
Extensions to the Continua Health Alliance “Aging Independently” Scenario

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Abstract

Continua Health Alliance developed a scenarioⁱ in which elderly people could live independently, in their homes, with the aid of technology. Included in that scenario was a list of issues requiring expansion of the scenario. We have addressed each of those issues with an extension to the original scenario. This extended scenario is being used to drive some of our current research.

Motivation

Employment of registered nurses in home health care is expected to increase rapidly (39% growth from 2006-2016) in response to the growing number of older persons with functional disabilities, consumer preference for care in the home, and technological advances that make it possible to bring increasingly complex treatments into the home. The type of care demanded will require nurses who are able to perform complex procedures.

Additionally, hundreds of thousands of job openings across all nursing care contexts will result from the need to replace experienced nurses who leave the occupation.ⁱⁱ

The cost of a routine home nursing visit by a Kaiser Permanente nurse in Santa Clara County, CA is \$123.00 (and many private agencies charge much more).ⁱⁱⁱ

The ever-increasing shortage of home health nurses, coupled with the rising cost of home visits, will result in significant problems for both patients and health care providers. It also provides a significant opportunity for applied research into the use of a range of technologies -- including remote sensing telepresence, and even robotics -- to make these scarce human resources more efficient while maintaining a high standard of care and controlling costs.

Extended “Aging Independently” Scenario

The Continua Health Alliance scenario begins with the following description.^{iv}

Sarah is 83 and living in the same home that she’s lived in for 50 years. She and her husband, George, raised their three children in this home and they are now living in it independently – it is home. Her children have long since moved out with the closest being Rachel who is a 45-minute drive away. Sarah has some cardiovascular conditions and she also, like many people her age, is starting to experience a bit of cognitive decline. She just doesn’t remember things as well as she used. Each day, Sarah gets up around 7:00 a.m., uses the bathroom, weighs herself, goes to the

kitchen to eat breakfast and take her various pills, makes a cup of tea and then settles into the den to watch the morning news. Around 9:00 a.m., a prompt appears across the TV screen reminding Sarah to take her blood pressure, which she does with a wireless-enabled blood pressure cuff that is sitting next to her easy chair in the den. Each morning around 10:00 a.m., Rachel, Sarah's daughter, receives a text message on her cell phone that says "Mom appears to be okay" – meaning that systems throughout her mother's home were able to determine that she got out of bed, she used the bathroom, her weight had not dramatically shifted, she took her pills correctly, the gas on the stove is off, and her blood pressure is stable. Rachel uses her cell phone to call her mother and ask her how she's doing that morning, but she already knows that her mother's day has generally gone according to her normal routine and they talk about Rachel's kids.

If Sarah had forgotten to take her pills that morning or if something else about her daily living had been abnormal, Rachel would have been alerted and she could have called her mother to help coach her or preventively called for more specific professional health care support.

The Continua Health Alliance scenario then alludes to other topics that should be addressed in a fully developed "Aging Independently" scenario. We address each of these topics with an extension to the original scenario.

- **Assistance with daily health and monitoring tasks**

Sarah has a daily routine that includes the basic health self-monitoring described above (taking weight & blood pressure). Sensors monitor her meal consumption and medication taking. Because she has a regular routine, a computer-based kitchen companion reminds her to eat breakfast and take her medications if she does not complete these tasks by 9:00 a.m.

- **Medical reminders**

Sarah schedules medical and dental appointments using her portable calendar. The calendar assistant coordinates transportation arrangements that will ensure that Sarah makes it to her appointments on time. The assistant also reminds Sarah of her appointments in plenty of time for her to prepare to be picked up.

- **Activity prompts**

One danger that Sarah faces with her cardiovascular health is sitting in one place for too long. It is very important for her to engage in some physical activity, even if it is just walking around her house for a few minutes every hour. Sensors in the home monitor her movement. If she does not get up and move about the house, she receives an activity prompt on her television screen or in whatever room of the house she has been stationary in for over an hour. Sarah can request a short video of movement exercises that she can carry out, rather than walking around her home.

- **Monitoring and early warning using bio-sensor data collection**

Sarah's cardiovascular problems include high blood pressure and occasional atrial fibrillation. These are managed with medications. However, the conditions must still be monitored. Sarah uses a special pulse rate monitor that can tell whether she is in atrial fibrillation. She uses it whenever she suspects that she has slipped into a-fib. When Sarah receives her daily reminder to take her blood pressure, her television screen reminds her of the correct position for taking her vital signs: feet resting on the floor, arm relaxed. This little reminder helps to ensure that readings will be accurate. Sarah has given permission for her bio-sensor data to be monitored by her

doctor and her daughter, Rachel. On this morning, her blood pressure reading is 150/95. Rachel is notified immediately, as this may be an indication that Sarah has not taken her blood pressure medication or that the medication dosage needs to be changed. Rachel receives the last week's readings so that she knows whether this is an aberration or a trend. However, this is just courtesy information; Rachel is not expected to be able to interpret the data. The doctor, under normal conditions, receives a weekly update of Sarah's data. It could be that Sarah is nervous about something this morning, and has elevated blood pressure as a result. Under her doctor's direction, if Sarah's blood pressure has been elevated above 135/90 for three days or if her blood pressure is 150/90 or higher (systolic or diastolic) for a single reading, Sarah's doctor's office is notified immediately with an electronic mail message that includes the data.

- **Automated dietician**

Sarah's cardiovascular problems require a low-fat, low-sodium diet. When she orders products from the supermarket, her automated dietician checks that each product she requests is low-fat and low-sodium. If the product does not meet her dietary restrictions, the automated dietician warns her of the dangers of the product. Optionally, Sarah can review a video that explains the dangers of fatty foods and/or high-sodium foods. She also receives recommendations for substitute food products that meet her dietary restrictions. Sarah can override the recommendations of the automated dietician, but that information will be passed along to Rachel if Sarah has agreed to this kind of supervision.

- **Emergency response**

Sarah is not feeling well and decides to take her blood pressure. Sarah's blood pressure is 190/110 with a pulse rate of 130. Her doctor has told her that any time her blood pressure is higher than 160/100, she must seek immediate medical attention. But, Sarah does not remember the exact numbers that should trigger her to seek urgent care assistance. The pulse rate of 130 suggests she might be in atrial fibrillation, which condition always makes her jittery and cognitively distracted. The health monitor assistant assures Sarah that help will be on the way and tells her that it is calling for an emergency response team. It contacts the local emergency response team with the data from her vital signs (in this case, blood pressure and pulse rate) and alerts them to Sarah's cardiovascular conditions and what medication she is taking.

- **Real-time alerts and communication**

(These are scattered throughout the scenario)

We elected to look at this scenario from the perspective of the health care provider. There are clear benefits that accrue for the health care provider when data are available in a timely way. In addition, aggregating data from many patients can help health care providers to recognize trends and correlations that can be helpful in proactive treatment.

- **From the perspective of the health care provider**

Elder-Care Medical Center has branches throughout California. They work closely with its patients to ensure high-quality, timely, and accurate care. They receive real-time reports of patient data. As a result, they are able to analyze the data and produce more accurate diagnoses. For example, they can distinguish atrial fibrillation from a quickened heartbeat and determine whether the patient will benefit from specific medication. With bio-sensors in the home environment, patients can be treated with fewer office visits and fewer visits from health care nurses in the home. In addition, they can receive timely notification of emergent situations.

Elder-Care Medical Center also looks at the aggregate data. They routinely conduct studies of at-risk populations and share the anonymized data with the National Institutes of Health. They have been able to track trends in the health of their elderly population, which enables them to prepare for increased frequency of certain ailments such as diabetes or hypertension. They have been able to detect correlations between medications, exercise, diet, and patient prognosis.

In particular, Sarah's daily weight, blood pressure and pulse rate data are accumulated with the data from others who suffer from hypertension and/or atrial fibrillation. George, who does not suffer from cardiovascular disease, also uploads his data, which becomes part of a control group. Data about medications (e.g., time taken & dosage) and data about exercise (e.g., type & duration) are also transmitted automatically. Elder-Care Medical Center analyzes the data to determine if there are correlations between certain kinds of exercise and atrial fibrillation, for example. They also check the correlation between the use of certain prescribed medications and the pattern of atrial fibrillation attacks, perhaps discovering which medications are most helpful in preventing those attacks.

ENDNOTES:

ⁱ "Aging Independently." Continua Health Alliance. 2008.

http://www.continuaalliance.org/use_cases/elderly_monitoring/ (accessed 25 Sep. 2008)

ⁱⁱ Bureau of Labor Statistics, *Occupational Outlook Handbook*, 2008-2009 edition.

ⁱⁱⁱ Kaiser Clinical Supervisor, personal communication, November 2008

^{iv} We have changed the names of the personas and have included an additional persona (George) because we have other scenarios developed around the personas of Sarah and George. We also changed the length of time that Sarah and George have lived in their home. Otherwise, the scenario is generally taken from the Continua Health Alliance website. Consult the Continua Health Alliance website [i] for the original text.