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Development And Validation Of Prognostic Scale In Respiratory Condition for Physiotherapist in ICU

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Article

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Abstract

Introduction : An intensive care unit (ICU) is an organized system for the provision of care to critically ill patients that provides intensive and specialized medical and nursing care, an enhanced capacity for monitoring, and multiple modalities of physiologic organ support to sustain life during a period of acute organ system insufficiency.Intensive care is appropriate for patients requiring or likely to require advanced respiratory support, patients requiring the support of two or more organ systems, and patients with chronic impairment of one or more organ systems who also require support for an acute reversible failure of another organ. Respiratory conditions such as COPD, pneumonia, acute respiratory failure, etc may experience worsening of symptoms, more loss of functions, and often require hospital treatment or in severe cases admission to ICU

Objective: To design, develop, and validate the prognostic scale for respiratory conditions admitted in the ICU.

Methodology: The studies qualitative and cross-sectional component was conducted in 2 stages at the initial stage, relevant literature review was carried out to conceptualize conceptualize and define the theoretical framework.

Results: the content validity ratio of prognostic scale is 0.846 which indicates it has good reliability and the Kappa statistics (Cohens kappa) $p<0.05$ which shows the inter rater reliability of the newly developed has perfect agreement

Conclusion: In conclusion, this study successfully developed and validated a prognostic scale for assessing respiratory conditions in critically ill patients in the ICU. The scale demonstrated excellent content validity and inter-rater reliability, confirming its robustness as a prognostic tool for ICU physiotherapists.

Introduction

An intensive care unit (ICU), is a structured setting where patients receiving critical care receive multiple forms of physiologic organ support to maintain life during an acute phase of organ system insufficiency, as well as intensive and specialised medical and nursing care. (1)

Worldwide prevalence of respiratory conditions is 7.8% and most of these patients require ICU admissions at some point in their life span. (2)

Intensive care is appropriate for patients requiring or likely to require advanced respiratory support. Respiratory conditions such as COPD, pneumonia, acute respiratory failure, etc may experience worsening of symptoms, more loss of functions, and often require hospital treatment or in severe cases admission to ICU (3) (4). As these conditions are severe there is always prolonged ICU stay which leads to pulmonary complications such as pulmonary edema, atelectasis, lung collapse, hospital-acquired pneumonia, pleural effusion, etc (5). Patients may also suffer from musculoskeletal, neurological, and

psychological complications affecting their quality of life. To avoid these complications physiotherapist play an important role.

According to diagnosis model patients with disorders of the pulmonary system such as acute respiratory failure requiring ventilatory support, pulmonary emboli with hemodynamic instability patients in an intermediate care unit who are demonstrating respiratory deterioration, need for nursing/respiratory care not available in lesser care areas such as a floor or intermediate care unit, Respiratory failure with imminent intubation, and massive haemoptysis are considered appropriate for ICU admissions. Given the scarce human and economic resources available to support the ICU units and the necessity to deliver appropriate treatment according to needs of patients, admission to these units and appropriate prognosis is imperative (6).

Prognostic planning is the process of transitioning a patient from one level of care to the next. Assessment for safe prognosis by the physician involves several key factors including the patient's physical ability to follow discharge instructions and perform activities of daily living, the patient's psychological ability to understand and follow discharge instructions, and a support system and financial means to obtain the appropriate follow-up care (7)

The purpose of prognosis scale is to ensure continuity of quality care between the hospital and the community by judging the patient's condition and transferring a patient from the ICU to a hospital ward or back to community care (under the care of a general practitioner) includes several elements that may shape patient outcomes and overall experiences (8). Initially, outcome prediction in critical illness was based on the subjective judgment of the clinicians. The rapid development of intensive care units (ICUs) created the need for quantitative and clinically relevant surrogate outcome measures in order to evaluate the effectiveness of treatment practices (9)

Methodology

The study comprised of 2 phases 1) scale development and content validity index 2) concurrent validity and reliability of the scale was determined. Ethical approval for the study was obtained from the Institutional Ethics Committee of KLE Academy of Higher Education and Research, Institute of Physiotherapy (Reference No: 611, dated 01 December 2023). All methods were performed in accordance with the relevant guidelines and regulations. Written informed consent was obtained from all participants or their legal guardians prior to participation in the study. Informed consent was also obtained from all experts who participated in the Delphi process for content validation.

The qualitative phase included scale development whereas in cross sectional study the scale validation was done. In the study participants who were included was adult participants (≥ 18 years of the age) diagnosed with respiratory conditions admitted in Intensive Care Unit (ICU).

The 1st phase of study included in design and development phase was primarily focused on the scale construction. After reviewing the literature and taking experts opinion 5 domains were identified. For

each domain respective items were identified and basic framework of the scale was designed. The Delphi method was used for content validation, involving 15 clinical and research experts with minimum experience of 2 years specialized in respiratory physiotherapy clinical practice. Informed consent was also obtained from all experts who participated in the Delphi process for content validation. Each 5 domain was reviewed by the experts and construct relevance. Using experts opinion 1 more domain was added and then it was again send to the 15 experts and final framework of the scale was done.

After final framework of the scale the 2nd phase of the study aimed for the check inter rater reliability of the scale which included, 30 participants diagnosed with respiratory condition. Written informed consent was obtained from all participants or their legal guardians prior to participation in the study. This participants were admitted in ICU and meeting with the inclusion criteria.

Content validation:

The principle investigator identified 6 domains/items then expert opinion was taken and one more domain was identified i.e. domain 7 and then again experts opinion was taken.

Results

Using SPSS software 23.0 statistical analysis was done to check the interrater correlation among the 2 examines total 30 participants were included in the study of both gender (male = 16 and female = 14) who was diagnosed with respiratory condition.

Discussion

The study aimed to develop and validate a prognostic scale tailored for ICU physiotherapists to assess respiratory conditions in critically ill patients, particularly those with diseases such as Chronic Obstructive Pulmonary Disease (COPD), pneumonia, and acute respiratory failure. The findings from the study are discussed in the context of existing literature, highlighting the significance, validity, reliability, and practical applications of the developed scale.

A key outcome of the study was the high content validity of the prognostic scale, reflected in a content validity ratio (CVR) of 0.846. This high CVR indicates that the scale successfully incorporates all critical components necessary for accurate prognostication in ICU settings. Content validity is a fundamental aspect of any clinical tool, as it ensures that the tool comprehensively captures all necessary factors to make accurate assessments. This study's content validity aligns with similar findings in critical care and respiratory therapy studies, where content validity ensures that the tool reflects the realities of patient care and outcomes. The inclusion of parameters such as respiratory rate, oxygen saturation, and arterial blood gas (ABG) analysis in the scale ensures that it covers the key clinical aspects needed for a comprehensive assessment of respiratory conditions in ICU patients (10).

The study also demonstrated high reliability through the use of kappa statistics to measure inter-rater agreement across different domains of the scale. Kappa values ranging from 0.4286 to 0.9425 indicated strong agreement between independent raters, particularly for critical parameters such as respiratory rate, pulse rate, and oxygen saturation (SpO2). Such high inter-rater reliability is essential to ensure that the scale can be applied consistently by various clinicians, making it a robust and reliable tool in ICU settings. High reliability ensures that different healthcare professionals can achieve consistent results when using the same tool, which is crucial in clinical practice. The study's findings are consistent with those of other clinical tool validation studies, where inter-rater reliability is a key measure of the robustness of a prognostic tool (11). The study further confirms the usefulness of Cohen's kappa in measuring inter-rater agreement, although it is important to acknowledge that certain studies suggest that Gwet's AC1 may provide more stable measures of reliability, particularly in cases where prevalence affects the kappa value.

The development of the prognostic scale followed a rigorous methodological process that incorporated both qualitative and quantitative components. The Delphi method was employed to achieve expert consensus on the most relevant items to be included in the scale. The Delphi method is a widely accepted technique in health research that allows for a structured approach to achieving consensus among experts. In this study, the Delphi process was crucial in refining the scale and adding a seventh domain based on expert feedback. This iterative process ensures that the final scale is comprehensive and reflects the collective expertise of professionals in the field. This method of development strengthens the scale's applicability in critical care environments, where decisions must be made quickly and accurately (12).

The study also validated the scale's concurrent validity by applying it to a sample of 30 ICU patients with respiratory conditions. The tool's ability to consistently predict patient outcomes across different patients and raters reinforces its validity as a prognostic tool. This consistency in predicting outcomes is crucial in ICU settings, where reliable outcome prediction can greatly improve patient management and resource allocation. The findings align with other studies on prognostic tools in ICU settings, which have shown that reliable prediction of outcomes is key to optimizing patient care and resource use(13).

The inclusion of diverse domains in the scale, such as physiological parameters, dyspnea, ABG analysis, and chest X-ray findings, ensures that the scale captures both clinical and diagnostic indicators essential for respiratory assessment. The inclusion of ABG analysis and chest X-ray findings is especially important, as these are routine diagnostic tools used in ICU settings to assess respiratory function and the extent of pulmonary involvement in conditions like pneumonia and COPD. Numerous studies have validated the importance of these parameters in ICU prognostication, making them indispensable components of any tool designed for respiratory assessment(14).

A notable strength of the study is its inclusion of both male and female participants in nearly equal numbers (16 males and 14 females). This gender balance enhances the generalize ability of the findings and addresses a common limitation in clinical research, where gender disparity may skew results.

Gender considerations are particularly important in respiratory diseases, as men and women may experience different disease progressions and respond differently to treatments. Research has shown that females may present with different symptoms or disease trajectories, which could impact prognosis and treatment outcomes in ICU settings(15).

The gender inclusivity of this study enhances the scale's applicability across diverse patient populations. While the study's cross-sectional design was useful for validating the scale, it has inherent limitations. Cross-sectional studies provide a snapshot of patient outcomes at a specific point in time but do not capture the dynamic nature of ICU patients' health. Future research should consider longitudinal designs that track patient outcomes over time, providing a more comprehensive understanding of the scale's ability to predict long-term outcomes such as ICU discharge, mortality, or quality of life post-ICU. Such longitudinal studies would offer more robust data on the scale's performance in predicting long-term prognosis and its utility in real-world clinical settings(16).

The study also opens up new possibilities for applying the prognostic scale in resource-limited ICU settings. In low-resource settings, many ICUs lack access to advanced diagnostic tools such as ABG analysis or chest radiography. The scale's emphasis on clinically observable parameters makes it an adaptable tool that could be used effectively in such environments. This adaptability is a significant strength, as the scale provides a reliable way to assess respiratory conditions even in settings where advanced technology may not be available (16).

Conclusion

In conclusion, this study successfully developed and validated a prognostic scale for assessing respiratory conditions in critically ill patients in the ICU. The scale demonstrated excellent content validity and inter-rater reliability, confirming its robustness as a prognostic tool for ICU physiotherapists. Its inclusion of essential physiological and diagnostic parameters ensures comprehensive assessment, while its validation in a real-world clinical setting enhances its practical applicability. Future research should focus on longitudinal validation and exploring the scale's adaptability in different ICU environments, particularly in resource-limited settings, to further strengthen its role in improving patient outcomes in critical care settings.

Declarations

Ethical Considerations:

Ethical approval for the study was obtained from the Institutional Ethics Committee of KLE Academy of Higher Education and Research, Institute of Physiotherapy (Reference No: 611, dated 01 December 2023). All procedures performed in this study involving human participants were conducted in accordance with institutional ethical standards and relevant guidelines and regulations. Written informed consent was obtained from all participants or their legal guardians prior to their inclusion in the study. In

addition, informed consent was obtained from all experts who participated in the Delphi process for content validation.

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NIL.

Conflict of interest:

There is no conflict of interest.

Data Availability

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request.

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