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RESEARCH ARTICLE

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Analysis of admissions to intensive care units that could be supported on an intermediate care unit

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Abstract

Background: Only one third of European countries use intermediate care units (IMCs). An IMC makes it possible to manage patients who do not require intensive care but who need a higher level of nursing care that cannot be provided on the general ward. In Belgium, there are no national criteria for ICU admission or discharge, and no policies regarding IMC care or for differentiating ICU intensity levels.

Aim/s: The aim of our study was to analyse the profile of ICU patients in Belgium on the basis of registered nursing activity in order to quantify the number of ICU days potentially transferable to an IMC.

Study Design: The study was conducted on 310 ICU beds. Patients admitted to the study were recruited during two different one-month periods in 2018 and were included into a prospective database that evaluated nursing workload carried out in 15 hospitals in the French-speaking part of Belgium. The number of ICU days that could be supported on an IMC was defined according to the Nursing Activities Score (NAS) items.

Results: A total of 3279 ICU patients for a total of 13 942 ICU days were included. 4987 days (35.8%) were considered as "transferable" to an IMC. The proportion of ICU days transferable to an IMC was highly variable among hospitals, ranging from 20.4% to 59.5% of all ICU days. On the day of ICU admission, 665/2142 (31.0%) of the patients were already identified as transferable to an IMC; this percentage significantly increased on day 2 (972/2066, 47.1%) and day 3 (650/1390, 46.7%).

Conclusions: In Belgian ICUs, 35.8% of ICU hospital days, as per recorded NAS, do not necessitate intensive monitoring. These 35.8% of days of ICU hospitalization could be supported on an IMC.

Relevance for Clinical Practice: In this study, a significant number of days spent in the ICU could be supported on an IMC, this could alleviate the workload of nurses and reduce the occupancy rate of intensive care units.

KEYWORDS
intermediate care unit, nursing activities score

1 | INTRODUCTION

Throughout the world, there is no consensus on the organization of intensive care units (ICU) and intermediate care units (IMCs). In the literature, the two major models include one in which the organization of ICU is broken down into intensive care intensity levels[1] and another that involves the use of IMCs.[2,3] Only one third of European countries use IMCs.[4] An IMC makes it possible to manage patients who do not require intensive care but who need a higher level of nursing care that cannot be provided on the general ward. The IMC concept has been suggested as a strategy to promote earlier ICU discharge, facilitate patient reassignment, reduce costs, and prevent unnecessary ICU readmissions.[5,6] There is no international consensus on the naming and operation of these IMC beds (High Dependency Unit, Step Down Unit, Progressive Care Unit, Medium Care Unit). We have chosen the name IMC, the most widely used in Europe since 2010.[3]

Belgium has one of the highest ratios of intensive care beds per 100 000 inhabitants in Europe with 17.4 intensive beds/100000 inhabitants[7] but the occupancy rate of intensive care beds in Belgian ICUs is relatively high, ranging from 75% to 90%.[8,9] In addition, Belgian ICUs have one of the highest nurse-to-patient (N/P) ratios in Europe.[7] In Belgium, the legal N/P in the ICU is 1/3. In Belgium, there are no national criteria for ICU admission or discharge, and no policies regarding IMC care or for differentiating ICU intensity levels. Coronary units and stroke units could be appropriate for this type of service but do not have well-defined admission criteria.[10,11] In practice, the case-mix and nursing activities vary from one ICU to another[7] and the nursing working time per patient is not homogeneous in French-speaking Belgian ICUs, suggesting that not all ICUs have the same population,[8] or the same level of intensity, and, therefore, the same needs for nursing staff.

On March 11, 2020, the World Health Organization declared severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) a pandemic.[12] This pandemic has had a significant impact on ICU caregivers in Europe, leading to the closure of beds due to staff shortages.[13] In Belgium, this pandemic has increased the risk of burnout and the intention to leave the ICU nursing profession.[14,15] However, lack of capacity within ICUs and unsuitable N/P ratios can lead to inadequate care, worse outcomes for patients, and increased mortality.[16] The creation of IMCs would make it possible to reduce ICU occupancy by reducing the length of stay in the ICU[17] and by making it possible to avoid admission to the ICU for certain patients.[18]

Finally, the nursing staff in the ICU represents a significant cost for the hospital.[9,19] In a context of economic restrictions and a shortage of health care personnel, it is wise in Belgium to take an interest in methods that make it possible to reduce expenditure without negatively influencing the care of patients.[20] IMCs present a cost-per-day of hospitalization that is lower than that of hospitalization in an ICU.[17,21] Despite significant heterogeneity in the use of IMCs at the international level, recommendations in terms of supervision of nursing staff are lower than those of the ICU[3] and the introduction of an IMC unit is associated with more appropriate use of ICU resources.[6,22]

What is known about the topic

- Only one third of European countries use IMCs.
- The IMC concept has been suggested as a strategy to promote earlier ICU discharge, facilitate patient reassignment, reduce costs, and prevent unnecessary ICU readmissions.

What this paper adds

- According to nursing activity, 35.8% of days of ICU hospitalization could be supported on an intermediate care service.
- This percentage varies from one hospital to another ranging from 20.4% of ICU days to 59.5% of ICU days.

The aim of our study was to analyse the profile of ICU patients in Belgium on the basis of registered nursing activity in order to quantify the number of ICU days potentially transferable to an IMC.

2 | MATERIALS AND METHODS

2.1 | Study design, setting and patients

We analysed data from the database of a prospective observational study evaluating nursing workload conducted in 16 hospitals in the French-speaking part of Belgium. It was a secondary analysis of a prospective observational study conducted in 2018. The objectives of this study were, therefore, to evaluate the N/P ratio and to study nursing activities in intensive care in French-speaking Belgium.[8] The study was conducted on 316 mixed ICU beds (surgical, medical, paediatric). Patients admitted to the study were recruited during two 1-month periods: from 15 January–15 February 2018, and from 1 May–31 May 2018. One centre was excluded because it had only encoded five patients. Paediatric patients and 118 incomplete nursing activities score (NAS) records were excluded. There is little data available in Belgium on our intensive care patients. The pandemic has increased the nursing shortage in the ICU, so we wanted to analyse stays to see if we could reduce the number of days spent in the ICU.

2.2 | Nursing activities score (NAS)

The NAS is a workload scale specific to intensive care. The scale is composed of 23 items corresponding to 23 nursing activities. The NAS gives a percentage score (from 0% to 177%) corresponding to the nursing time consumed per patient. A score of 100% means that a patient has consumed 100% of a nurse's time. Eighteen items are dichotomous and five are multiple-choice, depending on the intensity of the activity. NAS represents 81% of nursing activity and is

independent of disease severity.[23] For this study, we used the NAS and the guidelines translated and published in French in 2018.[24,25] The NAS was encoded at the end of each break by the nurse who took care of the patient. The NAS score per 24 h was obtained by taking the maximum of each item recorded per work shift.[23]

The nursing teams were trained for the NAS by the research team between March 2017 and November 2017. The one-hour training included a theoretical part and exercises. The training was the same in all participating hospitals and a reference person for the study was available by telephone 24 h per day and 7 days per week. The scale and the tutorial were available to all nurses. The research team also made explanatory videos available. In addition, a few reference nurses per hospital underwent additional training to facilitate the implementation of the NAS and check the correct recording of data on a daily basis.

2.3 | Intermediate care unit

There is no consensus on the use of an IMC, and it depends on local needs and public health policies. We used the definition that an IMC can manage patients who do not require intensive care but who need a higher level of nursing care that cannot be provided on the general hospital ward.[26]

We determined which ICU days could be supported on an IMC setting based on the NAS items. For this, we analysed recommendations on IMCs[6,26] as well as models of intensive care levels.[1,19] Level 1 of intensive care described in these models is very close to the IMC definition. We then selected a set of NAS items corresponding to care that could be arranged in an IMC based on the criteria for an IMC and level 1 criteria for differentiating intensive care levels.

We defined ICU days likely to be transferable to an IMC if the encoded NAS included all of the following characteristics (Figure 1):

- The patient does not require intensive monitoring (item 1B: "present at bedside and continuous observation or active for 2 h or more" and item 1C: "present at bedside and active for 4 hrs or more)
- The patient does not have an artificial airway (item 10: "care of artificial airway, orotracheal tube, or tracheostomy canula")
- The patient is not receiving vasoactive medication (item 12: "vasoactive medication")
- The patient does not have invasive cardiac monitoring (item 14: "left atrium monitoring")
- The patient does not require continuous or intermittent dialysis performed by the intensive care unit (item 16: "technical hemofiltration, dialysis techniques")
- The patient has no intracranial pressure measurement. (item 18: measurement of intracranial pressure)

With this selection of items, the maximum NAS score for patients defined as to be transferable to an IMC is 144.7%, versus 177% with the full NAS score.

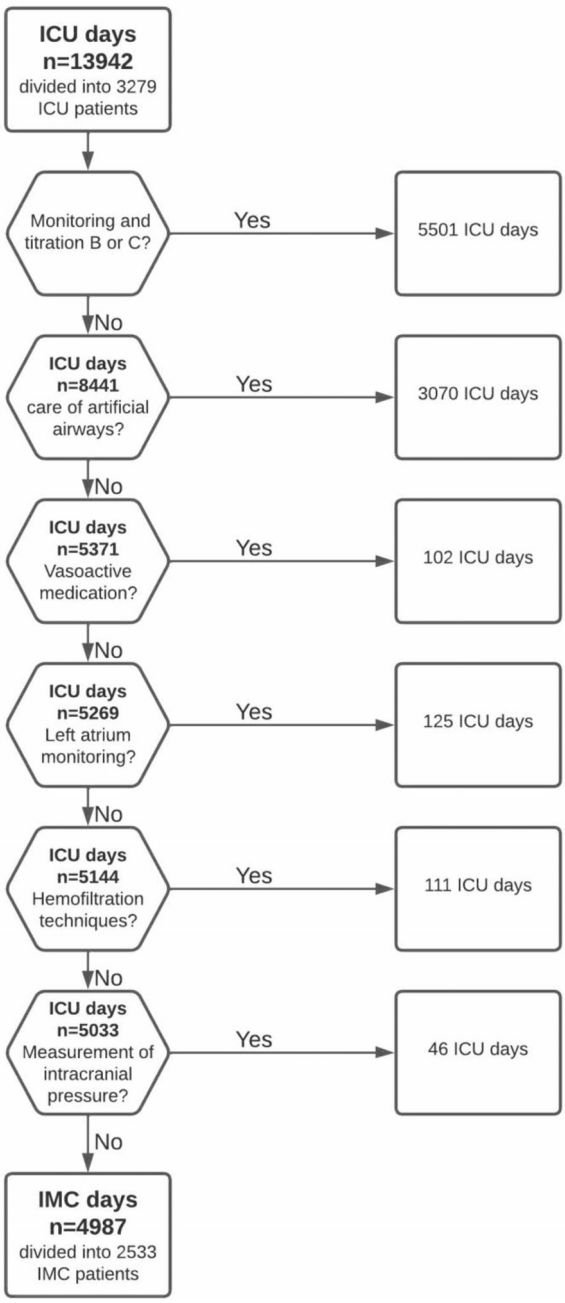

FIGURE 1 Selection of intensive care unit (ICU) and intermediate care unit (IMC) days based on nurse activity score (NAS) items.

2.4 | Other variables and data encoding

The following variables were collected at patient admission: age, sex, origin of admission, length of stay in the ICU, destination after the ICU. The number of nurses present at each shift was also encoded. All data was encoded via Epimed Monitor® and part of this data was directly extracted from the electronic patient file.

2.5 | Statistical analyses

Gaussian continuous variables were presented in mean ± standard deviation (SD). Non-gaussian continuous variables were described in

TABLE 1 Sociodemographic and hospital data.

Patients	All $n = 3279$	ICU patients $n = 746$	IMC patients $n = 2533$	Test value	p values
Age (years), mean ± SD	61.3 ± 20.5	62.3 ± 19.6	60.9 ± 20.7	$t = 1.68$	.046
Men, %	58.4	60.3	57.9	$\chi^2 = 1.68$	.430
BMI	26.6 ± 5.2	27.3 ± 5.9	26.5 ± 5	$t = 1.56$	.059
Length of stay (days), median [p24-p75]	2 [1–5]	3 [1–9]	2 [1–5]	$z = 6.40$	<.0001
Origin (%)					
Emergency Surgery	11.1	12.9	10.6	$\chi^2 = 19.49$	<.0001
Scheduled surgery	24.4	15.0	27.4		
Medical	64.5	72.1	62.0		
Destination (%)					
Deceased	8.9	28.5	4.7	$\chi^2 = 367.81$	<.0001
Ward	84.3	62.3	89.1		
Other hospital	3.6	5.9	3.4		
Home	3.2	3.3	2.8		
Description of hospitals					
Number of hospitals, *n*	15				
Number of ICUs, *n*	23				
Number of beds, *n*	310				
Number of beds, medical-surgical, *n* (%)	310 (100)				
Number of beds, neuro surgery, *n* (%)	135 (43.5)				
Number of beds, cardiac surgery, *n* (%)	157 (50.6)				
Occupancy rate, mean ± SD	73.8 ± 18.0				
Ratio ICU N/P, mean ± SD					
Morning	2.5 ± 0.68				
Afternoon	2.8 ± 0.9				
Night	3.0 ± 0.9				

Abbreviations: BMI, body mass index; ICU, intensive care unit; IMC, intermediate care unit; SD, standard deviation.

medians with interquartile ranges (IQR), that is, percentile P25 – percentile P75. Unpaired Student's *t*-test was used for means comparisons. The Wilcoxon test was used for medians comparisons. Pearson's χ^2 test was performed on categorical data to assess the difference between categories. The coefficient of variation expressed in percentage is the ratio of the standard deviation to the mean time 100 it is considered that a coefficient of variation lower than 15% indicates that the population is homogeneous and that a coefficient higher than 15% indicates that the values are relatively scattered.

All analyses were performed using SPSS for Windows version 14 (SPSS Inc, Chicago, IL) Data with a p-value <0.05 were considered statistically significant.

2.6 | Ethical considerations

A unique, anonymous number was randomly assigned to each patient and hospital setting included in the study. We obtained permission from all nursing directorates for implementation and data extraction. In addition, Epimed Monitor has signed confidentiality agreements with all hospital departments. Finally, a central ethics committee was consulted and we obtained authorization from local committees for hospitals that requested it (P17/82_20/12; B325201734614). Due to the observational nature of the study and the anonymization of the data, written consent from patients or relatives was not required.

3 | RESULTS

3.1 | Selection of IMC days based on NAS items

Our database included 3279 ICU patients for a total of 13 942 ICU days. Based on the NAS items, we separated, item by item, patients requiring high-level intensive care from those requiring care that could be provided in the IMC (Figure 1). Of these 13 942 ICU days, 5501 days were determined to be intensive days because the patients required continuous or active monitoring for ≥2 h beyond or ≥4 h (item "monitoring and titration" B or C). Among the remaining ICU days, we then removed 3070 ICU days because the patients had artificial airways, 102 ICU days because the patients were on vasoactive drugs, 125 days because the patients had left atrial monitoring, 11 days because the patients required hemofiltration, and 46 ICU

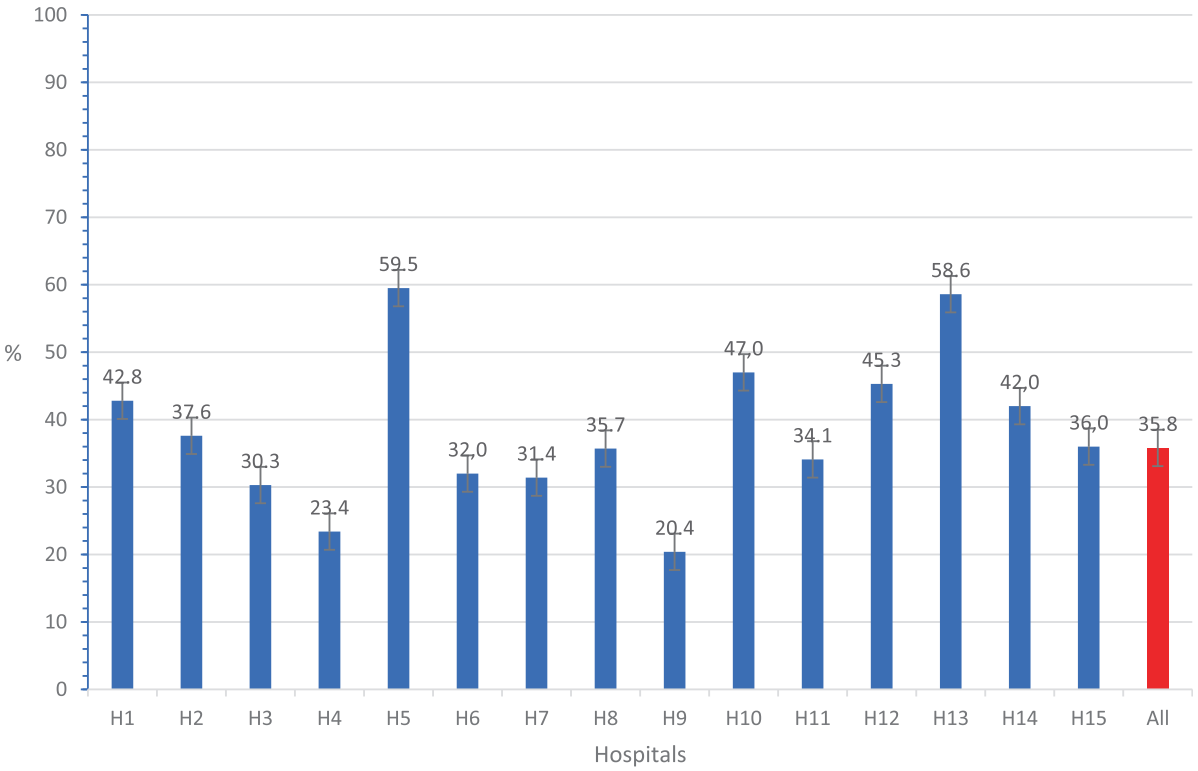

FIGURE 2 Proportion of intermediate care unit (IMC) days among all intensive care unit (ICU) days by hospital.

days because the patient had an intracranial pressure measurement. There remained 4987 ICU days left that could potentially be supported on an IMC (IMC days) distributed among 2533 patients (77.2%). A total of 746 patients (22.8%), never had one single ICU day that could be supported on the IMC during their stay. Following our analysis of the NAS items, 746 patients presented with an ICU stay without any days that could be supported on an IMC (ICU patients) and 2533 patients presented with at least one ICU day that was transferrable to the IMC (IMC patients) (Table 1).

3.2 | Differences between ICU and IMC patients

Main characteristics of the study population are reported in Table 1. IMC patients were younger than ICU patients (t:1.68, $p = .046$) and their length of stay was statistically shorter ($z = 6.40$, $p < .0001$). The mortality rate was significantly higher among the ICU patients (28.5% vs. 4.7%, $p = .0001$). The distribution of the origin of the patients was different between the two groups; For the IMC-patient group, 10.6% of the patients were emergency surgeries, 27.4% were scheduled surgeries, and 62% were medical-type surgeries; For the ICU-patient group, 12.9% were emergency surgeries, 15% were scheduled surgeries, and 72.1% were medical-type surgeries.

During the study period, the occupancy rate of these beds was 73.8%. Concerning the 310 beds investigated, they all accommodated medical-surgical patients, 135 (43.5%) of these beds were intended to accommodate patients who had undergone a neurosurgery procedure and 157 (50.6%) of these beds were intended to accommodate patients who had undergone a heart surgery procedure.

The N/P ratio (Mean ± standard deviation) was 2.5 ± 0.68 for the morning shift, 2.8 ± 0.9 for the afternoon shift, and 3.0 ± 0.9 for the night shift.

3.3 | Proportion of IMC days for all ICU days per hospital

Figure 2 shows the 13 942 ICU days, 4987 (35.8%) could be converted to days in the IMC (IMC Days). However, the distribution of the number of IMC days was highly variable from one hospital to another with a coefficient of variability of 29.1%. The proportion of ICU days transferable to IMC days ranged from 20.4% of ICU days to 59.5% of ICU days.

3.4 | Distribution of IMC days according to the day of hospitalization in the ICU

Figure 3 shows the proportion of IMC days according to the day of hospitalization during the first 2 weeks of hospitalization in the ICU. On the day of admission to intensive care (D1), 31.0% (665/2142) of the days were already identified as IMC days. The number of IMC days was higher during the first days in the ICU with 47.1% (972/2066) on D2, and 46.7% (650/1390) on D3.

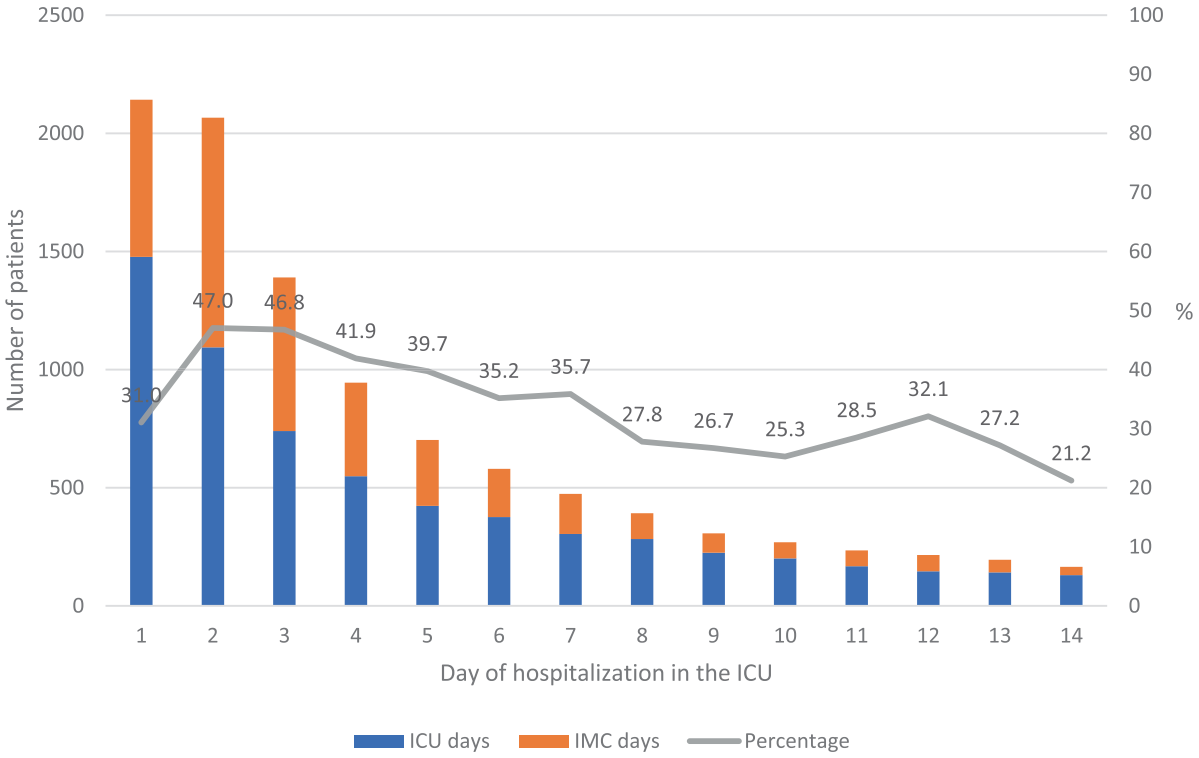

FIGURE 3 Distribution of intermediate care unit (IMC) days according to the day of hospitalization in the intensive care unit (ICU).

3.5 | Nursing working time of ICU days and IMC days per shift

During each shift, in Figure 4, the NAS score of the ICU days was higher than that of the IMC days. The median NAS score of ICU days for the morning shift was 67.2% compared with 53.7% ($z = 36.47$; $p < .001$) for IMC patients/day. The median NAS score of the ICU days for the afternoon shift was 61.9% compared with 49.3% ($z = 37.30$; $p < .001$) for the IMC days. The median NAS score of the ICU days for the night shift was 58.0% compared with 47.5% ($z = 37.65$; $p < .001$) for the IMC days.

4 | DISCUSSION

In this study, we explored the number of ICU days that could potentially be supported from an ICU setting on an IMC setting and we found that 35.8% des ICU days could be supported on an IMC. To achieve this, we used the NAS and we split the ICU days into two groups (ICU days and IMC days) according to the NAS items encoded. The NAS allowed us to have a good idea of the nursing care required by the patient. Another study had already suggested that the NAS could be a good criterion for discharge from the ICU and admission to the IMC.[26] We had 3279 patients included representing 13 942 ICU days. Based on the NAS encoded for these days/ICU, 4987 ICU days (35.8%) could be supported on the IMC. Indeed, these patients do not require intensive monitoring, they do not have an artificial airway (endo-tracheal tube or tracheostomy), they did not receive vasoactive drugs, they did not require monitoring of the left auricle, they did not require hemofiltration, and did not need intracranial pressure measurement. This percentage (35.8%) is in line with an earlier study carried out across seven European countries that showed that when there were no strict criteria for admission to the ICU, 35% to 40% of patients in the ICU could be treated at a lower level of care.[27] However, the 35.8% of ICU days that can potentially be supported on the IMC could be an underestimate given that the "care of artificial airways" item of the NAS score does not make it possible to differentiate between intubated patients and patients who simply have a non-ventilated tracheotomy, a situation that can be managed in an IMC.[28] Furthermore, based on the NAS items, we were unable to identify patients on non-invasive ventilation or high flow nasal cannula. According to the NAS guidelines,[25] the monitoring of these devices is included item 1B (present at bedside and continuous observation or active for 2 h or more) or item 1C: "present at bedside and active for 4 h or more We have therefore retained these patients as ICU patients". These patients are also potentially transferable to an IMC.[26] Moreover, in this study, we also did not check that the intensive monitoring devices were absolutely necessary. It could, therefore, be that the number of patients transferable to IMCs is greater than what we have reported here.

The 746 patients who had no transferable days to the IMC during their stay were significantly older and had a longer median length of stay than patients with at least one transferable day to the IMC (IMC patients). While these two groups were formed solely on the basis of nursing activity, the two patient groups, IMC and ICU, had a large difference in mortality. The provenance of these patients was also

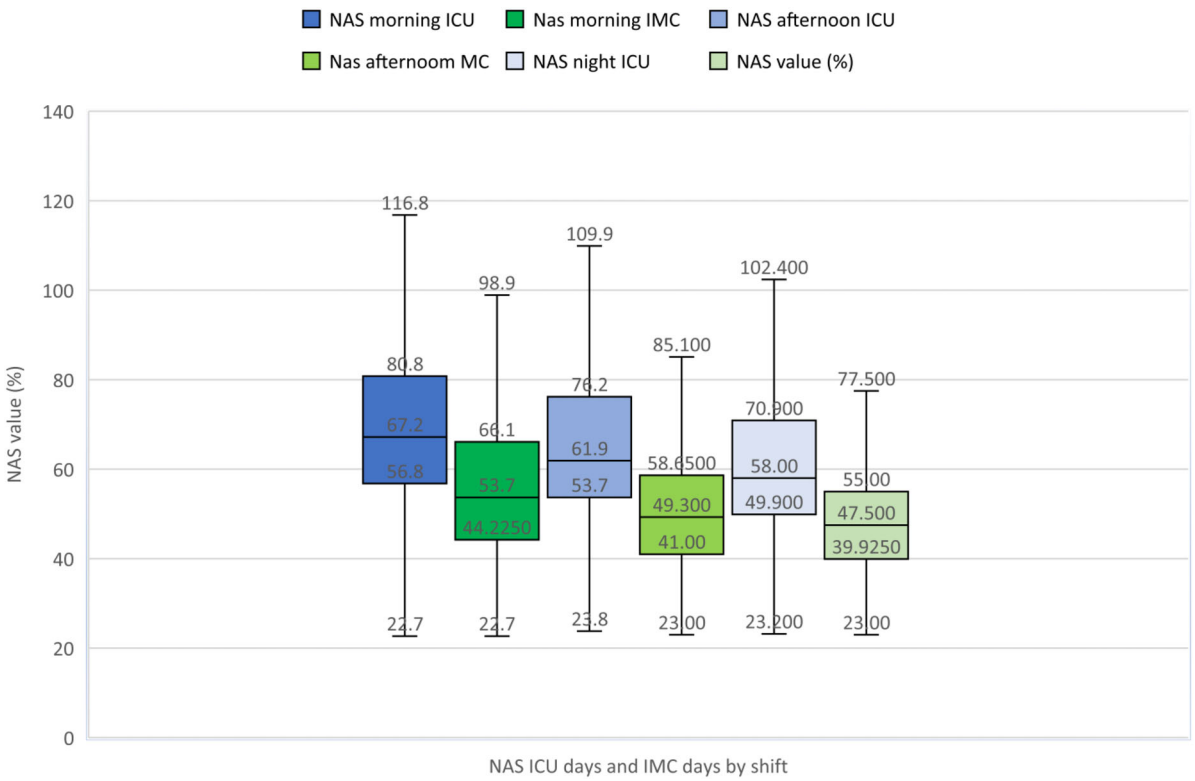

FIGURE 4 Nursing working time of intensive care unit (ICU) days and intermediate care unit (IMC) days by shift according to the nurse activities score (NAS).

different. IMC patients had more scheduled surgeries (27% vs. 15%). This could be explained by the fact that many postoperative recovery rooms are closed at night, on weekends, and on public holidays, the postoperative follow-up of patients presenting the least risk of deterioration must, therefore, take place in the ICU. This could also explain the large number of patients who can be supported on the IMC from day 1. In addition, in Belgium, staffing standards for hospitalization services are lower than WHO recommendations.[7] Patients at risk, who require closer monitoring, cannot therefore be optimally monitored in the inpatient departments and these patients must be admitted to the ICU. These patients do not require intensive care and could be monitored in an IMC. This analysis is supported by a Spanish experience which demonstrated that 26% of patients could be admitted directly to the IMC without going through the ICU.[18]

In Belgium, there are no national admission or discharge criteria for intensive care. Each center defines its own criteria for admission to and discharge from the ICU. But 30% were IMC on admission; so this means either we admite patient who do not require ICU or some ICU patients admitted for surveillance are lighter to manage. We noticed that the proportion of ICU days that could be supported on the IMC varied greatly from one hospital to another ranging from 20.4% of ICU days to 59.5% of ICU days with a coefficient of variation of 29.1%. The Belgian intensive care patient population is therefore heterogeneous.

We also found that IMC days consumed significantly less nursing work time during the three daily shifts. However, intensive care staffing standards in Belgium require "2 nurses per full section of 6 beds" regardless of the type of patients admitted to these beds. In view of these results, and the significant variation in the number of IMC days, it is necessary to revise the current standards and adapt them to the case-mix of patients rather than simply to the number of beds. This study also shows that the nursing work time consumed per patient was significantly higher in ICU patients compared with patients who could be supported on an IMC. Taking these patients out of the ICU, therefore, means that patients who consume more nursing time will be concentrated in the ICU. Other studies have made the same observation: the creation of an IMC increases the overall severity of the ICU population, with an increase in the "Therapeutic Intervention Scoring System" (TISS) and the duration of ventilation.[22] If an IMC is created, it will, therefore, be necessary to review the nursing staff standards in the ICU, which are already obsolete in Belgium.[8]

Our data were collected in ICUs where the nurse-to-patient ratio is lower compared with other European countries.[29] The establishment of Intermediate Care Units (IMCs) would help reduce the number of ICU beds in Belgium, which is one of the highest per capita, and thus improve the nurse-to-patient ratio, provided that the same nursing staff allocation is maintained.[30] Belgium faces a significant shortage of nurses in general care and nurses specializing in intensive care. Transferring 35.8% of ICU days to an IMC would reduce ICU activity and, therefore, the number of ICU beds needed. By reducing the number of ICU beds, it will also be possible to recover staff in order to increase supervision and increase the quality of care in the ICU.[15] In

addition, the nurse/patient (N/P) ratios recommended for an IMC (N/P of 1:4 to 1:5) are lower than those of the ICU (N/P of 1:1 to 1:2).[6] This would make it possible to be more efficient with the nursing staff in short supply.

Our study has certain limitations. This is an inventory of the Belgian ICU population over two periods of 1 month in 2018, outside of the pandemic period. It would be interesting to reassess the situation at present however no political decisions that could directly influence our ICU patient base have been made since 2018. Our results depend on the Belgian context where there are no IMCs, ICU admission criteria, or intensive care intensity levels and, therefore, cannot be generalized to other care policies. A second limitation is that we lack biological data and severity scores on patients. IMC days were selected solely on the basis of the NAS. Nevertheless, the majority of recommendations on IMC or level of intensive care are based solely on the clinical and support needs of patients.[1,26] However, it would be interesting to supplement our data from nursing activities with data including trajectory of recovery, clinical judgement, bed occupancy/discharge delay, severity of illness and perceived risk of deterioration. Finally, our criteria for IMC patients are based on nursing tasks; Clinical judgement and the risk of deterioration in ICU care were not evaluated. Creating an IMC would require an in-depth study of potential patients in order to avoid errors.[27] A Spanish study demonstrated that the mortality of patients admitted to the ICU via the IMC was higher than the mortality of patients admitted directly to the ICU.[18] The criteria for admission to the IMC and the ICU therefore require an in-depth analysis of clinical and medical criteria. In our study, ICU days were assessed overall. The fluctuation between ICU days' and days could be supported on an IMC could lead to organizational problems. In addition we did not investigate the impact of an IMC on the rest of the current hospital organization. However, based on reports in the literature, IMCs have had a positive impact on inpatient wards and have reduced the number of inappropriate admissions to wards when the ICU is overcrowded.[6,22]

This study, despite its limitations, provides interesting leads for the organization of care within the hospital in a context of, on the one hand, a shortage of human resources and, on the other hand, optimisation of the quality and safety of care according to patient severity levels. A multicentre, prospective study that would address the limitations cited in this work and that would benefit from an adjudication committee would be useful to confirm our recommendations.

4.1 | Recommendations

In order to determine the admission and discharge criteria for the IMC, a more in-depth analysis of the profiles of patients who can be supported on this type of service, including clinical and medical criteria, is necessary.

With a view to the creation of IMCs in Belgium, it would also be necessary to study the care supervision necessary for this type of patient. The number of caregivers (nurse to patient ratio) needed as well as their skills and training will need to be determined.

5 | CONCLUSIONS

In Belgian ICUs, based on recorded NAS, 35.8% of days of ICU hospitalization do not require intensive monitoring, have no artificial airway, receive no vasoactive drugs, have no invasive cardiac monitoring, do not require continuous or intermittent dialysis performed by the ICU, have no intracranial pressure measurement. These 35.8% of days of ICU hospitalization could be supported on an intermediate care service. This percentage varies from one hospital to another ranging from 20.4% of ICU days to 59.5% of ICU days.

AUTHOR CONTRIBUTIONS

All authors read and approved the final article. All authors were involved in data collection.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest to declare.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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REFERENCES

1. Marshall JC, Bosco L, Adhikari NK, et al. What is an intensive care unit? A report of the task force of the World Federation of Societies of Intensive and Critical Care Medicine. *J Crit Care*. 2017;37:270-276. doi:10.1016/j.jcrc.2016.07.015
2. Morland M, Haagensen R, Dahl FA, Berdal J-E. Epidemiology and prognoses in a medical intermediate care unit. *Tidsskriftet*. 2018;138:2-13. doi:10.4045/tidsskr.17.0496
3. Plate JDJ, Leenen LPH, Houwert M, Hietbrink F. Utilisation of intermediate care units: a systematic review. *Crit Care Res Pract*. 2017;2017:8038460. doi:10.1155/2017/8038460
4. Rhodes A, Ferdinande P, Flaatten H, Guidet B, Metnitz PG, Moreno RP. The variability of critical care bed numbers in Europe. *Intensive Care Med*. 2012;38:1647-1653. doi:10.1007/s00134-012-2627-8
5. Ridley SA. Intermediate care: possibilities, requirements and solutions. *Anaesthesia*. 1998;53:654-664. doi:10.1046/j.1365-2044.1998.466-az0557.x
6. Solberg BC, Dirksen CD, Nieman FH, et al. Introducing an integrated intermediate care unit improves ICU utilization: a prospective intervention study. *BMC Anesthesiol*. 2014;14:76. doi:10.1186/1471-2253-14-76
7. Van de Voorde C, Lefèvre M, Mistiaen P, Detollenaere J, Kohn L, Van den Heede K. Gestion de la capacité hospitalière en Belgique durant

la première vague de la pandémie de COVID-19 – Synthèse. Health Services Research (HSR). Bruxelles: Centre Fédéral d'Expertise des Soins de Santé (KCE). 2020. KCE Reports 335Bs. D/2020/10.273/33, n.d.

8. Bruyneel A, Tack J, Droguet M, et al. Measuring the nursing workload in intensive care with the nursing activities score (NAS): a prospective study in 16 hospitals in Belgium. *J Crit Care*. 2019;54:205-211. doi:10.1016/j.jcrc.2019.08.032
9. Debergh DP, Myny D, Van Herzeele I, Van Maele G, Miranda DR, Colardyn F. Measuring the nursing workload per shift in the ICU. *Intensive Care Med*. 2012;38:1438-1444. doi:10.1007/s00134-012-2648-3
10. Arrêté royal fixant les normes auxquelles les programmes de soins « pathologie cardiaque » doivent répondre pour être agréés. (MB du 15/06/2004) n.d. n.d.
11. Arrêté royal fixant les normes auxquelles les programmes de soins « soins de l'accident vasculaire cérébral (AVC) » doivent répondre pour être agréés (M.B. du 19/04/2014) n.d. n.d.
12. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed*. 2020;91:157-160. doi:10.23750/abm.v91i1.9397
13. WHO Regional Office for Europe. Health and care workforce in Europe: time to act. Copenhagen: WHO Regional Office for Europe; 2022. Licence: CC BY-NC-SA 3.0 IGO. 2022.
14. Bruyneel A, Smith P, Tack J, Pirson M. Prevalence of burnout risk and factors associated with burnout risk among ICU nurses during the COVID-19 outbreak in French speaking Belgium. *Intensive Crit Care Nurs*. 2021;65:103059. doi:10.1016/j.iccn.2021.103059
15. Van den Heede K, Bouckaert N, Detollenaere J, et al. *Dotation infirmière dans les soins intensifs belges: impact de deux ans de pandémie de COVID-19*. 1st ed. KCE Reports. Centre Fédéral d'Expertise des Soins de Santé (KCE); 2022.
16. Needleman J, Liu J, Shang J, Larson EL, Stone PW. Association of registered nurse and nursing support staffing with inpatient hospital mortality. *BMJ Qual Saf*. 2020;29:10-18. doi:10.1136/bmjqs-2018-009219
17. Vincent J-L, Rubenfeld GD. Does intermediate care improve patient outcomes or reduce costs? *Crit Care*. 2015;19:89. doi:10.1186/s13054-015-0813-0
18. Ramos JGR, dos Santos GMN, Bispo MCC, et al. Unplanned transfers from intermediate care units to intensive care units: a cohort study. *Am J Crit Care*. 2021;30:397-400. doi:10.4037/ajcc2021453
19. Nates JL, Nunnally M, Kleinpell R, et al. ICU admission, discharge, and triage guidelines: a framework to enhance clinical operations, development of institutional policies, and further research. *Crit Care Med*. 2016;44:1553-1602. doi:10.1097/CCM.0000000000001856
20. Su J, Lin C-Y, Chen P-J, Lin FJ, Chen S-K, Kuo H-T. Experience with a step-down respiratory care center at a tertiary referral medical center in Taiwan. *J Crit Care*. 2006;21:156-161. doi:10.1016/j.jcrc.2005.10.004
21. Solberg BC, Dirksen CD, Nieman FH, van Merode G, Poeze M, Ramsay G. Changes in hospital costs after introducing an intermediate care unit: a comparative observational study. *Crit Care*. 2008;12:R68. doi:10.1186/cc6903
22. Eachempati SR. The effect of an intermediate care unit on the demographics and outcomes of a surgical intensive care unit population. *Arch Surg*. 2004;139:315-319. doi:10.1001/archsurg.139.3.315
23. Miranda DR, Nap R, de Rijk A, Schaufeli W, Iapichino G. Nursing activities score. *Crit Care Med*. 2003;2003(31):374-382. doi:10.1097/01.CCM.0000045567.78801.CC
24. Bruyneel A, Guerra C, Tack J, Droguet M, Maes J, Miranda DR. Traduction sémantique en français et implémentation du Nursing Activities Score en Belgique. *Méd Intensive Réa*. 2018;27:260-272. doi:10.3166/rea-2018-0029
25. Padilha KG, Stafseth S, Solms D, et al. Nursing activities score: an updated guideline for its application in the intensive care unit. *Rev Esc Enferm USP*. 2015;49:131-137. doi:10.1590/S0080-623420150000700019
26. Tack J, Bruyneel A, Bouillon Y, Taton O, Taccone F, Pirson M. Analysis of nursing staff management for a semi-intensive pulmonology unit during the COVID-19 pandemic using the nursing activities score. *Dimens Crit Care Nurs*. 2023;42(5):286-294.
27. Zimmerman JE, Wagner DP, Knaus WA, Williams JF, Kolakowski D, Draper EA. The use of risk predictions to identify candidates for intermediate care units. *Chest*. 1995;108:490-499. doi:10.1378/chest.108.2.490
28. Capuzzo M, Volta CA, Tassinati T, et al. Hospital mortality of adults admitted to intensive care units in hospitals with and without intermediate care units: a multicentre European cohort study. *Crit Care*. 2014;18:551. doi:10.1186/s13054-014-0551-8
29. Khanna AK, Labeau SO, McCartney K, Blot SI, Deschepper M. International variation in length of stay in intensive care units and the impact of patient-to-nurse ratios. *Intensive Crit Care Nurs*. 2022;72:103265.
30. De Regge M, De Pourcq K, Van de Voorde C, Van den Heede K, Gemmel P, Eeckloo K. The introduction of hospital networks in Belgium: the path from policy statements to the 2019 legislation. *Health Policy*. 2019;123:601-605.

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