Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

Nursing team sizing in a reference unit for multidrug-resistant microorganisms: a mixed-methods study

Dimensionamento da equipe de enfermagem em unidade referência para microrganismos multirresistentes: estudo de métodos mistos

Dotación del equipo de enfermería en una unidad de referencia para microorganismos multirresistentes: estudio de métodos mixtos

Júlia Nogueira Treib[I]; João Lucas Campos de Oliveira[I]; Ana Maria Müller de Magalhães[I]; Nicole Hertzog Rodrigues[I]; Jéssica Azevedo Guardalupe[I]; Eduardo Lopes Pereira[I]; Patrícia Godoy Fanton[II]

[I]Universidade Federal do Rio Grande do Sul. Porto Alegre, RS, Brazil

ABSTRACT

Objective: to analyze the workload and staff sizing of a hospital inpatient unit that is a reference for the care of patients affected by multidrug-resistant microorganisms. **Method**: a mixed-methods, explanatory and sequential study, conducted in the aforementioned unit belonging to a hospital from southern Brazil. The quantitative data from the Patient Classification System scores between January 2022 and December 2023 were analyzed by means of descriptive statistical analysis and sizing parameters recommended by the regulatory body. The qualitative data were extracted from 13 interviews with the Nursing team, analyzed thematically and connected to the previous stage. **Results**: among 3,299 patient classifications, the Semi-intensive care stratum prevailed in both years (62.5% and 63.2%). The professionals reported high complexity levels in the clientele. The number of staff nurses was insufficient, but this differed from the workers' perception. **Conclusion**: there is high Nursing workload, explained by the patient profile and shortage of professionals.
Descriptors: Nursing Staff, Hospital; Workload; Infection Control; Drug Resistance, Microbial.

RESUMO

Objetivo: analisar a carga de trabalho e o dimensionamento do pessoal de enfermagem de uma unidade de internação hospitalar referência no atendimento a pacientes acometidos por microrganismos multirresistentes. **Método**: estudo misto, explanatório sequencial, realizado na unidade referida, pertencente a hospital do sul do Brasil. Dados quantitativos oriundos dos escores do Sistema de Classificação de Paciente, de janeiro de 2022 a dezembro de 2023, analisados por análise estatística descritiva e parâmetros de dimensionamento recomendados pelo órgão regulatório. Dados qualitativos extraídos por 13 entrevistas com a equipe de enfermagem, analisadas tematicamente e conectados à etapa anterior. **Resultados**: entre 3.299 classificações de pacientes, prevaleceu o estrato cuidados semi-intensivos nos dois anos (62,5% e 63,2%). Alto nível de complexidade da clientela foi referido pelos profissionais. O quadro de enfermeiros era deficitário, mas isso divergiu da percepção dos trabalhadores. **Conclusão**: há elevada carga de trabalho da enfermagem, explicada pelo perfil de pacientes e *déficit* de profissionais.
Descritores: Recursos Humanos de Enfermagem Hospitalar; Carga de Trabalho; Controle de Infecções; Resistência Microbiana a Medicamentos.

RESUMEN

Objetivo: analizar carga laboral y dotación de personal de enfermería en unidad de internación hospitalaria de referencia en la atención de pacientes afectados por microorganismos multirresistentes. **Método**: estudio mixto, secuencial, explicativo, realizado en unidad perteneciente a un hospital del sur de Brasil. Datos cuantitativos provienen de las puntuaciones del Sistema de Clasificación de Pacientes, de enero de 2022 a diciembre de 2023, examinados mediante análisis estadístico descriptivo, de acuerdo con parámetros de dimensionamiento recomendados por el organismo regulador. Datos cualitativos se extrajeron de 13 entrevistas al equipo de enfermería, con análisis temático y conexión a la etapa anterior. **Resultados**: entre 3.299 clasificaciones de pacientes, había predominio del estrato de cuidados semi-intensivos en ambos años (62,5%/63,2%). Los profesionales reportaron alto nivel de complejidad de la clientela. Se constató que el personal de enfermería era deficitario, pero difería de la percepción de los trabajadores. **Conclusión**: se advierte una elevada carga de trabajo de enfermería, explicada por el perfil de los pacientes y escasez de profesionales.
Descriptores: Personal de Enfermería en Hospital; Carga de Trabajo; Control de Infecciones; Farmacorresistencia Microbiana.

INTRODUCTION

Multidrug-resistant microorganisms (MDRs) are defined as infectious agents that have developed resistance to at least three classes of antimicrobials, leading to a clinical condition that hinders stopping infections. The World Health Organization (WHO) predicts that, without changes especially related to inadvertent use of therapies, antimicrobial resistance might result in 100 million deaths annually by 2050[1].

Corresponding author: Júlia Nogueira Treib. E-mail: julia.n.treib@gmail.com
Editor in Chief: Cristiane Helena Gallasch; Associate Editor: Magda Guimarães de Araujo Faria

Received: Oct 8th 2024 – Accepted: Mar 13th 2025

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

In Brazil and at the different health care levels, measures are provided for controlling these pathogens, such as the National Contingency Plan for Infections caused by MDRs in Health Services[2] and the Manual for the Prevention of Infections by MDRs in Health Services, which define Standard Precaution and Specific Precaution measures[1]. The Standard Precautions consist in a set of general indications for safe assistance, while the Specific Precautions are those targeted at contact with MDRs, such as the following: using individualized aprons, equipment care/hygiene, specific guidelines for patients and family members, periodic cleaning and disinfection of environments, using specific masks according to transmission routes, private rooms and glove use[1].

Adherence to precautionary measures and, consequently, MDR spread control, depends on health workers' individual and collective behaviors, but also on availability of resources in sufficient quantity and quality[3]. In this care context, there is an increase in the work demand for Nursing teams since, in addition to the need to perform routine assistance roles, specific measures are expected in the care of these patients, such as high volume of antimicrobial medications (which require even greater rigor in terms of time control) even more frequent and/or differentiated cleaning of the environment and transmission control measures, among others. Increased demand for health education aimed at family members/companions is also identified[4,5].

In addition to the higher care complexity level for patients with MDRs, certain gowning time is required for each contact, as well as increased precautions with hand hygiene and recurrent audits regarding adherence to prevention and control measures. These factors increase the professionals' workload, promote the professionals' psychosocial stress and may be one of the factors for high absenteeism rates[6]. Nursing Workload (NWL) can be defined as the sum of the physical and cognitive effort burdens and time spent on providing direct and indirect care[7]. It is a complex and multifactorial construct that directly affects Nursing workers' health and their quality of life at work, even in the MDR care setting[4,6].

Going beyond the consequences for Nursing workers, it is known that high NWL results in diminished assistance quality, exerting direct and unfavorable impacts on the clients' outcomes, such as mortality related to adverse events, development of pressure injuries and contracting in-hospital infections[8]. This warrants the need to rationalize NWL. Thus, it is known that through Nursing Staff Sizing (NSS), it is possible to manage the workload because it enables predicting the number of professionals by category (nursing technicians and nurses) according to the care demand of the context sized[9]. In Brazil, the Federal Nursing Council (*Conselho Federal de Enfermagem*, COFEN) revoked Resolution No. 543/2017[10] and issued Normative opinion No. 01/2024, which presents the parameters for nurses to plan the Nursing workforce[11].

Based on the scenario presented, it is clear that units that treat MDR cases have a peculiar work approach, requiring mapped work processes to safely assist clients already affected by potentially complicated health problems[5]. Proper functioning of these processes depends on the Nursing human capital. Thus, the current study was based on the following questions: Which is the measured and perceived Nursing workload in a clinical inpatient unit that is a reference in multidrug-resistant microorganisms? Is the projected/sized staffing structure compatible with the actual/available one?

In order to answer these questions, the objective was to analyze the Nursing staff workload and sizing in a hospital inpatient unit that is a reference in the care of patients affected by multi-drug resistant microorganisms.

METHOD

A mixed-methods study outlined in the sequential explanatory strategy. This type of study is developed in two different but connected stages. Through a retrospective study and of the preliminary documentary source type in a quantitative approach (QUAN), the data with the most weight in the research were collected and analyzed. Subsequently, the study continued with the qualitative data (qual) collection, guided by the first QUAN stage. Thus, the study can be expressed by the weight-sequentiality relationship: QUAN → qual[12].

The research was developed in the clinical inpatient unit of a high-complexity university hospital, an institutional reference in the care of patients affected by MDRs. The unit has 34 beds and belongs to an extra-large public hospital institution (>500 beds) located in southern Brazil.

In the quantitative stage, the inclusion criteria corresponded to records of the care dependence level of patients hospitalized for at least 24 hours at the chosen unit between January 2022 and December 2023. Patients hospitalized during the period assessed and who not classified at least once were not included, being considered

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

losses (missing data) with no measurement control. The research was census-based, covering all patient classifications recorded in the time frame defined.

The QUAN data collection process was performed using a report generated from the BASE® (Business Analytics Strategic Intelligence) institutional system, extracting the following variables: unit occupancy rate; number of evaluations in each degree/stratum of the Perroca[13] scale and overall total (sum of the classifications, by Scale stratum); number of days the scale was applied; and mean and rate of beds classified in each degree of the Perroca[13] scale.

As one of the Patient Classification Systems (PCS) recommended by COFEN[11], the Perroca scale[13] consists of nine indicators/areas: Care process planning and coordination; Investigation and monitoring; Body care and eliminations; Caring for skin and mucous membranes; Nutrition and hydration; Movement and activity; Therapy; Emotional support; and Health education. Based on the score, which ranges from 9 to 36 points, each patient can be classified as follows: Minimal care (9-12 points), Intermediate care (13-18 points), Semi-intensive care (19-24 points) or Intensive care (25-36 points)[13].

A descriptive statistical analysis was performed in the QUAN stage, with data processing in a *Microsoft Office Excel*® spreadsheet. The PCS strata were analyzed by means of absolute and relative frequencies. Subsequently, the current parameters (2024)[11] set forth by the professional association were applied to obtain the NSS value. The Technical Safety Index (TSI) and the weekly working hours used were 15% and 36 hours, respectively[11]. Although the study uses data from 2022 and 2023, the data analysis took place in the following year. Furthermore, choice to use the 2024 standardization is justified by the need to align the study results with the most recent and applicable guidelines for the current reality of the professional Nursing practice in Brazil.

The nursing staff working in the unit (available/actual personnel) was provided by the institution's People Management department for a subsequent comparative analysis with the expected staff structure, based on the NSS calculation and on parameters indicated by COFEN[11].

In the qualitative stage, the inclusion criteria encompassed nurses and nursing technicians that had worked in the unit for more than six months. Professionals that were on leave or vacation during the data collection period were excluded. The number of participants in the second stage (qualitative) was determined based on the data saturation criterion, that is, inclusion of new participants was interrupted when the information collected began to repeat itself without adding new elements to understanding of the phenomenon under study. The initial selection of participants followed convenience criteria, considering the professionals' relevance and availability for the research. This approach aimed at ensuring depth of the qualitative analysis and its complementarity with the previous quantitative data carrying more weight[12].

The qualitative data collection procedure was carried out from January to February 2024 through in-person, individual and semi-structured interviews at the inpatient unit premises and in a private location. Construction of the collection instrument (semi-structured interview script) was guided by the data from the QUAN stage. The interviews were recorded and subsequently transcribed and subjected to thematic content analysis, according to Bardin's framework[14]. The three stages were respected, namely: Pre-analysis; Exploration of the material; and Treatment of the results, inference and interpretation. The first stage (Pre-analysis) took place with systematization of the initial ideas, in order to develop a logical scheme to follow the analysis. In the second stage, the material was explored focusing on coding, as per the systematization from the first phase. It is to be noted that this coding had already been predetermined by the quantitative results, as governed by the research design[12]. In the third and final stage, the results were processed and interpreted, enabling inferences based on the qualitative findings combined with the previous measurements and/or through immersion of new discoveries.

The QUAN→qual data integration was performed through the data linkage mechanism[12]. This means that the quantitative data analyzed were directly used for the subsequent qualitative data collection procedure; in other words, the qualitative data had already been induced to an interpretation of the previous measurements. To illustrate data integration, the “Joint display” strategy was used to present the results and prepare the meta-inferences. A “Joint display” consists of a graphical representation for data integration and synthesis in mixed-methods research, thus increasing rigor of the study[15].

The interview excerpts were coded with the initial letter “N” for the reports by higher-level professionals and with “NT” for those with mid-level training. No data that could identify the subjects was analyzed in the QUAN stage. The study was approved by the Research Ethics Committee of the institution where the study was conducted. An Informed Consent Form was provided to the participants in the QUAL stage, as well as a social-work characterization form to survey the study sample profile.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

RESULTS

A total of 3,299 patient classifications were compiled, presented in Table 1.

Table 1: Dependence level on Nursing care in the inpatient unit, by Patient Classification System (PCS) stratum. 2022-2023. Occupancy rate in parentheses (n=3,299). Porto Alegre, RS, Brazil, 2023.

Dependence level on Nursing care	2022						2023						Entire period (87.9%)	
	1st sem. (88.8%)		2nd sem. (85.9%)		Year (87.4%)		1st sem. (87.3%)		2nd sem. (89.4%)		Year (88.4%)			
	n	f(%)	n	f(%)	n	f(%)	n	f(%)	n	f(%)	n	f(%)	n	f(%)
Minimal care	3	0.4	5	0.7	8	0.5	4	0.5	14	1.6	18	1.0	26	0.8
Intermediate care	93	11.0	110	14.0	203	13.0	99	12.0	178	20.4	277	16.3	480	14.5
Semi-intensive care	531	64.0	467	61.0	998	62.5	539	64.5	540	62.0	1,079	63.2	2,077	63.0
Intensive care	203	25.0	182	24.0	385	24.0	191	23.0	140	16.0	331	19.5	716	21.7
Total	830	100.0	764	100.0	1,594	100.0	833	100.0	872	100.0	1.705	100.0	3,299	100.0

The unit occupancy rate over the entire two-year period was 87.9%, ranging from 85.9% to 89.4%. Regardless of the semester or year under analysis, there was predominance of patients classified as Semi-intensive care. Tables 2 and 3 present data related to the mean daily number of patients and Nursing work hours.

Table 2: Mean daily number of patients and Nursing hours required per day in the unit, according to the 2024 NSS parameter, by semester and in 2022. Porto Alegre, RS, Brazil, 2023.

Dependence level on Nursing care	1st semester		2nd semester		Full year (2022)	
	Mean	NH/day	Mean	NH/day	Mean	NH/day
Minimal care	0.09	0.31	0.16	0.56	0.12	0.42
Intermediate care	3	15.8	3.5	18.4	3.2	16.8
Semi-intensive care	17.1	150.3	15	131.8	16	140.6
Intensive care	6.5	102.8	5.8	91.7	6.2	98
Total	26.69	269.21	24.46	242.46	25.52	255.82

Note: NH/day = Nursing hours/day calculated based on COFEN's 2024 parameters[11].

Table 3: Mean daily number of patients and Nursing hours required per day in the unit, according to the 2024 NSS parameter, by semester and in 2023. Porto Alegre, RS, Brazil, 2023.

Dependence level on Nursing care	1st semester		2nd semester		Full year (2023)	
	Mean	NH/day	Mean	Mean	NH/day	Mean
Minimal care	0.12	0.42	0.34	1.19	0.24	0.84
Intermediate care	3	15.8	4.3	22.6	3.7	19.5
Semi-intensive care	16.3	143.2	13.1	115.1	14.5	127.4
Intensive care	5.7	90.1	3.4	53.7	4.4	69.6
Total	25.12	249.52	21.14	192.59	22.84	217.34

Note: NH/day = Nursing hours/day calculated based on COFEN's 2024 parameters[11].

Both in the first and second semesters of 2022, the PCS was applied on 31 days, totaling 62 observation days in that year. In 2023, the PCS was applied more days (n=74), divided between the first (n=33) and second (n=41) semesters, a difference that was due to the work dynamics of the unit itself. Overall, 2022 demanded more Nursing work hours than 2023. The comparison of the unit's Staffing Structure (*SS*) (Table 4) shows that the number of higher-level professionals was insufficient.

Table 4: Comparison between the Nursing staffing structure sized using 2024 parameters and the actual/available one in the inpatient unit. Porto Alegre, RS, Brazil, 2023.

Nursing Staff Sizing (NSS)		Nurses		Nursing Technicians		Nursing Staff	
		NSS Calculation	Actual SS	NSS Calculation	Actual SS	NSS Calculation	Actual SS
2022	1st sem.	25	12	35	41	60	53
	2nd sem.	23	12	31	41	54	53
	Full year	24	12	33	41	57	53
2023	1st sem.	24	12	32	38	56	50
	2nd sem.	18	12	25	38	43	50
	Full year	21	12	28	38	49	50

Note: NSS = Nursing Staff Sizing. SS = Staffing Structure.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

The most unfavorable scenario was detected in the first half of 2022 (-52%) and the least unfavorable one in the second half of 2023 (-33.3%). Regarding the SS of mid-level professionals, it was in surplus quantity. The largest discrepancy was found in the second half of 2023, when there was a 52% surplus in the SS, and the smallest one was recorded in the first half of the same year, with a 17.1% surplus.

There was greater adherence to applying the PCS proposed in the first semesters of 2022 and 2023 (94.9% and 94%, respectively). The lowest adherence was in the 2nd semester of 2022 (89.8%). The overall adherence rate to the PCS was 92.3% and, overall, there was a slight reduction in adherence from 2022 to 2023 (92.3% to 92.2%), representing a 0.2% decrease.

The qualitative stage sample consisted of 13 professionals, equally distributed between mid-level workers (n=7) and nurses (n=6). Their mean time in the profession was 17.5 years (range: 7-34), their mean time working in the study institution was 10.2 years (range: 3-33) and their mean time working in the unit was 7.9 years (range: 1.7-33). Of the total, 46.2% of the professionals had been working in the unit since having joined the hospital.

All nurses interviewed had some additional training: four with *lato-sensu* training and two *stricto-sensu*. Most of the workers (84.6%) were female. Their mean age was 43.1 years old (range: 31-58). In relation to work shift, 46.2% worked at night (n=6), 38.5% in the afternoon (n=5) and 15.4% in the morning (n=2). As for experience in applying the PCS, it was found that the nurses had a mean of 7.8 years (range: 1.7-10).

Two main categories emerged from the thematic analysis: Unit profile and Nursing workload (NWL); and Nursing Staffing Structure (SS) and care provided. The thematic categories consist of their meanings nuclei, which in turn were articulated to the quantitative data in Joint display model presentations named as A, with meanings nuclei 1, 2 and 3 (Figures 1, 2 and 3), and B (Figures 4, 5 and 6).

<table>
<tr><td colspan="3" rowspan="2">Quantitative results (QUAN)</td><td colspan="2">Qualitative results (qual)</td><td rowspan="4">Meta-inferences</td></tr>
<tr><td>Nurses</td><td>Nursing Technicians</td></tr>
<tr><td colspan="3">Category 1 - Unit profile and Nursing workload</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="3">Meaning nucleus 1 - Complexity level and clinical profile of the clientele</td></tr>
<tr><td colspan="3">Prevalence of patients classified in the Semi-intensive care stratum, based on the Perroca scale scores</td><td colspan="2" rowspan="2">[...] the staff up there, in the administrative area, only saw the quantity, right? [...] But they didn't see their complexity, right? where the demand for assistance is very high [...] (N3)
[...] it's a unit that receives patients 60% from intensive care [...] (N4)
[...] As a rule, MDR [multidrug-resistant] patients have longer hospitalizations, with comorbidities coming up [...] (N6)
[...] they're patients in the ICU and after they stabilize, after being extubated for a while, stabilized, they come to us [...] (NT10)
[...] we're an intermediate ICU, because our workload is 10 hours, if you go there and do the math, it will be 10 hours at the bedside with the patients [...] (NT11)</td><td rowspan="2">Data convergence

Nursing workers assert that the care dependence level is high, which is confirmed by the data from the patient classification system.</td></tr>
<tr><td>62.5%
(2022)</td><td>63.2%
(2023)</td><td>63.0%
(Overall)</td></tr>
</table>

Figure 1: Joint display "A" (Meaning nucleus 1) showing the integrated quantitative and qualitative results on workload measured and perceived by Nursing team professionals in a reference unit for the care of patients affected by multidrug-resistant microorganisms. Porto Alegre, RS, Brazil, 2023.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

<table>
<tr><td colspan="3" rowspan="2">Quantitative results (QUAN)</td><td colspan="2">Qualitative results(qual)</td><td rowspan="3">Meta-inferences</td></tr>
<tr><td>Nurses</td><td>Nursing Technicians</td></tr>
<tr><td colspan="5">Category 1 - Unit profile and Nursing workload</td></tr>
<tr><td colspan="5">Meaning nucleus 2 - Work demand of the unit for the Nursing team</td><td></td></tr>
<tr><td colspan="3">Total nursing hours in the Unit</td><td colspan="2" rowspan="2">[...] apart from all that gowning we have to wear to enter each room, and also, with each patient, we have to do all that hygiene stuff. So, whether we like it or not, this also requires time from us [...] (N3)
[...] even more so because they're super-resistant bacteria, they [family members] don't understand what that is, why they went there. So, it's nurses that have to explain [...] I get about 3 or 4 accesses per night, difficult ones, which takes a lot of time [to puncture], imagine everything doing the strongest antibiotic there is, so there's no vein [...] (N2)
[...] clostridium patients in a 6-hour shift, 8 to 10 times, so we have to change diapers [...] There was a shift when one of my peers changed a patient's diaper 13 times. [...] there are patients that sometimes take up to an hour to do, right?, full care of bathing them, doing the dressing, right? (NT10)
[...] you have to be careful with the medication [...] there are 5, 6 patients, there are 4, 5 antibiotics for each patient [...] (NT13)
[...] today I have 3 transfers to hemodialysis and there's no one, so I have to do everything in a rush and paying attention [...] (NT14)</td><td rowspan="2">Data convergence

There is high work demand for the Nursing team, and this appears to be also related to the care specificity required for patients with multi-drug resistant microorganisms.</td></tr>
<tr><td>255.8 (2022)</td><td>217.3 (2023)</td><td>255.8 (2022)</td></tr>
</table>

Figure 2: Joint display "A" (Meaning nucleus 2) showing the integrated quantitative and qualitative results on workload measured and perceived by Nursing team professionals in a reference unit for the care of patients affected by mutidrug-resistant microorganisms. Porto Alegre, RS, Brazil, 2023.

<table>
<tr><td rowspan="2">Quantitative results (QUAN)</td><td colspan="2">Qualitative results (qual)</td><td rowspan="3">Independent inference</td></tr>
<tr><td>Nurses</td><td>Nursing Technicians</td></tr>
<tr><td colspan="3">Category 1 - Unit profile and Nursing workload</td></tr>
<tr><td colspan="3">Meaning nucleus 3 - Repercussions of the work activity on workers' health</td><td></td></tr>
<tr><td>Missing quantitative data - qualitative immersion</td><td colspan="2">[...] sleep problems also because they do a lot of extra work, they overload themselves a lot [...] they'd even need direct psychological support, many patients die [...] (N2)
[...] they're professionals who are always on the edge, they're always on a fine line on the brink of exhaustion, a lot of emotional fatigue, due to work overload, to the demands (N4)
[...] all these things gradually contribute to a feeling that we can't handle things. Or we can handle them at the expense of our physical and mental health, you know? (N6)
[...] stress from working in an environment with so much technical tension, having to pay extra attention to these medications and extra attention to your most critical patients [...] (N7)
[...] I think there's too few people for the work amount involved and the type of patients [...] (NT9)
[...] Many times I feel kind of bad, in pain, and I don't go to the doctor so as not to leave my peer alone there. So I sometimes end up whining in pain, but I go (laughs) (NT10)
[...] I see that a lot of people are getting sick, a lot of work leaves, people are getting sick, a lot of back problems [...] (NT13)</td><td>The professionals reported negative effects of high NWL on their health.</td></tr>
</table>

Figure 3: Joint display "A" (Meaning nucleus 3) showing the integrated quantitative and qualitative results on workload measured and perceived by Nursing team professionals in a reference unit for the care of patients affected by multidrug-resistant microorganisms. Porto Alegre, RS, Brazil, 2023.

DOI: https://doi.org/10.12957/reuerj.2025.87665

The second thematic category, which deals with the Nursing staffing structure in the unit, is illustrated below.

<table>
<tr><td colspan="3" rowspan="2">Quantitative results (QUAN)</td><td colspan="2">Qualitative results (qual)</td><td rowspan="4">Meta-inferences</td></tr>
<tr><td>Nurses</td><td>Nursing Technicians</td></tr>
<tr><td colspan="3">Category 2 - Nursing staff and care provided</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="3">Meaning nucleus 1 - Nursing staff</td></tr>
<tr><td>Year</td><td>NSS Calculation</td><td>Actual SS</td><td colspan="2" rowspan="4">[...] Nurses are OK, but I believe it's still not enough to provide differential treatment. (N1)
[...] Nurses, I think it's okay [...] there are nurses who'll say that they need more [...] I worked in a hospital before and I had three units, so it's easy for me. (N2)
[...] Currently, I think that the vacancies for nurses are well distributed like this [...] I feel like I'm in paradise now, considering what I've been through. (N3)
[...] I think that it's good in terms of nurses. (NT9)
[...] I think that nurses during the week [...] are okay [...] (NT10)
[...] I've noticed that the Nursing staff has improved [...] (NT11)
[...] It's suitable here, it always has two as a rule. (NT13)</td><td rowspan="4">Data divergence

The SS of active higher education professionals is insufficient.</td></tr>
<tr><td>2022</td><td>24</td><td>12</td></tr>
<tr><td>2023</td><td>21</td><td>12</td></tr>
</table>

Figure 4: Joint display "B" (Meaning nucleus 1) showing the integrated quantitative and qualitative results on workload measured and perceived by Nursing team professionals in a reference unit for the care of patients affected by multidrug-resistant microorganisms. Porto Alegre, RS, Brazil, 2023.

<table>
<tr><td colspan="3" rowspan="2">Quantitative results (QUAN)</td><td colspan="2">Qualitative results (qual)</td><td rowspan="4">Meta-inferences</td></tr>
<tr><td>Nurses</td><td>Nursing Technicians</td></tr>
<tr><td colspan="3">Category 2 - Nursing staffing structure and care provided</td><td colspan="2" rowspan="2"></td></tr>
<tr><td colspan="3">Meaning nucleus 2 - Mid-level Nursing staffing structure</td></tr>
<tr><td>Year</td><td>NSS Calculation</td><td>Actual SS</td><td colspan="2" rowspan="4">[...] I'd prefer having more technicians to provide better care, more responsible care [...] (N1)
[...] I think there's still not enough technical skills. (N2)
[...] So, I believe that there aren't enough technicians. (N8)
[...] we always thought that we should be more people, more technicians. (NT10)
[...] I think that if there was one more technician [per shift] there'd have to be one more person to help us with this demand for [vital] signs and transfers [...] (NT12)</td><td rowspan="4">Data divergence

The SS of active mid-level professionals is higher than expected, while the reports unanimously indicated insufficient SS.</td></tr>
<tr><td>2022</td><td>33</td><td>41</td></tr>
<tr><td>2023</td><td>28</td><td>38</td></tr>
</table>

Figure 5: Joint display "B" (Meaning nucleus 2) showing the integrated quantitative and qualitative results on workload measured and perceived by Nursing team professionals in a reference unit for the care of patients affected by multidrug-resistant microorganisms. Porto Alegre, RS, Brazil, 2023.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

Quantitative results (QUAN)		**Qualitative results (qual)**		**Meta-inferences**
		Nurses	Nursing Technicians	
Category 2 - Nursing staffing structure and car provided				
Meaning nucleus 3 - Scenario corresponding to the Nursing staffing structure and the care provided				
Higher Level SS				**Data convergence**
-50.0% (2022)	Deficit	[...] *many times you can't manage to do everything you'd like to do [...] because inures' work could be quite improved with 3 nurses [...] We can stay at the bedside more, I think we should do it but, with two* [nurses], *I think it's more difficult.* (N1) [...] *our staff that's still not enough, to truly meet, the needs [...] Mainly of these patients, right?, who come from intensive care, at least in the first 72 hours*. (N4) ...] *we'd sure like to offer a 100% job and sometimes with the rush we can only offer less than that, and we get upset [...] How many times you'd like to handle some thing, and you can't manage because, anyway, you're busy doing something else [...] a feeling that you just can't handle things. Or you do handle, but at the expense of your physical and mental health, you know?* (N6)		The scenario is marked by insufficient SS of higher level professionals, the reports point to a reduction in the quality of the service offered.
-42.9% (2023)				
Mid-Level SS				**Data divergence**
24.2% (2022)	Surplus	[...] *I think there's too few people for the work amount involved and the type of patients* [...] (NT9) [...] *many times I [nursing technician] don't have the necessary time, right? [...] to lift a patient out of bed, to bathe a patient, I've used our physical strength [...] there's so much demand, so much to do that I sometimes end up not using the equipment to protect myself [...] there are times when I don't stop to have a snack, to go to the bathroom* [...] (NT10) [...] *during the pandemic, there were six technicians at night, so our rates were much lower [...] we had no risk of falls during the pandemic [...] we were always doing the night rounds, we were more present at the bedside [...] of patients having their accesses pulled out, right?, accesses, nasogastric tubes too, it was much lower [...] and then after the pandemic ended we went back to having five* [nursing technicians per day shift]. *We have risk of falls, when you see a patient on the floor*. (NT11) [...] *you don't always manage to do your best for that patient or all your patients, then that ends up being frustrating [...] I go prioritizing, not failing to do anything, but prioritizing [...] not enough people to be able to provide a good quality service to the patients , not that we don't do so, but the same patient sometimes wants to talk and we can't [...] Due to lack of staff, I have to ask for help to some family member* (NT14)		The scenario is marked by surplus of mid-level professionals. However, the reports point out that there is little time to carry out assistance activities targeted at these workers, with impacts on service quality and risk of physical and emotional harms to the professionals.
35.7% (2023)				

Figure 6: Joint display "B" (Meaning nucleus 3) showing the integrated quantitative and qualitative results on workload measured and perceived by Nursing team professionals in a reference unit for the care of patients affected by multidrug-resistant microorganisms. Porto Alegre, RS, Brazil, 2023.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

DISCUSSION

During the period evaluated, the overall PCS adherence rate was 92.3%, a figure that can be interpreted as satisfactory, as a study conducted in Mato Grosso reported a lower adherence rate to management tools that involve care quality[16]. Staffing in Nursing is listed as one of nurses' main management actions[9], and PCS adherence is essential to support such action in the hospital context.

The data showed a downward trend both in Total Nursing Hours (TNHs) and in the mean daily number of patients. This finding may be associated with the lingering effects of the COVID-19 pandemic, a scenario in which the teams were significantly exhausted due to increased workload, resulting in high *Burnout* rates in Nursing teams[17]. Although the researched unit was an institutional reference for treating this condition, it is noted that there is diverse evidence that this scenario was already present before the teams, and that it was subsequently intensified[18].

Diverse evidence points to higher risks for patients and Nursing teams when there is work overload[8,18], commonly linked to deficits in team composition. In this study, overload can be mainly explained by the prevalence of patients classified as Semi-intensive care, understood as those with unstable vital functions, recoverable and without imminent risk of death, but requiring permanent and specialized nursing and medical assistance[11].

The literature has indicated a chronicity epidemiological profile and, consequently, clinical severity in the population that arrives at hospitals[19]. In turn, this requires the health care network to effectively allocate complex patients to hospital centers, as is the case in the field of this study. Given this scenario, it is important that Nursing managers are prepared to negotiate improvements in workforce composition, distribution and training.

As pointed out by the professionals, there is a relationship between high work demand and the care profile for patients affected by MDR, in line with the literature[6]. A study conducted in New York also showed a scenario marked by overload, with “Additional isolation precautions that delay patient care” and “Educating patients and family members about precautions against outbreaks and exposure” as the items that most increased work demand[4]. In Australia, the influence of the nurse-patient ratio on in-hospital infection control was observed[20], again reflecting the impacts of NWL. A study conducted in Iran assessed nurses' intention to work in the assistance to be provided to patients affected by infectious diseases, which involved job satisfaction, professional ethics, individual values and financial support or not, as well as fears regarding their exposure at work[21].

This study found that 46.2% of the professionals had been working in the unit since having joined the institution, which can be considered a high retention rate. Related to this phenomenon, we have turnover of Nursing professionals (a reality in Brazil[22]), with direct impacts on care quality indicators and additional costs for the institutions[23,24]. Although it is a multifactorial event, one of the predictors of turnover in Nursing is increased workload. A survey[23] conducted with 2,670 Nursing managers from 232 hospitals in Japan indicated that aspects such as number of Nursing staff members on shifts, number of patients assigned per Nursing worker and overtime work are among the most impactful factors on turnover in the profession.

It was verified that the unit has NWL specificities unrelated to the number of patients treated. In other words, overload was not exclusively and directly related to the unit's occupancy rate (even if it can be considered low, taking into account other SUS clinical hospitalization units[9.25]) but rather to the clientele complexity level. This finding reinforces the importance of the PCS as evidence, as it points out and quantifies the NWL, generating direct reflections on the SS sized[9.13].

A deficit in the higher-level team and a surplus in the mid-level one were identified. This trend in the SS categorical composition has already been identified in different Brazilian hospital care contexts, such as in clinical, surgical and pediatric inpatient units[25]. Internationally, the proportion of Registered Nurses is also lower than that of nurses, as shown in a North American research study that measured the proportion of nurses with higher academic degrees (Bachelor's) in the total of Nursing teams. The overall percentage for this indicator varied from 41% to 56% among the 519 hospitals investigated[26], values that are higher than the proportion of nurses found in the so-called “actual” staffing structures of this study, which remained around 23%.

Regarding the teams' perception, this relationship was inversely proportional when analyzing the actual SS. It is understood that this finding points to the actual role *versus* the “expected” performance of each professional level, which should take place differently, as there is a designation of the competences expected from each. COFEN Resolution No. 736 of 2024[27] is to mentioned here, which establishes each professional's performance in the Nursing Process. The referred standard meets the Professional Practice Law, treating the Nursing Diagnosis and

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

Nursing Prescription activities as exclusive to nurses[28], in this case synthetically understood as care planning activities, that is, care management. Although the normative proposal is legitimate, based on the results of this study, it is understood that this may be a contributing factor for professionals not legitimizing the deficit of nurses in the SS sized, as workers infer that the personnel insufficiency is noticed in the care execution activities, not in the planning ones.

Modeling the unit's SS on the sizing proposed by COFEN would probably not meet the needs identified by the team, as the overload was delegated to the mid-level team due to activities delegated. In other words, it is evident that workers do not recognize that direct care for patients (mostly highly dependent on care) could or should be provided by nurses, as they fail to identify the need for support in staffing in this category. This contradiction indicates the richness of the inferences made possible by mixed-methods research, and is a contribution of this study.

Although the study participants, including nurses, point out that the deficit in the number of professionals is concentrated in the technical team, this perception is contrary to what is assumed in the Brazilian staffing standardization and in the Law on Professional Practice itself assume[28]. Robust scientific data demonstrate that hospitals with better proportions of more qualified nurses on their teams can be associated with more positive (lower) results in mortality, readmission and hospitalization time[26].

The literature points to a trend contrary to that is suggested by the professionals in this research, as it discusses specialization of the care provided by nurses in different care contexts, and not their incorporation as members of mid-level teams[29,30,31]. Despite this, it is noted that reformulating work processes demands institutional actions that not only involve balancing workload, but also reviewing the culture and individual and collective organizational values regarding the performance expected from each Nursing team member[32].

This study showed reports of dissatisfaction among Nursing staff members with the care provided, related to high NWL, even in the mid-level professional stratum, which presented adequate or surplus SS in the two years evaluated, potentially explained by these professionals' leading role in performing care tasks. It is known that inadequate working conditions, overload and emotional exhaustion are some of the main reasons for job dissatisfaction and drivers of staff turnover[21,24,33].

Study limitations

The authors chose not to return the transcribed and analyzed content of the interviews to the Nursing professionals. Linked to showing the staff sizing previous quantitative data to the workers, this action might have provided more in-depth explanations of the phenomenon, especially due to divergence in the observation (quantitative *versus* qualitative) of the nursing staff deficit. Despite this, the data richness from this research, including important convergences and divergences, confirms its contribution to the Nursing science and practice. The study provides evidence to support improvements in the qualitative composition of Nursing teams in MDR care units, in addition to corroborating reflections on nurses' performance in high-complexity care sectors.

CONCLUSION

This study made it possible to assess (through the PCS scores) and understand (from the participants' reports) that the target unit demanded high NWL, influenced by its specificity, client profile and care demands. Nursing staff shortage was observed, concentrated in higher-level professionals; in turn, there was a slight surplus at the mid-level. However, the team perceived this scenario in the opposite way, that is, they indicated insufficient mid-level staff and an adequate number of nurses. This suggests misalignment between the roles expected from each professional category and availability of resources to perform these functions.

These findings have important repercussions both for the professional practice and for care quality, highlighting the need to review the criteria for sizing and distributing Nursing teams in order to balance workload and optimize the care provided. In addition, the study contributes to advancing scientific knowledge by deepening understanding of the teams' distribution in the work dynamics and its interface with patient safety, reinforcing the importance of management strategies based on concrete data to qualify decision-making in high-complexity units.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

REFERENCES

1. Agência Nacional de Vigilância Sanitária (Br). Prevenção de infecções por microrganismos multirresistentes em serviços de saúde – Série Segurança do Paciente e Qualidade em Serviços de Saúde/Agência Nacional de Vigilância Sanitária. Brasília: Anvisa; 2021 [cited 2024 Jul 18]. Available from: https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/publicacoes/manual-prevencao-de-multirresistentes7.pdf.
2. Agência Nacional de Vigilância Sanitária (Br). Plano de Contingência Nacional para Infecções causadas por Microrganismos Multirresistentes em Serviços de Saúde – PLACON-RM. Brasília: Anvisa; 2021 [cited 2024 Jul 18]. Available from: https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/publicacoes/placon-nacional-mr-09-11-2021.pdf.
3. Castro AF, Rodrigues MCS. Audit of standardized precautionary and contact practices in the Intensive Care Unit. Rev esc enferm USP. 2019 [cited 2024 Jul 18]; 53:e03508. DOI: http://doi.org/10.1590/S1980-220X2018018603508.
4. Hessels AJ, Kelly AM, Chen L, Cohen B, Zachariah P, Larson EL. Impact of infectious exposures and outbreaks on nurse and infection preventionist workload. Am J Infect Control. 2019 [cited 2024 Jul 18]; 47(6):623-7. DOI: https://doi.org/10.1016/j.ajic.2019.02.007.
5. Macedo ABT, Junges M, Mello DB, Lovatto CG, Souza SBC. Multidrug-resistant germs carriers unit: elaboration of a patients care protocol. Rev. Enferm. Atual In Derme. 2019 [cited 2024 Jul 18]; 83(21):61-83. Available from: https://revistaenfermagematual.com.br/index.php/revista/article/view/286.
6. Macedo ABT, Antoniolli L, Dornelles TM, Hansel LA, Tavares JP, Souza SBC. Psychosocial stress and resilience: a study in nursing professionals. Rev. Enferm. UFSM. 2020 [cited 2025 Feb 26]; 10(25):e25. DOI: https://doi.org/10.5902/2179769235174.
7. Souza P, Cucolo DF, Perroca MG. Nursing workload: influence of indirect care interventions. Rev Esc Enferm USP. 2019 [cited 2024 Jul 18]; 53:e03440. DOI: https://doi.org/10.1590/S1980-220X2018006503440.
8. Barbosa IE, Fonseca AR, Andrade EN, Maklouf DC, Ribeiro MC, Rodrigues AJ, et al. Patient safety: main adverse events in the Intensive Therapy Unit. Rev. Eletrônica Acervo Saúde. 2021 [cited 2024 Sep 10]; 13(2):e6454. DOI: https://doi.org/10.25248/reas.e6454.2021.
9. Guardalupe JA, Brum ID, Canto DF, Telles KCM, Magalhães AMM, Oliveira JLC. Comparison of patient classification systems for dimensioning nursing staff. Rev Esc Enferm USP. 2023 [cited 2024 Jul 18] 28; 57:e20230047. DOI: https://doi.org/10.1590/1980-220X-REEUSP-2023-0047pt.
10. Conselho Federal de Enfermagem. Resolução COFEN 543/2017. Brasília: Conselho federal de enfermagem; 2017 [cited 2025 Feb 26]. Available from: https://www.cofen.gov.br/wp-content/uploads/2017/05/RESOLU%C3%87%C3%83O-COFEN-N%C2%BA-543-2017-completa.pdf.
11. Cofen. Parecer Normativo Nº 1/2024/COFEN. Brasília: Conselho Federal de Enfermagem; 2024 [cited 2025 Feb 26]. Available from: https://www.cofen.gov.br/wp-content/uploads/2024/03/Parecer-Normativo-1-2024.pdf.
12. Creswell JW, Creswell JD. Projeto de pesquisa métodos qualitativo, quantitativo e misto. 5ª ed. Porto Alegre: Penso; 2021.
13. Perroca, MG. The new version of a patient classification instrument: assessment of psychometric properties. J. Adv. Nurs. 2013 [cited 2025 Feb 26]; 69(8):1862-8. 2013 [cited 2024 Jul 18]. DOI: https://doi.org/10.1111/jan.12038.
14. Bardin, L. Análise de conteúdo. São Paulo: Edições; 2016.
15. Younas A, Pedersen M, Durante A. Characteristics of joint displays illustrating data integration in mixed-methods nursing studies. J Adv Nurs. 2020 [cited 2024 Jul 18]; 76(2):676-86. DOI: https://doi.org/10.1111/jan.14264.
16. Lima SBO, Oliveira JLC, Silva RB, Rosa JS, Ribeiro MRR. Quality tools applied to the emergency car checking: mixed methods research. Esc Anna Nery. 2021 [cited 2024 Jul 18]; 25(2):e20200274. DOI: https://doi.org/10.1590/2177-9465-EAN-2020-0274.
17. Silva LS, Passos HR, Oliveira JV, Amaral GG. Contextos de salud y trabajo de profesionales de enfermería en tiempos de pandemia por COVID-19. Enferm. Actual Costa Rica. 2023 [cited 2024 Jul 18]; (44):1-14. DOI: https://doi.org/10.15517/enferm.actual.cr.i44.49421.
18. Fernandes MA, Rocha DM, Ribeiro HKP, Sousa CCM. Riscos ocupacionais e intervenções que promovem segurança para a equipe de enfermagem oncológica. Rev bras saúde ocup. 2021 [cited 2024 Jul 18]; 46:e15. DOI: https://doi.org/10.1590/2317-6369000000319.
19. Andrade AO, Jesus SR, Mistro S. Hospitalizations in Brazil according to national health survey estimates, 2013 and 2019. Rev Saude Publica. 2023 [cited 2024 Jul 18]; 57:73. DOI: https://doi.org/10.11606/s1518-8787.2023057004395.
20. Hoseinzadeh E, Ebadi A, Ashktorab T, Sharif-Nia H. Nurses' intention to care for patients with infectious disease: a content analysis study. BMC Nurs. 2023 [cited 2024 Jul 18]; 22:349. DOI: https://doi.org/10.1186/s12912-023-01538-9.
21. AbdELhay ES, Taha SM, El-Sayed MM, Helaly SH, AbdELhay IS. Nurses retention: the impact of transformational leadership, career growth, work well-being, and work-life Balance. BMC Nursing. 2025 [cited 2025 Feb 26]; 24:148. DOI: https://doi.org/10.1186/s12912-025-02762-1.
22. Oliveira EB, Xavier T, Zeitoune RCG, Passos JP, Oliveira BR, Ferreira ARA. Precarious work at a surgical center: implications for the organization and for the health of nursing workers. Rev Bras Enferm. 2023 [cited 2024 Jul 18]; 76(2):e20220120. DOI: https://doi.org/10.1590/0034-7167-2022-0120.
23. Sawada S, Takemura Y, Isobe T, Koyanagi H, Kida R. Perceived impact of nurse turnover on the organization: a Delphi study on managers of nursing. J. Nurs. Manag. 2022 [cited 2024 Jul 18]; 30(7):3168–77. DOI: https://doi.org/10.1111/jonm.13738.
24. Bae SH. Noneconomic and economic impacts of nurse turnover in hospitals: a systematic review. Int Nurs Rev. 2022 [cited 2025 Feb 26]; 69:392–404. DOI: https://doi.org/10.1111/inr.12769.
25. Moraes RM, Nishiyama JA, Báo AC, Costa FM, Aldabe LN, Oliveira JL. Sizing of nursing staff in clinical, surgical and pediatric hospitalization units. Texto Amp Contexto Enferm. 2021 [cited 10 Sep 2024]; 30:e20200377. DOI: https://doi.org/10.1590/1980-265x-tce-2020-0377.

Research Article
Artigo de Pesquisa
Artículo de Investigación

DOI: https://doi.org/10.12957/reuerj.2025.87665

26. Lasater KB, Sloane DM, McHugh MD, Porat-Dahlerbruch J, Aiken LH. Changes in proportion of bachelor's nurses associated with improvements in patient outcomes. Res Nurs Health. 2021 [cited 2024 Jul 18]; 44(5):787-95. DOI: https://doi.org/10.1002/nur.22163.
27. Conselho Federal de Enfermagem. Resolução Cofen Nº 736 de 7 de janeiro de 2024. Brasília: Conselho Federal de Enfermagem; 2024 [cited 10 Sep 2024]. Available from: https://www.cofen.gov.br/resolucao-cofen-no-736-de-17-de-janeiro-de-2024/.
28. Brasil. Lei n° 7.498, de 25 de junho de 1986. Dispõe sobre a regulamentação do exercício da enfermagem, e dá outras providências. Brasília: Congresso Nacional; 1986 [cited 2024 Jul 18]. Available from: https://www.planalto.gov.br/ccivil_03/leis/l7498.htm.
29. Modolo, FH, Pessoas GB, Zanela GC, Borges SS, Krause RCF. Auditoria como ferramenta de gestão do SUS: o papel do enfermeiro auditor no serviço de hemoterapia. Hematol Transfus Cell Ther. 2023 [cited 2024 Jul 18]; 45:S858-9. DOI: https://doi.org/10.1016/j.htct.2023.09.1546.
30. Gomes ET, Assunção MCT, Lins EM, Püschel VAA. Nursing in mechanical prevention of venous thromboembolism in surgical patients. Rev esc enferm USP. 2021 [cited 2024 Jul 18]; 55:e03738. DOI: https://doi.org/10.1590/S1980-220X2020002703738.
31. Győri Á, Ádám S. Profession-specific working conditions, burnout, engagement, and turnover intention: the case of Hungarian social workers. Front Sociol. 2024 [cited 2025 Feb 26]; 9:e1487367. DOI: https://doi.org/10.3389/fsoc.2024.1487367.
32. Oro J, Matos E. Possibilities and limits of organization of nursing work in the comprehensive care model in a hospital institution. Texto contexto enferm. 2013 [cited 2024 Jul 18]; 22(2):500–8. DOI: https://doi.org/10.1590/S0104-07072013000200028.
33. Bracarense CF, Costa NS, Raponi MBG, Goulart BF, Chaves LDP, Simões ALA. Organizational climate and nurses' turnover intention: a mixed method study. Rev Bras Enferm. 2022 [cited 2025 Feb 26]; 75(4):e20210792. DOI: https://doi.org/10.1590/0034-7167-2021-0792.

Author's contributions

Conceptualization, J.N. and J.L.C.; methodology, J.N. and J.L.C.; validation, J.L.C., A.M.M. and N.H.; análise formal, J.N., J.L.C., A.M.M., N.H. and J.A.; formal analysis, J.N. and J.A.; data curation, J.N. and J.A.; manuscript writing, J.N. and J.A.; review and editing, J.L.C., A.M.M., N.H., J.A., E.L. and P.G.; visualization, J.L.C., A.M.M., N.H., J.A., E.L. and P.G.; supervision, J.L.C.; project administration, J.N. All authors read and agreed with the published version of the manuscript.

Use of artificial intelligence tools

The authors declare that no artificial intelligence tools were used in the composition of the manuscript "Nursing team sizing in a reference unit for multidrug-resistant microorganisms: a mixed-methods study".