# ESRI RESEARCH NOTE

*Inpatient bed capacity requirements in Ireland in 2023:*

*Evidence on the public acute hospital system*

Brendan Walsh and Aoife Brick

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# INPATIENT BED CAPACITY REQUIREMENTS IN IRELAND IN 2023: EVIDENCE ON THE PUBLIC ACUTE HOSPITAL SYSTEM

## Brendan Walsh* and Aoife Brick[1]

### ABSTRACT

In this Note, we provide estimates of public acute hospital inpatient bed requirements in Ireland in 2023, based on earlier ESRI research published by Keegan et al. (2018), the Department of Health's Health Service Capacity Review (2018) and the National Development Plan (2018-2027). Each of these analyses projected hospital bed capacity requirements in Ireland based on a variety of projection scenarios. The Note finds that while absolute, and per capita, public acute hospital inpatient bed capacity has increased in recent years, large bed capacity deficits remain. Focusing on scenarios that assume an 85 per cent occupancy rate, we estimate that in 2023 there may be a bed capacity deficit of approximately 1,000 inpatient beds in public acute hospitals. This bed capacity deficit is likely a key contributor to recent overcrowding issues experienced in public acute hospitals. In addition to the deficit that currently exists in the system, over 300 additional inpatient beds are required per annum to keep up with demand pressures arising from an increasing and ageing population.

## 1. INTRODUCTION

OECD and European Union statistics consistently find the public acute hospital system in Ireland to have amongst the lowest inpatient bed per capita rate compared to comparator countries (Walsh et al., 2020a; OECD and European Union, 2022). In 2019, Ireland reported the highest average occupancy rate, 90 per cent, in the OECD (OECD and European Union, 2022), which is much higher than the frequently referenced 85 per cent occupancy rate above which patient safety risk can arise (Bagust et al., 1999). In its recent *Economic Survey of Ireland*, the OECD included a detailed analysis of health sector performance and efficiency (OECD, 2022). This report further reiterated low levels of capital investment in health infrastructure and capacity constraints, including low numbers of hospital beds associated with inpatient bed occupancy rates above international safety standards. Winter 2022/2023 also saw severe overcrowding experienced by the public hospital system; on 3 January 2023, there were 749 people waiting on trolleys in public acute adult hospitals.[2] It has been acknowledged by the HSE that this overcrowding was caused in part by insufficient bed capacity in public acute

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[2]   TrolleyGAR: http://137.191.241.85/ed/ED.php?EDDATE=03%2F01%2F2023.

* Brendan.Walsh@esri.ie

hospitals, and may continue for a number of years as the 'process to build beds is a long one'.[3]

The objective of this Note is to provide estimates of projected public acute hospital inpatient bed requirements in Ireland in 2023, and the additional capacity needed in the coming years to meet demand. The estimates are based upon existing public acute hospital inpatient bed projections for Ireland from three published sources; the ESRI (Keegan et al., 2018), the Department of Health's Health Service Capacity Review (2018) (PA Consulting, 2018), and the National Development Plan (2018-2027). The analysis based on the existing evidence linearly projects bed requirements for 2023.

The three publications on which these updated estimates are based are:

- Keegan et al. (2018). *How many beds? Capacity implications of hospital care demand projections in the Irish hospital system, 2015-2030*.

- PA Consulting (2018). *Health Service Capacity Review (HSCR) 2018*. The analyses in this review were compiled by PA Consulting on behalf of the Department of Health.

- Government of Ireland (2018). *National Development Plan (NDP) 2018-2027*.

## 2. PROJECTION SCENARIOS

Each of the publications provided projections, rather than forecasts, based upon demand and capacity in a baseline year (varying from 2015-2018) and a range of underlying assumptions and scenarios outlined in Tables 1-3. The use of more recent base year data (e.g. 2022) may result in differing demand and capacity estimates.

### 2.1    ESRI projections (Keegan et al., 2018)

This paper projected public acute hospital bed capacity requirements in Ireland from 2015-2030 based on the ESRI Hippocrates model.[4] Table 1 outlines the main assumptions made across the six scenarios included in the paper and projected inpatient bed requirements in 2030. Each scenario varies assumptions about population size, unmet demand (inpatient waiting lists), Healthy Ageing (this reflects the assumed changes in health and life expectancy), and efficiencies that

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3    Comments from the interim HSE CEO to the Joint Committee on Health, January 17, 2023. https://data.oireachtas.ie/ie/oireachtas/debateRecord/joint_committee_on_health/2023-01-17/debate/mul@/main.pdf.
4    Financial support for the development of the Hippocrates model was provided by the Department of Health through the ESRI/Department of Health Research Programme in Healthcare Reform.

could be made by reducing average length of stay (ALOS) and avoidable hospitalisations. Varying assumptions allow the wider possibility of needs to be accounted for, and provide controls for the inherent uncertainty in all projection exercises.

**TABLE 1        ESRI 'HOW MANY BEDS?' PROJECTION SCENARIOS AND ASSUMPTIONS**

| Scenarios | ASSUMPTIONS | | | | | | 2015 Baseline beds | 2030 Projected bed requirements |
|---|---|---|---|---|---|---|---|---|
| | Population growth | Healthy ageing[a] | Unmet demand | Public hospital inpatient occupancy rate | Public hospital ALOS | Avoidable hospitalis-ation rate reduction | | |
| **1. Status Quo** | Central | EM | None | No change | No change | No | 10,363 | 14,797 |
| **2. Healthy Ageing** | Central | DE | None | No change | No change | No | 10,363 | 13,359 |
| **3. High Population growth** | High | DE | None | No change | No change | No | 10,363 | 13,917 |
| **4. (2) + addressing unmet demand** | Central | DE | Yes | No change | No change | No | 10,363 | 13,740 |
| **5. (4) + reducing bed occupancy** | Central | DE | Yes | Converge to 85% by 2030 | No change | No | 10,363 | 15,308 |
| **6. (5) + reducing ALOS + reducing avoidable hospitalisations** | Central | DE | Yes | Converge to 85% by 2030 | Reduce ALOS by 10% by 2030 | 33% reduction in avoidable hospita-isation rate by 2030 | 10,363 | 12,983 |

*Source:*    Adapted from Keegan et al. (2018).
*Note:*    The 'expansion of morbidity' (EM) hypothesis assumes that additional life years gained are spent in bad health. The 'dynamic equilibrium' (DE) hypothesis posits that as life expectancy increases, all gains in life expectancy are spent in good health (or mild ill-health).

## 2.2    Health Service Capacity Review (2018) and NDP projections (2018-2027)

Tables 2 and 3 outline the main assumptions made across all scenarios within the HSCR and NDP reports, to the best of the authors' interpretation of the published reports. In Table 3, the Note assumes the base year (2018), and projections end year (2027) equate to the time-period of the NDP.

**TABLE 2 PROJECTION SCENARIOS FROM HEALTH SERVICE CAPACITY REVIEW (HSCR)**

| Scenarios | Assumptions | 2016 Baseline beds | 2021 | 2026 | 2031 Projected bed requirements |
|---|---|---|---|---|---|
| **Baseline (85%)** | | 10,500 | 13,000 | 14,500 | 16,300 |
| **Reform Scenario 1 (85%)** | Improved health and wellbeing | 10,500 | 13,100 | 14,200 | 15,500 |
| **Reform Scenario 2 (85%)** | Improved management of patients with complex comorbidities | 10,500 | 12,400 | 12,900 | 14,400 |
| **Reform Scenario 3(B) (85%)** | Improvements to patient flow through hospitals | 10,500 | 12,700 | 13,800 | 15,500 |
| **All Reforms (85%)** | 1+2+3(B) | 10,500 | 13,100 | 14,200 | 12,600 |

*Source:* Adapted from PA Consulting (2018).

**TABLE 3 PROJECTION SCENARIO FROM NATIONAL DEVELOPMENT PLAN (2018-2027)**

| Scenario | Assumptions | 2018 Baseline beds | 2027 Projected bed requirements |
|---|---|---|---|
| **NDP scenario** | 2,600 additional acute hospital beds (assumed 2018-2027). | 10,856 | 13,456 |

*Source:* Authors' interpretation of Government of Ireland (2018).

The 2015 baseline figure of 10,363 in the ESRI paper differs slightly from the 10,473 available inpatient beds reported in *Health in Ireland: Key Trends 2022* (Department of Health, 2022). Similarly, the 2016 baseline figure in the HSCR of 10,500 differs slightly from the 10,592 available inpatient beds reported in *Health in Ireland: Key Trends 2022*.

In this Note, only projection scenarios that assume a maximum of 85 per cent average bed occupancy are examined. There is growing evidence that insufficient bed capacity and high bed occupancy rates are linked to higher patient mortality, poor in-hospital outcomes, and risks to hospital staff welfare (Keegan, 2010; Madsen et al., 2014; Bosque-Mercader and Siciliani, 2022). High bed occupancy also results in overcrowding on hospital corridors and in Emergency Departments (as regularly experienced in Ireland, particularly in Winter 2022/2023) (Morley et al., 2018; Turner et al., 2020). The 85 per cent average occupancy rate threshold has been adopted by the OECD and other systems as an upper average threshold for hospitals to aim for. In Ireland, the Irish Paediatric Critical Care Audit (Healy et al., 2022), and recent Department of Health research (Shine and Hennessy, 2022) have used 85 per cent as a recommended limit when examining bed occupancy rates. The HSCR stated Ireland's 'occupancy rate is abnormally high' and estimated their bed projection based upon 'a more acceptable occupancy rate of 85 per cent' (PA Consulting, 2018, p.61).

### 3. INPATIENT BED AND POPULATION DATA

#### 3.1 Inpatient bed data

Public acute hopsital inpatient bed information from 2015-2021 were sourced from *Health in Ireland: Key Trends 2022* (Department of Health, 2022).[5,6] At the time of writing, no data on the number of inpatient beds available in December 2022 had been published. In this Note we estimate the December 2022 figure by adding the 907 acute beds that have been stated to have been delivered since 1 January 2020 according to the 2022/2023 HSE Winter Plan.[7] The December 2023 figure reflects an additional 321 beds funded and due by year end 2023 according to the 2022/2023 HSE Winter Plan.

#### 3.2 Population data

Published Census 2016 and Census 2022 data were used for each respective year to estimate:

- beds per 1,000 population (all ages), and

- beds per 1,000 population aged 65+.

Intercensal year populations are estimated by taking a linear trend between Census 2016 and Census 2022. Per capita estimates in Figures 3 and 4 include the published populations in Census 2016 and Census 2022.

### 4. RESULTS

Figure 1 outlines the 'actual' inpatient beds in public acute hospitals, and the projected inpatient bed requirements in Ireland using scenarios within the ESRI, HSCR, and NDP reports. Only projection scenarios that include an 85 per cent occupancy rate assumption are included in this Note. While five scenarios were presented in the HSCR, only the baseline 'without reforms' and the 'with all reforms' scenarios are included.

Figure 1 shows that between 2015 and 2022, an estimated 1,385 inpatient beds were opened in public acute hospitals. The majority of these beds (1,000) were opened since 2018. However, projected requirements have outpaced actual inpatient bed capacity for all scenarios, except for the HSCR 'with all reforms'

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5    We assume that bed information relates to end of year beds available, based upon the fact that in some years (e.g. 2020) the bed number equates to that reported in the Department of Health *Open Beds Report* for December of that year. https://assets.gov.ie/126246/5d94fe72-9a9d-4118-9b99-0412d2c5506a.pdf.

6    Since 2021, the National Rehabilitation Hospital acute beds (104 beds) were included in the Department of Health *Open Beds Reports,* but were not included previously.

7    https://www.hse.ie/eng/services/news/media/pressrel/winter-plan-2022-23.pdf.

scenario. Based on ESRI projection Scenario 5, an approximate 330 inpatient beds are required per annum to meet demand projections.
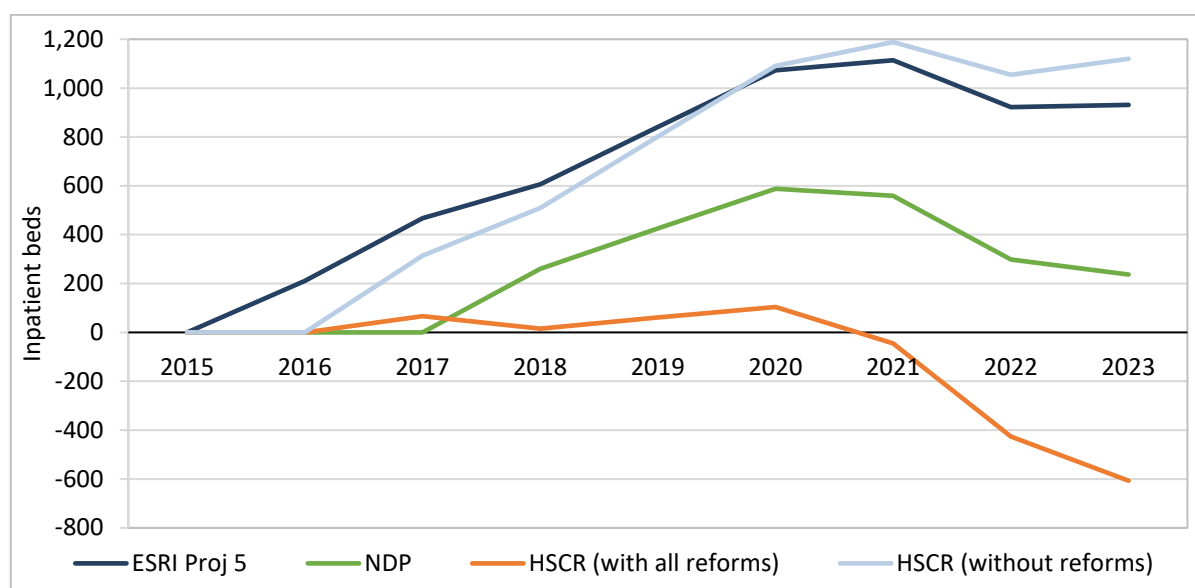
**FIGURE 1** **PUBLIC ACUTE HOSPITAL INPATIENT BEDS AND ESTIMATED INPATIENT BED REQUIREMENTS**
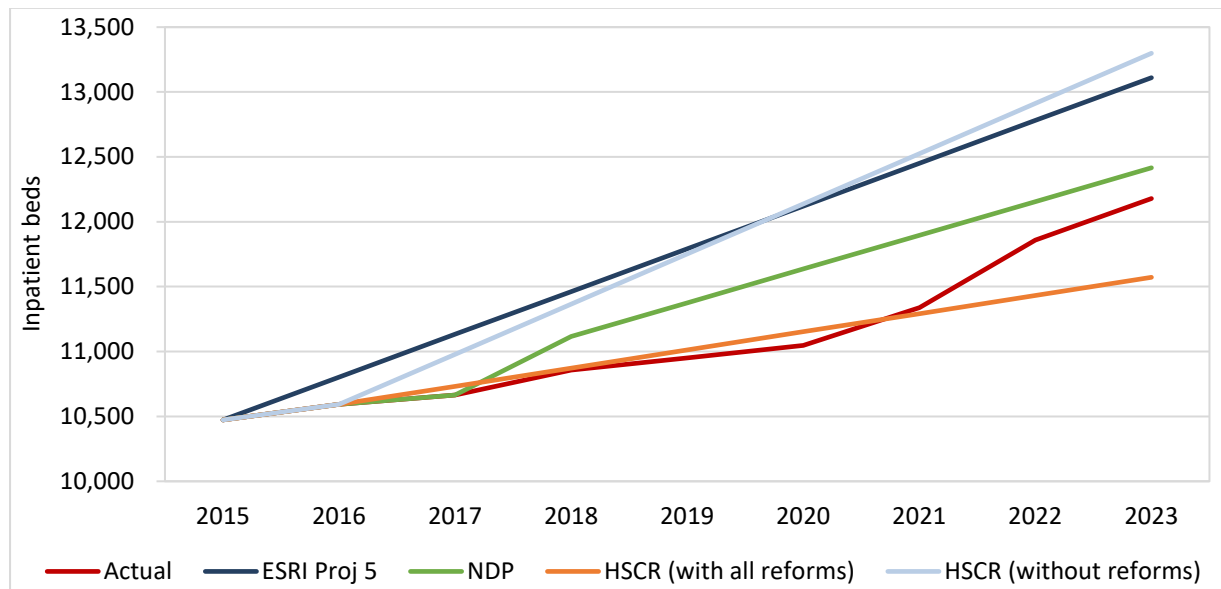


*Sources:* Authors' calculations based on Government of Ireland (2018); Keegan et al. (2018); PA Consulting (2018); Department of Health (2022); Health Service Executive (2022).
*Note:* Series break: 2022 and 2023 'actual' beds based upon 2022/2023 HSE Winter Plan.

Figure 2 shows the estimated bed shortfall by subtracting projection estimates (Figure 1) from actual beds reported for each year. The HSCR 'without reforms' scenario and ESRI projection Scenario 5 show the largest shortfall of over 1,100 and 900 beds by the end of 2023 respectively. This equates to a relative shortfall of up to 8 per cent. The NDP scenario shows a shortfall of almost 240 beds. The 'with all reforms' HSCR scenario estimates that current levels are over 600 beds above the estimated requirements.

FIGURE 2        PUBLIC ACUTE HOSPITAL INPATIENT BEDS ESTIMATED SHORTFALL



*Sources:*    Authors' calculations based on Government of Ireland (2018); Keegan et al. (2018); PA Consulting (2018); Department of Health (2022); Health Service Executive (2022).

The ESRI analyses (Keegan et al., 2018) estimated a number of other projection scenarios not included in Figures 1 and 2 (see Table 1). Projection Scenario 6 examined efficiency and model of care changes, and showed that reducing ALOS by 10 per cent and avoidable hospitalisations by 33 per cent would considerably reduce inpatient bed requirements. We do include this scenario in this analysis as ALOS actually increased in the intervening years.[8]

The ESRI analyses also estimated bed capacity requirements using both central and high population assumptions.[9] Projection Scenario 5 included a central population assumption. In reality, recent data from Census 2022 show a national population that was approximately halfway between the central and high population projections. Therefore, ESRI projection Scenario 5 bed requirements estimated in Figure 2 may be an underestimate based upon recent population increases.
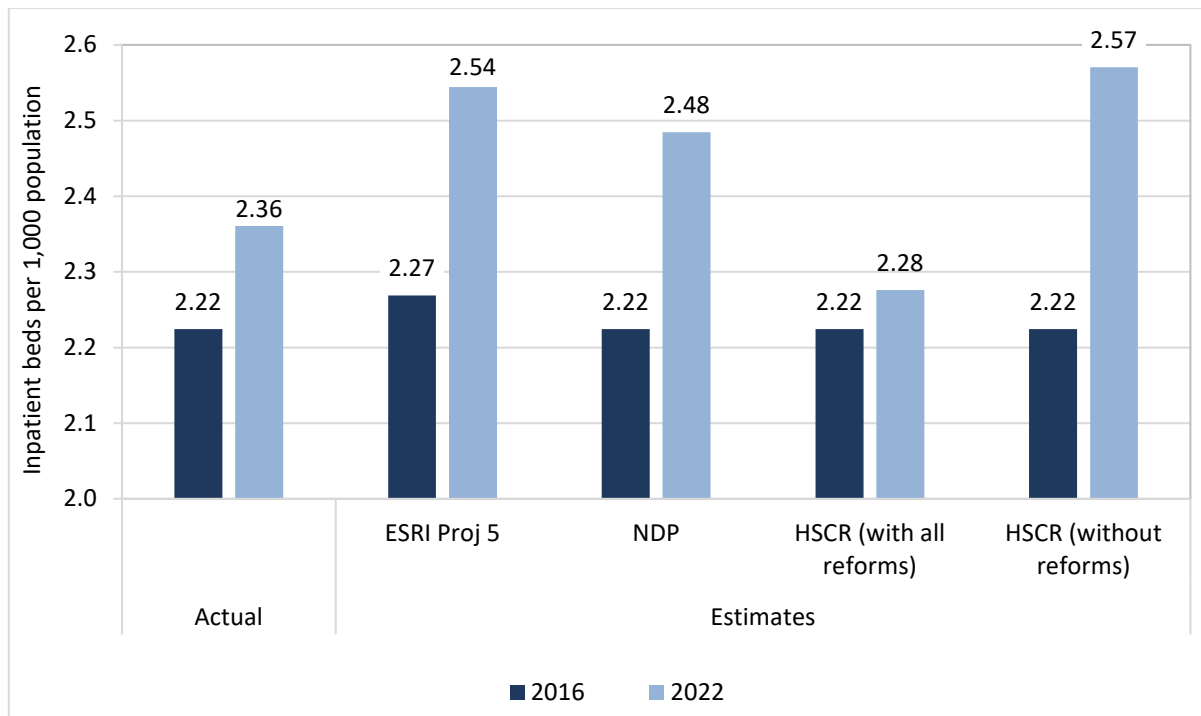
Figure 3 presents estimates of inpatient beds per 1,000 population in 2016 and 2022, the years in which censuses were carried out. We divide the number of actual and projected beds in 2016 and 2022 by the population size in each census year. The increases in public acute hospital inpatient bed capacity that have occurred in recent years have increased beds per capita. However, these increases have come off historically low bed capacity levels. The HSCR baseline scenario and ESRI

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[8]    See *Activity in Acute Public Hospitals in Ireland* 2019-2021 reports at http://www.hpo.ie.
[9]    Details on both population assumptions can be found in Keegan et al. (2018) and Wren et al. (2017).

projection Scenario 5 show per capita bed deficits of 0.18 and 0.21 beds per 1,000 population.
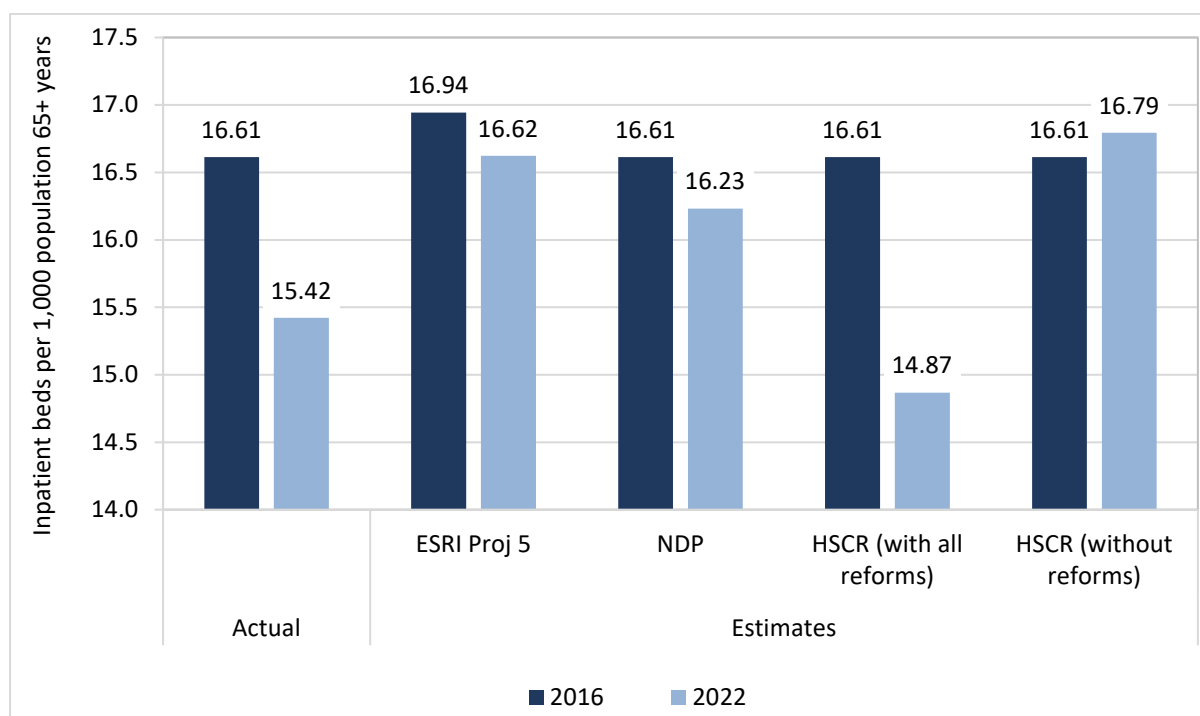
*Sources:*   Authors' calculations based on Government of Ireland (2018); Keegan et al. (2018); PA Consulting (2018); Central Statistics Office (2022); Department of Health (2022); Health Service Executive (2022).
*Note:*      Series break: 2022 and 2023 'actual' beds based upon 2022/2023 HSE Winter Plan.

Patients aged 65+ used over 55 per cent of all inpatient bed days in 2021 (Healthcare Pricing Office, 2022). Figure 4 estimates inpatient beds per 1,000 population aged 65+ in 2016 and 2022, the years in which censuses were carried out. We divided the number of actual and projected beds in 2016 and 2022 by the population size aged 65+ in each census year. The HSCR 'without reforms' baseline scenario is the only scenario where bed requirements per population aged 65+ increase over time. The optimistic dynamic equilibrium healthy ageing assumption, and population growth at older ages, made within ESRI projection Scenario 5 may explain some of the small reductions in bed requirements per population aged 65+.

**FIGURE 4    PUBLIC ACUTE HOSPITAL INPATIENT BEDS AND ESTIMATED INPATIENT BED REQUIREMENTS PER 1,000 POPULATION AGED 65+ YEARS**



*Sources:*    Authors' calculations based on Government of Ireland (2018); Keegan et al. (2018); PA Consulting (2018); Central Statistics Office (2022); Department of Health (2022); Health Service Executive (2022).
*Note:*    Series break: 2022 and 2023 'actual' beds based upon 2022/2023 HSE Winter Plan.

## 5.    CONCLUSIONS

Population increases, especially at older ages, will continue to increase demand for hospital care. The Irish population is projected to increase by 1 per cent on average per annum out to 2035, with the population aged 65+ projected to increase by 3.5 per cent on average per annum. This means that additional public acute hospital capacity will be required. Where appropriate, transferring care from hospitals into the community and lower acuity care settings (e.g. step-down and rehabilitation facilities) in line with Sláintecare is also needed. For instance, on 10 January 2023, there were 524 people in public acute hospitals categorised as delayed in the transfer of care (DTOC) awaiting discharge.[10] Previous ESRI evidence has shown that increases to post-acute care supply, such as home support, can reduce length of hospital stays, especially for those who are likely to be DTOC patients (Walsh et al., 2020b). Adopting Sláintecare proposals to reduce DTOC numbers will also reduce hospital bed capacity needs. However at least in the medium term, and in the context of Ireland's rapidly changing demographic position and long waiting lists for care, policymakers should be realistic about the need to invest in the acute hospital system. In this context, some of the more

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[10]    Comments from the HSE CEO to the Joint Committee on Health, January 17, 2023. https://data.oireachtas.ie/ie/oireachtas/debateRecord/joint_committee_on_health/2023-01-17/debate/mul@/main.pdf.

optimistic projection scenarios listed in the HSCR and NDP may underestimate bed capacity needs, especially without substantial improvements in primary and community-based care, and patient flow into post-acute settings, occurring. Meanwhile additional bed capacity will also require sufficient workforce to provide care. To inform workforce planning, a recent ESRI analysis using the Hippocrates Model also projected the workforce requirements for public acute hospitals to 2035, at both a national and regional level (Keegan et al., 2022).

This Note estimates that in 2023, based on ESRI projection Scenario 5 from Keegan et al. (2018), there may be a shortfall of over 900 beds in Irish public acute hospitals. This is despite the additional hospital bed capacity added in recent years. This shortfall increases the likelihood of overcrowding issues remaining a common feature of the Irish public acute hospital system in the short term. Examining average annual bed capacity requirements, ESRI projection Scenario 5 also estimates that an additional 330 inpatient beds may be required in the public acute hospital system, in addition to the over 900-bed shortfall that exists in 2023.

Keegan et al. (2018) estimated a number of sensitivity analyses that examine the percentage change in projected bed capacity if key assumptions (e.g. population size, healthy ageing, inpatient bed occupancy, ALOS) were altered. Those analyses highlighted that assuming a higher occupancy rate, e.g. 90 per cent, would reduce estimated bed requirements. However, the evidence linking high occupancy rates to poor patient- and system-level outcomes means the benefits of using high occupancy to determine bed capacity requirements would ultimately result in insufficient supply and continued periods of overcrowding in the system.

The Note finds that while inpatient beds per capita have increased, they remain amongst the lowest in the OECD. While the Note also finds that despite the population aged 65+ using more than half of all inpatient bed days, beds per 1,000 population aged 65+ have decreased considerably in recent years.

A number of caveats should be remembered when interpreting analyses in this Note. First, including a more recent base year data (e.g. 2022) may result in differing demand profiles and therefore different bed capacity estimates. Second, the impact of COVID-19 on population health and hospital demand is not incorporated in the estimates for this Note as all projection analyses exercises preceded the pandemic. The lasting effects in terms of infection control measures, COVID-19 outbreaks in hospitals, and increases in public hospital waiting lists may mean the estimates in Figure 2 underestimate the bed capacity shortfall in 2023. Third, it was necessary to estimate 2022 and 2023 inpatient bed figures as at the time of writing no published data exist on current bed numbers. Up-to-date

validated day patient and inpatient bed data from a single source would allow for an increased ability to examine hospital bed capacity requirements. Finally, while the analyses highlighted inpatient beds, it is important to understand that bed requirements must be considered in the context of infrastructure, workforce (clinical and non-clinical requirements; see Keegan et al., 2022), and overheads.

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