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## Original Article

# A care bundle for pressure ulcer treatment in intensive care units

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## ABSTRACT

Pressure ulcers (PUs) are localized injuries of the skin or underlying tissue caused by prolonged pressure, exposure to shear forces or friction. PUs represent a major concern for hospitalized patients and the health professionals responsible for their wellbeing. Intensive care unit (ICU) patients are at high risk of PU development, and the development of PUs can significantly extend the length of time a patient must remain in the ICU. Patients with PUs experience significantly increased morbidity, mortality and financial burden. A significant amount of evidence has accumulated indicating that PU prevention is an essential component of patient care. However, standardized guidelines and protocols for PU prevention in ICUs have not been universally implemented. This review aims to describe and analyze an optimized PU prevention care bundle based on the best available evidence and existing national guidelines. We distilled the available information into five main topics important for PU prevention: Risk Assessment, Skin Assessment, Support Surfaces, Nutrition and Repositioning. Further larger scale studies are needed to clinically verify the effectiveness of the care bundle.

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## 1. Introduction

Pressure ulcers (PUs), also known as pressure sores, decubitus ulcers and bed sores, are localized injuries of the skin or underlying tissue that most often occur over bony prominences and which can be caused by any combination of pressure, shear forces or friction [1]. PUs are internationally recognized as an important and mostly avoidable indicator of health care quality [2]. PU severity is described using a Stage I through IV

classification system, with Stage I representing the earliest stages of PU formation, and Stage IV representing the severest grade of PUs that are characterized by full thickness tissue loss and exposed bone, tendon or muscle tissue [1]. PUs occur most frequently over bony prominences, and the most common PU vulnerable locations include the sacrum, coccyx, heels and ear. Compression of the soft tissues over the bony prominence causes tissue ischemia of the skin, muscle and fascia in the compressed region between the skin surface and bone. Tissue ischemia at the point of compression is largely the result of the

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compression of small vessels in the compressed tissue, and this, in turn, blocks the local supply of oxygen and nutrients at the capillary interface as well as the venous return of metabolic wastes. If pressure is prolonged, metabolic wastes accumulate and induce a local vasodilatation response. The induction of the vasodilation response contributes to local edema, further compressing the small vessels in the affected region and increasing edema and ischemia in a positive feedback loop [2]. Ultimately, this cycle results in the local tissue death that culminates in the formation of a PU.

Patients admitted to intensive care units (ICUs) are at a higher risk of developing PUs than patients admitted to general care. A review of ICU related literature from 2000 to 2005 indicated a PU prevalence in the ICU of 4–49% and an incidence of 3.8–40.4% [3]. The 2009 International Pressure Ulcer Prevalence Survey indicated that facility-acquired PU prevalence rates were highest (12.1%) in the medical ICU (MICU) [4]. Studies have reported an association between PUs and increased morbidity and mortality [5]. PUs can also lead to serious infectious complications, like bacteremia and sepsis [6,7]. Because of these factors, PUs have been reported to extend the duration of a hospital stay by a median of 4.31 days [5]. Due to the adverse effects associated with PUs, PU prevention in the ICU is critically important.

PU prevention and treatment can consume limited resources in large quantities, including nursing care and money. In the United States, the economic cost of PUs ranges from 9.1 billion to 11.6 billion dollars per year [8]. In the UK, the total cost of PU care in the period from the years 1999–2000 ranged from 1.4 to 2.1 billion pounds per year, a cost representing 4% of the entire National Health Service expenditure [9]. In Australia, the cost of treating a single Stage IV ulcer has been estimated at more than \$61,000 Australian dollars [10]. A recent systematic review argued that the cost of PU treatment per patient per day is much higher than prevention [11]. Therefore, PU prevention is a critically important element of patient care, and additional attention paid to PU prevention is likely to meaningfully improve patient care and reduce the economic costs associated with treatment in the ICU.

## 2. The PU prevention care bundle

### 2.1. What is a care bundle?

A “care bundle” is also sometimes referred as a bundle of care, a patient care bundle, a prevention bundle, or a nursing cluster bundle. These terms interchangeably refer to the practice of creating a series of evidence-based treatment and nursing measures to deal with incidental risks or refractory clinical [12]. Thus, a care bundle is a collection of quality of care management ideas that can be implemented in the ICU with the goal of promoting cooperation among different healthcare disciplines and promoting the translation of clinical guidelines to clinical practice.

A care bundle usually includes three to six elements, each of which is supported by evidence from randomized controlled trials (RCTs) or systematic reviews (SRs). All the interventions in the care bundle must be performed in patients continuously, and the bundle is being incorrectly

applied if the health care practitioner is selecting only one or two measures from the bundle to perform. Care bundles are thought of as systems that are greater than the sum of their parts; only when the interventions are performed simultaneously can the care bundle achieve its maximum effect. Implementation of individual elements of the care bundle violates the spirit of the cluster intervention strategy and will not produce the desired results. Different cluster bundles have been specifically designed for the management of different diseases, and some common cluster bundle elements can be incorporated or eliminated to meet the specific challenges posed by individual diseases. In other words, there is no single compulsory therapeutic regime.

The existing PU care bundle was based on the best available evidence and guidelines: the International guidelines [1,13,14] and the guidelines of the Registered Nurses Association of Ontario (RNAO) [15]. These universal guidelines describe PUs, and include evidence-based recommendations incorporated from the results of RCTs and SRs. The current review further develops and specializes the recommendations of the PU prevention care bundle for adult patients hospitalized in ICUs. This review identifies five key elements of PU prevention and care: Risk Assessment, Skin Assessment, Support Surfaces, Nutrition and Repositioning.

### 2.2. Quality of evidence and definitions

Evidence quality was assessed according to the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group criteria. The GRADE criteria are increasingly being adopted by organizations worldwide, and this system for rating the quality of evidence and the strength of recommendations is explicit, comprehensive, transparent and pragmatic. The GRADE system classifies the quality of evidence in one of four levels [16]: 1) Very high quality, further research is very unlikely to change the consensus of confidence in the estimated effect; 2) High quality, further research is likely to have an important impact on the consensus of confidence in the estimated effect and may change the estimate; 3) Low quality, further research is very likely to have an important impact on the consensus of confidence in the estimated effect and is likely to change the estimate; 4) Very low quality, any estimated effect is very uncertain.

Evidence based on RCTs and SRs is frequently regarded as very high quality evidence; however, confidence in the evidence may decrease for several reasons. These reasons include: 1) Study limitations, 2) Inconsistent results, 3) Indirectness of evidence, 4) A lack of precision and 5) Reporting bias. Conversely, confidence in the evidence may be increased for several reasons, including: 1) A large effect, 2) Plausible confounding factors that could have opposed the effect and 3) Dose response grading [17].

## 3. Implementation process

### 3.1. Preparation before intervention

#### 3.1.1. The formation of a PUs quality control team

For effective implementation of the preventative care bundle, a team should be assembled and practical measures or guides

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