Exploring the Feasibility and Acceptability of a Home-based Smart Health Sensing System to Improve Cancer Pain Management for Patients and Family Caregivers

Virginia LeBaron¹, Leslie Blackhall², Ridwan Alam³, James Hayes³, Nutta Homdee³,
Kate Gordon¹, Yudel Martinez³, Emmanuel Ogunjirin³, Seth VandeBraak³,
Randy Jones¹, Tanya Thomas¹, John Lach³

¹University of Virginia (UVA) School of Nursing; ²UVA School of Medicine; ³UVA School of Engineering and Applied Science

BACKGROUND

- Cancer pain is a significant problem; affects 60-90% of patients with cancer
- Most cancer pain management occurs at home and family caregivers play a large role
- Opioids are important tool to manage serious cancer pain, but need careful monitoring
- Smart Health technology can support safe and effective management of cancer pain in the home environment

PURPOSE

- Pilot test **B**ehavioral and **E**nvironmental **S**ensing and **I**ntervention for **C**ancer (BESI-C) to:

1) Understand contextual factors that predict and influence the experience of breakthrough pain

2) Explore the dyadic effect between patient and caregiver experiences related to cancer pain

BESI-C SYSTEM COMPONENTS

Environmental Sensors

- Ambient audio
- Barometric pressure
- Light
- Temperature

Estimote Beacons

- Localization within home

Smart Watch

- Heart rate
- Accelerometer
- Ecological Momentary Assessments (EMAs)**

BESI-C SYSTEM ARCHITECTURE

SMART WATCH 'APP'

- EMAs mark pain events and assess overall quality of life

STUDY DESIGN

METHODS

Sample:

- Recruited from UVA Oncology Palliative Care Clinic
- Patients with advanced cancer and primary family caregiver
- Prescribed opioids for cancer related pain
- Pain scores of ≥ 6

Phase I: Qualitative Interviews (completed)

- 10 dyads; structured interviewed to assess:
 - Challenges of managing cancer pain at home
 - Contextual variables relevant to cancer pain
 - BESI-C design feedback

Phase II: BESI-C deployments (in progress)

- 15 dyads (target); in-home pilot testing to assess:
 - Fidelity of data capture
 - System utilization
 - Dyad experiences with BESI-C system

RESULTS (CONTINUED)

Phase I: Qualitative Interviews

Theme 3. Dyads validated proposed variables to measure by BESI-C; open to testing system

- I think it's a good idea myself. I think that would make a big difference in monitoring some things. – CG 6*
- Seems interesting...I think that I would try it. - Pt 5*
- As long as it ain't watching us! - CG 9*

Phase II: In-Home Deployments

- Preliminary data: Dyad marked pain events, environmental data from the living room, and patient heart rate data

CONCLUSIONS

- Dyads are open to novel approaches to managing pain in the home
- Significant potential exists for BESI-C to inform and deliver personalized pain interventions
- Future work to deploy BESI-C in rural areas and home hospice programs

Funding: University of Virginia Engineering in Medicine Seed Pilot Program; American Cancer Society Pilot and Exploratory Grant

Phase I: Qualitative Interviews

Theme 1. Cancer pain is unpredictable, stressful and impacts daily life, especially sleep and social interactions

- It hits me so bad sometimes it brings tears to my eyes...When I'm in really, really bad pain it gets me down. I get depressed and it's like, 'God, is this ever gonna quit?' - Pt 10*
- We went from being outside every day and doing things to pretty much watch watching her lay on the couch. - CG 9*

Theme 2. Difficulty tracking medications; fears of running out of medication; balancing side effects

- I worry about the medications and if I'm gonna have enough or God forbid if I lose some. - Pt 10*
- Most difficult? Taking my medicine. Sometimes I'll take more than I should if I'm really in a lot of pain, and I know I'm not supposed to but it's hard not to. - Pt 2*
- Keeping up with the medications and as they change. - CG 5*