



## Original article

# Efficacy of a care bundle to prevent multiple infections in the intensive care unit: A quasi-experimental pretest-posttest design study



Gulay Yazici, RN, PhD Instructor<sup>a,\*</sup>, Hulya Bulut, RN, PhD Associate Professor<sup>b,1</sup>

<sup>a</sup> Ankara Yıldırım Beyazıt University, Faculty of Health Science, Department of Nursing, Turkey

<sup>b</sup> Gazi University, Faculty of Health Science, Department of Nursing, Turkey

## 1. Introduction

Healthcare-associated infections (HAIs) are the most common complications in hospitalized patients worldwide (Çetinkaya-Şardan, 2010). HAIs, which threaten patient safety, cause extended hospitalization time and increase morbidity, mortality and treatment cost, are considered as the most important indicators of care quality in hospitals (Çetinkaya-Şardan, 2011; Ding et al., 2009; Oliveira, Kovner, & Silva, 2010). It is estimated that an HAI is developed in 1.4 million people around the world everyday. HAIs occur in 5–10% of hospitalized patients in developed countries and over 25% in developing countries (Pittet et al., 2008). More than 75% of these infections include catheter-associated urinary tract infections (CA-UTIs), ventilator-associated pneumonia (VAP) or central line-associated bloodstream infections (CLABSIs) (Ertürk, Çopur Çiçek, Köksal, Şentürk Köksal, & Özyurt, 2012; Pittet et al., 2008).

When the infections related to healthcare are reviewed, approximately 60–80% of hospital-acquired UTIs develop in association with the catheter (Gray, 2004). Although it is not possible in this study to provide the general CA-UTI rate in Turkey, it is reported that these infections are the most frequent hospital-acquired infections (Arda et al., 2012). In a multicenter study, it was reported that approximately 65% of UTIs were associated with the urinary catheter (Leblebicioğlu & Esen, 2003). As the second most frequent cause of HAIs, VAP is a serious complication, which develop in 8–28% of patients receiving mechanical ventilation support, mortality rate of which can raise up to 27–76% (Safdar, Dezfulian, Collard, & Saint, 2005).

It is reported that approximately 85% of hospital-acquired primary blood circulation infections are associated with the catheter and CLABSI rate change according to type of caterer and service. Every year, 80,000 CLABSIs develop in intensive care units (ICUs) in the USA and the cost of each of these infections varies between USD 6,000–40,000 (Çetinkaya-Şardan et al., 2013).

While the incidence of HAIs varies by the country, hospital and patient characteristics, the hospital average is 3–17%. This rate could raise up to 25–50% in ICUs (Pittet et al., 2008). The factors which increase the risk of HAIs in ICUs include a severe clinical course of

hospitalized patients, high number of elderly patients, the presence of patients with an operation history, immunosuppressive medications, a trauma, metabolic disorder or malignity, and the frequency of invasive procedures used on these patients (Rosenthal et al., 2006). Considering that 53.6% of HAIs result in death, it is important to prevent these infections (Alberti et al., 2002; Yüceer & Demir, 2009).

In hospitals, HAI rates are monitored by integrating infection control programs and quality improvement programs (Yokoe & Classen, 2008). HAI prevention studies indicate that it is possible to reach a target zero of hospital infection by applying bundled interventions which have demonstrated effectiveness in prevention of a certain hospital infection (Berenholtz et al., 2004; Cheema et al., 2011; Jarvis, 2007; Zingg, Walder, & Didier, 2011). In a study that aimed for zero CLABSIs, the CLABSI rate decreased from 11.3/1000 catheter days to 0/1000 catheter days after intervention. This difference was found statistically significant (Berenholtz et al., 2004). The care bundle of Helmick et al., decreased VAP from 2.50 to 1.60 per 1000 ventilator days and CLABSIs from 2.38 to 0.73 per 1000 catheter days (Helmick et al., 2014). Similarly, it was reported VAP infection rates decreased from 4.08 to 1.16 per 1000 ventilator days (Eom et al., 2014).

According to evidence-based studies, integration of care bundles is critical in intensive care patients. Especially, when compatibility is maximized, care bundle effectiveness increases and leads to decreased mortality and morbidity (Helmick et al., 2014; Horner & Bellamy, 2012; Raad, 2012). Implementation of care bundles creates an important opportunity to deliver evidence-based, safe healthcare to patients with using a multidisciplinary approach. Obtaining the desired results requires evidence-based bundle components that should be simple to apply. Also, compatibility should be monitored and feedback should be provided to authorities (Çetinkaya-Şardan, 2010).

Intensive care nurses, who accompany the patients for 24 h, have important responsibilities in implementing and inspecting care bundles. It is reported that accompaniment of the nurse during implementation and control of these bundles increases compatibility by 100% (Berenholtz et al., 2004; Raad, 2012). Intensive care nurses administer the bundle interventions and maintain continuous patient care, hence, it is important that they are aware that HAIs are preventable and they

\* Corresponding author at: Ayvalı Mahallesi Gazze Caddesi, Ankara Yıldırım Beyazıt Üniversitesi, Etlik Yerleşkesi Doğu Kampüsü B Blok Kat/8, Etlik, Ankara, Turkey.

E-mail address: [gyazici@ybu.edu.tr](mailto:gyazici@ybu.edu.tr) (G. Yazici).

<sup>1</sup> Emniyet Mahallesi Muammer Yasar Bostancı Caddesi No: 16 Besevler/Ankara TURKEY.

**Box 1**

Sub-parameters of the HAI prevention care bundle.

VAP	CLABSI	CA-UTI
Bedhead height suitable. No need for aspiration. No need for oral care. Cuff pressure suitable. No liquid accumulation in the ventilator circuits. Ventilator circuits are not dirty. Peptic ulcer prophylaxis received. Deep vein thrombosis prophylaxis received.	The need for catheter continues. Central venous catheter's dressing need has been met. Dressing has been suitably applied. Dressing date available. Fluid sets have been replaced.	The need for catheter continues. The urinary bag and catheter are below the bladder level. No withdrawal from the urinary bag. The urinary bag does not touch the floor.

keep abreast of universal measures to prevent and control infections and deliver the most effective care to patients by reinforcing their knowledge with practice (Yüceer & Demir, 2009).

Considering relevant literature studies, infection prevention care bundles are only applied in a single area. However, intensive care patients are mostly attached to a ventilator and/or a urinary and/or central catheter. An intensive care nurse treats the patients with integrity and deliver care for all interventions within the scope of integral patient care. The difference of this study from similar studies in the literature is that interventions for all three of the most frequent ICU-acquired infections, VAP, CLABSIs, and CA-UTIs, are discussed in the care bundle. The infection rates decreased with increased compatibility of the care bundle. From this perspective, the present study is believed to contribute to the nursing literature.

**2. Methods****2.1. Study design**

The study is a quasi-experimental pretest-posttest design aimed at evaluating the efficacy of a care bundle prepared to prevent three of the most frequent infections acquired in ICUs.

**2.2. Study setting**

This study was conducted in the adult Anesthesiology ICU in Turkey between 1st April – 30th September 2015.

**2.3. Samples**

All patients older than the age of 18 and receiving invasive mechanical ventilation therapy, or a central line catheter or urinary catheter at a University Hospital Anesthesiology ICU between 1st April and 30th September 2015 were included in the study, providing their family member consents are obtained. One hundred twenty patients were admitted to the ICU during the data collection. The sample comprised all patients attached to a mechanical ventilator for VAP, patients who were transferred to the ICU with a central catheter inserted and who had negative blood culture, or were attached to a central catheter by the intensive care physician for a CLABSI and all patients who were transferred to the ICU with a urinary catheter inserted and who had negative urinary culture or who were attached to a urinary catheter in the ICU for a CA-UTI.

**2.4. Data collection**

The tools developed by researchers (Alp et al., 2012; Arda et al., 2012; Arman et al., 2008; Çetinkaya-Şardan, 2010; Çetinkaya-Şardan

et al., 2013; O'Grady et al., 2011; Pittet et al., 2008; Rello et al., 2002; Rosenthal et al., 2006; Safdar et al., 2005; Usluer et al., 2006) were used. Five forms were included.

**Form I** provided identifying characteristics of the nurses, which are their age, gender, educational status, tenure as a nurse, tenure in intensive care and previous HAI training.

**Form II** comprised the pre- and post-test question form to evaluate the infection prevention knowledge level of the ICU nurses. The form contained two parts; part one included 20 multi-choice questions (five choices per question) and part two contained 30 true-false questions. The multiple choice questions covered all strategies for HAI prevention. The true-false questions comprised propositions considering VAP, CLABSIs, and CA-UTIs constituting the main aims of this study. Comprehension levels of the items in the question form were determined by the content validity index. Analyses found the form had a content validity index of 1. The form was distributed to all nurses simultaneously and allowed 20 – 25 min for completion.

**Form III** comprised the care bundle control form. This form demonstrated the days and hours to monitor compatibility with each of the parameters in the care bundle and the patient's name, surname, file number, age, gender, and diagnosis. The form was filled out by two nurses who attended the training but were commissioned outside the ICU. To prevent bias in the study, the ICU nurses were not informed about the hours of monitoring compatibility with the care bundle.

**Form IV** comprised the training material prepared for the ICU nurses. The training content was examined by six academic members and one infection committee nurse. Any necessary adjustments were made according to the feedback received.

Care bundle (**Form V**) was prepared based on evidence-based interventions in related literature (Berenholtz et al., 2004; Pittet et al., 2008; Rello et al., 2002; Rosenthal et al., 2006; Safdar et al., 2005; Usluer et al., 2006) and guidelines (the Centers for Disease Control and Prevention/ CDC, Turkish Society of Hospital Infections and Control/ HİDER, Arman et al., 2008; O'Grady et al., 2011; Alp et al.; Arda et al., 2012; Çetinkaya-Şardan et al., 2013). Care bundle consists of most common three chapter of HAIs, CA-UTIs, VAP and CLABSIs. As seen Box 1, each chapter contains sub-parameters. Additionally, the care bundle includes name, surname, file number, age, gender, and diagnosis of each patient. Content validity of infection prevention care bundle was analyzed by experts in the field, six faculty members and one infection committee nurse in order to evaluate subject relevance. Scoring forms were handed out to the experts along with the form. Content validity index of the care bundle form was found 1, higher than determined minimum score after analyses (Confidence coefficient:  $1 - \alpha = 1 - 0.05 = 0.95$ ).

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