Title:
Mobile Platform for Assessment, Early Detection, and Management of Breast Cancer-Related Lymphedema

Jane Armer, PhD
Sinclair School of Nursing and Ellis Fischel Cancer Center, University of Missouri, Columbia, MO, USA
Nathan C. Armer, MEd
Sinclair School of Nursing, University of Missouri, Columbia, MO, USA
Guilherme N. DeSouza, PhD
Department of Electrical and Computer Engineering and MU Informatics Institute, University of Missouri, Columbia, MO, USA

Session Title:
Nurse-Managed Technology to Enhance Cancer Care Outcomes for Survivors With Breast Cancer or Head/Neck Cancer
Slot:
F 14: Friday, 28 July 2017: 2:30 PM-3:45 PM
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2:30 PM

Keywords:
lymphedema, mobile device technology and prospective surveillance

References:
Lu, G., Han, K., DeSouza, G., Armer, J., Shyu, CR. (2014). A new algorithm for 3D registration and its application in self-monitoring and early detection of lymphedema. *Journal of Innovation and Research in BioMedical Engineering.* 35(6). 370-384. DOI:10.1016/j.irbm.2014.10.003.

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Ostby, P.L., Armer, J.M., Dale, P.S., Van Loo, M.J., Wilbanks, C.L., & Stewart, B.R. (2014). Surveillance Recommendations in Reducing Risk of and Optimally Managing Breast Cancer-Related Lymphedema. *Journal of Personalized Medicine, 4*(3):424-447.

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Cormier, J.N., Xing, Y., Zaniletti, I., Askew, R., Stewart, B.R., Armer, J.M. (2009). Minimal limb volume change has a significant impact on breast cancer survivors. *Lymphology, 42*(4), 161-175.

Armer, J.M., Culbertson, S.D., Radina, M.E, & Porock, D. (2003). Prediction of breast cancer lymphedema based on Lymphedema and Breast Cancer Questionnaire (LBCQ) symptom report. *Nursing Research, 52*(6), 370-9.

Abstract Summary:
We will describe development and testing of the 3D mobile device for application in clinical and home use for assessment, early detection, and self-management of lymphedema in those at risk following breast cancer treatment.

Comments to Organizers:
Unwithdrawn with session

Learning Activity:

LEARNING OBJECTIVES	EXPANDED CONTENT OUTLINE
Understand the application and utility of the smart phone in assessing limb volume change following breast cancer treatment.	Development and testing of the mobile platform will be described. Findings of limb volume estimated with the mobile device on healthy and lymphedematous limbs will be summarized in comparison to 'gold standards' of water displacement and perometry.
Describe the integration of mobile technology into the clinical setting in the prospective surveillance model.	The integration of the mobile device with symptom and circumferential limb assessments in the clinical setting will be described as components of the prospective surveillance model for breast cancer lymphedema.

Abstract Text:

Purpose: Early detection and management of secondary lymphedema (LE) can significantly reduce the potential for symptoms and complications. Unfortunately, many patients fail to seek medical assistance at first signs of the disease. It is estimated that approximately 500,000 people in the U.S. suffer from lymphedema, and 2.4 million breast cancer survivors are at-risk for developing this chronic condition. Objectives were to: (1) Test the two completely automated measuring systems we developed (using an IR depth camera and a smart phone) for individuals to use at home or in the clinic for early detection and self-monitoring of LE; (2) Integrate and evaluate the automated smart phone application in the clinical setting.

Methods: Over 280 data points (upper limbs) were sampled from healthy people and LE patients to exam the correlation between the mobile platform systems and the "gold standards" (water displacement and perometry); and to determine the reliability of both proposed methods. In comparison with water-displacement, 14 measurements of upper limbs from many repetitions for 7 healthy test subjects were done. Regarding the comparison with the Perometer, 34 upper limbs from 17 human subjects, including LE patients, were measured. IRB approval was received for integration of the 3D smart phone images with circumferences and symptom assessment in a prospective surveillance model with breast cancer survivors at risk of lymphedema.

Results: Pearson correlations of 0.97-0.98 with the kinect and smartphone 3D mobile platform systems and clinical limb volume measures of water displacement and perometry are reported. The two completely automated and robust systems for 3D image of human arms outperformed existing methods in many aspects, including cost, maintenance, and ease of use, while they maintained high correlations with the "gold standards." Patients and staff are open to, and, indeed, eager to, participate in the application of the mobile device in the clinical setting.

Conclusion: The systems will accurately assist patients in managing LE through early detection and monitoring in the clinic and at home. Algorithms will be further refined to facilitate even more efficient and accurate data capture in the clinical and home setting. We will be doing further testing as we work to assess the ease of use by patients and clinicians with variable levels of comfort with technology.