

Sensor + Single-Use Electrodes

Bluetooth Data Transfer

Remote Data Access and Analytics

CENTER FOR BIOENGINEERING INNOVATION & DESIGN

# LymphaSense

## An Early Detection Sensing Device for Lymphedema

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### Abstract

**LymphaSense** is the first **home-based** solution for the **early detection of lymphedema**. We envision our device to enable clinicians to intervene at the earliest warning signs of the disease, enabling improved clinical outcomes and significant cost savings.

#### What is Lymphedema?

Lymphedema is a disease commonly caused by breast cancer treatment that results in extreme limb swelling and pain.

|                     |  |
|---------------------|--|
| <b>1 in 8 women</b> | are diagnosed with breast cancer in the United States. |
| <b>20%</b>          | of breast cancer patients develop lymphedema.          |

### Objectives

**Need Statement:**  
**Doctors need a way to detect lymphedema before symptoms develop in order to enable early treatment to reduce the development of chronic lymphedema.**

The objectives of this project were to create an **accurate and affordable** solution that **streamlines care** for patients by **using it in their own homes**.

### Results

Benchtop testing has shown corroborating results, able to **detect precise changes** in interstitial **fluid buildup** with a resolution of about **1 ohm per mL** of subcutaneous fluid accumulated.

### Introduction

When the lymphatic system becomes damaged, lymphedema may develop, becoming completely **debilitating** if left untreated.

We are repurposing existing technology developed by our partners at **Baxter International, Inc.**. We are using two measurements, **bioimpedance spectroscopy** and **near-infrared spectroscopy**, to detect changes in underlying fluid and tissue composition.

#### How LymphaSense Helps

**LymphaSense** is a simple patch that measures fluid buildup over time, so patients and their doctors can detect the disease before it is too late.

With earlier detection, patients can start treatment faster, and the disease progression can be slowed or even halted.

### Methods

We have developed a **modular bench-top model of lymphedema** where we can alter different patient and device factors to evaluate potential failure modes.

Our **clinical study** set to run this spring at Johns Hopkins Hospital to validate the combination use of **NIRS, Bioimpedance Spectroscopy**, and **Tonometry** in lymphedema patients.

### Conclusions

We designed LymphaSense to be an early detection device comprised of a simple **sensor and single-use electrodes**. Further development will focus on integrating **additional sensors** into our measurement index, fine-tuning the desired **specificity** and **sensitivity**, and developing **corrective algorithms**.

Wireless, Internet-Based System For Monitoring Lymphedema