

Developing a Program for Tracking Heart Failure

William Long¹, Hamish Fraser¹, Shapur Naimi², Kathleen Perry², Linda Cotter²,
Marvin A. Konstam²

¹ MIT Lab for Computer Science, Cambridge, MA,

² Tufts-New England Medical Center, Boston, MA

This poster discusses the development of a program for tracking heart failure in patients at home using data available to the patient.

Introduction. Heart failure is a chronic condition representing a major and increasing cause of death and disability currently afflicting over four million Americans. A number of recent studies have shown that careful attention to the early signs of decompensation and appropriate care can decrease hospitalizations and improve quality of life. Approaches thus far have been labor intensive, using specially trained personnel to monitor and advise the patient at home. If the process of monitoring the patient's status was automated, more patients should benefit from improved control.

Methods. The program monitors the patient's weight, vital signs, symptoms, diet, exercise, and medications in the home setting. It uses a secure architecture to link the patient and physician to a database at the server. Changes in the patient state are detected and recommendations made for minor adjustments by the patient or intervention by medical personnel. The focus of this poster is the development of a program for distinguishing significant changes in weight from normal variation.

We used data from 22 patients participating in a prospective trial of SPAN-CHF (our heart failure management program), who have been measuring their weights, vital signs, and symptoms. Currently, we have an average of 9 weeks of daily weights and 25 weeks of weekly weights per patient. We have applied a decaying moving average of previous weights for classifying the change represented by the current weight. Combining these changes with the changes in the other parameters will allow the program to assess the likely significance of the changes. Figure 1 is a segment of data from one of the patients showing the weights, moving

average, symptoms, and medications. The difference between the weight and average identifies several of the weights as significant increases. This particular display is intended for the care provider to get an overview of the case. The patient will have the analysis presented as daily assessments and advice, although other formats will be available. Once the algorithms are completed they will be prospectively assessed on new data.

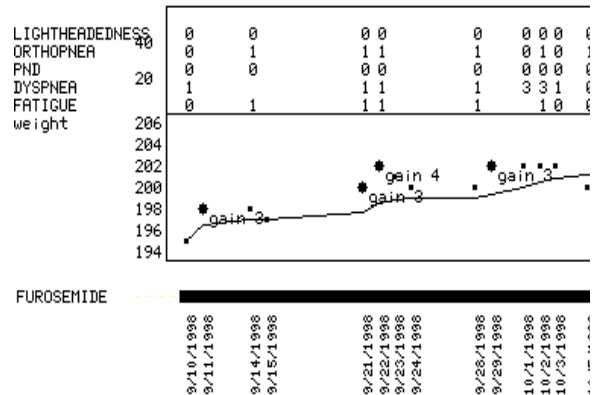


Figure 1: Tracking a Heart Failure Patient

Discussion. This approach brings together the various parameters affected by heart failure so that changes can be detected early at varying levels of certainty. When there is suspicion of decompensation, the program will ask the patient about dietary indiscretions and behavior changes. If the change is significant, the program can suggest an extra dose of diuretic, within bounds set by the physician. With important changes the program will also warn the appropriate medical personnel.

Conclusion. This program will make it possible for the patient to track his or her heart failure at home, manage it within limits by adjusting behavior and minor adjustments to medications and provide the physician with early notification of significant changes.