RESEARCH | PESQUISA

The profile of nursing workers at university hospitals and workloads: a cluster analysis[a]

Perfil de trabalhadores da enfermagem de hospitais universitários e as cargas de trabalho: análise por cluster

Perfil de trabajadores de enfermería de hospitales universitarios y las cargas de trabajo: análisis por cluster

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ABSTRACT

Objective: to analyze the sociodemographic and occupational profile and intensity of workloads among nursing professionals working in university hospitals. **Method:** This quantitative and cross-sectional study addressed 361 nursing workers from November 2019 to February 2020, using the *Escala de Cargas de Trabalho nas Atividades de Enfermagem* and cluster analysis. **Results:** Four clusters were identified: with female workers (2, 3, and 4) and male workers (1). Exposure to workload was reported to be intense (1, 2, and 3) and a little intense (4). The work units most frequently identified in clusters 1, 2, and 3 were the Emergency and Urgent Care Unit, Pediatrics, and Medical Clinic, whereas Maternity Services and Surgical Clinics were the units most frequently identified in cluster 4. Most workers in clusters 1 and 3 had from 1 to 5 years of experience, cluster 2 from 15 to 20 years, and the workers in cluster 4 had less than one year of work experience. **Conclusion and implications for practice:** the identification of four clusters enabled analyzing the profile of the nursing workers, which favors the planning of interventions intended to minimize workloads according to the specificities of each group.

Keywords: Cluster Analysis; Workload; Nursing; Hospitals, University; Work.

RESUMO

Objetivo: analisar o perfil sociodemográfico, laboral e a intensidade das cargas de trabalho de trabalhadores da enfermagem de hospitais universitários. **Método:** quantitativo e transversal, com 361 trabalhadores de enfermagem, entre novembro de 2019 e fevereiro de 2020, por meio da Escala de Cargas de Trabalho nas Atividades de Enfermagem. Realizou-se análise de *cluster*. **Resultados:** formaram-se quatro *clusters* com trabalhadores do sexo feminino (2, 3 e 4) e sexo masculino (1). A exposição às cargas de trabalho foi identificada como intensa (1, 2 e 3) e pouco intensa (4). As unidades de trabalho evidenciadas com mais frequência nos *clusters* 1, 2 e 3 foram a Rede de Urgência e Emergência, Pediátrica e Clínica Médica, e no *cluster* 4, a Maternidade e Clínica Cirúrgica. Os *clusters* 1 e 3 identificaram com mais frequência o período de trabalho de 1 a 5 anos, no *cluster* 2, foi de 15 a 20 anos, e no *cluster* 4, inferior a um ano. **Conclusão e implicações para a prática:** a identificação dos quatro *clusters* possibilitou a análise do perfil de trabalhadores de enfermagem, permitindo o planejamento de intervenções direcionadas a minimizar as cargas de trabalho de acordo com as particularidades de cada grupo.

Palavras-chave: Análise por Conglomerados; Carga de Trabalho; Enfermagem; Hospitais Universitários; Trabalho.

RESUMEN

Objetivo: analizar el perfil sociodemográfico, laboral y la intensidad de las cargas de trabajo de trabajadores de enfermería de hospitales universitarios. **Método:** cuantitativo y transversal con 361 trabajadores de enfermería, entre noviembre de 2019 y febrero de 2020, por medio de la Escala de Cargas de Trabajo en las Actividades de Enfermería. Se realizó el análisis de *cluster*. **Resultados:** se formaron cuatro *clusters*, con trabajadores del sexo femenino (2, 3 y 4) y sexo masculino (1), la exposición a las cargas de trabajo fue identificada como intensa (1, 2 y 3) y poco intensa (4). Las unidades de trabajo evidenciadas con más frecuencia en los *clusters* 1, 2 y 3 fueron la Unidad de Cuidados de Emergencia y Urgencia, Pediatría y Clínica Médica y en el *cluster* 4, los Servicios de Maternidad y de Clínica Quirúrgica. Los *clusters* 1 y 3 identificaron con más frecuencia el período de trabajo de 1 a 5 años, en el *cluster* 2 fue de 15 a 20 años y en el *cluster* 4, inferior a un año. **Conclusión e implicaciones para la práctica:** la identificación de los cuatro *clusters* posibilitó el análisis del perfil de los trabajadores de enfermería, permitiendo la planificación de intervenciones dirigidas a minimizar las cargas de trabajo de acuerdo con las particularidades de cada grupo.

Palabras clave: Análisis por Conglomerados; Carga de Trabajo; Enfermería; Hospitales Universitarios; Trabajo.

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INTRODUCTION

The Brazilian health system seeks to strengthen and ensure the population has access to health services. However, the health system and its workers have witnessed transformations that have changed the healthcare model and care delivery. Nursing workers are experiencing weariness, illnesses, outdated wages, and the job market is compromised[1].

Nursing is a profession mainly composed of women exposed to intense physical and psychological strain. The contingent of nursing workers comprises more than two million workers, including nurses, nursing technicians, and nursing assistants, working in the different organizational settings that compose the Brazilian health system, healthcare centers, outpatient clinics, Primary Heath Care Units, Emergency Rooms, Mobile Emergency Care Services, and hospitals, among others[2].

One study compared four university hospitals, two located in Brazil, one in Algeria and one in France, and reported that nursing workers perform activities in working places with inappropriate physical structures, insufficient material resources, deficient number of workers, high turnover, absenteeism, and high demand of administrative tasks. These factors compromise the organization of services and harm teaching activities[3].

Aspects related to working conditions refer to workloads identified as elements in the work environment that interact with workers, leading to physical and psychological strain. These include physical, chemical, biological, mechanical, psychological, and physiological workloads[4].

Workloads were found to affect the health of Brazilian workers negatively. Working conditions include heavy physical demands, bad postures due to repetitive movements, decision-making centralization, inappropriate furniture and physical structure, and inadequate instruments[5].

The consequences of workloads include low back pain, mental fatigue[5,6], bad mood, physical fatigue[4], pain in the upper limbs, cervical and thoracic pain, pain in the lower limbs and joints, muscle contracture, edema in the lower limbs, shortness of breath, digestive problems, headache, nervousness, forgetfulness, insomnia, eye irritation, weakness, and dizziness[6].

One study conducted in Rio de Janeiro, Brazil, identified the profile of nursing professionals working in outpatient clinics of university hospitals. The sociodemographic and occupational characterization of 388 participants revealed that 88.6% were women, most aged 50+ years old (48.4%), 68.3% had a college education, 30.1% were nurses, 50.5% were nursing technicians, and 19.1% were nursing assistants. Regarding the presence of diseases, 50.8% reported stress, 46.1% musculoskeletal disease, 45.4% varicose veins, 39.2% high cholesterol, and 38.7% high blood pressure[7].

The work performed in university hospitals involves the care provided to hospitalized patients, management activities, and teaching and research activities[8]. Hence, university hospitals were chosen to be the setting of this study because workers in these hospitals face intense demand for care, management, administration tasks, teaching, research, and extension activities.

In this sense, this study seeks to enable health institutions and universities to devise strategies to prevent harm to the workers' health by decreasing working loads, promoting healthy work environments and appropriate working conditions.

Therefore, this study's research question was: what is the profile of nursing professionals working in university hospitals, according to socio-demographic and occupational characteristics and workload intensity? Hence, the objective was to analyze the socio-demographic and occupational profile and the intensity of the workload of nursing professionals working in university hospitals.

METHOD

This quantitative, cross-sectional, and analytical study addressed nursing workers, that is, nurses, nursing technicians, and nursing assistants working in two university hospitals located in Rio Grande do Sul, Brazil. Both the hospitals belong to public universities and are linked to the Brazilian Company of Hospital Services.

A population of 752 nursing workers in the two university hospitals was considered to calculate the sample size. These professionals worked in units providing direct care to patients; workers performing activities in administrative sectors were not included. The statistical formula for finite populations was used, assuming a 95% confidence level and 5% sampling error; a minimum of 255 participants was found. In addition, a non-probability sampling technique (convenience) was adopted[9], to reach the highest number of participants possible.

Inclusion criteria were: working in one of the following: Medical Clinic, Surgical Clinic, Emergency Room (ER), Emergency and Urgent Care Unit (EUC), Obstetrical Clinic, Maternity Services, Pediatric Clinic, Surgical Center, and general and neonatal Intensive Care Unit (ICU). Exclusion criteria were: being on vacation or leave at the time of data collection.

Data were collected between November 2019 and February 2020 using a semi-structured instrument addressing socio-demographic and occupational variables and the "*Escala de Cargas de Trabalho nas Atividades de Enfermagem*" (ECTAE), developed and validated among nursing workers. The measure of the instrument's reliability coefficient was verified using Cronbach's alpha, which was 0.87 and indicated the instrument's reliability.

ECTAE was previously developed according to a theoretical framework, using an eight-step guide[10], containing 22 statements concerning situations involving workload exposure during nursing tasks[4]. ECTAE presents six constructs: psychological, physiological, biological, mechanic, physical, and chemical workload (Chart 1). Two five-point Likert scales were used for the respondents to rate statements in terms of intensity (not intense at all=0; a little intense=1; intense=2; very intense=3; and extremely intense=4) and frequency (never =0; sometimes=1; often=2; very often=3; and extremely often=4).

First, data were typed and organized in Microsoft Office Excel 2020 and then transferred to Statistical Package for Social Sciences, version 24, to be processed and analyzed. Descriptive

Chart 1. Description of the items composing the ECTAE.

Construct	Nursing Activities
F1 – Psychological load	Administrative tasks, care delivery, teaching, research, and extension activities; communication, guidance, supervision; teamwork; constant alertness; psychological and/or moral violence; stress.
F2 – Physiological load	Lifting heavy loads; moving patients; physical strain.
F3 – Biological load	Microorganisms; secretions; body fluids and procedures.
F4 – Mechanical load	Physical violence, falls, and occupational accidents.
F5 – Physical load	Infrastructure, lighting, physical space, material, waste disposal, and electronic shock.
F6 – Chemical load	Preparation and administration of medications, handling cleaning products, and disinfecting material.

Source: developed by the authors.

statistics and absolute and relative frequencies were used to characterize the participants.

Cluster analysis, a set of multivariate techniques to group objects according to their characteristics, was performed. Clusters must have high internal homogeneity (within clusters) and high external heterogeneity (between clusters). Hence, the Two-Step Cluster analysis, an exploratory tool that enables analyzing large data sets, using categorical and continuous variables, and automatically identifying the ideal number of clusters, was performed[11].

Principal components analysis was adopted to decrease the number of variables used and the likelihood distance measure, which measured the probability of distribution over the variables. The independence of two variables was tested as a criterion for the categorical variables, using the crosstabs procedure and the Chi-square test (p=0.000). The independence between two variables for the continuous variables was tested using bivariate correlations, and the procedure of means was the criterion adopted in the algorithm for variable selection[11].

Thus, four groups were identified with variables that predict the profile of nursing workers: sex, work experience, work unit, and workload intensity, which showed the quality of the formation of the clusters, with values ranging from 0 and 1, according to the cohesion measurement. Note that other variables were selected for the analysis but were excluded by the algorithm, as they did not show extra-group or intra-group heterogeneity.

Kolmogorov-Smirnov (p=0,000) test identified that data were normally distributed. Therefore, the parametric test of analysis of variance (ANOVA) was used to identify differences between the groups' means. A p-value <0.05 was adopted as statistical significance for the ANOVA test. The Institutional Review Board approved the study according to opinion report No. 79/2019, CAAE: 10639819.4.0000.5324.

RESULTS

A total of 361 nursing workers participated in the study, 295 (81.7%) women and 66 (18.3%) men, aged 38.9 years old on average (SD±8.6 years old). As for the work positions,

97 (26.9%) were nurses, 233 (64.5%) nursing technicians, and 31 (8.6%) were nursing assistants.

Regarding the number of workers per work unit, 20 (5.5%) worked in the Obstetrical unit, 49 (13.4%) in Maternity services, 28 (7.8%) in the Pediatric unit, 33 (9.1%) in the Emergency room, 57 (15.8%) in the Medical Clinic, 31 (8.6%) in the Surgical clinic, 20 (5.5%) in the Surgery Center, 25 (6.9%) in the general ICU, 46 (14.4%) in the neonatal ICU, and 52 (14.4%) in the Emergency and Urgent Care Unit (EUC).

Cluster analysis of the socio-demographic and occupational variables of the nursing workers and workload intensity resulted in four clusters with good quality, as shown in Figure 1.

Table 1 presents the distribution of nursing workers according to the clusters using the predictor variables.

The cluster analysis revealed that cluster 1 comprised 66 nursing workers, all men (100%), most (34.8%) with 1 to 5 years of experience, while the EUC was the most frequently identified unit, with 28.8% of the workers. In addition, the workers in this cluster classified their exposure to workload as intense, with a mean of 2.05.

Cluster 2 was the largest group (n=143), with female workers (100%), with 10 to 20 years of experience, while the unit most frequently identified was the Pediatric Unit, with 14% of workers. These workers classified their exposure to workloads to be intense, with a mean of 2.08.

Cluster 3 was composed of 91 nursing workers, all women (100%), with 1 to 5 years of experience (100%), while the most frequent unit was the Medical clinic with 25.3% of the workers. Workload exposure was considered intense, with a mean of 2.21, the largest mean among the clusters.

Cluster 4 was composed of 61 nursing workers, all women (100%), most (93.4%) with less than one year of experience, and Maternity services and the Surgical clinic were the most frequent units, with 18% of the workers each. Exposure to workload was classified as little intense, with a mean of 1.80, which differs from the remaining clusters regarding workload intensity.

Table 2 presents workload exposure considering the mean obtained by each cluster to facilitate understanding. The ANOVA test revealed a significant difference between the clusters and

the instrument, suggesting that the means differed, validating the clusters identified.
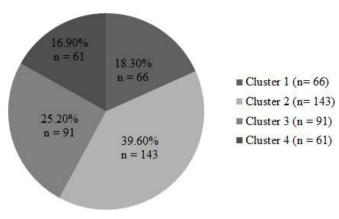

Figure 1. Cluster sizes.

DISCUSSION

Three (2, 3, and 4) of the four clusters are composed of female workers, and cluster 1 was composed of male workers. Workload exposure was considered intense by clusters 1, 2, and 3 and a little intense by cluster 4. The work units most frequently identified in clusters 1, 2, and 3 were EUC, Pediatric Unit, and Medical Clinic, and in cluster 4 were Maternity Services and Surgical Clinic. One to 5 years of experience were most common among the individuals in clusters 1 and 3, from 15 to 20 years in cluster 2, and less than a year in cluster 4.

As for the predominance of clusters with female workers, a study addressing 265 nurses and 810 nursing technicians and assistants from public hospitals found a similar result: 90.1% and 86.9% of women, respectively[12]. As the *Perfil da Enfermagem* shows, the nursing profession is predominantly composed of women, with 85.1% female workers. However, there have been a

Table 1. Clusters according to the predictor variables.

Variables		Cluster 1 (n = 66)	Cluster 2 (n = 143)	Cluster 3 (n = 91)	Cluster 4 (n = 61)
		n (%)	n (%)	n (%)	n (%)
Sex	Women	-	143 (100)	91 (100)	61 (100)
	Men	66 (100)	-	-	-
Work experience	< 1 year	1 (1.5)	2 (1.4)	-	57 (93.4)
	From 1 to 5 years	23 (34.8)	16 (11.2)	91 (100)	-
	From 5 to 10 years	11 (16.7)	31 (21.7)	-	-
	From 10 to 15 years	7 (10.6)	33 (23.1)		
	From 15 to 20 years	8 (12.1)	37 (25.9)	-	2 (3.3)
	From 20 to 25 years	3 (4.5)	12 (8.4)		1 (1.6)
	From 25 to 30 years	5 (7.6)	8 (5.6)	-	1 (1.6)
	>30 years	2 (3.0)	4 (2.8)	-	-
Unit	EUC	19 (28.8)	19 (13.3)	13 (14.3)	1 (1.6)
	Obstetrical Unit	-	1 (0.7)	10 (11)	9 (14.8)
	Maternity Services	2 (3.0)	18 (12.6)	18 (19.8)	11 (18)
	Pediatric Clinic	3 (4.5)	20 (14)	-	5 (8.2)
	ER	11 (16.7)	15 (10.5)	-	7 (11.5)
	Medical Clinic	13 (19.7)	11 (7.7)	23 (25.3)	10 (16.4)
	Surgical Clinic	4 (6.1)	10 (7.0)	6 (6.6)	11 (18)
	Surgery Center	1 (1.5)	18 (12.6)	-	1 (1.6)
	General ICU	5 (7.6)	12 (8.4)	5 (5.5)	3 (4.9)
	Neonatal ICU	8 (12.1)	19 (13.3)	16 (17.6)	3 (4.9)
Intensity of Workloads		$\bar{x}$ (SD)	$\bar{x}$ (SD)	$\bar{x}$ (SD)	$\bar{x}$ (SD)
		2.05 (0.76)	2.08 (0.65)	2.21 (0.56)	1.80 (0.66)

$\bar{x}$ – mean; SD – standard deviation; EUC: Emergency and Urgent Care Unit; ER: Emergency Room; ICU: Intensive Care Unit.

Table 2. Workload intensity according to each cluster

Cluster	Not intense at all	Little intense	Intense	Very intense	Extremely intense	p-value
	$\overline{x}$	$\overline{x}$	$\overline{x}$	$\overline{x}$	$\overline{x}$	
1	-	-	2.05	-	-	
2	-	-	2.08	-	-	0.002*
3	-	-	2.21	-	-	
4	-	1.80	-	-	-	

$\overline{x}$ – mean; * - p<0.05

growing number of male workers (14.4%) in the profission since the beginning of 1990[13].

Hence, cluster 1 included male workers (n=66), representing 18.3% of the sample. Studies have reported these changes in the profile of nursing graduates. For example, the percentage of men graduating at the School of Nursing, the University of São Paulo between 1950 and 1990 was 2.37% compared to 97.67% female students[14]. The percentage of male students increased to 7.6% from 2006 to 2012, while the percentage of women decreased to 92.4%[15]. Similar results were found in the Nursing School at the Federal University of Juiz de Fora, with 12% of male students graduating from 2005 to 2017[16].

Cluster 1 classified workload exposure to be intense. This result may be related to the fact that it is composed of male workers, and men experience challenges in the profession since they were included in this job market[17]. There is an example from women's health care in which most women attending a gynecological consultation prefer female nurses instead of male nurses[18]. Additionally, male nurses tend to occupy leadership and teaching positions[19], activities that may increase their exposure to workload.

The clusters exclusively composed of female workers characterize workload exposure as intense (clusters 2 and 3) and little intense (cluster 4). One study with the predominant participation of female workers identified workloads in the nursing environment and biological, psychological, physiological, chemical, physical, and mechanical loads stood out. Workloads include the presence of viruses and bacteria, humidity, accidents with sharp material, prolonged tension, conflicts, complicated interpersonal relationships, shift work, physical strain, and having to walk long distances within the facility[6].

Identifying the working conditions experienced by professionals in the work environment is needed to understand workload exposure. An analysis of the socio-environmental context of university hospitals and the presence of professors and students in hospitalization units reveals that nursing workers are exposed to workloads. The reason is that the hospital is linked to the university, and many activities are performed in this context, such as care delivered to patients, teaching, research, and extension activities during the school year. Hence, establishing interpersonal relationships and positive interactions between students and workers are essential to provide a healthy workplace, the exchange of experiences, and quality care delivery[20].

Among the work units in which nursing workers perform care activities, the most frequently identified in clusters 1, 2, and 3 were EUC, Pediatric Unit, and Medical Clinic, respectively. The nursing workers in these units experience high rates of productivity loss, resulting from illnesses caused by workloads[21].

The emergency service is the main entrance of patients to a hospital setting, and workers may face problems related to high demand and turnover of patients, which can cause stress among workers. Among the items that demand attention to improving care delivery include workers having the liberty to solve problems within the unit and receiving the support of the health institutions[22].

The Pediatric unit is characterized by factors in the work environment that can generate dissatisfaction among workers, such as difficulties with teamwork and with the multi-professional team, problems faced with support services, lack of time to discuss care delivery, little support provided by the institution, lack of autonomy, and inadequate staffing[23]. Additionally, nursing workers in the pediatric unit report that it demands a differentiated profile due to the specificity of providing care to children and their families, which requires sensitivity and emotional involvement. The work process involves including the family in care actions and appreciating their participation[24].

The Medical Clinics is also characterized by high complexity and risk of death among patients, which requires the administration of potentially harmful medications, invasive procedures, and constant monitoring, requiring many workers. Hence, the work performed in this unit is indirectly linked to the workers' illnesses, adversely affecting their quality of life, and consequently absenteeism in the hospital environment[25].

The workers in cluster 4 most frequently worked in the Maternity Services and Surgical Clinic. The nurses reported that the work performed in Maternity Services is satisfactory because they have the autonomy to provide care to patients, the support of their superiors, and control what happens in the unit. The relationship in the nursing staff are based on trust, and everything that occurs within the department is resolved by holding meetings to solve problems[26]. As for the work performed in the Surgical Clinic,

collaboration, and good interdisciplinary communication, support from colleagues, good teamwork, and opportunity to express opinions are factors that alleviate workloads[27].

Regarding work experience in the profession, the clusters most frequently reported 1 to 5 years of work experience, 100% of the workers in cluster 3, and 34.8% of the workers in cluster 1. One study addressing 301 nursing workers corroborates this finding as 36.5% of its sample presented 1 to 4 years of work experience, reporting that the working conditions and work organization increase workloads. Factors such as work pace, working hours, productivity requirements, and the need to meet deadlines, physical structure, equipment, and instruments used in the delivery of care are accounted for generating physical and mental strain[5].

A total of 25.9% of the workers in cluster 2 had 15 to 20 years of work experience. One study identified that workers with 5 to 16 years of work experience presented the highest mean of physical and cognitive fatigue and absenteeism; workers missed from 11 to 29 workdays, and tiredness caused by their jobs was a possible risk factor for abseenteism[28].

Cluster 4 comprised the highest percentage (93.4%) of workers with less than one year of experience. The fact these workers were recently introduced to the workplace might explain why they consider workload exposure to be less intensive and less harmful to health. It may occur because young nurses need to acquire technical and functional competence during care delivery[19]. Additionally, despite the presence of workloads in the context of public hospitals, many workers are not aware of their exposure[5].

CONCLUSION AND IMPLICATIONS FOR PRACTICE

The identification of four clusters enabled analyzing the profile of the nursing workers from two university hospitals located in Rio Grande do Sul, Brazil, according to sex, years of experience, work unit, and workload intensity.

The results enable planning interventions directed to the specificities of each group to decrease workloads in university hospitals, especially among female nursing workers. In addition, identifying working conditions, years of experience, and units in which most nursing workers perform care activities enables the implementation of changes to minimize the consequences arising from workloads in the workplace, such as illnesses, occupational accidents, and absence from work.

The intensity of workloads reported by the workers promotes reflections upon the work conditions in which nursing activities are performed. Hence, workload exposure must be minimized, interpersonal relationships within the teams improved, and appropriate infrastructure is needed, providing quality and sufficient material and equipment. Additionally, the remuneration of workers, staffing, and working hours need to be compatible with the needs of institutions and workers.

This study's limitation concerns its cross-sectional design, making it impossible to make causal inferences. Future studies are needed to discuss findings regarding the profile of nursing workers and the intensity of workloads.

AUTHOR'S CONTRIBUTIONS

Study design. Deciane Pintanela de Carvalho. Laurelize Pereira Rocha. Aline Neutzling Brum.

Data collection. Deciane Pintanela de Carvalho.

Data analysis. Deciane Pintanela de Carvalho. Laurelize Pereira Rocha. Aline Neutzling Brum.

Interpretation of results. Deciane Pintanela de Carvalho. Laurelize Pereira Rocha. Aline Neutzling Brum. Evilin Diniz Gutierres. Aline Carniato Dalle Nogario. Simoní Saraiva Bordignon.

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