

Skin-to-Skin Contact Simulation: Improving Health Outcomes for Medically Fragile Newborns in the Neonatal Intensive Care Unit

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Abstract : Introduction: Premature infants are at risk for neurodevelopmental deficits and hospital readmissions, which can increase the financial burden on the health care system and families. Kangaroo care (skin-to-skin contact) is a practice that can improve preterm infant health outcomes. Preterm infants can acquire adequate body temperature, heartbeat, and breathing regulation through lying directly on the mother's abdomen and in between her breasts. Due to some infant's condition, kangaroo care is not a feasible intervention. The purpose of this proof-of-concept research project is to create a device which simulates skin-to-skin contact for pre-term infants not eligible for kangaroo care, with the aim of promoting baby's health outcomes, reducing the incidence of serious neonatal and early childhood illnesses, and/or improving cognitive, social and emotional aspects of development. Methods: The study design is a proof-of-concept based on a three-phase approach; (1) observational study and data analysis of the standard of care for 2 groups of pre-term infants, (2) design and concept development of a novel device for pre-term infants not currently eligible for standard kangaroo care, and (3) prototyping, laboratory testing, and evaluation of the novel device in comparison to current assessment parameters of kangaroo care. A single center study will be conducted in an area hospital offering Level III neonatal intensive care. Eligible participants include newborns born premature (28-30 weeks of age) admitted to the NICU. The study design includes 2 groups: a control group receiving standard kangaroo care and an experimental group not eligible for kangaroo care. Based on behavioral analysis of observational video data collected in the NICU, the device will be created to simulate mother's body using electrical components in a thermoplastic polymer housing covered in silicone. It will be designed with a microprocessor that controls simulated respiration, heartbeat, and body temperature of the 'simulated caregiver' by using a pneumatic lung, vibration sensors (heartbeat), pressure sensors (weight/position), and resistive film to measure temperature. A slight contour of the simulator surface may be integrated to help position the infant correctly. Control and monitoring of the skin-to-skin contact simulator would be performed locally by an integrated touchscreen. The unit would have built-in Wi-Fi connectivity as well as an optional Bluetooth connection in which the respiration and heart rate could be synced with a parent or caregiver. A camera would be integrated, allowing a video stream of the infant in the simulator to be streamed to a monitoring location. Findings: Expected outcomes are stabilization of respiratory and cardiac rates, thermoregulation of those infants not eligible for skin to skin contact with their mothers, and real time mother Bluetooth to the device to mimic the experience in the womb. Results of this study will benefit clinical practice by creating a new standard of care for premature neonates in the NICU that are deprived of skin to skin contact due to various health restrictions.

Keywords : kangaroo care, wearable technology, pre-term infants, medical design

Conference Title : ICEETWT 2020 : International Conference on Embedded Electronics in Textiles and Wearable Technology

Conference Location : Amsterdam, Netherlands

Conference Dates : November 05-06, 2020