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# Patient Safety, Error Reduction, and Pediatric Nurses' Perceptions of Smart Pump Technology

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Patient safety and error reduction are essential to improve patient care, and new technology is expected to contribute to such improvements while reducing costs and increasing care efficiency in health care organizations. The purpose of this study was to assess the relationships among pediatric nurses' perceptions of smart infusion pump (SIP) technology, patient safety, and error reduction. Findings revealed that RNs' perceptions of SIP correlated with patient safety. No significant relationship was found between RNs' perceptions of SIP and error reduction, but data retrieved from the pumps revealed 93 manipulations of the pumps, of which error reduction was captured 65 times.

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PATIENT SAFETY AND error reduction are essential to improve patient care management (Rosenthal, 2004; Schwend, 2008; Vecchione, 2007), and new technology is expected to contribute to such improvements while reducing costs and increasing care efficiency in health care organizations (Jensen & Aanestad, 2007; Longest & Darr, 2008; Nymark, 2007). Smart infusion pump (SIP) is an infusion device used by pediatric nurses to reduce medication administration errors; because health care organizations are purchasing these or similar pumps to promote safety, it is important to know how nurses who work with these pumps regard them. These pumps are equipped with safety features such as user-alerts that activate when clinicians set the parameter of the pump outside a specified safety limit, or when there is a risk of an adverse drug interaction (Cummings & McGowan, 2011; U. S. Food

and Drug Administration, 2010). The goal of this study was to assess (a) pediatric nurses' perceptions of SIP technology and (b) to understand the association between these perceptions and patient safety and error reduction in an inpatient pediatric care environment.

## Background

According to the landmark report, *To Err is Human: Building a Safer Health System*, 44,000 to 98,000 hospitalized patients die annually in the United States as a result of medical errors, and medication error is the eighth leading cause of patient death (Institute of Medicine [IOM], 2000). Medical errors cost Americans \$37 billion in lost wages, medical expenses, and non-medical costs; preventable errors cost \$17 billion (IOM, 2000). Medication error increases a patient's hospital length of stay by an average of 2.2 days, costing \$4,684 (IOM, 2000). Physician

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ordering (39%) and administration of medication (38%) are the two top causes of medication errors (IOM, 2000). The Institute of Medicine (IOM) report asserted that the health care industry must move from placing blame on health care practitioners, to designing quality and safety into the health care delivery system (IOM, 2000).

The developmental needs and distinctive physiology of pediatric patients make them vulnerable to medication errors (American Academy of Pediatrics [AAP], 2011; Lacey, Smith, & Cox, 2008). In pediatrics, one in 6.4 physician orders result in preventable medication errors that are linked to physician ordering, pharmacy dispensing, and nurse administration of medications (AAP, 2011). The AAP (2011) reported that patient harm or death from medication errors is higher in pediatrics (31%), compared to adults (13%).

Registered nurses (RNs) make up the largest workforce in the health care system (Health Resources & Services Administration [HRSA], 2010). Patient care is heavily dependent on RNs on a 24-hour basis (HRSA, 2010). The RNs' scope of practice defines safe, quality care provided to patients (American Nurses Association [ANA], 2004, 2011). The pediatric RN has responsibilities that include patient assessment, patient activity management, medication administration, and physician orders evaluation (ANA, 2004; Bates et al., 2004). Technology is used by pediatric RNs to improve nursing practices and patient care management (Barnard & Locsin, 2007). Acceptance of technology by RNs is gained from its ease of use, usefulness, and ability to improve workflow processes (Carayon, Hundt, & Wetterneck, 2010; Davis, 1993).

Health care organizations have adopted the SIP technology to decrease errors in medication administration (Carayon et al., 2010; Morgan & Siv-Lee, 2009). The built-in safety features of the SIP technology serve as an additional double check system in medication administration (Carayon et al., 2010). Proper use of the SIP technology yields benefits that include enhanced workflow for RNs and error reduction from medication administration (Carayon et al., 2010). The SIP technology has built-in software applications that support the creation of specific drug libraries, including parameters for medication dosing specific to pediatrics (Morgan & Siv-Lee, 2009). Appropriate use and programming of the SIP technology activates these safety features.

## Purpose of the Study

The purpose of this descriptive study was to assess the relationships among pediatric nurses' perceptions of SIP technology, patient safety, and error reduction at a pediatric inpatient health care system. Two research questions were addressed:

1. What is the relationship between pediatric nurses' perceptions of SIP technology and patient safety?
2. What is the relationship between pediatric nurses' perceptions of SIP technology and error reduction?

## Conceptual Model

### Locsin's conceptual model, *Technological Competency as Caring in Nursing*

*A Model for Practice* guided this study. In Locsin's (2005) model, the concepts of technology and caring within the framework of competency exemplify the realities of purposefully advancing technologies in health care. Locsin (2005) stated, "Competency with technology is the skilled demonstration with intentional, deliberate, authentic activities by experienced RNs who practice in environments requiring technological expertise" (p. 7).

Technological Competency as Caring in Nursing is a conceptual model that emphasizes the link that exists between caring in nursing and technology use in nursing (Locsin, 2005). RNs encounter multiple types of technologies in the contemporary patient care environment. Locsin's model specifically incorporates the RNs' work with technologies used to deliver patient care. Although technologies are rapidly advancing patient services, caring by RNs remains a vital constant (Locsin, 2001). However, RNs are challenged to create a caring environment in the midst of rapidly evolving technologies (Locsin, 2001).

Nursing and the use of technology in patient care delivery are indissoluble. Locsin's conceptual model identified three linked areas in which RNs care for their patients (see Figure 1). The three linked areas of the diagram are technological competence, human beings as persons, and caring in nursing (Locsin, 2005). The purpose of Locsin's conceptual model was to explain the relationship between technology, nursing, and caring. According to Locsin (2005), the contemporary nurse becomes acquainted with the patient as a whole person from the constant and purposeful use of technologies in the patient care environment.

Technology has revolutionized health care and is incorporated into the work of RNs. In order for RNs to safely use technology, skilled competency is required. RNs have to understand the importance of the use of the technology in the care provided to patients. Although the practice of nursing has been transformed with the coexistence of caring and technology, safe nursing care should not be compromised by the use of technology. Instead, RNs must find ways to build a strong connection with their patients through the competent use of technologies (Locsin, 2005).

## Method

### Population, Setting and Sampling

Eligible participants were 109 pediatric RNs from three acute inpatient care units at a Magnet<sup>®</sup> recognized non-profit

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