The Dutch pressure sore assessment score or the Norton scale for identifying at-risk nursing home patients?

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Abstract

Objective: to investigate the usefulness of a Dutch pressure sore risk assessment scale—the Centraal Begeleidingsorgaan voor de Intercollegiale Toetsing (CBO; National Organization for Quality Assurance in Hospitals) score—in the detection of patients at risk of developing pressure sores after admission to a nursing home. As the Norton score is the standard method of risk assessment, we also investigated which score (Norton or CBO) has the stronger relationship to the development of pressure sores.

Design: longitudinal cohort design.

Patients: 220 nursing home patients, 80 men, 140 women, mean age 79 years (standard deviation 3).

Measures: admission assessments for the presence of pressure sores, CBO and Norton scores, preventive measures and demographic characteristics. We made observations every week for 4 weeks.

Main outcome measure: presence or absence of pressure sores.

Main results: 54 patients (25%) developed a pressure sore. A significant, nonlinear relationship was found between the CBO score on admission and the development of pressure ulcers for the first 2 weeks after admission. Multiple logistic regression analysis showed that only mobility (odds ratio = 3.6, P = 0.0001) and mental state (odds ratio = 2.0, P = 0.03) showed a significant relationship with the development of pressure ulcers. The CBO score was no better in risk assessment than the Norton score.

Conclusions: the CBO score can be used for assessment of the risk of developing pressure ulcers in the first 2 weeks after admission to a nursing home, but is no better than the Norton score. Since the Norton score is easier to use, it is slightly preferable for use in this setting. However, neither score is a good indicator of patients at risk. Physicians should not depend solely on risk scores when prescribing preventive measures.

Keywords: aged, Dutch (CBO) pressure sore assessment score, Norton scale, nursing home, pressure sore, risk assessment

Introduction

Pressure sores are a common problem. In residents of care homes, the prevalence ranges from 2.4 to 23% [1–3]. Incidence rates are similar [4–6]. Some people are at particular risk of pressure sores—for example, there is a prevalence of 66% among elderly patients admitted with femoral fracture [7]. There is an increased risk of developing a pressure sore [8, 9] in the first few weeks after admission to a health-care facility.

In the past 30 years, many scores have been developed to assess the risk of pressure sores, the Norton and Braden scores being the most extensively tested [8–15]. A new pressure sore risk score was recently introduced in the Netherlands by the Centraal Begeleidingsorgaan voor de Intercollegiale Toetsing (CBO; National Organization for Quality Assurance in Hospitals) [16]: details are shown in Table 1. Since the CBO score has never been evaluated, it is unclear whether it is suitable for risk assessment in nursing homes. The CBO gave no explanation of why they
introduced a new risk score. However, since their recommendations are generally accepted and followed in Dutch nursing homes and hospitals it is important to evaluate the scale and compare its value with other such assessment scales.

We have investigated the usefulness of the CBO score in the detection of patients at risk of developing a pressure sore after admission to a nursing home. To assess the optimum intervals at which to reassess this risk, we also investigated the time between risk assessment and development of pressure sores. Since the Norton score is the standard method of risk assessment, we also investigated which of the two scores had the stronger relationship with the development of pressure sores.

Patients and methods

Design

We carried out a cohort study to assess the relationship between the score on the CBO risk assessment scale on admission and the risk of developing pressure sores. We examined patients prospectively for the development of pressure sores for 4 weeks. We determined the admission CBO score retrospectively, based on the medical records. We assessed the Norton score on admission. The protocol was approved by the ethical review board of the Vrije Universiteit Hospital, Amsterdam.

Patients

We gathered data from a cohort of newly-admitted patients (n = 319) to an Amsterdam nursing home who met the following criteria: age above 64 years, not admitted for psychogeriatric care, examined for pressure sores within 48 h of admission, and informed consent obtained. Patients were excluded if they scored 3 in the CBO mental status scale (stuporose or comatose) or if mental status was considered impaired by the nursing home physician. If no re-examination took place (because of death or discharge), the patient was excluded from the analyses. We also excluded patients whose medical records could not be retrieved.

Measurements

Pressure sores

The staging of pressure sores was done according to the recommendations of the National Pressure Ulcer Advisory Panel [17]. Each patient was examined by a research physician within 48 h of admission. The patient was then re-examined weekly (or more often when the patient had intercurrent illness) by the same research physician to check for the development of new pressure sores.

Norton score

The Norton score is based on an ordinal scale containing five items: physical condition, mental condition, activity, mobility and incontinence [9]. For each item, a value of 1 (worst condition) to 4 (best condition) is scored. The sum of the five separate items represents the total Norton score, which varies from 5 to 20. Nurses assessed the Norton score on admission.

CBO score

The CBO score was developed in the Academic Hospital in Utrecht. It consists of 10 items. For each item, with the exception of the item ‘neurology’, a score from 0 and 3 is given. A score of 3 indicates a maximum risk of developing pressure sores for that specific item, a score of 0 indicates minor risk. The item ‘neurology’ has a slightly different score range, as can be seen in Table 1. The possible values of the CBO score are: 0–29, 31, 33, 36 and 39. The CBO score on admission was assessed retrospectively by a research physician (other than the one who examined the patient for the presence of pressure sores) based on the medical records.

Prevention

Specific measures for the prevention of pressure sores were prescribed by the nursing home physicians, who were unaware of the results of the examinations made by the research physician. These were based on subjective clinical assessment. Preventive measures were defined as all measures (other than standard nursing care) which could influence the duration or intensity of the pressure received or which may decrease friction between skin and bed. Preventive measures were not prescribed using a standard protocol, but based on the clinical experience of the nursing home physicians. Prevention was registered dichotomously by the examining research physician.

Analysis

Gender distribution and pressure sore incidence in the group of patients for whom the medical records could not be retrieved were compared with that in the group of patients for whom the medical records could be retrieved, using a $t^2$ test. Mean age was compared by using the Mann–Whitney test.

The risk of developing pressure sores was determined by calculating the incidence of patients with new pressure sores during follow-up.

To determine the relationship between the CBO score and the risk of developing pressure sores, we performed logistic regression analysis, checking for nonlinearity in this relationship. Since we expected this relationship to weaken in time, we also carried out
this analysis separately for pressure sores which developed during the first and last 2 weeks of the follow-up period. All analyses were made with and without the inclusion of prevention as a potential confounder.

We performed stepwise backward multiple logistic regression analysis to determine the relative contribution of each separate item of the CBO score to the total value of the score in predicting the development of pressure sores. This analysis was carried out for the follow-up period during which the relationship between the CBO score and the development of pressure sores was the strongest.

To determine whether the CBO score is a better indicator of patients at risk for developing pressure sores than the Norton score, we did logistic regression analysis to determine the relationship between the Norton score and the risk of developing pressure sores, including prevention as a possible confounder. The model \( \chi^2 \) of both analyses were compared. We calculated sensitivity and specificity from both the Norton score and the CBO score for each possible outcome and plotted in a receiver operating characteristics (ROC) curve. For each test, \( P \)-values < 0.05 were considered to be significant.

## Results

From the cohort of 319 patients, 267 were re-examined for the development of pressure sores (10 patients refused to take part in the study, 16 died or were discharged before it was possible to do the first follow-up examination, 16 were unable to give informed consent and 10 could not be examined within the study period). We retrieved medical records or sufficient information to determine the CBO score on admission for only 220 patients [mean age (SD): 79 (3) years; 80 men, 140 women]. The group of patients whose medical records could not be retrieved did not differ from whose records were obtained.

The patient frequency for each outcome of the CBO score is shown in Figure 1. Pressure sore development and the frequency of preventive measures provided are presented in Table 2. Of the 54 patients who developed

![Figure 1. Number of patients by CBO score (n = 220).](image)

### Table 1. Items and categories of the CBO score for pressure sore risk assessment

<table>
<thead>
<tr>
<th>Score</th>
<th>Mental status</th>
<th>Neurology</th>
<th>Mobility</th>
<th>Nutritional status</th>
<th>Nutritional intake</th>
<th>Incontinence</th>
<th>Age</th>
<th>Temperature</th>
<th>Medication</th>
<th>Diabetes mellitus</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal (109)</td>
<td>Normal (40)</td>
<td>Normal (8)</td>
<td>Good (170)</td>
<td>No help (174)</td>
<td>None (130)</td>
<td>&lt; 50 (0)</td>
<td>&lt; 37.5 (202)</td>
<td>None (76)</td>
<td>None (175)</td>
</tr>
<tr>
<td>1</td>
<td>Listless; depressed; disoriented; anxious (98)</td>
<td>Minor disturbances; strength impairment (91)</td>
<td>Minor impairment; walks with help; wheelchair patient with good arm function (156)</td>
<td>Moderate; not eating for several days (40)</td>
<td>Parenteral feeding (1)</td>
<td>Occasionally of urine (32)</td>
<td>&gt; 50 (0)</td>
<td>&gt; 37.5 (14)</td>
<td>Corticosteroids, anticoagulants (18)</td>
<td>Diet only (10)</td>
</tr>
<tr>
<td>2</td>
<td>Severe depression; psychotic; confused; totally apathetic (13)</td>
<td>Sensory disturbances; minor hemipareses (44)</td>
<td>Bedridden, only out of bed for washing or bed cleaning: passive in chair all day (67)</td>
<td>Poor, not eating for more than a week, with vomiting and diarrhoea (9)</td>
<td>Tube-feeding; no appetite; does not want to eat (44)</td>
<td>Urine; faeces in case of catheter (34)</td>
<td>&gt; 60 (21)</td>
<td>&gt; 38.5 (3)</td>
<td>Sedation, analgesia, tranquillisers, oral antibiotics (125)</td>
<td>Diet and oral medication (19)</td>
</tr>
<tr>
<td>3</td>
<td>Stuporose, comatose (0)</td>
<td>Hemipareses, spinal lesion—under T6 or above T6 (45)</td>
<td>Completely bedridden (9)</td>
<td>Cachectic, as in terminal cancer (1)</td>
<td>None (1)</td>
<td>Completely incontinent (24)</td>
<td>&gt; 70 (199)</td>
<td>&gt; 39 or &lt; 35 (1)</td>
<td>Parenteral (1)</td>
<td>Diet and insulin (16)</td>
</tr>
</tbody>
</table>

\( a \)Number of patients in the present study.

\( b \)Score: 3 \times 2 = 6 points; \( c \)Score: 3 \times 3 = 9 points; \( d \)Score: 3 \times 4 = 12 points.
a pressure sore during the first 4 weeks, 30% developed a stage I sore, 44% a stage II sore, 22% a stage III sore and 4% a stage IV sore. For those who developed a pressure sore despite preventive measures (n = 29), these figures were 17%, 45%, 34% and 3%.

The outcome of the CBO score showed a nonlinear relationship \[ y = -0.71 - 0.26b + 0.0177b^2 \] \((P < 0.01)\), where \( y = \log_e (p_{ulcer}/1-p_{ulcer}) \) with the risk of developing pressure sores during the first 4 weeks (Figure 2). The prescription of preventive measures did not significantly alter the strength of the relationship between the CBO score and the risk of developing pressure sores. A significant relationship was also found for the first 2 weeks after admission but could not be found for the third and fourth week \((P = 0.12)\).

The results of the stepwise backward multiple logistic regression show that only the items on mobility (odds ratio = 3.6, \(P = 0.0001\)) and mental state (odds ratio = 2.0, \(P = 0.03\)) have a significant relationship with the development of pressure sores. The \(\chi^2\) resulting from the logistic regression analysis of the CBO and Norton score did not differ (Norton score 29.3; CBO score 29.7). Figure 3 shows the ROC curves of both scores.

**Discussion**

We have demonstrated a positive, nonlinear relationship between the outcome of the CBO score and the risk of developing pressure sores. The value of the risk assessment on admission is limited to the first 2 weeks, since no significant relationship could be found between the CBO score and the development of pressure sores later than 2 weeks after the assessment. Since the calculated relative risks for this relationship in the first 2 weeks and in the second 2 weeks of the follow-up period did not differ greatly, it is possible that the absence of a relationship is due to a lack of power, resulting from the small number of pressure sore patients in our study.

We found that only the items on mobility and mental condition have a simultaneous relationship with the development of pressure sores. This does not mean that other factors have no relationship, but is a result of the characteristics of the population we studied. Nearly every patient in our study was over 70 and in a stable condition on admission. This implies that the items ‘age’ and ‘temperature’ in the CBO score on admission show little variation. Therefore, in this study, these factors do not play an important role in risk assessment. However, in other settings or populations, the differentiation within each item may be greater and the results of a study in other settings might differ from ours.

That 25% of the patients developed a pressure sore during the study period is not inconsistent with the incidence figures in other studies [4, 6]. Patients admitted to nursing homes are often frail and poorly mobile.

It is not surprising that impaired mobility is an important risk factor for the development of pressure sores. Many longitudinal studies state mobility as an important risk factor [18–21]. However, the role of ‘mental condition’ in the development of pressure sores, although also found in other cross-sectional studies, is not so clear [22]. Every patient with a score
of 3 on mental status was excluded and many with a score of 2 were also excluded. These patients will often have poor mobility and a low nutritional intake. Correlation analysis shows that the item ‘mental status’ is correlated with ‘mobility’ (P < 0.001), ‘nutritional intake’ (P < 0.001) and ‘incontinence’ (P < 0.01). The 13 patients with a score of 2 on the item ‘mental status’ who were included were—according to the opinion of their nursing home physician—able to give informed consent; had all patients been included regardless of their mental status, the relationship between mental status and the risk of developing pressure sores would have probably been higher.

Comparison of the CBO score with the Norton score is not helpful in deciding which risk score should be preferred. The ROC curves of both of the scores show a pattern that is far from ideal. An ideal risk assessment score which uses a cut-off point should have both high sensitivity and high specificity. Since the area under the curve of the Norton score is only slightly larger than that of the CBO score, it cannot be the preferred option on this basis. The argument for choosing the Norton score rather than the CBO score lies in its simplicity.

Our study has several limitations. A major confounding factor in the evaluation of risk scores is that patients at high risk of pressure sores are usually prescribed preventive measures. In the patients who were prescribed special measures, many (32%) still developed pressure sores. The susceptibility of these patients to pressure sores must have been very high. This is supported by our finding that of these 21 patients, six died during the study period and two had to be admitted to hospital (8/21 = 38%), whereas 10% of the remaining 199 patients in the study were discharged from the nursing home or died within the study period. The risk of developing pressure sores for this category of patients would probably have been even higher if preventive measures had not been prescribed. A problem with this item is that preventive measures were not prescribed using a standard protocol, but based on the clinical perception of the nursing home physicians. Using a standardized preventive strategy (based on CBO guidelines) may have lowered the incidence figures.

Another problem is that the items on most risk assessment scales are seldom clearly defined, which leaves room for subjective interpretation. A more detailed definition of all items of the scale would be necessary to obtain optimal reliability. The fact that quantitative data on different items are transferred into data of equal merit and added up to give a total score is also a weakness in risk scores.

We have shown that the CBO score can be used for assessment of the risk of developing pressure sores, but that it is no better than the Norton score. Since the latter is easier to score, we conclude that in nursing homes the Norton score is preferable. However, both scores are poor indicators of patients at risk. Doctors should not depend solely on the risk scores when considering measures to prevent pressure sores.

### Key points

- The Dutch pressure sore risk assessment score (CBO) can be used in the first 2 weeks after nursing home admission.
- The score is no better than the Norton scale, which is easier to use.
- In multiple logistic regression analysis of all 10 items of the CBO score, only the factors ‘mobility’ and ‘mental condition’ have a simultaneous relationship with the development of pressure ulcers.
- Neither score predicts all patients at risk for sores; clinical judgement is still needed.

### References


Received 4 December 1996; revised version received 28 January 1999; accepted in revised form 16 March 1999