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Hospital Performance: An Analysis of HSE Key Performance Indicators

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Paper Summary

- A growing divergence between hospital expenditure and activity has been observed since 2017 which motivates consideration of performance. This paper provides an overview of hospital performance across the years 2017-2021 by analysing 18 Key Performance Indicators (KPIs) at a Regional Hospital Area (RHA) level, hospital model level, and at an individual hospital level covering three aspects of hospital performance: Emergency Department Services, Acute Medical/Surgical Services, and Medical Safety.

- Variation in performance is observed across hospitals and regions for each area examined and also relative to HSE set targets. In some cases, hospitals with persistent non-compliance with HSE performance targets can be identified for a given KPI, highlighting the need for subsequent analysis to identify drivers and potential remediatory intervention. The analysis also highlights the need for a more concise and focused set of performance targets for the acute care system in Ireland to facilitate this subsequent analysis.

- The authors acknowledge that performance on the KPIs examined have a multitude of drivers including varying demographics, healthcare needs, management practices/processes or resources available in each hospital, and that this is a key limitation of the analysis. The identification of hospital performance relative to KPIs remains valuable as it enables agile identification of areas for additional exploration and remediation within the acute care system.

Findings

- **ED Waiting Times:** Wide variation in ED wait times across hospitals is observed. At a hospital level, 23 out of 26 (88%) hospitals are below the HSE designated target of 70% admissions within six hours. ED wait time performance in hospitals is persistent across years, indicating that interventions to reduce long waits have been potentially ineffective. The literature demonstrates that ED wait times can have significant clinical consequences for patients, so further remediatory actions should likely be taken to reduce these costs.

- **Incomplete Treatment in ED Settings:** Incomplete treatment represents a patient safety concern and an inefficiency in the provision of emergency department services. Relative to the HSE set target - < 6.5% - substantial differences in hospital performance is identified, with performance varying from 16.7% of patients having incomplete treatment in St James, to 1.3% in St Luke's Kilkenny.

- **Acute Medical Assessment Unit (AMAU) Utilisation:** Potential under-utilisation of AMAUs is observed across the acute care system, with 19 out of 29 hospitals having AMAU discharge rates below HSE targeted level. Effective utilisation of AMAUs is shown in the literature to reduce hospital average length of stay (ALOS), reduce ED wait times for beds, improve the rate of appropriate treatment, and reduce all-cause in-hospital mortality. Further research is needed to determine potential interventions for increasing AMAU utilisation, and whether current targets could be refined to account for differences in patient and hospital characteristics such as patient complexity.

- **Medical Readmissions:** Readmissions to hospital have an associated clinical and economic cost. In total, 10 out of 29 hospitals have readmission rates higher than the HSE target of 11.1%, with these hospitals in every case being model 2 and 3 facilities. Targeted intervention to reduce readmissions and learning from peer hospitals with lower readmissions rates could therefore be a useful avenue of exploration for performance improvement in the Irish healthcare system.

- **Elective Day-Of-Surgical-Admission:** HSE Model of Care guidelines outline numerous benefits from admission of patients on day of surgery. Compliance for hospitals on this metric is mixed, with 22 out of 30 hospitals having day of surgery admission rates above 70% (compared to a national HSE target of 80%). A few hospitals are identified as underperformers on this metric, with St. James having a day of surgical admission rate of 16.5%. Further analysis is therefore required to explore whether improvements can be made for a select group of hospitals on this metric.

- **Delayed Transfer of Care:** Delayed Transfers of Care have a material impact on bed utilisation levels in Irish hospitals, with 7% of all bed days used attributable to patients suitable for discharge. The HSE has set a target for Delayed Transfers of Care affecting 200k discharges in 2019, falling to 175k in 2021. In 2019 a total of 240,000 beds were subject to delayed transfer of care, with this dropping to 141,666 in 2021. Substantial regional and hospital level variation in the level of delayed transfer of care is also identified, with for example 10% of bed days used in the north Dublin border region (RHA A) attributable to patients awaiting discharge compared to just 4% in Connacht / Donegal (RHA F).

- **Patient Safety:** Hospital acquired infections (HCAIs) and medication incidents pose costs for both patients and hospitals. Incidence of HCAIs is spread across all hospitals, although hospitals of greater complexity appear to have higher rates of infection for *S. aureus*, while no clear linkage is present for *C. difficile* infections. A greater focus on mitigating the spread of *C. difficile, CPE*, and *S. aureus* may be a cost-effective strategy to improve hospital performance, although further research would be required to determine what achievable reductions in HCAIs are in each hospital model or RHA.

Recommendations

- **Review of the HSE Acute care active performance management system:** Non-compliance with HSE specified key performance indicators is observed for many hospitals for all years examined. The persistence of below target performance across years, and the non-comparability of some KPIs across hospitals draws into question the efficacy of the current regime in promoting active performance management and policy intervention. Authors would encourage a review of the existing list of HSE acute care performance indicators, providing a concise list of KPIs and targets against which hospital performance can be actively monitored and managed.

- **Learnings and identification of areas for active performance management:** This paper identifies hospitals and regions that have the highest and lowest levels of compliance for each KPI examined. While the drivers of performance on these metrics is multi-factoral, performance across each KPI nonetheless may enable a more systematic approach to identifying improvements to the acute care delivery. Areas for further examination include the drivers of long ED wait times, high rates of incomplete treatment, under-utilisation of AMAUs and the rates of healthcare acquired infections in some hospitals.

- **Remediatory Interventions to improve hospital performance:** Where appropriate, focused interventions to improve hospital performance on designated KPIs should be undertaken such as the in the areas outlined above. The benefits of improved performance on designated KPIs are in most cases quantifiable, so the level of potential investment to be undertaken should be reflective of this with costs commensurate or lower than potential benefits.

1. Introduction

1.1. Motivation

Content

The paper provides an overview of hospital performance utilising HSE National Service Plan Key Performance Indicators as its primary mode of analysis. The paper specifically focusses on the areas of unscheduled care performance, efficiencies in hospital admission and discharge (for example, admission pathways & Delayed Transfer of Cares), and patient safety. The paper examines performance across Regional Health Areas ("RHAs") and hospitals on numerous Key Performance Indicators, aiming to provide:

- An evaluation of the currently performance management system in the HSE;
- Identify areas for improvement across RHAs and hospitals and;
- Provide learnings for approaches to improve performance in hospitals on the suite of KPIs examined;

This research provides a high-level overview of several hospital performance areas, with subsequent analysis likely to focus on the identification of core drivers and dynamics in a given area so that policy can be designed to enhance performance.

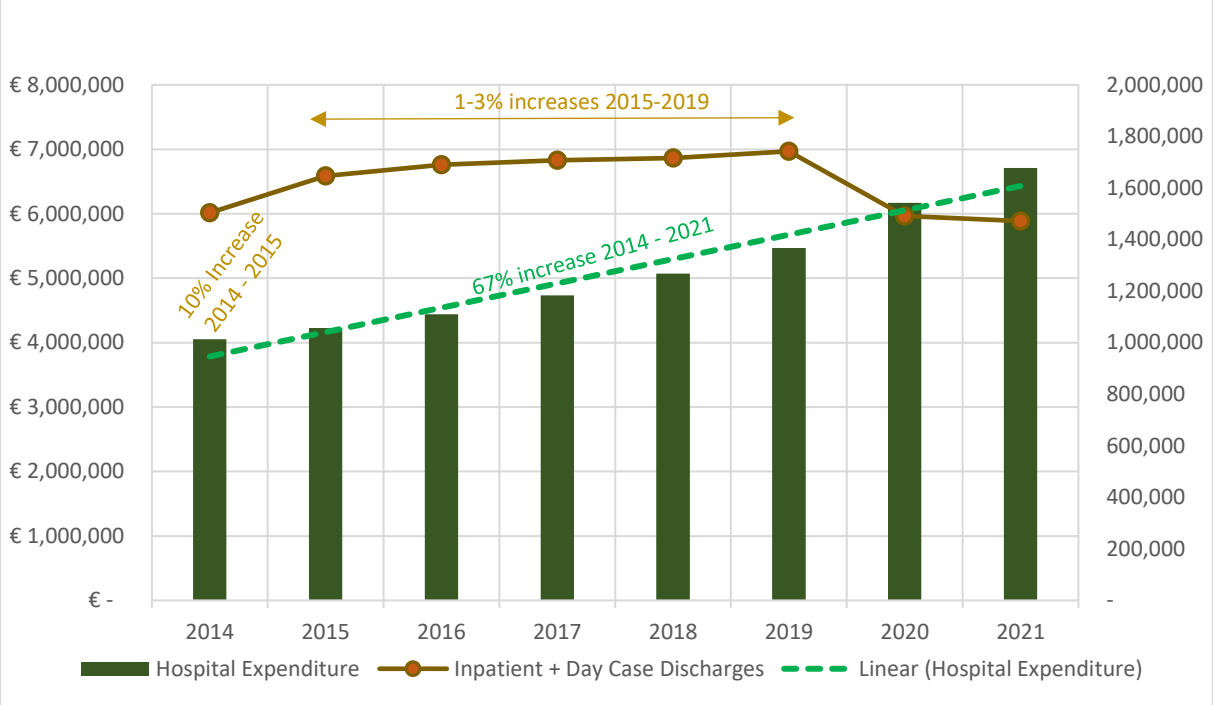
Recent Trends in Acute Care Expenditure and Outputs

Acute care is where a patient receives active but short-term treatment for a severe injury or episode of illness, an urgent medical condition or during recovery after surgery. There is a wide variety of services delivered in this context, including inpatient scheduled care, unscheduled or emergency care, maternity care, outpatient care, and diagnostic services. Under Sláintecare reforms the role of acute hospitals in the healthcare system is expected to fundamentally change, with more care delivered in the community, and acute care being reserved for treatment of patients with more intensive care needs (Government of Ireland, 2018).

Acute care constitutes roughly a third of overall expenditure per year. In nominal terms, expenditure on acute care has grown considerably in recent years, rising from €4.05bn in 2014 to €6.7bn in 2021, a 66% increase. This has been met with a commensurate rise in workforce, with total hospital whole time equivalents rising from 49,701 in 2014 to 70,129 in 2021, a 41% increase. In spite of the large rise in both expenditure and staffing, activity over the same period has been relatively stable. For example,

inpatient and day case discharges rose from 1.5m in 2014 to 1.75m in 2019, a 16% increase, before falling below their 2015 level in both 2020 and 2021[1] (see figure 1.1 & 1.2).

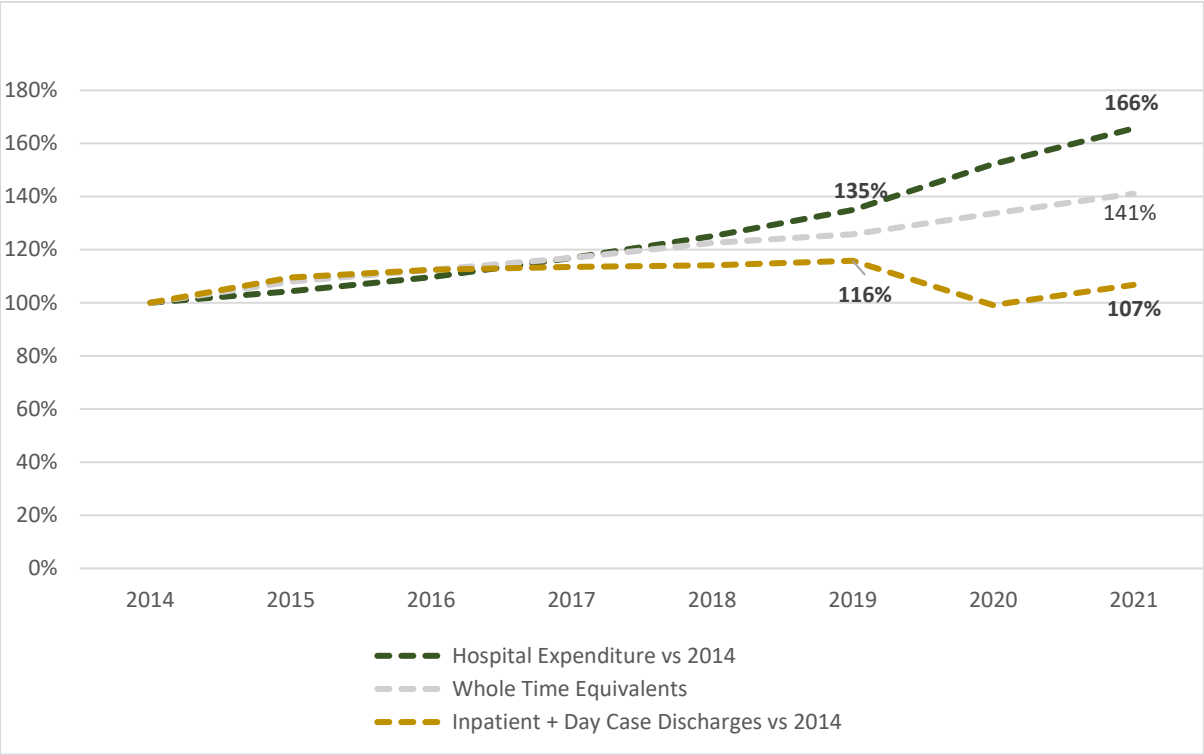
Figure 1.1: Hospital Expenditure (Nominal) and Hospital Discharges, 2014 – 2021 (Activity YTD Dec 2021)



Source: HSE Data Management Reports (2014 – 2021)

[1] Acute care activity was reduced in 2020 and 2021 due to the COVID-19 pandemic, with elective and emergency care reduced during this period (HSE, 2021).

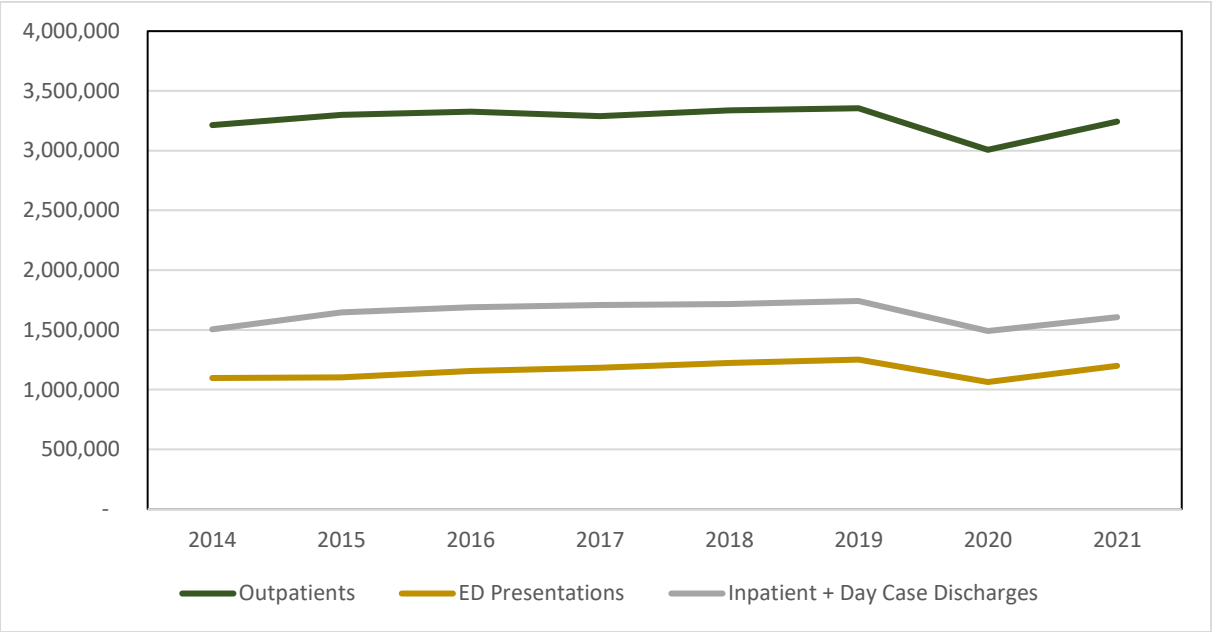
Figure 1.2: Hospital Expenditure (Nominal), WTEs and Hospital Discharges Total % Change vs 2014 level



Source: Author's calculations

Other measures of activity such as outpatient and ED attendances have also followed the same trend, with outpatient appointments rising from 3.2m in 2014 to 3.35m in 2019, a 4% increase, before falling back to 3.25m in 2021. Equally, ED attendances rose from 1.1m in 2014 to 1.251m in 2019, a 14% increase, before falling to 1.2m in 2021 (see figure.1.3).

Figure.1.3: Hospital Outpatient attendances, ED attendances and Discharges, 2014 – 2021



Source: HSE Data Management Reports (2014 – 2021)

While aggregated expenditure, workforce and activity figures can only provide a high-level understanding of performance in hospitals in Ireland, the disconnect between inputs and outputs in this context is a concern. The divergence in this relationship in recent years also does not appear to be well understood. While the reductions in activity during 2020 and 2021 can in part be explained by the onset of the COVID-19 pandemic and the associated restriction on non-urgent care in hospitals, this reduction was in spite of record levels of investment over the same period. Indeed, projected 2022 hospital activity is expected to increase just 5% relative to its 2019 level, compared to a projected 26% increase in nominal expenditure over the same period[2]. Equally, previous analysis from Lawless (2018) showed that increasing complexity of patient cases explains just some of the divergence in this relationship, with inpatient complexity increasing by 4% from 2014-2017 and day-case complexity increasing by 0.6% despite a 17% increase in expenditure and WTEs over the same period[3].

The changing role of hospitals in Ireland under the Sláintecare transition, coupled with the divergence in hospital inputs and activity motivates an exploration of hospital performance. While hospital performance is a complex phenomenon with many different drivers, this paper aims to provide a top-down view of performance based on HSE National Service Plan Key Performance Indicators (KPIs) for a variety hospital service areas. Through analysing KPIs associated with different but interconnected

[2] This is not purely related to healthcare inflation. Equally over this period there has been a 14.5% increase in acute care WTEs.

[3] This divergence can also be partially explained by other factors including increased costs associated with pharmaceuticals, new treatments & technologies in hospitals, and the recovery of healthcare expenditure from a supressed level after reductions during the Irish financial crisis.

hospital services – emergency department, acute medical, and surgical services – this paper provides a better understanding of where resources could be prioritised to best improve outcomes across the system. In addition, the examination of HSE defined performance indicators has two specific additional benefits:

I. It allows for the potential identification of trends within hospital on particular metrics, with the potential of follow-up examination of these hospitals providing lessons learned that could be applied to the rest of the hospital system[4].

II. It enables an evaluation of HSE defined "targets" for performance in this context – providing some insight into the potential economic and clinical consequences of non-compliance with these targets, and an assessment in some instances of whether these targets are useful for improving the governance and oversight of hospital performance.

Busse et al. (2019) defines the three core principles of hospital quality: safety, effectiveness, and patient-centredness. The list of KPI's selected for analysis throughout the paper bear these principles in mind, aiming to sufficiently cover the broad concept that is hospital performance. Throughout the paper a series of literature reviews are conducted corresponding to three key dimensions of hospital performance: ED services, acute medical/surgical services, and patient safety.

1.2. Regional Health Areas

To align the analysis in this paper with ongoing reforms in the organisation of the healthcare system this paper uses "Regional Health Areas" as its primary aggregated geographic metric of interest. Regional Health Areas (RHAs) reform the administrative alignment of healthcare service delivery in Ireland, integrating the existing nine Community Health Organisations (CHOs) and six Hospital Groups (HGs) into singular regionalised entities. Regional Health Areas are intended to enable a better transition between acute and primary care services, as well as the introduction of a population-based approach to service planning by region. RHAs have clearly defined populations and have at their inception accounted for referral patterns between different hospitals and community services.

RHAs are geographically-based units with clearly defined populations. They align community and hospital services within specific areas. The HSE will retain a strong but leaner central organisation, with more service provision developed at a local level.

[4] It is acknowledged that hospital performance in this context is not only driven by the internal organisation of a hospital, but also external factors such as differences in demographics, population health needs, adequacy of facilities and other factors. Examination of KPIs also enables closer determination of the external factors influencing perceived performance on these indicators.

The six Regional Health Areas to be introduced are comprised of the following areas:

- Area A: North Dublin, Meath, Louth, Cavan, and Monaghan;
- Area B: Longford, Westmeath, Offaly, Laois, Kildare, and parts of Dublin and Wicklow;
- Area C: Tipperary South, Waterford, Kilkenny, Carlow, Wexford, Wicklow, part of South Dublin;
- Area D: Kerry and Cork;
- Area E: Limerick, Tipperary and Clare;
- Area F: Donegal, Sligo, Leitrim, Roscommon, Mayo, and Galway.

The 6 RHAs are further broken down into 96 Community Healthcare Networks (CHNs). CHNs deliver primary and community services to an average population of 50,000 people each.

The CHN framework supports multi-disciplinary teams to bring decision-making closer to the point of care. CHNs also function to provide targeted and coordinated care based on the identified health and social care needs of local communities. 39 CHNs have already been established with leadership posts in place and at least 25% staff recruited, with the remainder of the total 96 due to be rolled out by the end of 2022.

Fig.1.4 Map of the Regional Health Areas

Source: Department of Health Statistics and Analytics Unit,2022

1.3. Hospital Models

In 2010, the HSE established the National Acute Medicine Programme (NAMP) to standardise and improve the management of acutely ill medical patients in the Irish Healthcare system. The overarching aims of the National Acute Medicine Programme are to ensure that all acute medical patients have a better patient experience comprised of; improved communication; quality care; timely diagnosis and; the delivery of appropriate treatment in the most appropriate environment. The programme emphasises the fundamental importance of allowing senior clinical decision makers to assess acutely ill patients without delay to initiate rapid investigation, diagnosis and treatment, and the concept of Clinical Justice (Health Service Executive).

The NAMP defined the four hospital models now used to describe the basic functionality of acute hospital activity in Ireland, and accepted by the Department of Health, Health Services Executive,

Royal Colleges, Hospital Information and Quality Authority (HIQA). The purpose of these models is to provide a clear delineation of hospital services based upon the safe provision of patient care with the constraints of available facilities, human resources and local factors.

The four model types are:

- **Model 1 hospitals** are community hospitals where patients are currently under the care of resident medical officers. These hospitals do not have surgery, emergency care, acute medicine (other than a select group of low-risk patients) or critical care.
- **Model 2 hospitals** can provide the majority of hospital activity including extended day surgery, selected acute medicine, local injuries, a large range of diagnostic services (including endoscopy, laboratory medicine, point-of-care testing, and radiology (CT, US and plain film X Ray)), specialist rehabilitation medicine and palliative care (See HSE (2011) for further information).
- **Model 3 hospitals** provide 24/7 acute surgery, acute medicine, and critical care.
- **Model 4 hospitals** are similar to model 3 hospitals but provide tertiary care and, in certain locations, supra-regional care (National Centres of Excellence).

It must be noted that even within Hospital Model types there is variation in the services provided, for example neurosurgery is performed in a limited number of Model 4 sites and orthopaedics is not a specialty provided in all Model 3 Hospitals.

2. Methodology and Limitations

2.1 Methodology

The data analysed throughout the paper was obtained from the Health Service Executive Business Information Unit (HSE BIU) through the *Compstat* database (HSE: Business Information Unit, 2022). Due to a significant portion of the data being nominal in nature (i.e., non-standardised) certain adjustments were introduced to enable comparison across hospitals and RHAs. These adjustments centred around population-based conversions and hospital scale adjustments (Inpatient Discharges), with 2016 CSO population figures presented in an RHA format obtained from the Atlas Finder Database (Atlas Finder, 2022). For convenience of analysis and interpretation, an annualised monthly average figure was taken for each KPI per year for which the data was available. While this does not account for certain cyclical features experienced by the Irish health system such as the Winter Flu Season (Power, 2021), and reduces the nuanced accuracy present in the dis-aggregated monthly raw data, it makes cross-sectional analysis at a hospital/RHA level digestible, and intuitive, both necessary components of effective analysis. Similarly, data analysed at an RHA level is measured as an annualised monthly average of each hospital in an RHA.

A simple average of performance across hospitals is used to calculate RHA level performance by year. While authors' considered weighting hospital performance by scale metrics (such as ED presentations, or inpatient discharges) to account for differences in the number of hospitals and activity by region, no such adjustment was viewed as both sufficiently representative and easily digestible by readers.

In Section.4 and Section.5, the cost of a bed day is used to estimate potential opportunity costs associated with not on day surgical admission and healthcare associated infections. The analysis presented within Section.5 uses the assumption of an additional 10 days in hospital from acquiring a healthcare associated infection. This approximation is based on the Irish National Adverse Events Study (INAES) (Rafter, et al., 2021). The costing of Healthcare Associated Infections is difficult and the HIQA report on AMR in 2021 identified that there no Gold Standard approach for the practice (HIQA, 2021). The application of internationally observed costs for healthcare associated infections was considered but ultimately deemed inappropriate by subject matter experts.

The KPI dataset initially began with a list of over 100 KPIs accounting for a total of 51 hospitals. Through analysing the significance and rationale underlying each KPI, alongside a viewing of data availability, an initial list of KPIs were drafted for more detailed analysis. The availability of target values for relevant KPIs permits further discriminatory power to the analysis, to not only compare hospital

against hospital, and to contrast RHA level performance, but also to compare performance relative to HSE targets/upper-bound limits.

Accordingly, the number of KPIs was reduced to a total of 18 which covered a broad array of hospital performance dimensions including:

1. The demand for Unscheduled care services (Unscheduled care presentations = ED Presentations + LIU Presentations);
2. Unscheduled care wait times;
3. Inefficiencies arising from incomplete unscheduled care treatment;
4. Surgical & acute medical hospital re-admissions;
5. Effective acute medical assessment unit (AMAU) implementation;
6. Delayed Transfer of Cares;
7. The percent of elective surgical inpatients admitted on day of surgical procedure and;
8. Preventable hospital infections and incidents.

2.2 Limitations of Paper

The paper has a number of limitations, owing to the administrative nature of the dataset, the impact of the COVID-19 pandemic, and the many other drivers that can determine performance on HSE identified KPIs outside of the internal organisation of a given hospital.

The primary limitation of the analysis presented is **the inability to identify the causal factors driving the observed trends in hospital performance**. Outside of population-based factors a variety of determinants influence healthcare demand in Ireland: alternative demographic characteristics, socioeconomic inequalities, clinical factors, and health-related behaviours and activities (Busse et al., 2019). While this is a clear limitation of the analysis, the identification of hospital performance on the basis of KPIs remains valuable as they indicate areas for additional exploration and improvement within the healthcare system, as well as serving as an important mechanism for governing acute care performance.

Another limitation is the administrative nature of the dataset analysed. As KPIs are recorded locally before being compiled centrally, measurement error may occur, attributable to factors such as differences in interpretations between hospitals,or human error. The data referenced also feeds into the HSE's National Service Plan, and some elements may be subject to cross-checking through the Hospital Inpatient Patient Enquiry (HIPE) data collection exercise. Because of reconciliation of some HIPE metrics, associated key performance indicators may be subject to downward or upward

adjustment relative to what is reported in this paper. Equally variations in definitions and targets across years limits the levels of inference which can be done across years.

The onset and persistent presence of Covid-19 in the Irish context represents another limitation of subsequent point-in-time and longitudinal analysis. Changes in hospital performance between the years 2019, 2020, and 2021 maybe more representative of the impact of reduced activity due to restrictions on the type of care delivered during the pandemic than a real-world change in hospital performance. Readers should also be aware of this limitation when reading hospital level reporting for KPIs, as the performance in 2021 is also influenced by the pandemic. Authors have however noted a persistence in performance across most years for many metrics, irrespective of this limitation.

Finally, it should be noted that this analysis is based on authors' (DoH) own calculations using HSE Compstat Data. In some instances, differences in methodologies or reporting periods may result in some differences in figures reported in the paper, and those reported in the HSE Management Data Reports. While in general figures are comparable this paper should not be taken as a source for specific hospital level performance information, and queries should instead be directed to the HSE Business Information Unit. All errors are the authors' own.

3. Unscheduled Care Performance

3.1 Literature Review

Unscheduled care can be defined as health and/or social care which cannot reasonably be foreseen or planned in advance of contact with the relevant professional. It follows that such demand can occur any time and that services to meet this demand must be available 24 hours a day seven days a week (Cork University Hospital, 2022). Unscheduled care is delivered in many settings including but not limited to Emergency Departments and Local Injury Units. Local Injury Units (LIU) provide treatment to patients with minor injuries which are unlikely to require hospitalisation. Emergency Departments provide an enhanced level of care which can treat patients of a higher acuity than those suitable for treatment in an LIU. There are currently 29 24-hour Emergency Departments in Ireland and 14 Local Injury Units. The use of the term emergency presentations can be used to describe the quantum of presentations across both settings.

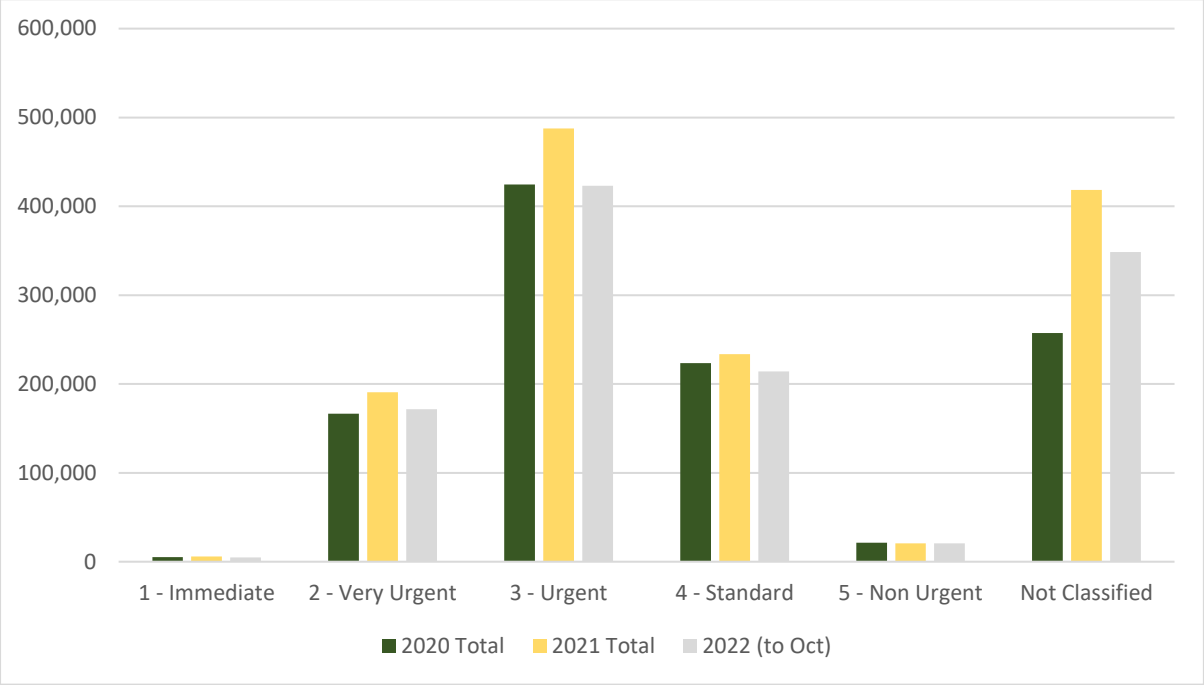
Unscheduled care access has been a focus of much public attention over the last two decades. As the National Emergency Medicine Programme (2012) highlights, Emergency Departments in Ireland have been consistently reported as being in a state of "crisis", with much of this scrutiny focussed on waiting times and patient experiences in unscheduled care settings. These criticisms have not subsided in more recent years, with unscheduled care pressures continuing to be a common area of public and media scrutiny.

Upon arrival at an unscheduled care setting such as an Emergency Department or Local Injury Unit, patients are registered and screened by triage nurses and assigned a rating. This triage rating is used to prioritise the treatment of patients with time-critical and emergency care needs in order of those most in need of immediate treatment. Triage ratings are scored from 1 to 5, with category 1 admissions in need of immediate care, while triage category 5 admissions are expectant, or not urgent care (see Figure.3.1 for distribution of ED attendances by Triage Rating). Once a triage rating has been received, patients wait for care, with different risk levels and illnesses requiring different levels of care. For most patients, discharge can occur after tests or treatment are carried out within an unscheduled care environment.

The Irish Emergency Medical Early Warning System (IMEWS) has been introduced within unscheduled care settings in response to the HIQA 2012 report on Tallaght and its recommendations. IMEWS is used in situations where patients are waiting longer than the recommended time frame to see a

treating clinician for their triage score (Department of Health, 2018). Some patients require admission to a hospital for specialist care. When there is not a bed available in a hospital ward, patients may be required to wait in an emergency department, until a bed becomes available, with treatment being continued in the interim in this setting. Patients awaiting admission to an inpatient hospital bed are referred to as persons "on trolleys", with these numbers reported daily in each hospital via the TrolleyGAR system (A breakdown of the number of persons on trolley by Regional Health Area ("RHA") is available in Shine & Hennessy (2022)).

Figure.3.1: Distribution of Emergency Department Triage Ratings, National By Year (2022, Jan-Oct).



Source: Patient Experience Time (PET) Data, DoH 2022

In terms of demand, unscheduled care attendances have experienced moderate increases over time, with presentations rising from 1.1m in 2014 to 1.35m in 2019, a 23% increase. Unscheduled care demand has additionally increased since 2019 with 1.5 million presentations over the 12-month period (21st November 21 to the 20th November 22). This additionally does not account for unmet demand, which given historically long wait times for unscheduled care services may be large. Unscheduled care attendances also have the potential to increase in the future due to the oncoming shift in Ireland's age structure[5]. For persons presenting unscheduled, a generational disparity is observed, with elderly individuals attending unscheduled care services more frequently and with

[5] Ireland's age structure is expected to rapidly shift in coming decades, with the old age dependency ratio increasing from 24 percent at present to 47 percent by 2050 (Department of Finance, 2021).

higher acuity care needs relative to their younger counterparts (Cummins et al., 2022; He et al., 2011). Alongside demographic shifts, Cummins et al. (2022) find socio-economic status and proximity to health services to be significant drivers of unscheduled care presentations in the contemporary Irish context. There is also some uncertainty regarding the substitutability of unscheduled care for other healthcare services. For example, Krakau & Hassler (1999) suggest that increased access and choice of health services (such as Local Injury Units (LIUs)) does not necessarily reduce the demand for unscheduled care services, while Gill et al. (2000) in contrast finds that the availability of alternative sources of care is a key driver to reduce demand for under-pressure unscheduled care services. Sláintecare places significant focus on shifting utilisation towards non-acute care services, including in the acute and primary care. In this context, improvement of these services is expected to reduce acute care pressures, including unscheduled care pressures (e.g see Health Service Capacity Review (2018)).

While unscheduled care wait times are an intuitive and efficient consequence of the triaging system mentioned above, the presence of wait times, especially excessive wait times has a number of adverse impacts on patients and hospital staff: patients incur both an opportunity cost associated with lost-time, and potential adverse health outcomes associated with delayed treatment of care (Connolly, 2019). Long unscheduled care wait times are also disadvantageous for the functionality of the acute care system, with hospital staff experiencing attributable poor morale and staff wellbeing (Chernoff et al., 2019). Literature on the topic of unscheduled care wait times highlight the significant impact occupancy levels have in restricting the effective capacity of unscheduled care decisions to admit/discharge, with low levels of inpatient capacity impacting unscheduled care waiting times in the context of England (Paling et al., 2019).

Unscheduled care wait times are also directly related to adverse events for patients, with Jones et al. (2022) finding a significant linear relationship between unscheduled care all-cause mortality rate and waiting times (beginning at 5 hours). The authors find in the context of the NHS in England, that an additional death occurs for every 82 patients who are delayed for more than 6 to 8 hours. While the context of analysis is different and, therefore, the findings are not directly generalisable to the Irish context, long waiting times appear to have significant health/economic costs through influencing unscheduled care mortality rates. This assertion is also supported in the Irish context, with Plunkett et al. (2011) finding an increase in 30-day mortality from 8.6% to 17.7% for patients waiting over 9 hours in unscheduled care settings (for further reading see Schull et al., 2015; Pines et al., 2009). The relationship between unscheduled care wait times and adverse patient outcomes is also supported by the HSE, with the rationale associated with unscheduled care wait time performance targets citing

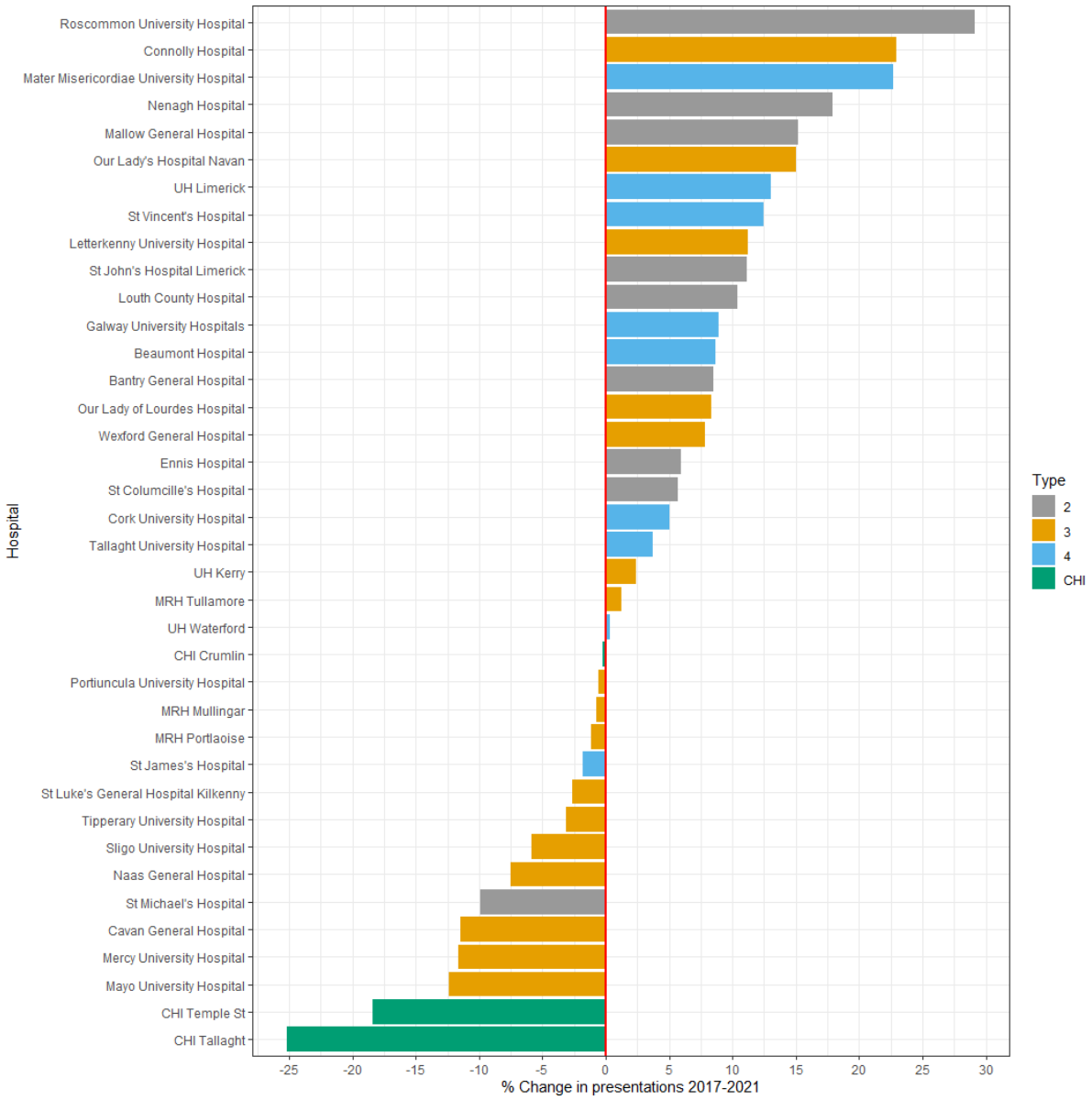
disadvantages of long unscheduled care waits including poorer patient outcomes, increase morality, increased adverse outcomes, and poor utilisation of resources among other factors (HSE, 2022). According to the OECD, 12% to 56% of emergency hospital admissions are for illnesses and ailments that could have been treated better or at least equally as well in less costly health care settings (OECD, 2017).

3.2 Unscheduled Care Presentations: 2017 – 2021[6]

Unscheduled care is an essential service for individuals in life-threatening condition who have care needs of high acuity (HSE(b), 2022). Overcrowding occurs when there is an excess of demand for unscheduled care services over the aggregate supply of hospital resources. As highlighted in Section 3.1, unscheduled care overcrowding has effects on hospital performance and outcomes. From a policy perspective, understanding and effectively meeting the demand for unscheduled care services is of critical importance, with the potential for remediatory policy or investment in areas most consistently under pressure.

[6] Due to the way unscheduled care presentation data is collected by the HSE it is worth noting that unscheduled care presentation figures include presentations made to local injury units (LIUs). Accordingly, the number of presentations outlined below may marginally overestimate the true demand for unscheduled care services.

Fig.3.2: Changes in Unscheduled Care Presentations: 2017-2021



Source: Authors Calculations,2022

A point-in-time analysis comparing the change in the monthly average number of unscheduled presentations from 2017 to 2021 represents a reasonable proxy for changes in demand over time and is illustrated in Fig.3.2. Roscommon Hospital, Connolly Hospital, and the Mater Hospital (MMUH) have experienced the highest positive change in unscheduled presentations from 2017-2021, with substantial growth valued at 29.1%, 23%, and 22.7% respectively. Conversely, Mayo University Hospital, Mercy University Hospital Cork and Cavan General Hospital have experienced a decrease in unscheduled care presentations across the time period, with presentations decreasing by 12.3%, 11.6%. and 11.5% respectively.

3.3 Unscheduled Care Waiting Times: 2018-2020.

A HSE priority is the reduction of unscheduled care presentation waiting times, while maintaining the quality of care provided to patients (HSE(c), 2022). This section analyses unscheduled care waiting times over two timelines: six hours (HSE Target = 70%) and nine hours (HSE Target = 85%). In Table.3.3, an international comparison of waiting time targets in other countries is provided. It can be noted that most countries which have set a target for unscheduled care presentations have a target lower than that of the HSE for wait times, with only Ontario having a comparable target to Ireland.

Table.3.3: International Comparison of Emergency presentation wait targets

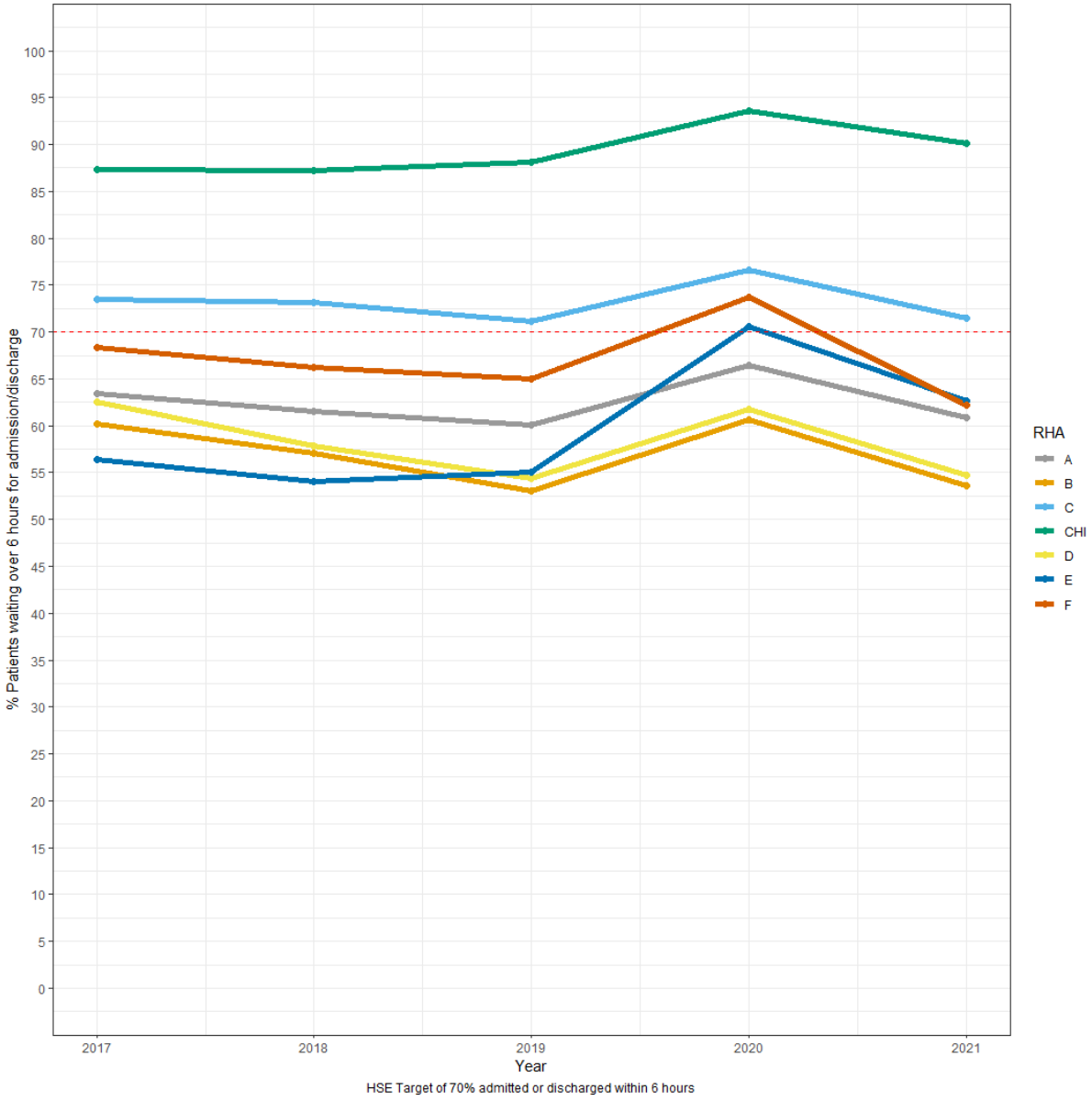
England	Less than 5% have a stay greater than 4 hours.
Ontario (Canada)	90% of patients with minor conditions <4 hours and complex conditions <8 hours
Victoria (Australia)	Less than 25% have a stay greater than 4 hours
Ireland	70% of Patients admitted in 6 hours and 85% of patients admitted within 9 hours.[7]
Stockholm (Sweden)	Less than 29% of patients under 80 have a stay of >4 hours
Netherlands	No target

Source: UK Government,2014

Analysis is also conducted on waiting times for patients over the age of 75 (Target = 1% for >9 hours) i.e., those most at risk from prolonged waiting times on average due to heightened clinical risk associated with age (Bauernfreund et al., 2018). As with prior sections, performance will be evaluated initially at an RHA level, followed by a hospital level point-in-time analysis, ending with a target divergence chart indicating the spread of performance from HSE targets.

[7] There also exists specific targets for patients over the age of 75 of 95 admitted/discharged within 6 hours and 99% admitted or discharged within 9 hours.

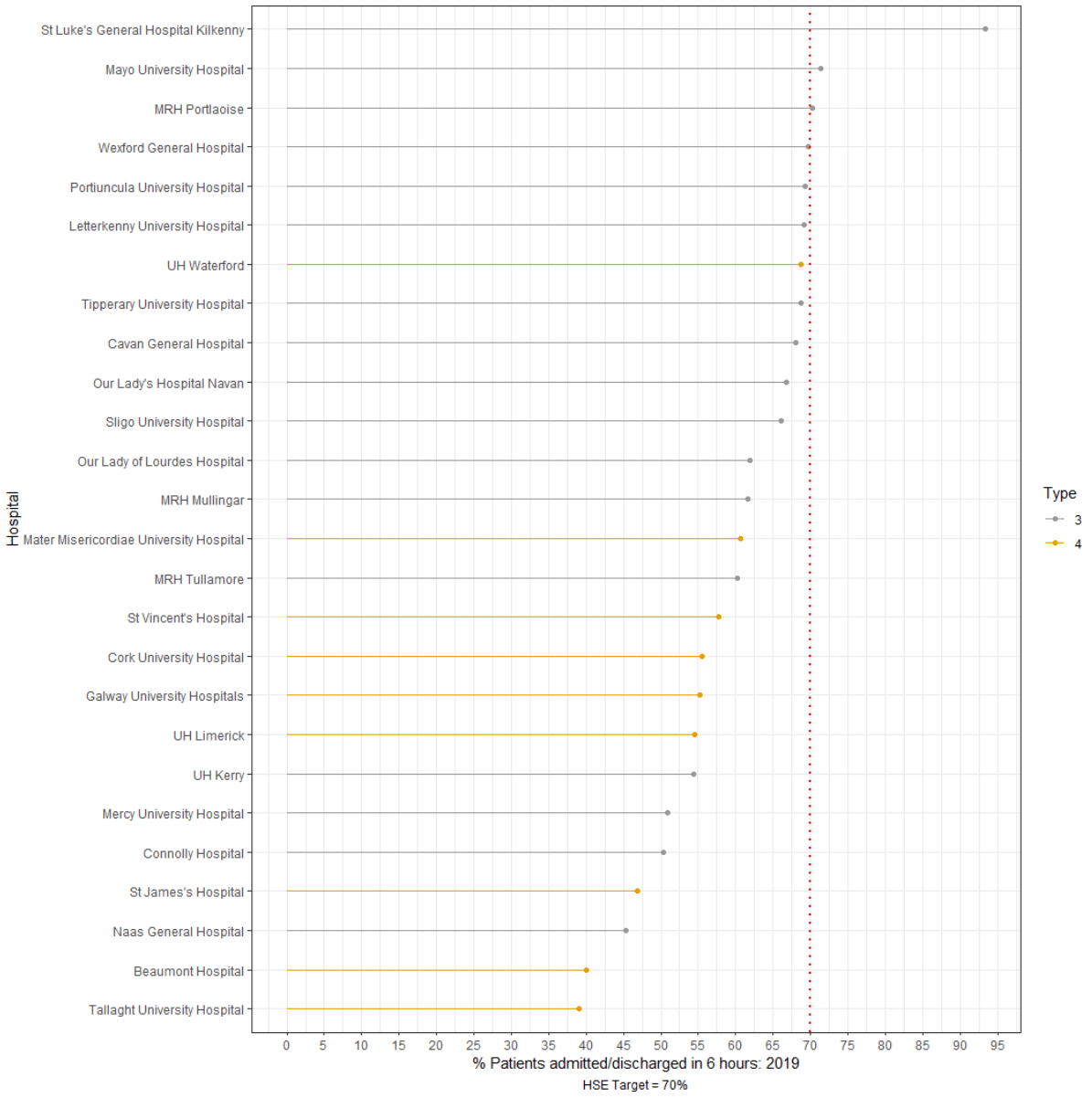
Fig.3.4: % discharged/admitted within 6 hours: 2017-2021



Source: Authors Calculations using Patient Experience Time,2022

In Fig.3.4, above the RHA level performance is observed, with only RHA C and CHI being above the HSE target of 70% of patients receiving a decision within 6 hours in all years examined. RHA E has only one emergency department in University Hospital Limerick, which impacts the comparability of this figure.

Fig.3.5: % discharged/admitted within 6 hours:2019



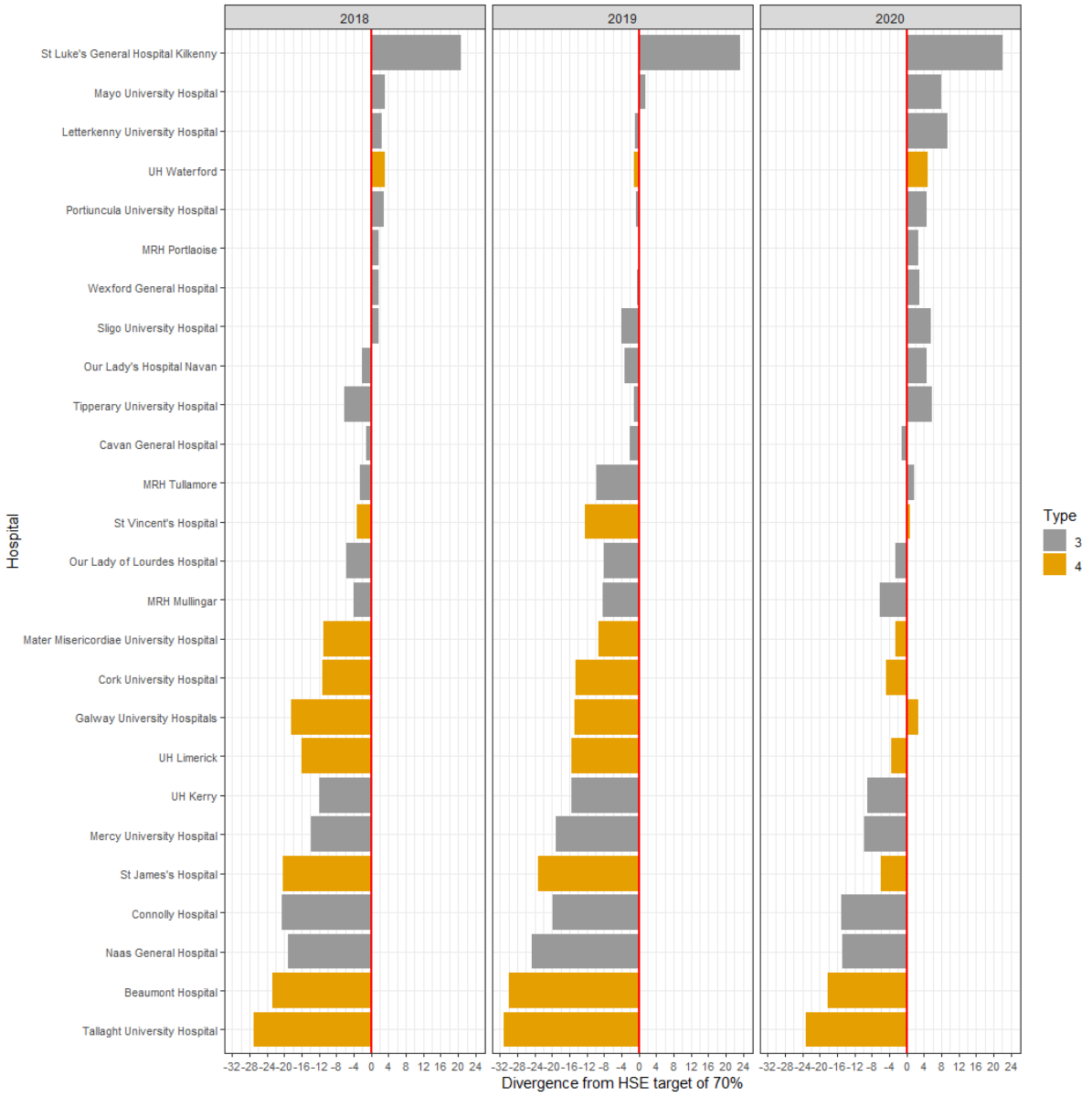
Source: Authors Calculations,2022

Fig.3.5, above presents hospital level unscheduled care performance relative to the HSE set target of 70%[8] for emergency presentations to be admitted or discharged within 6 hours. One can see that many hospitals are significantly below targeted performance levels, with Tallaght, Beaumont, and Naas admitting or discharging 39%, 40% and 45% within six hours of presentation. This would imply that for every 100 presentations at each of these sites, 61, 60 and 55 patients would wait over 6 hours for a decision to admit or to be discharged. Equally, St Luke's Kilkenny General Hospital, Mayo University Hospital, and MRH Portlaoise admit or discharge 93%, 71% and 70% of patients within six

[8] This target had been 75% in 2019, however it has been adjusted to a current target of 70%.

hours of presentation. The comparison of hospitals by performance to these metrics in this singular view has limitations. Larger hospitals (Model 4) have a higher burden of complex patients. Equally, the relative number of presentations will vary significantly across sites over a given period, limiting the ability of the health system to proactively respond. These factors will have direct effects on the performance of a site along with other factors such as staff mix, management practices and infrastructural capacity.

Fig.3.6: % Unscheduled emergency presentations admitted or discharged within 6 hours, 2018 – 2020



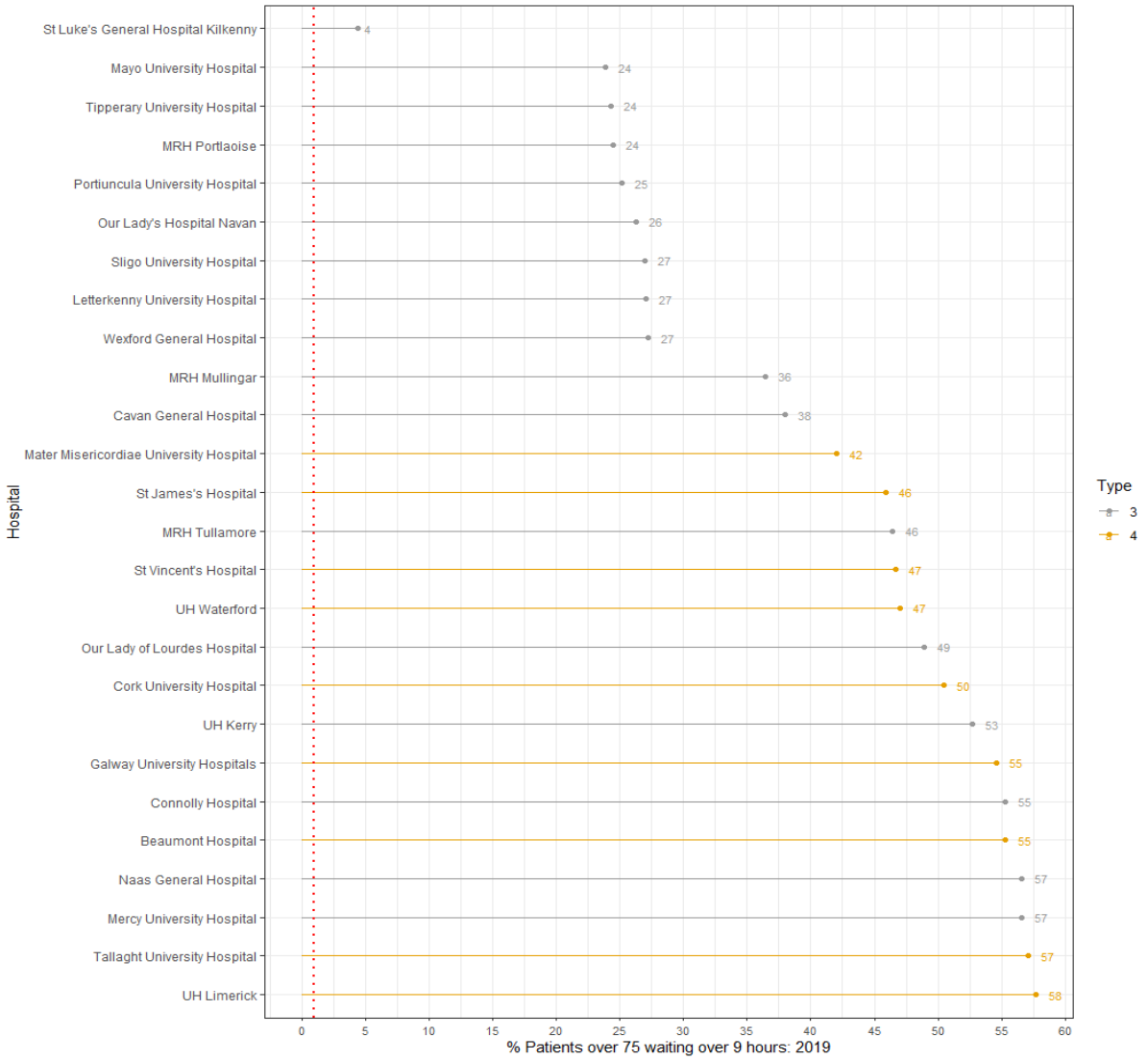
Source: Authors Calculations,2022

In Fig.3.6 above, ED wait time performance between 2018 and 2020 is examined. In general, it can be seen that hospital performance is persistent over time, with Hospital's performance across years

varying to a small degree. This would raise questions about the efficacy of any strategies implemented within hospitals intended to reduce patient wait times, particularly those with historically long waits.

Waiting times do not adversely affect all patients equally. Due to geriatric patients on average experiencing relatively more adverse health effects associated with waiting times, it is sensible to also identify geriatric emergency presentation waiting times in hospitals. (Bauernfreund et al., 2018). Figure.3.7 presents the percentage of emergency presentations not admitted or discharged within 9 hours. The HSE has set a target of 1% for this metric, signifying the undesirability of prolonged wait times for geriatric patients. The five hospitals with the lowest levels of compliance, University Hospital Limerick, Tallaght University Hospital, Naas Hospital Mercy University Hospital Cork, and Connolly Hospital receiving values of 58%, 57%, 57%, 57%, and 55% on this metric. This likely indicates that this metric is not being used to actively manage performance in this domain, raising concerns over the effectiveness of specified HSE KPIs for the active governance and management of hospital performance.

*Fig.3.7: Over 75s Waiting Times: % **not** discharged/admitted within 9 hours*



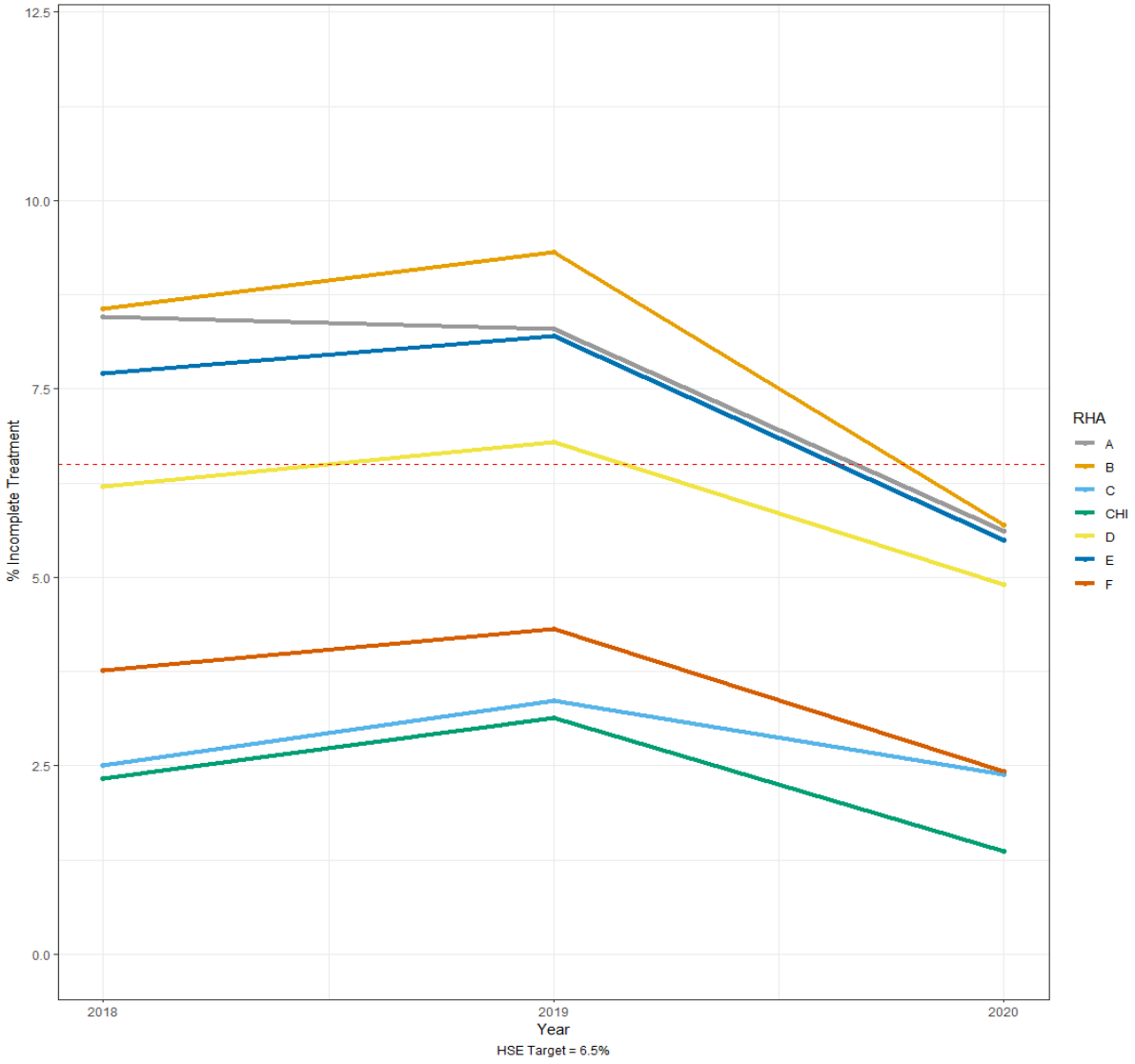
Source: Authors Calculations,2022

3.4 Incomplete Treatment: 2018-2020.

Incomplete treatment is both a patient safety concern and a reduction in efficient use of resources in the context of the Irish healthcare system; mitigating incomplete treatment, therefore, represents an opportunity to improve hospital performance. As highlighted in Section 3.1, incomplete treatment can be separated into two important categories: necessary and unnecessary attendances. The HSE conceptualises and measures incomplete treatment as the '% of emergency presentations who attended an emergency department but left before their treatment is completed. These patients are recorded as did not wait on hospital system', with an upper-bound target value set at 6.5% (HSE: Business Intelligence Unit, 2022). The subsequent sections of analyses aim to identify longitudinal

trends in incomplete treatment at an RHA level, a hospital-model level, and an individual hospital level.

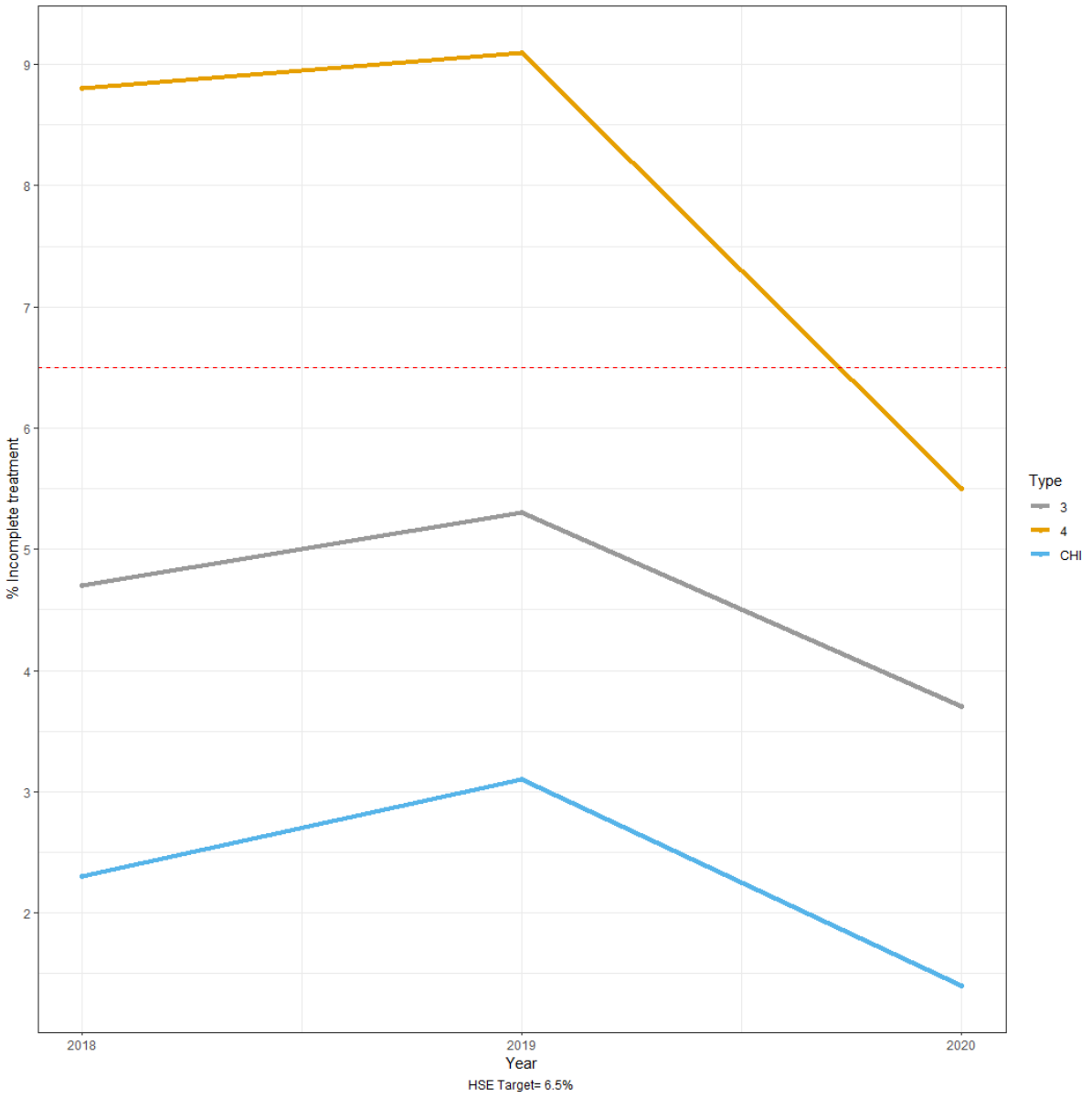
Fig.3.8: RHA Level Incomplete Treatment: % Incomplete Treatment 2018-2020



Source: Authors Calculations, 2022

Figure.3.8 visualises the spread and magnitude of incomplete treatment at an RHA level. Variation exists at this level of analysis, with RHA A, and B experiencing higher adjusted average values across all years. For the year 2020, all RHAs are compliant with the HSE target, although total presentations in 2020 were lower due to the COVID pandemic. The higher levels of incomplete treatment within some regions may be influenced by factors such as access to primary care, and unscheduled care waiting times.

Fig.3.9: Hospital Model Incomplete Treatment: % Incomplete Treatment 2018-2020



Source: Authors Calculations

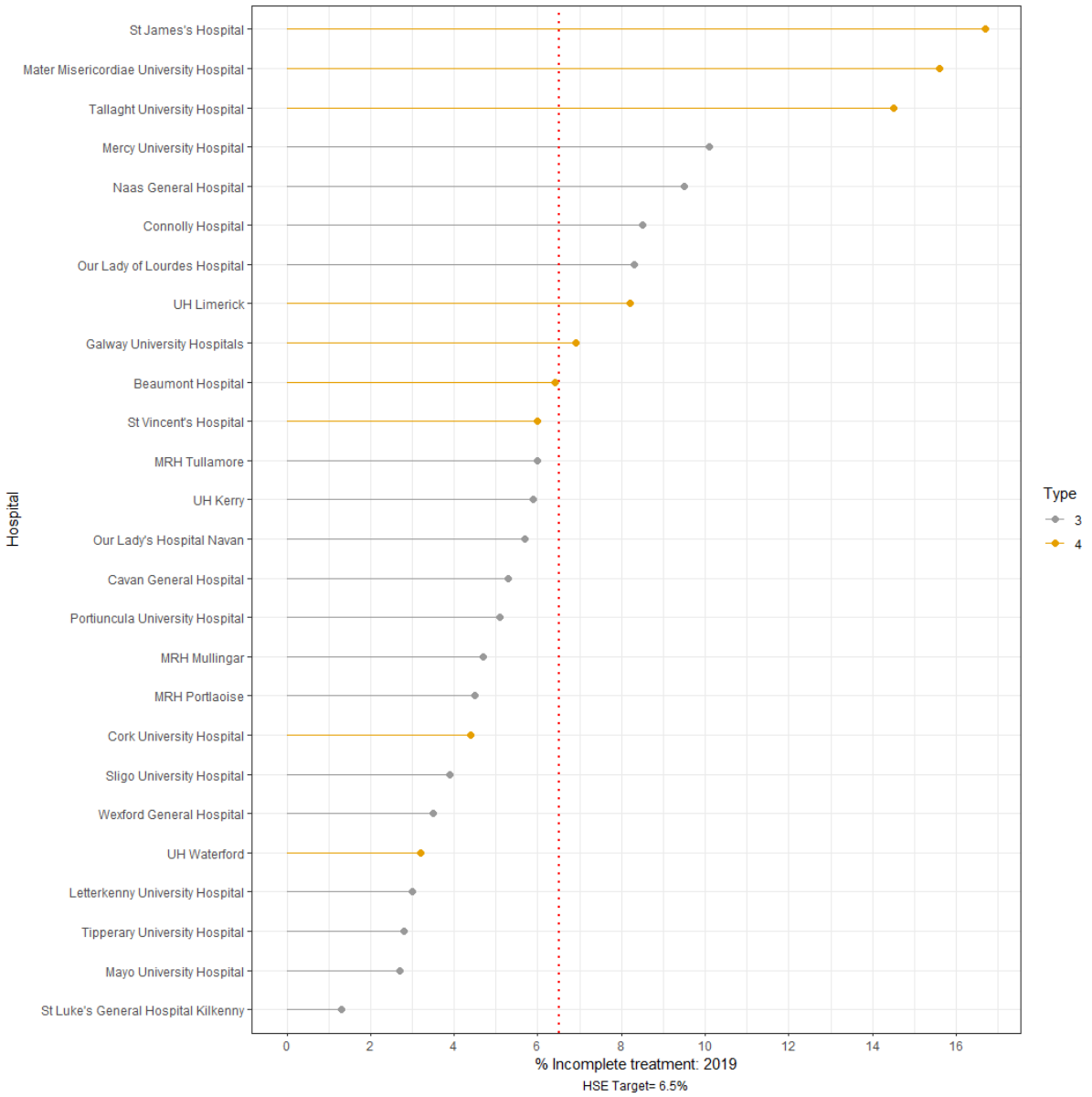
Figure.3.9 identifies that model four hospitals receive on average the highest number of incomplete treatment cases, with frequency decreasing with scale (excluding CHI). For the year 2020, all hospital-models receive average values below the HSE target.

Breaking the analysis down further to an individual hospital-level point-in-time analysis (see Fig.3.10) reveals that the St James' Hospital, the Mater Misericordiae Hospital, Tallaght University Hospital, and Mercy University Hospital Cork receive the highest level of incomplete treatments for the year 2019 with values of 16.7%, 15.6%, 14.5%, and 10.1% respectively. Relative to other KPIs analysed prior, compliance in this context across the system is moderately positive, with only nine hospitals receiving

values more than the HSE upper-bound target of 6.5%. The year 2019 was selected due to concerns regarding distortions of values due to Covid-19 and the availability of data.

Decreases in the number of incomplete treatments in the context of unscheduled care does not necessarily imply improved performance of hospitals in mitigating the patient safety risks associated with incomplete treatment. Instead, alternative factors such as changes in unscheduled care wait-times may alter the perceived benefit of such services, causing individuals who otherwise would have stayed for the duration of their unscheduled care presentations to leave.

Fig.3.10: % Incomplete Unscheduled Care Treatment: 2019



Source: Authors Calculations,2022

3.5. Summary of Unscheduled Care Performance

Unscheduled care services are a crucial point of entry for hospital services, with performance in this domain important to effective service delivery and patient outcomes. Analysis of changes in unscheduled presentations reveals variation across hospitals: with Roscommon University Hospital and Mayo University Hospital experiencing the highest percentage growth and the highest decline in the number of presentations changes of +29.1% and -12.3% respectively.

In terms of six- and nine-hour unscheduled care wait times, wide variation in performance is observed. At a hospital level, underperformance relative to the HSE specified target of 70% for 6 hours is evident, with 23 out of 26 hospitals (88%) below targeted performance in 2019. Persistence in hospital performance is also evident across years, with Tallaght, Beaumont, and Connolly consistently among the worst performing hospitals on ED wait times between 2018 and 2020. The persistence of performance in this manner draws into question what interventions have been undertaken to improve wait times, and whether these interventions have been effective.

Concerning wait times for over persons over 75, the target of 99% of admissions within nine hours for this group is missed by every hospital in 2019. University Hospital Limerick, Tallaght University Hospital, and Naas General Hospital receive the lowest compliance with 58%, 57%, 57% of all patients greater than 75 years of age not receiving an admit/discharge decision into ED within nine hours.

In relation to incomplete treatment, relative to the HSE set target of 6.5%, St James' Hospital, the Mater, Tallaght Hospital, and Mercy University Hospital Cork receive the highest non-compliant scores in 2019 of 16.7%, 15.6%, 14.5%, and 10.1%. Conversely many other hospitals are more in line with HSE designated performance, with 17 out of 26 hospitals having a lower rate of incomplete treatment than specified by the HSE set target in 2019.

St Luke's Hospital Kilkenny, Mayo University Hospital and Tipperary University Hospital have the lowest values of incomplete treatment with figures equal to 1.3%, 2.7%, and 3% respectively, representing the best performers in this context. Incomplete treatment is found to be correlated with all waiting time KPI values, indicating a strong, but non-causal, relationship between the time individuals wait for unscheduled care services and the likelihood of the, leaving without completing treatment.

The widespread non-compliance with HSE targets observed in many areas draws into question the effectiveness of the existing suite of targets for the active management of hospital performance across the hospital system. The clinical and economic consequences of non-compliance with targets are also

likely to be severe, with Jones (2022) and Plunkett et al. (2011) among others observing a relationship between 30-day mortality and unscheduled care waiting times.

4. Sources of Hospital Efficiency in Admissions and Discharges

The following section examines four KPIs related to hospital efficiency in the context of admissions procedures:

I. Acute Medical Discharges Admitted through an Acute Medical Assessment Unit (AMAU)/Medical Assessment Unit (MAU).
II. Acute Medical 30-day re-admission Rate.
III. % Of Elective Surgical Inpatients Admitted Day of procedure.
IV. Delayed Transfer of Care from Hospital.

These four metrics all provide some insight into the management and performance of a hospital beyond assessment of persons presenting to Emergency Departments or Local Injury Units. As will be discussed, performance on these metrics is also more directly related to hospital efficiency, with greater levels of AMAU/MAU utilisation, lower levels of admission, greater levels of day of procedure admissions and lower levels of Delayed Transfer of Care all associated with greater hospital outputs relative to a given level of inputs. AMAUs are primarily found in Model 3 and 4 Hospitals, with Medical Assessment Units being found within Model 2 settings. Medical Assessment Units accept patients who have already seen a General Practitioner whereas Acute Medical Assessment Units accept patients who may not have already attended a General Practitioner.

4.1 Function of Acute Medical Assessment Units

The Irish Acute Medicine Programme (AMP) and the Royal College of Physicians London define acute medicine as 'that part of general (internal) medicine concerned with the immediate and early specialist management of adult patients with a wide range of medical conditions who present in hospital as emergencies' (McGovern, 2013, p.10). Acute Medical Assessment Units (AMAUs) are alternative pathways into acute hospital services distinct from ED. Scott., Vaughan, and Bell (2009) conceptualise the purpose of AMAUs as providing:

- more appropriate and timely assessment;
- diagnosis and treatment of patients leading to reduced length of stay;
- more organised work environment with standardized admission and discharge admissions;
- improved bed management and smoother patient flows;
- increased staff job satisfaction and;
- more effective use of resources of the hospital as a whole.

In terms of the operational benefits of AMAUs, Moloney et al. (2005) find in the context of St James' Hospital Dublin that the introduction of the AMAU improved access to acute medical services through a variety of mechanisms. Patients assessed through the AMAU had median length of stays significantly lower than their non-AMAU counterparts (5 vs 6 days respectively), freeing up space for additional AMAU presentations. The provision of the AMAU in James also had spill-over effects on the number of patients waiting admission for a hospital bed, with 30% less emergency presentations awaiting an inpatient bed in 2003 relative to 2002.

Such findings are supported by Watts et al. (2011), who examine the discharge destination of those assessed in an AMAU versus an unscheduled care presentation to an Emergency Department (ED). They find that out of 1,562 patients presenting to an AMAU, 196 (12.5%) were admitted to an in-patient bed while a further 1,148 (73.5%) were entered into diagnosis driven outpatient pathways. In contrast, out of 1,465 patients assessed in ED, 43.5% were admitted as inpatients. Importantly, the authors contend the 'remarkably similar Manchester Triage Score[s][9] across both groups' make differences in the acuity of service required unlikely, and the difference, therefore, attributable to the quality of AMAU assessment. Similar findings are found in the context of the Royal Liverpool University Hospital, with the implementation of an AMAU increasing the proportion of patients appropriately cared for following admission from 26-57% (Moore et al., 2006).

Regarding clinical benefits of AMAUs, Rooney et al. (2008) find that the introduction of an AMAU significantly reduced all-cause hospital mortality in acute medical patients from a value of 12.6% to 7% (from 2002-2006). Concerning patient satisfaction finally, Hanlon et al. (1997) (as cited in Scott, Vaughan, and Bell, 2009) find that patient subjective satisfaction levels increased following the introduction of an AMAU. Overall, AMAUs appear to be an effective alternative pathway to acute medical hospital services, with a range of ancillary benefits.

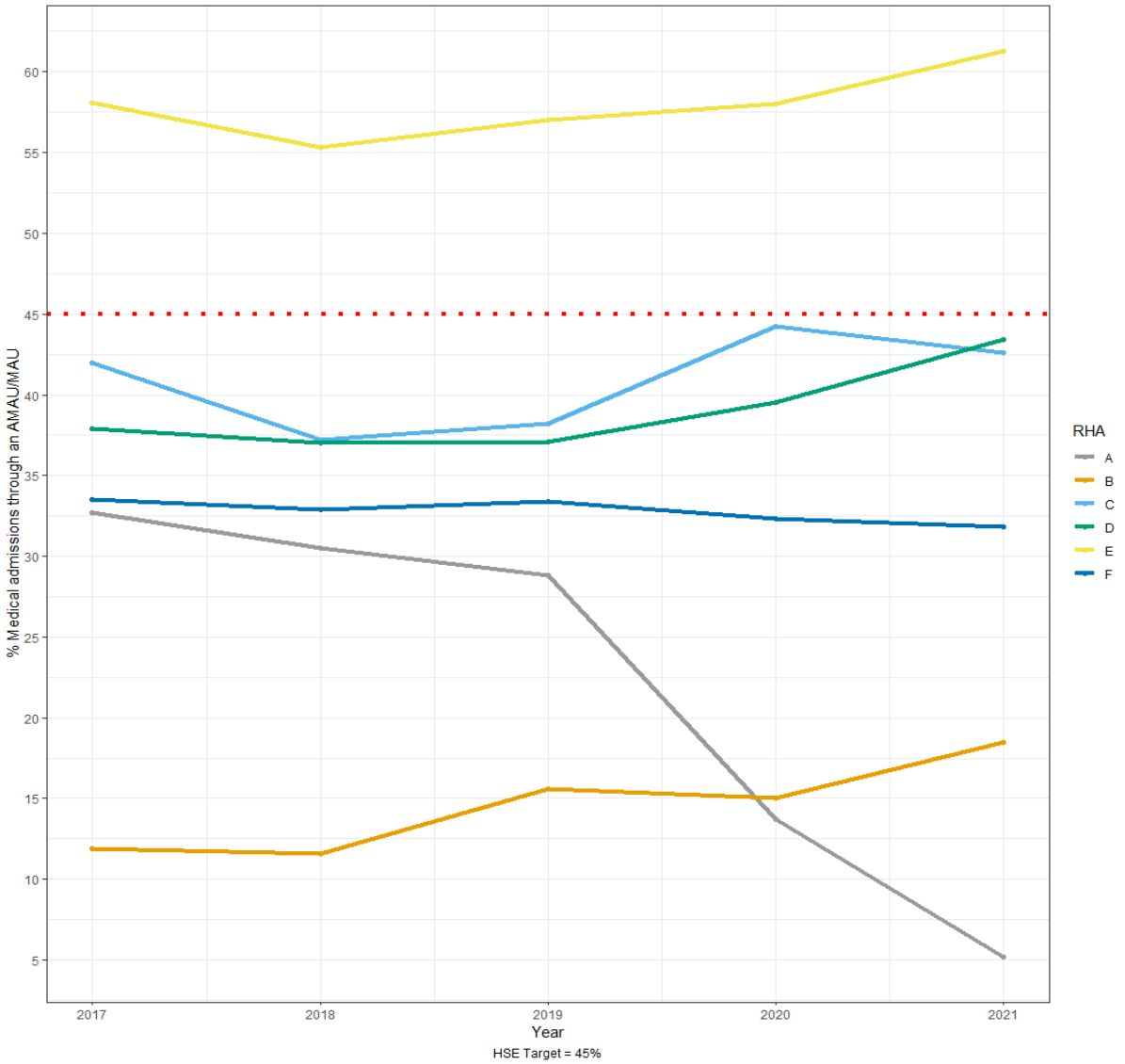
[9] Manchester Triage Scale: 'The Manchester Triage System is a clinical risk management tool used by clinicians worldwide to enable them to safely manage patient flow when clinical need far exceeds capacity.' (Manchester Triage System, 2022)

4.2. Utilisation of Acute Medical Assessment Units and Medical Assessment Units

Considering the evident widespread benefits associated with the effective utilisation of AMAUs, the following section aims to identify utilisation of such units in the assessment and processing of acute medical patients in the Irish healthcare system. The HSE has set a lower-bound target associated with the utilisation of AMAUs equal to 45% (HSE: Business Intelligence Unit, 2022). This target aims to have 45% of all medical admissions admitted through an Acute Medical Assessment or Medical Assessment Unit within each Hospital. In line with prior analysis, regional differences in the utilisation of AMAUs will be investigated through examining the spread of use at an RHA level. To account for differences in the complexity and scale of hospitals across regions, a subsequent analysis of AMAU utilisation is provided at a hospital-model level. Lastly, compliance at a hospital level is identified by the degree of variation from the HSE specified target, although it should be noted that divergence in performance is partially explained by differences in measurement of AMAU admissions and differences in the complexity of patients presenting across hospitals[10].

[10] Notably, while a standardised metric for the % of AMAU admissions is recorded across all hospitals, in reality some smaller hospitals operate a Local Injury Unit (LIU) rather than an ED. As patients cannot be admitted through an LIU, this means that relative admissions through an AMAU is higher in these smaller hospitals. This causes smaller hospitals (model 2 / 3) to appear to have comparatively better performance for this KPI.

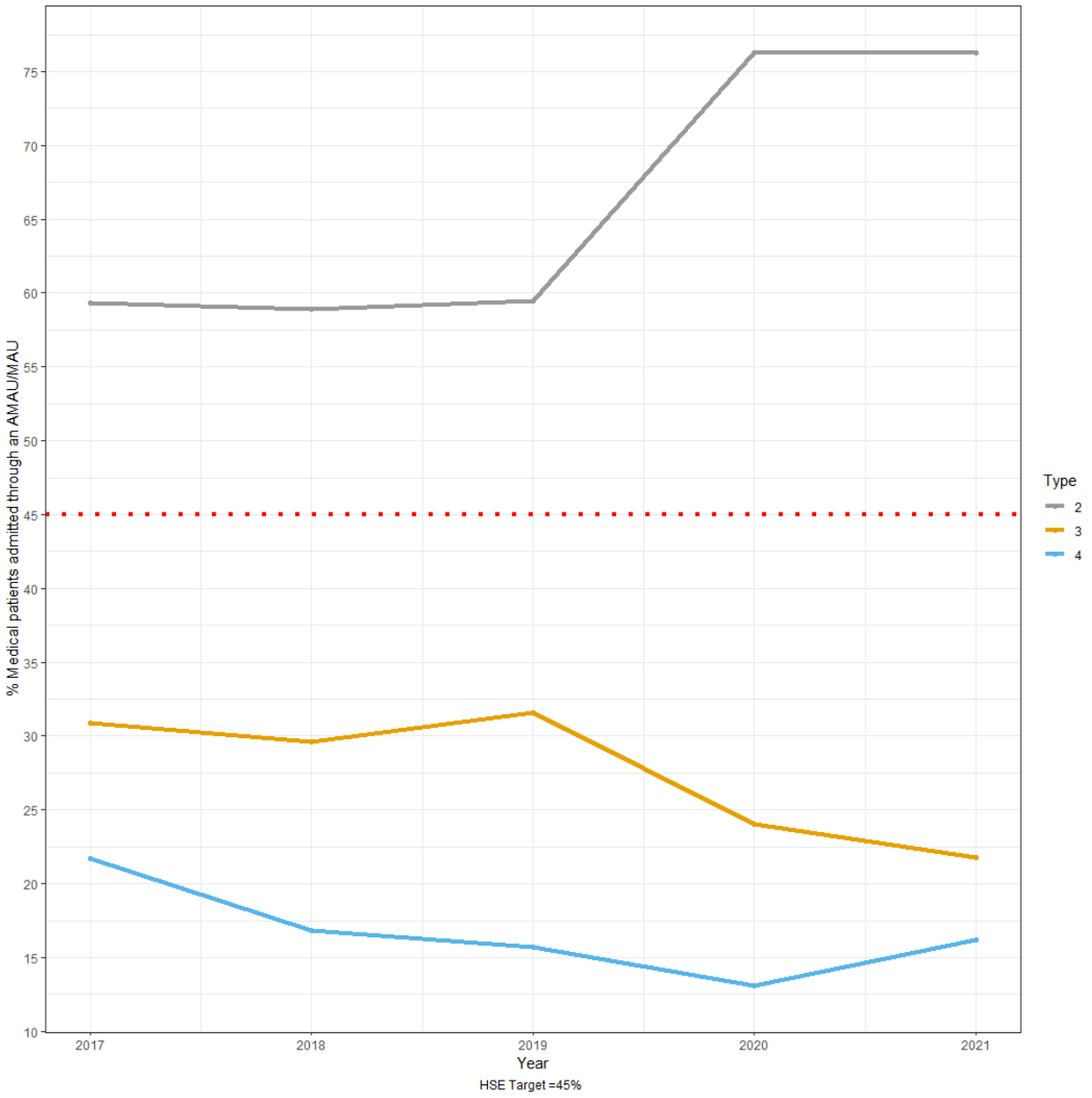
Fig.4.1: % Acute medical patients discharged/admitted through an AMAU/MAU 2017-2021 by RHA



Source: Authors Calculations,2022

As observed in Figure.4.1, regional differences are present in the utilisation of AMAU/MAUs across the Irish healthcare system. Throughout the period 2017-2021, performance varies across RHAs, with only RHA E being consistently compliant with targeted performance levels. While differences in the composition of hospitals across RHAs make direct comparisons in this context difficult, there remains value in comparison in changes over time. One can see that different strategies were likely employed during the COVID period, with RHA A experiencing a decline in AMAU utilisation, while many other RHAs improved on this metric over the same timeframe.

Fig.4.2: % Acute medical patients discharged admitted through an AMAU/MAU 2017-2021



Source: Authors Calculations,2022

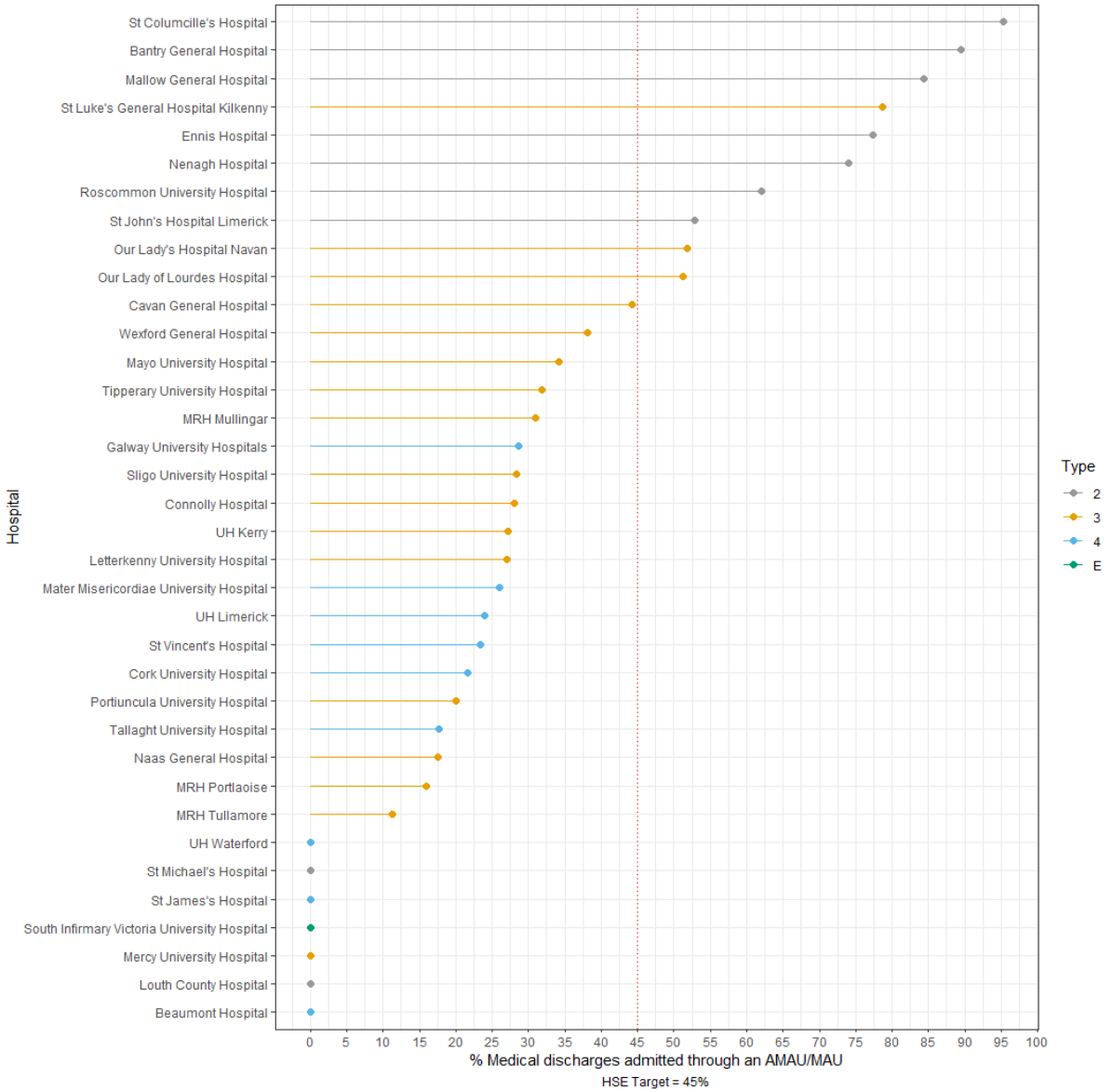
Figure.4.2 reflects the performance of hospitals by Model type which enables the differentiation between MAU and AMAU utilisation as pathways for medical admissions. Clear differences in the relative usage of AMAU/MAUs exist across hospital models. Model two hospitals are compliant across all five years analysed. The methods of referral to Model 2 hospitals are different however, with model 2 hospitals operating Medical Assessment Units (MAUs) which are solely accessible by General Practitioner referral[11]. This is a consequence of the lack of emergency departments in model 2

[11] A change in referral to also allow attendances through National Ambulance Service Triage has been implemented in some sites in early 2022.

hospitals, causing the proportion of admissions through MAU to be comparatively higher than in hospitals of greater scale. Most model 3 and 4 hospitals operate AMAUs which accept both GP referrals and non-GP referred patients and have an emergency department. The low levels of AMAU utilisation observed suggests that model 3 and model 4 hospitals may be under-utilising AMAUs as an efficient and effective pathway into acute hospital services, although additional analysis would be needed to confirm if this is the case[12]. More broadly, the analysis emphasises the need for a disaggregated performance indicators for AMAU/MAU admissions by hospital model – with a generalised target of 45% likely setting too low of a performance measure for MAU utilisation for model 2 hospitals, and too high a measure for model 3 and 4 hospitals.

[12] One caveat of the analysis is that the size of each AMAU unit relative to total hospital size is unknown.

Fig.4.3: % Acute medical patients discharges admitted through an AMAU/MAU 2019



Source: Authors Calculations,2022

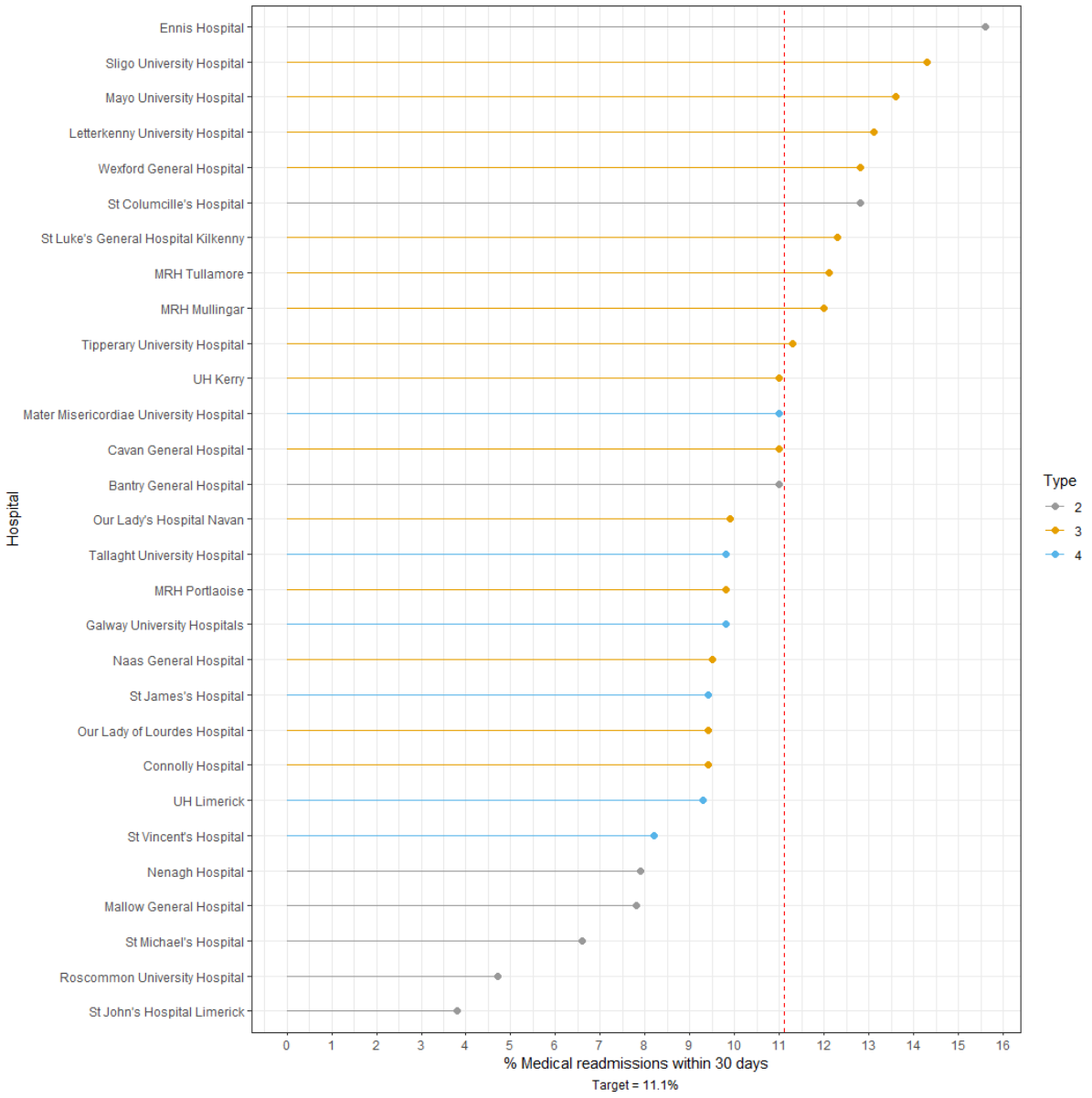
Figure.4.3 visualises the average percentage of medical discharges admitted through an AMAU/MAU at a hospital level. Multiple hospitals report 0% of medical patients are admitted through an AMAU/MAU, likely indicating discrepancy in how this data is collected and reported to the HSE. The top 5 most compliant hospitals, St. Colmcille's Hospital, Bantry Hospital, Mallow Hospital, St. Luke's Hospital and Ennis hospital admit 95.3%, 89.4%, 84.4%, 78.6%, and 77.3% of patients through AMAUs. As noted, compliance with this target is likely as much driven by hospital and patient characteristics as by management decisions in a given facility, indicating the need for a metric which more adequately accounts for these differences.

4.3 Acute Medical: 30 Day Re-admission Rate (Same Hospital) - 2017-2020.

A hospital readmission occurs when a patient returns to hospital after initial discharge within 30 days. In general, higher levels of hospital readmissions rates indicate ineffectiveness of treatment during past hospitalisations. Readmissions also consume hospital resources that could instead be dedicated to the care of other patients (Moloney, Bennett, & Silke, 2004). Hospital readmissions therefore serving as a good indicator of where a clear performance improvement in hospitals could be made. In terms of readmissions behaviour, individuals at the older end of the age spectrum are significantly more likely to be re-admitted as an acute medical patient, with 71% of such re-admissions subsequently deemed avoidable (Shalchi et al., 2009)(for similar findings: Conroy et al., 2013). Improved community care, especially to this patent group could therefore provide an avenue to reduce hospital-level pressures concerning bed availability, acute medical median length of stay, and patient quality of life.

Concerning Irish acute medical re-admissions performance, the HSE has set a target of 11.1%. Accordingly, relative performance at a RHA level, hospital-model level, and at an individual hospital level can be identified in comparison to the above set target. Figure.4.4 examines readmissions rates at an individual hospital level. For the year 2019, 30-day readmissions rates exceeding the target of 11.1% are seen in 10 out of 38 hospitals examined, with Ennis having the highest rate at 15.6%, followed by Sligo University Hospital with 14.3%. Given the additional costs and the patient safety risks represented by readmission of patients, further analysis of the drivers of readmissions in hospitals in Ireland may be advised. Recent readmissions rates appear to be favourable to those present in Irish hospitals historically. For example, Glynn et al. (2011) find an overall readmissions rate of 27% between 2002 and 2008 in St. James Hospital. Gorman et al. (2010) meanwhile finds an overall readmissions rate of 19.5% in Galway University Hospital in 2006. While not systematic, these examples provide some indication of reductions in re-admissions within Model 4 hospitals compared to historic data. No clear association between readmission rates and patient complexity appears to be present in the data, with all hospitals exceeding the specified target being model three or four. This may indicate the prospect of improved performance in this category through examination of hospitals with better readmissions outcomes, such as St Vincent's or UH Limerick.

Fig.4.4: Hospital Level Acute Medical Re-Admissions: 30-day re-admission rate 2019



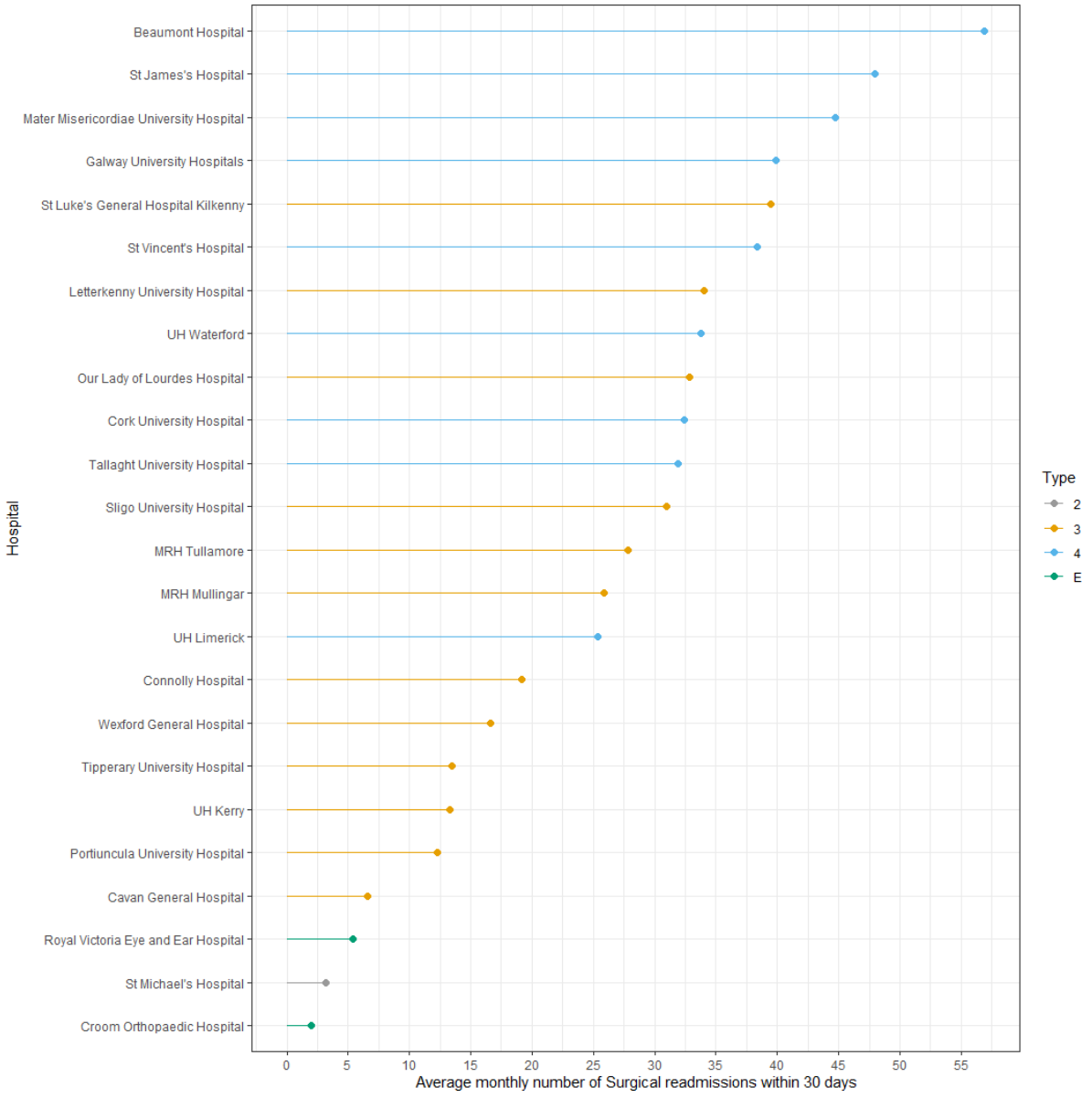
Source: Authors Calculations,2022

4.3.1 Surgical Re-admissions

In addition to general hospital readmissions, we can also examine readmissions of surgical patients within 30 days of their initial treatment. The HSE have set a target of 3% readmissions for patients of this type. In Fig.4.5, the monthly average number of surgical patients readmitted within 30 days is observed. Hospitals such as Beaumont, St. James and the Mater experience the highest levels of readmission. This could be intrinsically linked to the acuity and complexity of the patients whom they provide surgical care too. This would imply that hospitals undertaking lower acuity procedures should have lesser levels of readmissions. However, hospitals such as St. Luke's appear to have greater levels

of readmission than would be expected based on its procedure complexity, indicating room for improvement in some contexts.

Fig.4.5: Count of Average Number of Monthly Surgical Readmissions: 2019



Source: Authors Calculations, 2022

4.4: Elective Surgical Inpatients Admitted on Day of Surgical Procedure

The HSE has published Model of Care guidance for Elective Surgery recommending admission of patients of this type on the day of surgery (HSE, 2018). Elective surgical procedures are generally provided to individuals sufficiently medically stable as to not require admission to hospital prior to the day of their surgery. Such procedures can be understood as being preventative in nature, providing care to those who in the imminent future would require more acute or more costly healthcare

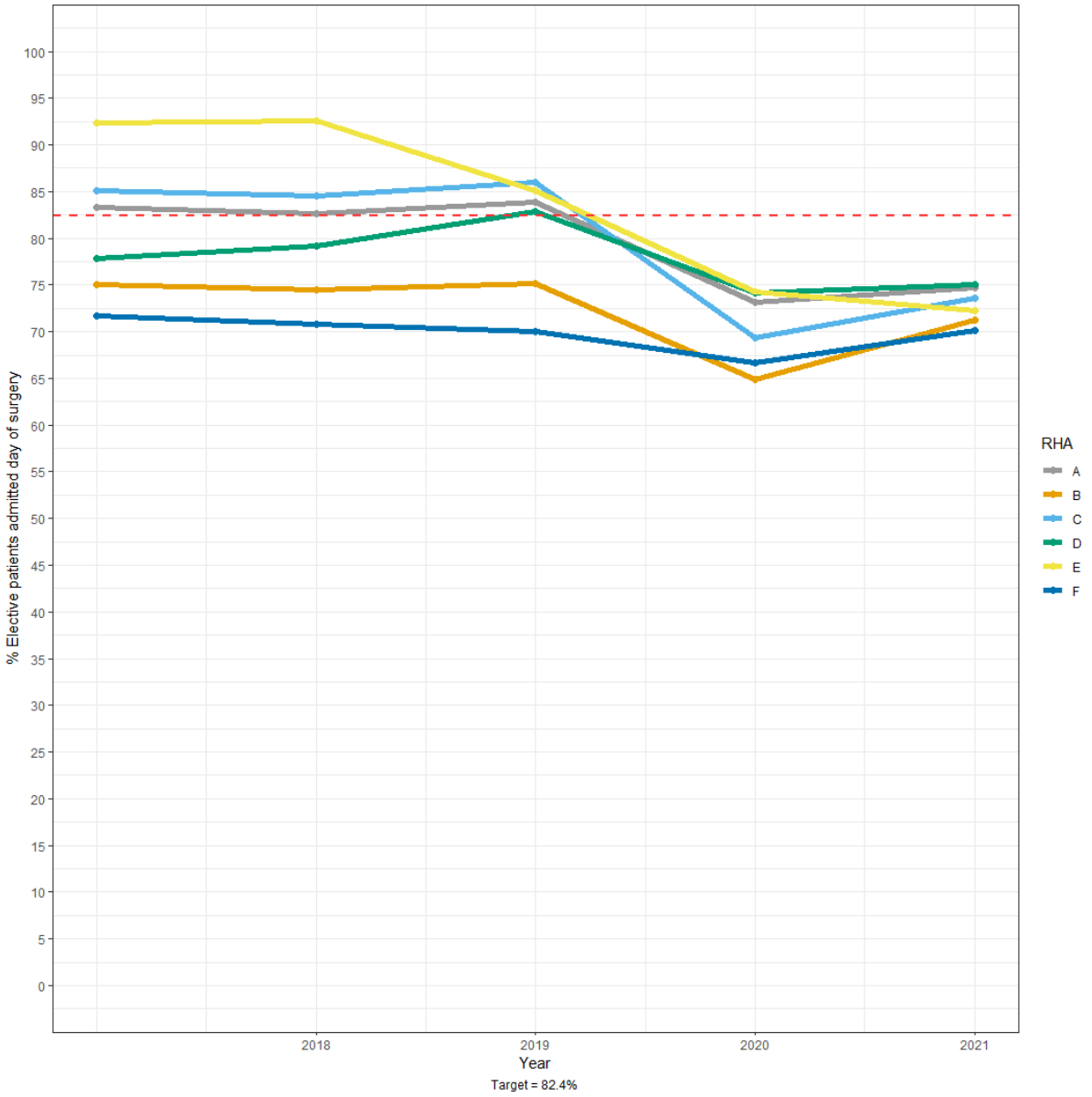
services. The demand for acute surgical services is high: constituting 60% of surgical activity in many departments throughout the Irish healthcare system (HSE, 2018). Individuals admitted as inpatients prior to day of surgery may represent an inefficiency: such individuals may have a better patient experience at home, and the hospital may require the bed for an emergently acute presentation in the interim. As such, hospital admissions prior to day of surgery may represent an inefficient use of patient time and hospital resources.

HSE Model of Care guidance outlines a number of additional benefits from admission of patients on day of surgery, including:

I. Reduction in elective surgery cancellations;
II. Optimal theatre utilisation;
III. Improvements in throughput and hospital case-mix;
IV. Reduced patient length of stay and disruption;
V. Reduced surgical bed requirements;
VI. Reduced running costs of surgical wards;
VII. Reduced waiting times for elective surgeries.

Given the numerous benefits outlined, admission of patients on day of surgery clearly represents an important consideration for hospital performance and improving the efficient use of resources in the sector. In relation to recent Irish performance for this metric, The HSE has set a lower-bound national target value corresponding to the percent of elective surgical inpatients admitted on the day of surgical procedure equal to 82.4%, however site-specific targets also exist. The following section aims to identify trends in elective surgical inpatient admissions at an RHA level, hospital-model level, individual hospital level, and lastly, ending with an illustrative costing analysis, estimating the potential economic cost of admissions prior to day of surgery.

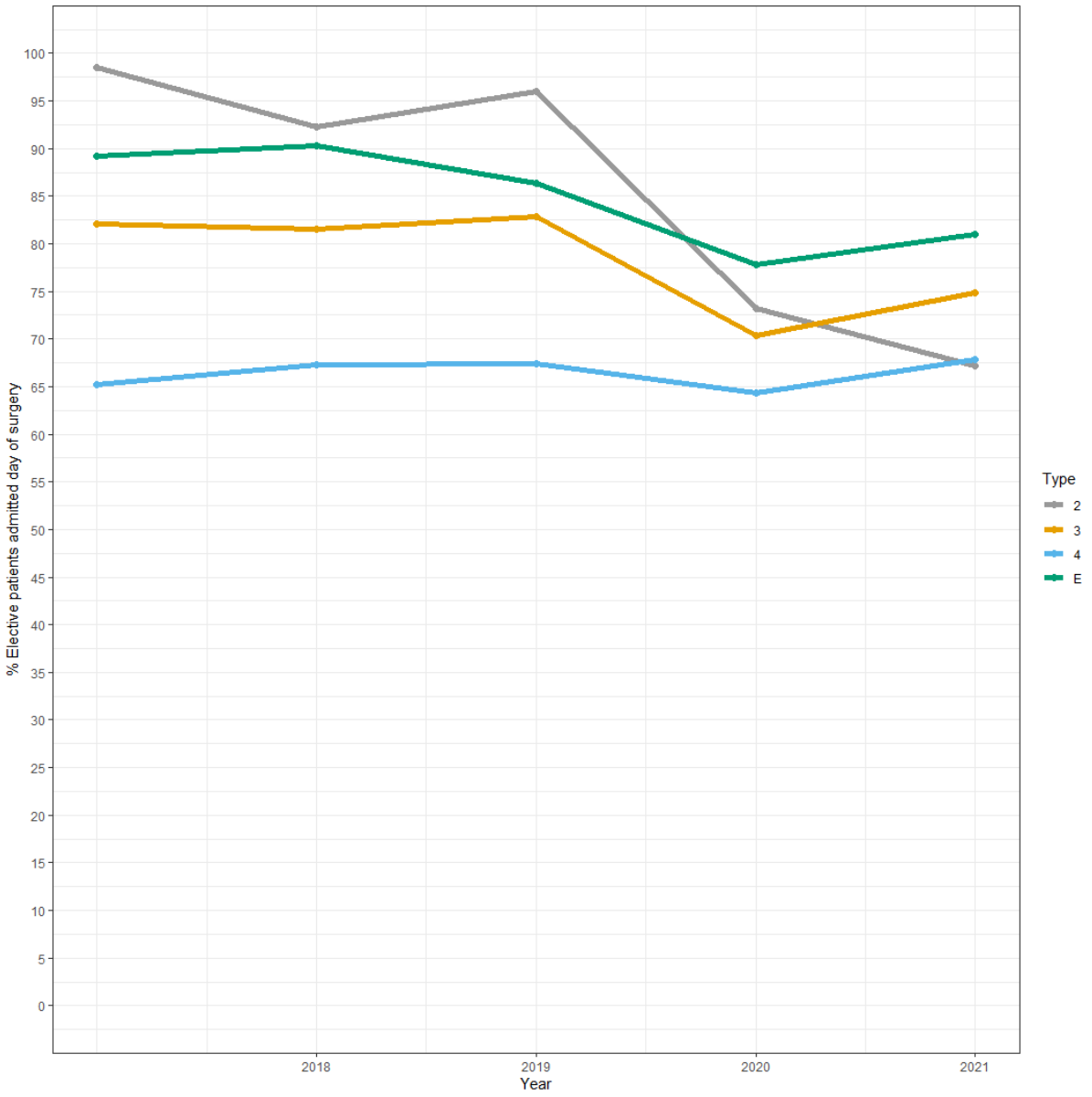
Fig.4.6: RHA Level Day of Surgical Admission: 2017-2021



Source: Authors Calculations,2022

Figure.4.6 demonstrates the spread of performance across RHAs. As can be observed, a dip in performance on this metric is observed from 2018 onwards across all RHAs. This is surprising, given the publication of the referenced HSE guidance on surgical admissions in 2018. Factors such as proximity to hospital may play a significant role in determining the on-the-day-admission of elective surgical patients and warrants further investigation (i.e., regions with patients living on average further from hospitals have more of a reason to admit patients prior to the day of surgery, although this does not explain declines *within* a given region).

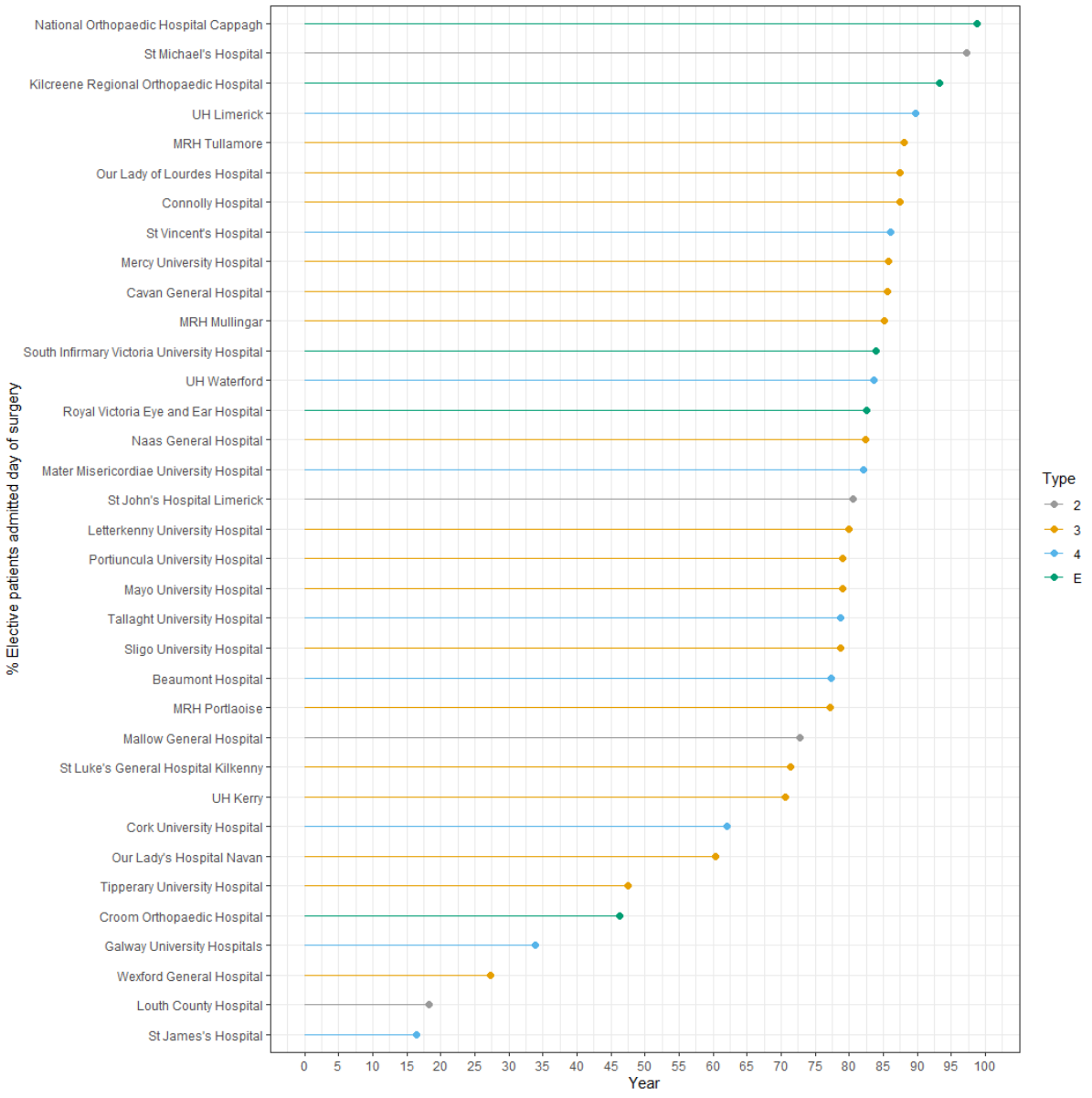
Fig.4.7*: Hospital Model Level Day of Surgical Admission: 2017-2021*



Source: Authors Calculations,2022

Analysis at a hospital-model level provides a more nuanced picture of elective surgical performance in Ireland. Across the period 2017 to 2021 model two, elective, and model 3 hospitals have experienced a decline in performance, with model four hospitals appearing relatively consistent with marginal improvement in 2021. Model two hospitals have experienced the most pronounced deterioration in performance across this time period, receiving the best performance value in 2017 and the worst value in 2021.

Fig.4.8: Hospital Level Day of Surgical Admission: 2021

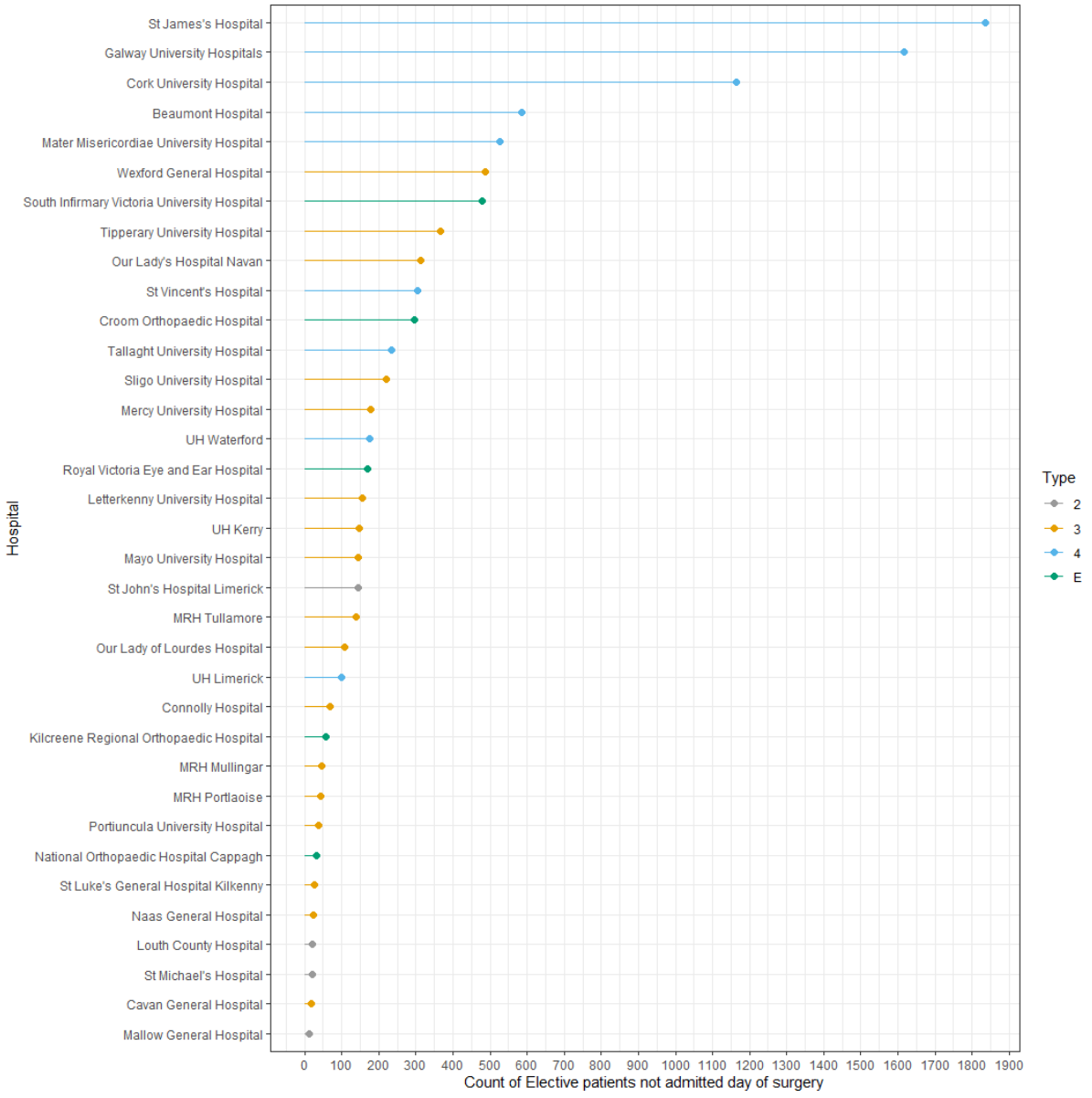


Source: Authors Calculations,2022

The analysis of admissions on the day of surgical procedure at an individual hospital level provides additional context to earlier graphics, allowing the identification of specific under-performers for this metric. As can be observed in Figure.4.8 the lowest performing hospitals in 2021 is St. James' Hospital, with just 15.3% of admissions taking place on day of surgery. For reference, the 2019 value corresponding to St James' hospital (30%) indicates that only 30% of elective surgical inpatients were admitted the day of surgical procedure. The comparability of performance in this metric assumes a homogenous degree of acuity across hospitals, i.e., the elective procedures in St James' hospital on average are of equal acuity as those provided in the best performing hospital, in this case Mallow

hospital with a corresponding value of 100%. Therefore, it is best to compare the relative levels of performance by Hospital Model, which would have a similar procedure complexity and catchment area. When evaluating performance by Model, the variation is quite noticeable with University Hospital Limerick admitting approximately 90% of patient's day of surgery compared to the lower levels of DOSA in Galway, and James' among other hospitals.

*Fig.4.9: Hospital Level Admissions Occurring **Not** on Day of Surgery: 2021*

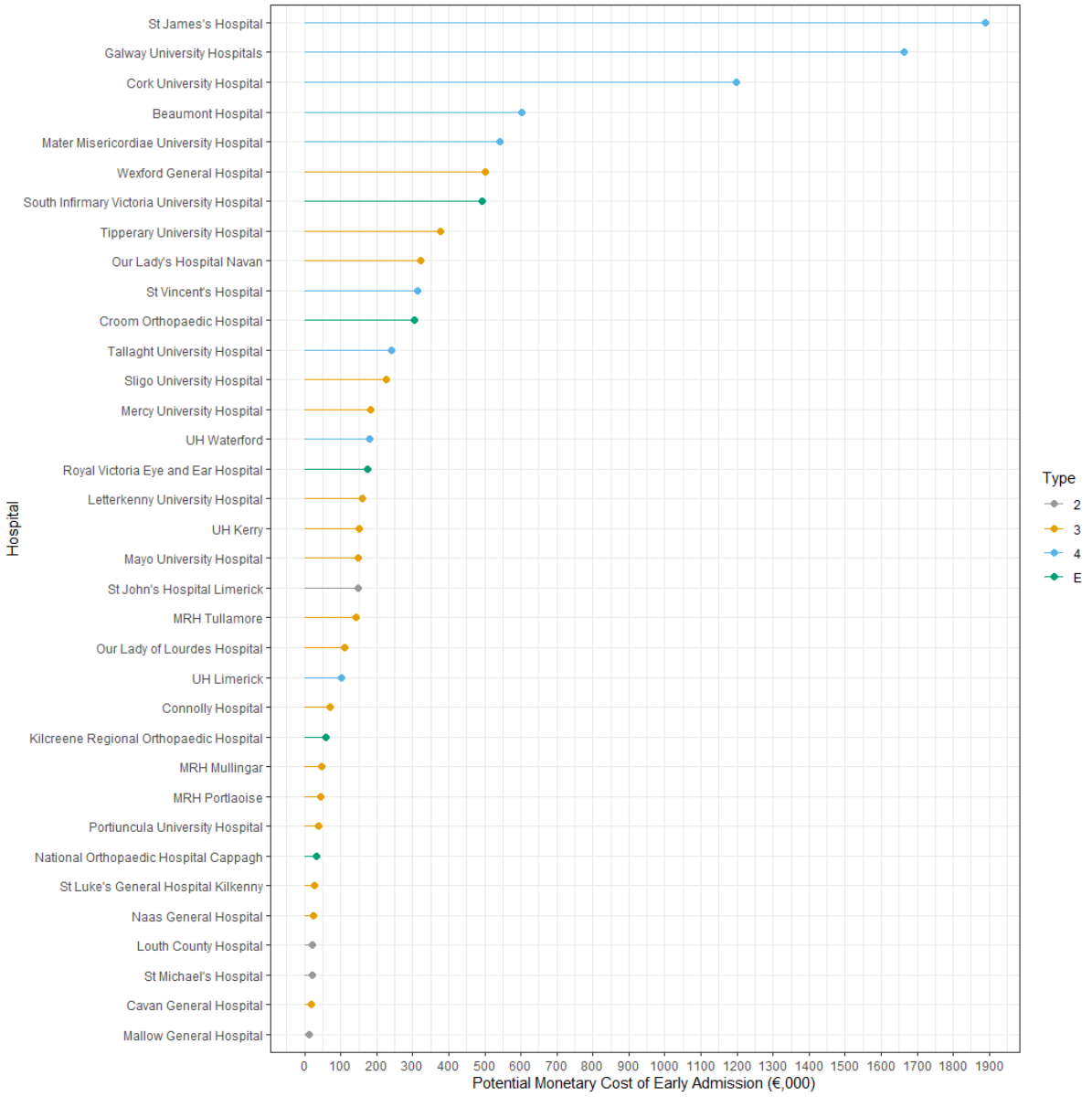


Source: Authors Calculations

Through examining the percentage of elective surgical inpatients admitted the day of surgery (DOS) and the number of elective surgical inpatient discharges, we can calculate the number of elective surgical inpatient discharges admitted DOS for a given month. Accordingly, the number of individuals

not admitted DOS can be calculated by subtracting the number of individuals admitted day of surgery from the number of elective surgical inpatient discharges. This produces a monthly, and subsequently - through an annualised extrapolation – a yearly average annualised number of elective surgical inpatients not admitted DOS. Figure.4.9, displays this, visualising the yearly number of elective inpatient admissions not occurring on the DOS.

Fig.4.10: Hospital Level Yearly Cost associated with not-on-the-day Surgical Admission 2021



Source: Authors Calculations, 2022

The National Finance Division (2022) identifies the average daily running cost of an in-patient hospital bed across acute hospitals to be equal to €1,029 per day[13]. Accordingly, under a conservative assumption that each elective surgical inpatient not admitted DOS was admitted one day prior to surgery (it is likely that the duration of not-on-the-day inpatient admission is not limited to one day), the following section calculates the economic cost associated with not-on-the-day-admission to hospital for elective surgical patients.

Figure.4.10 displays the estimated yearly cost of hospital admissions attributable to not-on-the-day inpatient surgical admission. As can be observed, St. James' Hospital, Cork University Hospital, and Galway University Hospitals experience the highest estimated nominal costs associated with not-on-the-day elective surgical admissions: €1.88 million, €1.66 million, and €1.2 million respectively. The estimated total national yearly cost associated with not-on-the-day elective surgical admissions equals €10.58 million. Evidently if these beds were freed up given the strains on the system it is likely that these costs would have been absorbed by other patients presenting and requiring treatment. Therefore, the reduction in early admission may not result in direct cost savings but would instead be viewed as an economic improvement in terms of cost per patient treated.

4.5 Delayed Transfer of Care from Hospital

A Delayed Transfer of Care is a patient who remains in hospital after a senior doctor (consultant or registrar) has documented in the medical chart that the patient can be discharged (Department of Health, 2018). Delayed Transfer of Cares are caused by a variety of factors including lack of availability of home / nursing home care, staff shortages and inadequate administration systems.

Delayed Transfer of Cares are generally categorised in three ways[14];

- Category A: Going Home (due for release);
- Category B: Long Term Care, and;
- Category C: Rehabilitation/ Other.

[13]This cost is the "fully-absorbed" cost of a hospital bed, meaning it not only includes the running costs of a hospital bed but also treatment and care costs (such as diagnostics, theatres etc). While this figure is therefore an over-estimate of the true cost of the bed occupancy from admission prior to the day of surgery, the numerous non-financial benefits of day of surgical admission for hospital process / pathways outlined by the HSE (2018) likely means that the associated cost of non-compliance in this context could be higher than estimated here.
[14] further information on these categories, including the recently expanded list of definitions for delayed transfers can be found here: https://www.hse.ie/eng/services/publications/performancereports/performance-profile-january-to-march-2022.pdf

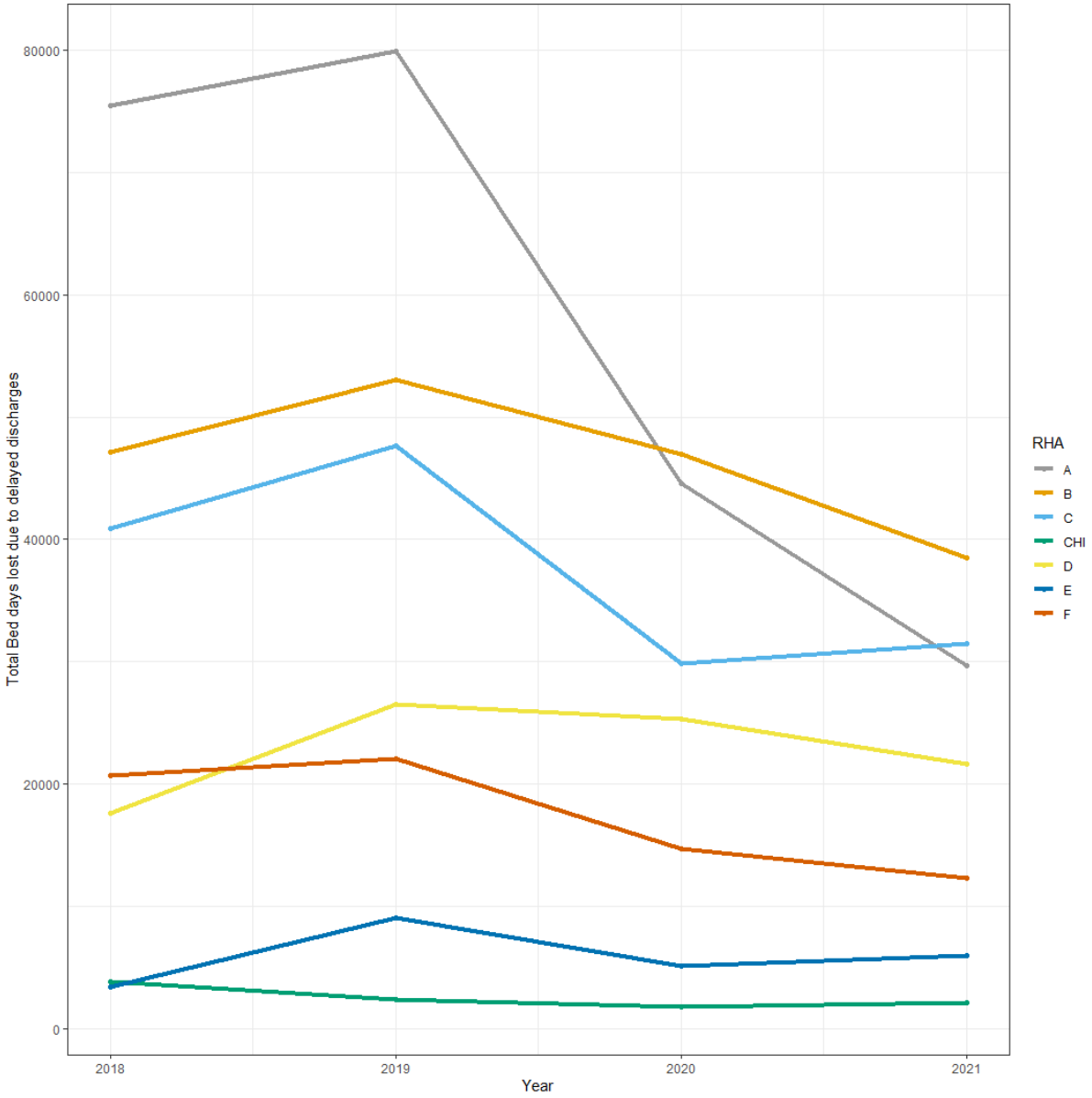
In 2018 an Independent Expert Review of Delayed Transfer of Care was completed providing a number of short- and long-term recommendations to improve performance in the area of Delayed Transfer of Cares including:

- Improvements in Delayed Transfer of Care data quality, in particular an extension of the Delayed Transfer of Cares dataset to the non-acute setting;
- Joint Planning and information sharing between hospitals and community services to optimise patient flow;
- Better communication to families due to receive discharged patients to reduce potential delays;
- The use of multi-disciplinary teams from acute and community care settings to facilitate single discharge assessments and;
- The establishment of an early discharge pathway to prevent admissions, thereby reducing the risk of Delayed Transfer of Cares occurring. This would involve the placement of social workers or allied health professionals in emergency departments, enabling expedited assessment of patients and thereby improving overall patient flow.

Per hospital Delayed Transfer of Care (DTOC) data is available for analysis through the Compstat database between 2017 and 2021. Delayed Transfer of Cares are examined at an RHA and hospital level relative to illustrate where the issue of Delayed Transfer of Care is most prevalent.

In Fig.4.11, an analysis of DTOC by RHA is provided. One can see that there is pronounced regional variation in DTOC, with a considerably higher proportion of total bed days lost in some RHAs over others. RHA A has both the largest stock of beds and the largest number of bed days lost to Delayed Transfer of Care, with approximately 80,000 bed days, or 10% of total activity lost due to Delayed Transfer of Care in 2019.

Fig.4.11: RHA level analysis of Delayed Transfer of Cares,2019

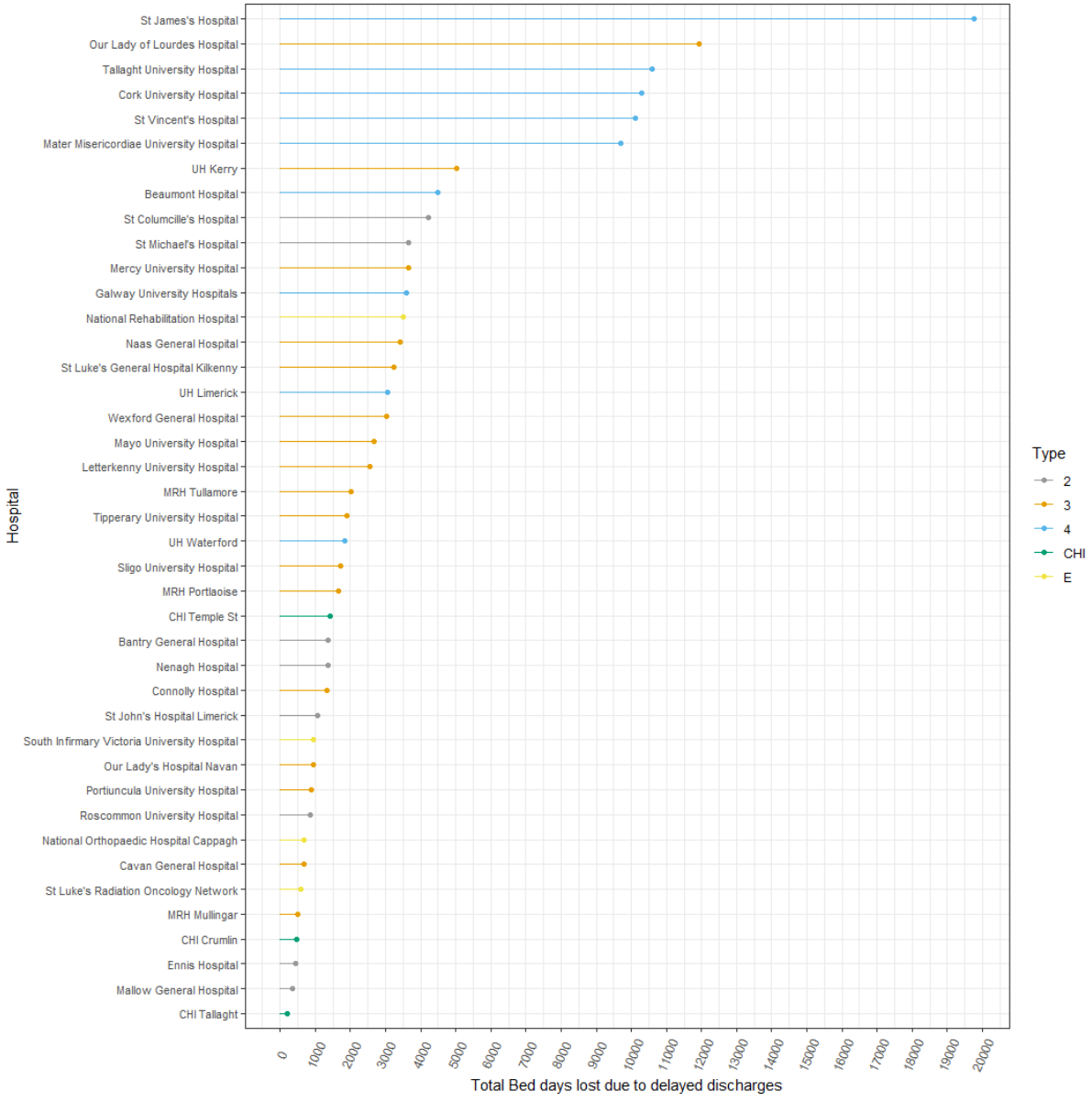


Source: Authors Calculations,2022

To further nuance this finding, Fig.4.12 provides the number of bed days lost per hospital in 2021 in each hospital. This illustrates on a per-hospital level where DTOCs are most prominent, allowing for the potential identification of where remediation could be focussed for maximum benefit. Examination on a per hospital basis also allows comparison of performance to the HSE designated target for discharges. In 2019, the national target for Delayed Transfer of Cares was a loss of 200,750 bed days, compared to total bed days used in 2019 due to DTOCs of 240,000. It should also be noted that this target was reduced to 175,200 bed days lost due to Delayed Transfer of Care in 2021, with a total of 141,666 bed days lost in 2021. One can see that excess bed days lost from Delayed Transfer of Cares (over the targeted level) is an issue across the healthcare system in some hospitals of each

model type. Wide variation in performance across hospital model implies room for improvement in each setting for performance on Delayed Transfer of Cares. What becomes apparent from this analysis and reflection on other years is that the most burdened hospitals with delayed discharges consistently are within the Greater Dublin Region, and University Hospital Cork. The potential additional costs of delayed discharge for patients is discussed below in Fig.4.13

Fig.4.12: Count of Bed days lost to Delayed Transfer of Cares by Hospital, 2021



Source: Authors Calculations

Lost bed days from Delayed Transfer of Cares come with an opportunity cost in terms of the provision of additional services to patients. For example, Coughlan (2001) observes that beds used by patients awaiting discharge could instead be reallocated to urgent or elective procedures. Low bed availability

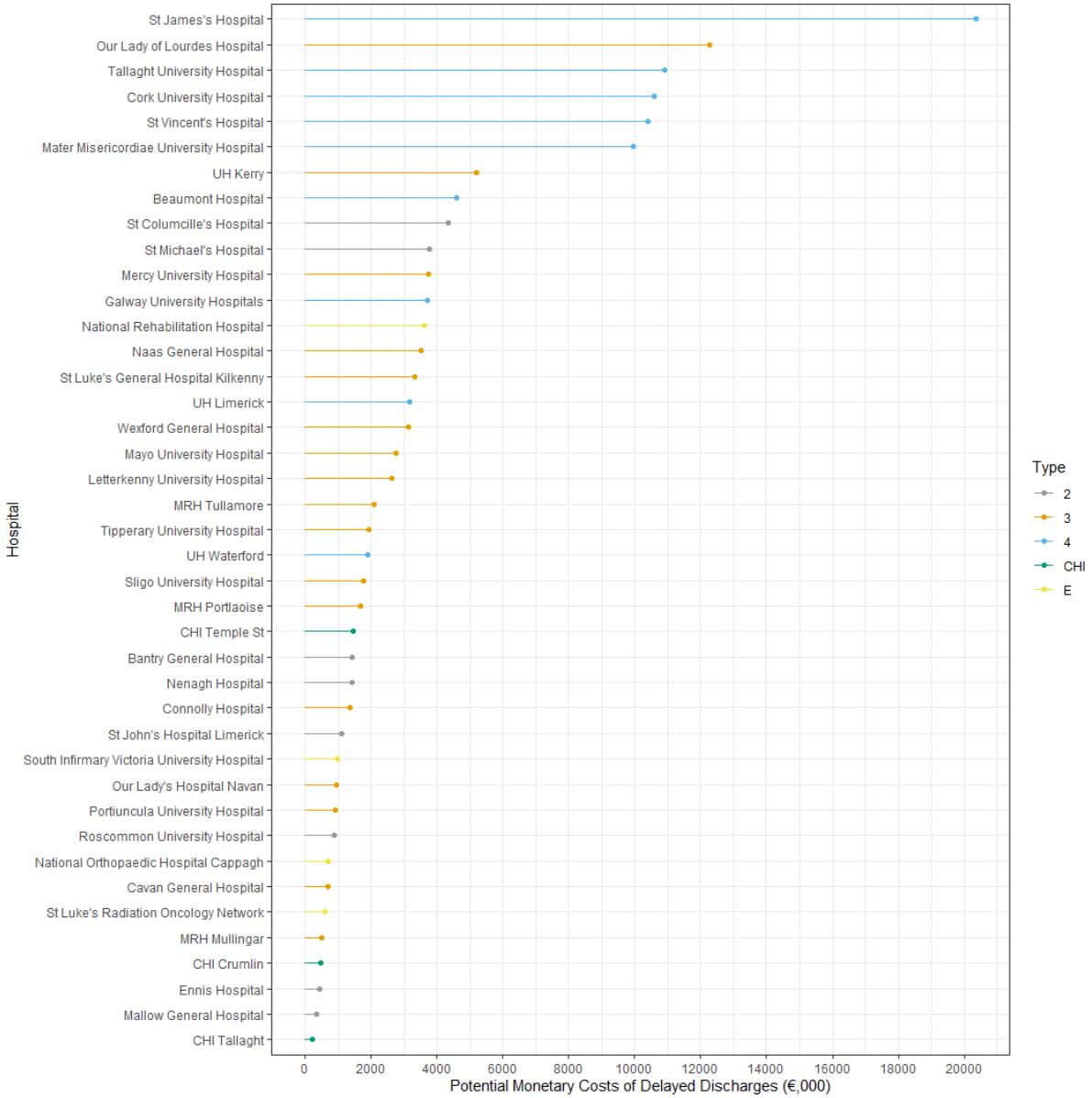
is also a common reason for the cancellation of surgery, with high bed occupancy also being associated with negative staff and patient outcomes (for discussion in Irish context see Shine & Hennessy (2022)).

Given the quantum of Delayed Transfer of Cares within the studied period, the reduction of Delayed Transfer of Cares could provide a significant increase in activity for acute inpatient elective procedures. Equally, irrespective of increased hospital activity the treatment of patients within a more clinically appropriate setting could have benefits to the patients and cost savings for the exchequer. For example, the cost of a long-term care bed funded by the Nursing Home Support scheme varies between €800-1400 per week with this being considerably less than the average cost of a week's stay within an acute hospital of €7,203 per week based on the HSE National Finance estimate of the absorbed cost of a hospital bed[15]. This estimate can also be used in an illustrative manner to provide a potential estimated economic cost of Delayed Transfer of Cares, although uncertainty regarding Delayed Transfer of Care bed day or substitute care costs makes this analysis very preliminary.

In 2021, a potential cost of €145.8 million was spent treating patients in Acute Settings who could have been treated elsewhere. These 141,666 bed days could have been used to potentially increase elective activity/ reduce the number of patients on trolleys within Acute Hospital settings. While the elimination of all delayed transfers of care is likely impossible, the significant potential savings from a reduced level of this type of activity motivates targeted intervention particularly in those hospitals experiencing the highest proportional level of transfer delays.

[15] As stated earlier, this is the absorbed cost of a hospital bed – meaning it likely exaggerates the nominal financial cost of these beds for patients awaiting discharge. It should however be noted that the nominal financial cost does not account for spillover effects from delayed discharges (e.g, reduced staff productivity).

Fig.4.13: Illustrative Economic costs of Delayed Transfer of Cares: 2021



Source: Authors Calculation,2022

4.6 Summary of Acute Medical/Surgical Performance

In general, hospital readmissions are a cause for concern given the potential patient safety risks and additional costs to the exchequer and the patient from readmission. There is some indication that performance on readmissions rates has markedly improved since the 2000s, with readmissions rates of 27% observed in St James Hospital between 2002 and 2008, and a rate of 19.5% observed in Galway University Hospital in 2006. In total, 10 out of 29 hospitals have readmission rates higher than the HSE target of 11.1%, with these hospitals in every case being model 2 and 3 facilities.

In general, admission prior to day of surgery is not required, with not-on-the-day admissions identified by the HSE as a source of economic inefficiency for Irish hospitals. Under an assumption that all not-on-the-day elective surgical inpatient admissions occur only one day prior, the economic cost associated with admissions prior to the day of surgery can be estimated. The findings indicate that not-on-the-day elective surgical inpatient admissions cost the Irish healthcare system €10.58 million for the year 2021. While these costings are inexact, the numerous non-financial benefits associated with admission on day of surgery supports the claim that benefits of this nature could be obtained through better adherence to HSE policy in this context. However, these costs are better described as an opportunity cost given that this capacity will most likely be used by other patients given the demands on the system.

Findings are similar for Delayed Transfer of Cares, with substantial variation across regions, hospital models and individual hospitals in terms of the proportion of bed days used by patients deemed suitable for release from hospital. On an RHA level, 10% of bed days used in 2019 in RHA A are attributable to patients awaiting discharge, versus just 4% in RHA F. The reduction in delayed transfers of care in 2021 over 2019 may be directly related to the reduced levels of activity during the pandemic. Therefore, performance on this metric should be revaluated in 2023, once a complete dataset for 2022 is available to understand if this decrease was temporary.

Regional differences exist in AMAU/MAU usage, with approximate 2021 values for RHA E having 61% medical admissions through this pathway, whereas RHA A had 5% - the highest and lowest values of compliance observed. At a hospital model level, model two hospitals receive compliant values for each year analysed, with both model 3 and 4 hospitals receiving scores below this target. One limitation of the AMAU analysis is the inability to discriminate the relative size of an AMAU to other hospital services (AMAU might be highly effective, but relatively smaller in scale to other pathways, producing a lower utilisation rate under this metric). It would therefore be advisable for AMAU admissions targets to be set relative to the scale of a given facility, enabling discriminatory analysis and potential remediatory intervention.

5. Healthcare Associated Infections/Patient Safety Incidents:

5.1. Background

Healthcare Associated Infections are infections acquired by patients during their stay in a hospital or another healthcare setting. Although some of these infections can be treated easily, others may more seriously affect a patient's health, increasing their stay in the hospital and hospital costs, and causing considerable distress to these patients[16]. The excessive consumption of antibiotics is also a concern in this context, resulting in Antimicrobial resistance.

Antimicrobial resistance (AMR) occurs when micro-organisms adapt over time and no longer respond to antimicrobials. When micro-organisms become resistant to antimicrobials, infections become more difficult and more expensive to treat. AMR presents a significant threat to public health globally, as it is associated with substantial levels of mortality and morbidity. The financial cost of treating resistant infections places a significant burden on society, as patients infected with drug resistant micro-organisms are more likely to remain in hospital for a longer period of time, to have poorer outcomes and to be unable to work[17].

Ireland's National Action Plan (iNAP) on Antimicrobial Resistance (2017-2020) was co-launched by the Minister for Health and the Minister for Agriculture, Food and the Marine on 25 October 2017. iNAP is based on the five strategic objectives in the 'World Health Organization (WHO) Global Action Plan on AMR and recognises the critical importance of a One Health approach, in that human health, agriculture and environmental sectors need to work together to effectively tackle AMR. One of the five key strategic objectives of iNAP is to 'promote research and sustainable investment in new medicines, diagnostic tools, vaccines and other interventions'[15]. This was followed on by iNAP 2, (2021-2025), which is expected to have a mid-cycle review in early 2023.

The onset in the COVID-19 Pandemic resulted in a shift in Infection Prevention and Control (IPC) from a broader focus on healthcare associated infections, to focus on the reduction in the spread of COVID-19 within Acute hospital settings. This stratification of focus on COVID-19 and the potential misappropriate use of anti-microbials to treat COVID-19 in the period directly following the onset of the pandemic may have resulted in incidence rate rises for other infection types.

[16] https://www.ecdc.europa.eu/en/healthcare-associated-infections
[17] https://www.hiqa.ie/sites/default/files/2021-07/Report-of-Economic-Burden-of-AMR.pdf

5.1.1 Literature Review:

Preventable healthcare associated infections (HCAIs) such as *Clostridioides difficile (CDI)* and *Staphylococcus Aureus (S. Aureus)* infections, and medication-based incidents can be understood as an opportunity cost and an inefficient use of resources. Hospitals experiencing high HCAI rates can be understood as being a patient safety risk, through their inability to mitigate the spread, risk, and economic cost associated with such infections. Similarly, high rates of medication errors in hospitals represents a patient safety risk in the dimension of medication safety, with associated negative clinical outcomes. Hospitals which identify infections in patients may have to reduce activity and delay elective procedures, as capacity will be reduced as part of an infection control procedures. The colonisation of patients with an infection equally has negative public health consequences. The following section discusses the literature on the topic of healthcare associated infections and medication-based incidents, highlighting the causes of, and outcomes associated with each form of patient safety concern. Analysis is then provided for incidence levels of each HCAI or medication incident by hospital in Ireland.

Nosocomial CDI is a potentially fatal healthcare associated infection of the large intestine caused by the bacteria *Clostridioides difficile*, with an overall mortality rate reported as approximately 22% of which 2% was directly associated with CDI (National Clinical Effectiveness Committee, 2014). Even further, *Clostridioides difficile infection* (CDI) is attributable to 2% of all deaths in the Irish healthcare system (ibid.). Literature on the topic of CDI highlight the significance of age and antibiotic use (Leffler & Lamont, 2015), and duration of hospital stay in CDI prevalence (National Clinical Effectiveness Committee, 2014). As the Irish age demographic continues to transition to an increasingly elderly population, the importance of mitigating the adverse health outcomes and spread of CDI becomes of significant additional importance. Following the digestion of antibiotics, a deterioration of microbial diversity in the patient is likely, with such deterioration potentially persisting for months (Jernberg et al., 2007). Accordingly, antibiotic usage is significantly associated with increased risk of CDI and associated clinical consequences. Therefore, strategies to reduce Antimicrobial resistance through more informed prescribing may also aide in the reduction of CDI cases in the long run.

Aside from the negative health outcomes associated with CDI, Lofgren et al. (2014) find that ICU patients with CDI experience both increased lengths of stay and heightened mortality rates relative to non-infected individuals. Evidently, a high level of CDI in a healthcare system impacts patients – through reducing their quality adjusted life years – and hospitals – through resources used on their prevention and treatment.

Through quantifying the cost of CDI, the economic burden at a hospital and national level can be identified, and the cost-effectiveness of a variety of preventative and curative treatments can be subsequently evaluated. The literature points to several measures to constrain CDI that can be considered at the outset. For example, Bartsch et al. (2012) proposes that screening, alongside isolation precautions, may be a cost-effective preventative strategy to reduce the economic burden and adverse health outcomes associated with CDI.

Staphylococcus aureus is a ubiquitous organism prevalent in the skin and mucus of human beings, with approximately 50% of all humans being carriers (Food Safety Authority of Ireland, 2011). Within hospital settings it represents a significant risk to patient safety patients acquiring nosocomial S. aureus five-times more at risk of in-hospital mortality relative to their non-infected peers (Noskin et al., 2005: as cited in Bamberger & Boyd, 2005). Individuals at the extremes in age profile (Y.C. Tong et al., 2015), those undergoing surgery, and patients who are frequent drug users are those most at risk. Infections occur during a breach of skin, allowing access for the bacteria into the human body (Lowry, 1998).). Estimates from Y.C. Tong et al. (2015) indicate that the population incidence of *S. Aureus* infections spans between 10 – 30 per 100,000 persons per year. Understanding the cause and frequency of S. aureus infections permits subsequent analysis to identify preventative strategies, establish individuals most at risk, and compare the prevalence of *S. Aureus* in the Irish population relative to our international peers. With regards to the mitigation of nosocomial *S. aureus* infections, antibiotic stewardship[18] has been shown to successfully reduce the spread of *S. aureus* in hospital settings, although the cost-effectiveness of such a policy is in contention, due to the labour-intensive nature of such an intervention (Vonberg et al., 2008). Findings from Kline et al. (2018) indicate that pre-surgical *S. aureus* screening is not a cost-effective strategy in reducing surgical site infections.

Medication error presents itself as a potentially significant source of patient morbidity and mortality (Walsh et al., 2016). While not all medication-based incidents result in patient harm, such occurrences may represent an inefficiency in the form of increased average length of stay, adding to hospital burden (Paradis et al., 2009; Choi et al., 2016). The HSE conceptualise medication incidents as being: "[a]n unplanned, unexpected or uncontrolled occurrence, which causes (or has the potential to cause) injury, ill-health and/or damage" related to medication. An incident can be a harmful incident (adverse event), a no harm incident, a near miss, dangerous occurrence (reportable circumstance) or

[18] Antimicrobial stewardship is a set of coordinated measures designed to improve and measure the appropriate use of antimicrobials. This is done by promoting the optimal antimicrobial course of treatment, dosage, duration of therapy and way in which the medication is taken (for example, oral) (Antimicrobial Stewardship - HSE.ie, 2022)

complaint" (HSE, 2022). Walsh et al. (2017) undertakes a systematic review of the economic impact of medication error, finding the cost of medication error presented in the fifteen studies ranging from €2.58 - €111,727. The broad range of costings highlights the various channels in which medication errors occur and the severity of their occurrence. Drug-drug interactions - a form of medication error in which the consumption of two or more non-mutually suitable substances – for example were shown to be significantly related to length of stay and cost of hospitalisation (a seven day increase in length of stay, on average) (Moura, Acurciuo, and Belo, 2009). The lowest economic cost reported per incident, €2.58, was related to 483 erroneous vaccines provided to children, while the highest economic cost per incident, €111,727 was related to drug errors for anaesthesia. This highlights the need for context specific examination of medication errors to estimate clinical and economic costs, something HSE performance data is currently unable to provide.

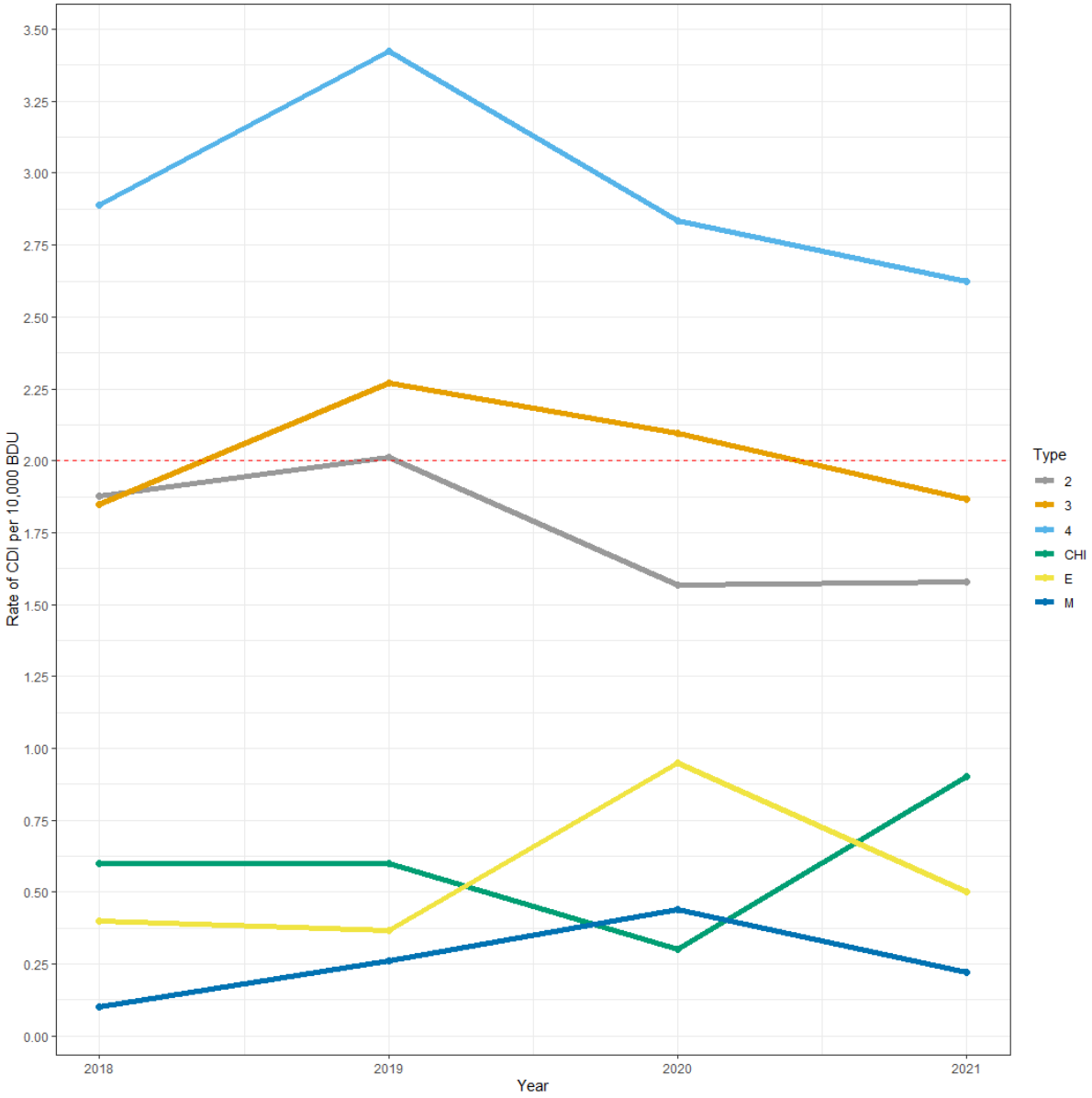
The effects which colonisation of individuals by infections have on general public health is a risk, which this paper doesn't measure but reflects on the potential risks of treating colonised patients and the risks of unidentified colonised patients in communal settings within the health system.

5.2.1 Patient Safety: Clostridioides difficile Infections: 2018-2021

Due to the nature of CDI, its prevalence can only be mitigated as all infections are not avoidable. Nonetheless, preventing the spread of CDI has been shown to reduce hospital mortality and prevent a reduction in hospital activity due to IPC measures, and is therefore a useful consideration for acute care policy. The following section identifies the prevalence and quantifies the economic burden associated with CDI across the Irish healthcare system. The HSE has set an upper-bound target level of CDI of 2 cases per 10,000 bed days used (BDU) (HSE: Business Intelligence Unit, 2022). The availability of a target permits the following analysis to identify compliant and non-compliant hospitals and recognize performance across hospital models. The HSE has decided on the use of stretch measures to encourage the continued work to consistently decrease the rates of infection prevalence with the target for CDI being 2.2 in 2019 before being reduced to the current target in 2020.

In Fig.5.1 below, the average incidence rates of CDI by hospital model level are available over the period 2018-2020. Across most of hospital models, the levels of infection appear to peak in 2019, before dropping in 2020. The increases in rates within Elective Hospitals may be directly related to the effects of COVID-19 and the potential reorganisation of such facilities to treat other patients than they would traditionally treat. Equally it must be noted that during the early days of the COVID-19 pandemic there was inappropriate prescribing of antimicrobials to treat COVID-19 which would have evidently increased the potential rates of CDI, along with decreasing activity levels across the system.

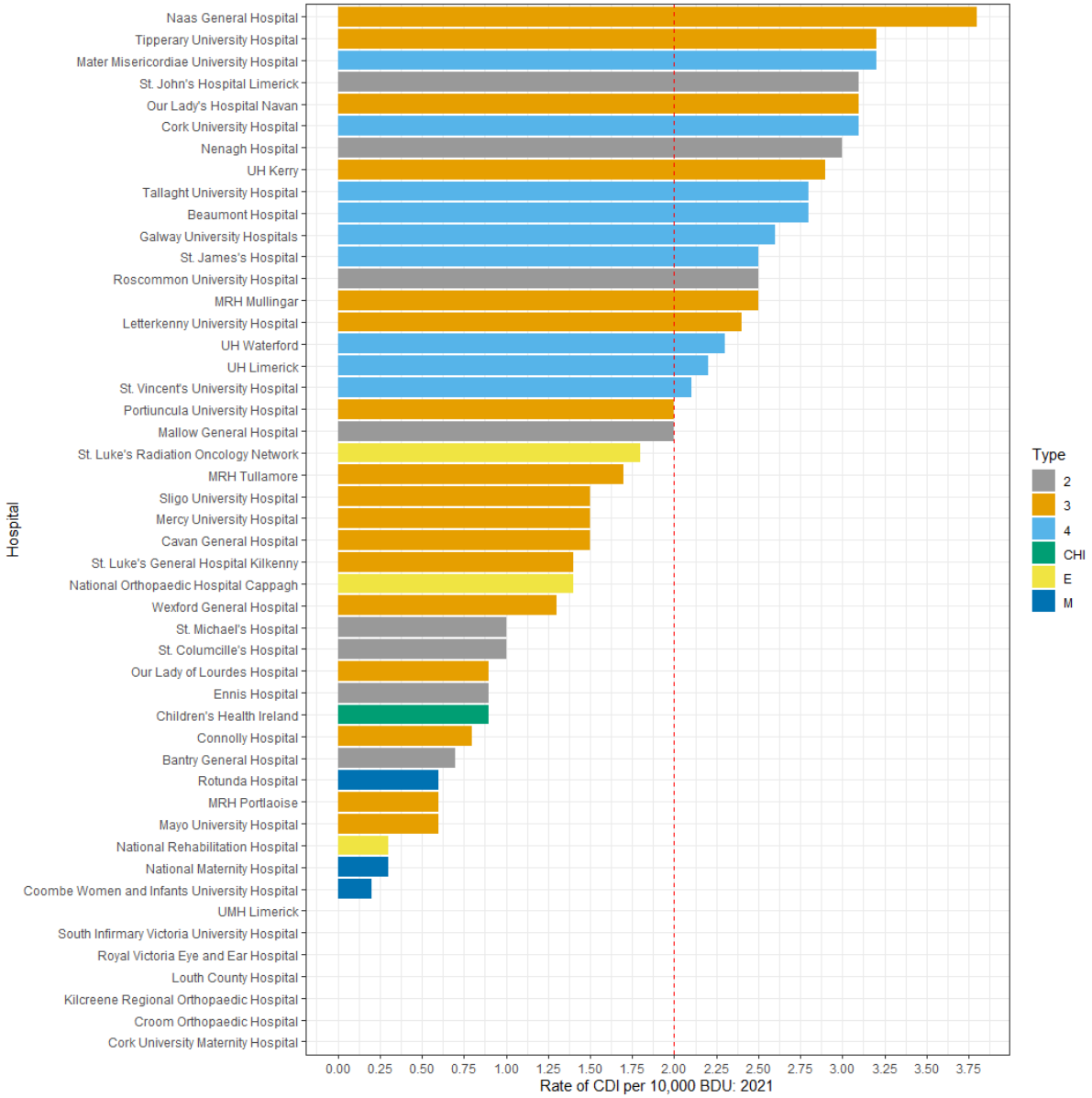
Fig.5.1: Incidence of CDI by Hospital Model



Source: Authors Calculations

In Fig.5.2, below the rates of CDI per 10,000 bed days is used, examined on a 2019 basis as 2021 data is not available. This is obtained by calculating an average monthly rate by hospital. In this graphic it becomes apparent that there may have been numerous outbreaks of CDI throughout multiple hospitals within the public health system. The management of CDI may limit activity in hospitals where infrastructure is not suitable for modern IPC practices. For example, if no isolation rooms are present in a hospital, a 6-bed ward may be closed to isolate one patient with CDI.

Fig.5.2: Incidence of CDI by Hospital[19]:2021



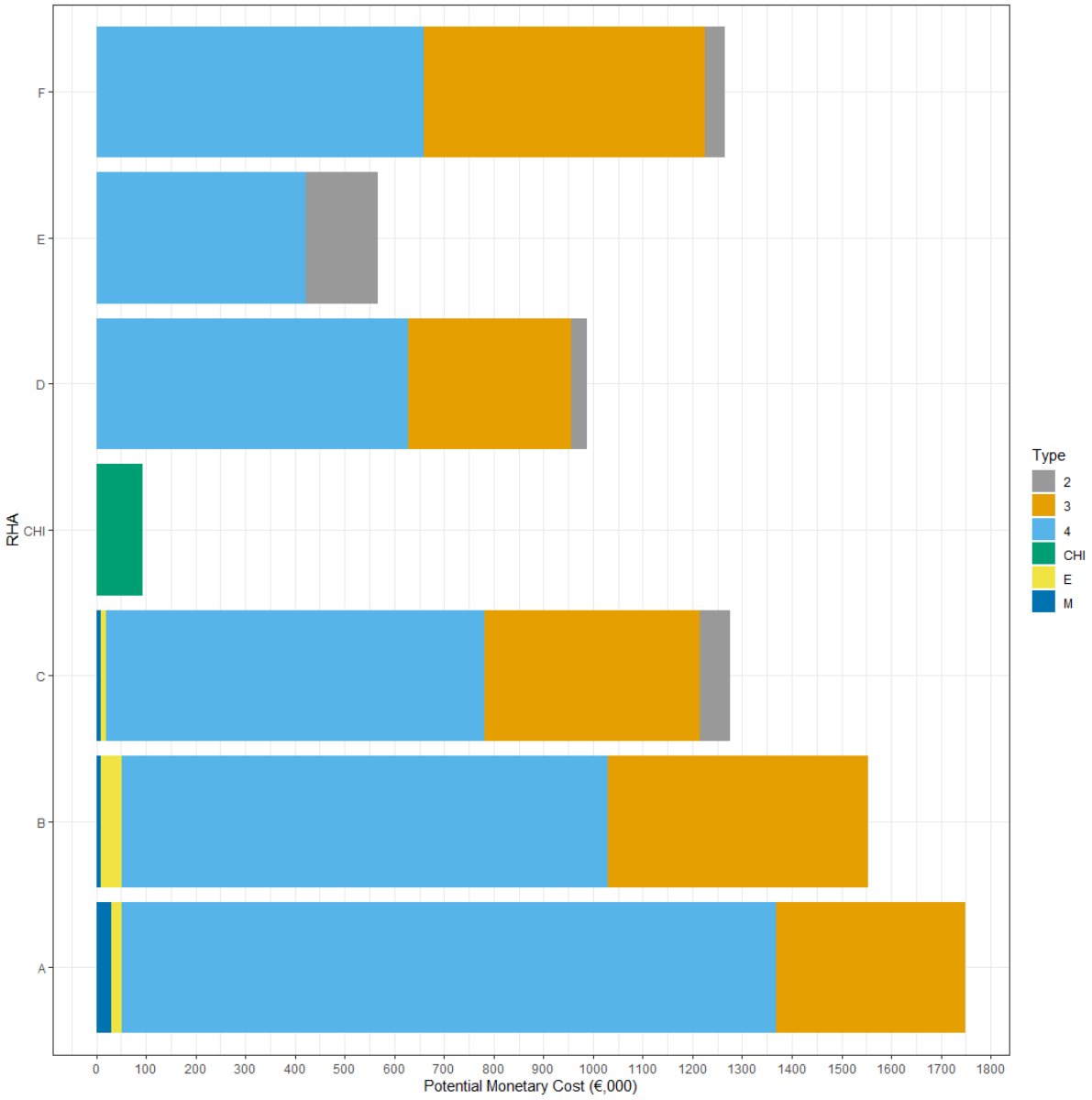
Source: Authors Calculations,2022

In Fig.5.2.1, the potential opportunity cost of CDI is outlined using simple assumptions based on INAES reporting of an average 10 additional days length of stay in hospital for each infection coupled with an estimated cost for a bed day from the National Finance Division (2022). Under these assumptions in 2021 Model 4 hospitals potentially had €4.8 million in additional bed day costs due to CDI, with Model 3 hospitals had a potential additional cost of €2.2 million. While this quantum of expenditure is small, the larger clinical and economic costs of CDI infection need also be considered, such as

[19] Louth County Hospital has been removed from Hospital level analysis as this hospital has only one inpatient bed, causing outcomes for HCAIs to be noncomparable.

reduced life expectancy, increased waiting times for elective patients due to reduced levels of activity, and Antimicrobial resistance.

Fig.5.2.1: Potential Economic Costs of CDI:2021



Source: Authors Calculations

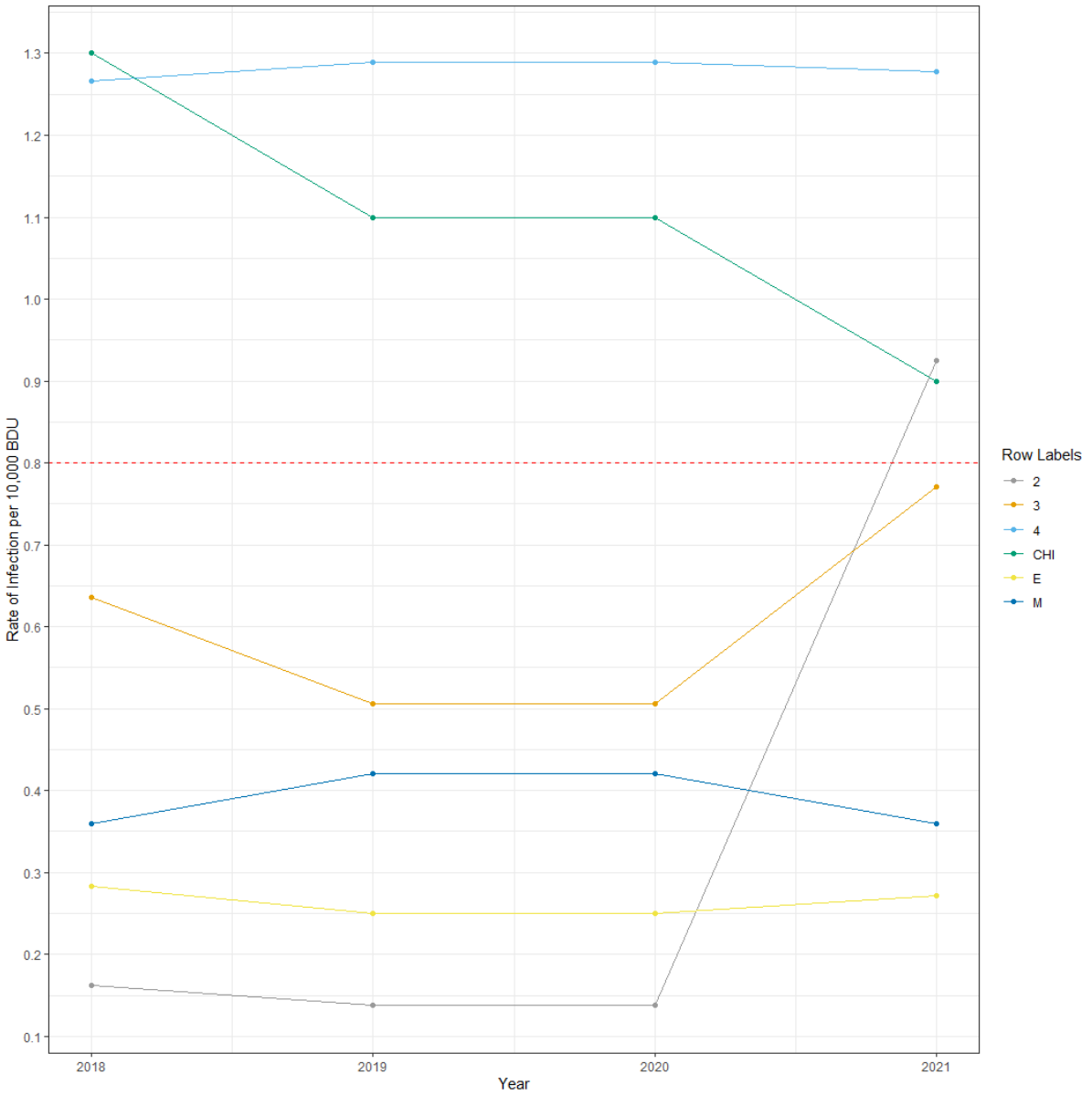
5.2.2 Patient Safety: Staphylococcus Aureus Bloodstream Infections 2019 -2021

As highlighted in section 5.1, S. aureus infections (SAIs) have the potential to be a severe burden on the Irish healthcare system. As in the previous section, we can also estimate the economic costs of SAIs at a hospital level and national level. The HSE has set a SAI upper-bound target level of 0.8 infections per 10,000 BDU (HSE: Business Intelligence Unit, 2022). This target was reduced from a target of 1 per 10,000 BDU in 2019 to 0.8 per 10,000 BDU in 2020, this was to encourage the continued persistence in reducing infection rates. As in section 5.2.1, analysis conducted at a hospital model level assumes that hospital scale and the acuity of care provided across hospitals of the same categories is relatively homogenous across the healthcare system.

In Fig.5.2.2 below the rates of Staph infections by hospital model is analysed. Model 4 hospitals and CHI are non-compliant with HSE targets for Staph infections across all years examined; however, CHI appears to be making year on year reductions in its rates of infection. Inference from this analysis is also limited as the patients most susceptible to this form of infection would be most likely found in Model 4 hospitals[20].

[20] For example, cancer and transplant patients.

Fig.5.2.2: Rate of Staph Infections 2018-2021 Hospital Model Level

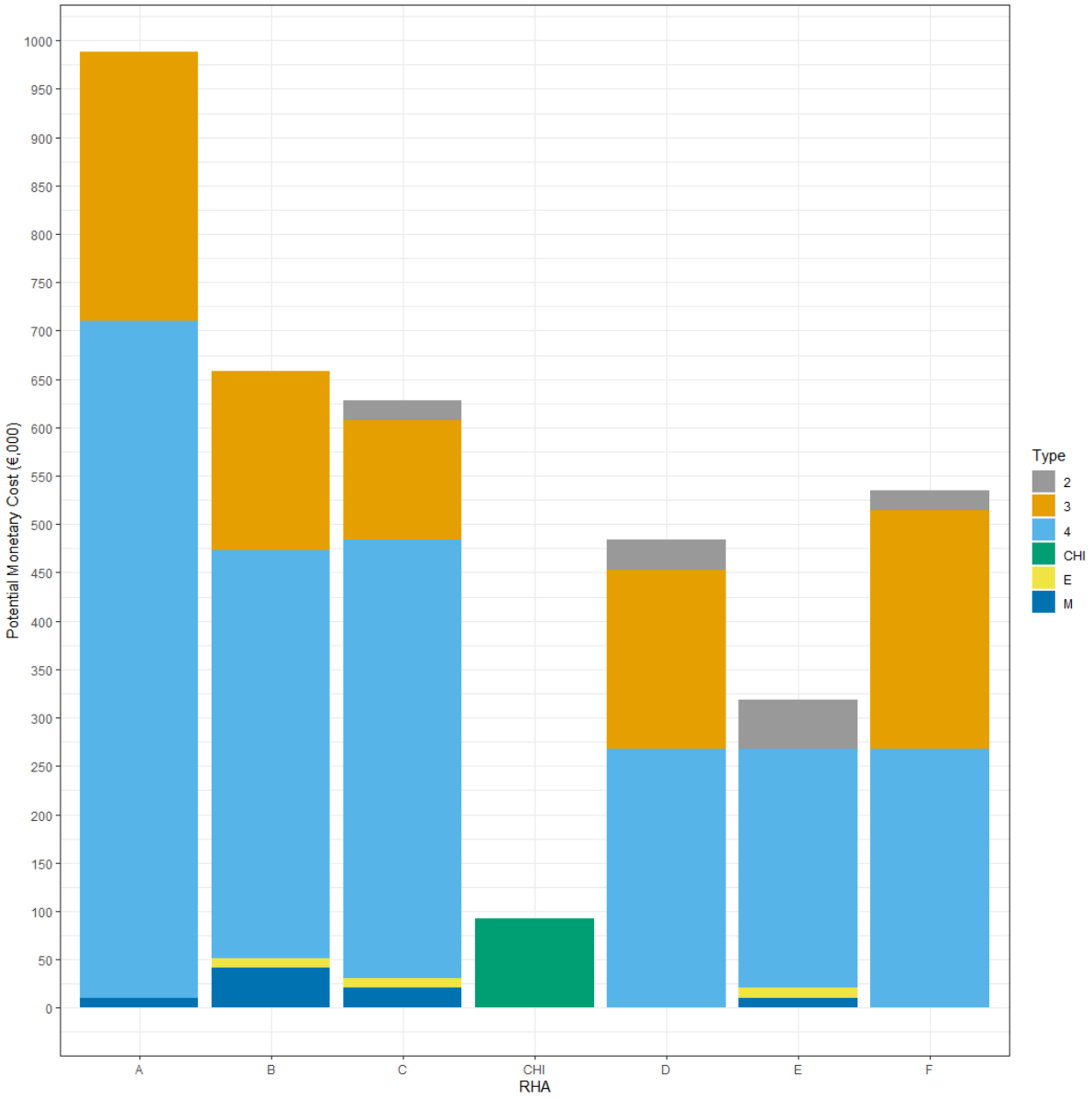


Source: Authors Calculations,2022

In Fig.5.2.3, the potential opportunity cost of *Staph infections* in 2021 is outlined. This cost estimate uses the same methodology as for the *C.difficile* calculation, using the INAES estimate of an additional 10 days length of stay for each infection, coupled with an average per bed-day cost. Staph infection costs are most pronounced once more in Model 3 and 4 hospitals, with €2.4 million in costs associated with additional length of stay in Model 4 hospitals and €1 million in costs due to additional length of stay in Model 3 hospitals. The uncertainty around this estimate is high given the absence of an Irish specific estimated cost for Staph infections, though the quantum of expenditure is informative for planning of remediatory action. This estimated cost also does not take into account the associated

qualitative and quantitative benefits of reduced infection rates, such as improved health outcomes and patient flow.

Fig.5.2.3: Potential Monetary Costs of Staph Infections 2021



Source: Authors Calculations,2022

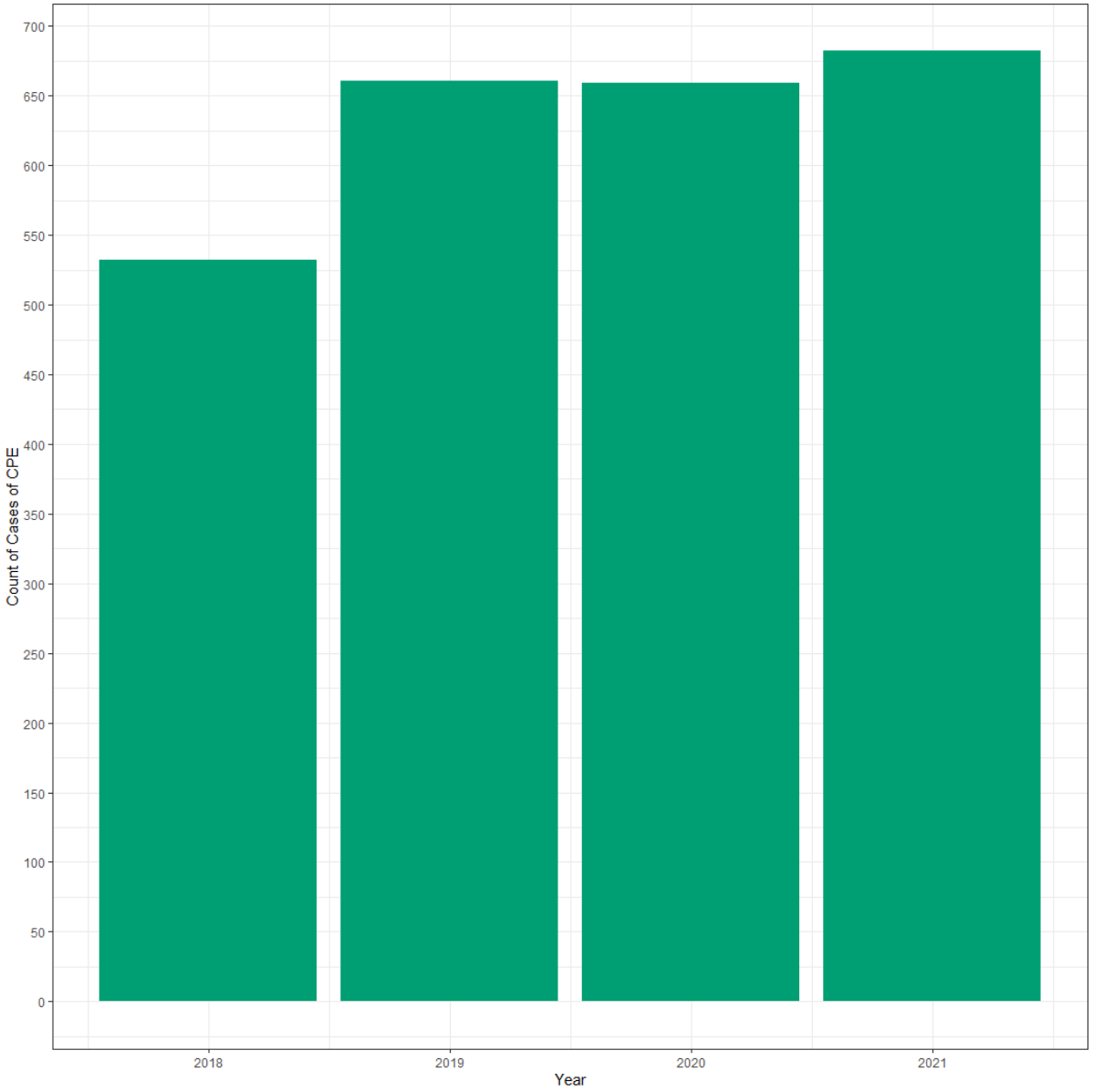
5.2.3 Carbapenemase Producing Enterobacterales (CPE) Infections 2019 - 2021

In October 2017, the Minister for Health declared *Carbapenemase Producing Enterobacterales (CPE)* a public health emergency. CPE is the newest in a long line of 'superbugs' (bacteria that are hard to kill with antibiotics). The National Public Health Emergency Team (NPHET) was established in November 2017, and it manages the response to the CPE emergency at national level and provide reports to the Minister for Health (Department of Health, 2019). CPE has a high mortality rate, with

40-50% of infections ending in the death of a patient. The clinical and economic costs with CPE are high. Treatment of patients infected with CPE is expensive, with Rodriguez-Acevedo (2020) finding these patients to be 6 times as costly to treat as non-infected patients. In addition, CPE patients are at risk of infecting others, with the level of anti-biotic treatment required to treat patients also likely to promote further Anti-microbial resistance of the bacteria (Maria Pawlak, 2021).

CPE infections are concentrated among patients of higher complexity, with Lusignani (2020) showing hospital length of stay, invasive device use and the presence of underlying diseases all being independent predictors of carriage of CPE. Figure.5.2.3.1, shows a count of CPE infections in hospitals in the years 2018-2021. Across this period CPE infection levels increased from 532 cases in 2018, to 661 in 2019, 659 in 2020 and 682 in 2021. The incidence of CPE is most pronounced in Model 4 hospitals which account for a large proportion of all cases annually. This intuitively makes sense given the risk factors for CPE infection are most pronounced in Model 4 hospitals.

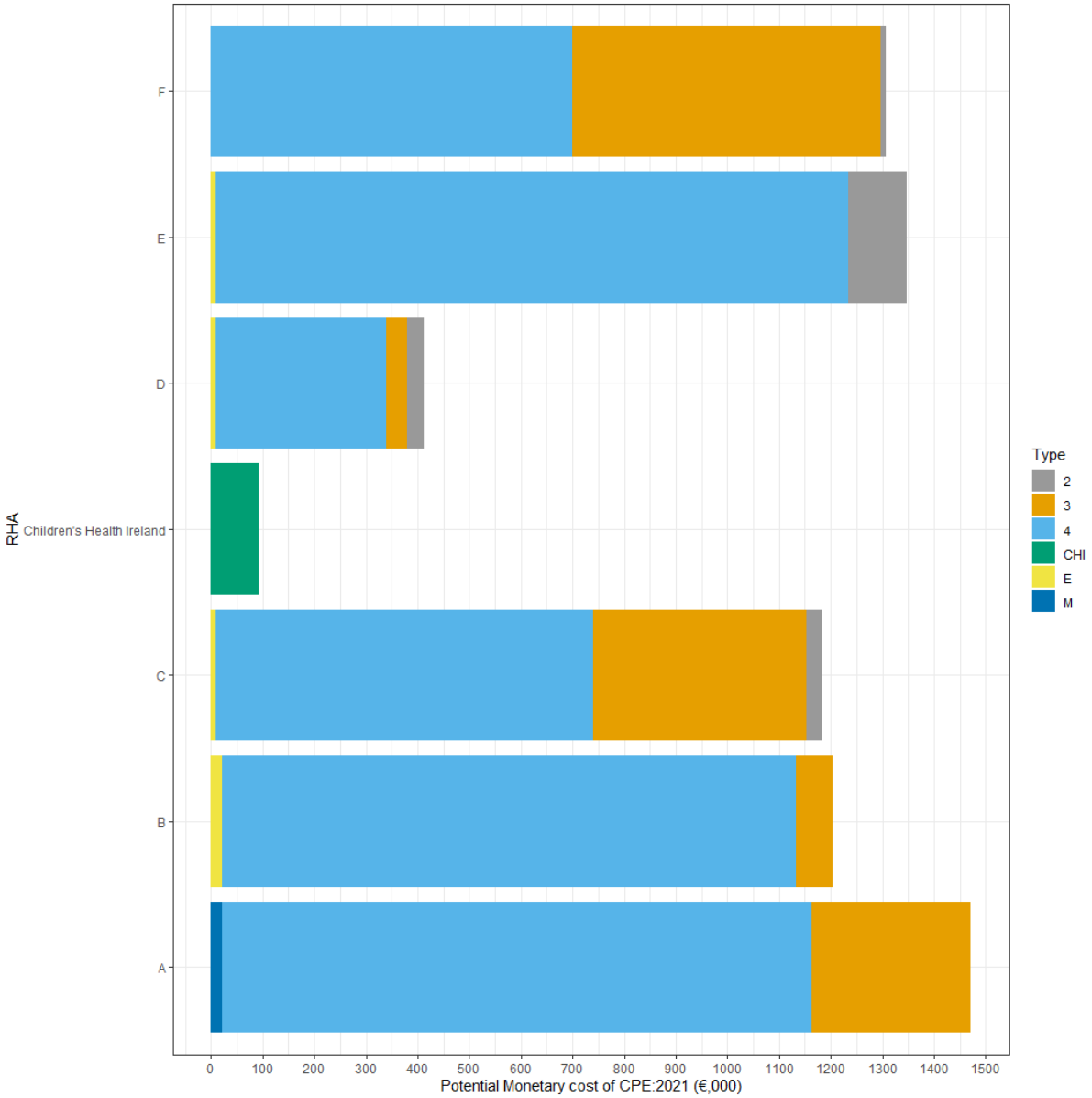
Fig.5.2.3.1: Count of CPE infections 2018-2021



Source: HSE Management Data Reports, 2019-2022

As outlined above in earlier subsections within Section.5 the economic costs of CPE are estimated using the same assumptions of an additional ten-day length of stay per infection, although the particularly severe clinical outcomes of CPE infection mean that this may be a particularly low estimate in this case. The estimated total costs of CPE due to increased length of stay in 2021 are €7 million. As before, this estimate also does not take into account other qualitative or quantitative benefits associated with infection prevention.

Fig.5.2.3.2: Potential Monetary Costs of CPE infections 2021



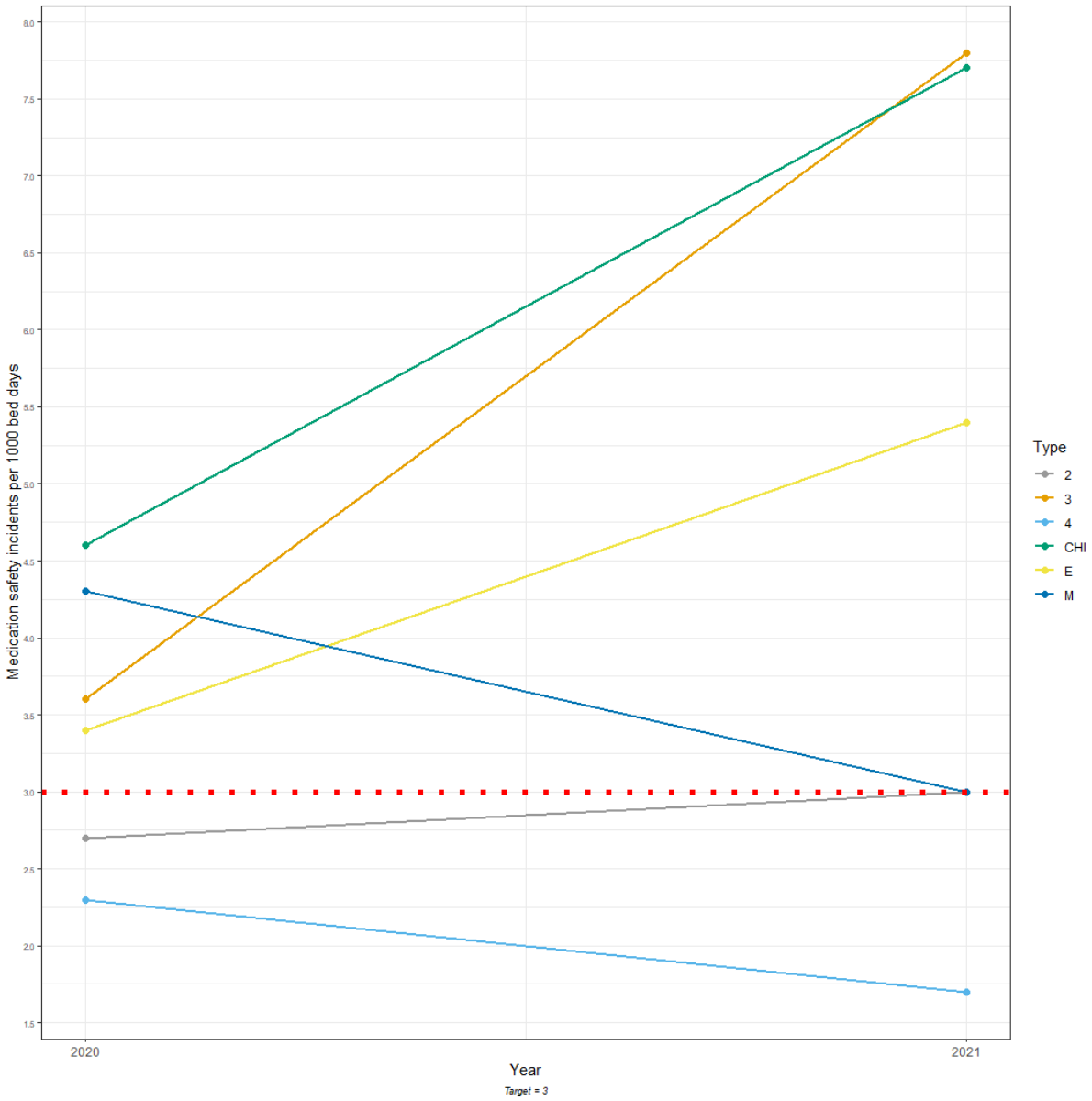
Source: Authors Calculations

5.3 Patient Safety: Medication Incidents per 1000 beds: 2020-2021

Medication incidents are another source of concern for patient's safety in acute care settings and the negative effects of such events can be quantified in monetary terms. The degree to which inefficient expenditure is experienced by the Irish healthcare system is relatively unknown, with the following section identifying trends and differences across hospital models over time. The HSE has set an upper-bound target value of 3 medication incidents as reported to NIMS per 1,000 beds. As in section 5.2.1 and section 5.2.2, analysis conducted at a hospital model level assumes that hospital scale and the acuity of care provided across hospitals of the same categories is relatively homogenous across the

healthcare system. This is however also the implicit assumption that underlines the HSE's own reporting of these Key Performance Indicators.

Fig.5.12: Hospital Model Patient Safety: Rate of Medication Incidents 2020-2021

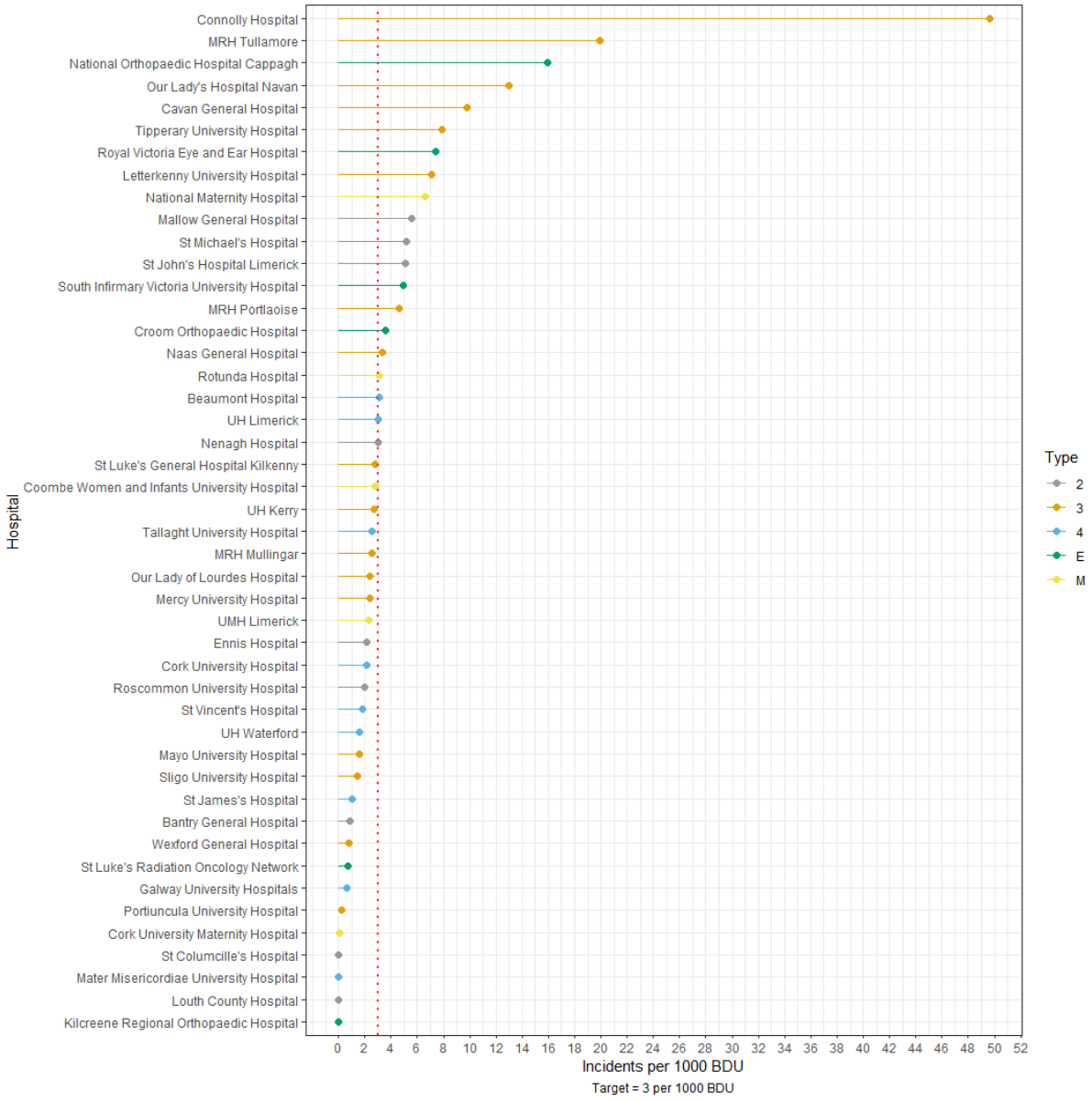


Source: Authors Calculations, 2022

Figure.5.12, displays significant variation in trends of medication incidents across the Irish healthcare system between 2020-2021. Model four and maternity hospitals have experienced a marginal decrease in their rate of incidents, with changes from 2.3 – 1.74 & 2.68 – 2.08 cases respectively. On the other hand, CHI, model three, model two, and elective hospitals have experienced heterogenous growth in their rate of medication incidents, with changes from 4.63 - 7.73, 3.53 – 7.44, 2.98 – 4.1, and 3.43 – 5.42 cases respectively. Findings from Kozer (2009) suggest that medication incidents occur

more frequently among the most ill patients (i.e., those with the highest-level acuity of care). Such findings would suggest that the rate of medication incidents should on average increase with hospital model, attributable to such hospitals generally providing a higher acuity of care. Our analysis does not support such findings, with no clear relationship emerging between hospital model and medication incidents.

Fig.5.13: Hospital Level Medical Safety: Rate of Medication Incidents 2021



Source: Authors Calculations, 2022

Figure.5.13, permits the identification of the hospitals with the highest and lowest levels of patient safety incidents related to medication for the year 2021. Connolly Hospital, Midlands Regional Hospital Tullamore (MRH Tullamore), Cappagh National Orthopaedic Hospital, and Our Lady's Hospital

Navan, experienced the highest rate of medication incidents per 1000 beds with respective values of 49.6, 19.9, 15.9, 13, and 13. Connolly Hospital remains a clear outlier, receiving a value over 16.5 times the target set by the HSE. Such a high rate of medication errors is unlikely to be attributable to natural variation and would instead warrant further investigation. As discussed, the inability to distinguish the type of medication incident occurring means it would not be appropriate to associate an economic cost with the above analysis. A more detailed analysis of medication incidents including type, perceived clinical consequences, and estimated economic costs would be a useful addition to this research.

5.4. Summary of Patient Safety: HCAIs and Medication Incidents

Healthcare associated infections are a cause of substantial clinical and economic costs to the Irish healthcare system, with the prevention of infections being a potential avenue for performance improvement.

Clostridioides difficile Infections are spread across all hospitals, with 18 out of 41 hospitals (43%) in excess of the HSE defined infection rate target per 10,000 bed days used, and these hospitals being model 2, 3 and 4 facilities. Staph infections have a more direct association with patient complexity, with model 4 hospitals persistently in excess of the HSE defined infection rate target over a number of years. In both cases, an economic improvement in outcomes may result from targeted intervention to control infections in specified facilities, although further research would be needed to verify this possibility.

Contrary to findings from Kozer (2009) who finds that medication incidents occur more frequently among the most ill patients (i.e., those with the highest acuity of care), the analysis in this paper find model 4 hospitals to experience the lowest rate of medication incidents as reported to NIMS per 1000 beds. All hospital types, including model 2, 3, elective hospitals, and paediatric hospitals are compliant with the HSE target of 3 per 10,000 BDU. Considering the year 2021, the findings indicate that Connolly hospital, Midlands Regional Hospital Tullamore, Cappagh National Orthopaedic Hospital experience medication incidents in excess of the specified HSE target, with corresponding values of 49.6, 19.9, and 15.9. The high levels of medication incidents in a few hospitals for 2021 warrants further examination for potential drivers and remediatory measures that could be taken.

6. Findings

This paper has analysed acute care performance at a national, regional health area and hospital level based on 18 HSE designated key performance indicators for services delivered in this setting. The analysis provides:

I. An overview of metrics which feed into active performance management of acute hospitals by the HSE and the forthcoming regional health areas (Hospital Groups in the interim), including whether they are appropriate;
II. Identification of hospital level performance on each designated KPI, although acknowledging the caveats inherent to this approach and;
III. Considerations for active policy intervention to improve performance in specified areas, including which hospitals to target for remediation, relevant Irish and international literature related to each area, and where available the potential costs and benefits associated with better performance.

In general, under-performance relative to HSE designated KPIs is found for many hospitals for all years examined (2018 – 2021). Performance on these metrics is also persistent on a per hospital basis, with limited improvements observed for a given hospital that is noncompliant in a given year, and the hospital's performance in subsequent years. This could indicate that HSE KPI data is not being used to designate hospitals for remediatory interventions; that these interventions are ineffective; or that other factors are driving performance beyond investment and organisational behaviour in the health system (e.g, changing demand pressures, changing quality / complexity of services delivered, etc.). In terms of performance relative to HSE designated KPIs, we observe the following:

I. **ED Waiting Times:** Wide variation in ED wait times across hospitals is observed. International and Irish literature, as well as HSE policy documentation reveal an association between ED wait times and mortality, indicating that these wait times have significant clinical implications for the Irish healthcare system as well as associated impacts on patient flow and staff wellbeing.

II. **Incomplete Treatment in ED Settings:** There is wide variation in the level of incomplete treatment occurring in Irish hospitals, with incomplete treatment relative to ED attendances varying from 16.7% in St James in 2019, to 1.3% in St Luke's Kilkenny. Underperformance on this metric is concentrated, with just 9 out of 26 hospitals above the HSE designated target for incomplete unscheduled care treatment of 6.5%. Under-performance is generally concentrated in larger hospitals of higher complexity, although many examples are also

presented of model 3 and 4 hospitals performing far better than the HSE target. This may therefore be an area where hospital-specific exploration and remediatory policy could be undertaken to improve performance in the underperformers identified.

III. **Acute Medical Assessment Unit / Medical Assessment Unit (AMAU/MAU) Utilisation:** A general under-utilisation of AMAUs, relative to designated HSE target for discharges through this pathway (45%) is observed in many hospitals. In 2019, 19 out of 29 hospitals reporting had AMAU discharge rates below targeted HSE levels. Performance on this KPI has a strong relationship with hospital model indicating that direct comparison between hospitals of different models may be inappropriate. This draws into question whether this KPI can meaningfully be used to design active remediatory policy for hospitals of any model type as a result of being over-generalised. In general, wide variation in AMAU utilisation between hospital models of the same type is also observed, indicating room for improvement.

IV. **Medical Readmissions:** Readmissions to hospital have an associated clinical and economic cost. In total, 10 out of 29 hospitals have readmission rates higher than the HSE target of 11.1%, with these hospitals in every case being model 2 and 3 facilities. Targeted intervention to reduce readmissions and learning from peer hospitals with lower readmissions rates could therefore be a useful avenue of exploration for performance improvement in the Irish healthcare system.

V. **Elective Day-Of-Surgical-Admission:** HSE Model of Care guidelines outline numerous benefits from admission of patients on day of surgery. Compliance for hospitals on this metric is mixed, with 22 out of 30 hospitals having day of surgery admission rates above 70% (compared to a national HSE target of 80%). A few hospitals are identified as underperformers on this metric, with St. James having a day of surgical admission rate of 16.5%. Further analysis is therefore required to explore whether improvements can be made for a select group of hospitals on this metric.

VI. **Delayed Transfer of Cares:** Delayed Transfer of Cares have a material impact on bed utilisation levels in Irish hospitals. In 2019, 7% of all bed days used were for patients suitable for discharge based on the Delayed Transfer of Care designation. The HSE has set a target for Delayed Transfer of Cares of 200k bed days in 2019, with this falling to 175k in 2021. In 2019, a total of 240,000 bed days were lost due to Delayed Transfer of Cares across the acute care

system with this falling to 141,000 bed days lost due to delayed transfers in 2021. Substantial regional and hospital level variation in the level of delayed transfer of care is also identified, with for example 10% of bed days used in RHA A attributable to patients awaiting discharge compared to just 4% in RHA F.

VII. **Patient Safety:** Hospital acquired infections (HCAIs) and medication incidents pose costs to both hospitals and patients. Incidence of HCAIs is spread across all hospitals, although hospitals of greater complexity appear to have higher rates of infection for Staph infections, while no clear linkage is present for C. difficile infections. A greater focus on mitigating the spread of C. difficile, CPE, and S. aureus may be a cost-effective strategy to improve hospital performance, although further research would be required to determine what achievable reductions in HCAIs are in each hospital model or RHA.

7. Policy Recommendations

This paper has provided an overview of HSE designated key performance indicators for Irish hospitals. Three main recommendations emerge from the review, highlighting how evidence-based policy can be used to pursue streamlined and effective interventions to improve acute care performance and overall value for money in the area. Recommendations emerging from the analysis are as follows:

I. **Review of the HSE acute care active performance management system:** Non-compliance with HSE specified key performance indicators is observed for many hospitals for all years examined. The persistence of poor performance across years, and the non-comparability of some KPIs across hospitals draws into question the efficacy of the current regime in promoting active performance management and policy intervention. Authors would encourage a review of the existing list of HSE acute care performance indicators, aiming to provide:

   - A more concise, streamlined set of KPIs against which cross hospital performance can be evaluated and potential interventions planned. The current list of over 100 KPIs is unwieldy for use in active performance management, with many hospital KPIs unsuitable for comparison or unrelated to performance such as workforce and activity figures in a given hospital, wait times and policy compliance[21].
   - An updated set of KPI targets against which performance can be evaluated. These targets should be SMART (Specific, Measurable, Actionable, Realistic, and Time Bound). Consideration should be given to making targets specific to a given hospital model level, given that performance on some metrics is largely driven by the complexity of care delivered (e.g, healthcare associated infections, AMAU utilisation). These targets should be used to actively manage performance, with further analysis and intervention prompted by observed underperformance in certain hospitals or regions.
   - A dynamic dashboard or smart reporting system for acute care KPIs, allowing for a clear interpretation of cross-country hospital performance for policymakers, hospital managers and the public. In this respect, the upcoming Health System Performance Assessment dashboard may serve as a suitable model for replication.

[21] While these are materially important areas, they have many external drivers which makes comparative evaluation of hospital performance difficult.

II. **Learnings and Identification of areas for active performance management:** This paper identifies the performance of hospitals and the forthcoming regional health areas for each KPI examined. While the drivers of performance on these metrics is multi-factorial, performance across each KPI nonetheless may enable a more systematic approach to identifying improvements to the acute care delivery. Hospitals with higher levels of compliance can be examined to provide learnings for the rest of the system, while hospitals with lower levels of compliance, can be examined to understand where remediatory policy and investment can be focussed. Some examples of where further examination is required includes:

- An examination of the drivers of long unscheduled care wait times in hospitals such as Beaumont and Tallaght, and whether these can be improved through active policy intervention or investment;
- Whether incomplete treatment rates in hospitals such as St. James, the Mater & Tallaght (14-15%) can be brought in line with other model 4 hospitals with better performance such as Beaumont or St Vincents (~6%).
- Whether the utilisation of AMAUs could be improved across the hospital system, noting the low level of utilisation in many hospitals (20-25%) relative to the specified target (45%).
- Whether admissions on the day of surgical procedure could be improved in hospitals that are below the HSE targeted level, including St James, Galway and Wexford Hospital.

III. **Remediatory Interventions to improve hospital performance:** Where appropriate, policymakers could then work to develop focussed interventions to remediate performance. These could incorporate learnings from international evidence, best performers identified through Irish performance indicators, and considerations as to any additional investment required to improve compliance with targeted performance levels. An advantage of this approach is that the benefits of improved performance would be clearly distinguishable as each KPI target already has a clear clinical and economic rationale outlined. These potential benefits alongside consideration of existing resources available could then set the parameters for proposed future investment related to hospital performance.

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