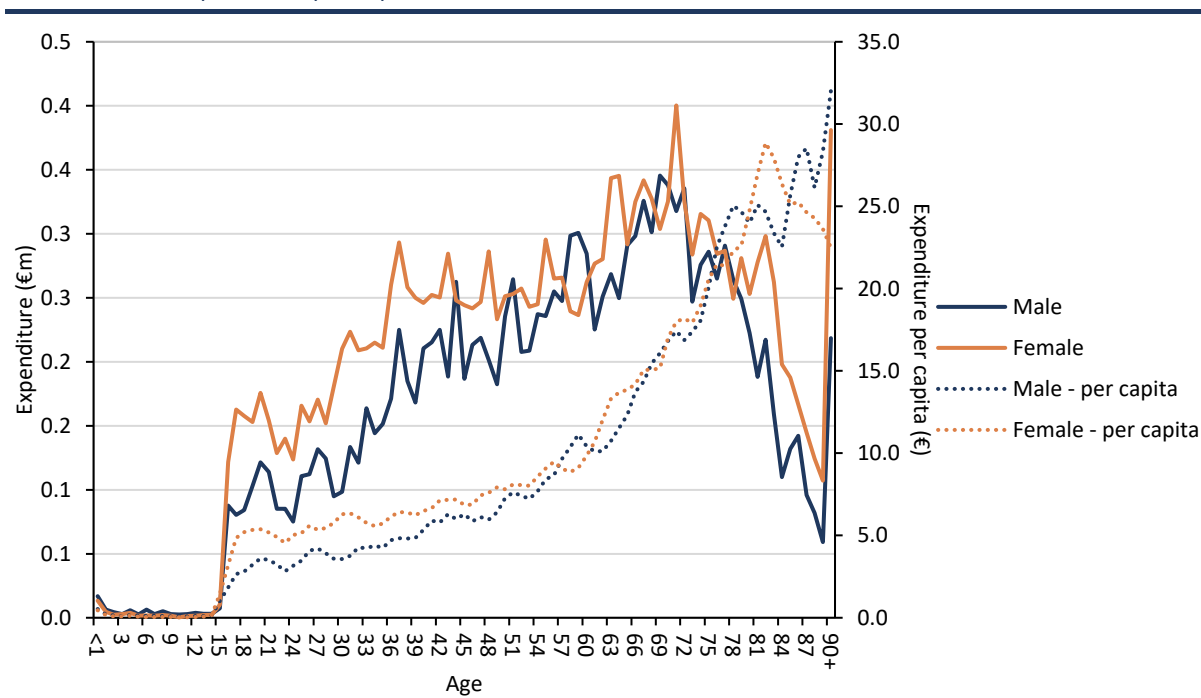


Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

AMAU/ASAU in-patient

Expenditure on AMAU/ASAU only in-patient discharges amounted to €33.1m in 2018 or 1.1 per cent of total in-patient expenditure. Most units do not treat children, which explains the age distribution of expenditure. Expenditure increases with age to approximately 70 years old at which point it begins to decrease, while expenditure per capita increases with age (Figure 5.12).

FIGURE 5.12 AMAU/ASAU only (excl. maternity) – age- and sex-specific complexity-weighted expenditure and expenditure per capita, 2018

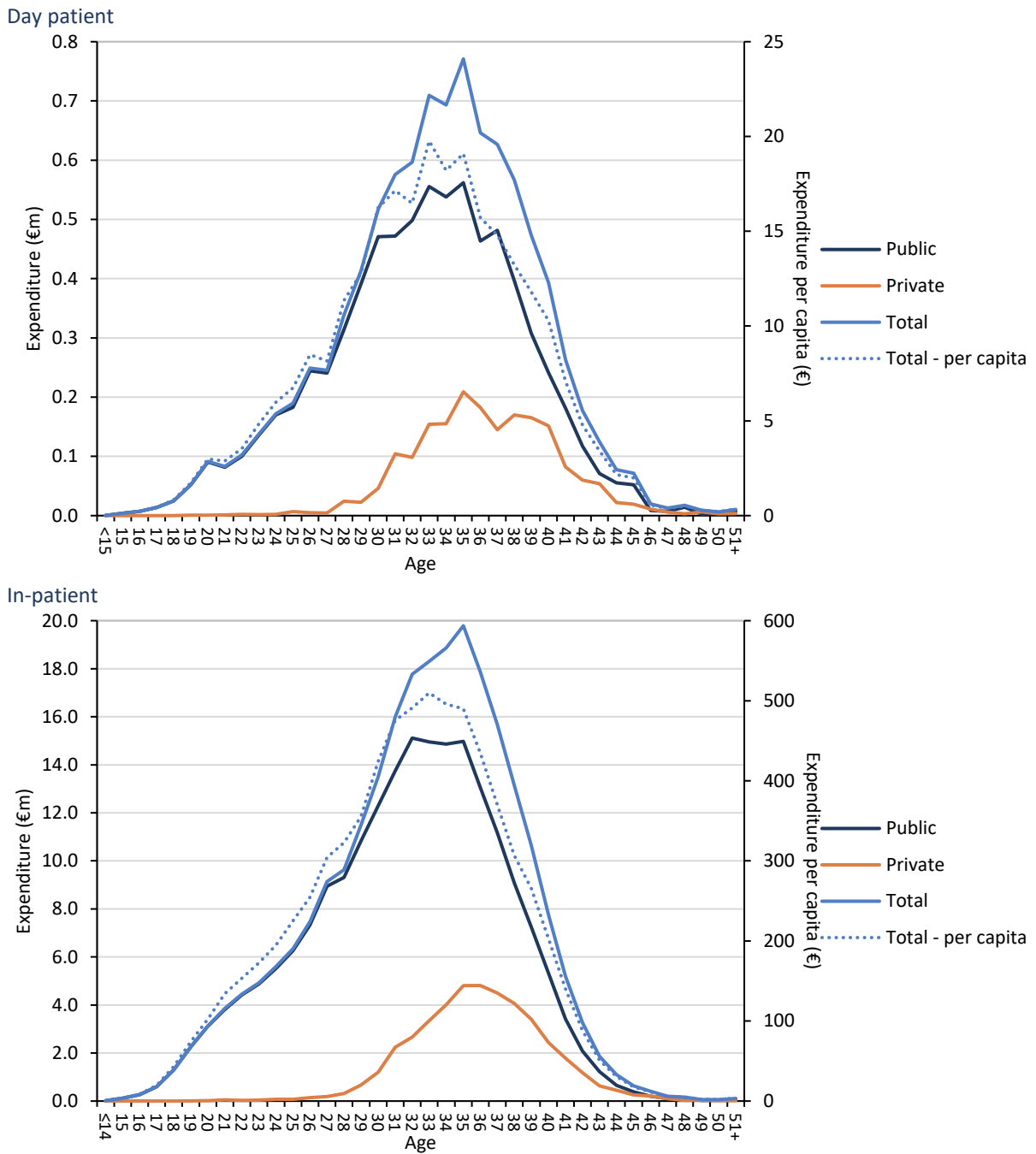


Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

5.4.3 Maternity

Expenditure on maternity discharges accounted for €262.4m in 2018, 3.6 per cent of which relates to maternity day patients. The age-specific distribution of expenditure is presented in Figure 5.13. Expenditure increases with age until approximately 35 years at which point it begins to decrease. Expenditure on private maternity patients accounts for 20.3 per cent of day-patient maternity expenditure and 17.3 per cent of in-patient maternity expenditure.

FIGURE 5.13 Maternity patients – age-specific complexity-weighted expenditure and expenditure per capita by patient type and public/private status, 2018



Notes: Expenditure per capita is calculated from ESRI population estimates of the female population aged 14–51 years.
Source: HIPE, 2018; HPO Specialty Costing, 2018; ESRI population data, 2018.

5.5 FINDINGS – EXPENDITURE PROJECTIONS

In the following section, we present service-level findings of three projection scenarios: low-pressure, central and high-pressure. These scenarios group together assumptions on demand (population growth and ageing, healthy ageing) and cost (pay cost, drug cost, ‘other’ non-pay cost growth).⁶⁴ The low- and high-pressure scenarios incorporate assumptions that would place lesser or greater expenditure pressures on acute services relative to the central scenario. Table 5.2 summarises the assumptions applied in each of the projection scenarios (a more detailed description of these assumption and scenarios is provided in Chapter 4). Expenditure projections are presented in both real and nominal terms between 2018 and 2035.⁶⁵ Real projections hold costs constant at 2018 values, thus enabling analysis of projected volumes of care as if the cost of care had not changed. Nominal projections capture both demand and cost effects.

TABLE 5.2 Projection scenario assumptions

	Low pressure	Central	High pressure
Demand assumptions			
Population growth and ageing	Low	Central	Central
Healthy ageing ^a	Dynamic equilibrium	Moderate healthy ageing	None
Cost assumptions			
Pay	COSMO <i>Delayed Recovery</i> – projected government-sector wage growth (2.2% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth + 1 pct point p.a. (3.5% p.a.)
Non-pay			
Drug cost ^b	4.2% increase p.a.	5.2% increase p.a.	6.2% increase p.a.
Other ^c	COSMO <i>Delayed Recovery</i> – indexed to projected inflation rates + 0.5 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rates + 1 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rates + 1 pct point p.a.

Notes: a No healthy ageing shifts applied to maternity care.
 b Applied to day-patient and in-patient projections only.
 c Based on personal consumption deflator.

5.5.1 Attendances

Emergency department

Table 5.3 presents real and nominal projected expenditure growth for public ED care from 2018 to 2035 based on our three projection scenarios. In real terms, ED attendance expenditure is projected to increase by 11.7 per cent, 16.7 per cent and 18.5 per cent across our low-pressure, central, and high-pressure scenarios, respectively between 2018 and 2035. This equates to projected real ED expenditure in 2035 of between €467.5m and €496.0m. In nominal terms, ED expenditure is projected to increase by 62.2 per cent, 78.2 per cent and 109.2 per cent across our low-pressure, central, and high-pressure scenarios, respectively

⁶⁴ The drug cost assumption applies to the day and in-patient projections only.

⁶⁵ Appendix D reports projected expenditures for the services analysed in this report in terms of average annual growth rates.

between 2018 and 2035. This equates to projected nominal ED expenditure requirements in 2035 of between €679.0m and €876.0m.

TABLE 5.3 ED – projected real and nominal expenditure growth by projection scenario, 2018–2035

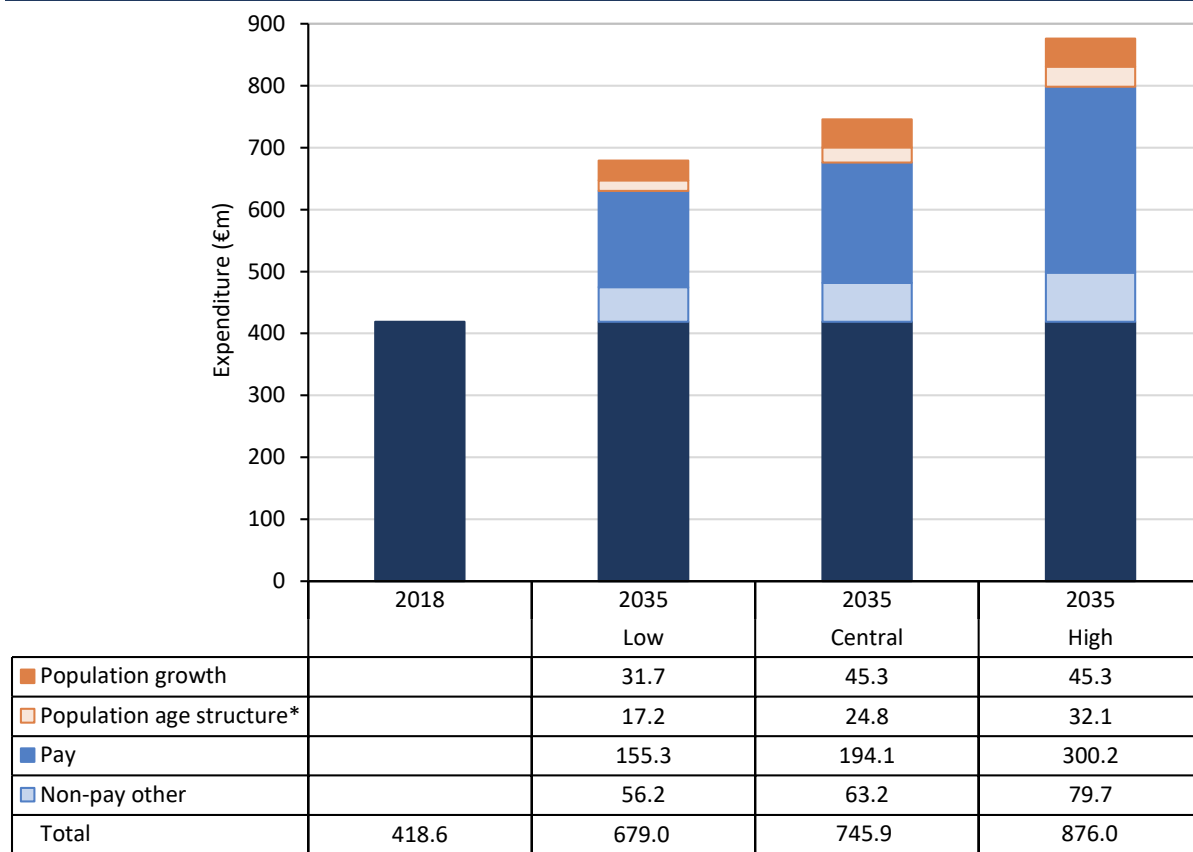
	2018		Projected HCE growth 2018–2035 (%)					
			Real ^a			Nominal		
	Activity	Expenditure (€m)	Low	Central	High	Low	Central	High
Male	715,411	213.0	11.2	16.5	18.3	61.4	77.8	109.0
Female	690,416	205.6	12.2	17.0	18.6	63.0	78.6	109.5
Total	1,405,828	418.6	11.7	16.7	18.5	62.2	78.2	109.2

Notes: a Real projections hold base costs constant at their 2018 values.

Source: HPO Specialty Costing, 2018; HSE Patient Experience Time, 2018; ESRI population data, 2018, authors' calculations.

Nominal projections presented in Table 5.3 point towards cost (which is held constant at 2018 values under real projections) rather than demand pressures as the major driver of projected ED expenditure. This is illustrated in more detail in Figure 5.14 which, for each scenario, decomposes projected ED expenditure. Under the central scenario, for example, population growth (€45.3m) and changes to the population age structure (€24.8m) account for a combined additional €70.1m of expenditure by 2035. In contrast, pay (€194.1m) and non-pay (€63.2m) drivers account for a combined €257.2m of additional expenditure by 2035. Pay cost places the largest pressure on projected expenditure and reflects the fact that the vast majority (76.3%) of the unit cost of delivery of care in EDs is pay-related (Figure 5.1).

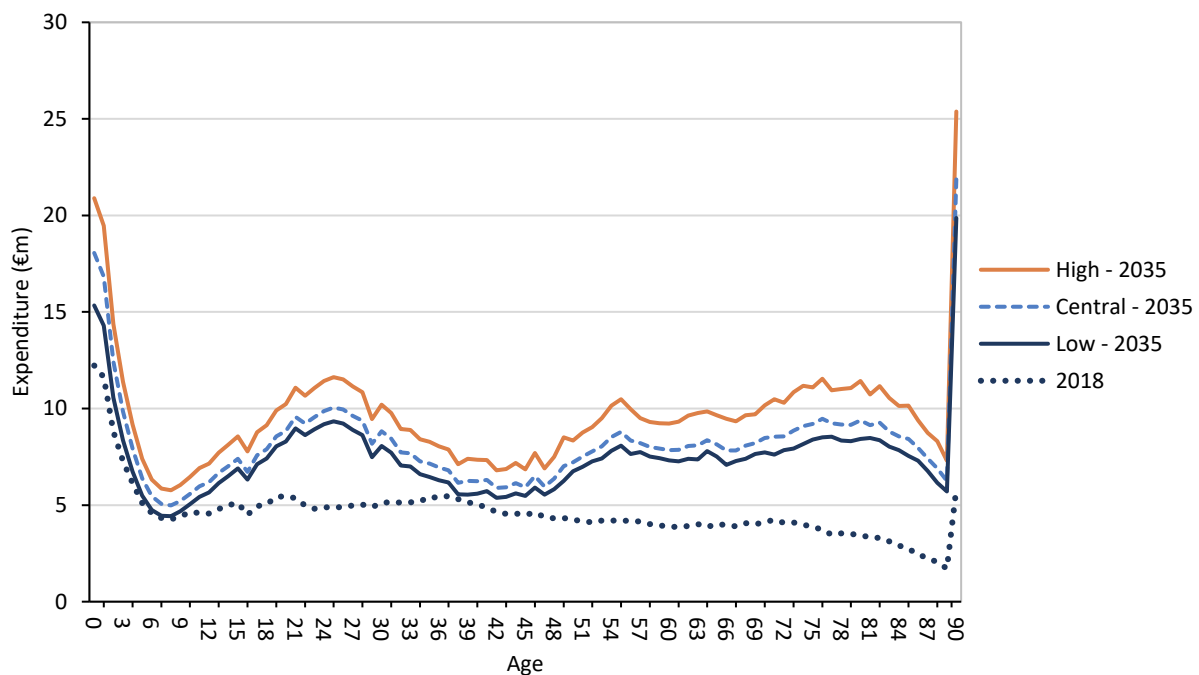
The relative contribution of demand and cost drivers also varies consistently across our low- and high-pressure scenarios. For instance, relative to the central scenario, combined demand pressures are lower under the low-pressure scenario (€48.9m), due to the combined effect of lower population growth and more optimistic healthy ageing. Similarly, combined demand pressures are greater under the high-pressure scenario (€77.4m), where no healthy ageing is assumed. However, similar to the central scenario, pay is the dominant driver across low- and high-pressure projection scenarios. This is particularly true of the high-pressure scenario whereby pay (€300.2m) accounts for 65.6 per cent of all additional projected expenditure by 2035.

FIGURE 5.14 ED – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035

Notes: * Adjusted for healthy ageing in the low and central scenarios

Source: HPO Specialty Costing, 2018; HSE Patient Experience Time, 2018; ESRI population data, 2018, authors' calculations.

Figure 5.15 illustrates baseline 2018 public ED attendances, by age, and projections for 2035 for each of the projection scenarios. As the activity rate distributions underlying our demand projections differ by age, but unit costs do not, the shape of these projected age-specific curves will be influenced by demographic factors. Increases in expenditure are most notable for younger adults and those aged 45 years and over. Relative to other services, the ED activity rate is uniform across much of the age distribution (Brick and Keegan, 2020a). Population growth (driven by net inward migration of younger adults over the medium term) plays a more important role than the population age structure in driving increased expenditure.

FIGURE 5.15 ED – expenditure by age and projection scenario, 2018 and projected 2035 (nominal)

Source: HPO Specialty Costing, 2018; HSE Patient Experience Time, 2018; ESRI population data, 2018; authors' calculations.

Outpatient department

Table 5.4 presents real and nominal projected expenditure growth for public OPD care from 2018 to 2035, based on our three projection scenarios. In real terms, OPD care expenditure (incl. maternity) is projected to increase by 12.1 per cent, 16.4 per cent and 18.1 per cent across our low-pressure, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to overall projected real OPD expenditure in 2035 of between €758.5m and €798.6m. Notably, either flat (0.3%) or slightly negative (-3.3%) real expenditure growth is observed for maternity OPD across scenarios. This is heavily influenced by the projected decline in absolute numbers in the population of those aged 30–39 by 2035, the age cohort in which use of these services is most intensive (Figure 5.5).

In nominal terms, OPD expenditure is projected to increase by 63.4 per cent, 77.8 per cent and 107.6 per cent across our low-pressure, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to projected OPD expenditure requirements in 2035 of between €1,105.2m and €1,404.2m. While projected maternity OPD expenditure was noted to be relatively flat in real terms, nominal increases of 40.8 per cent, 53.2 per cent and 76.3 per cent are observed across the low-pressure, central and high-pressure scenarios by 2035, respectively. Similar to ED expenditure, this highlights the strong influence of cost on projected expenditure.

TABLE 5.4 OPD—projected real and nominal expenditure growth by projection scenario, 2018–2035

	2018		Projected HCE growth 2018–2035 (%)					
			Real ^a			Nominal		
	Activity	Expenditure (€m)	Low	Central	High	Low	Central	High
Male	1,525,348	260.2	14.1	19.3	21.9	66.3	82.2	114.3
Female								
Excl. maternity	1,900,075	324.1	15.0	18.6	20.1	67.5	81.3	111.2
Maternity ^b	539,880	92.1	-3.3	0.3	0.3	40.8	53.2	76.3
Total	3,965,303	676.4	12.1	16.4	18.1	63.4	77.8	107.6

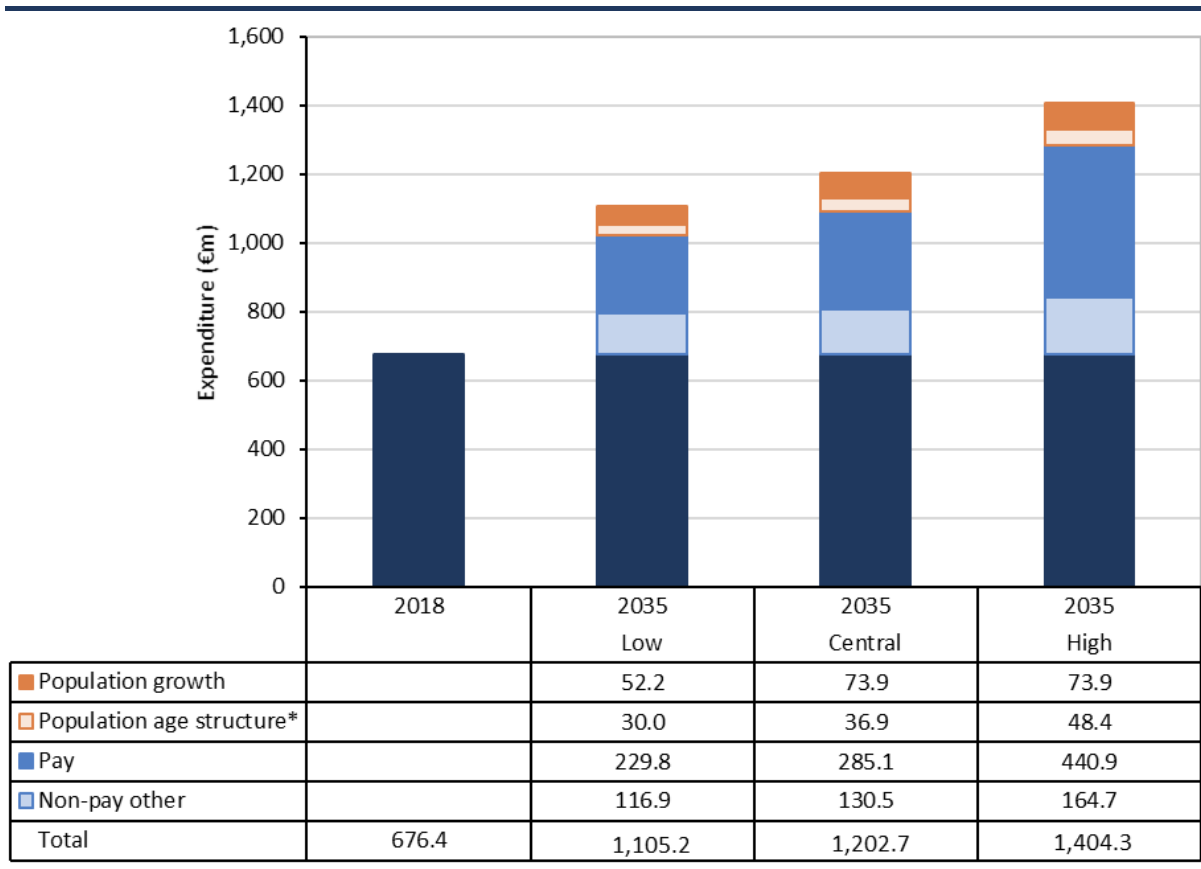
Notes: a Real projections hold base costs constant at their 2018 values.

b We assume no healthy ageing effects for maternity care.

Sources: HPO Specialty Costing, 2018; National Treatment Purchase Fund, 2018; NHS 2018-2019; ESRI population data, 2018; authors' calculations.

Figure 5.16 takes a closer look at the relative contribution of demand and cost drivers, through decomposing nominal OPD expenditure projections by scenario. Under the central projection scenario, population growth (€73.9m) and changes to the population age structure (€36.9m) account for a combined additional €110.8m of expenditure by 2035. In contrast, pay (€285.1m) and non-pay (€130.5m) drivers account for a combined €415.6m of additional expenditure by 2035. Similar to ED, pay cost places the largest pressure on projected expenditure and reflects the fact that the majority (69.6%) of the unit cost of treating an OPD attendance is pay-related (Figure 5.2.).

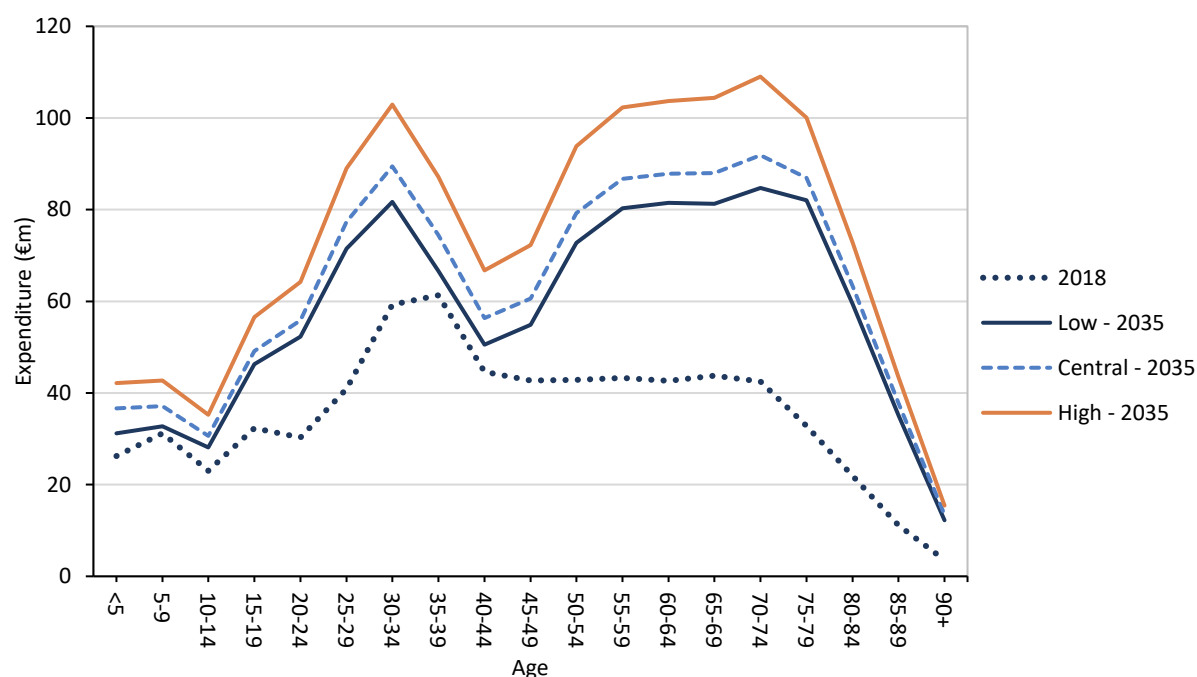
As with ED care, pay remains the most significant driver of projected expenditure growth across all scenarios; the large projected expenditure increases under the high-pressure scenario are particularly sensitive to the assumed evolution of pay. Under the high-pressure scenario, pay (€440.9m) accounts for 60.6 per cent of all additional projected nominal expenditure by 2035.

FIGURE 5.16 OPD – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035

Notes: * Adjusted for healthy ageing in the low pressure and central scenarios
We assume no healthy ageing effects for maternity care.

Sources: HPO Specialty Costing, 2018; National Treatment Purchase Fund, 2018; NHS 2018-2019, ESRI population data, 2018; authors' calculations.

Figure 5.17 illustrates the projected change in OPD expenditure between 2018 and 2035 across the age distribution for all scenarios. Across all scenarios, there are two peaks apparent in OPD expenditure growth, one around 25–34 years and the other at older ages. This reflects differences in underlying age-related activity profiles (Brick and Keegan, 2020a). In particular, maternity activity is largely driving the peak at 25–34 years. At older ages, assumed healthy ageing effects incorporated in the low-pressure and central scenarios reduce expenditure relative to what they otherwise would be.

FIGURE 5.17 OPD – expenditure by age and projection scenario, 2018 and projected 2035 (nominal)

Source: HPO Specialty Costing, 2018; National Treatment Purchase Fund, 2018; NHS 2018-2019; ESRI population data, 2018; authors' calculations.

5.5.2 Discharges

Table 5.5 reports real and nominal projected expenditure growth for public day-patient and in-patient care (incl. maternity) from 2018 to 2035 based on our three projection scenarios. In real terms, total day-patient expenditure is projected to increase by 20.7 per cent, 26.6 per cent and 30.7 per cent across our low-pressure, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to projected total real day-patient expenditure requirements in 2035 of between €1,109.8m and €1,201.5m.

Projected real growth rates for in-patient care are noticeably higher across scenarios, reflecting a higher concentration of (complexity-weighted) in-patient per capita expenditure at older ages in 2018 relative to day patients. Between 2018 and 2035, total real in-patient expenditure is projected to increase by 25.1 per cent, 32.8 per cent and 38.0 per cent across our low-pressure, central and high-pressure scenarios, respectively. This equates to projected total real in-patient expenditure requirements in 2035 of between €4,029.4 and €4,445.6m. For both day-patient and in-patient care, projected growth in real public expenditure is moderately greater than projected growth in real private expenditure to 2035.

Notably, real expenditure on maternity care is set to decline for both day patients (between -4.6% and -8.3%) and in-patients (between -2.5% and -6.2%) by 2035. The decline in the absolute numbers in the 30 to 39 age cohort over time leads to a reduction in demand for maternity care. These reductions are especially large for

private maternity care, reflecting the older profile of women who use private services.

While total in-patient expenditure growth is set to outstrip day-patient expenditure growth in real terms, the opposite is the case for nominal expenditure growth. In nominal terms, total day-patient expenditure is projected to increase by 92.0 per cent, 118.7 per cent and 160.7 per cent, across our low-pressure, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to projected total nominal day-patient expenditure requirements in 2035 of between €1,765.8m and €2,396.9m.

In contrast, by 2035 nominal in-patient expenditure is expected to increase by 85.9 per cent, 108.6 per cent and 150.0 per cent across our low-pressure, central and high-pressure scenarios. This equates to projected total nominal in-patient expenditure requirements in 2035 of between €5,985.3m and €8,050.0m. The larger nominal expenditure growth for day patients is driven by the large projected increase in the cost of drugs (Figure 5.17), which represent a much larger proportion of the cost of delivering day-patient relative to in-patient care (see Figure 5.1). As with real expenditure, for both day-patient and in-patient care, projected growth in nominal public expenditure is moderately greater than projected growth in real private expenditure to 2035.

While real expenditure on day and in-patient maternity care is set to fall by 2035 due to lower projected volumes of care, nominal expenditure is set to increase as a result of projected increases in the cost of delivery of a unit of service. In nominal terms, total day-patient maternity expenditure is set to increase by between 45.9 and 90.4 per cent, while total in-patient maternity expenditure is set to increase by between 39.3 and 76.6 per cent, between 2018 and 2035.

TABLE 5.5 Day patient and in-patient – projected real and nominal expenditure growth by public/private status and projection scenario, 2018–2035

	2018		Projected HCE growth 2018–2035 (%)					
	Complexity-weighted discharges	Expenditure (€m)	Real ^a			Nominal		
			Low	Central	High	Low	Central	High
Day patients								
Total	1,038,825	919.5	20.7	26.6	30.7	92.0	118.7	160.7
Male	505,172	447.1	21.7	28.8	33.8	93.7	122.4	166.9
Female	533,653	472.3	19.7	24.6	27.7	90.5	115.2	154.8
Excl. maternity ^b	522,937	462.9	20.3	25.2	28.4	91.4	116.2	156.1
Maternity	10,715	9.5	-8.3	-4.6	-4.6	45.9	64.8	90.4
Public	859,387	760.6	20.8	26.9	31.1	92.3	119.2	161.6
Male	423,141	374.5	21.9	29.1	34.2	94.0	122.9	167.8
Female	436,245	386.1	19.8	24.8	28.1	90.6	115.6	155.6
Excl. maternity ^b	427,703	378.6	20.3	25.4	28.7	91.4	116.5	156.9
Maternity	8,542	7.6	-6.2	-2.5	-2.5	49.2	68.4	94.5
Private	179,438	158.8	17.0	23.6	28.4	86.2	113.4	156.1
Male	82,030	72.6	18.0	25.6	31.3	87.8	117.0	162.0
Female	97,407	86.2	16.2	21.8	25.9	84.8	110.3	151.2
Excl. maternity	95,234	84.3	16.9	22.6	26.8	86.0	111.7	153.0
Maternity	2,173	1.9	-16.3	-12.6	-12.6	33.1	50.9	74.3
In-patients								
Total	646,077	3,220.5	25.1	32.8	38.0	85.9	108.6	150.0
Male	316,645	1,578.4	27.8	36.6	42.8	89.9	114.5	158.5
Female	329,433	1,642.1	22.5	29.2	33.5	82.0	103.0	141.8
Excl. maternity	278,695	1,389.2	27.7	35.0	40.1	89.7	112.1	153.6
Maternity	50,738	252.9	-6.2	-2.5	-2.5	39.3	53.2	76.6
Public	530,083	2,642.3	25.0	32.8	38.2	85.6	108.7	150.2
Male	260,351	1,297.8	27.3	36.2	42.5	89.1	113.9	158.0
Female	269,732	1,344.5	22.7	29.6	34.0	82.3	103.6	142.7
Excl. maternity	227,780	1,135.4	27.7	35.1	40.3	89.6	112.3	154.1
Maternity	41,951	209.1	-4.0	-0.3	-0.3	42.6	56.6	80.5
Private	115,995	578.2	23.3	31.6	37.4	83.1	106.8	148.8
Male	56,294	280.6	27.8	37.2	44.0	89.8	115.5	160.8
Female	59,701	297.6	19.1	26.4	31.2	76.9	98.5	137.5
Excl. maternity	50,915	253.8	25.2	33.2	38.8	86.0	109.2	151.3
Maternity	8,786	43.8	-16.7	-12.9	-12.9	23.7	36.8	57.7

Notes: a Real projections hold base costs constant at their 2018 values.

b We assume no healthy ageing effects for maternity care.

Source: HIPE, 2018; ESRI population data, 2018; authors' calculations.

Table 5.6 reports real and nominal projected expenditure growth for in-patient elective and emergency care from 2018 to 2035 based on our three projection scenarios. In real terms, total elective in-patient expenditure is projected to grow by 22.4 per cent, 29.3 per cent and 34.2 per cent, across our low-pressure, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to projected real elective in-patient expenditure requirements of between €967.7m and €1,061.3m by 2035. Larger projected real expenditure increases are observed for emergency in-patient care, reflecting the steep per capita age gradient associated with this care (see Figure 5.10). Total real emergency in-patient expenditure is projected to increase by 29.0 per cent, 37.9 per cent and 44.3 per cent across our low-pressure, central and high-pressure scenarios, respectively, by 2035. This equates to projected real emergency in-patient expenditure requirements of between €2,764.7m and €3,093.4m by 2035. For both elective and

emergency in-patient care, there is little variation in projected growth rates when split in terms of whether the care was public or privately financed.

In nominal terms, total elective in-patient expenditure is projected to grow by 81.7 per cent, 103.1 per cent and 143.0 per cent across our low-pressure, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to projected nominal elective in-patient expenditure requirements of between €1,437.4m and €1,921.7 by 2035. By 2035, total nominal emergency in-patient expenditure is projected to grow by 91.6 per cent, 116.6 per cent and 161.3 per cent across our three scenarios, respectively. Spending requirements for this care type are therefore projected to be between €4,106.8m and €5,601.4m by 2035.

TABLE 5.6 Elective and emergency in-patients (excl. maternity) – projected real and nominal expenditure growth by projection scenario and public/private status, 2018-2035

	2018		Projected HCE growth 2018-2035 (%)					
	Complexity-weighted discharges	Expenditure (€m)	Real ^a			Nominal		
			Central	Low	High	Central	Low	High
In-patients – elective								
Total	158,669	790.9	22.4	29.3	34.2	81.7	103.1	143.0
Male	82,190	409.7	22.1	29.9	35.6	81.3	104.1	145.6
Female (excl. maternity)	76,479	381.2	22.7	28.6	32.7	82.2	102.0	140.2
Public	120,957	602.9	21.8	29.0	34.0	81.0	102.7	142.6
Male	62,718	312.6	21.5	29.4	35.1	80.5	103.3	144.5
Female (excl. maternity)	58,239	290.3	22.2	28.6	32.9	81.5	101.9	140.6
Private	37,712	188.0	19.9	28.2	34.8	78.1	101.4	144.1
Male	19,472	97.1	20.3	29.9	37.4	78.7	104.0	148.9
Female	18,240	90.9	19.4	26.4	32.0	77.4	98.6	139.0
In-patients – emergency								
Total	430,019	2,143.5	29.0	37.9	44.3	91.6	116.6	161.3
Male	231,449	1,153.7	28.8	38.4	45.4	91.3	117.4	163.3
Female (excl. maternity)	198,569	989.8	29.2	37.3	43.1	91.9	115.6	159.1
Public	361,005	1,799.5	28.4	37.5	44.1	90.7	116.0	161.0
Male	194,837	971.2	28.1	37.8	45.0	90.3	116.5	162.5
Female (excl. maternity)	166,169	828.3	28.8	37.1	43.1	91.3	115.4	159.2
Private	69,014	344.0	26.8	37.3	45.3	88.4	115.7	163.0
Male	36,613	182.5	28.4	39.3	47.6	90.8	118.9	167.2
Female (excl. maternity)	32,401	161.5	25.0	35.0	42.7	85.7	112.1	158.3

Notes: a Real projections hold base costs constant at their 2018 values

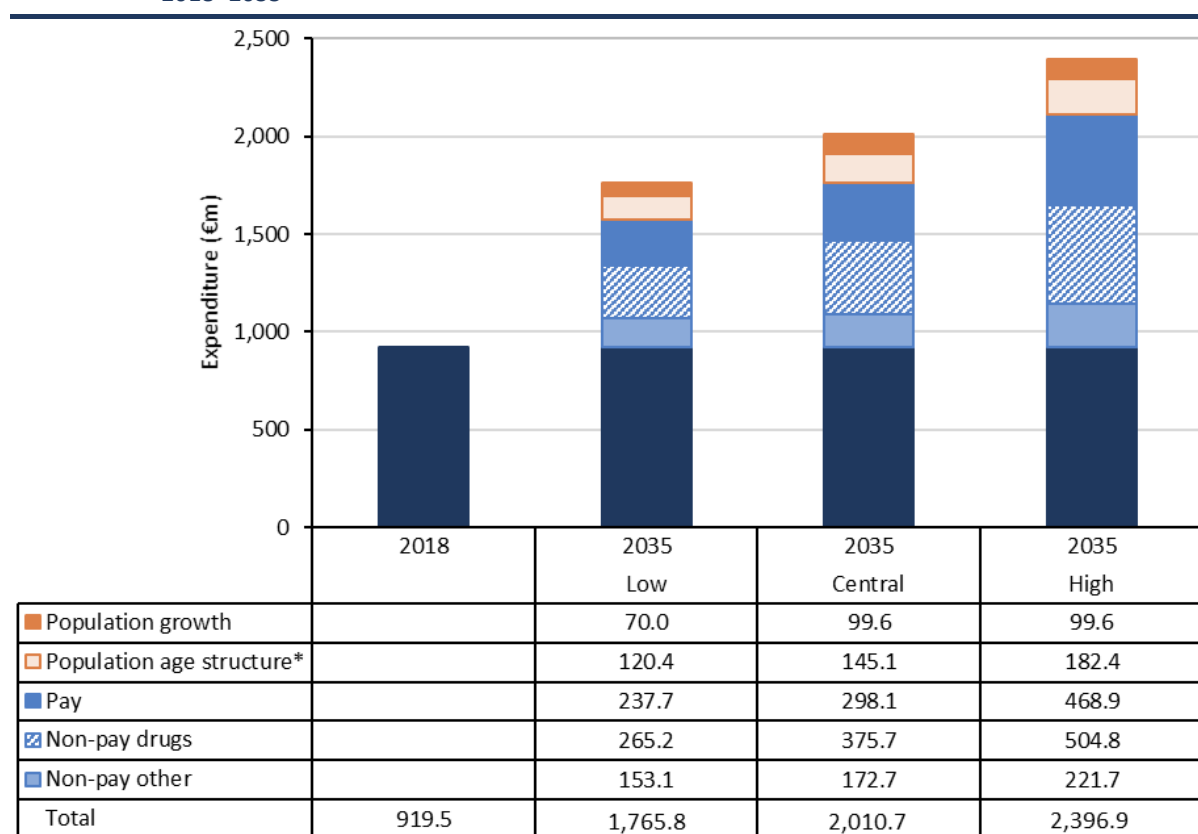
Source: HIPE, 2018; ESRI population data, 2018; authors' calculations.

Figure 5.18 presents a decomposition of nominal day-patient expenditure growth between 2018 and 2035. Similarly to other services examined, cost rather than demand is the major driver of nominal expenditure projections. Under the central scenario, for instance, population growth (€99.6m) and changes to the population age structure (€145.1m) account for a combined additional €244.8m of required expenditure by 2035. The proportionately greater impact of ageing, not observed for OPD and ED, is again reflective of the steeper per capita expenditure age gradient associated with admitted care. Pay (€298.1m) and drugs (€375.7m) and other non-pay (€172.7m) cost drivers, in contrast, account for a combined €846.4m

of additional expenditure by 2035. As noted previously, projected drug cost growth is expected to be the largest driver of future day-patient expenditure requirements.

Relative to the central scenario, combined demand pressures on expenditure are lower under the low-pressure scenario (€190.4m), due to the combined effect of lower population growth and more optimistic healthy ageing. Similarly, combined demand pressures are greater under the high-pressure scenario (€282.0m) where no healthy ageing is assumed. However, as in the central scenario, pay and drugs are the dominant drivers across the low- and high-pressure projection scenarios. This is particularly true of the high-pressure scenario whereby pay (€468.9m) and drug (€504.8m) cost pressures account for 65.9 per cent of all additional projected expenditure by 2035.

FIGURE 5.18 Day patient – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035



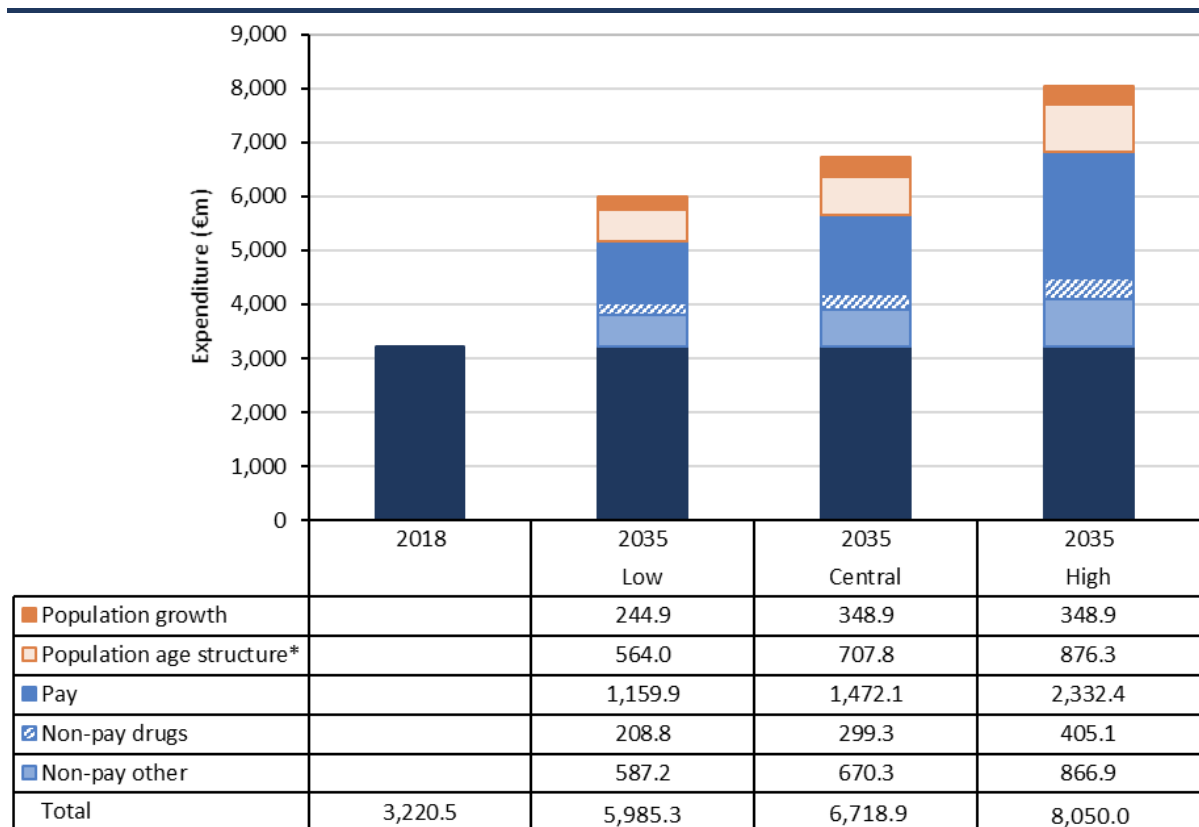
Notes: * Adjusted for healthy ageing in the low- pressure and central scenarios. We assume no healthy ageing effects for maternity care.

Source: HIPE, 2018; ESRI population data, 2018; authors' calculations.

Figure 5.19 presents a decomposition of nominal in-patient expenditure growth between 2018 and 2035. Similar to other services, cost drivers dominate demand drivers. Consistent with underlying per capita expenditure profiles, changes to the population age structure have a proportionately large effect as a demographic driver of expenditure, and are estimated to account for €707.8m of the €1,056.7m combined demographic effect under the central scenario. This concentration of expenditure at older ages is enhanced through complexity-weighting (see Brick and Keegan, 2020a). Pay is the dominant cost driver, accounting for €1,472.1m of projected additional expenditure. Compared with day patients, drug costs are a less significant driver of in-patient expenditure growth. This reflects the much lower proportion of in-patient care delivery attributable to drug costs (Figure 5.1).

As with the other services examined, stronger assumed healthy ageing and lower population growth reduce additional demographic pressures (€808.9m) under the low-pressure scenario, while no assumed healthy ageing under the high-pressure scenario leads to increased demographic pressures (€1,225.2m), relative to the central scenario. However, modelled pay cost pressures (an additional €2,332.4m) under the high-pressure scenario is the most significant differentiating factor in terms of overall projected growth across scenarios.

FIGURE 5.19 In-patient – decomposition of projected nominal expenditure growth by projection scenario, 2018–2035

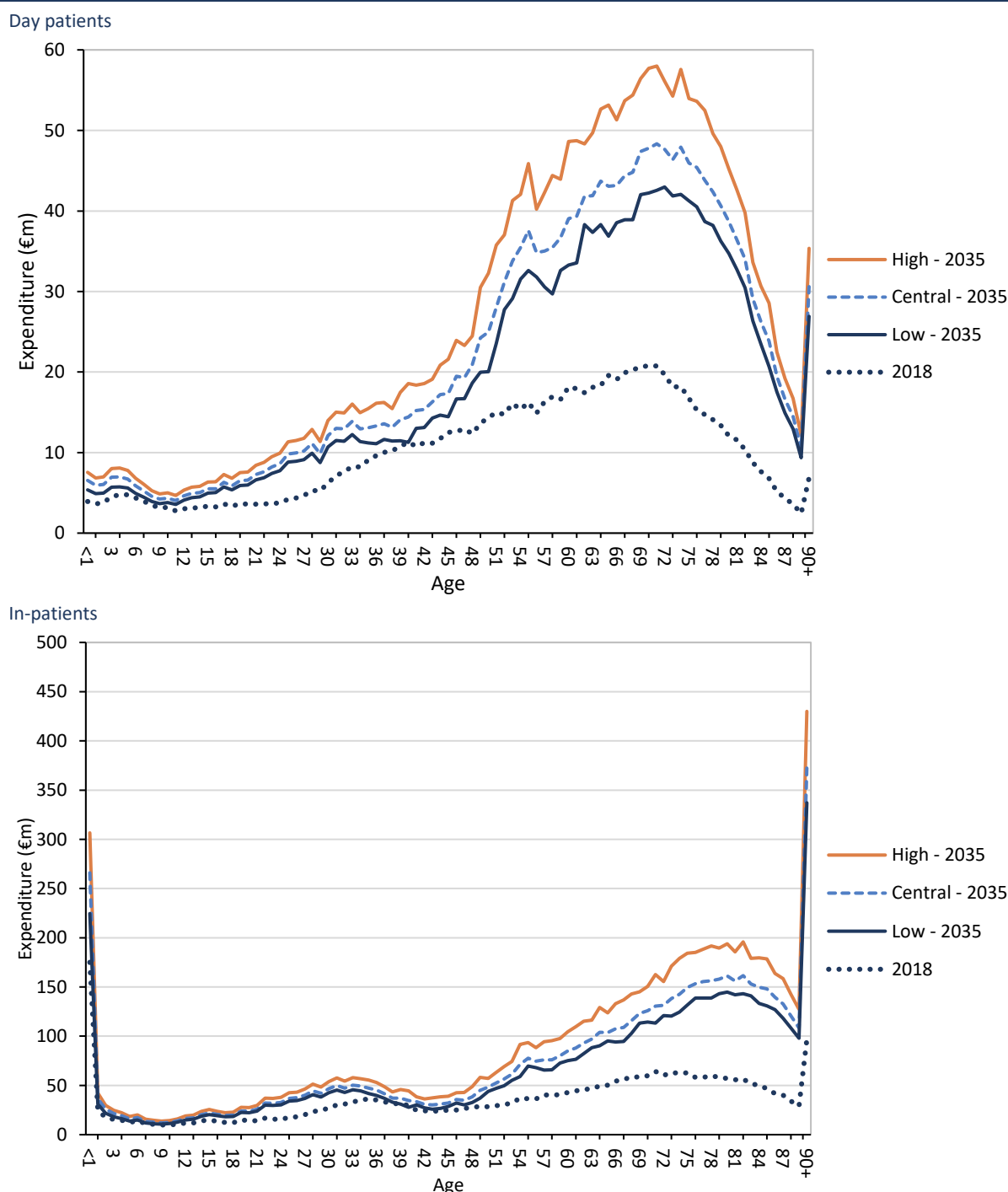


Notes: * Adjusted for healthy ageing in the low pressure and central scenarios. We assume no healthy ageing effects for maternity care.

Source: HIPE, 2018; ESRI population data, 2018; authors' calculations.

Figure 5.20 presents the projected change in both day patient and in-patient nominal expenditure between 2018 and 2035 across the age distribution for all scenarios. For both day and in-patient care, growth in expenditure between 2018 and 2035 takes place predominantly at the older end of the age distribution. This is consistent with the relatively large impact of ageing as a demographic driver for these services (even under assumed healthy ageing effects in the low-pressure and central scenarios) illustrated in Figures 5.18 and 5.19.

FIGURE 5.20 Day patient and in-patient – expenditure by age and projection scenario, 2018 and projected 2035 (nominal)



Source: HIPE, 2018; ESRI population data, 2018; authors' calculations.

5.6 SUMMARY

This chapter provided baseline estimates and expenditure projections for care in Irish public acute hospitals. Its focus was on comprehensively capturing baseline expenditure for the main public hospital services and types of care, and projecting that expenditure to 2035 under a range of alternative projection scenarios. Baseline expenditure and projections capture all non-capital expenditure associated with the delivery of care. For admitted public acute hospital patients, this expenditure can be financed by a combination of public and private (largely private health insurance) sources.

5.6.1 Baseline expenditure, 2018

Estimating baseline expenditure profiles required development of detailed 2018 base-year activity rate profiles⁶⁶ and unit costs of care. The baseline expenditure analysis alone provides a detailed and more comprehensive analysis of expenditure on public acute hospital services than has previously been available for Ireland.

The baseline analysis highlights variation in expenditure profiles and the level and composition of unit costs of care across services. The cost of delivering a unit of service varied widely, from €171 on average for an OPD attendance to €4,985 for an in-patient hospital stay, in 2018. The major component of all unit costs was pay, although this varied by service from over three-quarters of the total unit cost for ED care (76.3%) to just under half for day-patient care (49.2%). Nearly a quarter of the unit cost (23.6%) of delivering day-patient care was attributable to drug costs, a far higher proportion than for other services. This is consistent with the substantial drug-related requirements for delivery of much of the care in day-patient settings. For example, chemotherapy and radiotherapy combined accounted for 21.0 per cent of total day-patient discharges in 2018.

The baseline analysis also found that, while expenditure on services tended to increase with age, there was large variation in the underlying per capita expenditure profiles. Per capita expenditure profiles express the distribution of underlying activity rates in expenditure terms, and many of the findings in this regard reflect previous insights reported in Wren et al. (2017). For instance, the emergency in-patient (excl. maternity) profile shows expenditure per capita peaks twice, at older ages and also in the youngest ages (<1 year) as any newborns requiring treatment are admitted as emergency in-patients.

⁶⁶ See Brick and Keegan (2020a) for a detailed analysis of these activity profiles.

ED and OPD care show less concentration of expenditure in older ages compared with admitted day-patient and in-patient care. While older individuals tend to use in-patient services more frequently, they also tend to use them more intensively. It was possible to account for both these factors through complexity-weighting these expenditure profiles. These complexity-weighted profiles are not something that have been published in detail previously.

5.6.2 Expenditure projections, 2018 to 2035

Variation in the shape of baseline expenditure per capita profiles (reflecting underlying activity rate profiles) and the composition of unit costs of care form the basis for variation in projected growth in expenditure on services. The impact of demographic factors can be most readily seen when considering real expenditure projections. Under the three scenarios examined, projected percentage increases in expenditure on ED (11.7% to 18.5%) and OPD (12.1% to 18.1%) are lower than for day-patient (20.7% to 30.7%) and in-patient care (25.1% to 38.0%). In line with evidence on the relationship between acute care expenditure and ageing (see Chapter 2), we model healthy ageing effects as part of the low-pressure and central scenarios, but not under an assumed high-pressure scenario, which represents the upper range of projected expenditure growth.

While demographic pressures drive expenditure through the projected volumes of services to be delivered, analysis from this chapter suggests that it is the projected cost of delivering these services that will be the more dominant driver of nominal expenditure to 2035. These findings align with previous projections of Irish healthcare expenditure that have also reported on the relative importance of cost over demographics (Irish Fiscal Advisory Council, 2018).

Given the labour-intensive nature of healthcare delivery, pay represents the largest single driver of increases in nominal expenditure for ED, OPD and in-patient care. In addition to pay, the large percentage increases in day-patient expenditure reported are also predominantly driven by projected drug cost pressures. As noted, drugs accounted for a large component of the unit cost of day-patient care in 2018. The innovative and high-tech nature of hospital drugs suggests that historical patterns of large increases in costs could continue over the medium term, leading to strong pressure on projected day-patient care expenditure.

Reflecting these cost considerations, and the varying impact of demographics across services already discussed, under the three scenarios examined nominal ED expenditure and OPD expenditure are projected to increase by between 62.2 per cent and 109.2 per cent and 63.4 and 107.6 per cent, respectively, by 2035. In contrast, day-patient and in-patient expenditure are projected to increase by

between 92.0 and 160.7 per cent and 85.9 and 150.0 per cent, respectively, by 2035.

Finally, this chapter did not take account of any assumed productivity improvements that could be expected to offset some of the cost increases modelled in this analysis. Nor did we consider any models of care change that may affect projected acute expenditure trajectories. Modelling assumptions in relation to acute care productivity improvements is challenging given that no historical acute care (or broader healthcare) productivity index has been developed for Ireland. Analyses, however, suggest recent challenges in delivering productivity improvements in Irish hospitals (Burke et al., 2014; Lawless, 2018). That said, we consider the potential impact of productivity effects on projected expenditure growth under sensitivity analysis in Chapter 8. Chapter 6 uses the age- and sex-specific expenditure profiles developed as part of this chapter to develop a comprehensive age- and sex-specific aggregate expenditure profile for public acute hospitals in 2018. As part of that analysis, we also introduce an additional projection scenario (progress scenario) that considers the impact of improved waiting-list management and reduced rates of avoidable hospitalisation on projected total public acute expenditure.

CHAPTER 6

Findings: Projected aggregate public acute hospital expenditure

6.1 INTRODUCTION

This chapter presents findings for baseline public acute hospital gross expenditure in 2018 and projections of expenditure to 2035. These estimates include gross expenditure required to care for both public and private patients in public hospitals. In this way, we record and project total gross expenditure on public acute hospital services, even if not financed by public sources. Gross expenditure on acute hospital services is estimated through aggregating (by age and sex) our baseline profiles (developed in Chapter 5) for public emergency department (ED), outpatient department (OPD), day-patient and in-patient care. Data limitations have meant that Ireland has traditionally struggled to develop age- and sex-specific expenditure profiles for healthcare services. Ireland, as a consequence, has been one of only three countries unable to submit age-cost profiles to the European Commission to inform their Ageing Reports (European Commission, 2009b; 2012b; 2015; 2018). Findings in this chapter, therefore, represent a significant step forward as for the first time a comprehensive age- and sex-specific expenditure profile is developed for public acute hospital services in Ireland. We then aggregate these age- and sex-specific expenditure profiles, which account for just under 90 per cent of HSE-recorded acute hospital gross expenditure in 2018. Following adjustment for the unexplained residual expenditure, we project from this basis to 2035.

In addition to the low-pressure, central and high-pressure projection scenarios examined in Chapter 5, this chapter introduces an additional progress scenario. The motivation behind this additional scenario is to examine the potential impact on projected acute expenditure of progressing two important dimensions of healthcare reform (Houses of the Oireachtas Committee on the Future of Healthcare, 2017).

First, we project the additional activity and related cost required to reduce waiting list backlogs for OPD appointments and elective day patient and in-patient treatment (augmented by Covid-19-related cancellation of non-urgent elective care) and to sustain future waiting times below 12 weeks. This is based on a method developed in the UK (Findlay, 2017) and recently applied as part of NHS expenditure projections (Charlesworth and Johnson, 2018).

Second, we examine the potential impact on acute hospital expenditure of improved investment in, and access to, primary healthcare services. We simulate this by reducing the rate of hospitalisation in relation to (vaccine-preventable)

influenza and pneumonia, urinary tract infections (including pyelonephritis) and COPD. These conditions can be classified as ‘avoidable hospitalisations’ and relate to conditions for which hospitalisation can be considered avoidable through timely and effective utilisation of primary care. Moreover, rates of avoidable hospitalisation are often used as a marker of primary care quality (Gibson et al., 2013; Rosano et al., 2013). The conditions described above are the three most resource-intensive avoidable hospitalisations recorded in Irish public hospitals and have been identified as a priority for targeted primary care investment (McDarby and Smyth, 2019). In 2018, these three conditions together accounted for 70.7 per cent of total (complexity-weighted) avoidable hospitalisations identified (see Appendix A). More detail on these assumptions is provided in Chapter 4.

In examining how projected growth rates may differ through the course of the projection horizon in this chapter, we also adjust our projections to consider the impact, over the short and longer term, of large Covid-19-related shocks to healthcare expenditure growth in the period 2020–2022. More detail on this approach is also provided in Appendix C.

Section 6.2 describes findings in relation to baseline acute public hospital gross expenditures. Section 6.3 presents findings in relation to projections of total acute public hospital gross expenditures. Section 6.4 discusses and concludes.

6.2 FINDINGS – AGGREGATE GROSS EXPENDITURE

Table 6.1 provides a summary of total public acute hospital gross expenditure for 2018 by main service category and overall. Gross expenditure captures all expenditure on delivering public acute hospital care prior to any income deductions (for example, in relation to treatment of private patients). Combining the main service categories of expenditure examined in Chapter 5 yields a total gross expenditure of €5,234.9m on these services in 2018. Most of this expenditure relates to in-patient care (61.5%), followed by day-patient care (17.6%), OPD care (12.9%) and ED (8.0%). For comparison, HSE gross expenditure on public acute hospitals in 2018 was €5,907.1m.^{67,68} By aggregating our service-level profiles, we therefore capture just under 90 per cent of public acute hospital gross expenditure as recorded by the HSE in 2018.⁶⁹

⁶⁷ The final expenditure figure of €5,907.1m was provided by HSE Finance, personal communication, 7 October 2020.

⁶⁸ The corresponding net expenditure figure (after income adjustment) was €5,064.4m (HSE Finance, personal communication, 7 October, 2020).

⁶⁹ It is difficult to fully reconcile the residual amount of €672.2m not captured by our expenditure categories. However, a large proportion (€300m) is related to hospital costs incurred in relation to external services (e.g. hospital laboratory testing for primary healthcare providers). We also do not capture approximately €100m in activity related to Minor Injury Units (MIU) and other non-casemix hospital activity. We are also missing some OPD expenditure incurred outside the 40 Activity-Based-Funding (ABF) hospitals.

TABLE 6.1 Public acute hospital gross expenditure, 2018

	Expenditures	
	€m	%
ED attendances	418.6	7.1
OPD attendances (incl. maternity)	676.4	11.4
Day-patient discharges (incl. maternity)	919.5	15.6
In-patient discharges (incl. maternity)	3,220.5	54.5
Combined services total	5,234.9	88.6
Residual	672.2	11.4
Total HSE gross expenditure	5,907.1	100

Source: HPO Specialty Costing, 2018; HIPE, 2018.

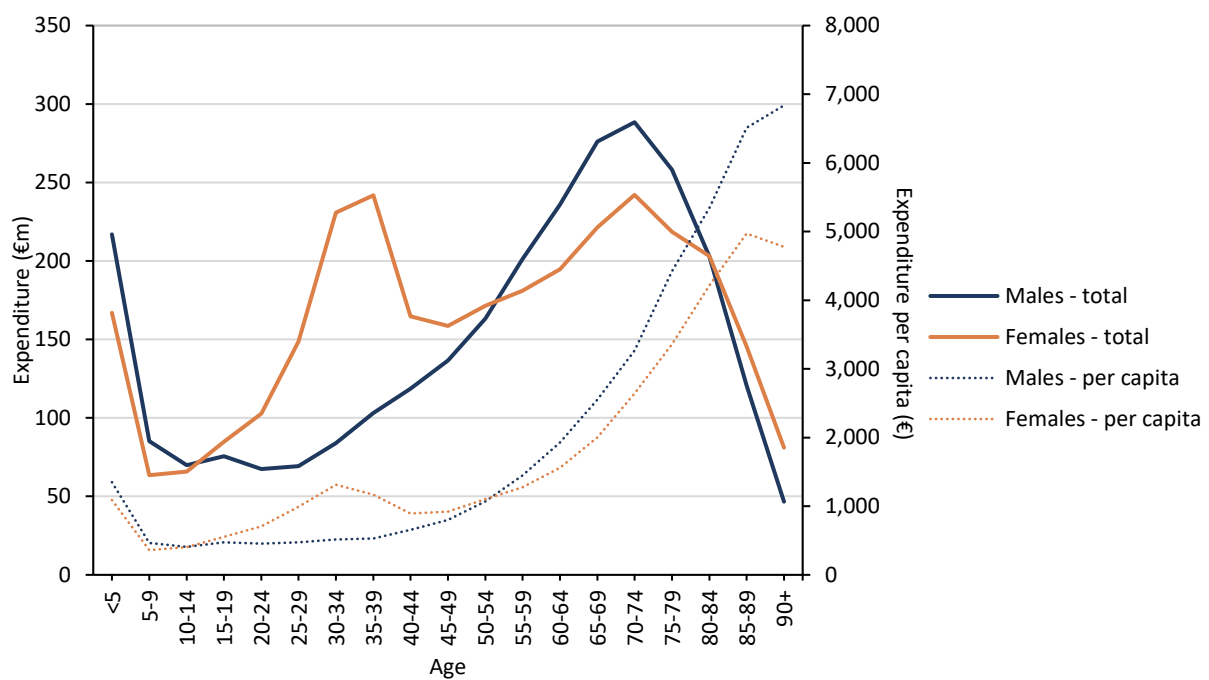
Figure 6.1 reports the distribution of public acute hospital gross expenditure and gross expenditure per capita by age and sex. This figure aggregates expenditure on ED, OPD, day-patient and in-patient activity, and distributes the residual component of gross expenditure identified above (€672.2m) in line with the overall age and sex distribution of service use.

In 2018, 52.3 per cent of expenditure related to females (€3,087.6m) and 47.7 per cent to males (€2,819.6m). Expenditures peak at two points for females: at ages 35–39 (€241.8m) and 70–74 (€242.1m). Expenditures peak at age 70–74 for males (€288.4m). While expenditure on males is greater than on females at the youngest and older ages (apart from the oldest age groups), the reverse is the case between the ages of 15–19 to 50–54, largely coinciding with maternity years for females.

Overall expenditure per capita is estimated at €1,169 for males and €1,253 for females.^{70,71} Expenditure per capita follows a similar pattern to overall expenditure volumes but peaks at older ages (90+ years for males and 85–89 years for females). Of note, sex-specific expenditure per capita profiles widen at older ages while at very old ages expenditure per capita plateaus for females approaching end-of-life while it continues to rise for males. This reflects a similar pattern in acute healthcare utilisation, observed in Wren et al. (2017), and may be associated with higher rates of residential long-term care use by females at end of life, which can act as a substitute to more costly public acute care (Jakobsson et al., 2006).

⁷⁰ Combined total expenditure per capita is estimated at €1,212.

⁷¹ Substantial expenditure and expenditure per capita for those <5 years mainly relates to expenditure on emergency in-patient discharges of <1 years old (males €2,819; females €2,353).

FIGURE 6.1 Public acute hospital gross expenditure – age and sex-specific profiles, 2018

Source: Authors' calculation.

6.3 FINDINGS – AGGREGATE GROSS EXPENDITURE PROJECTIONS

In the following section we present public acute hospital gross expenditure projections, applying the three main projection scenarios examined in Chapter 5 (low-pressure, central and high-pressure) as well as an additional 'progress' scenario. The assumptions underlying the progress scenario are outlined in Table 6.2 (a more detailed description is provided in Chapter 4). In addition to the standard demand and cost drivers employed and described in projections in Chapter 5, in the progress scenario we introduce additional assumptions in relation to improved waiting-list management and a reduction in the rate of avoidable hospitalisations through improvement in primary care delivery. It is important that these assumptions are modelled jointly as it would be unrealistic to assume that beds and other acute resources made available through shifting care to the community would not be then directed towards those waiting to access hospital care.

The waiting-list management assumption applies and refines methods developed in the UK (Findlay, 2017) to estimate the non-recurring activity (and associated expenditure) required to reduce waiting-list backlogs and the recurring activity (and associated expenditure) to maintain waiting times at target levels (Brick and Keegan (2020b), and Appendix D). The avoidable hospitalisation assumption seeks to model the potential effect of improved access and investment in primary care on hospital expenditure. This is achieved through reducing the rate of ED attendance and emergency in-patient (excl. maternity) hospitalisation for activity related to the three most frequent avoidable hospitalisations: vaccine-preventable

influenza and pneumonia, Chronic Obstructive Pulmonary Disorder (COPD), and urinary tract infections (including pyelonephritis) (see Appendix A). In this chapter we linearly reduce the rate of these avoidable hospitalisations (and associated ED attendances) each year, converging to a 33 per cent reduction in avoidable hospitalisations in 2035. A sensitivity analysis (reported in Chapter 8) examines the effect on projected expenditure of varying assumptions in relation to avoidable hospitalisation reduction and improved waiting-list management (as well as other drivers of demand and cost).

Expenditure projections in this section are presented in both real and nominal terms. Real projections hold costs constant at 2018 values, thus enabling analysis of projected volumes of care as if the cost of care had not changed. Nominal projections capture both demand and cost effects. Projections are run for each service area individually and then summed for each projection year. The residual component of total HSE acute gross expenditure is projected in line with the yearly growth rate of the combined service projections.

TABLE 6.2 Progress projection scenario – assumptions

	OPD	ED	Day patient and in-patient
Demand assumptions			
Population growth and ageing	Central	Central	Central
Healthy ageing ^a	Moderate healthy ageing.	Moderate healthy ageing.	Moderate healthy ageing.
Waiting list management	Additional non-recurring activity to reduce current backlog between 2021–2025. Additional recurring activity to sustain 12 week waiting times.	N.A.	Additional non-recurring activity to reduce current backlog between 2021–2025. Additional recurring activity to sustain 12 week waiting times.
Avoidable hospitalisations	N.A.	Linearly reduce ED attendances in line with in-patient avoidable hospitalisations each year.	Linearly reduce rate of avoidable hospitalisations each year, converging to 33% reduction by 2035.
Cost assumptions			
Pay	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)
Non-pay			
Drug cost ^b	N.A.	N.A.	5.2% increase p.a.
Other ^c	COSMO <i>Recovery</i> – indexed to projected inflation rates + 0.5 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rates + 1 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rates + 1 pct point p.a.

Notes: a We do not apply healthy ageing shifts to maternity care.

b Applied to day-patient and in-patient projections only.

c Based on personal consumption deflator.

Source: Authors' representation.

Table 6.3 presents real and nominal projected gross expenditure growth for public acute hospital care between 2018 and 2035, based on our four main scenarios outlined above. In real terms, total public hospital gross expenditure is projected to increase by 28.3 per cent under the central scenario between 2018 and 2035.

This falls to 21.6 per cent under our low-pressure scenario and increases to 32.6 per cent under our high-pressure scenario. In nominal terms, expenditure is expected to more than double by 2035 under our central scenario (104.0%). This falls to 82.2 per cent under our low-pressure scenario and increases to 143.2 per cent under our high-pressure scenario. Under the assumptions specified, our progress scenario suggests a projected expenditure increase of 24.9 per cent in real terms and 98.7 per cent in nominal terms. In both instances, these projected increases are below those recorded under our central scenario but higher than under our low-pressure scenario. Across all scenarios, by 2035 we project acute public gross expenditure requirements of between €7,183.2.5m and €7,834.1m in real terms and between €10,760.6m and €14,363.3m in nominal terms.

The variation in projected expenditure growth between the central and progress scenarios is driven by greater non-recurring activity taking place to clear the OPD, day-patient and in-patient backlogs (2021–2025), greater recurring activity to maintain target waiting times (2021–2035), and reduced ED and emergency in-patient activity in line with a reduction in the rate of avoidable hospitalisation (2021–2035). Over the entire projection horizon, the assumed reduction in the rate of avoidable hospitalisation (linearly converging to a 33% reduction by 2035) outweighs the additional activity required to manage waiting lists and therefore has the effect of reducing overall projected expenditure relative to the central scenario.

TABLE 6.3 Public acute hospital gross expenditure – sex-specific real and nominal growth rates by projection scenario, 2018–2035

	Expenditure (€m)	Projected HCE growth 2018–2035 (%)							
		Real				Nominal			
		Low	Central	High	Progress	Low	Central	High	Progress
Male	2,831.2	23.9	31.6	36.9	27.8	85.7	109.4	151.2	103.4
Female	3,075.9	19.5	25.3	22.3	22.3	78.9	99.0	135.8	94.4
Total	5,907.1	21.6	28.3	32.6	24.9	82.2	104.0	143.2	98.7

Notes: Real projections hold base costs constant at their 2018 values.

Source: Authors' calculations.

Table 6.4 presents nominal projected public acute hospital gross expenditure average annual growth rates by scenario and projection period. Over the entire projection period, nominal growth rates vary between 3.6 and 5.4 per cent. For comparison, growth in HSE acute hospitals' gross nominal expenditure between 2013 and 2018 was 4.5 per cent on an average annual basis.

Some noticeable variation in growth rates is also observable in the defined early projection period, 2018–2025. Included in the assessment of this variation is an additional scenario, modelled on our central projection scenario, that makes adjustments to 2020, 2021, and 2022 projections to factor in the effect on growth

rates of Covid-19-related expenditures in these years. Specifically, we assume a 10 per cent increase in expenditure in 2020, a 15 per cent increase in 2021 and static 2022 expenditure, before the model returns to projected growth paths. (More details and analysis underlying these assumptions are provided in Appendix C). As expected, the assumed effects are most noticeable to 2025 where the average annual growth under this scenario is projected at 6.0 per cent, higher than under the other scenarios. The effect of this shock recedes over the period 2018–2035 as the average annual growth rates, and projected expenditures, for the central-adjusted scenario fall within the bounds of our main projection scenarios.

Under the progress scenario, we also project higher annual growth rates in the period 2018–2025. This largely reflects the assumption that significant additional activity will take place in the period 2021–2025 to reduce waiting-list backlogs.⁷² Once these backlogs are addressed, in later years a smaller amount of activity and expenditure will be needed to sustain waiting times at target levels (see Appendix E). Expenditure requirements under the progress scenario are further reduced in later years due to the progressive reduction in the rate of avoidable hospitalisations.

Over the entire period, expenditure growth rates are lower than they otherwise might have been due to refined population growth assumptions linked to weaker economic conditions and lower subsequent medium-term net migration. Over the short term, however, we also model lower net migration due to uncertainty about the evolution of the pandemic, lower confidence and travel restrictions (see Table 3.2). In the period 2018–2025 this effect, along with lower assumed inflation, can be most clearly observed across our low, central and high projection scenarios.

TABLE 6.4 Public acute hospital gross expenditure – nominal average annual growth rates by projection scenario, 2013–2035

2013-2018	Nominal expenditure growth (average annual)				
	Low	Central	High	Progress	Central – adjusted
	4.5				
2018-2025	3.3	4.1	5.3	4.5	6.0
2026-2030	3.8	4.4	5.5	4.2	4.4
2031-2035	3.8	4.3	5.4	4.1	4.3
2018-2035	3.6	4.3	5.4	4.1	5.1

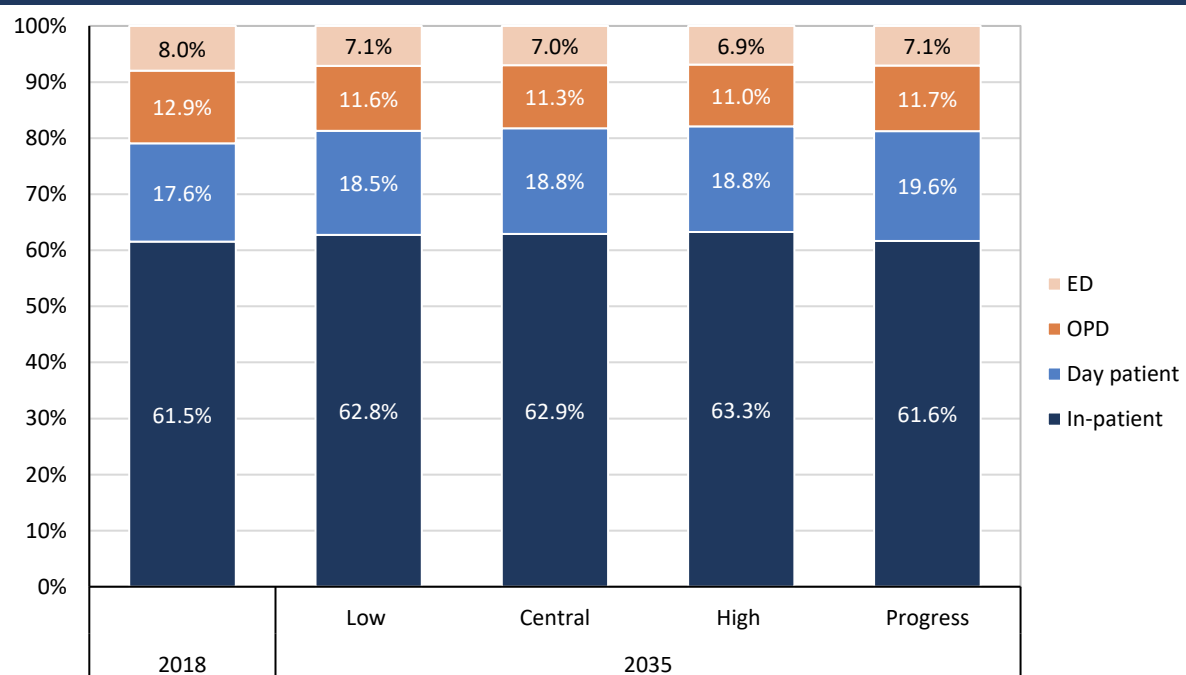
Source: 2013–2018 – HSE Management Data Reports, December
2018–2035 – authors' calculations.

⁷² Projected expenditure estimates to clear waiting-list backlogs and manage waiting times into the future, as with all projected expenditure estimates in this report, exclude any associated capital costs.

Figure 6.2 illustrates the proportional contribution of each service area to total public acute hospital gross expenditures.⁷³ In 2018, ED, OPD, day-patient and in-patient expenditure accounted for 8.0 per cent, 12.9 per cent, 17.6 per cent and 61.5 per cent of combined expenditures respectively. Under all projection scenarios, the proportionate contribution of day-patient and in-patient care to total combined expenditures increases by 2035, while the proportionate contribution of ED and OPD falls. This is consistent with the higher projected relative expenditure increases for day-patient and in-patient care observed in Chapter 5. As discussed in Chapter 5, these higher projected expenditures on day-patient and in-patient care are driven by high rates of activity in older ages and the separate modelling of drug cost trends for these services.

Under the progress scenario, however, the proportionate increase in in-patient expenditure by 2035 is marginal (61.5% to 61.6%). Again, this reflects the impact of assumed reductions in the rate of avoidable hospitalisation over the projection period in reducing in-patient projected expenditures relative to what they otherwise would have been.

FIGURE 6.2 Public acute hospital gross expenditure – service category and projection scenario, 2018 and 2035 (nominal)



Note: Excludes the residual component of expenditure.

Source: Authors' calculations.

⁷³ For ease of presentation, these totals exclude the small residual proportion of expenditures used to scale up to baseline and projected HSE public acute hospital gross expenditure.

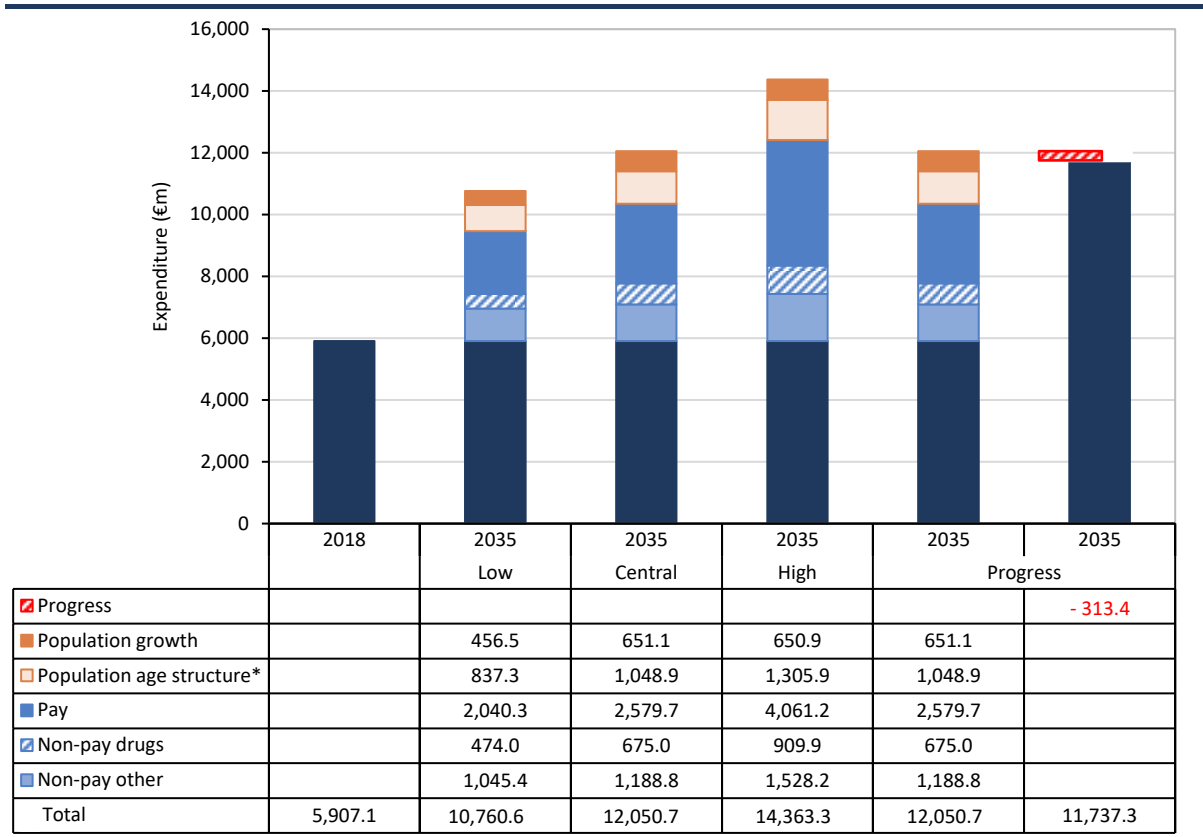
Figure 6.3 presents the relative contribution of demand and cost drivers by decomposing public acute hospital gross expenditure projections by scenario. Consistent with analyses of component services in Chapter 5, cost is expected to be a larger driver of projected expenditures than demand. Under the central scenario, for example, population growth (€651.1m) and changes to the population age structure (€1,048.9m) are estimated to account for €1,700.0m of projected additional expenditure by 2035. In contrast, pay (€2,579.7m), in-patient and day-patient non-pay drugs (€675.0m) and other non-pay costs (€1,188.8m) are estimated to account for a combined €4,443.5m. Pay costs are expected to account for 42.0 per cent of the projected additional public acute gross expenditure between 2018 and 2035.

Relative to the central scenario, combined demand pressures on expenditure amount to €1,293.7m under the low-pressure scenario, due to the combined effect of lower population growth and more optimistic healthy ageing. Combined demand pressures on expenditure are highest under the high-pressure scenario, accounting for €1,956.8m where no healthy ageing is assumed. However, as in the central scenario, pay is the dominant driver across the low- and high-pressure projection scenarios. This is particularly true of the high-pressure scenario whereby pay (€4,061.2m) accounts for 48.0 per cent of all additional projected expenditure by 2035.

Our progress scenario projects an acute expenditure saving effect in 2035 of €313.4m. This suggests that, by 2035, the increased acute expenditure associated with clearing OPD and elective waiting-list backlogs and sustaining waiting-time targets into the future can be offset through preventing certain hospitalisations for conditions more appropriately treated in the community. As shown in Appendix E, the bulk of expenditure required to manage waiting lists is required from 2021–2025 (€212m on average per year), with lower levels of recurring additional expenditure required from 2026 onwards.⁷⁴

⁷⁴ Waiting-list expenditure estimates exclude any associated capital costs.

FIGURE 6.3 Public acute hospital gross expenditure – growth decomposition by projection scenario, 2018–2035 (nominal)

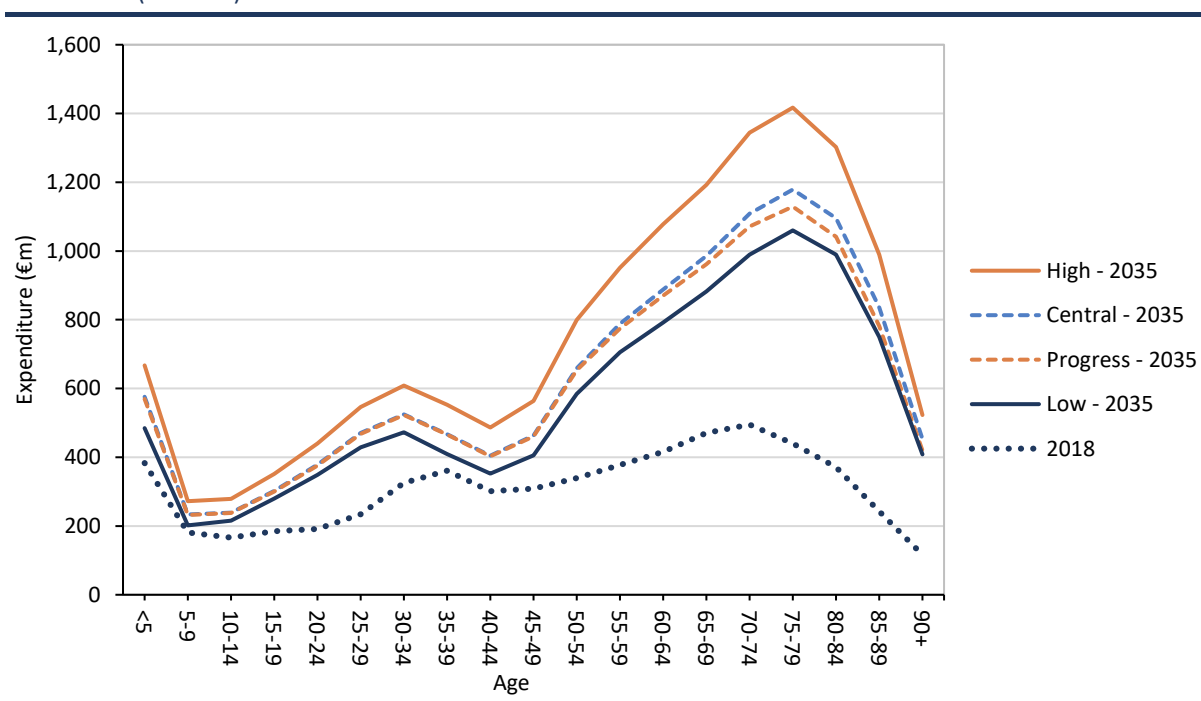


Notes: * Adjusted for healthy ageing in the low and high scenarios

Source: Authors' calculations.

Figure 6.4 illustrates the projected change in gross acute public hospital expenditure between 2018 and 2035 across the age distribution for all scenarios. Reflecting changes in the size and structure of the population, a large proportion of expenditure growth takes place at relatively older ages. This is related to the shape of the profiles of per capita age- and sex-specific expenditure presented in Figure 6.1. Expenditure per capita increases sharply with age, and when combined with a projected ageing population, this results in large increases in expenditure in older age cohorts. The impact of this population ageing effect, however, is reduced under the low-pressure and central projection scenarios that assume healthy ageing effects.

FIGURE 6.4 Public acute hospital gross expenditure – projections by age and projection scenario, 2018 and 2035 (nominal)



Source: Authors' calculations.

6.4 SUMMARY

Building on the age- and sex- specific expenditure profiles developed for public OPD, ED, day-patient and in-patient care in Chapter 5, this chapter developed an aggregate age- and sex- specific gross expenditure profile for public acute hospitals in Ireland for 2018, and projected that expenditure to 2035 under a range of projection scenarios.

6.4.1 Public acute hospital gross expenditure, 2018

The 2018 acute hospital expenditure profile developed in this chapter represents the most comprehensive age- and sex specific profile of acute hospital expenditures that has been developed for Ireland, capturing approximately 90 per

cent of recorded gross expenditure. This represents a substantial contribution to understanding the age-cost profile of Ireland's healthcare expenditure. As described in Chapter 1, Ireland has struggled noticeably in this regard relative to peer countries (Parliamentary Budget Office, 2019).

The findings highlight significant variation in acute expenditure profiles by age and sex in 2018. In volume terms, the distribution of female expenditure is trimodal in nature, with peaks in expenditure observed for the very young (< 1 years), those aged 35 to 39, and those aged 70 to 74. In contrast, male expenditures peak for the very young (<1 years) and for those aged 70 to 74. Scaled in per capita terms, this shows marginally higher expenditures for females on average (€1,253) relative to males (€1,169). While per capita spending for both males and females increases strongly with age, female per capita expenditure outstrips male expenditure at younger ages, and this trend reverses at older ages. At very old ages, this per capita differential is considerable. It may reflect higher rates of residential long-term care use by females at the end of life, which can act as a substitute to more costly public acute care (Jakobsson et al., 2006).

6.4.2 Public acute hospital gross expenditure projections, 2018 to 2035

In real terms, total public acute hospital gross expenditure is projected to increase by between 21.6 and 32.6 per cent across our scenarios, respectively, between 2018 and 2035. Including projected changes to the cost of delivering this care, this equates to a projected growth rate of between 82.2 and 143.2 per cent in nominal terms. These growth rates explicitly capture the assumed impact of Covid-19 on acute expenditures over the horizon as both underlying demographic and macroeconomic assumptions have been adjusted from 2020 onwards to capture the assumed short- and medium-term impacts of the pandemic (see Chapter 3).

Both day-patient and in-patient care are expected to increase their relative shares of total public acute hospital gross expenditure by 2035, while shares attributable to OPD and ED care are set to fall. This reflects findings from Chapter 5 that day-patient and in-patient care are likely to be subject to both greater demographic and cost pressures over the medium term.

As overall growth rates are a function of the length of the projection horizon, it is useful to also consider projected expenditure growth in terms of average annual rates. Findings from this chapter suggest that, over the entire projection period, average annual nominal growth rates vary between 3.6 and 5.4 per cent. This range appears consistent with recent historic expenditure growth in gross public acute hospital expenditure. Additionally, we project variation in average annual growth rates for different projection periods. As described in Chapter 1, public acute

hospital expenditure in 2020 and 2021 is likely to be very large. This raises projected public acute hospital expenditure above trend in the short term but does not materially affect our projected expenditure range over the medium term.

Additionally, under the progress scenario, we calculate the expenditure, excluding any associated capital costs, required to clear existing OPD and elective backlogs, beginning in 2021, to amount to €212m on average per year in nominal terms over five years (Brick and Keegan (2020b) Appendix E). While this expenditure would be relatively substantial over this period, the additional expenditure required to sustain waiting-time targets at 12 weeks from 2026 onwards is less, even following adjustment for future demographic and cost pressures. For instance, we estimate this total expenditure at €70.5m per year on average between 2031 and 2035.

While improved waiting-list management increases acute expenditure requirements under the progress scenario, these increases could be offset over time through appropriate management of care in the community. Specifically, we modelled the effect of a reduction in the rate of emergency in-patient hospitalisation and associated ED attendance for (vaccine-preventable) influenza and pneumonia, urinary tract infections (including pyelonephritis) and COPD by 2035.

While this analysis did not consider the expenditure implications of additional staffing and other resources required to facilitate greater levels of care in the community, the three conditions examined in this chapter represent the most resource-intensive of all avoidable hospitalisations identified in 2018 (see Appendix A) and, importantly, there is an evidence base for cost-effective treatment or prevention of these conditions at primary care level (McDarby and Smyth, 2019; OECD, 2019a).

CHAPTER 7

Findings: Public acute psychiatric in-patient services expenditure

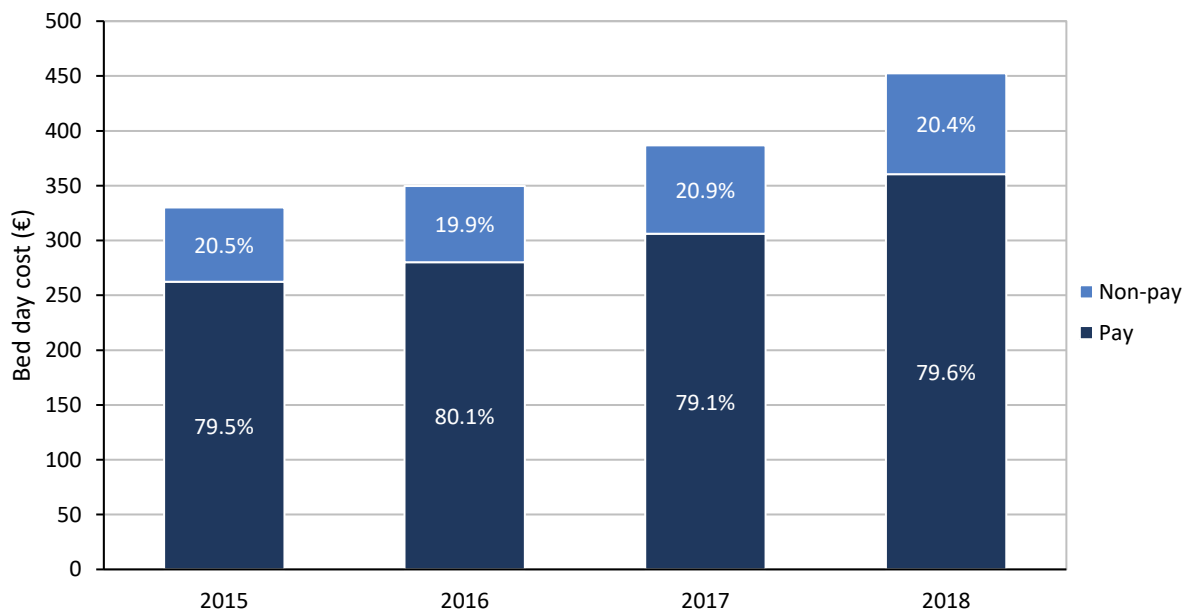
7.1 INTRODUCTION

This chapter presents findings on expenditure on public acute psychiatric in-patient services for adults in 2018.⁷⁵ The estimated cost for a public psychiatric in-patient adult bed day is presented, as well as baseline age- and sex-specific expenditure profiles. In addition to these profiles, the chapter presents three (low-pressure, central and high-pressure) projection scenarios. The scenarios incorporate assumptions that place varying pressures on acute adult in-patient psychiatric services to 2035. The results for this service are presented separately to those in Chapters 5 and 6 as the expenditure relates to specialist mental health services and not acute hospital services.

7.2 FINDINGS – BED DAY COST

Figure 7.1 presents the estimated unit cost for a public acute adult psychiatric in-patient bed day between 2015–2018. Using the top-down method described in Chapter 4, we estimate the unit cost of an in-patient bed day in 2018 to be €453, with an average annual compound growth rate of 11 per cent between 2015 and 2018. The HSE reports that pay contributes 80 per cent to total gross expenditure in these units per annum.

FIGURE 7.1 Psychiatric in-patient – cost per bed day by category, 2015–2018



Notes: Author calculations based on HSE CSO System of Health Accounts returns.

Source: HSE, 2015–2018 and HRB National Psychiatric In-Patient Reporting Scheme (NPIRS), 2015–2018.

⁷⁵ See Appendix B for detail on the units included.

7.3 FINDINGS – BASELINE EXPENDITURE

Expenditure on public acute psychiatric in-patient services for adults amounted to €179.3m in 2018. Figure 7.2 shows the estimated age- and sex-specific expenditure profile for 2018. We estimate that 54 per cent of expenditure related to male bed days (€96.7m) and 46 per cent to female bed days (€82.6m). Given the distribution of bed days, the distribution of expenditure is quite different for males compared with females. Expenditure for males peaks at 35–39 years (€11.0m) while for females it does not peak until 50–54 years (€8.1m).⁷⁶ Male expenditure is higher than female in younger age groups, while from 50 years onwards, except for 75–84 years, female expenditure is higher. Per capita expenditure is highest for males aged 30–34 years (€64.8) and highest for females aged 70–74 years (€64.6).

FIGURE 7.2 Psychiatric in-patient – age- and sex-specific expenditure and expenditure per capita, 2018



Notes: Author calculations based on HSE CSO System of Health Accounts returns.
Per capita expenditure is calculated using ESRI population estimates for 2018, 18 years and older.
There was a small number of episodes/bed days in adult units relating to children aged less than 18 years.

Source: HSE, 2018 and HRB NPIRS, 2018.

⁷⁶ This is due to differing diagnoses between males and females in these age groups. There is a high number of males with a diagnosis of 'F20-F29 Schizophrenia, schizotypal and delusional disorders', which is associated with a relatively high mean bed days per episode (Brick et al., 2020a; Daly and Craig, 2019).

7.4 FINDINGS – EXPENDITURE PROJECTIONS

In the following section we present findings from the three expenditure projection scenarios as applied to psychiatric in-patient care. Table 7.1 summarises the demand and cost assumptions.⁷⁷ Of note in terms of the assumptions applied here are the use of the high population projection in the high-pressure scenario; no healthy ageing is assumed; and, due to limitations in the expenditure data, no assumptions on changes in drug costs are possible. As in Chapters 5 and 6, expenditure projections are presented in both real and nominal terms.

TABLE 7.1 Projection scenario assumptions

	Low pressure	Central	High pressure
Demand assumptions			
Population growth and ageing	Low	Central	High
Healthy ageing ^a	None	None	None
Cost assumptions			
Pay	COSMO <i>Delayed Recovery</i> – projected government-sector wage growth (2.2% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth (2.5% p.a.)	COSMO <i>Recovery</i> – projected government-sector wage growth + 1 pct point p.a. (3.5% p.a.)
Non-pay			
Drug cost	None	None	None
Other ^b	COSMO <i>Delayed Recovery</i> – indexed to projected inflation rates + 0.5 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rates + 1 pct point p.a.	COSMO <i>Recovery</i> – indexed to projected inflation rates + 1 pct point p.a.

Notes: a We assume no healthy ageing effects for in-patient psychiatric care.
b Based on personal consumption deflator.

Table 7.2 presents real and nominal projected expenditure growth for public acute psychiatric in-patient care from 2018 to 2035, based on our three projection scenarios (Table 7.1). In real terms, expenditure is projected to increase by 16.4 per cent, 18.8 per cent and 24.5 per cent across our low, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to overall projected real expenditures in 2035 of between €208.8m and €223.3m.

In nominal terms, expenditure is projected to increase by 68.8 per cent, 81.3 per cent and 120.4 per cent across our low, central and high-pressure scenarios, respectively, between 2018 and 2035. This equates to projected expenditure requirements in 2035 of between €302.7m and €395.2m. This again highlights the strong influence of cost on projected expenditures.

⁷⁷ A detailed description of the assumptions underlying the scenarios is provided in Chapter 3.

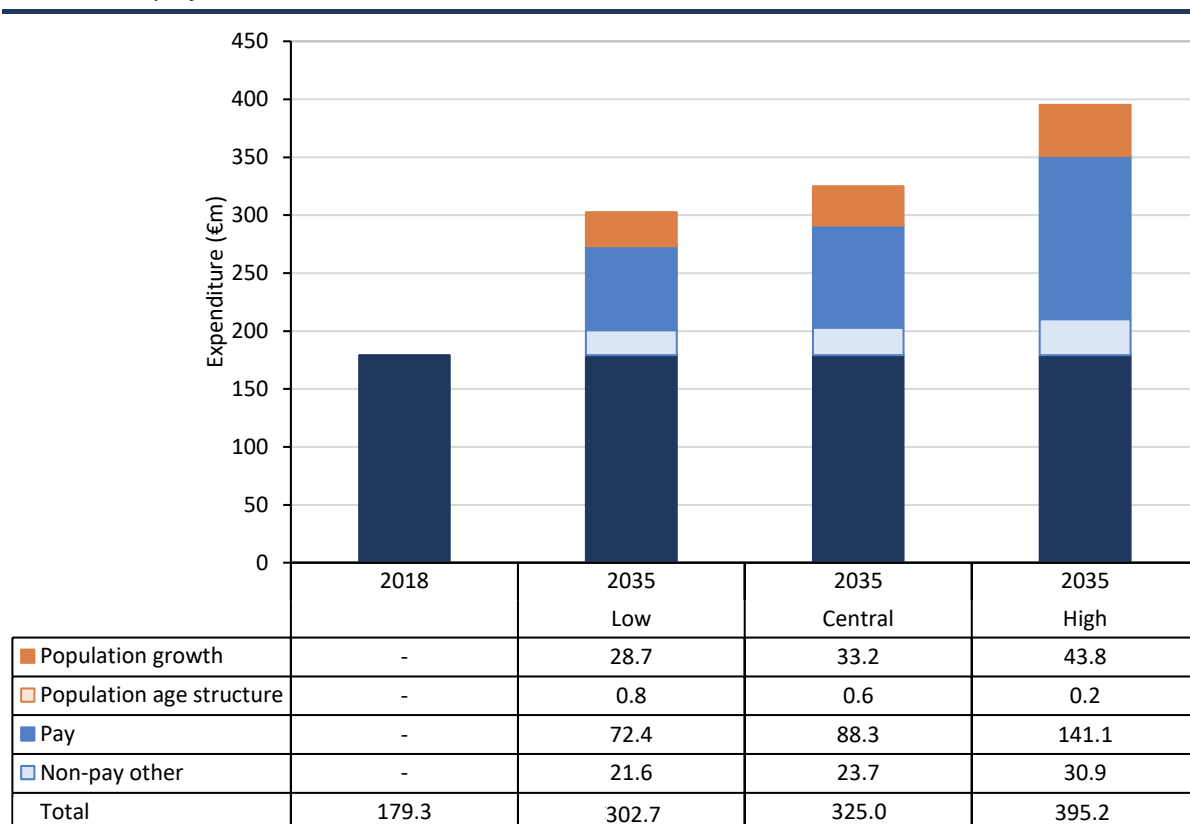
TABLE 7.2 Psychiatric in-patient – projected real and nominal expenditure growth by projection scenario, 2018–2035

	2018		Projected HCE growth 2018-2035 (%)					
	Bed days	Expenditure (€m)	Real ^a			Nominal		
			Low	Central	High	Low	Central	High
Male	213,760	96.7	14.5	17.1	23.4	66.0	78.7	118.4
Female	182,434	82.6	18.7	20.8	25.9	72.1	84.3	122.8
Total	396,194	179.3	16.4	18.8	24.5	68.8	81.3	120.4

Notes: a Real projections hold base costs constant at their 2018 values.
b We assume no healthy ageing effects for psychiatric in-patient care.

Source: Authors' calculations.

Figure 7.3 examines the relative contribution of demand and cost drivers, through decomposing nominal expenditures projections by scenario. Under the central projection scenario, population growth (€33.2m) and changes to the population age structure (€0.6m) account for a combined additional €33.8m of expenditure by 2035. Cost drivers, pay at €88.3m and non-pay at €23.7m account for a combined €112.0m of additional expenditure by 2035. These place the largest pressure on projected expenditure and reflect the fact that most (79.6% in 2018) of the average cost of a psychiatric in-patient bed day is pay-related (Figure 7.1).

FIGURE 7.3 Psychiatric in-patient – decomposition of projected nominal expenditure growth, 2018-2035, by projection scenario

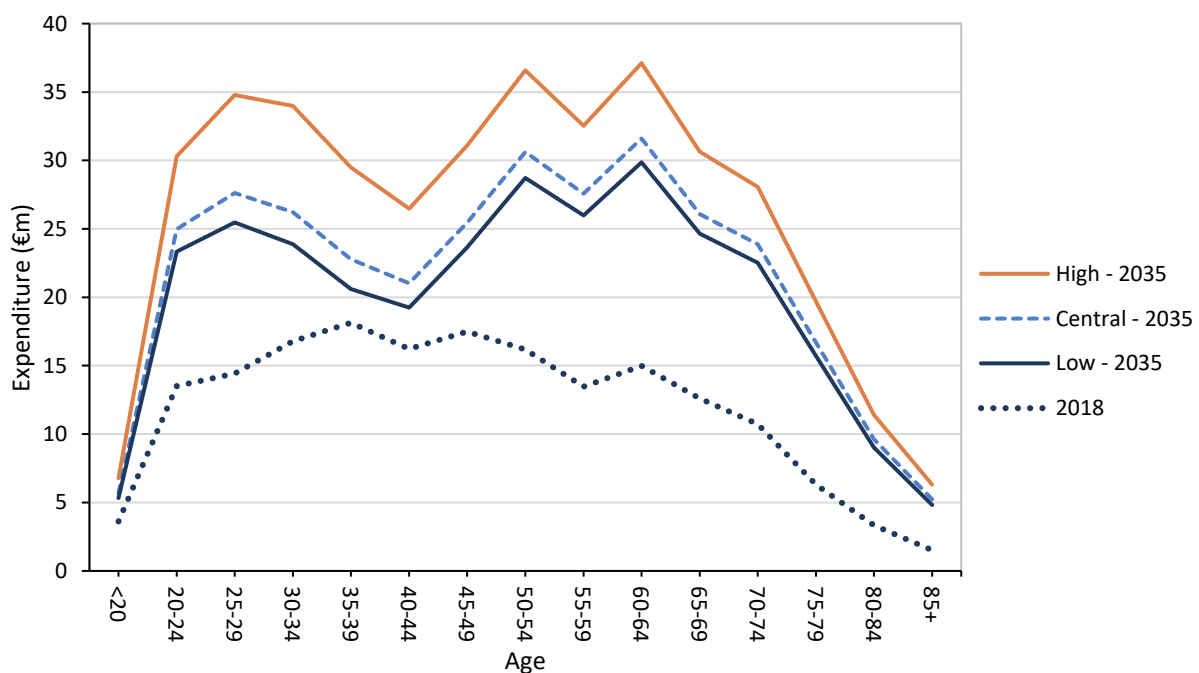
Notes: We assume no healthy ageing effects for psychiatric in-patient care.

Source: Authors' calculations.

Pay is the largest driver of expenditure growth across all scenarios. The pay component of nominal expenditure growth over the period ranges from €72.4m (58.6%) in the low-pressure scenario to €141.1m (65.3%) in the high-pressure scenario.

Figure 7.4 illustrates the projected change in expenditure between 2018 and 2035 across the age distribution for all scenarios. Across all scenarios, large proportions of growth in nominal expenditure take place at younger (20–29 years) and older ages (50 years and older). Lower proportionate expenditure growth is projected for the 30–49 age groups, which reflects decreasing projected demand for bed days in the underlying age-related activity profiles (Appendix, Figure B.3). This in turn reflects a projected fall in the population aged 30-49 between 2018 and 2035 as the end of the baby-boom generation is not replaced (see Figure 3.8).

FIGURE 7.4 Psychiatric in-patient – projected nominal expenditure by age and projection scenario, 2018 and 2035



Notes: We assume no healthy ageing effects for psychiatric in-patient care.

Source: Authors' calculations.

7.5 SUMMARY

This chapter has provided baseline estimates and expenditure projections for care in public (HSE and HSE-funded) acute adult psychiatric in-patient units. To our knowledge, this is the first time an age- and sex-specific expenditure profile has been estimated for public acute adult psychiatric in-patient care in Ireland. The baseline expenditure profiled here accounts for the 29 public acute adult psychiatric in-patient units in Ireland, which together account for 80 per cent of

total public in-patient psychiatric gross expenditure⁷⁸ and 89 per cent of in-patient bed days in 2018.⁷⁹

To estimate an expenditure profile, we have calculated a unit cost per in-patient bed day in 2018 using aggregated expenditure data from the HSE and HRB NPIRS. This unit cost was then applied to the age- and sex-specific distribution of 2018 bed days. As with the services reported on in Chapter 5, pay was the major component of the unit cost of a psychiatric in-patient bed day (79.6%). The expenditure profiles show that expenditure increases with age to 39 years for males and 49 years for females, and decreases with age thereafter.

For acute adult psychiatric in-patient services, growth in nominal expenditure of between 68.8 and 120.4 per cent, or between €100m and €200m, is projected by 2035. As in the analysis in Chapter 5, it is the impact of projected cost, particularly pay, that is the dominant driver of nominal expenditure growth over the projection horizon.

⁷⁸ As reported by the HSE to the CSO as part of the System of Health Accounts submission.

⁷⁹ Public children's units and the forensic hospitals account for the remaining expenditure and bed days. It is hoped to extend the analysis to cover these units in future iterations of Hippocrates.

CHAPTER 8

Summary and conclusion

8.1 INTRODUCTION

This is the second report to be published applying the Hippocrates projection model of Irish healthcare demand and expenditure developed at the ESRI in a programme of research funded by the Department of Health. Previous analyses have applied the Hippocrates Model to estimate baseline utilisation of healthcare services in Ireland and to provide projections of demand and capacity. This analysis extends the Hippocrates Model to provide baseline estimates of expenditure for public acute hospitals and psychiatric in-patient services in Ireland in 2018 and to project expenditures for these services to 2035. This required a detailed analysis of service-level unit costs of care and development of assumptions on how components of these costs may evolve through the projection horizon. The analysis provides age- and sex-specific aggregate expenditure profiles, which up to now have not been available for Ireland. This chapter summarises these analyses, providing an overview of gross expenditure on Irish public acute hospitals and psychiatric in-patient services, and analyses projected expenditure and the underlying drivers.

The model is bottom-up in nature, with expenditure projections developed from a demand and cost base in 2018. To inform this, a detailed review of the demographic and non-demographic drivers of healthcare expenditures and associated modelling frameworks was undertaken in Chapter 2. We modelled demand projections primarily based on projected demographic change and assumptions on the relationship between life year gains and healthcare use. Projected demand for respective services was then costed through modelling assumed trends in pay, drug and other non-pay costs. Additional modelling assumptions were incorporated to examine the acute expenditure implications of improved waiting-list management and of improved access to and investment in primary care.

The outbreak of Covid-19 in 2020 resulted in short-term shocks to acute hospital utilisation and expenditure. While hospital beds were occupied to treat Covid-19 cases, there was a corresponding initial sharp drop in non-Covid attendances at public hospital emergency departments (EDs) (Brick et al., 2020b), and cancellation of all but the most urgent elective services. In response to the ongoing threat of Covid-19 and acknowledged hospital capacity deficits, the HSE announced an ambitious 'Winter Plan' plan in September 2020. This was followed by an announced record health budget of €22.1 billion for 2021 (October 2020), including €1.8 billion in direct Covid-related supports. Funding priorities relate to changing

the model of care delivery in line with Sláintecare objectives, addressing known capacity deficits, and tackling waiting lists. We adjusted our analysis where relevant to consider this expenditure shock on projections of gross public acute hospital expenditure.

The Covid-19 pandemic may also have longer-lasting impacts on the demand for, and the cost of delivering, acute services – relevant for modelling trends in expenditures over the medium term. To account for these effects, we adjusted our projections in several ways. The demographic projection scenarios were updated and revised in light of the potential impact of Covid-19. This incorporated adjustments to 2020 mortality rates and downward revisions to projected trends in international migration. Additionally, the pay and non-pay price trends that informed the projected trajectory of healthcare costs were drawn from two alternative Covid-19 economic recovery scenarios, generated through the ESRI macro-econometric model, COSMO. In costing improved waiting-list management, we also accounted for the spike in waiting-list numbers attributable to cancellation of elective treatments due to Covid-19.⁸⁰

In recognition of the uncertainty surrounding the key assumptions relating to drivers of demand and cost, alternative expenditure projection scenarios were also developed in this report. (These expenditure projection scenarios are discussed in detail in Chapter 4, and the underlying macroeconomic and demographic scenarios are discussed in Chapter 3.) The alternative expenditure projection scenarios vary assumptions related to population change, healthy ageing, and pay and non-pay cost drivers. Assumptions were grouped to provide projections of expenditure under low-pressure, central and high-pressure expenditure scenarios. For instance, under our low-pressure scenario we combined assumptions on low population growth, optimistic healthy ageing, and relatively low projected pay and non-pay cost pressures. We also defined a ‘progress’ scenario where we examined the effect on total public acute hospital expenditure of improved waiting-list management and reorientation of appropriate care to the community through a reduction in avoidable hospitalisations. These reflect important dimensions of the Sláintecare reforms (Houses of the Oireachtas Committee on the Future of Healthcare, 2017). Waiting-list management assumptions consider how much increased activity and associated expenditure would be required to clear existing OPD and elective waiting-list backlogs and sustain shorter waiting times into the future. Simultaneously, we asked how much public acute hospital expenditure growth could be mitigated if there were a reduction in the rates of the three most

⁸⁰ The analysis does not account for any potential longer-term Covid-related effects on acute healthcare expenditure (e.g. ‘long’ Covid, the health effects of postponed or cancelled screening or treatment, the effects on mental health). It may be possible to factor these longer-term effects into subsequent analyses as the evidence emerges.

common and resource-intensive avoidable hospitalisations in Ireland through a shift in care to the community.⁸¹

Also, in this chapter, additional analyses are presented which demonstrate the sensitivity of our projections to changes in key assumptions. As part of the sensitivity analysis, we also examine the effects on projected expenditures of assumed improvements in productivity. The current Irish evidence-base in relation to trends in acute hospital productivity was considered too weak to model assumptions as part of our main scenario analysis. However, as described in Chapter 2, productivity improvements can play an important role in offsetting increases in the cost of delivering care. Therefore, as part of our sensitivity analysis we subjected projections to varying rates of annual productivity improvement to examine the effect on public acute hospital expenditure growth. Additionally, we considered the impact of more pessimistic pay growth assumptions. Particularly considering the recent increased expenditure burdens on the Irish State in response to Covid-19, we modelled the effect of a public pay freeze in 2021 and 2022 in addition to lower assumed wage growth over the remainder of the projection horizon.

In considering the findings in this and previous chapters, it is important to note that we model projections, not forecasts, of acute expenditures. Over the short term, expenditures may vary from year to year due to unanticipated shocks, of which the Covid-19 pandemic is a salient example. In addition, spending decisions are ultimately political in nature and based on government priorities. Budgetary constraints often create trade-offs in terms of pay, volumes of services delivered and level of unmet demand. However, informed by the anticipated evolution of key drivers of expenditures, the modelling approaches adopted are considered to provide a reasonably reliable guide to the future over the medium term (Charlesworth and Johnson, 2018).

Section 8.2 summarises and discusses this report's main findings on baseline and projected expenditure from Chapters 5 to 7. Section 8.3 discusses the sensitivity of our projection scenarios to alternative assumptions on the drivers of demand and cost. Section 8.4 discusses the limitations of the analysis. Section 8.5 examines the implications of our demand projections for policy, reflects, and concludes.

⁸¹ Vaccine-preventable influenza and pneumonia, urinary tract infections (including pyelonephritis), and COPD. See Appendix A for more details on the activity and expenditure on these conditions in 2018.

8.2 SUMMARY AND DISCUSSION OF FINDINGS ON BASELINE AND PROJECTED ACUTE EXPENDITURE BY SERVICE

8.2.1 Baseline expenditure, 2018

Table 8.1 summarises the report’s findings for baseline and projected expenditure for the major services examined in Chapters 5 to 7. Expenditure relates to services provided in public acute hospitals and public psychiatric in-patient hospitals/units. In 2018, we estimate expenditure on in-patient discharges in acute hospitals to be €3,220m and expenditure on day-patient discharges to be €919m. While the volume of complexity-weighted day-patient activity was higher (1,038,825 discharges) compared with in-patient activity (646,077), the unit cost of an in-patient stay (€4,985) far exceeded that of a day patient stay (€885). The majority of in-patient expenditure related to emergency in-patient discharges (€2,143m). OPD expenditure amounted to €676.4m based on 4.0m attendances, while ED expenditures were €418.6m, based on 1.4m attendances. We estimate the cost of adult psychiatric in-patient care in public hospitals at €179m.

This analysis also splits day and in-patient expenditure by the public/private status of discharges.⁸² To do this, we applied the overall average cost of hospital care for day patients and in-patients respectively to public and private activity profiles.⁸³ Based on our estimates, expenditure on public and private discharges amounted to €3,403m and €737m, respectively.⁸⁴ Expenditure on private discharges represents approximately 18 per cent of expenditure in acute public hospitals. Of this, in-patient expenditure on private discharges accounted for €578m, including €344.0m on emergency in-patients and €188.0m on elective care, with the remainder on maternity and AMAU/ASAU-only care.

8.2.2 Projected expenditure, 2018–2035

Expenditure projections in real terms, 2018 to 2035

Expenditure is projected to increase across all services shown in Table 8.1. The real-terms increase in expenditure is driven by Ireland’s changing demographic profile. As discussed in previous analyses (Keegan et al., 2018a; Wren et al., 2017), driven by net migration, Ireland has historically experienced high rates of population growth relative to other European countries. Despite having a comparatively young age profile, the absolute numbers in older age cohorts have grown. These broad

⁸² Public/private status refers to whether the patient saw the consultant on a private or public basis. It does not relate to the type of bed occupied nor is it an indicator of private health insurance (Healthcare Pricing Office, 2019a).

⁸³ As acknowledged in Chapter 5, while the hospital resources used to treat both public and private patients are largely similar, ideally separate public and private base costs could be applied. However, these are not calculated by the HPO and it was not possible to estimate them for this analysis.

⁸⁴ As context, public hospital private income in 2018 is estimated at €524m (Independent Review Group, 2019). However, part of this differential may reflect the application of an average base cost while not all the cost of private care may be covered by income.

trends are set to continue, meaning that the impact of demographics on future demand for healthcare services is likely to be important.

As described in detail in Chapter 3, Covid-19 is likely to have had both short- and medium-term impacts on Ireland's projected demographic profile and, by extension, projected demand for and expenditure on healthcare. Using the ESRI's demographic model, our demographic projections have therefore been adjusted to this new reality (see Chapter 3). Considering findings from our favoured low and central population projection scenarios, between 2018 and 2035, the total population in Ireland is now projected to increase by between 8 and 11 per cent. From 2018 to 2035, the population share aged 65 years and over is projected to increase from 14 per cent to between 20 and 21 per cent. At the same time, the proportion of the population accounted for by children (0–14 years old) will become smaller over time as there will be relatively fewer women in the key child-bearing age groups. In 2018, 21 per cent of the population were under the age of 15 years, while the comparable proportion in 2035 is projected to be between 15 and 16 per cent. Driven by assumptions on future net inward migration, the population aged 15–64 years is expected to increase by between 6 and 8 per cent by 2035.

The largest increases in real expenditures are observed for day-patient and in-patient discharges. As shown in Chapter 5, these are the services where expenditures per capita increase most dramatically with age, and therefore are most affected by projected population ageing. For these services it was also possible to complexity-weight expenditure profiles, which helped to further refine the relationship between ageing and resource use. Between 2018 and 2035, across our four projection scenarios (low-pressure, central, high-pressure and progress) real expenditure, which removes the effects of cost increases, is projected to increase by between 21 and 31 per cent for day patients and 25 and 38 per cent for in-patients. This implies projected real 2035 expenditure requirements of €1,109.8m to €1,201.5m for day patients and €4,029.4m to €4,445.6m for in-patients.

In contrast, ED and OPD display relatively more uniform age-related per capita expenditure distributions, meaning that changes to the population age structure have a less pronounced effect on projected expenditures. Between 2018 and 2035 real expenditure on ED and OPD care are both projected to increase by between 12 and 18 per cent. This equates to projected real expenditure requirements in 2035 of between €467.5m and €496.0m for ED attendances and €758.5m and €798.6m for OPD attendances. Combining all service profiles in Chapter 6, we project real HSE gross expenditure on public acute hospitals to increase by between 22 and 33 per cent by 2035, reflecting 2035 gross real expenditure requirements of between €7,183.2m and €7,834.1m.

Psychiatric in-patient care (separately part of the HSE mental health budget) in adult HSE/HSE-funded acute hospitals/units is projected to increase by between 16 and 25 per cent in real terms by 2035, equating to projected expenditure requirements of €208.8m to €223.3m in 2035.

Expenditure projections in nominal terms, 2018 to 2035

While demographic pressures drive expenditure through the projected volumes of services to be delivered, our analysis suggests that it is the projected cost of delivering these services that will be the more dominant driver of nominal expenditure to 2035.

In projecting nominal acute expenditures, Hippocrates models pay and non-pay components of costs separately. Pay and non-pay (non-drug) costs in this analysis are modelled through the ESRI's macro-econometric model COSMO. These costs are modelled based on two COSMO scenarios for economic recovery following the Covid-19 pandemic: a *Recovery* scenario and a *Delayed Recovery* scenario. Pay is modelled based on assumptions related to projected trends in government-sector average earnings growth (and tied to wage growth in the wider economy) over the projection horizon. Between 2018 and 2035 these earnings are assumed to grow at an average annual rate of between 2.2 and 3.5 per cent in nominal terms. Non-pay (non-drug) costs growth reflects trends in projected inflation (based on a personal consumption deflator) but, across scenarios, between 0.5 and 1 percentage point(s) higher growth per annum is modelled. Hospital drug cost growth for day-patient and in-patient care is projected to increase between 4.2 and 6.2 per cent per annum, based on historic trends.

Decomposition analysis of expenditure drivers conducted in Chapters 5 to 7 highlighted pay as the single largest driver of nominal expenditure increases for ED, OPD, and in-patient and adult psychiatric care. This is reflective of the labour-intensive nature of healthcare delivery; pay is the dominant contributor to the cost of care delivery for all services. In addition, the unit cost of day-patient care had a high drug cost component (24 per cent in 2018). These drugs are often innovative and expensive, reflecting the nature of service delivery in day-patient settings (e.g. chemotherapy and radiotherapy). Hospital expenditure on drugs has increased substantially in recent years, above other non-pay costs (Department of Public Expenditure and Reform, 2018) and can be expected to do so into the future, particularly with a large number of new oncology drugs likely to come on stream (Connors, 2017).

Reflecting these cost considerations, and the varying impact of demographics across services already discussed, under the three scenarios examined nominal ED expenditure and OPD expenditure are projected to increase by between 62 and 109 per cent, and 63 and 108 per cent, respectively, by 2035. In contrast, day-patient and in-patient expenditure are projected to increase by between 92 and 161 per cent, and 86 and 150 per cent, respectively, by 2035. Combining these profiles in Chapter 6, we project nominal HSE gross expenditure on public acute hospitals to increase by between 82 and 143 per cent by 2035, reflecting 2035 gross nominal expenditure requirements of between €10,760.6m and €14,363.3m.

Psychiatric in-patient care (separately part of the HSE mental health budget) in adult HSE/HSE-funded acute hospitals/units is projected to increase by between 69 and 120 per cent in nominal terms by 2035, equating to 2035 projected expenditure requirements of €302.7m to €395.2m.

TABLE 8.1 Public acute hospital and acute psychiatric hospital expenditure – 2018 baseline and 2035 low- and high-pressure projections by service

	Public/ private status	Baseline activity ^a	Baseline expenditure (€m)	Projected expenditure 2035 (€m)		Percentage change 2018–2035 (%)	
		2018	2018	Real ^b	Nominal	Real ^a	Nominal
Attendances							
ED	Total	1,405,828	418.6	467.5–496.0	679.0–876.0	11.7–18.5	62.2–109.2
OPD	Total	3,965,303	676.4	758.5–798.6	1,105.2–1,404.3	12.1–18.1	63.4–107.6
Discharges							
Day patient ^c	Public	859,387	760.6	919.2–997.6	1,462.5–1,990.1	20.8–31.1	92.3–161.6
	Private	179,438	158.8	185.9–203.9	295.7–406.8	17.0–28.4	86.2–156.1
	Total	1,038,825	919.5	1,109.8–1,201.5	1,765.8–2,396.9	20.7–30.7	92.0–160.7
In-patient ^c	Public	530,083	2,642.3	3,302.1–3,651.1	4,905.0–6,611.3	25.0–38.2	85.6–150.2
	Private	115,995	578.2	712.8–794.5	1,058.9–1,438.7	23.3–37.4	83.1–148.8
	Total	646,077	3,220.5	4,029.4–4,445.6	5,985.3–8,050.0	25.1–38.0	85.9–150.0
Elective ^d	Public	120,957	602.9	734.6–807.9	1,091.3–1,462.9	21.8–34.0	81.0–142.6
	Private	37,712	188.0	225.3–253.4	334.7–458.8	19.9–34.8	78.1–144.1
	Total	158,669	790.9	967.7–1,061.3	1,437.4–1,921.7	22.4–34.2	81.7–143.0
Emergency ^e	Public	361,005	1,799.5	2,310.7–2,593.7	3,432.4–4,696.5	28.4–44.1	90.7–161.0
	Private	69,014	344.0	436.4–499.7	648.2–904.9	26.8–45.3	88.4–163.0
	Total	430,019	2,143.5	2,764.7–3,093.4	4,106.8–5,601.4	29.0–44.3	91.6–161.3
Acute gross expenditure^b	Total	–	5,907.1	7,183.2–7,834.1	10,760.6–14,363.3	21.6–32.6	82.2–143.2
Acute psychiatric in-patient	Total	396,194	179.3	208.8–223.3	302.7–395.2	16.4–24.5	68.8–120.4

Notes: a For day and in-patient discharges, activity is complexity-weighted; for psychiatric in-patient activity is measured in bed days.

b Real projections hold base costs constant at their 2018 values.

c These estimates are inclusive of maternity activity in public hospitals.

d These estimates exclude maternity activity in public hospitals.

e These estimates exclude maternity and AMAU/ASAU-only activity in public hospitals.

Source: Chapters 5 to 7.

Gross acute hospital expenditure, decomposition of expenditure drivers, 2018–2035

As described above, our analysis suggests that it is the projected cost of delivering future care, rather than the demographic impacts on demand, that will be the main driver of acute hospital expenditure increases to 2035. This is in line with previous Irish findings in relation to healthcare expenditure (Irish Fiscal Advisory Council, 2018; Parliamentary Budget Office, 2019).

As seen in Chapter 6 (Figure 6.3), across the scenarios examined, combined demographic effects are projected to add between €1,293.7m and €1,956.8m to total acute care expenditure growth by 2035. Within this, population ageing has a greater impact than population growth. This is despite modelling optimistic relationships between life-expectancy gain and hospital expenditure (i.e. healthy ageing) in our low-pressure and central scenarios, in line with international evidence. The main driver of projected expenditure increases, however, are pay costs. This reflects the labour-intensive nature of healthcare delivery; pay is the dominant contributor to the cost of care delivery for all services (see Chapter 5). Across scenarios, pay alone is projected to account for between €2,040.3m and €4,061.2m in additional expenditure requirements by 2035. The additional cost of drugs for day and in-patient care delivery account for between €474.0m and €909.9m. The remaining expenditure growth across the low-pressure, central and high-pressure scenarios reflects the impact of increases in other non-pay costs tied to the delivery of acute care (e.g. medical equipment and supplies, overheads, etc).

Our progress scenario projects a net acute expenditure saving effect by 2035 of €313.4m. This suggests that, by 2035, the increased acute expenditure associated with clearing OPD and elective waiting-list backlogs and sustaining waiting-time targets into the future can be more than offset through preventing certain hospitalisations for conditions more appropriately treated in the community. As shown in Appendix E, the bulk of expenditure, excluding any associated capital costs, to manage waiting lists is required from 2021–2025 (€212m on average per year), with lower levels of recurring additional expenditure required from 2026 onwards.

Gross acute hospital expenditure, average annual growth 2018–2035

As projected expenditure growth is a function of the length of the specified projection horizon, it is useful to also consider growth in terms of average annual change. As shown in Table 8.2, we project an overall average annual increase in total public acute hospital gross nominal expenditure of between 3.6 and 5.4 per

cent.⁸⁵ Between 2013 and 2018, HSE gross expenditure on acute hospitals has increased at an average annual rate of 4.5 per cent (see Chapter 6). However, the impact of Covid-19 is likely to result in public hospital expenditure growth being different over the coming years than otherwise would have been the case. We assume an increase of 10 per cent and 15 per cent in expenditure in 2020 and 2021, respectively, followed by zero net growth in expenditure in 2022 as Covid-19 supports are withdrawn. Accounting for this raises average annual growth in hospital expenditure to 6.0 per cent to 2025 (see Table 6.4). While this permanently alters projected expenditure growth to 2035, it falls within the range of our main scenarios.

Over recent years, growth in the Irish economy, whether measured on a GDP or GNI* (which removes globalisation effects) basis, has outstripped overall current healthcare expenditure increases. Between 2014 and 2018, current healthcare expenditure as a proportion of GNI* (GDP) fell from 15.1 (11.5) per cent to 11.4 (6.9) per cent (Central Statistics Office, 2018a). When considering the sustainability of projected nominal expenditure increases over the projection horizon, it is therefore important to view these increases in the context of growing national income which will contribute to the tax base necessary to finance future care needs.

Moreover, when the effect of pay and non-pay cost increases are removed, we project a considerably lower real (or volume) average annual increase in expenditure growth of between 1.2 and 1.7 per cent. Adjusting for projected population growth over the period, projected per capita average annual real expenditure growth ranges between 0.6 and 0.9 per cent.

TABLE 8.2 Public acute hospital gross expenditure – nominal and real average annual growth rates, and average annual growth rates per capita, by projection scenario

	Average annual growth rates 2018–2035 (%)			
	Low	Central	High	Progress
Real	1.2	1.5	1.7	1.3
Real per capita	0.7	0.9	0.6	0.7
Nominal	3.6	4.3	5.4	4.1
Nominal per capita	3.1	3.7	4.3	3.5

Notes: Real projections hold base costs constant at their 2018 values.

Source: Authors' calculations.

⁸⁵ Projection exercises from other countries tend to report overall healthcare expenditure projections, making it difficult to compare findings from this analysis, internationally. Charlesworth and Johnson (2018), in their analysis of UK health spending projections report projected annual hospital spending growth of between 3.6 and 4.0 per cent between 2018/19 and 2033/34. These projections, however, model real price effects (over and above general inflation) and are not directly comparable with the nominal or real projections presented in this analysis.

8.3 SENSITIVITY ANALYSIS

Table 8.3 presents the projected expenditure in 2035 arising from assuming our central projection scenario, and examines the percentage change in expenditure if key assumptions are altered independently of other assumptions.

This sensitivity analysis shows that sensitivity to population growth assumptions is greatest in services which are delivered more uniformly across the age distribution, such as ED and OPD care. Applying our low or high population growth projections affects expenditure on these services to a greater extent than day-patient or in-patient services, where care is delivered to a greater extent to older people. This differing impact of the population growth assumptions arises because the major driver of the difference in population projections is the assumed level of migration, which affects numbers in younger and middle-age cohorts (see Chapter 3).

The central projection scenario assumes moderate healthy ageing in line with international evidence on healthy ageing effects in relation to hospital expenditure (see Chapter 2). Consequently, assuming no health ageing effects increases projected 2035 expenditure relative to the central scenario, while increasingly stronger assumed healthy ageing effects in the form of dynamic equilibrium and compression of morbidity assumptions (see Section 4.2.2) reduce projected expenditures. Dynamic Equilibrium assumes that gains in health (proxied by activity rates shifts) match gains in age-specific life-expectancy change. Moderate Healthy Ageing, in contrast, assumes gains in health at 50 per cent gains in life expectancy, while Compression of Morbidity assumes gains at 150 per cent. Table 8.3 demonstrates that services for which expenditures are more concentrated in older ages (i.e. day-patient and in-patient hospital care) are most sensitive to healthy ageing effects. For instance, assumed Dynamic Equilibrium reduces projected 2035 in-patient expenditure by 4.2 per cent, while Compression of Morbidity reduces projected 2035 expenditure by 8.4 per cent, relative to the central scenario.

As discussed in Chapter 2, while causality is difficult to identify, inverse associations exist between avoidable hospitalisation, and primary care accessibility and resourcing. For this analysis we limited our set of avoidable hospitalisations to the three most resource-intensive avoidable hospitalisations, and for which evidence exists for appropriate treatment or prevention outside hospital, and thus have been considered as areas for priority primary care investment (McDarby and Smyth, 2019).⁸⁶ Under our progress scenario, we assumed that improved investment and access to primary care may lead to a 33 per cent reduction in the rate of in-patient emergency discharges (and ED attendances) for these conditions

⁸⁶ Vaccine-preventable influenza and pneumonia, COPD, and urinary tract infections (including pyelonephritis). See Appendix A for more details.

by 2035. Choice of this parameter, however, was subject to considerable uncertainty, and (as shown in Table 8.2) expenditure projections are sensitive to the rate of reduction specified. For instance, if by 2035 there is a fall in the rate of in-patient emergency discharges by 33 per cent, this would equate to a 5.4 per cent reduction in in-patient expenditure, while a 50 per cent reduction in the activity rate would equate to an 8.2 per cent reduction in expenditure. This reflects the relatively large amount of resources consumed by these conditions (particularly vaccine-preventable influenza and pneumonia – see Appendix A). Therefore, policies that achieve fewer hospitalisations for these conditions (for instance, improved influenza vaccine uptake) could free up significant amounts of acute hospital resources.

As described throughout this chapter, however, expenditure projections are most sensitive to assumed trends in the cost of care delivery, particularly pay costs. As part of this sensitivity analysis, we examine the extent to which pay costs may be offset through assumed gains in productivity – essentially assuming that the same projected quantity of care could be delivered but at a lower unit cost. In terms of productivity, we examine the effect on projected expenditures of a 1.0 and 1.5 per cent increase in productivity per annum, respectively. Findings presented in Table 8.3 highlight that significant expenditure reductions could be realised with relatively small per annum improvements in labour productivity. The findings are strongest for services where pay accounts for the greatest proportions of the overall cost of care delivery (i.e. OPD, ED, adult in-patient psychiatric care). For instance, a 1 per cent per annum improvement in labour productivity could reduce projected ED expenditures by 11.7 per cent. This increases to a 16.8 per cent reduction under an assumed 1.5 per cent per annum improvement.

Additionally, we consider, in the context of recent increased public expenditure burdens required to tackle the Covid-19 pandemic, the impact of tighter public-sector pay policy in the coming years on projected hospital expenditure. Under one assumption, we consider the impact of a public pay freeze in 2021 and 2022, followed by a return to projected pay growth modelled under the central scenario. Under an alternative assumption, we consider the impact of a pay freeze in 2021 and 2022, followed by a return to more moderate 1.5 per cent per annum pay growth for the remaining projection years.^{87,88} Implementation of the pay freeze in 2021-2022 alone would result in relatively modest reductions in 2035 expenditure, between 2.1 and 3.8 per cent, relative to the central scenario. Combining this pay freeze with assumed projected wage growth of 1.5 per cent per annum for the

⁸⁷ As reported in Table 3.1, government-sector nominal average wage growth over the projection period averages 2.5 per cent per annum under the *Recovery* scenario applied under our central projections.

⁸⁸ The focus of the sensitivity exercise is to illustrate the relative effects of varying key assumptions on projected expenditure rather than specifying plausible scenarios. Particularly, modelling longer-term pay restraint (i.e. 1.5% per annum) may have wider implications for projected expenditures in terms of workforce and the economy that are not captured.

remaining projection years results in larger reductions in 2035 expenditure, of between 7.0 and 12.8 per cent, relative to the central scenario.

TABLE 8.3 Sensitivity analysis – effect on projected expenditure for main services of varying key assumptions and productivity effects

		Public acute hospitals				Psychiatric in-patient
		ED	OPD	Day patients	In-patients	Adult
Projected 2035 expenditures based on central scenario		746	1,062	1,995	6,332	325
Assumption		Percentage effect on 2035 expenditure of changing one assumption (%)				
Population	Low	-3.0	-2.2	-1.6	-2.0	-2.0
	High	7.1	5.3	3.7	4.4	4.8
Healthy ageing	None	1.5	1.7	3.2	4.2	N.A.
	DE	-1.5	-1.7	-3.2	-4.2	N.A.
	CM	-3.0	-3.3	-6.4	-8.4	N.A.
Avoidable hospitalisation reduction	0.25% by 2035	-1.2	N.A.	N.A.	-4.1	N.A.
	0.33% by 2035	-1.6	N.A.	N.A.	-5.4	N.A.
	0.50% by 2035	-2.4	N.A.	N.A.	-8.2	N.A.
Pay	Productivity improvement					
	1.0% p.a.	-11.7	-10.6	-6.6	-9.8	-12.2
	1.5% p.a.	-16.8	-15.4	-9.6	-14.2	-17.6
	Pay freeze					
	2021-2022	-3.7	-3.3	-2.1	-3.1	-3.8
	2021-2022, 1.5% p.a. wage growth thereafter	-12.3	-11.2	-7.0	-10.3	-12.8

Notes: Excludes maternity-related expenditures.

We do not model varying assumptions in relation to waiting-list management, since the 2035 effect on expenditure is small relative to other drivers.

Source: Authors' calculations.

8.4 LIMITATIONS

The modelling in this analysis was subject to some limitations. While detailed administrative data on activity and costs were available for the most acute services examined, gaps in activity and unit-cost information affected certain services. For instance, administrative age- and sex-specific data on use of public outpatient (OPD) care in Ireland is relatively poor. This necessitated the use of a variety of data sources to generate the underlying activity profiles used in this analysis (see Brick and Keegan (2020a) for details). Additionally, as described in Chapter 4, the lack of available cost data in relation to public acute psychiatric care required the calculation of an overall top-down unit cost of a bed day as a basis for expenditure projection.

While this analysis examined the potential acute care expenditure implications of shifting certain appropriate care to the community, it did not explicitly consider other models of care change that may also realise future expenditure savings. This includes the ability to improve the model of care delivery within the acute system (e.g. in-patient care delivered in a day-patient setting or day-patient care delivered in an OPD setting) or policies in relation to improved workforce skill-mix. As shown in the sensitivity analysis conducted above, productivity-improving policies such as these could further mitigate against some of the projected acute expenditure growth.

As described by Bojke et al. (2017), productivity is one of the key measures against which health policy achievements can be judged. It is often considered in claims about health system performance and in justifying resource allocation or in appealing for additional funding. Productivity effects in this analysis, however, were modelled as a sensitivity due to a weak evidence base in relation to health or hospital care productivity trends in Ireland.⁸⁹ Future healthcare projection exercises, and policy considerations in general, would benefit from the construction and publication of healthcare-specific productivity indices for Ireland. The Office for National Statistics (ONS), for example, currently provides annual growth rates and indices for healthcare inputs, quality and non-quality adjusted output and productivity for England. This could serve as a useful template for the Irish system.

⁸⁹ The productivity effect is all-encompassing; while not explicitly, it could include improvements due to shifts in activity to other settings, e.g. from in-patient to day patient and from day patient to OPD. While beyond the scope of this analysis, it would be possible in a future iteration of Hippocrates to consider such changes explicitly. This would require a detailed analysis of trends in activity as well as substantial input from clinicians (e.g. the National Clinical Programme for Surgery). Such an exercise would benefit from improvements in the available OPD data, such as detailed patient-level activity and expenditure data.

8.5 POLICY IMPLICATIONS, REFLECTIONS, AND CONCLUSIONS

The main finding of this report is that due to a combination of a growing and ageing population and increasing costs of care delivery, expenditure on public acute and psychiatric in-patient services will be required to increase significantly by 2035. The main driver of this increased expenditure is the future expected cost of care delivery, particularly pay-related cost. The delivery of acute and psychiatric in-patient care is very labour-intensive; unit costs of care derived for this analysis show that pay is the major component cost of care delivery across all services. These findings therefore have major implications for expanded staffing, workforce planning and training. Decades of underinvestment in acute hospitals, combined with a growing and ageing population, have also left the acute hospital system capacity constrained, resulting in large backlogs for access and long waiting times. Additional capital investment will also be required to meet the underlying demand growth and to deliver timely access to services. While this has long been acknowledged, the 2021 Budget has allocated additional capital spending to increase bed capacity in line with recommendations (PA Consulting, 2018). This includes funding to increase the stock of public acute hospital beds by 1,146, and to increase the stock of critical-care beds to 321, by the end of 2021 (Government of Ireland, 2020).

While the outbreak of Covid-19 in 2020 resulted in a short-term shock to acute hospital utilisation and expenditure, the pandemic will also likely leave longer lasting impacts on demand for, and cost of delivering, hospital services, which are more relevant for modelling trends in expenditure over the medium term. In line with the broader macroeconomic implications of the pandemic, projected trends in net migration and pay and non-pay prices have been adjusted. The large recent increase in waiting-list numbers for hospital care – a result of cancellation of all but essential elective services – has also been incorporated into estimates of the additional expenditure required if this backlog is to be addressed over the next number of years.

With the above in mind, this report projects that total HSE gross expenditure on public hospital services will increase by between 22 and 33 per cent in real terms, and 82 and 143 per cent in nominal terms, by 2035. In nominal terms this reflects an average annual increase of between 3.6 and 5.4 per cent, within the range of average annual increase in acute expenditure over recent years. However, increased expenditure in response to Covid-19 will likely drive expenditures above trend in the short (but not longer) term. Expenditure requirements also increase if a policy decision is made to address existing waiting-list backlogs. In addition to demographic and cost pressures, we estimate the expenditure in terms of additional activity required to address these backlogs (and sustain lower waiting times) at €212m on average per year in nominal terms between 2021 and 2025 with an additional €58m (2026–2030) to €71m (2031–2035) on average per annum

required to keep waiting times below a 12-week target over the remainder of the projection horizon. As the system is currently operating at close to full capacity, as noted, additional capital investment in beds is also required. At an acute service level, the greatest projected expenditure pressures are observed for day and in-patient care. These are the services where expenditure per capita increase most dramatically with age and are therefore most affected by projected population ageing. Additionally, many services provided in a day patient setting require the delivery of innovative and expensive drugs (e.g. oncology drugs). This has been identified as a further significant cost pressure in addition to pay.

Findings from this analysis provide some insights into how policy may respond to mitigate against some of these projected expenditure pressures. As identified by Sláintecare (Government of Ireland, 2018b; Houses of the Oireachtas Committee on the Future of Healthcare, 2017), our health system remains hospital-centric and the prevention or treatment of many conditions could be better provided in the community. Taking an evidence-based approach, we focused on three such conditions that currently consume significant hospital resources: vaccine-preventable influenza and pneumonia, COPD, and urinary tract infections (including pyelonephritis). We showed that reducing the rate of hospitalisation for these conditions by a third by 2035 could result in material acute expenditure savings. While this analysis did not consider the associated expenditure implications of additional staffing and other resources required to facilitate greater levels of care in the community, there is evidence for cost-effective community treatment or prevention (McDarby and Smyth, 2019). For instance, close to €300m was spent in 2018 in treating vaccine-preventable influenza and pneumonia in public acute hospitals. Yet, while seasonal influenza and pneumococcal vaccination are considered the primary approach to preventing morbidity and mortality associated with these conditions, vaccination rates for these conditions lag significantly behind the UK (McDarby and Smyth, 2019). Future research planned under the ESRI Research Programme in Healthcare Reform will provide baseline estimates and expenditure projections on public and private non-acute health and social care services.

Sensitivity analysis has also shown that reasonable productivity improvements could offset some of the large projected increases in the unit cost of care delivery. Examples of how this might be achieved include improved information and communication technology (ICT), changes in hospital staff skill-mix, and better management (Wanless, 2002). An improved integration with post-acute hospital care could also reduce delayed discharges, allowing more hospital patients to be seen. Recent ESRI research has shown that hospital stays for older people are shorter in areas with better supply of home care and residential care services (Walsh et al., 2020b; Walsh et al., 2019). The flexibility of Hippocrates also allowed for analysis of the sensitivity of projected expenditures to assumed changes in

public-sector pay policy. It is also important to consider, however, that projected increases take place in a context of national income growth which will increase the ability to finance future expenditure requirements.

In addition to projections of expenditure, this report has developed a more detailed and comprehensive analysis of public hospital age- and sex-related expenditure profiles than has previously been available for Ireland. These findings may have wider uses and applications. Already this is evidenced in that the expenditure profiles developed for this analysis formed the foundation for a Department of Health submission, for the first time, of Irish age-cost profiles to the European Commission. Until now, Ireland was only one of three countries unable to submit age-cost profiles to the Commission to inform its Ageing Reports. It was outside the scope of this analysis to consider the impact of plans to remove private activity from public hospitals; however, the presentation of estimated acute expenditure profiles separately for public and private activity may provide useful insights regarding these reforms (Independent Review Group, 2019). A detailed understanding of public hospital expenditure on private emergency and maternity activity, in particular, becomes important under such reforms as expenditure on this care is likely to remain within the public system, given the elective care focus of private hospitals (Keegan et al., 2018b). Finally, conversion of activity profiles to expenditure required detailing and analysis of unit costs of hospital services by pay and non-pay cost components. Ireland does not routinely publish on healthcare unit costs. These estimates may have wider applicability for policy and also for research in other areas such as costing or cost-effective analyses.

APPENDIX A

Avoidable hospitalisations

DIAGNOSIS CODES

As discussed in Section 4.3.2, 21 avoidable hospitalisation conditions were identified. The International Classification of Diseases Tenth Revision, 8th edition diagnosis codes used to identify these conditions in HIPE are outlined in Table A.1. In addition, the table presents the number of weighted and complexity-weighted emergency in-patient (excl. maternity) discharges with these conditions in 2018 and the proportion of the total they account for.

TABLE A.1 Avoidable hospitalisations – diagnosis codes, unweighted and complexity-weighted discharges, 2018

Condition	ICD-10-AM diagnosis codes ^a	Emergency in-patient (excl. maternity)					
		Unweighted discharges		Complexity weighted discharges		Bed days	
		N	%	N	%	N	%
Vaccine preventable							
Influenza and pneumonia (vaccine-preventable)	Any DX (excl. ADX D57) of: J09- J11, J13-J14, J16.8, J18.1, J18.8-J18.9	25,300	25.6	58,584	50.2	405,435	48.6
Other vaccine-preventable conditions	A08.0 (any), A35-A37, A80, B05-B06, B16.1, B16.9, B18.0-B18.1, B26, G00.0 (any), M01.4 (any)	323	0.3	222	0.2	1,026	0.1
Acute							
Urinary tract infections, including pyelonephritis	N10-N12, N13.6, N39.0	14,804	15.0	14,068	12.0	123,519	14.8
Convulsions and epilepsy	G40, G41, R56	7,623	7.7	5,650	4.8	32,024	3.8
Cellulitis	L03-L04, L08, L08.8-L08.9, L88, L98.0, L98.3	6,601	6.7	5,275	4.5	40,969	4.9
Ear, nose and throat infections	H66-H67, J02-J03, J06, J31.2	7,170	7.3	2,580	2.2	11,710	1.4
Gangrene	Any DX: R02	447	0.5	1,761	1.5	10,691	1.3
Perforated/bleeding ulcer	K25.0- K25.2, K25.4-K25.6, K26.0-K26.2, K26.4-K26.6, K27.0-K27.2, K27.4-K27.6, K28.0-K28.2, K28.4-K28.6	518	0.5	1,021	0.9	5,144	0.6
Dehydration and gastroenteritis	E86, K52.2, K52.8, K52.9	932	0.9	732	0.6	5,391	0.6
Dental conditions	K02-K06, K08, K09.8, K09.9, K12-K13	790	0.8	545	0.5	2,333	0.3
Pneumonia (not vaccine-preventable)	Any DX (excl. ADX D57): J15.3-J15.4, J15.7	139	0.1	455	0.4	2,301	0.3
Pelvic inflammatory disease	N70, N73-N74	285	0.3	204	0.2	1,275	0.2
Chronic							
COPD	J40-J44	15,161	15.4	13,277	11.4	115,072	13.8
Congestive cardiac failure	I50, I11.0, J81	6,429	6.5	7,955	6.8	65,754	7.9
Diabetes complications	E10.0–E10.8, E11.0–E11.8, E13.0–E13.8, E14.0–E14.8	3,938	4.0	5,626	4.8	35,408	4.2
Asthma	J45-J46	3,860	3.9	1,724	1.5	9,948	1.2
Angina	Excl. ADX blocks 1820-2140: I20, I24.0, I24.8-I24.9	2,453	2.5	1,628	1.4	8,742	1.0
Iron deficiency anaemia	D50.1, D50.8-D50.9	1,991	2.0	1,293	1.1	8,432	1.0
Hypertension	I10, I11.9	2,508	2.5	675	0.6	5,421	0.6
Bronchiectasis	J47	471	0.5	532	0.5	4,519	0.5
Nutritional deficiencies	E40-E43, E55.0, E64.3	7	0.0	58	0.1	362	0.0
Total avoidable hospitalisations^b		98,676	100	116,768	100	834,561	100

Notes: a Principal diagnosis unless otherwise stated.
DX: diagnosis; ADX: additional diagnosis.

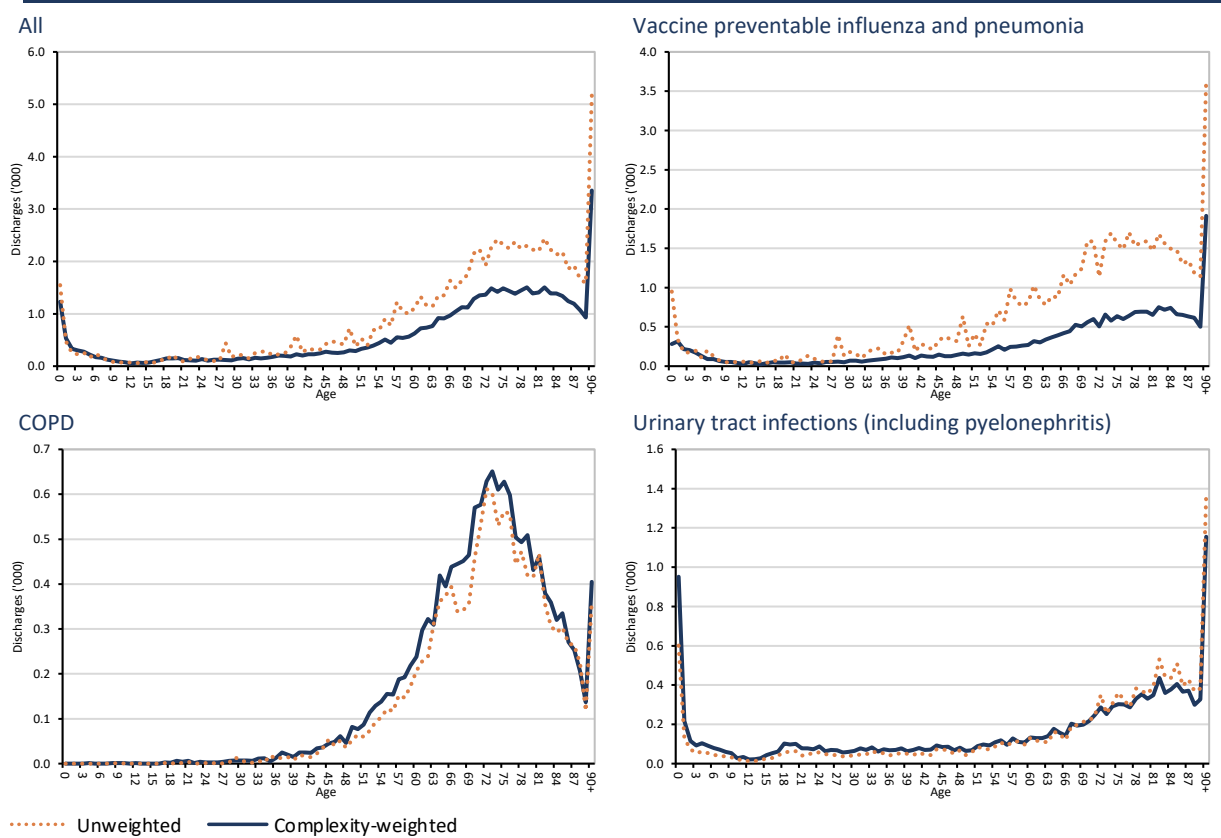
b A discharge is counted as one if one or more of the 21 conditions are recorded.

Source: HIPE, 2018; Australian Institute on Health and Welfare (2020); McDarby and Smyth (2019).

DISCHARGE PROFILES, 2018

The selected conditions for further analysis are vaccine-preventable influenza and pneumonia, COPD, and urinary tract infections (including pyelonephritis). Collectively they account for 54.2 per cent of unweighted and 70.7 per cent of complexity-weighted avoidable hospitalisations recorded in 2018.⁹⁰ Figure A.1 outlines the age-specific unweighted and complexity-weighted discharges in 2018 for the three conditions and the sum of the three. All three conditions are most prevalent in older ages. Vaccine preventable influenza and pneumonia had the highest volume of discharges (25,300) of the three conditions in 2018 and is most affected by complexity weighting (58,584), particularly at older ages.

FIGURE A.1 Avoidable hospitalisations – age- specific unweighted and complexity-weighted discharges, 2018

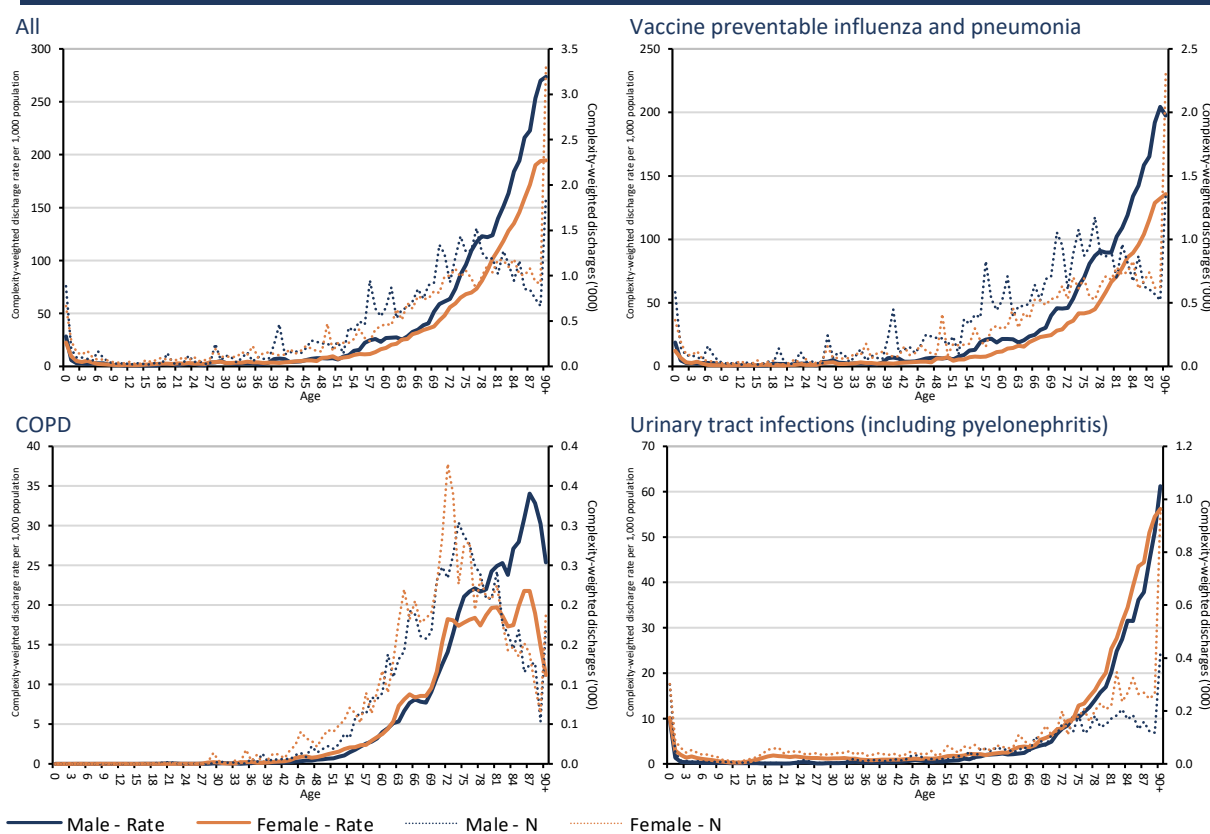


Source: HIPE, 2018.

⁹⁰ The number of in-patient bed days recorded for those discharges aged 65+ years with vaccine preventable influenza and pneumonia accounts for half of the total bed days recorded for all three conditions.

Figure A.2 shows age- and sex-specific profiles of complexity-weighted discharges and the discharge rate per 1,000 population. The rate per 1,000 population for all three conditions increases with age from approximately 50 years. There are more male than female discharges for both COPD and vaccine preventable influenza and pneumonia, with the differential particularly high at 75 years and older. For COPD the rate per 1,000 population for females becomes relatively stable from 70 years onwards, while for males it continues to increase with age.

FIGURE A.2 Avoidable hospitalisations – age- and sex-specific complexity-weighted discharges and discharge rates per 1,000 population, 2018

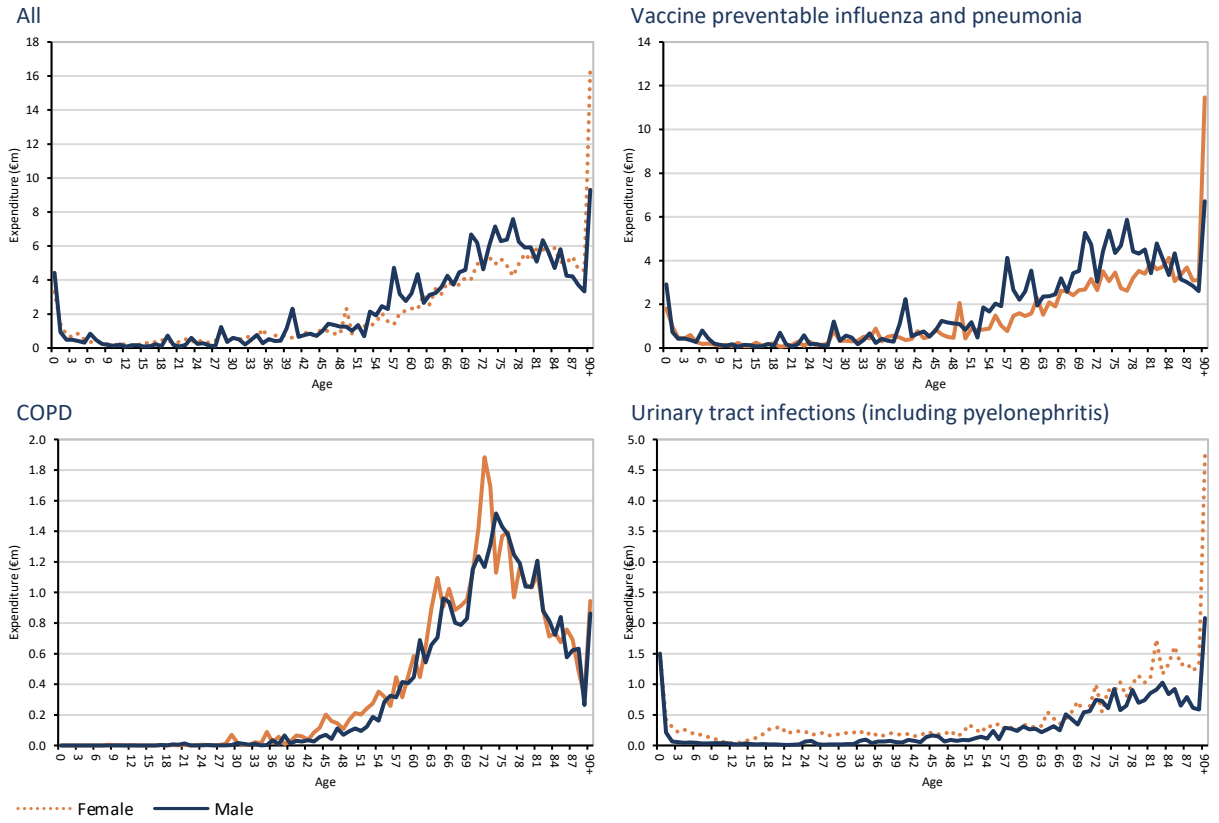


Source: HIPE, 2018.

EXPENDITURE PROFILES, 2018

Total expenditure on the three selected conditions in 2018 was €411m. The majority, €292m, related to vaccine preventable influenza and pneumonia. Most of the expenditure was concentrated in older ages (50 years and older) (Figure A.3).

FIGURE A.3 Avoidable hospitalisations – age- and sex-specific expenditure, 2018



Source: HIPE, 2018.

APPENDIX B

Public acute psychiatric in-patient service utilisation, 2018–2035

To align with the highly aggregated expenditure data available for public acute psychiatric in-patient services, data from the HRB NPIRS was aggregated to align with the units included in the CSO System of Health Accounts expenditure category pertaining to acute adult in-patient units.⁹¹ Table B.1 lists the 29 public acute adult HSE and HSE-funded units included in the SHA and Hippocrates.^{92,93}

TABLE B.1 HSE and HSE-funded acute adult psychiatric in-patient units by Community Healthcare Organisation

Total CHO 1	Total CHO 6
Cavan General - Unit	Cluain Mhuire
Letterkenny General - Unit	St Vincent's University Hospital, Elm Park Unit
Sligo Mental Health Services	Newcastle Hospital
Total CHO 2	Total CHO 7
Mayo General Hospital - Unit	St James Hospital - Unit
Roscommon General Hospital - Unit	Tallaght Hospital - Unit
UCHG - Unit	Lakeview Unit, Naas General Hospital – Unit
Total CHO 3	Total CHO 8
Acute Psychiatric Unit, Ennis General Hospital, Co. Clare	Midlands Regional Hospital Portlaoise - DOP Unit
Acute Psychiatric Unit 5B, University Hospital Limerick	St. Loman's Hospital, Mullingar
Total CHO 4	Cluain Lir Care Centre, Mullingar
Bantry General - Unit	Drogheda Department of Psychiatry, Crosslanes
Cork University Hospital - Unit	Total CHO 9
Mercy University Hospital - Unit	Connolly Hospital - Unit Pine & Ash Ward
St Stephen's Hospital	St Vincent's Fairview - Hospital
University Hospital Kerry - Unit	Mater Hospital - Unit
Total CHO 5	Ashlin Centre – Joyce & Sheehan Units
St Luke's Hospital Kilkenny - Unit	
Waterford General Hospital	

Source: HSE Mental Health Division (2019).

⁹¹ These are defined as acute adult psychiatric in-patient units with a 24-hour medical presence and classified as approved centres by the Mental Health Commission under the Mental Health Act 2001. SHA category HP1.2 – Mental Health Hospitals, HC1.1.2 – specialised in-patient curative care, HF1.1.1 – central government schemes.

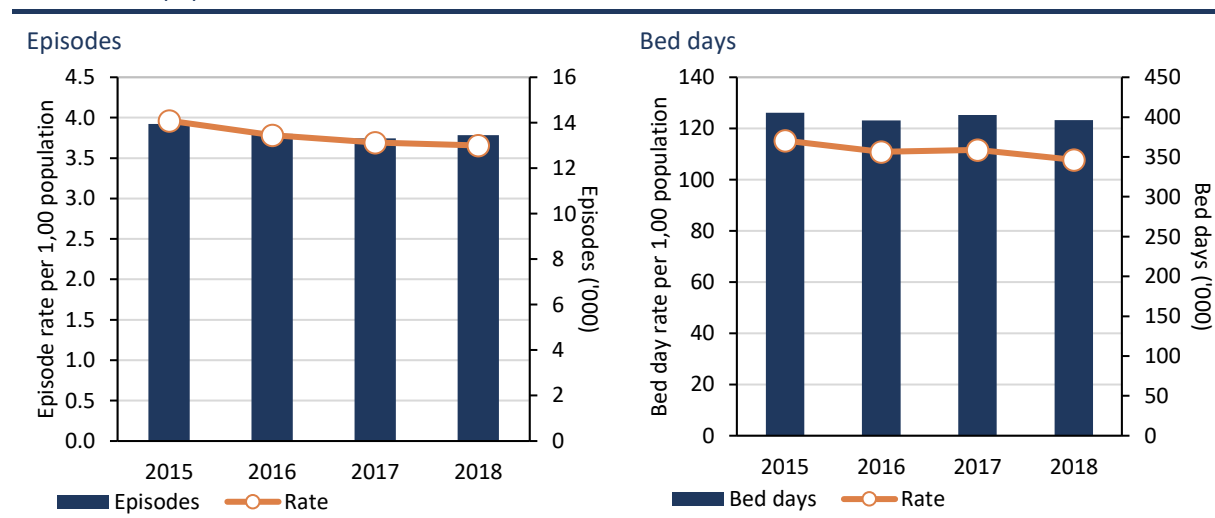
⁹² The included units accounted for 80 per cent of total acute psychiatric in-patient unit expenditure and 89 per cent of acute psychiatric in-patient bed days in 2018.

⁹³ It is hoped that, when the expenditure data available for mental health services improves, additional services may be added to the Hippocrates Model.

BASELINE UTILISATION, 2018

Figure B.1 presents the number of episodes/episode rate⁹⁴ and bed days/bed day rate for adult psychiatric in-patient units from 2015–2018. Rates are calculated using ESRI population estimates for 2018 for those aged 18 years and older.⁹⁵ Episodes and bed days and their accompanying rates have decreased slightly over the period.

FIGURE B.1 Psychiatric in-patient – episodes and bed days and episode and bed day rates per 1,000 population, 2015–2018



Note: Rates calculated using ESRI population calculations for 2018, 18 years and older.

Source: HRB NPIRS, 2015–2018.

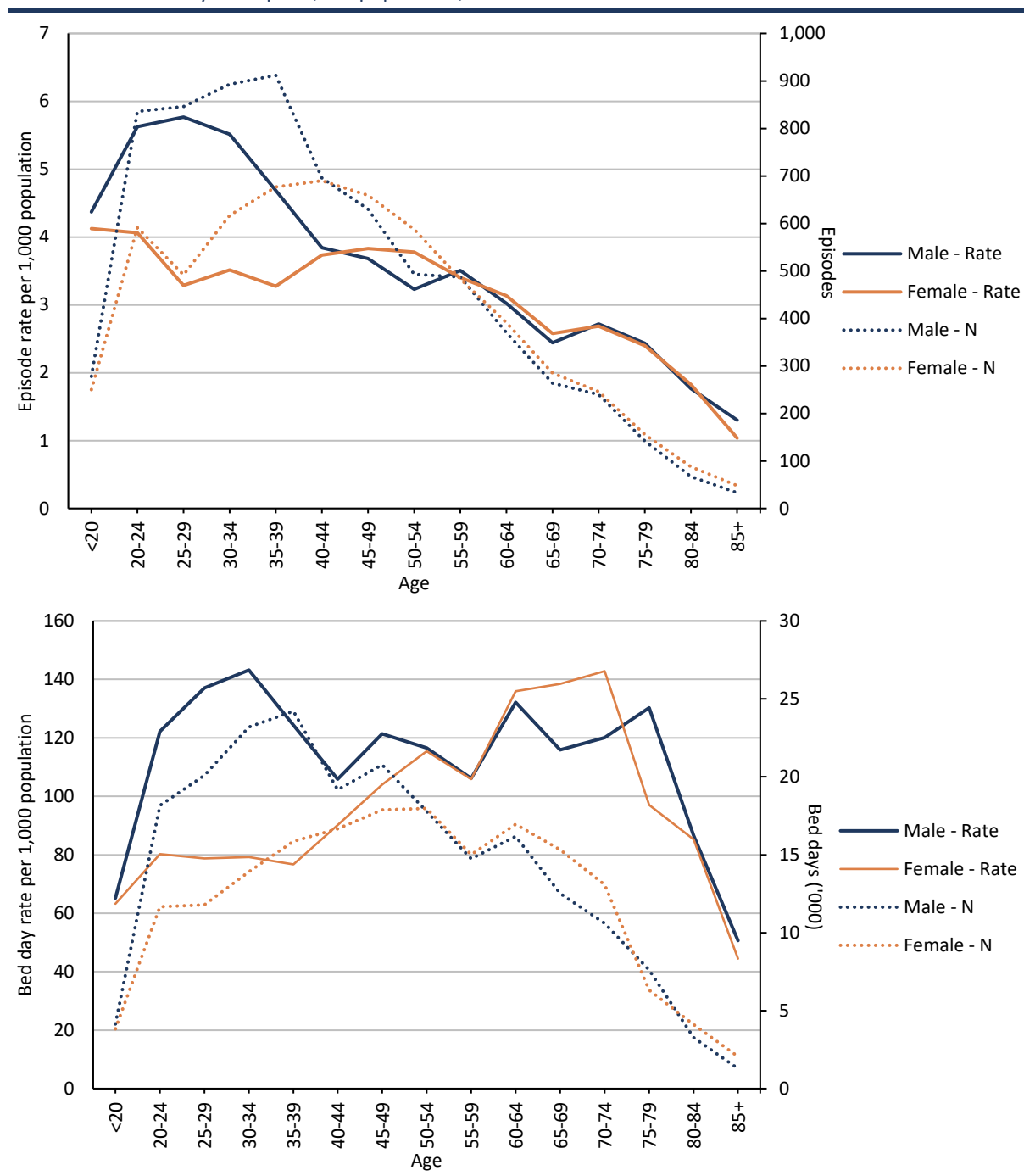
Figure B.2 presents age- and sex-specific in-patient episodes and bed days, with accompanying rates per 1,000 population for 2018. The number of episodes is highest for males in the 35–39 age group while for females it is in the 40–44 age group. There is a large differential in the episode rate for males and females in the 25–34 age groups; the male rate is between 1.5 and 1.75 times greater than the female rate. For adult bed days the distribution of the number of bed days and the bed day rate is quite different for males than females. The number of male bed days peaks at 35–39 years (24,209) while the bed day rate peaks at 30–34 years (143.2 per 1,000 population).⁹⁶ For females the number of bed days peaks at 50–54 years while the bed day rate does not peak until 70–74 years (142.8 per 1,000 population). The male rate is higher than the female rate at all ages, except for the 65–74 age groups.

⁹⁴ The term episodes is used rather than discharges, admissions or patients, as this analysis uses an aggregation of the following activity in 2018: completed episodes – discharges and deaths in 2018; active new episodes – patients admitted in 2018 who have not yet been discharged by 31 December 2018, and active long-stay episodes – patients admitted prior to 2018 that have not yet been discharged on 31 December 2018 (Brick et al., 2020a).

⁹⁵ It should be noted that there was a small number of episodes/bed days in adult units relating to children aged less than 18 years.

⁹⁶ This is due to differing diagnoses between males and females in these age groups. There are a high number of males with a diagnosis of 'F20-F29 Schizophrenia, schizotypal and delusional disorders' which is associated with a relatively high mean bed days per episode (Brick et al., 2020a; Daly and Craig, 2019).

FIGURE B.2 Psychiatric in-patient – age- and sex-specific in-patient episodes and bed days and episode and bed day rates per 1,000 population, 2018



Note: Rates calculated using ESRI population calculations for 2018, 18 years and older.
Source: HRB NPIRS, 2018.

PROJECTIONS OF DEMAND, 2018–2035

Table B.2 presents projected bed day demand and projected demand growth for the three projection scenarios (see Chapter 7). Bed day demand in acute psychiatric in-patient units is projected to grow to 461,356 days, 470,803 days, and 493,444 days, across our low, central and high-pressure scenarios, respectively, between 2018 and 2035. Larger growth is projected for females than males across all scenarios.

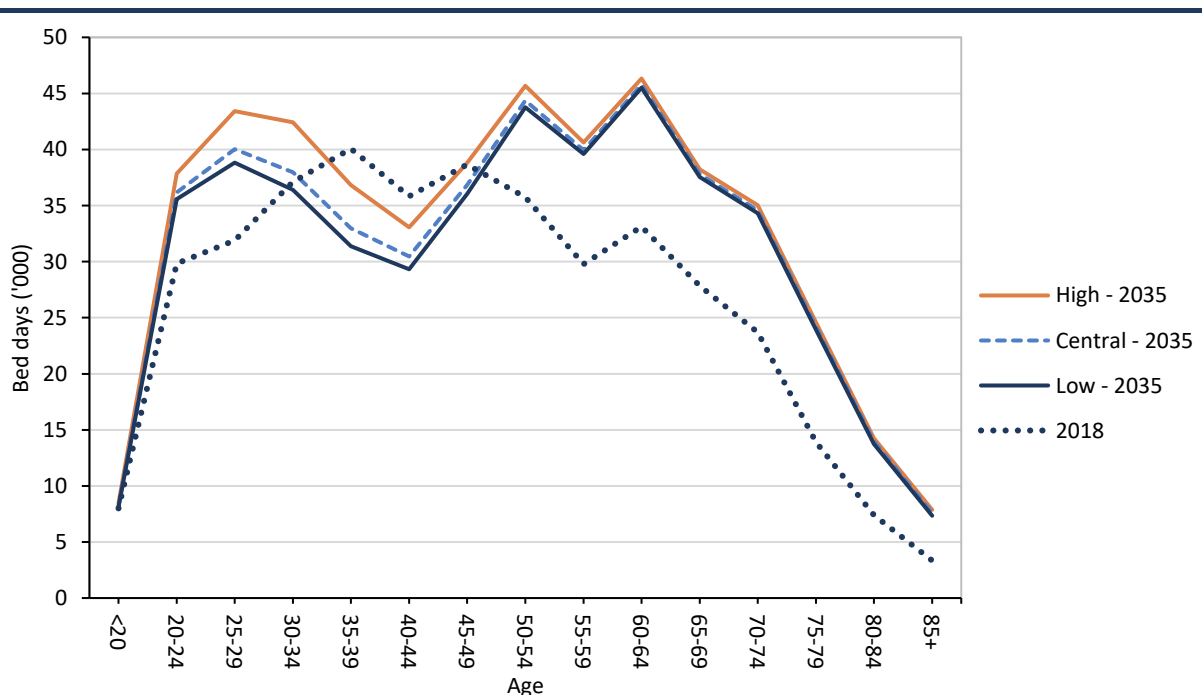
TABLE B.2 Psychiatric in-patient – projected bed day demand by projection scenario, 2018 and 2035

	2018	2035 ^{a,b}		
	Activity	Low	Central	High
Male	213,760	244,781 (14.5)	250,338 (17.1)	263,779 (23.4)
Female	182,434	216,575 (18.7)	220,465 (20.8)	229,665 (25.9)
Total	396,194	461,356 (16.4)	470,803 (18.8)	493,444 (24.5)

Note: a Percentage growth 2018–2035 in parentheses.
 b We assume no healthy ageing effects for psychiatric in-patient care.
 Source: HRB NPIRS (2018) and author calculations.

Figure B.3 presents age-specific bed day projections for acute adult psychiatric in-patient units by projection scenario. Across all scenarios, a relatively large proportion of the projected bed day demand growth takes place at older ages (50 years and older). Substantial growth is also seen in the 20–29 years age groups, particularly in the high-pressure scenario. In the 30–49 years age groups, demand for in-patient bed days is projected to decrease between 2018 and 2035 in all scenarios. These changes reflect the underlying demographic projections across the scenarios.

FIGURE B.3 Psychiatric in-patient – age-specific projected bed day demand by projection scenario, 2018 and 2035



Note: We assume no healthy ageing effects for psychiatric in-patient care.
 Source: HRB NPIRS (2018) and author calculations.

APPENDIX C

Short-term expenditure adjustments – Assumptions and analysis

BACKGROUND

As described throughout this report, Hippocrates has been developed as a medium-term projection model. It projects annual expenditure requirements based on known drivers of demand and cost (e.g. demographics, pay). The model does not forecast expenditure, which may vary from year to year due to unanticipated shocks, of which Covid-19 represents a striking example. As outlined in Chapter 1, additional resources have been, and are planned to be, provided to the health system in 2020 and 2021 in response to the demands placed on the system by Covid-19, and relatedly to expand capacity, tackle waiting lists and transform care delivery in line with Sláintecare. In this appendix, we consider how projected expenditures over the short and medium term may differ when directly accounting for these Covid-related expenditure shocks, which may represent a mix of both temporary and permanent additions to expenditure. We incorporate these adjustments into analysis in Chapter 6.

To examine the effects these direct adjustments may have on our projections, we specify an additional scenario (central – adjusted) that adjusts expenditure requirements in 2020, 2021 and 2022 as follows:

- 2020:** 10% increase in public acute gross expenditure
- 2021:** 15% increase in public acute gross expenditure
- 2022:** Gross expenditure at 2021 levels. This reflects the net effect of assumed removal of Covid-related supports and increased expenditure due to demographic and cost considerations.
- 2023-2035:** A return to the central projection growth path.

The assumptions in relation to 2020 and 2021 are discussed in more detail below.

2020

Since the outbreak of the Covid-19 pandemic, acute hospitals have incurred additional Covid-related expenditure in 2020, relating to costs such as personal protective equipment (PPE), infection control measures, and additional staff.⁹⁷ Additional acute funding for 2020 was included in the HSE Winter Plan (Health Service Executive, 2020b). However, at the time of writing it is unclear how much final 2020 expenditure will differ from the 2020 National Service Plan estimates

⁹⁷ Personal communication, HSE Finance, 23 October 2020.

(Health Service Executive, 2019). In this analysis we assume that these extra measures may contribute to a 10 per cent increase in 2020 expenditure.⁹⁸

2021

In October 2020, the Government announced a total health budget of €22.1 billion for 2021 – an increase of €3.8 billion, or 20.7 per cent, on 2020. While difficulty arises in understanding how these funds will be split between acute and non-acute services, broad breakdowns of allocations have been published (see Table C1). In terms of hospital care, large capital funding allocations have been earmarked to increase acute and critical care bed capacity in line with the 2018 Capacity Review. These, however, are separate to current funding allocations.⁹⁹ In terms of current funding, one large item with potential relevance to hospital care is the ‘improving access to care’ initiative (see Table C1). Overall, this is set at €318m, and includes €210m provided for a new ‘access to care’ fund to improve access to care for those significantly affected by the Covid-19 pandemic (Government of Ireland, 2020). Included in the health budget allocation is a Covid-19 current expenditure allocation of €1,751m (Government of Ireland, 2020). A yet unknown portion of this temporary funding will be directed towards hospital care; for example, in terms of additional PPE, planning for surge-related acute capacity, and infection prevention and control. Overall however, based on Table C.1 and associated commentary on these allocations (Government of Ireland, 2020), it is reasonable to assume that most of the 2021 health budget funds will be directed to either capital projects or primary and social care. In that regard, we consider it instructive to model a 15 per cent increase in hospital funding (expenditure) in 2021.

TABLE C.1 Summary of new expenditure measures in the health service, 2021

Item	Cost in 2021 (€m)
Increasing capacity to progress implementation of the Capacity Review 2018	467
Delivering enhanced community and social care services	425
Disability Services	100
Mental Health Services	38
Implementing National Strategies and Expert Review	147
Public Health, Well Being and the National Drug Strategy	53
Improving access to care	318
Introducing New Drugs	50
e-Health	58
COVID-19 Measures: Public Health Initiatives	1,300
COVID-19 Measures: Additional supports	404

Source: Government of Ireland (2020).

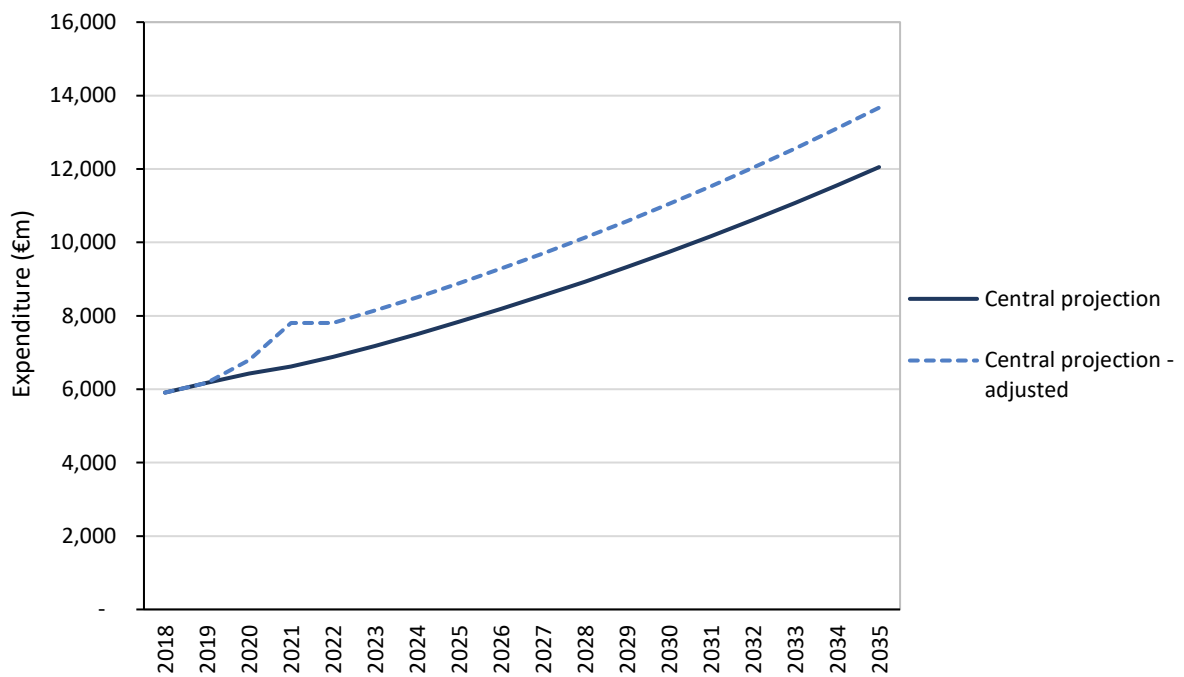
⁹⁸ Personal communication with HSE Finance (22 October 2020) suggests that this is a reasonable approximation of 2020 gross forecasted public acute hospital expenditure.

⁹⁹ Although increased capacity should allow for more activity to take place, increasing current expenditure requirements, particularly given the large levels of unmet demand for care evident in the Irish hospital system.

FINDINGS

Figure C.1 highlights the impact of these expenditure adjustment assumptions on projected public acute hospital expenditure through the projection horizon relative to the central projection scenario. Expenditure under the ‘adjusted’ central scenario in 2035 is projected at €13,669m relative to €12,050m under the central scenario. As can be seen, the expenditure increases are modelled to have both a permanent and temporary dimension.

FIGURE C.1 Projected expenditure growth under the central and central-adjusted scenarios, 2018-2035



Source: Authors' calculation.

While some of the assumed expenditure increases in 2020 and 2021 permanently raise projected expenditure requirements, the effect of this shock is less pertinent over the entire projection period, with average annual growth rates, and projected expenditures, falling within the bounds of our main projection scenarios (see Table C.2). Over the period 2018–2035, we report average annual increases of 4.3, 5.1, and 5.4 per cent in the central, central-adjusted and high-pressure scenarios, respectively.

TABLE C.2 Public acute hospital gross expenditure – nominal average annual growth rates by projection scenario and incorporating short-term assumed expenditure and budgetary adjustments

	Nominal expenditure growth (average annual)				
	Low	Central	High	Progress	Central - adjusted
2013-2018*	4.5				
2018-2025	3.3	4.1	5.3	4.5	6.0
2026-2030	3.8	4.4	5.5	4.2	4.4
2031-2035	3.8	4.3	5.4	4.1	4.3
2018-2035	3.6	4.3	5.4	4.1	5.1

Source: 2013–2018 – HSE Management Data Reports, December; 2018–2035 – authors' calculations.

APPENDIX D

Projected expenditures – average growth rates 2018–2035

Table D.1 below converts overall projected expenditure growth for public acute hospital care (reported in Chapter 5) and public acute psychiatric in-patient care (reported in Chapter 7), by projection scenario, into average annual growth rates over the period 2018 to 2035.

TABLE D.1 Public acute and psychiatric in-patient gross expenditure – real and nominal average annual growth rates by projection scenario, 2018–2035

	Expenditure growth (average annual) 2018–2035 (%)					
	Real			Nominal		
	Low	Central	High	Low	Central	High
Emergency Department	0.7	0.9	1.0	2.9	3.5	4.4
Outpatients	0.7	0.9	1.0	2.9	3.4	4.4
Day patients	1.1	1.4	1.6	3.9	4.7	5.8
Public	1.1	1.4	1.6	3.9	4.7	5.8
Private	0.9	1.3	1.5	3.7	4.6	5.7
In-patients	1.3	1.7	1.9	3.7	4.4	5.5
Public	1.3	1.7	1.9	3.7	4.4	5.5
Private	1.2	1.6	1.9	3.6	4.4	5.5
Psychiatric in-patient units/hospitals	0.9	1.0	1.3	3.1	3.6	4.8

Notes: Real projections hold base costs constant at their 2018 values.

Source: Authors' calculations.

APPENDIX E

Waiting-list management

Table E.1 summarises the results of our waiting list management analysis (see Brick and Keegan (2020b) for full details on the data, methods, results and sensitivity analysis). We estimate that, over the first five years, to clear the backlog of cases waiting for appointments/treatment and to keep pace with the trend in waiting lists and population change would require an additional spend, excluding any associated capital costs, of €1,058.4m, or €211.7m per annum. Once the backlog has been cleared, we estimate that over the following five years (2026–2030) an average of €58.4m per annum would be required to maintain waiting lists at a 12-week level. This would increase to an average of €70.5m per annum in the subsequent five years (2031–2035).¹⁰⁰

TABLE E.1 Projected activity and nominal expenditure required to clear backlogs (2021–2025) and sustain elective waiting times at <12 weeks for OPD, day patient, and in-patient care

	Average annual additional activity and expenditure					
	2021–2025		2026–2030		2031–2035	
	Activity per year	Expenditure per year (€m)	Activity per year	Expenditure per year (€m)	Activity per year	Expenditure per year (€m)
OPD	148,761	28.6	47,379	10.4	49,461	12.3
Day patient	59,013	78.7	14,269	22.1	14,914	27.2
In-patient	11,999	104.5	2,590	26.0	2,706	31.1
Total		211.7		58.4		70.5

Source: Brick and Keegan (2020b).

¹⁰⁰ As the OPD backlog is cleared it would be important to reassess future requirements as the day and in-patient waiting lists stabilise.

REFERENCES

- Acemoglu, D., A.N. Finkelstein and M. Notowidigdo (2013). "Income and health spending: evidence from oil price shocks." *Rev Econ Stat* 95(4): 1079-1095. https://www.mitpressjournals.org/doi/10.1162/REST_a_00306.
- 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 Commission on Safety and Quality in Healthcare (2017). *A guide to the potentially preventable hospitalisations indicator in Australia*. Commonwealth of Australia, Sydney.
- 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>.
- Baker, L.C. and S.K. Wheeler (1998). "Managed care and technology diffusion: the case of MRI." *Health Aff (Millwood)* 17(5): 195-207. <https://doi.org/10.1377/hlthaff.17.5.195>.
- Baltagi, B. and F. Moscone (2010). "Health care expenditure and income in the OECD reconsidered; Evidence from panel data." *Econ Model* 27(4): 804-811. <https://doi.org/10.1016/j.econmod.2009.12.001>.
- Baltagi, B.H., R. Lagravinese, F. Moscone and E. Tosetti (2017). "Health Care Expenditure and Income: A Global Perspective." *Health Econ* 26(7): 863-874. <https://doi.org/10.1002/hec.3424>.
- Barati, M. and H. Fariditavana (2018). "Asymmetric effect of income on the US healthcare expenditure: evidence from the nonlinear autoregressive distributed lag (ARDL) approach." *Empirical Economics* 58: 1879-2008 (2020). <https://doi.org/10.1007/s00181-018-1604-7>.
- Barrett, A. and A. Bergin (2005). "Assessing Age-related Pressures on the Public Finances 2005 to 2050." *Budget Perspectives 2006*: 3-20.
- Barros, P.P. (1998). "The black box of health care expenditure growth determinants." *Health Econ* 7(6): 533-544. [https://doi.org/10.1002/\(sici\)1099-1050\(199809\)7:6<533::aid-hec374>3.0.co;2-b](https://doi.org/10.1002/(sici)1099-1050(199809)7:6<533::aid-hec374>3.0.co;2-b).
- Barry, F. and A. Bergin (2019). "Export Structure, FDI and the Rapidity of Ireland's Recovery from Crisis." *Econ Soc Rev* 50(4): 707-724.
- Bech, M., T. Christiansen, E. Khoman, J. Lauridsen and M. Weale (2011). "Ageing and health care expenditure in EU-15." *Eur J Health Econ* 12(5): 469-478. <https://doi.org/10.1007/s10198-010-0260-4>.
- Bergin, A., N. Conroy, A. Garcia Rodriguez, D. Holland, N. McInerney, E. Morgenroth and D. Smith (2017). *COSMO: A new COre Structural MOdel for Ireland*. Economic and Social Research Institute, Dublin.
- Bergin, A., A. Garcia Rodriguez, N. Mc Inerney and E. Morgenroth (2016). Baseline: Methodology, Assumptions and Projections. *Ireland's Economic Outlook*. Dublin: Economic and Social Research Institute.
- Bergin, A., A. Rodriguez Garcia, L. Rehill and E. Sweeney (2020). Exploring the impacts of Covid-19, a hard Brexit and recovery paths for the economy. *Quarterly Economic Commentary Autumn 2020*. Dublin: Economic and Social Research Institute.
- 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>.
- Bojke, C., A. Castelli, K. Grasic and A. Street (2017). "Productivity Growth in the English National Health Service from 1998/1999 to 2013/2014." *Health Econ* 26(5): 547-565. <https://doi.org/10.1002/hec.3338>.
- Brick, A. and C. Keegan (2020a). *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. and C. Keegan (2020b). *Paying more to wait less: Estimating the cost of reducing Ireland's public hospital waiting lists*. Working Paper No. 688. Economic and Social Research Institute, Dublin.
- Brick, A., C. Keegan and M.A. Wren (2020a). *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>.
- Brick, A., B. Walsh, C. Keegan and S. Lyons (2020b). *COVID-19 and emergency department attendances in Irish public hospitals*. QEC Special Article. ESRI, Dublin. https://doi.org/10.26504/qec2020may_SA_lyons.
- Burke, S., S. Thomas, S. Barry and C. Keegan (2014). "Indicators of health system coverage and activity in Ireland during the economic crisis 2008-2014 – from 'more with less' to 'less with less'." *Health Policy* 117(3): 275-278. <https://doi.org/10.1016/j.healthpol.2014.07.001>.
- Central Bank of Ireland (2020). *Quarterly Economic Bulletin QB4 – October 2020*. Central Bank of Ireland, Dublin.
- Central Statistics Office (2013). *Population and Labour Force Projections: 2016-2046*. Central Statistics Office, <http://www.cso.ie/en/statistics/population/populationandlabourforceprojections2016-2046/>.
- Central Statistics Office (2018a). *System of Health Accounts 2018*. Retrieved 27th November, 2020, <https://www.cso.ie/en/releasesandpublications/ep/p-sha/systemofhealthaccounts2018/healthexpenditureinireland2018/>.
- Central Statistics Office (2018b). *Population and Labour Force Projections: 2017-2051*. <https://www.cso.ie/en/releasesandpublications/ep/p-plfp/populationandlabourforceprojections2017-2051/>.
- Central Statistics Office (2019). *Population and Migration Estimates, April 2019*. <https://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimatesapril2019/>.
- Central Statistics Office (2020a). *System of Health Accounts*. Retrieved 3 October, 2020, <https://www.cso.ie/en/statistics/governmentaccounts/systemofhealthaccounts/>.
- Central Statistics Office (2020b). *Productivity in Ireland 2018*. Retrieved 28 July, 2020, [cso.ie/en/releasesandpublications/ep/p-pii/productivityinireland2018/seg/](https://www.cso.ie/en/releasesandpublications/ep/p-pii/productivityinireland2018/seg/).
- Chakroun, M. (2010). "Health care expenditure and GDP: An international panel smooth transition approach." *International Journal of Economics* 4(1): 189-200. <http://ssrn.com/abstract=1369153>.
- 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.
- Charlesworth, A., T. Watt and T. Gardner (2020). *Returning NHS waiting times to 18 weeks for routine treatment. The scale of the challenge pre-COVID-19*. The Health Foundation, London. <https://www.health.org.uk/publications/long-reads/returning-nhs-waiting-times-to-18-weeks>.
- Christiansen, T., M. Bech, J. Lauridsen and P. Nielsen (2006). *Demographic changes and aggregate health-expenditure in Europe*. ENEPRI Research Report No. 32, <https://www.ceps.eu/download/publication/?id=5483&pdf=1423.pdf>.
- Colombier, C. and W. Weber (2011). "Projecting health-care expenditure for Switzerland: further evidence against the 'red-herring' hypothesis." *Int J Health Plann Manage* 26(3): 246-263. <https://doi.org/10.1002/hpm.1068>.
- Connolly, S. and M.-A. Wren (2019). "Universal Health Care in Ireland—What Are the Prospects for Reform?" *Health Systems & Reform* 5(2): 94-99. <https://doi.org/10.1080/23288604.2018.1551700>.
- Connors, J. (2017). *Spending Review 2017: Future Sustainability of Pharmaceutical Expenditure*. Department of Public Expenditure and Reform.
- Costa-Font, J. and C. Vilaplana-Prieto (2020). "'More than one red herring'? Heterogeneous effects of ageing on health care utilisation." *Health Econ*. <https://doi.org/10.1002/hec.4035>.
- Curtis, L. and A. Burns (2019). *Unit Costs of Health & Social Care 2019*. Personal Social Services Research Unit, University of Kent, Canterbury. <https://doi.org/10.22024/UniKent/01.02.79286>.

- Daly, A. and S. Craig (2019). *Activities of Irish Psychiatric Units and Hospitals 2018: Main Findings*. Dublin, HRB Statistics Series 39.
- 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.
- de la Maisonneuve, C., R. Moreno-Serra, F. Murtin and J. Oliveira Martins (2017). "The Role of Policy and Institutions on Health Spending." *Health Econ* 26(7): 834-843.
<https://doi.org/10.1002/hec.3410>.
- de Meijer, C., M. Koopmanschap, D.U. TB and E. van Doorslaer (2011). "Determinants of long-term care spending: age, time to death or disability?" *J Health Econ* 30(2): 425-438. <https://doi.org/10.1016/j.jhealeco.2010.12.010>.
- Department of Finance (2018). *GDP and 'modified GNI' – Explanatory Note*. Dublin, Government Publications.
- Department of Finance (2019). *Budget 2020, Economic and Fiscal Outlook*. Dublin, Government Publications.
- Department of Finance (2020). *Minister Donohoe publishes economic forecasts that will underpin Budget 2021*. Retrieved 27 October, 2020, <https://www.gov.ie/en/press-release/4b5e5-minister-donohoe-publishes-economic-forecasts-that-will-underpin-budget-2021/>.
- Department of Health (2012). *Future Health – A strategic framework for reform of the health service 2012-2015*. Department of Health, Dublin.
- Department of Health (2016). *Department of Health Statement of Strategy 2016 – 2019*. Department of Health, Dublin, <http://health.gov.ie/wp-content/uploads/2016/12/DoH-SoS-2016-2019-Final-En.pdf>.
- Department of Health (2017). *Spending Review 2017: Acute Hospital Expenditure Review*. Department of Health, Dublin.
- Department of Health (2019a). *Health in Ireland: Key Trends 2019*. Department of Health, Dublin.
- Department of Health (2019b). *Sláintecare Action Plan 2019*. Department of Health, Dublin. <https://assets.gov.ie/9379/05384619bb2240c18c294b60578117e1.pdf>.
- Department of Public Expenditure and Reform (2018). *2018 Expenditure Report*. Department of Public Expenditure and Reform, T. S. Office, Dublin. [http://www.budget.gov.ie/Budgets/2018/Documents/Expenditure%20Report%202018%20\(Parts%20I-III\).pdf](http://www.budget.gov.ie/Budgets/2018/Documents/Expenditure%20Report%202018%20(Parts%20I-III).pdf).
- Dormont, J., M. Oliveira and P. M (2010). Health expenditures, longevity and growth. In: P. Garibaldi, J. Oliveira Martins and J. van Ours (eds.) *Ageing, Health and Productivity*. Oxford University Press.
- Dybczak, K. and B. Przywara (2010). *The role of technology in health care expenditure in the EU*. *Economic Papers* 400. European Commission, Brussels, http://ec.europa.eu/economy_finance/publications/economic_paper/2010/pdf/ecp400_en.pdf.
- Eighan, J., B. Walsh, S. Connolly, M.A. Wren, C. Keegan and A. Bergin (2020). "The great convergence? Mortality in Ireland and Europe, 1956-2014." *Eur J Public Health*. <https://doi.org/10.1093/eurpub/ckaa060>.
- 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 (2009a). *The 2009 Ageing Report: Economic and budgetary projections for the EU-27 Member States (2008-2060)*. European Commission, Brussels
https://ec.europa.eu/economy_finance/publications/pages/publication14992_en.pdf.
- European Commission (2009b). *The 2009 Ageing Report: Underlying Assumptions and Projection Methodologies*. European Commission, Brussels,
http://ec.europa.eu/economy_finance/publications/publication13782_en.pdf.
- European Commission (2011). *The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies*. European Commission, Brussels.

- European Commission (2012a). *The 2012 Ageing Report: Economic and budgetary projections for the 27 EU Member States (2010-2060)*. European Commission, Brussels. <https://doi.org/10.2765/19991>.
- European Commission (2012b). *The 2012 Ageing Report: Underlying Assumptions and Projection Methodologies*. European Commission, Brussels. https://ec.europa.eu/economy_finance/publications/european_economy/2011/pdf/ee-2011-4_en.pdf.
- European Commission (2014). *The 2015 Ageing Report: Underlying Assumptions and Projection Methodologies*. European Commission, Brussels. <https://doi.org/10.2765/76255>.
- European Commission (2015). *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>.
- European Commission (2018). *The 2018 Ageing Report: Economic and Budgetary Projections for the 28 EU Member States (2016-2070)*. The European Commission, Brussels. <https://doi.org/10.2765/615631>
- Falster, M.O., L.R. Jorm, K.A. Douglas, F.M. Blyth, R.F. Elliott and A.H. Leyland (2015). "Sociodemographic and health characteristics, rather than primary care supply, are major drivers of geographic variation in preventable hospitalizations in Australia." *Med Care* 53(5): 436-445. <https://doi.org/10.1097/MLR.0000000000000342>.
- Findlay, R. (2017). *The cost of restoring 18 week waits*. *Health Services Journal*. <https://blog.gooroo.co.uk/2017/11/the-cost-of-restoring-18-week-waits/>.
- Fitzgerald, J. (2018). *National accounts for a global economy: the case of Ireland. QEC Special Article*. ESRI, Dublin. https://www.esri.ie/system/files/media/file-uploads/2018-06/QEC2018SUM_SA_FitzGerald.pdf.
- Fries, J.F. (2002). "Aging, natural death, and the compression of morbidity. 1980." *Bull World Health Organ* 80(3): 245-250, <https://www.ncbi.nlm.nih.gov/pubmed/11984612>.
- Gerdtham, U.G. (1992). "Pooling international health care expenditure data." *Health Econ* 1(4): 217-231. <https://doi.org/10.1002/hec.4730010404>.
- Gerdtham, U.G., B. Jonsson, M. MacFarlan and H. Oxley (1998). "The determinants of health expenditure in the OECD countries: a pooled data analysis." *Dev Health Econ Public Policy* 6: 113-134. https://doi.org/10.1007/978-1-4615-5681-7_6.
- Gerdtham, U.G., J. Sogaard, F. Andersson and B. Jonsson (1992a). "An econometric analysis of health care expenditure: a cross-section study of the OECD countries." *J Health Econ* 11(1): 63-84. [https://doi.org/10.1016/0167-6296\(92\)90025-v](https://doi.org/10.1016/0167-6296(92)90025-v).
- Gerdtham, U.G., J. Sogaard, B. Jonsson and F. Andersson (1992b). "A pooled cross-section analysis of the health care expenditures of the OECD countries." *Dev Health Econ Public Policy* 1: 287-310. https://doi.org/10.1007/978-94-011-2392-1_14.
- 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 (2018a). *Project Ireland 2040: National Development Plan 2018-2027*, Dublin, Ireland.
- Government of Ireland (2018b). *Sláintecare Implementation Strategy*, Dublin, <https://assets.gov.ie/9914/3b6c2faf7ba34bb1a0e854cfa3f9b5ea.pdf>.
- 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%20II%20-%20Expenditure%20Allocations%202021.pdf>.
- Ha, N.T., D. Hendrie and R. Moorin (2014). "Impact of population ageing on the costs of hospitalisations for cardiovascular disease: a population-based data linkage study." *BMC Health Serv Res* 14: 554. <https://doi.org/10.1186/s12913-014-0554-9>.

- Hale, T., N. Angrist, E. Cameron-Blake, L. Hallas, B. Kira, S. Majumdar, A. Petherick, T. Phillips, H. Tatlow and S. Webster (2020). *Oxford COVID-19 Government Response Tracker*, Blavatnik School of Government.
- Hartwig, J. (2008). "What drives health care expenditure? Baumol's model of 'unbalanced growth' revisited." *J Health Econ* 27(3): 603-623. <https://doi.org/10.1016/j.jhealeco.2007.05.006>.
- Hartwig, J. (2011). "Can Baumol's model of unbalanced growth contribute to explaining the secular rise in health care expenditure? An alternative test." *Applied Economics* 43: 173-184. <https://doi.org/10.1080/00036840802400470>.
- Health Insurance Authority (2020). *Annual Report and Accounts 2019*. Health Insurance Authority, Dublin, <https://www.hia.ie/sites/default/files/81105%20HIA%20Annual%20Report%202019%20FULL%20WEB.pdf>.
- Health Service Executive (2019). *National Service Plan 2020*. Health Service Executive, Dublin.
- Health Service Executive (2020a). *Primary Care Reimbursement Service: Statistical Analysis of Claims and Payments 2019*. Health Service Executive, Dublin.
- Health Service Executive (2020b). *Winter Planning within the COVID-19 Pandemic*. Health Service Executive, Dublin, <https://www.hse.ie/eng/services/publications/winter-planning-within-the-covid19-pandemic-october-2020-april-2021.pdf>.
- Healthcare Pricing Office (2019a). *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 (2019b). *Specialty Costing – Instruction and Process Manual for Costing File, Medical Pay File and OPD File*. Health Service Executive.
- 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>.
- HSE Mental Health Division (2019). *Delivering Specialist Mental Health Services 2018*. Dublin, Health Service Executive.
- Hurst, I., I. Liadze, B. Naisbitt and G. Young (2020). *A preliminary assessment of the possible economic impact of the coronavirus outbreak: update*. NiGEM Observations No. 18, 27 March.
- Independent Review Group (2019). *Report of the Independent Review Group established to examine Private Activity in Public Hospitals*. Department of Health, Dublin, <https://assets.gov.ie/26529/aed7ee0317ff49a7a609974772cf2191.pdf>.
- Irish Fiscal Advisory Council (2018). *Stand-Still Scenario for Government Spending in the Medium Term, 2019-2023*. Irish Fiscal Advisory Council, Dublin.
- Irish Fiscal Advisory Council (2020). *Long-term Sustainability Report: Fiscal challenges and risks 2025-2050*. Irish Fiscal Advisory Council, Dublin.
- Jakobsson, E., T. Johnsson, L.O. Persson and F. Gaston-Johansson (2006). "End-of-life in a Swedish population: demographics, social conditions and characteristics of places of death." *Scand J Caring Sci* 20(1): 10-17. <https://doi.org/10.1111/j.1471-6712.2006.00374.x>.
- 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., A. Brick and M.-A. Wren (2018b). *An examination of activity in public and private hospitals in Ireland, 2015*. ESRI. Working Paper No. 601, <https://www.esri.ie/system/files/media/file-uploads/2018-10/WP601.pdf>.
- Lawless, J. (2018). *Hospital Inputs and Outputs: 2014 to 2017*. Department of Public Expenditure and Reform, Dublin.
- Leu, R.E. (1986). The public-private mix and international health care costs. In: A. J. Culyer and B. Jonsson (eds.) *Public and Private Health Services*. Oxford: Basil Blackwell.
- Licchetta Mirko and Michal Stelmach (2016). *Fiscal sustainability analytical paper: Fiscal sustainability and public spending on health*. Office for Budget Responsibility, London, England.

- Licchetta Mirko and Stelmach Michal (2018). *Fiscal sustainability analytical paper: Fiscal sustainability and public spending on health*. Institute for Fiscal Studies, London, England.
- Lindgren, B. (2016). *The rise in life expectancy, health trends among the elderly, and the demand for health and social care. Working Paper No. 142*. National Institute of Economic and Social Research, Cambridge, US.
- 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.
- Lubitz, J., L. Cai, E. Kramarow and H. Lentzner (2003). "Health, life expectancy, and health care spending among the elderly." *N Engl J Med* 349(11): 1048-1055. <https://doi.org/10.1056/NEJMsa020614>.
- Marino, A., D. Morgan, L. Lorenzoni and C. James (2017). *Future trends in health care expenditure: A modelling framework for cross-country forecasts*. OECD Publishing, Paris. <https://doi.org/10.1787/5667f23d-en>.
- Martin, J.J., M. Puerto Lopez del Amo Gonzalez and M. Dolores Cano Garcia (2011). "Review of the literature on the determinants of healthcare expenditure." *Applied Economics* 43: 19-46. <https://doi.org/10.1080/00036841003689754>.
- Mayer, S., C. Fischer, I. Zechmeister-Koss, H. Ostermann and J. Simon (2020). "Are Unit Costs the Same? A Case Study Comparing Different Valuation Methods for Unit Cost Calculation of General Practitioner Consultations." *Value Health* 23(9): 1142-1148. <https://doi.org/10.1016/j.jval.2020.06.001>.
- 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>.
- McQuinn, K., C. O'Toole, M. Allen-Coghlan and C. Coffey (2020). *Quarterly Economic Commentary Autumn 2020*. Economic and Social Research Institute, Dublin.
- McQuinn, K. and P. Varthalitis (2018). *How openness to trade rescued the Irish economy. Working Paper No. 608*. Economic and Social Research Institute, Dublin.
- Mercille, J. (2018). "Privatization in the Irish hospital sector since 1980." *J Public Health (Oxf)*. <https://doi.org/10.1093/pubmed/fdy027>.
- Moscone, F. and E. Tosetti (2010). "Health expenditure and income in the United States." *Health Econ* 19(12): 1385-1403. <https://doi.org/10.1002/hec.1552>.
- Newhouse, J.P. (1977). "Medical-care expenditure: a cross-national survey." *J Hum Resour* 12(1): 115-125. <https://doi.org/10.2307/145602>
- Newhouse, J.P. (1992). "Medical care costs: how much welfare loss?" *J Econ Perspect* 6(3): 3-21. <https://doi.org/10.1257/jep.6.3.3>.
- 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>.
- O'Toole, C. (2020). *The lockdown tale of two economies in Ireland: How big tech and pharma bucked the trend. QEC Special Article*. ESRI, Dublin. <https://doi.org/10.26504/rn20200301>.
- OECD (2019a). *Health at a Glance 2019: OECD Indicators*. OECD Publishing, Paris. <https://doi.org/10.1787/4dd50c09-en>.
- OECD (2019b). *OECD Health Statistics, 2019*. <https://stats.oecd.org>.
- Okunad, A.A. and V.N. Murthy (2002). "Technology as a 'major driver' of health care costs: a cointegration analysis of the Newhouse conjecture." *J Health Econ* 21(1): 147-159. [https://doi.org/10.1016/s0167-6296\(01\)00122-9](https://doi.org/10.1016/s0167-6296(01)00122-9).
- PA Consulting (2018). *Health Service Capacity Review 2018* Department of Health, Department of Health, Dublin, Ireland.
- Parliamentary Budget Office (2019). *The Effect of Changing Demographics on Irish Health Expenditure – An Analysis of Different Approaches and Findings*. Houses of the Oireachtas, Dublin, Ireland, https://data.oireachtas.ie/ie/oireachtas/parliamentaryBudgetOffice/2019/2019-08-28_the-effect-of-changing-demographics-on-irish-health-expenditure-an-analysis-of-different-approaches-and-findings_en.pdf.

- Polder, J.J., J.J. Barendregt and H. van Oers (2006). "Health care costs in the last year of life – the Dutch experience." *Soc Sci Med* 63(7): 1720-1731. <https://doi.org/10.1016/j.socscimed.2006.04.018>.
- Preston, S.H., Y.C. Vierboom and A. Stokes (2018). "The role of obesity in exceptionally slow US mortality improvement." *Proc Natl Acad Sci USA* 115(5): 957-961. [10.1073/pnas.1716802115](https://doi.org/10.1073/pnas.1716802115).
- 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>.
- Seshamani, M. and A. Gray (2004). "Ageing and health-care expenditure: the red herring argument revisited." *Health Econ* 13(4): 303-314. <https://doi.org/10.1002/hec.826>.
- Sexton, E. and D. Bedford (2016). "GP supply, deprivation and emergency admission to hospital for COPD and diabetes complications in counties across Ireland: an exploratory analysis." *Ir J Med Sci* 185(2): 453-461. <https://doi.org/10.1007/s11845-015-1359-5>.
- 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>.
- Smith, S., J.P. Newhouse and M.S. Freeland (2009). "Income, insurance, and technology: why does health spending outpace economic growth?" *Health Aff (Millwood)* 28(5): 1276-1284. <https://doi.org/10.1377/hlthaff.28.5.1276>.
- Tussing, A. and M.-A. Wren (2006). *How Ireland cares: The case for health care reform*. Dublin, New Island.
- 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 and S. Lyons (2020a). *How is Ireland's healthcare system coping with coronavirus?* <https://www.coronavirusedtheconomy.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*. [10.1002/hec.4158](https://doi.org/10.1002/hec.4158).
- Walsh, B., M.-A. Wren, S. Smith, S. Lyons, J. Eighan and E. Morgenroth (2019). *An Analysis of the Effects on Irish Hospital Care of the Supply of Care Inside and Outside the Hospital*. ESRI Research Series No. 91.
- 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>.
- Werblow, A., S. Felder and P. Zweifel (2007). "Population ageing and health care expenditure: a school of 'red herrings'?" *Health Econ* 16(10): 1109-1126. <https://doi.org/10.1002/hec.1213>.
- Whelan, S. (2008). "Projecting population mortality for Ireland." *Journal of the Statistical & Social Inquiry Society of Ireland* 37: 135-163.
- Whelan, S. and R. Naqvi (2019). "Future Life Expectancies in Ireland." *Journal of the Statistical and Social Inquiry Society of Ireland*.
- Whyte, R., M.-A. Wren, C. Keegan and A. Brick (2020). *An analysis of trends in Irish public healthcare expenditure and staffing*. Working Paper No. 660. Economic and Social Research Institute, Dublin.
- Wittenberg, R., B. Hu and R. Hancock (2018). *Projections of Demand and Expenditure on Adult Social Care 2015 to 2040*, Personal Social Services Research Unit, <https://www.pssru.ac.uk/publications/pub-5421/>.
- Wittenberg, R., B. Hu, C. Jagger, A. Kingston, M. Knapp, A. Comas-Herrera, D. King, A. Rehill and S. Banerjee (2020). "Projections of care for older people with dementia in England: 2015 to 2040." *Age Ageing* 49(2): 264-269. <https://doi.org/10.1093/ageing/afz154>

- Wong, A., P.H. van Baal, H.C. Boshuizen and J.J. Polder (2011). "Exploring the influence of proximity to death on disease-specific hospital expenditures: a carpaccio of red herrings." *Health Econ* 20(4): 379-400. <https://doi.org/10.1002/hec.1597>.
- Wren, M.-A. and S. Connolly (2016). *Challenges in Achieving Universal Healthcare in Ireland*. Economic and Social Research Institute (ESRI), Dublin, <https://www.esri.ie/pubs/BP201701.pdf>.
- Wren, M.-A. and A. Fitzpatrick (2020). *How does Irish healthcare expenditure compare internationally?* Economic and Social Research Institute, Dublin. Research Series Number 114.
- 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.
- Xu, K., P. Saksena and A. Holly (2011). *The determinants of health expenditure. A country-level panel data analysis. Working Paper*. World Health Organisation, https://www.who.int/health_financing/documents/report_en_11_deter-he.pdf?ua=1.
- Yang, Z., E.C. Norton and S.C. Stearns (2003). "Longevity and health care expenditures: the real reasons older people spend more." *J Gerontol B Psychol Sci Soc Sci* 58(1): S2-10. <https://doi.org/10.1093/geronb/58.1.s2>.
- Zare, H., A.J. Trujillo, E. Leidman and C. Buttorff (2013). "Income elasticity of health expenditures in Iran." *Health Policy Plan* 28(6): 665-679. <https://doi.org/10.1093/heapol/czs106>
- Zucchelli, E., A.M. Jones and N. Rice (2012). "The evaluation of health policies through dynamic microsimulation methods." *Journal of Microsimulation* 5(1): 2-20, http://microsimulation.org/IJM/V5_1/1_IJM_5_1_spring_2012_Zuchelli_Rice_Jones.pdf.
- Zweifel, P., S. Felder and M. Meiers (1999). "Ageing of population and health care expenditure: a red herring?" *Health Econ* 8(6): 485-496. [https://doi.org/10.1002/\(sici\)1099-1050\(199909\)8:6<485::aid-hec461>3.0.co;2-4](https://doi.org/10.1002/(sici)1099-1050(199909)8:6<485::aid-hec461>3.0.co;2-4).

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