

# Assistive Technologies for Dialysis Patients \*

**Katie A. Siek**

Computer Science  
Indiana University  
Bloomington, Indiana  
ksiek@cs.indiana.edu

**Kay H. Connelly**

Computer Science  
Indiana University  
Bloomington, Indiana  
connelly@cs.indiana.edu

## Abstract

Dialysis patients can only consume 1 liter of fluid and a few milligrams of sodium each day. Currently, patients try to remember or write down in a food diary their fluid and sodium consumption. However, these techniques are insufficient because 80% of patients are unable to restrict their fluid intake. If patients miscalculate their fluid intake they run the risk of hypertension, pulmonary edema, and death. Our research focuses on creating a personal digital assistant application to assist dialysis patients accurately monitor their fluid and sodium intake. Our application will allow patients with reduced cognitive skills to easily record dietary information, allow all patients to get immediate feedback on their fluid and sodium intake, reduce the stigma of disease as a medium for recording dietary information, and assist researchers gain information about patient fluid and sodium compliance for future studies. We will present what steps we are taking to create a personal digital assistant application for dialysis patients.

## 1 Introduction

Imagine a liter of water and a few milligrams of salt. Can you picture it? Now try to figure out how much water and salt you consume in one day. How much water does the apple you had for lunch contain? If you pass on the potato chips during lunch, could you have cheese on your dinner? If I have a cup of coffee in the morning, a soft drink with lunch, can I afford to have a drink with dinner? These are just some of the questions dialysis patients think of every day.

Currently patients keep track of their fluid and sodium intake by remembering or writing what they eat in a food diary. Welch et al. has shown that these techniques are insufficient since 80% of patients are unable to restrict their fluid intake [1]. Research has shown 1/3 of dialysis patients have difficulty performing simple calculations [2]. If patients miscalculate their fluid intake they run the risk of hypertension, pulmonary edema, and death.

\*Katie A. Siek is supported in part by a National Physical Science Consortium Fellowship and by a stipend from Sandia National Laboratories/CA. Kay H. Connelly is partially supported by a grant from the Lilly Endowment.

We are creating a proof-of-concept handheld application for dialysis patients to monitor fluid and sodium intake. Patients can select food icons on the PDA screen or scan food UPCs to easily input food. The application will allow patients with reduced cognitive skills to easily record dietary information and get immediate feedback on fluid and sodium intake. Handheld computers could help reduce the stigma of disease because the general population is accustomed to seeing people tap on handheld computers instead of recording information in food diaries. The application would assist researchers gain information about patient fluid and sodium compliance for future studies. Monitoring fluid and sodium levels could help clinicians teach patients about the relationship between fluid consumption and their ideal “dry weight.”

## 2 Impact and Importance

The advantages of our application ensure

- **Automatic computation.** Dietary and fluid intake will be automatically computed for patients.
- **All literacy rates.** Patients will not need to read labels, make mathematical conversions, or do mathematical computations to effectively use the application.
- **Improved accuracy.** Accurate diet and fluid intake can be recorded and monitored with the application.
- **Improved decision making.** Ongoing feedback can be provided to help patients make improved decisions about diet or fluid intake on a prospective basis.
- **No stigma.** Tapping on a PDA is commonplace, thus the application will remove the stigma of disease.

## 3 Visual Poster Layout

We will present a color poster describing background information, our current and future goals, and overall hardware and software design. Our background section will discuss why kidneys fail and what is dialysis. The hardware design will describe and show color pictures of the devices used (i.e. Socket SDIO In-Hand scanner, Baracoda Scanning Pencil, Palm Tungsten T3). We will briefly describe the software components we use (nutritional database, UPC database, scanning software, etc.) and visually show how the components interface together in a color diagram. In addition to presenting our poster, we would like to demonstrate our software and hardware. Attendees can scan food items or enter food to see how much fluid and sodium each item contains.

## References

- [1] J. Welch, S. Perkins, J. Evans, and S. Bajpai. Differences in beliefs by stage of fluid adherence. *Journal of Renal Nutrition*, 2003.
- [2] J. Evans, C. Wagner, J. Welch. Cognitive Status in Hemodialysis Patients. *Renal Failure*