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Effect of daily use of electronic checklist on physical rehabilitation consultations in critically ill patients

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ABSTRACT

Rationale: In intensive care unit (ICU) practice, great emphasis is placed on the functional stabilization of the major organ systems, sometimes at the expense of physical rehabilitation. Checklists have shown to be an effective tool for standardizing care models. Our aim was to the study the effect of the use of an electronic checklist on occupational therapy/physical therapy (OT–PT) consults in critically ill patients.
Methods: A retrospective observational study of all adults admitted for the first time in an academic medical ICU in year 2014 was conducted. The patient demographics, outcomes, checklist use, and physical therapy consults were collected from Electronic Medical Records (EMR).
Results: A total of 2399 unique patients were admitted to the medical ICU, 55% were male and median (IQR) age was 65 (52–77) years. A total of 17% of patients received OT–PT consults among patients with checklist use (N = 1897), and among non-checklist user (N = 502), it was 7.6%. The total time of OT–PT administered in the ICU was 48 vs 31 min, $p = 0.08$.The patients who received the daily electronic checklist had high medical acuity but had lower ICU mortality. Hospital mortality was found to be no different.
Conclusions: The use of the electronic checklist in the ICU was associated with increased number of the OT–PT consults.

1. Background

In modern intensive care unit (ICU) practice, great emphasis is placed on the functional stabilization of the major organ systems, i.e., cardiovascular, respiratory, renal, neurological, and gastrointestinal, sometimes at the expense of physical rehabilitation [1]. Unfortunately, bed rest is the typical activity level of the ICU population, and lack of physical activity has multiple deleterious consequences, including decreased functional capacity, critical illness myopathy, atelectasis/pneumonia, deep venous thrombosis/pulmonary embolism, skin breakdown/decubiti ulcers, and cardiovascular deconditioning, among others [2]. Compounding the situation, a significant number of the treatments offered to the critically ill patient initiate or magnify these unintended consequences [3]. To address this issue, several institutions have improved staff awareness of the patient's needs for physical activity, facilitated the access to physical therapy, and/ or implemented mobility protocols [4].

To enhance both efficiency and fidelity of acute care delivery, multiple tools have been recently developed, tested, and validated [5]. These include multidisciplinary rounds, daily goals of care sheets, and smart alarms. Analogous to the complex industry environment (i.e. aviation, nuclear power plants), simplified checklists and care bundles have been recently introduced on a large scale in various medical settings [6,7]. For instance, the worldwide implementation of a relatively simple WHO surgical safety checklist has led to improved outcomes postoperatively [8]. Another example is the introduction of "goals of care sheet" and checklist prompting during daily rounds; both have led to substantial improvement in efficiency and reliability of daily plan of care and were associated with decreased complications [9,10].

Our aim was to study the effect of the use of an electronic checklist on occupational therapy/physical therapy consults in the critically ill patients.

2. Methods

2.1. Study design

This is a single-center retrospective cohort study.

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2.2. Setting

Medical ICU of a tertiary care academic hospital, between January 1st and December 31st 2014. The study period was selected based on the completeness and accuracy of the available data, and being from most recent year. The data have been rechecked and validated against errors previously [11].

2.3. Participants

All adult (age 18 or more) patients admitted for the first time to the medical ICU in a tertiary care center in year 2014, including only those who has given research authorization. Readmissions and patients who have not given consent for review of their medical records for research were excluded (Fig. 1). The study was approved by the Mayo Clinic IRB.

2.4. The checklist use

The electronic checklist was implemented in the medical and surgical ICUs as a part of AWARE (Ambient Warning and Response Evaluation). While the checklist use was expected to be used by the ICU leadership, the enforcement was variable. The checklist adoption followed the behavioral change cycle (early adopters, main stream, slow adopters, and other factors). The study has been done prior to 100% checklist implementation. This checklist consists of 24 interactive items grouped by organ systems and is based on current evidence-based practice in the ICU (Fig. 2). The checklist also includes a decision support tool, which provides relevant information for each checklist item. An electronic checklist reduces ICU provider workload and checklist errors. Thus, implementation of an electronic checklist in the ICU setting is feasible and has the potential to improve patient care [12]. AWARE is a novel electronic medical record (EMR) dashboard designed by clinicians to support bedside clinical information management in the ICU. AWARE sits on top of pre-existing, comprehensive EMR systems [13].

2.5. Variables

The electronic checklist use, occupational therapy/physical therapy (OT/PT) consults, patient demographics, Sequential Organ Failure Assessment (SOFA) score over the first 24 h of admission, Acute Physiology and Chronic Health Evaluation (APACHE) III score, ICU outcomes (use of mechanical ventilation, duration of mechanical ventilation, length of stay, mortality), and hospital mortality and length of stay were collected. According to the status of the electronic checklist (used or not used), patients were divided into two groups (Fig. 1). Then the groups were compared on the status of the OT–PT consults done, APACHE III score, SOFA score, ICU outcomes, and hospital mortality and length of stay.

2.6. Data sources/measurement

The data were derived from a previously validated database, electronic medical record (EMR) data sources [11].

2.7. Statistical methods

Quantitative variables are reported as median with interquartile range (IQR) as appropriate. Categorical variables, such as sex, electronic checklist use, and OT–PT consults, are reported as base number with the percentage of patients within the subgroup (checklist use and no checklist use). Univariate analysis was used to describe the statistical differences in the variables between the two groups (checklist used vs checklist not used). Student t test, chi-square test, and Fisher exact test were used as appropriate and $p < 0.05$ was considered significant. We used JMP 10.0.0 (SAS Institute Inc.) for analysis.

3. Results

We reviewed data from 2925 patients in the medical ICU, 5 patients aged <18 years old were excluded. A total of 526 readmissions were excluded to have a final 2399 unique patient's first admission (Fig. 1). Out of these, 1337 (55%) were male, the median (IQR) age was 65 (52–77) years, and body mass index (BMI) 27.98 (23.46–34.26) kg/m^2. The daily electronic checklist was used in 1897 (79%) patients.

In univariate analysis, the cohort was divided into two groups: patients with checklist use and patient without checklist use. There was no difference in gender, age, and BMI between the two groups (Table 1).

The patients with checklist use received higher OT/PT consults, 328 (17.3%), than the other group, 38 (7.6%), $p < 0.01$. The patients who received the daily electronic checklist were sicker—APACHE III—63 (48–77) vs 58 (43–75), $p \leq 0.01$, and with higher SOFA scores 4 (2–6) vs. 3 (2–5), $p < 0.01$ (Table 1).

More patients from the daily electronic checklist use group had invasive and non-invasive use of mechanical ventilation with longer duration (Table 2). Patients from the daily electronic checklist use group had more ICU length of stay (LOS) with a median of 1.50 days vs

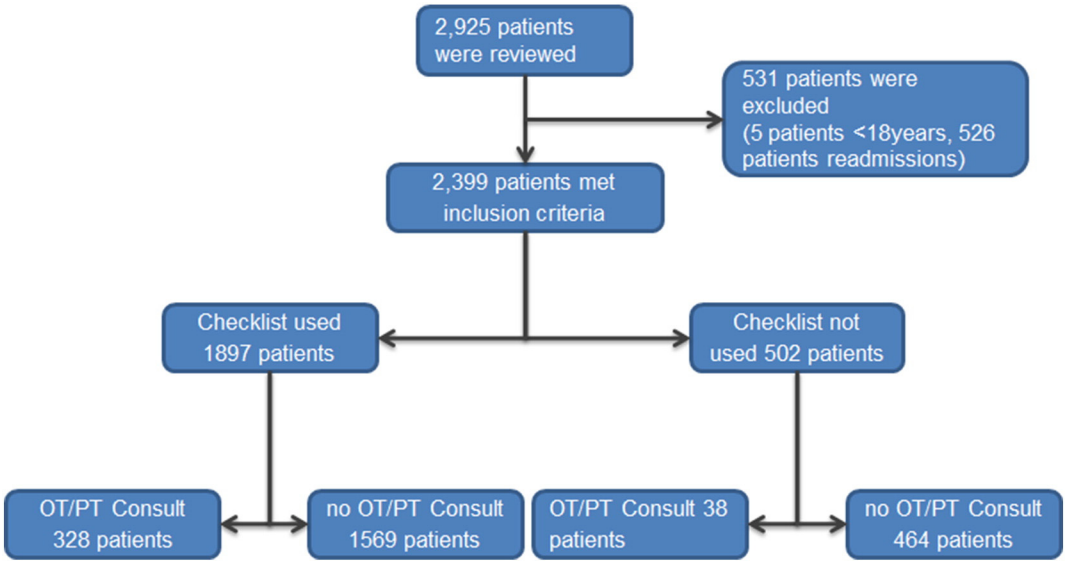

Fig. 1. Flow chart of the study.

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