Wearable patient sensor improves pressure ulcer prevention efforts

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Background: Over the past few years, the market for wearable health-tracking technology has begun to explode. Wearable technology has enabled consumers to track virtually all aspects of their daily lives, including activity level, sleep patterns, vitals signs, and even their mood. Recently, there has been a push to utilize wearable technology in the patient care environment, where it can be used to improve diagnostic capabilities and therapeutic outcomes. One new application of wearable technology has been to address the problem of pressure ulcers. Each year ~2.5 million Americans will suffer from a pressure ulcer, which accounts for an estimated $10 billion in annual healthcare spending. It is well established that frequent and regular patient turning is a key element to pressure ulcer prevention. The currently accepted standard of care is to turn high-risk patients at least every two hours, day and night. In many healthcare facilities, such a turning protocol is difficult to maintain. Prior studies have estimated that compliance rates with these protocols are only 60-70%. To help address the need for improved pressure ulcer prevention methods, we developed a system that provides caregivers with information regarding a patient's position over time, thus enabling them to easily identify which patients are turning adequately on their own and which patients are in need of caregiver-assisted turns. Furthermore, the system was designed to enable dynamic turning protocols that are based on individual patient-care needs.

Methods: A small, wireless, disposable sensor (Leaf Healthcare, Pleasanton, CA) was adhesively attached to hospitalized adult patients. The sensor continuously measured each patient's orientation and transmitted this data wirelessly to a central monitoring station. A user-interface displayed each patient's turn history and current status and also alerted staff if any patient required a caregiver-assisted turn. The turning protocol compliance was calculated before and after implementation of the turn management system.

Results: The monitoring system was successfully tested in a medical-surgical unit (~8,000 hours of patient position data was recorded and analyzed). The system enabled the delivery of a dynamic and high-quality pressure ulcer prevention program. Following implementation of the monitoring system, compliance with the institution's turning protocol increased from 64% to 98%. This improvement was significant and sustained ($p<0.01$). The system's highly visual monitoring display allowed nurses to easily prioritize patient care needs, while ensuring that no patient was neglected.

Conclusions: Wearable health-tracking technology is becoming increasingly popular and the potential applications in healthcare are expanding. In this study we demonstrated that the Leaf Patient Monitoring System significantly increased compliance with patient turning protocols and improved pressure ulcer prevention

efforts. Furthermore, this technology opens the door for the development of Dynamic Turning Protocols (DTPs) that are based on individual patient-care needs.