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Featured Article

Developing Low-Cost, High-Fidelity Resources for Blood Glucose Measurement and Cord Blood Sampling

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Abstract

Background: Simulation is a valuable teaching strategy within health care curricula that has the potential to better prepare students for clinical practice. Educators are using simulation in innovative ways to increase the level of clinical competence and confidence of nursing students in relation to task-based skill acquisition and proficiency.

Methods: The authors present two innovative and cost-effective high-fidelity devices that can be used to teach blood glucose measurements and cord blood sampling techniques to nursing and midwifery students.

Results: In this article, we provide step-by-step instructions for these simulation innovations that can be used to replicate real word practice in any laboratory or simulation setting.

Conclusion: Both of the low cost devices presented here have the potential to be employed a teaching resources in skills teaching and also in higher fidelity complex immersive teaching events that require students to engage in critical thinking.

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Simulation in nursing education has been shown to be a valuable teaching strategy that utilizes various levels of fidelity to provide "hands-on" experience while suspending the risk to patients that is inherent to training in the health disciplines (Health Workforce Australia [HWA], 2010; McCaughey & Traynor, 2010). While high-fidelity scenarios encourage participants to immerse themselves in the simulation experience (Reilly & Spratt, 2007), lower fidelity simulated learning that targets specific skill acquisition can provide valuable student preparation, develop competence, and encourage confidence for future clinical placement (HWA, 2010; McCaughey & Traynor, 2010).

In their review of the use of simulated learning environments (SLEs) within nursing curriculum throughout Australia, the national health workforce agency Health Workforce Australia made a series of recommendations designed to inform future development within this area (HWA, 2010). This review recognizes that within

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nursing curriculum, there are certain core capabilities that can be achieved to a level of competency or a clinical placement prerequirement through simulated learning environments. Included on the list of identified capabilities are medication and intravenous products, clinical monitoring and management, communication and documentation, clinical interventions, and teamwork and interprofessional practice (HWA, 2010). They also noted the need for educators involved in simulation to ensure that there is collaboration and a sharing of resources between facilities and faculties which would contribute to the development of a best practice network. It is with a view to these two recommendations that we present the following practice resources that showcase innovations in the teaching assessment of blood glucose and collection of blood samples from the umbilical cord postdelivery.

Key Points

- Simulation is a valuable teaching tool for the health disciplines.
- Using low cost innovative simulation devices are as effective as real world experience to prepare learners for clinical practice.
- Sharing of teaching innovations contributes to a best practice network in simulation.

Blood Glucose Monitoring

Diabetes is the most common chronic illness that a health care provider will encounter (Shaw, Sicree, & Zimmet, 2010). The global burden of diabetes is increasing, and we now have a population that is living longer and has increased obesity and lower activity levels. Couple this with greater surveillance, identification, and improved management, we are seeing more people diagnosed with diabetes and those that develop it are living longer. It is a disease that today's student nurses will repeatedly be required to work with during their career in health care.

Blood glucose level (BGL) monitoring is fundamental to diabetes management and a core skill that student nurses need to be able to accurately perform. It is also a skill that lends itself to systematic learning through repetition. On clinical placements, BGL monitoring is a skill, such as blood pressure and temperature taking, that student nurses are expected to be proficient at from a very early time in their studies.

Within nursing curricula over the years, it had been accepted practice for students to be introduced to blood glucose monitoring using pipetted glucose fluids of various concentrations, or to perform needle sticks either on themselves or each other to gain experience with the task. The first of these practices does not allow for any level of fidelity or relationship to the act of blood sampling for glucose monitoring, and there are now standards built around the latter and its performance outside of laboratory environments (i.e., in clinical teaching spaces; Australian/New Zealand Standards, 2010). As there is no commercially available manikin that provides the means to collect a blood glucose sample and facilitate student practice of this clinical assessment or use of associated equipment, the authors identified the need to develop an alternative means of teaching the psychomotor and cognitive skills required to conduct a BGL measurement. We present a technique for creating a low-cost high-fidelity simulation resource that can be used as a teaching tool to assist students in the development of the skills required for measuring a BGL.

Cord Blood Sampling

Collection of arterial or venous blood samples from the umbilical cord postdelivery has traditionally been used for identification of the infant's rhesus status (Coombs test, Shreeve, 2004). Increasingly today, we see umbilical cord blood being collected and cryopreserved for private or public stem cell storage, as well as samples being taken for metabolic analysis as an indicator of infant well-being and a measure of the quality of intrapartum care delivery following a difficult, or emergency, delivery (Gluckman et al., 2011; White, Doherty, Newnham, & Pennell, 2014). Some clinicians have called for universal umbilical cord blood sampling to be introduced on all maternity units to improve postpartum infant management and to serve as evidence surrounding care delivery (White et al., 2014).

Cord blood sampling is a procedure that a midwife needs to be competent in performing, but also one that there is limited opportunity to rehearse in clinical practice. Tong, Egan, Griffin, and Wallace (2002) identified the high error rate that was seen in cord blood sampling when it was collected for metabolic analysis (Tong et al., 2002). As arterial blood is necessary to gain a picture of the baby's metabolic status, if blood is drawn mistakenly from the vein or a mixed sample is taken, the results are invalid. The call for routine sampling from both the artery and vein was determined to be overzealous; however, they recommended universal arterial sampling that should be backed up by a venous sample if the pH of the arterial cord blood sample is <7.15, in cases where the delivery has been a difficult one or when the infant is not "vigorous" at birth (Tong et al., 2002). The collectors for this study were predominantly experienced midwives; they were still prone to a high error rate (around 18% of samples collected in this study [n = 289]). It is evident that obtaining individual vessel cord blood is a difficult skill (Tong et al., 2002). As part task trainers that are currently available do not include capability that allows