Evaluation of Pain and Accuracy Diagnostic in Hospitalized Children

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Pain is a symptom that occurs in over 50% of hospitalized children aged 4-14 years with a history of moderate to severe pain. During a hospital stay, children are subjected to a variety of procedures inherent to the diagnostic and therapeutic process that can induce pain and suffering (Teixeira, 2006). Although pain in children has been studied for over three decades, hospitalized children must still deal with inadequate pain control (Beyer, 2000; Kotzer, 2000). Studies confirm that pain is underestimated and underreported (Duignan & Dunn, 2008; Tecla, Hayashida, & Lima, 2008).

In this scenario, accurate nursing assessment strategies should be implemented with the objective of minimizing the suffering of hospitalized children with a nursing diagnosis (ND) of acute pain (Ferreira, Predebon, Cruz, & Rabelo, 2011). The accuracy of this diagnosis has been little explored in the literature, as has the role of training in the implementation of clinical nursing assessment of children in vulnerable situations. Considering this context, the current literature stresses that nurses’ evaluations and interpretations in the pursuit of accuracy when choosing an ND are an essential aspect of the implementation
of improved pain control interventions (Carlson, 2004).

Advancements in nursing knowledge suggest that nurses’ evaluations in clinical practice vary. Studies that seek to evaluate diagnostic accuracy are crucial to legitimizing the choice of one diagnosis over another in a specific clinical scenario (Carlson, 2004).

At the institution under study, a systematic evaluation for the integral care of children was implemented after the nursing staff was trained to assess pain as the fifth vital sign in pediatric units. This study was motivated by the need to assess the accuracy of nursing diagnoses of acute pain in this new environment before and after the implementation of a systematic evaluation of pain. The hypothesis of the study is that, after training in the assessment of pain in children and implementation of the study intervention (systematic evaluation of pain), the accuracy of nursing diagnoses of acute pain would increase. In short, the objective of the study was to determine the accuracy of the acute pain ND after implementation of a systematic evaluation of pain.

Methods

This before-and-after study was conducted in the pediatric units of a university hospital. Before-and-after, or pre/postintervention, designs are indicated when the study sample consists of patients who are undergoing an intervention or treatment. The investigator collects data on the outcome of interest (in this study, the accuracy of the acute pain ND as recorded in nursing notes) before an intervention (in this study, implementation of a systematic evaluation of pain as the fifth vital sign after a training period) and after the intervention, with a view to determining the behavior of the sample in response to the intervention. This enables determination of whether any changes in the outcome of interest were directly related to implementation of the intervention (Hulley, Schmidt, & Duncan, 2008).

Four units were included in this study: a pediatric intensive care unit (PICU), an inpatient unit and surgical clinic for children up to 3 years of age, an inpatient unit and surgical clinic for children up to 13 years of age, and a pediatric oncology unit for all ages. The intervention used was the implementation of systematic pain evaluation.

The sample consisted of 712 medical records of children with a hospital diagnosis of acute pain. From this sample, 549 records were included in this study; 167 were excluded because they involved hospitalized children older than 13 and did not follow the nurse’s process during the acute pain diagnosis. Accuracy was assessed by the Nursing Diagnosis Accuracy Scale (NDAS), which was developed and validated by researchers in Brazil to estimate the level of a diagnostic affirmation and whether it is sustained in the clinical information in patient records. The appropriate use of this tool requires the evaluator to have sufficient and clear knowledge of the concepts and terms used in the scale, appropriate training for its use, and an in-hand diagnosis classification (Matos & Cruz, 2009). The NDAS consists of four dichotomous items, which assess the presence of indicators to the diagnosis, and whether these indicators are relevant, specific, and consistent. In the presence of indicators item, indicators are defined as patients’ manifestations that represent indications, traces, or signs and symptoms of the diagnosis being evaluated. The relevance of indicators considers whether the level of an indicator (or a set of indicators) is appropriate for the indication of the diagnosis under evaluation. The specificity of the indicator consists of the extent to which an indicator (or a set of indicators) is consistent with the diagnosis under evaluation. Coherence is the extent to which an indicator (or a set of indicators) is consistent with the diagnosis under evaluation and with the information available. The potential score of each category in the scale ranges from 0 to 13.5, and can be categorized into null (0), low (1), moderate (2, 4.5, or 5.5), or high accuracy (9.0, 10.0, 12.5, or 13.5) (Matos & Cruz, 2009).
The accuracy of acute pain was assessed at two periods by a nurse trained in the use of the NDAS. In the preimplementation period, nursing teams were trained in systematic pain evaluation from December 2007 to October 2008. Training consisted of seven meetings, for a total of 37 hr of training, which were attended, on average, by 24.2 out of 57 nurses from the studied units. Although training included all members of the nursing team (registered nurses and nurse technicians), the NDAS was only applied to notes made by nurses. Strategies such as expository-dialogue classes and discussion forums were used to sensitize the team to pain management. The training addressed conceptual content about pain, the neuropathophysiology of pain, analgesic management, and the use of the Children’s and Infant’s Postoperative Pain Scale (Alves et al., 2008; Büttner & Finke, 2000) and the Visual Analogue Scale (Huskisson, 1974) for the evaluation of pain intensity according to pediatric age range. Lecturers were hospital nurses who were members of the Grupo de Estudos da Dor em Pediatria (Pediatric Pain Study Group). The intervention in this study was the implementation of the systematic evaluation of pain as the fifth vital sign. After the implementation of this intervention, all nurses, regardless of whether they had taken part in training, were instructed to record their clinical evaluations of pain, including reports and manifestations of pain by the child, in patient records. Therefore, the postintervention period began in October 2008.

Data were collected from the nursing records with the subsequent application of the NDAS (Matos & Cruz, 2009). The defining characteristics described in NANDA-International (NANDA-International, 2009) and the prescription of fixed or intermittent analgesia were accepted as indicators to the diagnosis. The study was approved by the ethics committee of the institution, and the authors signed a Term of Use for record data due to the impossibility of patients signing the consent form.

**Data Analysis**

The statistical analysis was conducted with the Statistical Package for the Social Sciences version 18.0 (SPSS Inc., Chicago, IL, USA). For continuous variables, we used the mean and standard deviation or the median (quartiles 25–75). Categorical variables were expressed as frequencies and percentages. The results of the accuracy category were evaluated over time by the chi-square test of linearity. A t test and a Mann–Whitney test were used to compare continuous data. A chi-square test was used to compare accuracy categories between the two periods. To assess the difference between the categories and between the units in the pre- and post-periods, the results were considered statistically significant if $p < .05$ with a 95% confidence interval. When necessary, the procedure for multiple Tukey-type comparisons was used to identify the differences identified by the chi-square using the program Win-Pepi (Abramson, 2004).

**Results**

Initially, a query was made of all NDs cited in the pediatric admissions records of the four units under study. This query revealed 5,500 admissions in the period of interest. A total of 11,992 different NDs were made in these patients, and the diagnosis of acute pain accounted for 6.1% of these NDs. In the preimplementation phase, acute pain was established as a diagnosis in 12.7% of 5,500 admissions, increasing significantly to 19% in the postimplementation period ($p < .001$).

The sample consisted of 549 records: 228 (41.5%) corresponded to the preimplementation period, and 321 (58.5%) corresponded to the postimplementation period. Fifty percent of the children were between 4 and 5 years of age, and most of the children were hospitalized due to clinical causes in both periods. Fifty percent of the children remained hospitalized for 10 days. There was no difference between the units in the number of children’s records evaluated.
There was no significant statistical difference for any examined variable, as shown in Table 1. Continuous variables are presented as medians (interquartile range), and categories are expressed as n (%).

Table 2 shows the NDAS scale items separately in assessments conducted in the pre- and postimplementation phases. In dichotomous responses, a higher frequency of responses confirms the item. Over 60% of the diagnostic processes included indicators to the diagnostic study. The relevance and specificity of the diagnoses was moderate to high for most of the records. We observed the highest frequency of the high category, followed by null, moderate, and low. We observed that the increase in the moderate accuracy category between the pre- and postimplementation phases was substantial, but the high category decreased by approximately 10%. A smaller percentage of variation occurred for the null and low categories, with a trend toward the difference between the categories and the evaluation period, \( p = .05 \). Of the evaluated records with an acute pain diagnosis, the researcher supported the diagnosis in more than 90% of the cases in which an indicator was present.

### Table 1. Sample Characteristics of Children With Acute Pain Nursing Diagnosis

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pre (n = 228)</th>
<th>Post (n = 321)</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender (male)</td>
<td>130 (57)</td>
<td>179 (56)</td>
<td>.77*</td>
</tr>
<tr>
<td>Age (years)</td>
<td>5 (2–8)</td>
<td>4 (1.1–8)</td>
<td>.24*</td>
</tr>
<tr>
<td>Clinical ward</td>
<td>141 (61.8)</td>
<td>178 (55.5)</td>
<td>.13*</td>
</tr>
<tr>
<td>Surgical ward</td>
<td>87 (38.2)</td>
<td>143 (44.5)</td>
<td></td>
</tr>
<tr>
<td>Start of ND and hospitalization day</td>
<td>2 (1–5)</td>
<td>2 (1–5)</td>
<td>.97*</td>
</tr>
<tr>
<td>Days of hospitalization</td>
<td>10 (6–22)</td>
<td>10 (5–21)</td>
<td>.67*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unit</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Intensive care unit</td>
<td>33 (14.5)</td>
<td>56 (17.4)</td>
<td>.45*</td>
</tr>
<tr>
<td>2 Inpatient unit 10° North</td>
<td>78 (34.2)</td>
<td>92 (28.7)</td>
<td></td>
</tr>
<tr>
<td>3 Inpatient unit 10° South</td>
<td>68 (29.8)</td>
<td>107 (33)</td>
<td></td>
</tr>
<tr>
<td>4 Inpatient unit 3° East</td>
<td>49 (21.5)</td>
<td>66 (20)</td>
<td></td>
</tr>
</tbody>
</table>

*Pearson’s chi-square test.
*Mann-Whitney statistical test.
ND, Nursing Diagnosis.

### Accuracy of Acute Pain ND in the Evaluation Period (December 2007–December 2009)

Figure 1 shows the accuracy category during this period. It is noteworthy that the highest percentage of moderate/high accuracy was found in April 2008 and August 2009. The highest percentage of null/low accuracy was found in the postimplementation period, in July and October 2009. In the comparison, we observed a trend toward a statistical difference between the categories during this period.

### Comparison of Accuracy Category Between Units: Moderate/High or Null/Low

Figure 2 shows the accuracy categories between the units during the study period. It is notable that for all units, the category moderate/high was predominant. There was a trend toward statistical difference between units one and two (\( p < .05 \)), and a significant difference between units one and three (\( p < .001 \)).
### Table 2. Prevalence of NDAS Items in Pre- and Postimplementation Periods of Pain Assessment

<table>
<thead>
<tr>
<th>Presence of indicator (n = 350)</th>
<th>Pre (n = 228)</th>
<th>Post (n = 321)</th>
<th>p^a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>137 (70.6)</td>
<td>213 (60.0)</td>
<td>.13</td>
</tr>
<tr>
<td>Relevance of indicator (n = 350)</td>
<td>133 (97.1)</td>
<td>209 (98.1)</td>
<td>.5</td>
</tr>
<tr>
<td>Low</td>
<td>4 (2.9)</td>
<td>4 (1.9)</td>
<td></td>
</tr>
<tr>
<td>Specificity (n = 350)</td>
<td>129 (94.2)</td>
<td>195 (91.5)</td>
<td>.3</td>
</tr>
<tr>
<td>Low</td>
<td>8 (5.8)</td>
<td>18 (8.5)</td>
<td></td>
</tr>
<tr>
<td>Consistency (n = 350)</td>
<td>118 (86.1)</td>
<td>178 (83.6)</td>
<td>.5</td>
</tr>
<tr>
<td>Low</td>
<td>19 (13.9)</td>
<td>35 (16.4)</td>
<td></td>
</tr>
<tr>
<td>Accuracy category (n = 549)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Null</td>
<td>75 (32.9)</td>
<td>124 (38.6)</td>
<td>.05</td>
</tr>
<tr>
<td>Low</td>
<td>4 (1.8)</td>
<td>5 (1.6)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>12 (5.3)</td>
<td>32 (10)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>137 (60.1)</td>
<td>160 (49.8)</td>
<td></td>
</tr>
<tr>
<td>Decision to maintain the diagnosis (n = 350)</td>
<td>Yes</td>
<td>130 (94.2)</td>
<td>193 (90.6)</td>
</tr>
</tbody>
</table>

^aPearson’s chi-square.

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**Figure 1. Accuracy Categories Along the Period in All Units. Chi-square for Linearity, \( p = .07 \)**

![Accuracy Categories along the period](image1.png)

**Figure 2. Accuracy Categories Per Unit. *Pearson’s chi-square***

![Accuracy Categories per unit](image2.png)
Discussion

This is one of the first studies to use the NDAS in a clinical environment. We evaluated the accuracy of establishing an ND of acute pain before and after the implementation of the systematic evaluation of pain in pediatric units. Although there was a significant increase in the occurrence of this diagnosis after the implementation of a pain assessment, accuracy did not follow the same trend.

With regard to diagnostic accuracy, we observed a trend toward statistical significance for the occurrence of moderate/high compared to null/low throughout the study period. In the preimplementation assessment of pain, there was a predominance of the moderate/high category, although it was not significant. However, in the postimplementation period, accuracy did not follow the same trend. When the four units were compared, there was a significant difference in the moderate/high category between unit one (PICU) and unit two (clinical-surgical unit), and between unit one (PICU) and unit three (clinical-surgical unit).

When the two periods are compared, the result related to the increased frequency of the diagnosis in the study is noteworthy. Other studies corroborate this result and underline the potential for the occurrence of this diagnosis in clinical nursing (Almeida, Araujo, & Ghezzi, 1998; Batista, Cruz, & Pimenta, 2008; Lucena & Barros, 2006). It should be noted that the increased frequency with which nurses established the diagnosis did not accompany an increase in diagnostic accuracy. The process in the nursing records lacked information; the indicators to the diagnosis were largely omitted from the records. We believe that the increased frequency of this diagnosis in the second period may have been stimulated by the training toward “making the pain visible,” which may have encouraged more nurses to establish this diagnosis. The nurses may have established the diagnosis based on evidence and indicators; however, these were not addressed at registration.

When the categories of accuracy were analyzed and compared in the pre- and post-periods, we confirmed the downward trend of the moderate/high category in all units. Although the diagnosis of acute pain was established more frequently, the indicators supporting this diagnosis were not recorded at the same frequency. In Brazil, using a different instrument, the Lunney Scoring Method Rating (LSM) (Lunney, 1990), and assessing accuracy in hypothetical clinical cases, the authors identified that approximately 21% of the determination of a diagnosis was based on a single indicator (Cruz & Peres, 2003). In another study, also with LSM, 76% of the assessed diagnoses had low precision (Marini & Chaves, 2011). More recently, a randomized study conducted in Japan used LSM to assess the difference in diagnostic accuracy between two groups, one that used a computer system and the other that did not. No difference was observed between the groups, and the hypothesis that the system would assist in the improvement of accuracy was not confirmed (Kurashima, Kobayashi, Toyabe, & Akazawa, 2008).

Our study did not confirm the hypothesis that diagnostic accuracy increases after the implementation of the systematic evaluation of pain. We observed that the diagnosis under study was more accurate in the preimplementation phase than in the postimplementation phase. During the training, themes such as the application of scales, signs and symptoms presented by patients with pain, and the importance of systematically evaluating pain, regardless of complaints, were discussed. It is possible that in the preimplementation phase, the team was more sensitive to identifying the problem, both for its novelty and for the group’s mobilization as a whole. In the postimplementation period, there was a reduction of training hours and meetings between the team members to discuss issues related to the importance of assessing pain. These factors may have contributed to the reduced accuracy of the records, without prejudice in establishing the diagnosis.

Another significant aspect in the development of the study was the turnover of 14 nurses among the inpatient units during the period of the study. Of
these 14 nurses, three went through three different units during the study. Seven of these nurses (50%) did not undergo the training in pain assessment. However, they received on-the-job institutional training specific to each unit.

When the accuracy in the postimplementation period was evaluated, we observed a significant difference between units one and two, and units one and three. The proportion of nurses to patients in the intensive care unit (unit one) was greater than in the inpatient units in the studied institution. This proportion may allow the assessment records in the PICU to be updated more frequently and with more detail than in the inpatient unit, mainly due to the instability of the patients. A comparison of ICU nursing records and records in other medical and surgical units confirms these findings (Carlson, 2004). A study on the quality of nursing records in units of medical-surgical clinics found that only 50% of the records were considered complete (Setz & D’Innocenzo, 2009). A multicenter study in the Netherlands confirmed this trend: of 341 records evaluated, 50% documented all stages of the nursing process, of which 28% were considered complete. Importantly, reliable written data for the collected diagnoses were found in 50% of the cases (Paans, Sermeus, Nieweg, & Van Der Schans, 2010).

Study Limitations

The authors believe the hiring of new nurses during the postintervention period constitutes a limitation, as does the involvement of nurses who did not take part in the specific training sessions.

Conclusions and Clinical Implications

We conclude that the diagnosis of acute pain increased significantly in the postimplementation phase of the systematic evaluation of pain.

The accuracy of the diagnosis of acute pain followed a trend toward moderate/high throughout the study period, but 4 months later, the accuracy was predominantly null/low.

The increased occurrence of the ND of acute pain was a significant and positive finding, as nurses made this diagnosis more often after implementation of a systematic evaluation of pain. We conclude that the result was statistically significant, with moderate diagnostic accuracy, and, we believe, clinically relevant. Furthermore, we would like to stress that training promotes greater awareness in clinical assessments related to the theme presented in training, and enables hands-on acquisition of new knowledge; however, this may not be reflected by the quality of nursing records in the short term.

When comparing the two periods, we found that the category of moderate/high accuracy dominated in 60% of the cases in the period in which the training took place, when, in fact, the pain had not yet been systematically assessed. With the subsequent implementation of the systematic evaluation of pain, the same category decreased by approximately 10%.

We emphasize the significant difference in the moderate/high category when comparing the units. Unit one (ICU) had higher percentages of this category when compared with the inpatient units, unit two \( p < .05 \) and unit three \( p < .001 \).

Future studies are needed to develop strategies to improve the quality of nursing records in the establishment of diagnoses in clinical practice, teaching, and research. Accurate and early nursing diagnoses contribute to more effective interventions and to better outcomes for patients.

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References

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