

RESEARCH ARTICLE (ORIGINAL) 

Nursing Delirium Screening Scale: Evaluation of psychometric properties in an orthopedic service in Portugal

Nursing Delirium Screening Scale: Avaliação das propriedades psicométricas num serviço de ortopedia em Portugal

Nursing Delirium Screening Scale: Evaluación de las propiedades psicométricas en un servicio de ortopedia de Portugal

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Abstract

Background: The identification of *delirium* by nurses extremely relevant. The Portuguese version of the Nursing *Delirium* Screening Scale (Nu-DESC) is a tool that can be used in this setting.

Objective: To evaluate the psychometric properties of the Portuguese version of the Nu-DESC in a surgical context.

Methodology: Methodological study with patients aged 65 years or older with a diagnosis of proximal femur fracture. Three assessment tools were used to analyze the agreement between the results.

Results: In a sample of 81 patients, the sensitivity of the Nu-DESC was 92% compared to the Confusion Assessment Method (CAM) and 91% compared to the application of the DSM-5 criteria. The specificity of the instrument was 98% compared to CAM and 94% compared to the DSM-5. Cronbach's alpha ranged between 0.86 and 0.89

Conclusion: The evaluation of the psychometric properties of the Nu-DESC in a surgical context confirmed the validity and reliability of the instrument. The results show that the scale has a high sensitivity and specificity for assessing *delirium*.

Keywords: postoperative care; nursing; *delirium*; orthopedics; psychometrics

Resumo

Enquadramento: A identificação do *delirium* pelos enfermeiros é de extrema relevância. Assim, parece relevante a possibilidade de recurso à versão portuguesa da Nursing *Delirium* Screening Scale (Nu-DESC).

Objetivo: Avaliar as propriedades psicométricas da versão portuguesa da Nu-DESC em contexto cirúrgico.

Metodologia: Estudo metodológico, incluindo utentes com 65 ou mais anos de idade, com o diagnóstico de fratura proximal do fémur. Recorreu-se a três medidas de avaliação para analisar a concordância entre os resultados obtidos através das mesmas.

Resultados: Numa amostra de 81 utentes, a sensibilidade da Nu-DESC foi de 92% relativamente ao Confusion Assessment Method (CAM) e de 91% face à aplicação dos critérios do DSM-5. Já a especificidade do instrumento foi de 98% relativamente ao CAM e de 94% face à aplicação dos critérios do DSM-5. O alfa de Cronbach da Nu-DESC variou entre 0,86 e 0,89.

Conclusão: A avaliação das propriedades psicométricas da Nu-DESC num contexto cirúrgico confirmou que a escala apresenta uma elevada sensibilidade e especificidade para a avaliação de *delirium* nesse mesmo contexto.

Palavras-chave: cuidados pós-operatórios; enfermagem; *delirium*; ortopedia; psicometria

Resumen

Marco contextual: La identificación del delirio por parte del personal de enfermería es extremadamente importante. De ahí la posibilidad de utilizar la versión portuguesa del Nursing *Delirium* Screening Scale (Nu-DESC).

Objetivo: Evaluar las propiedades psicométricas de la versión portuguesa del Nu-DESC en entornos quirúrgicos.

Metodología: Estudio metodológico que incluyó a usuarios de 65 años o más, con diagnóstico de fractura proximal de fémur. Se utilizaron tres medidas de evaluación para analizar la concordancia entre los resultados obtenidos a través de ellas.

Resultados: En una muestra de 81 usuarios, la sensibilidad del Nu-DESC fue del 92% en relación con el Confusion Assessment Method (CAM) y del 91% cuando se aplican los criterios del DSM-5. La especificidad del instrumento fue del 98% en relación con el CAM y del 94% frente a la aplicación del DSM-5. El alfa de Cronbach de la Nu-DESC varió entre 0,86 y 0,89.

Conclusión: La evaluación de las propiedades psicométricas de la Nu-DESC en un contexto quirúrgico confirmó que la escala presenta una alta sensibilidad y especificidad para la evaluación del delirio en este mismo contexto.

Palabras Clave: cuidados posoperatorios; enfermería; *delirium*; ortopedia; psicometría



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Introduction

According to the “Diagnostic and Statistical Manual of Mental Disorders” (5th ed.; DSM-5), delirium is characterized as a disturbance of consciousness, with reduced ability to focus, sustain or shift attention, or a change in cognition over short periods (American Psychiatric Association, 2015). It manifests as a result of an underlying medical condition and/or exposure to a substance (Rafaela & Cerejeira, 2016).

The DSM-5 criteria are one of the most widely used tools for diagnosing delirium, but these tend to be used by psychiatrists.

Delirium is prevalent in older people and is recognized as acute brain failure. Being an acute change in cognition, it is a challenging condition with a significant risk of death (Pryor & Clarke, 2017). Its multifactorial emergency nature requires a quick assessment (Abreu, 2020).

The Nursing Delirium Screening Scale (Nu-DESC) is a delirium assessment scale designed to be a rigorous, simple, and accurate observational tool (Gaudreau et al., 2005). This instrument has already been translated and validated for the Portuguese population, but only for intensive care settings (Abelha et al., 2013). However, the orthopedic surgical inpatient unit has different characteristics from intensive care units.

Ho et al. (2022) suggested that further psychometric assessment studies should be conducted because, despite the high sensitivity and specificity of the Nu-DESC in this study, there were some more disparate values due to geographical heterogeneity. Thus, carrying out this study in another context, Portugal, also justifies the relevance of this study in a surgical context in our country.

Thus, since no instrument for the nursing assessment of delirium in surgical settings and validated for the Portuguese population was found in the literature, the objective of this study was to assess the psychometric properties of the Portuguese version of the Nu-DESC in surgical settings, specifically in an orthopedic and traumatology unit.

Background

The reality of healthcare, particularly Nursing, is changing due to population aging. There is a renewed need for nurses to provide clinically competent, appropriate, and timely care to patients with mental and physical health needs (Pryor & Clarke, 2017).

An increase in the incidence of proximal femur fracture is related to population aging. The incidence of the diagnosis in 1990, which was 1.7 million, is estimated to increase to 6.3 million by 2050, and a major associated complication is the development of postoperative delirium during hospitalization (Gonçalves et al., 2018; Qi et al., 2022). In surgical services, the incidence of delirium is particularly high, especially in older adults undergoing surgery with a proximal femur fracture. This pathology is more common in orthopedic services, where the prevalence is around 50% (Jeon & Sohng, 2021).

According to changes in the psychomotor behavior of the patient, delirium can be classified into subtypes: hypoactive, hyperactive, or mixed. In hyperactive delirium, the patient is hypersensitive to stimuli, and psychomotor activity is increased. In hypoactive delirium, sensitivity and psychomotor activity are decreased. A patient may also alternate periods of agitation with lethargy throughout the day, in which case the patient has mixed delirium (Bisinotto et al., 2017).

Delirium affects patients, their families, and the healthcare system, resulting in emotional, functional, and financial consequences. It also leads to longer hospital stays, increased mortality and morbidity, and, consequently, increased healthcare costs (Çınar & Aslan, 2019; Mosharaf et al., 2022).

Research question

Is the Portuguese version of the Nu-DESC valid and clinically feasible to assess delirium in postoperative surgical inpatients?

Methodology

This study is reported according to the STROBE - Strengthening the Reporting of Observational Studies in Epidemiology - guidelines (Von Elm et al., 2007). A methodological study was conducted in an orthopedics and traumatology unit of a public hospital in northern Portugal. The study included patients who met the following inclusion criteria: a) aged 65 years or older; b) medical diagnosis of proximal femur fracture; and c) treated in the unit during the entire hospitalization period. No sampling technique was used since, during the data collection, the entire accessible population that met the inclusion criteria and agreed to participate in the study was included. It was determined a priori that, as recommended by Nunnally and Bernstein (1994), the sample should consist of a minimum of 50 participants (10 participants per item).

Data collection took place over eight months, from 1 May 2021 to 14 January 2022, and informed consent was requested from the patient or, when the patient lacked the capacity for self-determination, from the legal representative. The study was previously approved by the Ethics Committee of the hospital where data collection took place, with the number 82/CES/JAS.

The Nu-DESC is a short, easy-to-use, and simple instrument based on the nurses' observations of the patient's behavior during their shifts, with a completion time between 1 and 2 minutes. Five delirium symptoms (disorientation, inappropriate behavior, inappropriate communication, illusions/hallucinations, and psychomotor retardation) are rated from 0 to 2 depending on their severity, with a total score ≥ 2 indicating the presence of delirium (Gaudreau et al., 2005). In addition, the instrument has been validated in several countries and contexts and is intended for exclusive use by nurses

(Çınar & Aslan, 2019; Ho et al., 2022).

A recent systematic review and meta-analysis assessing the accuracy of this instrument concluded that it could be considered an accurate tool for diagnosing delirium due to its high sensitivity and specificity and reliable psychometric properties (Ho et al., 2022).

Three delirium assessment tools were used for data collection: i) the Nu-DESC, an instrument that we aimed to validate for surgical settings; ii) the Confusion Assessment Method (CAM), a delirium assessment instrument validated for the Portuguese population (Sampaio and Sequeira, 2013); and iii) the DSM-5 criteria. These three delirium screening and diagnosis instruments were used to verify whether there was an agreement between the results obtained by the instrument in the validation process for surgical settings (Nu-DESC), an instrument already validated for the Portuguese population for delirium screening (CAM), and the application of the diagnostic criteria for delirium agreed upon at a global level (DSM-5). Specifically, CAM is an observer-completed instrument composed of four items which, in its Portuguese version, had a sensitivity of 67% and a specificity of 97% for the diagnosis of delirium (Sampaio & Sequeira, 2013). On the other hand, the Nu-DESC is an instrument that, in its original version (Gaudreau et al., 2005), had a sensitivity of 86% and a specificity of 87% for the diagnosis of delirium. In its Portuguese version, validated for intensive care settings, the instrument had a sensitivity of 100% and a specificity of 86% (Abelha et al., 2013).

With regard to the data collection procedure, between the first and the third postoperative day, at the end of the morning shift, the presence of delirium was assessed through the CAM by one of the nurse researchers, the Nu-DESC by another nurse researcher and the nurse caregiver responsible for the patient on that shift (to assess interobserver agreement), and the DSM-5 criteria by a psychiatrist. These evaluations were performed independently and sequentially to minimize potential biases. It is important to emphasize that the nurses from the orthopedics and traumatology unit who applied the instruments received previous training for this purpose provided by research team members.

With regard to data analysis, the validity of the Nu-DESC was assessed by calculating its sensitivity, specificity, and predictive values, with the respective 95% confidence intervals, compared with the assessment performed by a nurse researcher using the CAM and with the assessment performed by a psychiatrist (using the DSM-5 criteria for the diagnosis of delirium). ROC curve analyses were also performed, including evaluating the cut-off points using the Youden index. The reliability of the instrument was also evaluated by calculating Cronbach's alpha.

Agreement between raters using the Nu-DESC was esti-

mated (comparison between nurse researchers and nurse caregivers) using percentages of absolute agreement with the respective 95% confidence intervals for each instrument item. Agreement between raters who used the Nu-DESC was calculated for their total score using the intraclass correlation coefficient. All statistical analysis was performed using IBM SPSS Statistics, with a significance level set at 0.05.

Results

Sample characterization

A psychiatrist and nurses (researchers and caregivers) performed 81 concomitant patient assessments using the Nu-DESC and CAM scales and applying the DSM-5 criteria for the diagnosis of delirium over eight months. As regards the sample characterization, 76.5% of the assessed patients were female, with a mean age of 82.48 years ($SD = 7.83$). Based on the CAM, delirium was diagnosed in 36 out of 81 patients (44.4%), and according to the application of the DSM-5 criteria, delirium was diagnosed in 34 out of 81 patients (42.0%).

Sensitivity, specificity, and ROC curve analysis

With a positive score (presence of delirium), corresponding to Nu-DESC ≥ 2 , the sensitivity of the instrument was 92% (95% CI [76%, 98%]) compared to CAM. When compared to the application of the DSM-5 criteria for the diagnosis of delirium by a psychiatrist, the sensitivity of the Nu-DESC was 91% (95% CI [75%, 98%]). With a negative score (absence of delirium), corresponding to Nu-DESC < 2 , the specificity of the instrument was 98% (95% CI = [87%, 100%]) compared to CAM. When compared to the application of DSM-5 criteria for the diagnosis of delirium by a psychiatrist, the specificity of the Nu-DESC was 94% (95% CI [81%, 98%]).

The positive predictive value of Nu-DESC compared to CAM was 97% (95% CI [83%, 100%]). Its negative predictive value compared to CAM was 95% (95% CI [81%, 98%]). Compared to the DSM-5 criteria for the diagnosis of delirium applied by a psychiatrist, the Nu-DESC had a positive predictive value of 91% (95% CI [75%, 98%]) and a negative predictive value of 94% (95% CI [81%, 98%]).

Figure 1 illustrates the predictive validity of the Nu-DESC, using the ROC curve, concerning the diagnosis of delirium (vs. absence of delirium) resulting from the application of the CAM. The evaluation by the nurse researchers resulted in an area under the ROC curve (AUC) of 0.95 (95% CI [0.89, 1.00]; $p < 0.01$). The assessment by the nurse caregivers obtained an AUC of 0.99 (95% CI [0.96, 1.00]; $p < 0.01$).

Figure 1

ROC Curves for the Assessment of Delirium by Nurse Researchers and Nurse Caregivers with the Nu-DESC Compared to CAM

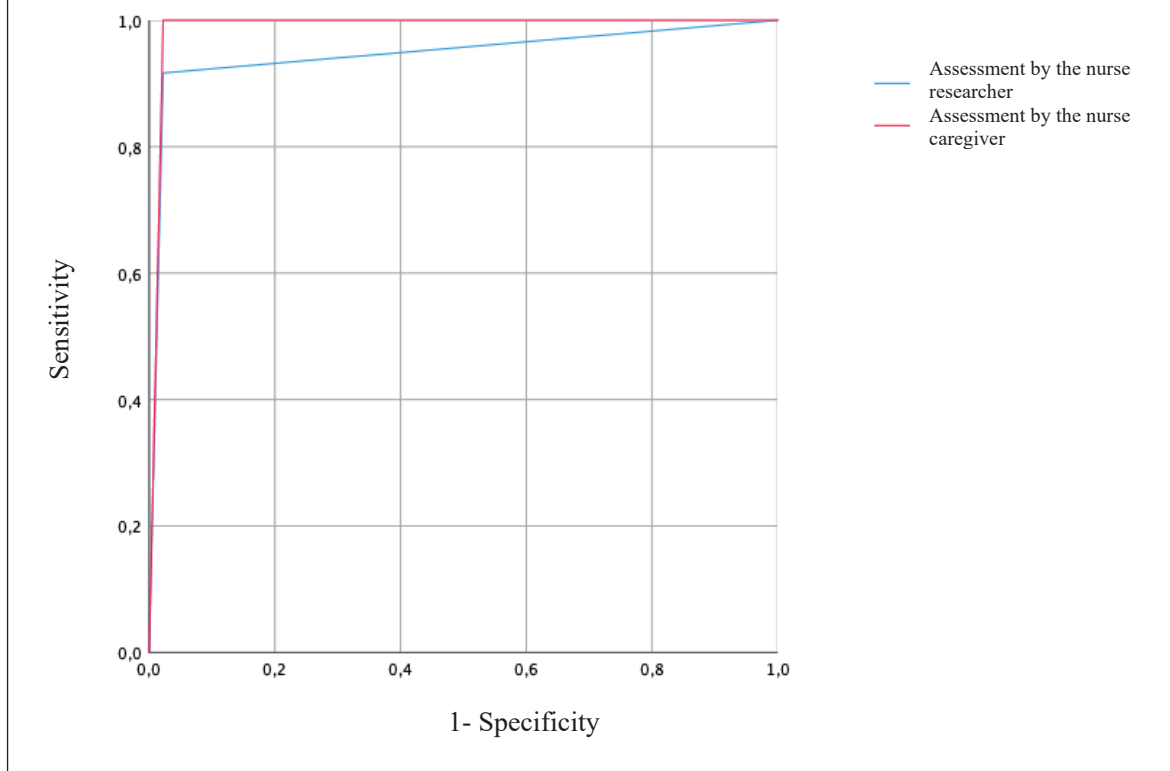
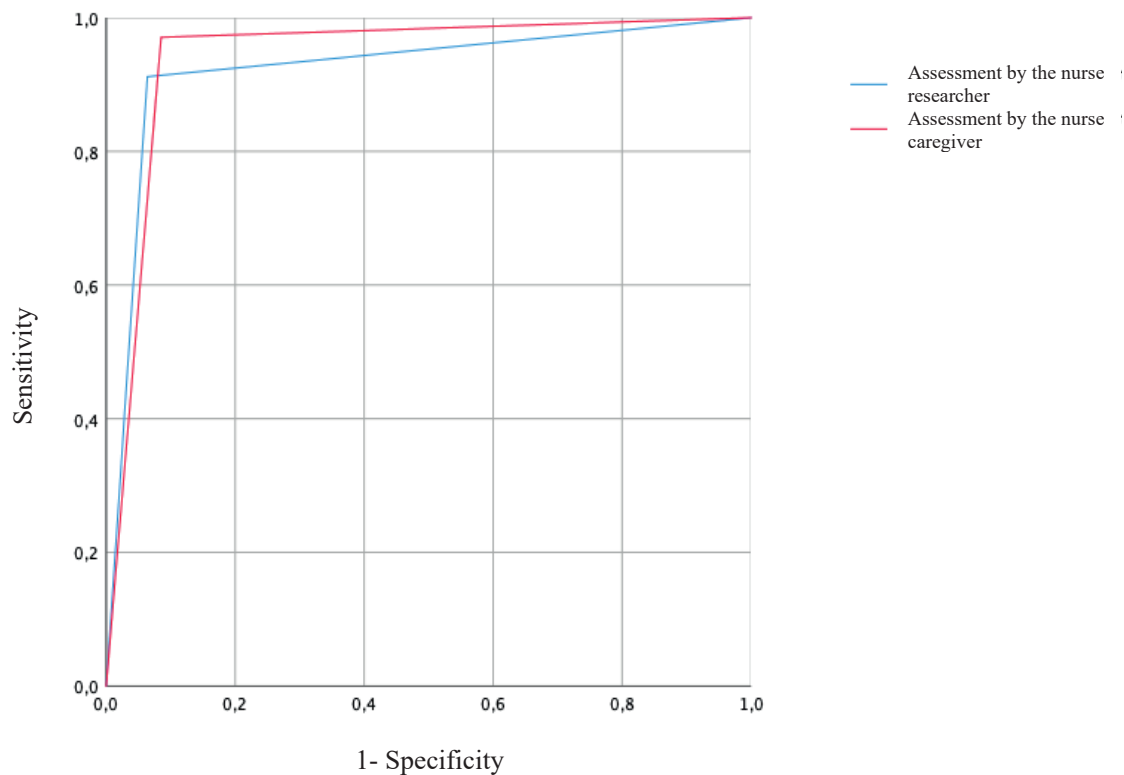


Figure 2 illustrates the predictive validity of the Nu-DESC, using the ROC curve, concerning the diagnosis of delirium (vs. absence of delirium) resulting from the application of the DMS-5 criteria for the diagnosis of

delirium by a psychiatrist. The nurse researchers' assessment resulted in an AUC of 0.92 (95% CI = [0.86, 0.99]; $p < 0.01$). The nurse caregivers' assessment obtained an AUC of 0.94 (95% CI = [0.89, 1.00]; $p < 0.01$).

Figure 2

ROC Curves for the Assessment of Delirium by Nurse Researchers and Nurse Caregivers with the Nu-DESC Compared to the Application of the DSM-5 Criteria for the Diagnosis of Delirium



The cut-off points for the ROC curves represented in Figure 2 were analyzed. This analysis showed that the Nu-DESC cut-off points with the highest Youden index correspond to the value 1.5.

Reliability and agreement

The Cronbach's alpha of the Nu-DESC was similar between nurse researchers' and nurse caregivers' application of it

(0.86; 95% CI [0.73, 0.88] vs. 0.89, 95% CI [0.80, 0.91]). In the 81 observations performed, all absolute agreement values between nurse researcher/nurse caregiver for the items of the Nu-DESC scale were high (≥ 0.76). For all patient assessments, the agreement between nurse researcher/nurse caregiver was high (Table 1). The intraclass correlation coefficient for the nurse researcher/nurse caregiver agreement for the Nu-DESC total score was 0.96 (95% CI [0.93, 0.07]).

Table 1

Agreement Between Nurse Researchers/Nurse caregivers For Each Item of the Nu-DESC Calculated by Absolute Agreement Ratios (n = 81)

Nu-DESC items	Absolute agreement ratios (95% CI)
Disorientation	0.96 (0.94; 0.97)
Inappropriate behavior	0.95 (0.91; 0.96)
Inappropriate communication	0.97 (0.95; 0.98)
Illusions/hallucinations	0.76 (0.63; 0.85)
Psychomotor retardation	0.82 (0.73; 0.89)
Delirium (total score ≥ 2)	0.96 (0.94; 0.98)

Note. CI = Confidence Interval.

Discussion

This study aimed to assess the psychometric properties of the Nu-DESC in a surgical inpatient setting in Portugal, specifically in an orthopedics and traumatology unit. The results show the high sensitivity and specificity of the instrument applied by nurses for delirium diagnosis. In 2013, Abelha et al. had already conducted a study to validate the Nu-DESC for the Portuguese population. However, data collection was limited to an intensive care unit in this case. According to the authors, the Nu-DESC had a sensitivity of 100% and a specificity of 86%, and the Intensive Care Delirium Screening Checklist was used for comparison. This study obtained lower values for sensitivity but higher values for specificity. Still, all these values were above 90%, which underlines the high sensitivity and specificity of the Nu-DESC in the surgical setting. However, these comparisons should be made with caution, given that the assessment instruments used for comparison purposes are not the same in this study as in the one conducted by Abelha et al. (2013).

In another study carried out in a traumatology unit in the Czech Republic, the sensitivity presented by the Nu-DESC was 92.7%, and the specificity was 96.5% (Ševčíková et al., 2021), values closer to those obtained in this study. Even so, and once again, the interpretation of the results should be performed with caution since, for comparison purposes with the Nu-DESC, in the study conducted by Ševčíková et al., the assessment instrument used (Delirium Observation Scale) was also different from those used in this study.

In another study with a high level of evidence (systematic literature review with meta-analysis), which included 2062 surgical patients, the Nu-DESC showed a sensitivity of 73% and a specificity of 93% (Ho et al., 2022).

The optimal cut-off point found (1.5) for the Nu-DESC is close to that recommended by the authors of the instrument (Gaudreau et al., 2005).

Thus, when comparing the psychometric properties of the Nu-DESC obtained in this study with those found in previous studies, the results tend to be similar. Nevertheless, the assessment of some psychometric properties, such as the sensitivity and specificity of an instrument, always needs comparison with the results obtained in another assessment instrument, and no study was found in the literature in which CAM and the DSM-5 criteria were used for comparative purposes.

One of the main strengths of this study was the use of two delirium diagnostic strategies for comparative evaluation of the psychometric properties of the Nu-DESC.

Because the study was planned based on the consultation of literature on delirium and its assessment tools, the authors chose to use CAM, a delirium screening tool (Sampaio & Sequeira, 2013), which is widely used and recognized (Abelha et al., 2013), as a comparative instrument. Some authors even consider that delirium should be considered the seventh vital sign (Pryor & Clarke, 2017), although, naturally, this deserves further analysis and reflection.

Although the study has strong points, such as those mentioned above, it has some limitations. The potential limitation is the sample size, which limits the power of the test to detect minor differences, despite being in line with the recommendations by Nunnally and Bernstein (1994). Another potential limitation is that data were collected in a specific surgical context (orthopedics and traumatology unit) and exclusively in patients with a medical diagnosis of proximal femur fracture.

Conclusion

The validation of the Nu-DESC in an orthopedics and traumatology service confirmed the validity and reliability of the instrument for use in surgical settings. The results confirmed that the scale has a high sensitivity and specificity for assessing delirium, specifically in postoperative surgical inpatients.

Thus, integrating the Nu-DESC into nursing clinical practice for assessing delirium is recommended, as it is a short-use, simple, and accurate assessment tool specifically designed for nurses. In addition, and for the reasons already mentioned, it also seems relevant to include content related to the Nu-DESC in undergraduate nursing curricula and some master's programs leading to the award of the professional title of nurse specialist.

Studies should also be conducted in other surgical settings and even in other orthopedic and/or traumatology services to compare the results and increase the robustness of the psychometric analysis of the instrument. Finally, future studies should use larger samples.

Orthopedics and traumatology services are surgical services in which a significant percentage of older adult patients at risk of developing delirium are admitted. The patient with delirium becomes a constant challenge, not only for nurses but also for the interdisciplinary team facing this reality on a daily basis. Therefore, there is a clear need for the early detection of patients with delirium, the identification of the causes of delirium, and the definition of strategies to deal with these patients to achieve a Nursing care practice of excellence.

Author Contributions

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