An Roinn Caiteachais Phoiblí agus Athchóirithe
Department of Public Expenditure and Reform

ANALYTICAL NOTE SERIES

Economies of Scale in Irish Hospitals

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Context

A common health policy goal globally is to increase hospital size in order to achieve economies of scale. However, both theory and practice suggest these economies are exhausted once hospitals reach a relatively small size.

The aim of this note is to determine efficient hospital size in an Irish context. The question will be addressed in two ways: bed utilisation and expenditure per inpatient, weighted for complexity. The key findings of the paper are summarised across.

Key Findings

The key findings from this note are:

- Hospitals with less than 105 beds appear to operate with excess capacity and at high cost. For hospitals with more than 105 beds, it is not clear there are additional economies of scale to be made.
- Net of all transitional costs, relocating services from smaller hospitals would save an estimated €60m annually but adversely impact on patient access.
- However, given that small hospitals account for 5% of hospital spending, their relative inefficiency is unlikely to be a major driver of overall hospital costs.
- More substantial savings may be achievable by focusing on improving efficiency across the hospital system.

Irish Government Economic and Evaluation Service

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SECTION ONE

Introduction

Larger hospitals are often assumed to be more efficient than smaller ones due to economies of scale. However, these economies may not be theoretically justified. When a larger entity is able to operate more efficiently than a smaller one it is because its fixed costs are spread over a larger base. In the case of hospitals, much of the operating costs are variable rather than fixed (Posnett, 2002).

Illustrating this, the performance of a coronary bypass requires a certain amount of personnel and a certain amount of equipment. Assuming both are running at capacity, if a larger hospital performs more coronary bypasses than a smaller one it will require proportionally more personnel and equipment – it is not obvious that economies of scale are achievable. Where some economies may be achievable, however, is in management and administrative costs, with these perhaps not rising in equal proportion to hospital size.

This note will evaluate hospital efficiency on two metrics: utilisation and expenditure. Utilisation will be determined by the number of weighted inpatient units discharged by a hospital divided by its number of inpatient beds, with more efficient hospitals presumably able to achieve greater utilisation. For expenditure, the average spend per weighted unit of inpatient care will be assessed. Based on these two measures, it will be seen whether an efficient hospital size can be determined.

SECTION TWO

Bed Utilisation

Excluding specialist hospitals and those not currently part of the Hospital Inpatient Enquiry (HIPE) scheme that records patient data, this paper focuses on the efficiency of 35 public hospitals. In 2012 the number of inpatient beds in these hospitals ranged from a low of 49 in Nenagh to a high of 821 in St. James's, with an average of 260.

Excluding same-day discharges from acute medical assessment units, these 35 hospitals collectively discharged approximately 485,000 inpatients in 2014. To account for the complexity of this activity, inpatient discharges are classified into different diagnostic related groups (DRGs) that cluster clinically similar cases which are expected to consume similar amounts of resources. Each DRG has an associated complexity index and weighted inpatient discharges are product of this index and the units of inpatient care. For example, a tonsillectomy discharge might be relatively straightforward and count for 0.7 of a weighted discharge while a knee replacement might be relatively complex and count for 2.5 weighted discharges.

Adjusting for case complexity using the DRGs, then, the number of weighted inpatient units discharged by the 35 hospitals in 2014 was 537,000. Assuming that the number of inpatient beds in 2014 was

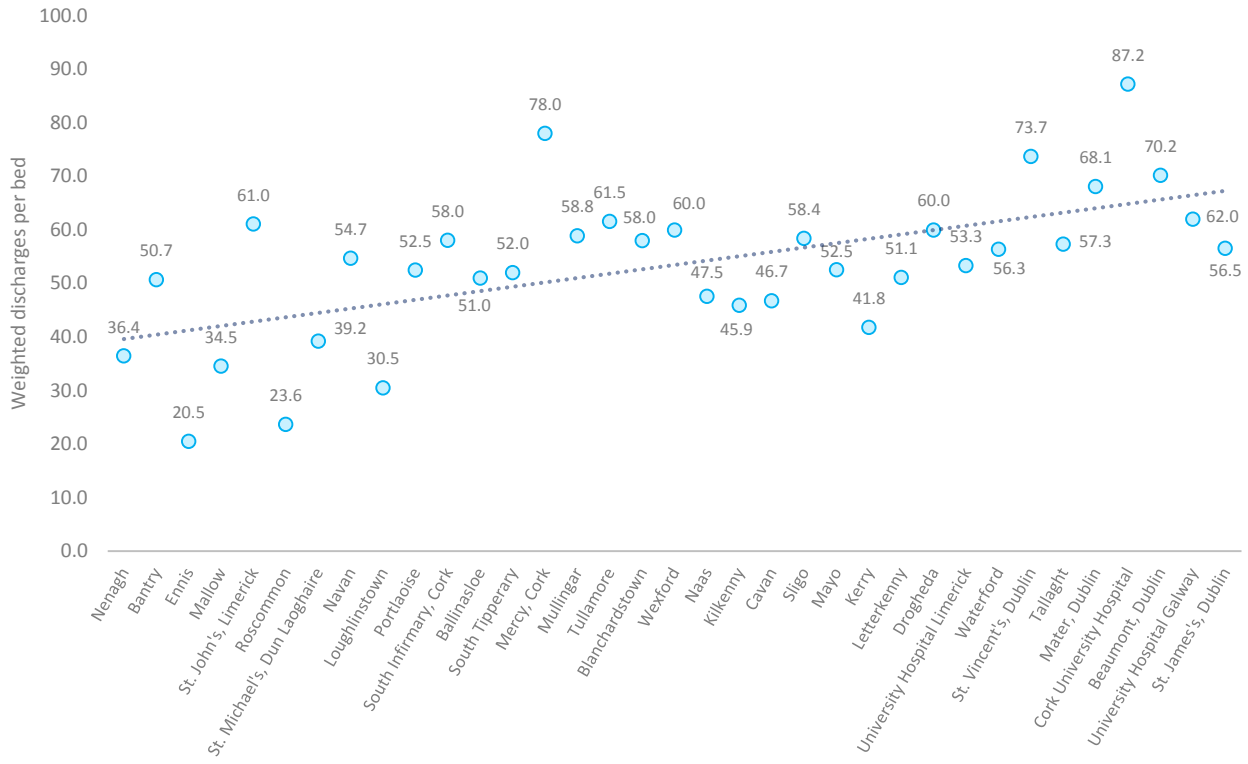
unchanged from 2012, the number of weighted units discharged per bed ranged from 20.5 to 87.2, averaging 53.4. Figure 1 below charts discharges per bed for all 35 hospitals.

As can be seen, the number of discharges per bed was relatively low for the smallest hospitals. Seven of the nine hospitals with less than 105 beds discharged less than the average. On the other hand, only two of the eleven hospitals with more than 300 inpatient beds discharged less than average. For the fifteen hospitals in the middle, with between 105 and 300 beds each, eight discharged less than average and seven more than average.

Taking the findings as a whole, this suggests that small hospitals run at less than capacity and inefficiently, mid-sized hospitals realise some efficiencies and tend to operate at close to average bed utilisation, and large hospitals operate most efficiently. As for what this means for efficient hospital size, it appears that a lot of economies of scale are exhausted by the time a hospital reaches 100 beds, with utilisation not appearing to markedly improve until hospital size reaches around 400 beds.

Discharges per bed increase with hospital size

Figure 1: Weighted inpatient discharges per bed, 2014



Sources: Department of Health; HSE

SECTION THREE

Expenditure

Inpatient discharges are widely acknowledged to be the biggest driver of hospital costs. In the future, the HSE's activity-based funding model

should precisely quantify each hospital's budget for inpatient and day case care but currently it is difficult to establish exactly how much of a hospital's costs are attributable to inpatients. That said, in correspondence with D/PER the HSE has estimated that the gross value of inpatient activity in the 12 months to June 2013 was €2.48bn. In the same period, total gross acute hospital spending was €4.72bn. This suggests about 53% of hospital costs are attributable to inpatient care.

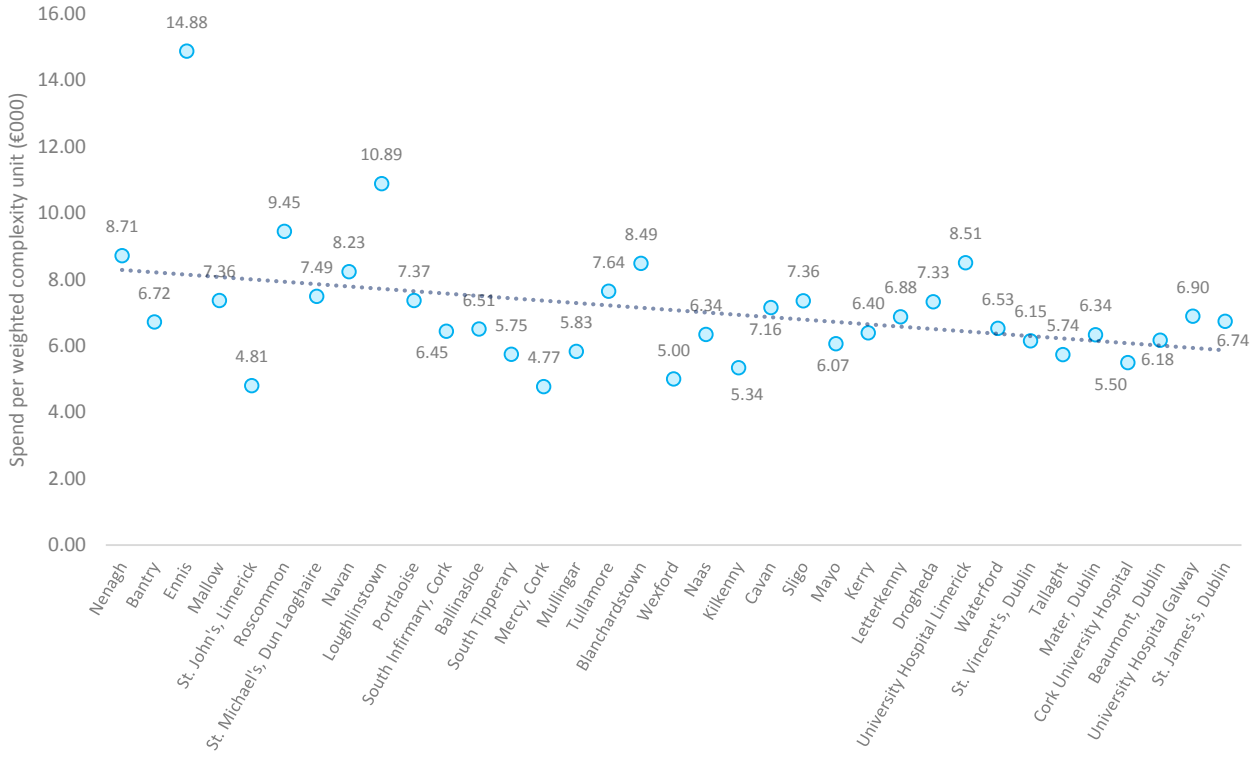
In the absence of specific expenditure for inpatient care, this analysis will use overall net expenditure. While this is not ideal, the above estimate indicates that inpatient care accounts for the majority of spending and is therefore likely to be a strong predictor of overall spending. Conversely, total net expenditure should be a good proxy for inpatient expenditure.

Adjusting for complexity using ABF data, net expenditure per inpatient discharged ranged from €4,800 at Mercy University Hospital Cork to a high of €14,900 at Ennis. The average net expenditure per inpatient discharge was €7,100. Figure 2 above charts net expenditure per inpatient discharge for the 35 hospitals.

Again, the performance of the smallest hospitals is worst. The nine hospitals with 105 inpatient beds or less spent an average of €8,700 on a weighted inpatient unit, with seven of the nine spending more than average. The group of fifteen hospitals with between 105 and 300 beds spent an average

Expenditure per discharge decreases with hospital size

Figure 2: Net expenditure per weighted inpatient discharge, 2014



Sources: Department of Health; HSE, Management Data Report December 2014

of €6,400, with just five spending more than average. For the largest eleven hospitals with more than 300 beds, average spend per weighted inpatient unit was €6,600 and just two – University Hospital Limerick and Drogheda – spent more than average.

Collectively, the data shows that small hospitals are relatively expensive. There may be an element of confounding here, with these hospitals also tending to have lower rates of bed utilisation than average. Perhaps if they were to operate more closely to capacity their unit costs would be closer to average.

SECTION FOUR

Efficient Hospital Size

Based on the findings so far, it appears that hospitals with less than 105 beds may be operating relatively inefficiently. Beyond this threshold the evidence for further economies of scale is mixed: hospitals with more than 300 beds tend to have higher rates of bed utilisation but are also slightly more expensive than hospitals in the 105-300 bed range.

Given that the case for large hospitals being more efficient than mid-sized hospitals is unclear, the remainder of this note will focus on the hypothetical situation where all inpatient care is delivered in hospitals with more than 105 beds.

The nine smallest hospitals had net expenditure of €206m in 2014

Table 1: Net expenditure for hospitals with less than 105 inpatient beds, 2014

Hospital	Inpatient Beds (2012)	Net expenditure (€000)
Mid-Western Regional Hospital Nenagh	49	15,556
Bantry General Hospital	50	17,020
Mid-Western Regional Hospital Ennis	55	16,769
Mallow General Hospital	66	16,781
St. John's Hospital Limerick	68	19,950
Roscommon County Hospital	81	18,093
St. Michael's Hospital Dun Laoghaire	83	24,384
Our Lady's Hospital Navan	96	43,214
St. Colmcille's Hospital Loughlinstown	103	34,181
Total	**651**	**205,948**

Sources: Department of Health; HSE, Management Data Report December 2014

Surprisingly, mid-sized hospitals tend to be marginally more cost-efficient than the largest hospitals, suggesting there may be diseconomies of scale once a hospital's size increases beyond 300 beds. This finding must be caveated by the fact that all eleven hospitals with more than 300 beds are teaching hospitals, and the slight differential in cost may reflect additional expense associated with medical training.

Net expenditure for the nine smallest hospitals is given in Table 1 above. Collectively, they had a net spend of just under €206m in 2014, about 5% of total acute sector net expenditure of €4bn.

For the purposes of estimating the savings if all inpatient care were to be delivered in hospitals with more than 105 beds, the activity of these nine hospitals is assumed to be absorbed by the closest hospital operating at better-than-average expenditure per weighted inpatient discharge, with that hospital's 2014 net spend adjusted upward on a pro-rated basis. Estimated savings and the displacement of services is given in Table 2.

If services in the nine smallest hospitals were delivered in a more efficient setting €60m might be saved

Table 2: Estimated net savings and displacement from relocating services of smaller hospitals

Hospital	New service location	Estimated net saving (€000)	Service displacement (km)
Mid-Western Regional Hospital Nenagh	Ballinasloe	3,944	63
Bantry General Hospital	Cork	4,929	80
Mid-Western Regional Hospital Ennis	Galway	8,996	67
Mallow General Hospital	Cork	5,907	38
St. John's Hospital Limerick	Clonmel	-3,901	77
Roscommon County Hospital	Mullingar	6,931	65
St. Michael's Hospital Dun Laoghaire	Dublin 4	4,361	6
Our Lady's Hospital - Navan	Mullingar	12,602	52
St. Colmcille's Hospital Loughlinstown	Dublin 4	14,859	11
	Total:	**58,628**	**459**

As can be seen, the estimated total net saving of relocating services from the nine smallest hospitals is just under €60m – about 1.5% of net hospital spending. However, such a saving would have an adverse impact on patient access with services displaced by a total of 460km. Excluding the two Dublin hospitals on the list, the average service displacement is over 60km.

It is important to note that €60m represents the full-year saving after the initial costs of relocation have been met. In reality, it is likely that the saving would be smaller.

While it is difficult to accurately estimate what the capital cost of developing 651 new inpatient beds would be due to regional variation in construction costs, an indicative figure can be obtained. In November 2015, 24 new inpatient beds were opened at University Hospital Limerick at a cost of approximately €3m. This implies that the capital cost of a single inpatient is €125,000. Applying this rate to the 651 inpatient beds in the nine smallest hospitals gives a total relocation cost of €81m.

In the first year, then, relocating services in smaller hospitals would actually cost an additional €20m. Indeed, given that five of the relocation sites are in Cork, Dublin or Galway, this is likely to be an underestimate, and this is before considering the myriad other costs and considerations associated with relocating services such industrial relations and patient access. Taking these factors into consideration, it is unlikely that substantial savings could be achieved if care was only delivered in hospitals with more than 105 beds.

Scale is not the only way to achieve efficiencies however. Rather than simply trying to concentrate more activity into larger hospitals, research suggests that there are productivity gains to be made from having hospitals specialise in certain types of care (Freeman, Savva and Scholtes, 2016). At a regional level, this might mean having a smaller number of general hospitals, which provide care across the complete range of services, supplemented by specialised hospitals that focus on particular services or types of care.

In an Irish context, the 2013 announcement and subsequent establishment of the seven new hospital groups may present an opportunity to align services on this basis. The largest hospitals such as St. James's, Cork and Galway could continue to offer a full suite of services but be supported by smaller, specialised regional hospitals that focus on delivering specific types of care and are more efficient as a consequence of this focus. Such a model has the potential to both safeguard the future of smaller hospitals and improve efficiency of the entire hospital system.

SECTION FIVE

Conclusion

- The evidence suggests that hospitals with less than 105 beds are operating relatively inefficiently.
- Beyond this point, it is not clear that further economies of scale can be achieved.
- Assuming economies are exhausted at 105 beds, hypothetical savings of €60m a year may be achieved if inpatient care in the nine smallest hospitals were delivered in a larger hospital.
- However, this would have an adverse impact on patient access and carry considerable up-front costs.
- A narrow focus on the relative inefficiency of smaller hospitals risks overlooking the fact that 95% of hospital resources are accounted for elsewhere.
- Given this, efforts should be made to encourage efficiency improvements system-wide. One way this might be done is by having smaller hospitals focus on delivering particular types of care.

DATA SOURCES

Freeman, M., Savva, N. and Schlotes, S. (2016) *Economies of Scale and Scope in Hospitals* (working paper). Cambridge, UK: Judge Business School, University of Cambridge.

Posnett, J. (2002) 'Are bigger hospitals better?' in *Hospitals in a Changing Europe*, edited by Martin McKee and Judith Healy. Buckingham and Philadelphia, PA: Open University Press.

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