Title: Nursing Workload, Knowledge about Pain, and their Relation to Pain Records

Running Title: Workload and Pain in ICU

David ZUAZUA-RICO: PhD. MSc. RN. University of Oviedo. Medicine Department, Nursing Area. Hospital Universitario Central de Asturias. ORCID: https://orcid.org/0000-0002-5945-5945.

M. Pilar MOSTEIRO-DIAZ: PhD. RN. University of Oviedo. Medicine Department, Nursing Area. ORCID: https://orcid.org/0000-0002-3375-9334

Alba MAESTRO-GONZALEZ*: PhD. MSc. RN. University of Oviedo. Medicine Department, Nursing Area. Instituto Nacional de Silicosis. ORCID: https://orcid.org/0000-0002-1588-9362. *Corresponding autor:* E-mail address: maestroalba@uniovi.es. Correspondence to Alba Maestro-Gonzalez at Facultad de Medicina y Ciencias de la Salud. Enfermería. Campus del Cristo S/N, 33006, Oviedo, Asturias, Spain.

Julio FERNANDEZ-GARRIDO: PhD. MSc. RN. University of Valencia. Faculty of Nursing and Podiatry. ORCID: https://orcid.org/0000-0001-5195-5227

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Keywords: Intensive Care Units, Critical Care Nursing, Pain Management, Pain Measurement

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Competing Interest

The authors declare no competing interest.

Nursing Workload, Knowledge about Pain, and Nurses' Relation to Pain Records

ABSTRACT

Purpose: To study the relationship between frequency of pain assessment and nursing workload, and also to analyse the frequency of pain assessment and its relation with knowledge and attitudes towards pain on nursing professionals in intensive care unit.

Methods: An ambispective study was conducted in a Spanish tertiary level Intensive Care Unit between October 2017 and April 2018. For the measurement of workload, the "Nursing Activities Score" scale was used, and for the measurement of pain knowledge, the "Knowledge and Attitudes Survey Regarding Pain" was used.

Results: There were 1207 measurements among 41 nurses and 1838 among 317 patients. The average nursing workload was high (70.97 points). We found statistically significant positive effect between nursing workload and the frequency of assessment *($p<0.001$)*, as well as in patients with communicative capacity *($p = 0.008$)*.

Conclusions: Nursing workload affects the registration and assessment of patients' pain, resulting in a greater number of records as the workload performed by nurses´ increases.

Clinical Implications: It is necessary to study in greater depth how the severity and the gender of the patients and the shift of the nurses´ influence pain registration and assessment.

Keywords: Intensive Care Units, Critical Care Nursing, Pain Management, Pain Measurement

INTRODUCTION

Despite a variety of guidelines for effective pain control, it is estimated that between 50% and 80% of hospitalized patients suffer from pain, considered intense in many cases (Payen, Bosson, Chanques, Mantz, & Labarere, 2009; Puntillo et al., 2013), and affecting the quality of life of patients during and after their hospital stays (Granja et al., 2005; Rotondi et al., 2002).

Intensive Care Units are especially prevalent in pain studies. Their numbers may be higher due to the clinical diagnoses of patients, the pathologies responsible for their admission, and the different techniques and procedures carried out (Al Sutari, Abdalrahim, Hamdan-Mansour, & Ayasrah, 2014; Clukey, Weyant, Roberts, & Henderson, 2014; Puntillo et al., 2001; Puntillo et al., 2013).

The consequences of poorly controlled pain have been described extensively throughout the literature. Problems in wound healing, increased mechanical ventilation times, nosocomial infections, cardiac arrhythmias, increased myocardial oxygen consumption, increased risk of thromboembolic accidents, delirium or other psychiatric disorders, increased healthcare costs, and mortality are fundamental consequences of inadequate pain management (Dale et al., 2013; Dunwoody, Krenzischek, Pasero, Rathmell, & Polomano, 2008; Pasero et al., 2009; Payen et al., 2009; Robinson et al., 2008; Sacco & LaRiccia, 2016; Yamashita, Yamasaki, Matsuyama, & Amaya, 2017).

There are several circumstances that make it difficult to manage and eliminate pain in patients. These may be related to the patient, the staff giving care, or the institution itself. The patient's clinical status or cultural determinants can make diagnosis difficult. On the other hand, desensitization of hospital staff may result in a lower prioritization of pain management in favour of other parameters, such as haemodynamics or ventilation, which can be limiting elements for a good diagnosis or proper pain control (Pasero et al.,

2009; Rose et al., 2011; Sigakis & Bittner, 2015). In turn, a low level of knowledge has been shown to be one of the limitations that contributes to poor pain management, and is especially problematic for those who cannot express themselves clearly (Medrzycka-Dabrowka, Dąbrowski, Gutysz-Wojnicka, Gawroska-Krzemińska, & Ozga, 2017; Pretorius, Searle, & Marshall, 2015; Rose et al., 2012; van der Woude, Bormans, Hofhuis, & Spronk, 2016). Finally, restrictive or excessively conservative policies in the face of advances in treatments and techniques for pain management, distrust among professional staff, or a perceived excessive workload constitute the leading barriers attributable to the health system (Kizza & Muliira, 2015; Pretorius et al., 2015; Rose et al., 2012; Sneyers, Laterre, Perreault, Wouters, & Spinewine, 2014; Subramanian, Allcock, James, & Lathlean, 2012; Wioletta, Sebastian, & Andrzej, 2016).

The concept of measuring a nurse's workload originated in the 1970s, to quantify the costs involved in admitting patients to intensive care units (Cullen, Civetta, Briggs, & Ferrara, 1974). As time progressed, workload assessment studies began to focus on improving staff management practices in order to increase efficiency in intensive care units. Staff management plays a decisive role in the organization of the nursing workload in these units, since it has been determined that a high workload increases complications in critical patients, increases the frequency of adverse events such as medication error and accidental extubations, and increases mortality risk (Aycan et al., 2015; Cremasco, Wenzel, Zanei, & Whitaker, 2013; Daud-Gallotti et al., 2012; Halm, 2019; Novaretti, Santos, Quitério, & Daud-Gallotti, 2014; Schwab, Meyer, Geffers, & Gastmeier, 2012; Seynaeve et al., 2011; Strazzieri-Pulido, S. González, Nogueira, Padilha, & G. Santos, 2019).

Hence, the purpose of our study was to study the relationship between frequency of pain assessment and nursing workload, and also to analyse the frequency of pain

assessment and its relation with knowledge and attitudes towards pain on nursing professionals in intensive care unit.

METHODS

Study design

An ambispective analytical study was conducted to assess the relationship between nursing workload, nurses' knowledge of pain, and clinical records between October 2017 and April 2018. All health care professionals agreed to participate in the study by signing informed consent forms. In addition, the study was approved by the Regional Ethics and Research Committee (45/17), and carried out in accordance with the ethical standards set forth in the Helsinki Declaration of 1975.

Sample

The sample consisted of 41 randomly selected intensive care nurses out of a total staff of 84. This study had a confidence interval of 95%, 80% power and an adjustment for possible losses of 10%. They all worked in a rotating shift at a Spanish hospital in the tertiary level of the national public health network, consisting of 989 beds. The unit where the study was conducted had 44 beds for intensive polyvalent care, with a nurse:patient ratio of 1:2.

Measurement

In the first instance, nurses' awareness and attitudes toward pain management were assessed. Following this, their supported workload was measured, which consisted of the

sum of the workload for each of their patients, and the frequency of pain assessments entered in their electronic records, during the morning shift (8 AM–3 PM), afternoon shift (3PM–10 PM), and night shift (10 PM–8 AM). It should be noticed that nurses were not informed specifically of the chart review to prevent Hawthorne effect (Argimón Pallás & María, 2013). Additionally, data were collected about their age, gender, marital status, academic degree, work experience, and shift. The individual characteristics of their patients were also analysed: workload, reason for admission (medical, surgical, trauma), age, sex, severity at admission (APACHE II, which is a severity-of-disease ICU classification system applied whithin 24 hours of admission of a patient in this unit. Higher scores correspond to more severe disease and a higher risk of death (Knaus, Zimmerman, Wagner, Draper, & Lawrence, 1981)), type of analgesia (opioid, non-opioid), and their communication capacity (yes/no). Those patients subjected to neuromuscular block, or under suspicion or confirmation of brain death, were excluded from the part of the study on pain assessment (their charts were excluded from the chart review) because they cannot express pain in any circumstance; however, they were taken into account when calculating the nurses' workloads when they took care of two patients.

For the measurement of pain knowledge, the Spanish version of the "Knowledge and Attitudes Survey Regarding Pain" (KASRP) (Zuazua-Rico, Maestro-González, Mosteiro-Díaz, & Fernández-Garrido, 2019) was applied, which is the most widely used questionnaire and the one with the most evidence to express the concept. This tool has been undergoing revisions and extensions since its creation; the most recent version was distributed in 2014 (Ferrell & McCaffery, 2014). It comprises 39 items, 22 of which are true-or-false questions, 15 are multiple-choice questions, and 2 are clinical case studies with 2 questions each. We calculated the KASRP score by assigning a score of 1 to correctly answered questions and a score of 0 to incorrectly answered or unanswered

questions, the maximum score was 41 points. We then calculated the total percentage of correct answers. It is considered that if a nurse scored less than 80%, his or her ability to care for a patient experiencing pain was considered to be significantly compromised (McCaffery & Robinson, 2002).

For the measurement of workload, the Spanish version of the "Nursing Activities Score" scale (NAS) (Arias-Rivera et al., 2013) was used, due to its efficacy in expressing the time spent by nursing professionals on the care of a patient regardless of severity. It covers up to 81% of all nursing activities. The NAS consists of 23 items with sub-items, representing the percentage of time that one nurse spends on a specified activity. The percentages obtained in all items are then added to obtain the final result, which ranges from 18.3% to 177%. It is estimated that 100 points on the NAS equals the maximum dedication of the nursing staff for a duration of 24 hours (Miranda, Nap, de Rijk, Schaufeli, & Iapichino, 2003), being able to reach higher scores in case of overload.

To determine the frequency of pain assessment, the clinical records of patients seen by the nurses selected during the study period were reviewed, and the number of pain assessments were registered. Quality of the recorded pain assessment was not considered.

Analysis

A descriptive analysis of each variable was performed, providing frequency distribution and position measurements (mean, median, standard deviation, and range). For the comparison of variables, a fixed effects model was chosen. The comparison of quantitative variables between two categories was carried out using Student's *t*-test (with the Welch correlation if the variances were different), or the Wilcoxon test for

independent samples, depending on whether the normality hypothesis was verified. The comparison of quantitative variables between three categories was performed with an ANOVA test and the Tukey post hoc test, or the Kruskal-Wallis test and Dunn post hoc test, depending on whether the previous hypotheses of normality (Shapiro-Wilk's test) and homoscedasticity (Bartlett's test and the Ansari-Bradley test) were met. The Pearson or Spearman's correlation coefficient and the associated hypothesis contrast were used to study the linear relationship between continuous variables, depending on whether the normality hypothesis was fulfilled.

Finally, a multivariate mixed effects model was constructed to evaluate the global model of the study. A level of significance of $p < 0.05$ was used. The statistical analysis was carried out using the R (R Development Core Team) program, version 3.4.3.

RESULTS

There were 1,207 measurements among the 41 nurses, and 1,838 measurements among the 317 patients admitted during the study period, divided into morning (32.2%), afternoon (34.4%), and night (33.2%) shifts. The main sociodemographic and situational characteristics of both nurses and patients are shown in **Table 1**. The population of nurses was predominantly female (85%), while that of the patients was predominantly male (70.5%).

The predominant type of analgesia was non opioid analgesia (60.7%), compared to other types that included the use of opiates. All the patients studied (except those who were under suspicion or confirmation of brain death) had analgesic treatment prescribed. The predominant type of admission was medical (51.4%), followed by surgical (38.7%),

and traumatological (9.9%). In most of the cases analysed, patients had the capacity to communicate with staff (70.2%).

The average workload of the nurses was 70.97 points on the NAS scale (*SD*: 26.14), and the average score on the KASRP was 59.7% (*SD*: 9); on the other hand, the average workload of each patient was 47.14 points on the NAS scale. The average number of assessments by nurses was 1.3 measurements per patient/shift (*SD*: 0.68). Of the cases studied, 35.8% did not have any pain assessments during the shift.

We found statistically significant differences related to the workload of the nurses. The morning and afternoon shift had a higher workload than the night shift ($p < 0.001$). Moreover, between the academic degree of the professionals and the number of pain assessments performed on patients, those with a master's degree or higher performed a larger number of assessments ($p = 0.003$). The workload of the nurses increased the frequency of pain assessments ($p < 0.001$). It was verified that there were more pain assessments conducted during the afternoon shift ($p = 0.020$) than the morning and night shifts, as well as on patients with communicative capacity ($p = 0.008$), and among women ($p = 0.013$), as shown in **Tables 2 and 3**.

We found no relationship between the frequency of pain assessments and the nurses' age, sex, marital status, professional experience, or level of knowledge about pain. Regarding the patients, we found no differences in the frequency of pain assessments by professionals due to patients' age, diagnosis of admission, type of analgesia, or individual workload.

DISCUSSION

Although our absolute results about the frequency of pain assessment were within the standards established by the Spanish Society of Critical Care, which establish a minimum of 1 measurement per shift (Sociedad Española de Medicina Intensiva Crítica y Unidades Coronarias, 2017), our results agree with previous studies that showed a low priority is given to the control of pain by nursing staff in intensive care. With respect to the omission of pain assessment records, our data were more comprehensive than those obtained by Purser et al. (2014), where 85% of the patients studied did not have a record; or by Ravaud et al. (2004), where no postoperative patients were evaluated. Even so, it should be noted that in 35.8% of the data obtained, no pain assessments were recorded, which leads us to affirm that an optimal pain control is compromised (considering the nursing assessments expressed in the clinical history). Since physicians rely on the documentation of pain assessments, by the nursing staff, lack of documentation leaves the physician with insufficient information to evaluate effectiveness of the pain management. This could be related to the tendency to prioritize others factors perceived as more urgent, such as haemodynamics or mechanical ventilation (Manias, Bucknall, & Botti, 2005; Payen et al., 2007; Pretorius et al., 2015). These results match those of an investigation carried out in the United States (Chanques et al., 2006), where the average frequency of assessment was 1.2 times per shift. In Norway, Woien et al. (2014) observed that 20% of patients studied received no pain assessment during their hospital stays. A study in Canada placed the percentage at 28.6% (Haslam, Dale, Knechtel, & Rose, 2012), and research conducted in other European centres found percentages similar to those found in our study (Payen et al., 2007). These results indicate a disparity in published studies on the frequency of pain assessment, since studies conducted in different countries show a frequency that generally ranges between 2 and 16 pain assessments every 24 hours (Gélinas, Tousignant-

Laflamme, Tanguay, & Bourgault, 2011; Radtke et al., 2012; Rose, Haslam, Dale, Knechtel, & McGillion, 2013; Topolovec-Vranic et al., 2010; Wøien et al., 2014).

During the afternoon shift, the nurses performed more frequent pain assessments. This result is in contrast to that obtained by Olsen et al. (2015), where the morning shift saw the most pain assessments by nurses. We consider our result to be due to the possibility that during the morning shift the nurses are more occupied with matters not directly focused on the patient (although they are concerned about the patient), a result of greater presence and pressure by the medical personnel in the unit, a circumstance that is not explicitly included in the NAS scale, but shows the complexity of the measurement (Alghamdi, 2016). This explanation is supported when comparing the different workloads per shift, where we observed, despite the empirical evidence, that there are no significant differences measured by the NAS scale between the morning and afternoon shifts according to Deberg et al. (2012). It was also observed that during the night shift, the staff recorded more assessments than during the morning shift, although in this case the results did not show significant differences.

As can be seen, we found a relationship between the academic degree of the nursing staff and the number of pain assessments they performed, which increased with the degree of qualification; contrary to the findings of Rose et al. (2011), which did not find such a relationship. From these results, it can be deduced that increased academic education could lead to higher quality care (Morrison et al., 2011).

From our results, we cannot confirm the influence of knowledge on the attitudes about pain management shown by the nurses in their records, mainly because our study population was homogenous in its KASRP score. Our results differ from those obtained in other investigations where such influences were found (Arbour & Gelinas, 2011; Erdek, 2004; Haslam et al., 2012; Medrzycka-Dabrowka et al., 2017; Purser et al., 2014;

Radtke et al., 2012; Ravaud et al., 2004; Rose et al., 2013; Topolovec-Vranic et al., 2010). However, those results derived from the practice of specific training actions, while our study is based on a static model without intervention on the staff.

Considering the communication capacity, a patient who can communicate clearly makes it considerably easier for nurses to assess their pain. The systematic assessment of non-communicative patients constitutes a challenge for nurses. Better communication could result in benefits such as less frequent use of sedatives (Dale et al., 2013; Payen et al., 2009; Robinson et al., 2008; Sacco & LaRiccia, 2016; Yamashita et al., 2017). In this respect, our results match those of other studies, where non-communicative patients received fewer assessments than those who were able to communicate clearly (Haslam et al., 2012; Rose et al., 2011; Topolovec-Vranic et al., 2010).

On the other hand, we did not find a relationship between the assessment of pain and the diagnosis at admission. These results agree with those of Rose et al. (2013), where, although there were differences regarding pain and diagnosis at admission, they did not find a statistical relationship.

We must be careful when analysing the relationship between the level of severity of the patients at admission and the frequency of pain assessments performed by staff ($p \leq 0.001$), since our model did not take into account the patients' dates of admission. Our analysis was performed from a random point of view, thus allowing a more comprehensive overview, encompassing all possible moments: from admission, to the end of treatment, or death.

The workload of the nursing staff increased the pain records in the clinical history, contrary to the findings of another study carried out by Olsen et al. (2015) that did not find such an association. Our results diverge from those based on subjective opinions in

which the workload was considered a limiting factor (Kizza & Muliira, 2015; Pasero et al., 2009; Pretorius et al., 2015; Rose et al., 2011; Sigakis & Bittner, 2015; Wang & Tsai, 2010). Evaluating the work of a nurse based on a chart audit is complex since, sometimes the documentation does not fully reflect their work, but it is the only way available that supports us as professionals.

The patients' scores on workload differed from those of the nursing staff. We must bear in mind that the workload of a nurse is given, as a rule, as the sum of care for several patients, so a high workload for nursing staff may not correspond to a high workload for each patient. We consider that a higher nursing workload might increase the concentration of nurses attending to the different situations that occur when caring for critical patients.

CONCLUSIONS

Pain is still a low priority element for critical care nurses, despite efforts made in recent years with the development of new assessment instruments and new treatments. We found that when nursing workload was higher, nurses tended to complete and document pain assessments more than when workload was lower. Although the workloads were similar between the morning shift and the afternoon shift, nurses were more likely to document pain assessments in the afternoon shift. We did not find a significant difference between Knowledge and Attitude Scores among the nurses studied. Regarding academic degree, those nurses with a master degree tended to document pain assessments more than those with basic nursing studies. Moreover, those patients who had communicative capacity received more pain assessments than those who couldn´t communicate by themselves.

CLINICAL IMPLICATIONS

It is necessary to study in greater depth how the severity of the patients and the shift of the nurses´ influence pain registration and assessment; in particular, it is necessary to perform a differentiated evaluation based on the gender of the patient. There is a need to educate nurses on pain knowledge facts as a means to try to improve pain assessments.

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Table 1

Table 2

Table 3