An assessment of unmet need for critical care in Wales

All-Wales Implementation Group

Delivery Plan for the Critically Ill

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Executive Summary

The problem
Timely access to a critical care unit that is adequately staffed with suitably qualified and experienced health care personnel saves lives.

Unfortunately in Wales, such timely access is not always possible due to:

1. Wales having the lowest number of critical care beds per head of population in Europe; and
2. Such beds not always being used appropriately due to
   - Patients having their discharge from critical care delayed for many hours
   - Patients being admitted inappropriately, e.g. when palliative care would be a more suitable option.
   - Beds being available but without the staff to manage them.

This leads to:

- Delays admitting patients to critical care;
- Patients being transferred to another hospital because the local critical care unit is full;
- Operations being cancelled because of a lack of a critical care bed;
- Patients being discharged from critical care before they are ready; and
- Patients being discharged from critical care at times when it is known to be unsafe.

The Intensive Care Society (ICS) recommends in its Standards for Intensive Care Units[3] that critical care units should operate at a maximum of 75% occupancy in order to manage peaks in demand. Most units in Wales routinely operate at over 75% capacity; some operate for very long periods at around 100% capacity and most, at times, operate at over 100% capacity. In order to do this, beds are opened that are inadequately staffed or patients are cared for in operating theatre recovery rooms.

The pressures on critical care are growing each year and have worsened with the reduction in the number of critical care beds in the last fifteen years, which now number four fewer than during the health crisis of 1999. Unless action is taken, the situation is likely to get worse still, largely due to the increasing number of elderly people who often have multiple chronic illnesses that make them more likely to need critical care when they become ill.

In addition, demand for critical care is expected to grow at a rate of approximately five per cent per annum.

Assessing Current Need

Due to the nature of different healthcare systems, there isn't and never will be an internationally agreed number of critical care beds per head of population. However, a number of methods have been proposed for establishing the required number of beds needed, the most widely recognised probably being the method devised by Lyons[1]

A study of unmet need in Wales using the method devised by Lyons was carried out in 2000 and calculated that 85 critical care beds were required for a population of 500,000. In Wales, this constituted 510 beds – an increase of 340 beds and over three times the number of beds then available in Wales. This was considered excessive by professional consensus. No increase in funding was received.

A new method for establishing unmet need was devised by The North Wales Critical Care Network in 2013 and piloted across their units. It was agreed to use this method to establish unmet need in Wales. (See Appendix 1 for details of the study methods)

Results

The study found there was a need for an additional 73 beds in Wales immediately, rising to a total of 295 additional beds in ten years time to accommodate the expected increase in need for critical care. While this is fewer than recommended by the Lyons study, it is still a very high number of beds.

Conclusions

The results show that a massive increase in critical care capacity is required to meet demand both now and in the future. However, the levels recommended by the study, although fewer than previously recommended by the Lyons modelling, are still high compared to current established bed numbers. Whatever methodology is used, and whatever adjustments are made for current inappropriate use, an increase from the current number of critical care beds in Wales is the inevitable result.

While additional beds are likely to be required, adding new capacity while existing resources are widely used inappropriately for patients who are awaiting discharge to a more appropriate setting is unlikely to alleviate the problem. It is important to focus on reducing Delayed Transfers of Care (DTOCs) and ensuring that admissions are appropriate and in the patients' best interests in order to make best use of existing beds before proceeding with planned expansion of bed numbers.

Background to Critical Care in Wales

- **Critical care beds in Wales have reduced by four since 1999**
- **Wales has the lowest critical care capacity in Europe**
- **Most Welsh critical care units routinely run at above the recommended 75 per cent bed occupancy rate.**
- **Demand for critical care is expected to rise by five per cent per year on average, although the demography of Wales means this might be higher for an ageing population with high rates of chronic illness**

Critical care is a vital element in the provision of a full range of healthcare for patients with medical and surgical conditions. Every year, around 9000 patients across Wales are admitted to a critical care unit and benefit from the expertise of highly skilled healthcare professionals and greater levels of monitoring and interventions than are possible on a general ward.

Critical care units predominantly provide care for patients who need it for a relatively short period of time before going on to recover and leave hospital. However, a small number of patients are admitted to critical care inappropriately. Those who are the end of their lives and for whom no further medical intervention will prolong or improve the quality of their lives are sometimes admitted to critical care as a last resort. In addition, some patients with ongoing needs for ventilation after traumatic injury can find themselves on critical care units for months or even years at a time. Meanwhile, people who could benefit from critical care to improve the outcome of their hospital stay have to be turned away and patients who wished to be organ donors are unable to be admitted to facilitate organ retrieval, thus leading to a failure on the part of the Health Service to respect their final wishes and the loss of potential organs for donation.

In 1999, an Emergency Pressures Taskforce was convened by the then Welsh Health Minister, Jane Hutt, to recommend solutions to the ongoing crises arising from emergency pressures across Wales. As part of their findings, an immediate increase of 25 critical care beds across Wales was proposed[2]. This increase was never carried out. Fifteen years later, there are four fewer critical care beds across Wales.

The current numbers of critical care beds in Wales are the lowest in Europe. On average, there are 3.2 beds per 100,000 people in Wales,

while in England there are 4. The average across the whole of Europe is 11 beds per 100,000 people.

The average of 3.2 beds in Wales masks even lower numbers in some Health Boards, where the beds number below 3 per 100,000 people. This puts critical care beds under high pressure. Recommendations from the Intensive Care Society[3] state that ICU bed occupancy should be between 70 and 75 per cent on average in order to manage the peaks in demand that every unit can expect.

We have an ageing population, with the number of elderly and, especially the very elderly (over 80 years old), increasing rapidly. The older the population the greater the demand for critical care beds, while the number of older people occupying critical care beds is increasing faster than the population is ageing[4], with nearly two-thirds of critical care beds occupied by people over the age of 65[5]. In Wales, two thirds of people over the age of 65 report having at least one chronic disease. With the rates of chronic diseases higher in older people[6] and ICU admission rates known to rise with an increasing number of co-morbid illnesses, this places additional pressure on an already stretched critical care service.

The changes in legislation on organ donation should also lead to an increased pressure on available critical are beds. In addition, the baseline growth in critical care demand from changing demography is expected to be approximately five per cent per year[7,8].

While there is much about the way in which critical care services are used and managed that can be improved, this does not remove the underlying need for additional capacity.

Current situation

- **Critical care beds across Wales have reduced by 4 in the last 15 years**
- **Published guidelines[9] and research[8] suggest that more patients than are currently being routinely identified could benefit from critical care**
- **Delayed Transfers from Critical Care, which should be five per cent or less, regularly reach over 50 per cent with over 80 per cent listed in some hospitals**

The publication by Welsh Government of the Delivery Plan for the Critically Ill[10] in 2013 set out a vision for the development of world-class care for the critically ill in Wales. The plan made it clear that the responsibility for providing this care was shared by everyone across Health Boards in monitoring, referring and expediting discharge for patients who have a critical illness.

The pressure on critical care beds, is exceptionally high and unsustainable.

The current numbers of critical care beds across Wales are as follows:

North Wales			South Wales											
BCUHB			**ABHB**		**ABMU**		**C&V**		**Cwm Taf**		**Hywel Dda**			
WM	YGC	YG	NHH	RGH	MH	PoW	UHL	UHW	PCH	RG	BGH	WH	PPH	GGH
12	10	11	8	16	23	8	6	27	6	10	3	7	5	14

The Welsh Government target for discharge of patients from critical care states that no more than five per cent should be delayed for more than four hours. In reality, around 50 per cent of patients across Wales are delayed beyond this time and for some this can mean a delay of days rather than hours. In some units, where pressures on ward beds from emergency admissions and elective surgery are greatest, the proportion of critical care patients delayed can exceed 80 per cent.

Study Method

In order to capture the unmet need for critical care, the Critical Care Networks in Wales – led by the North Wales Network – devised a methodology to identify patients who could potentially benefit from critical care but would not have ordinarily been referred to critical care during a study period of one week.

It was agreed that unmet demand can fall into two categories:

a) **Known unmet demand** – a patient, who has been referred to critical care cannot be accepted into a bed due to lack of capacity; and
b) **Unknown unmet demand** – patients who require critical care but are not referred or, where national guidance (or similar) recommends that patient outcomes are improved if they have a period of critical care, e.g. patients with a risk of death after surgery of greater than or equal to ten per cent should be admitted to critical care to prevent unexpected deaths[9].

Patients who require critical care can be admitted for either surgical or medical reasons. Patients for whom surgery is a high risk due to other medical conditions and the complexity of the operation have been found to benefit from critical care after their procedure, while patients whose medical condition is deteriorating on a general ward can improve with the higher degree of monitoring and treatment on offer in a critical care unit.

In order to measure both known and unknown demand for medical and surgical patients, the following methodology was piloted in North Wales prior to implementation in South Wales.

- **Critical care unit information**
  During the seven day study period, critical care teams recorded the bed availability on the unit hourly to capture the number of beds empty or occupied , patients awaiting discharge and those awaiting admission. Staff were asked to include requests for admissions that were either deferred or refused due to lack of available beds.

- **Ward information**
  In each hospital site, members of nursing staff were assigned to collect information from acute wards about patients who scored three or more on a single National Early Warning Score (NEWS) parameter or scored six or more overall. Ward staff were also asked to include patients whose NEWS score was not elevated but about whom they were concerned.

Once this information was collected, patients who were referred and accepted onto critical care, improved on the ward or had already been declared that they were not appropriate for escalation of care were excluded from the numbers for unmet need.

- **Surgical information**
  Throughout the same study period, surgical staff collected information for all patients having an operation except those for whom a critical care bed was already booked. POSSUM (Physiological and Operative Severity Score for Mortality and Morbidity) scores were calculated and, if a patient had a predicted mortality of ten per cent or greater recorded, they were included in the study. This was done contemporaneously through daytime operating lists and retrospectively for emergency surgery out of hours. Staff were also asked to include patients for whom predicted mortality was less than ten per cent but for whom there were other possible reasons for admission, such as sleep apnoea.

Analysis

It is also clear that Wales does not currently have, nor has it historically had, sufficient critical care capacity.

As there are significant pressures on critical care bed availability due to patients who are fit for discharge but their discharge is delayed (DTOCs), the analysis took such patients into account.

Unmet need for the sample week was extrapolated to a full year and added to the baseline information for 2012/13 – the most recent year for which full, validated data is available from ICNARC. Once this was complete, the average critical care time lost due to delays in discharge from critical care were taken from the projections to give an adjusted prediction of activity.

The number of additional beds required in order to manage the unmet demand also includes an increase in beds to keep beds under an average of 75 per cent occupancy. While this may seem relatively low compared to other specialties, the low bed numbers in critical care combined with the greatly fluctuating nature of the demand means that this buffer is required to accommodate the majority of situations that critical care will be required to handle. Units will still be required to maintain plans to expand their capacity by 100 per cent to deal with extremes in demand such as pandemic influenza or major civil incidents.

The detail of the analysis, along with assumptions made, is contained in Appendix 1.

Results

The table below shows the number of **additional** beds required to manage current demand, projected demand in five years time and projected demand in ten years time.

	North Wales			South Wales											
	BCUHB			**ABHB**		**ABMU**		**C&V**[1]		**Cwm Taf**		**Hywel Dda**			
	WM	YGC	YG	NHH	RGH	MH	PoW	UHW	UHL	PCH	RG	BGH	WH	PPH	GGH
Now	2	3	2	1	12	7	3	25	0	0	0	8	8	0	2
5 yrs	5	7	6	2	18	15	5	38	1	2	2	11	11	2	6
10 yrs	10	11	11	4	32	34	10	68	4	6	8	18	19	5	15
Occupancy	83%	90%	83%	80%	95%	98%	0%[2]	100 %	100 %	62%	70%	86%	55 %	88 %	94%
Average Length of Stay (days)	5.7	3.7	5	4	6.4	8	4.6	6.2	5.5	4.4	5.3	3.7	6.0	6.7	5.1

Based on identified unmet need and current rates of occupancy, there is a clear need for an increase in critical care capacity. The table above also gives a clear indication of where the greatest need for that capacity increase is felt. The activity and unmet need data used shows that some of the units are coping with their existing capacity while others are experiencing an unmanageable amount of existing utilisation and demand for services.

[1] Cardiff & Vale University Health Board declared occupancy data identical to their bed availability. It is likely that the beds were over their funded capacity and therefore not captured on their systems.

[2] At time of writing, ABM University Health Board had not submitted data to allow occupancy to be calculated in Princess of Wales Hospital for the study week.

	North Wales			South Wales											
	BCUHB			ABHB		ABMU		C&V[3]		Cwm Taf		Hywel Dda			
	WM	YGC	YG	NHH	RGH	MH	PoW[4]	UHW	UHL	PCH	RG	BGH	WH	PPH	GGH
General ward (n)	0	0	22	0	5	0	0	5	0	0	0	10	5	0	0
POSSUM >10% (n)	0	6	2	0	5	0	0	11	0	0	0	0	0	0	0
DTOC >4hrs (hours lost)	548	95	130	35	554	290	63	935	21	32	345	35	123	32	76
Bed available (hours)	208 Range=0 -3 beds	140 Range=0 -2 beds	333 Range= 0-4 beds	232 Range= 0-3 beds	96 Range=0 -3 beds	81 Range= 0-2 beds	-	402 Range= 0-5.5 beds	447 Range= 0-4 beds	380 Range= 0-4.5 beds	496 Range= 0-4 beds	71 Range= 0-3 beds	377 Range = 0-4 beds	101 Range = 0-2 beds	143 Range= 0-3 beds

[3] Due to staffing constraints, Cardiff and Vale University Health Board were only able to collect General ward and unplanned ward data for nine wards out of a total of 21 on the University Hospital of Wales site and none on the University Hospital Llandough site. As a result, the estimates of unmet need are likely to be conservative.

[4] At time of writing, ABM University Health Board had not submitted data to allow available bed hours to be calculated in Princess of Wales Hospital for the study week.

Discussion

The study uncovered unmet demand in a number of hospitals across Wales. It also demonstrated insufficient bed capacity to manage the identified need safely in the majority of units. However, in addition to the strengths of the study there are a number of acknowledged limitations in as it was undertaken.

This study is the first of its kind. A methodology for assessment of both unknown and known unmet need has previously not been undertaken on such a large scale. There is a dearth of literature as to suggestions for assessing unmet need, probably due to the complexity of the issue.

The study has an obvious strength in the rigour with which its methodology has been developed. Previous requirements for critical care beds were ascertained from perception. Despite its limitations, the methodology does provide Health Boards with the ability to more fully assess the demands on critical care from patient needs. This provides a clearer and more assured way in which planning critical care capacity can be undertaken.

As with most studies there are limitations.

- Not all hospitals undertook the study at the same time, some Autumn, some Winter and some in the Spring
    - This may mean that the hospitals were under differing pressures which may impact in the units' capacity, and thus unmet need
- The average length of stay (ALOS) used to model the additional capacity required varies from unit to unit. This means that:
    - a) current inefficiencies are built into the modelling
    - b) units with higher ALOS need more beds for the same volume of patients when compared to units with lower ALOS
- One or two hospitals were unable to undertake the study on all wards therefore a proportion of unmet need may have been missed.

Any decisions taken about the future provision of critical care in Wales should be done with the acknowledgement of the strengths and weaknesses of the study.

Findings
The results show that a massive increase in critical care capacity is required to meet demand both now and in the future. This is set against a number of issues and strategic drivers for change.

- **Delayed Transfers of Care**

DTOCs continue to have a significant impact on available critical care resources. Patients who would be more appropriately cared for in other healthcare settings occupied over 20 beds across Wales during the respective study periods. DTOCs have been taken out of the calculations for required future capacity, which makes it even more important to ensure that they are addressed. Addressing DTOCs will free up much needed capacity and ensure that any additional resources provided are not squandered on patients who will receive no clinical benefit.

- **Occupancy levels**

High occupancy levels are recorded in units where capacity is used by patients who could be cared for on general wards rather than for those who are critically ill. Caution needs to be used when assessing occupancy levels in isolation as these are not a good surrogate for capacity requirements alone.

Using CCMDS it is possible to exclude delayed discharges to understand occupancy levels of true critical care patients in units. As a result, activity projections have been calculated to exclude DTOCs to ensure as accurate a prediction of critical care need as possible.

- **Organ Donation**

During the study periods, instances were recorded where patients were unable to fulfil their wishes to become organ donors due to lack of critical care capacity to accommodate them while retrieval could be arranged. While these are few in number both during the study and on an annual basis, at current levels of critical care capacity and with current bed occupancy rates, clinicians will continue to balance making space available for potential organ donors with meeting the unmet need for patients who are likely to benefit from critical care interventions.

- **Bed numbers**

As stated above, one of the limitations of the study is the use of existing practices in the model of future requirements. The number of beds required if concentrated on fewer hospital sites is unclear. However, due to the availability of healthcare professionals of all disciplines and the provision of staffing to meet the requirements of the Delivery Plan for the Critically Ill, it's likely that there will need to be fewer sites across Wales providing Tier 3 care in order to ensure clinical standards are met.

Glossary

BGH	Bronglais Hospital
DTOC	Delayed Transfer of Care
GGH	Glangwili Hospital
ICNARC	Intensive Care National Audit and Research Centre
ICU	Intensive Care Unit
MH	Morriston Hospital
NHH	Nevill Hall Hospital
PCH	Prince Charles Hospital
PoW	Princess of Wales Hospital
PPH	Prince Phillip Hospital
RG	Royal Glamorgan Hospital
RGH	Royal Gwent Hospital
UHL	University Hospital Llandough
UHW	University Hospital of Wales
WH	Withybush Hospital
WM	Wrexham Maelor Hospital
YG	Ysbyty Gwynedd
YGC	Ysbyty Glan Clwyd

Appendix1 – Methodology and assumptions

- **Study Methodology**
  Ward Information
  During the seven day study period the Acute Intervention Teams (similar to Outreach) collected information on all the acute wards for patients who scored > 3 NEWS (National Early Warning Score) in one parameter within last 24hrs or >6 overall. The staff were also asked to include patients who may not have had an elevated NEWS but whom they were concerned about. In addition they were also asked to:

  - Exclude TLC/not for escalation patients
  - Exclude patients who respond to treatment within a given time (see Outreach/AIT protocol) i.e. not unmet need
  - Exclude patients referred and accepted to critical care (where bed available)

  This information was forwarded to the Critical Care Network for collation.

  Surgery Information
  During the same seven day study period medical staff collected information for all surgical patients except patients going to, or already in critical care.

  POSSUM Scores were calculated and, if the patient scored greater than 10 per cent predicted mortality, recorded. This was done both contemporaneously for daytime patients and retrospectively for any overnight patients.

  Members of staff scoring patients were asked to include patients if there was ANY other reason to consider for admission to critical care but predicted mortality less than 10 per cent, e.g. sleep apnoea.

  Critical Care Information
  During the same seven day study period, critical care staff recorded bed availability hourly. This included empty beds, patients awaiting admission, patients awaiting discharge (DToC) and beds closed (for example, due to staffing constraints).

  Staff were asked to include requests for admissions, for example patients refused (due to lack of a bed) and deferred (due to lack of a bed).

- **Calculation of unmet need**
  Results from the study showed the number of patients who may have benefited from critical care during the course of the sample week. Once this figure had been obtained, unmet need was calculated using the following formula.

Unmet need patient	x	**Unit average length of stay**	=	**Bed days required**

  These bed days were factored into projections later in the analysis.

- **Current and projected activity including/excluding DTOCs**
  Current activity was taken at the 2012/13 ICNARC data as the most rigorously validated data available. The number of episodes was multiplied by the average length of stay to give bed utilisation.

  From the data of the same year, the total DTOC hours were taken for each unit and worked out as a percentage of the total available bed hours. This percentage was applied to the projections to give a clearer idea of likely bed occupancy without the current levels of DTOC usage.

- **Future bed requirements**
  Each bed, if fully utilised, gives 8,760 hours of available care. Recommendations for bed occupancy state that an average of 75 per cent allows for the fluctuations that come from surges in demand for a very scarce resource.

  In each unit, 75 per cent bed occupancy was calculated using the following formula.

$$\left(\textbf{Number of beds} \times \textbf{24 hours a day} \times \textbf{365 days a year}\right) \times 0.75$$

  Once this had been obtained for all units, the expected bed occupancy in hours was compared against the number of hours required for 75 per cent bed occupancy. When this figure was exceeded, an additional bed was added to keep the unit below 75 per cent on average.

- **Assumptions**
  The following assumptions were made in calculating the future demand for critical care.

    - Building on the baseline of 2012/13 activity plus the identified unmet demand, the future growth in critical care need is assumed to be five per cent compound growth year-on-year.
    - Future demand excludes DTOCs completely.
    - Capacity required is based on current unit average length of stay. This is variable between units and may change in future.
    - Stated capacity requirements are based on current service configuration. No assumptions can be made from this study on how bed number requirements might change due to changes in critical care service delivery in terms of number of units.

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