Informatics applications may facilitate improved chronic disease care, but designing for this environment may have unique requirements. Clinic specific and generalized models of workflow and information flow were developed based data from over 150 hours of direct observation in three chronic disease clinics. Semi-structured interviews were also conducted to gather additional data and to verify the models. These models can be used to design more effective informatics tools for chronic disease care.

INTRODUCTION
Understanding the needs of end users and the usage context are important elements of user-centered design. We investigated workflow and information flow in three chronic disease clinics: multiple sclerosis, cystic fibrosis, and diabetes. Our hypothesis was that workflow and information flow during management of different chronic diseases share core similarities, but also have some crucial differences. The specific aim was to evaluate and compare workflow and information flow in the ambulatory care environment across three chronic disease domains. The results included models of workflow and information flow for each clinic, generalized models of workflow and information flow for chronic disease care, and a set of design guidelines for software development for this environment.

METHODS
An iterative data collection and modeling process was conducted over the course of 10 months. One investigator (KMU) observed activities throughout the care process in each of the three clinics, focusing on interactions between people, processes, and technology. Detailed notes were taken during observation periods. Themes were extracted from the data and models of workflow and information flow in each clinic were developed iteratively. Observation continued until models were stable, with over 150 hours of observation total between the three clinics. The accuracy of subsets of the models was evaluated through semi-structured interviews. Interviews provided clarification on cognitive aspects of the observed activities. Nine semi-structured interviews were conducted. The generalized models of workflow and information flow in chronic disease care were refined based on data from the interviews.

RESULTS
Each clinic had a specific task and workflow pattern, with variations between and within provider types.