Projections of Demand for Healthcare in Ireland, 2015-2030: First Report from the Hippocrates Model

ESRI presentation to Society of Actuaries

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Outline

- Introduction
- Demographic methods and findings
- Healthy ageing evidence
- Methods: baseline, healthy ageing, unmet need and demand
- Findings: baseline analysis, projections, sensitivity analysis
- Policy implications

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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ESRI/Department of Health Programme

- ESRI Programme in Healthcare Reform began July 2014
- Department/ESRI steering group agrees research programme
- *An Examination of the Potential Costs of Universal Health Insurance in Ireland* (Wren, Connolly and Cunningham, 2015)
- Development of Hippocrates Model of healthcare demand and expenditure began 2015
- *Projections of Demand for Healthcare in Ireland, 2015-2030* (Wren, Keegan, Walsh et al., 2017)
- Currently scoping *Projections of Irish Healthcare Expenditure, 2015-2030*

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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THE HIPPOCRATES MODEL

The Hippocrates Model

Objectives

- Project future demand for services (planning) *and* future expenditure (funding)
- Analyse drivers of demand and cost
- Analyse current and future capacity and staffing needs
- Analyse costs/benefits of reforms e.g. changes to eligibility, models of care

Scope

- *All* health and social care services (acute, primary, community, long-term, mental health, disability)
- Public *and* private demand and expenditures (private hospitals, private payments for GP and other non-acute care)

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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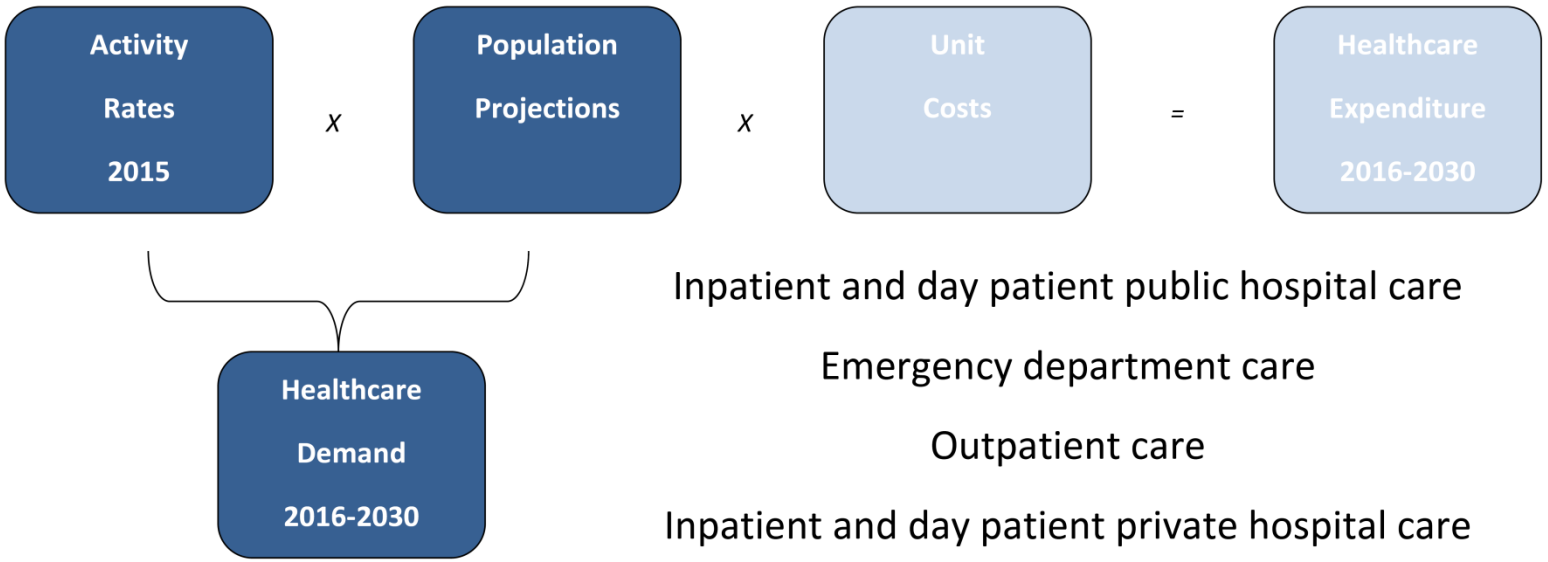
The Hippocrates Model



Inpatient and day patient public hospital care

Emergency department care

Outpatient care

Inpatient and day patient private hospital care

General Practice services

Community pharmaceuticals

Long-term and intermediate care

Community based care – home care

Community based care – allied healthcare professionals

Mental healthcare

Disability services

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Application of model to projecting demand in this report

- Base year and time horizon: 2015 –2030
- Very detailed analysis of healthcare use in 2015
- Comparator projection purely population growth
- Sensitivity analyses vary
  - population growth assumptions
  - healthy ageing assumptions
  - unmet need and demand assumptions
- Preferred projection scenarios developed by sector generate range of projected demand
- Key assumption no change in models of care

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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DEMOGRAPHIC PROJECTIONS

Demographic Context

- Ireland's demographic profile is unusual in an EU context
  - Rapid population growth, 1996-2016: 31%; 6% in EU-28
  - Relative to the EU, have a favourable demographic structure (e.g. 2016: 13% of pop aged 65+; 19% in EU-28)
- However the population is ageing…
  - Between 1996-2016: 64% increase in pop aged 80+
  - And continued population ageing expected over the short to medium term

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Demographic Modelling - Approach

- Modelling Approach: Cohort Component Method
  - In-house demographic model, first projections based on Census 2016
  - Procedure used for projecting the population by single year of age and sex according to assumptions about three *components* of population change (fertility, mortality, and migration)
- Of these components migration is the key driver of total population change in Ireland
  - Migration flows are very sensitive to economic conditions so migration projections need to be consistent with future macro economic outlook – link to macro-model COSMO
  - Migration predominately affects 15-44 age group so limited impact on older age cohorts over projection horizon

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Demographic Modelling - Approach

- Mortality
  - Follow CSO (2013) based on Whelan (2008)
  - General consensus that improvements in life expectancy will continue for the foreseeable future, but at what rate?
  - Targeting Method: assumes short-term rates of improvement in mortality (by gender and age) will slowly (over 25 years) converge (decline) to a long-term rate of improvement and rates of improvement will remain constant thereafter
    - Approach dependent on current trends in mortality

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

Demographic Modelling - Assumptions

- Three different population scenarios (Central, High and Low)
- Each demographic scenario combines different assumptions on fertility, mortality and migration

Component	Assumptions - Central	Assumptions - High
Fertility: Total Fertility Rate	Unchanged at 1.94	Rises to 2.1 by 2021 and constant thereafter
Migration: Net Immigration	Averaging 9,000 p.a. to 2021 and 13,000 p.a. thereafter	Averaging 39,000 p.a. to 2021 and 28,000 thereafter
Mortality: LE at birth	LE at birth to increase from 78.4 to 82.9 years for males and 82.9 to 86.5 for females by 2030	Increase to 83.2 years for males and 86.8 years for females by 2030

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Summary of Population Projections

- Population to increase to between **5.35m** to **5.79m** by 2030 in Central and High scenarios
  - This is an overall increase of between 14 to 23% on 2015
  - Migration is key driver of differences in Central and High scenarios
- The number of older persons is set to increase
  - Population aged 65+: 1 in 8 now. By 2030: 1 in 6
- Central scenario growth between 2015 and 2030:
  - Total: 14%; aged 65+: 60%; aged 80+: 89%
- High scenario growth between 2015 and 2030:
  - Total: 23%; aged 65+: 63%; aged 80+: 94%

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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HEALTHY AGEING EVIDENCE

Determinants of Future Healthcare Demand

- Population Growth
  - The increase in the number in the population will impact overall demand for care.
- Population Ageing and Increased Life Expectancy
  - The age structure of the population will also drive the demand for healthcare.
- Healthy Ageing
  - Although population ageing is often associated with increased healthcare utilisation, competing hypotheses exist about the nature of this relationship.
- Other factors such as effects of technology, higher incomes to be included as model includes expenditure

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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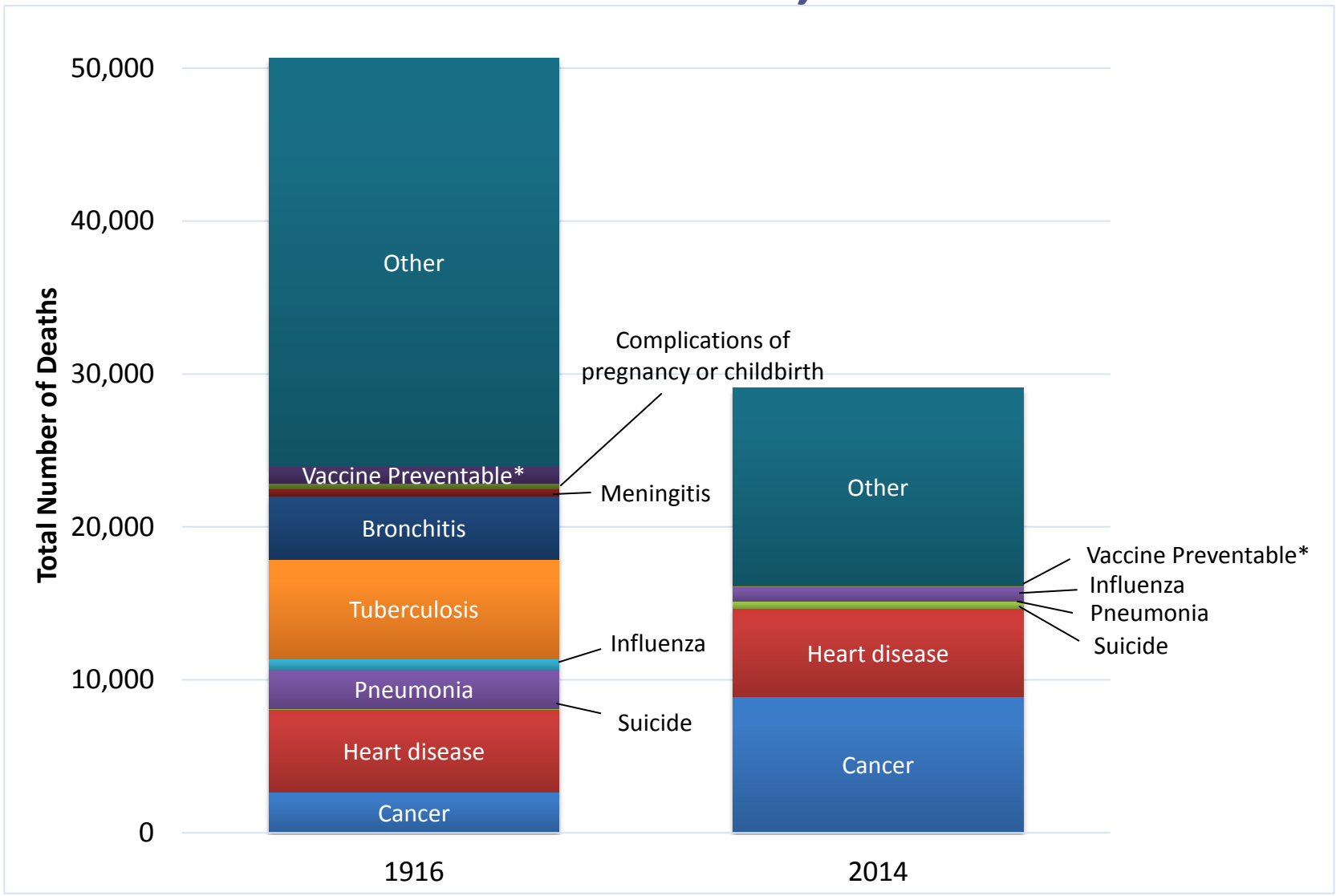
Causes of Death Ireland, 1916 and 2014



Source: Registrar-General Annual Report for 1916, Vital Statistics CSO 2014.

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Healthy Ageing

- Healthy Ageing approaches adopted in this report reflect evidence from the national and international literature
- Where available, evidence from each respective health and social care area examined separately
- There are three main Healthy Ageing assumptions:
  - Expansion of Morbidity
  - Dynamic Equilibrium
  - Compression of Morbidity

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

How Healthy Ageing Scenarios Impact Projected Demand

- **Expansion of Morbidity**
  - As life expectancy increases, additional years of life are spent in bad health (morbidity/disability)
- **Dynamic Equilibrium**
  - As life expectancy increases, the number of years in bad health remains fixed
- **Compression of Morbidity**
  - As life expectancy increases, the number of years in bad health reduces
- **Moderate Healthy Ageing**
  - Intermediate point, halfway between Expansion of Morbidity and Dynamic Equilibrium

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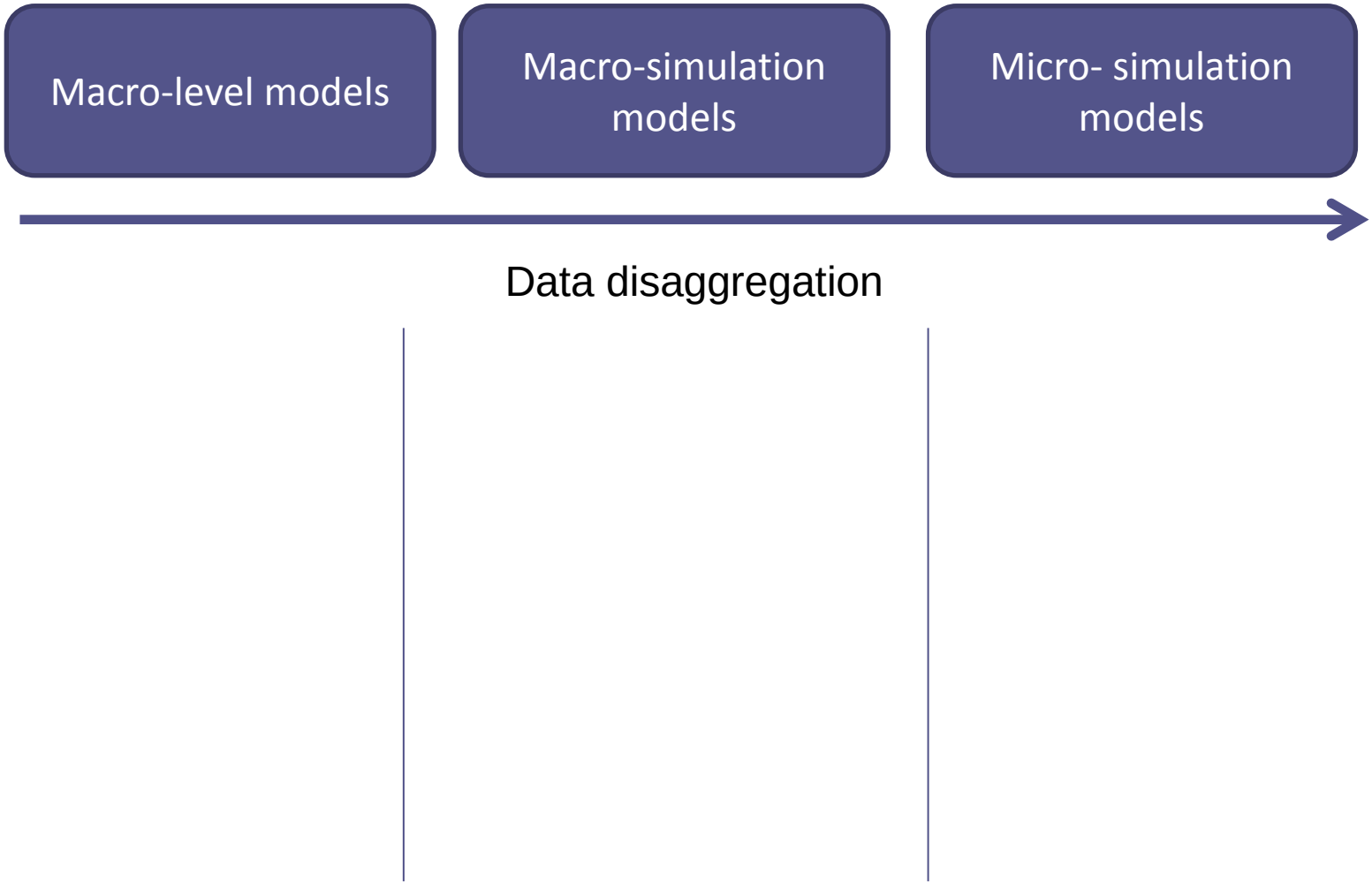
PROJECTION MODEL METHODS

Taxonomy of projection models



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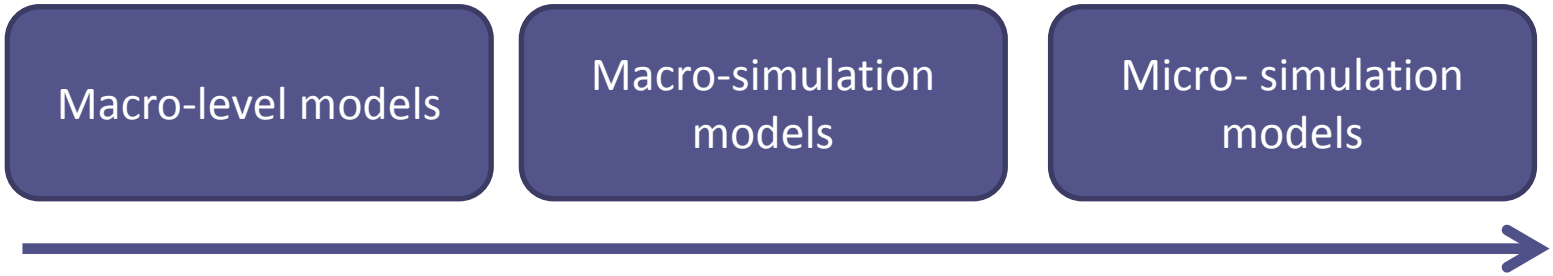

- Aggregate expenditures
- Trend extrapolation
- Limited data requirements
- Appropriate for short term projections

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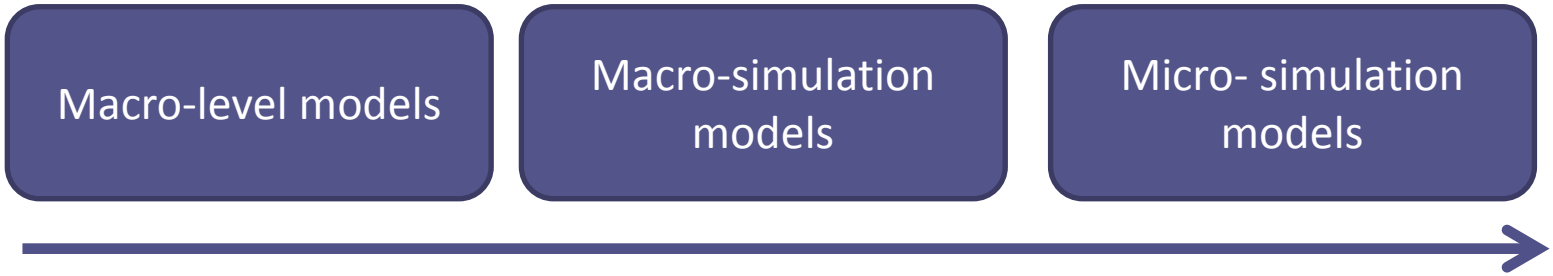

- Aggregate expenditures
- Trend extrapolation
- Limited data requirements
- Appropriate for short term projections

- Activity/cost grouped by cohorts
- Moderate data requirements
- Heterogeneous data aggregation
- Transparent
- Popular approach

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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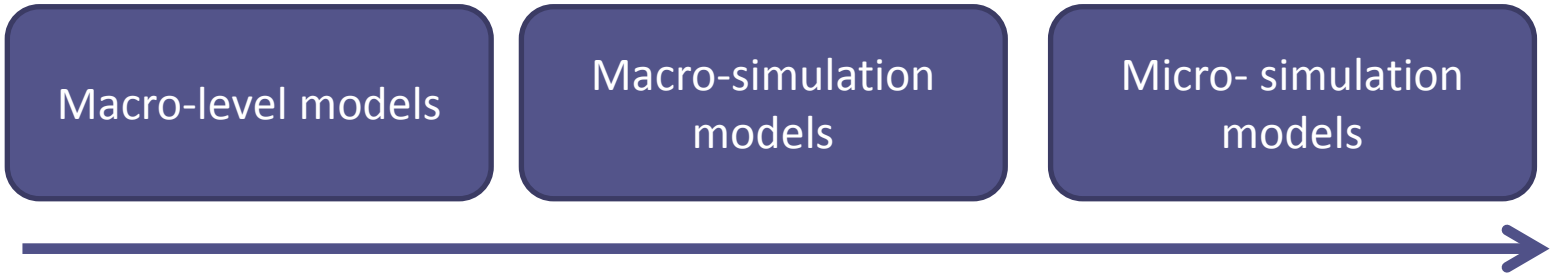

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- Model impact of interventions over lifespans
- Allow for detailed 'what if' modelling
- Substantial data requirements
- Relatively uncommon

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Model construction

- Activity grouped by into cohorts based on limited set of characteristics (e.g. age and sex)

$$R(2015, s, a) = \frac{V(2015, s, a)}{P(2015, s, a)}$$

- Demand for the j^{th} projection year is based on changes in size and structure of the population

$$D(2015 + j, s, a) = R(2015, s, a) * P(2015 + j, s, a)$$

- And aggregated

$$D(2015 + j) = \sum_{s=1}^{2} \sum_{a=1}^{n} D(2015 + j, s, a)$$

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

ADJUSTMENTS TO ACTIVITY RATES
1: HEALTHY AGEING SHIFTS

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Healthy ageing shifts

- The activity rate distribution acts as a proxy for morbidity
- Shift activity curve to the right to represent healthy ageing
- E.g. under dynamic equilibrium if the life expectancy of a 70 year-old is expected to increase by 2 years between 2015 and 2030, then the activity profile of a 70 year old in 2030 will reflect the activity profile of a 68 year old in 2015
- Formally,

$$R(2015 + j, s, a) = R(2015, s, (a - \delta \Delta LE(j, s, a))) \quad iff \; a > 35$$

And

$$\Delta LE(j, s, a) = LE(2015 + j) - LE(2015)$$

- δ = 0 Expansion of Morbidity
- **δ = 0.5** **Moderate Healthy Ageing**
- δ = 1 Dynamic Equilibrium
- δ = 1.5 Compression of Morbidity

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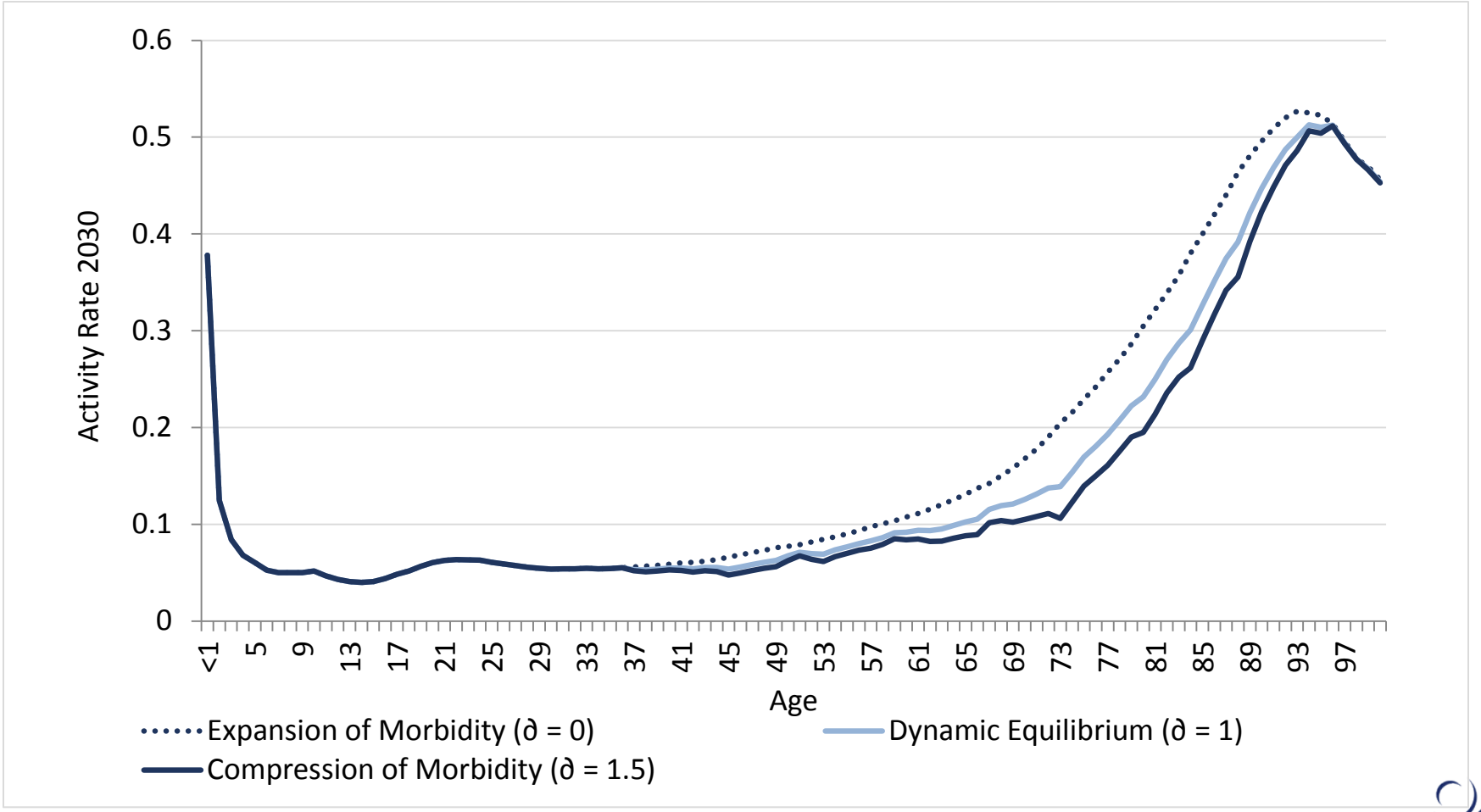
Healthy ageing shifts – example



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Healthy Ageing by Sector

Services	Assumptions
• Hospital inpatient and day cases • EDs • Pharmaceuticals	• **Dynamic Equilibrium**
• General Practice	• **Expansion of Morbidity** • **Moderate Healthy Ageing**
• Residential Long Term Care • Home Care • Physiotherapists; Occupational Therapists	• **Compression of Morbidity** • **Dynamic Equilibrium**
• Public Health Nurses;	• **Moderate Healthy Ageing** • **Dynamic Equilibrium**
• Hospital maternity services • Speech and Language therapists • Hospital Outpatients	• **N/A**

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ADJUSTMENTS TO ACTIVITY RATES 2: UNMET NEED AND DEMAND

Unmet Need/Demand

- Unmet need for care generally understood to refer to a need for care not being met
  - Unmet demand refers to unmet need where care has been sought (e.g. hospital waiting lists)

- Three key factors contribute to unmet need
  - Access e.g. cost
  - Availability
  - Acceptability

- In international reviews, Ireland scores quite badly on levels of unmet need for healthcare, particularly due to access (Koolman, 2007)

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

Unmet Need/Demand

- The model calculates the volume of unmet need/demand in 2015 and applies this to our baseline activity rate

$$D(2015+j,s,a) = \boldsymbol{R'(2015,s,a)} * P(2015+j,s,a)$$

- where

$$R'(2015,s,a) = R(2015,s,a) + R_{un}(2015,s,a)$$

- Survey data (e.g. GP visits, PHN visits)
  - Self-reported levels of unmet need converted into measure of activity
- Administrative waiting list data (e.g. public hospital outpatient and inpatient care, residential LTC places, home help)
  - Unmet *demand* measured at end of the year and converted to activity
  - Avoids double-counting
  - For hospital care, we apply national and international time thresholds

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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ANALYSIS OF HEALTH AND SOCIAL CARE USE, 2015 BASELINE

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Irish health and social care activity 2015 – baseline findings

Sector	Measure of activity	Baseline Volume of activity in 2015/ end 2015 '000s
Public hospitals	Inpatient discharges	514
	Daypatient discharges	1,010
	Inpatient bed days	3,273
	ED attendances	1,138
	OPD attendances	3,299
Private hospitals	Inpatient admissions	133
	Daypatient admissions	459
	Inpatient bed days	613
General practice	GP visits	17,551
	Practice nurse visits	5,944

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Irish health and social care activity 2015 – baseline findings

Sector	Measure of activity	Baseline volume of activity in 2015/ end 2015 '000s
Long-term care	Residents/places	29
	LTC bed days	10,580
Home care	Home help service	66
	HCP recipients	15
	Home help hours	14,311
Allied Healthcare Professionals	Public PT referrals	189
	Public OT referrals	88
	PHN visits	1,362
	Public PT visits	760
	Public OT visits	347
	SLT visits	7

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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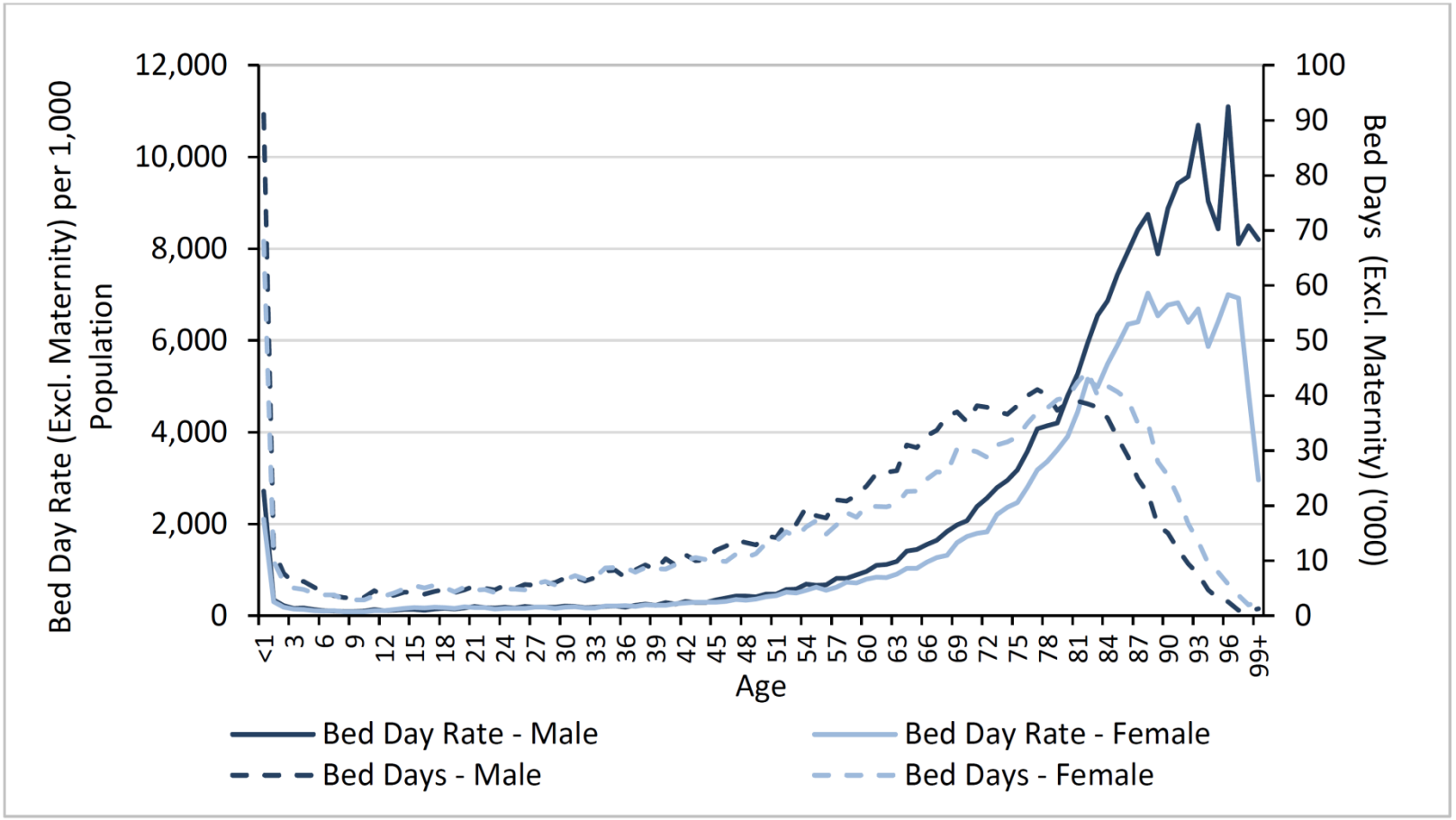
Public hospital inpatient bed days, 2015



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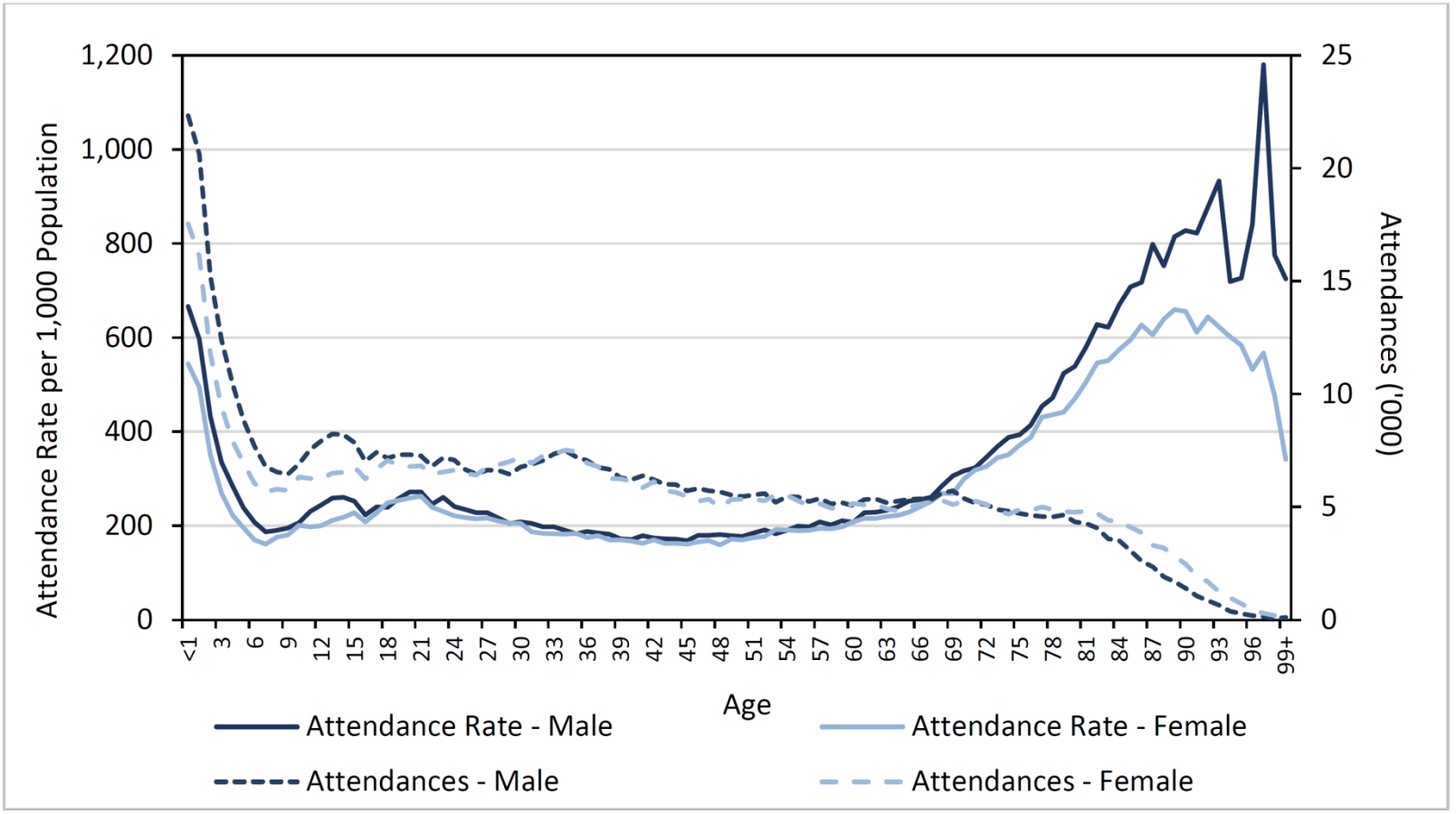
Public hospital ED attendances, 2015



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FINDINGS: PROJECTIONS

Projected demand increase 2015-2030

Sector	Measure of activity	Baseline Volume of activity in 2015/ end 2015 '000s	Lower projection	Upper projection	Lower + unmet demand/ need
			Percentage Increase		
Public hospitals	Inpatient discharges	514	24	30	28
	Daypatient discharges	1,010	23	28	29
	Inpatient bed days	3,273	32	37	36
	ED attendances	1,138	16	26	-
	OPD attendances	3,299	21	29	30
Private hospitals	Inpatient admissions	133	20	25	-
	Daypatient admissions	459	24	28	-
	Inpatient bed days	613	28	32	-
General practice	GP visits	17,551	20	27	22
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Sector	Measure of activity	Baseline Volume of activity in 2015/ end 2015 '000s	Lower projection	Upper projection	Lower + unmet demand/ need
			Percentage Increase		
Long-term care	Residents/places	29	40	54	44
	LTC bed days	10,580	40	54	44
Home care	Home help service	66	44	57	48
	HCP recipients	15	44	57	66
	Home help hours	14,311	38	54	-
Allied Healthcare Professionals	Public PT referrals	189	25	32	32
	Public OT referrals	88	36	41	42
	PHN visits	1,362	26	35	-
	Public PT visits	760	24	30	-
	Public OT visits	347	33	38	-

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FINDINGS: SENSITIVITY ANALYSIS

Sensitivity to population growth

Sector		Public Acute Hospitals		Long-Term Care	Home Help
Activity		Inpatient bed days	ED attendances	Residents	Home Care Packages
Population	Low	-2%	-4%	-2%	-2%
	High	4%	8%	3%	3%
Healthy Ageing	MHA	-5%	-1%	-7%	-7%
	DE	-10%	-3%	-14%	-15%
	CM	-15%	-4%	-22%	-22%
Unmet Need/ Demand	Low	1%		2%	15%
	Med	2%			
	High	3%			

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030*
ESRI Research Series Report

Sensitivity to healthy ageing

Sector		Public Acute Hospitals		Long-Term Care	Home Help
Activity		Inpatient bed days	ED attendances	Residents	Home Care Packages
Population	Low	-2%	-4%	-2%	-2%
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Sensitivity to unmet need/demand

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	Med	2%			
	High	3%			

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Conclusions

- Ireland is unusual in recent and projected rapid population growth
- Population growth is a major driver of demand
- Population growth in older age cohorts will be a major driver of demand even if optimistic healthy ageing assumptions prove correct
- Annual average projected demand growth of 1-3%
- In the context of rising population and labour force

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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Policy implications

- Demand projections have major implications for capacity planning, capital investment, workforce planning and training

- Demand will need to be met in most if not all settings to avoid increased unmet demand

- The healthcare system is currently within this projection period and experiencing these pressures

Source: Wren et al. 2017. *Projections of Demand for Healthcare in Ireland 2015-2030* ESRI Research Series Report

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ESRI report available at:

//www.esri.ie/publications/projections-of-demand-for-healthcare-in-ireland-2015-2030-first-report-from-the-hippocrates-model