Can an Automated Tailored Health Messaging System Be an Effective Tool for the Health Coaching of Older Adults?

By

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Abstract

BACKGROUND: By 2040, it is estimated that more than 20% of the U.S. population will be at least 65 years of age. Prevalence of chronic disease within this segment creates challenges and, thus, an opportunity for healthcare informatics to be of particular value through the use of remote automated tailored health coaching. Coaching can positively influence health behaviors, and tailored health messaging has been shown to be more effective than generic or targeted communication strategies.

OBJECTIVE: To demonstrate that it is feasible to develop an automated tailored health messaging system that will enable health coaches to provide service to a significantly larger number of patients than could be coached using conventional Internet tools alone.

METHODS: Six health coaches provided coaching to a panel of 10 patients using a simulated tool. Patients were represented by profiles typical of actual persons, but no patient subjects participated in this aspect of the study. Within both the control group and the intervention group, coaches had access to patient information including demographic data, current health status and cognitive game play assessment. The control group was asked to create coaching messages using only conventional Internet tools, whereas the intervention group was provided an automated suggested message selected according to the patient profile parameters. The time required to complete the coaching tasks was recorded. The quality of messages was rated by coaches and older adults with profiles similar to the simulated patients.

RESULTS: The quantitative evaluation showed a measurable difference in efficiency between the automated and the manual coaching system, with no significant loss of message quality. The usability feedback demonstrated willingness by coaches to use an automated system, which could be tailored to the patient and the coach when appropriate.

Introduction

Finding ways to enable more people to live healthier, happier, more productive lives as they age addresses both human needs and economic necessity. A large majority of elder citizens would prefer to "age in place;" [1] however, the progression of often debilitating chronic disease makes it difficult to remain independent and at home. The Automated Health Coaching Project work being conducted within the Oregon Center for Aging & Technology (ORCATECH) is developing expertise and tools which are responsive to individualized health needs including physical and cognitive limitations, yet could ultimately help lower the cost of care. Providing computer-based health coaching interventions is intended to promote improved health behaviors such as regular exercise, healthful eating and adherence to treatment plans, while striving for economy of scale.

The intent of this investigation was to demonstrate the feasibility of developing an automated tailored health messaging system that would enable health coaches to provide service to a significantly larger number of patients than could be coached using conventional Internet tools alone, while maintaining the quality of the coaching messages. Within the context of the ongoing ORCATECH endeavors, the purpose of this research was to investigate whether health coaches working remotely with an older adult population, utilizing an automated tailored health messaging tool, could be more effective than health coaches using only conventional Internet tools. We recorded the time expended by health coaches to manage a panel of patient profiles using basic on-line search and information tools and compared that to the time taken using a simulation of an automated tool that presented the coach with a fully composed message for each patient.

We also measured the perceived quality of the resulting measure from both the coach and client perspective.

Background and Significance

Life expectancy in the United States today for a person who has reached the age of 65 averages nearly 84 years. [2] Individuals attaining age 75 will, on average, have 12 additional years of life. The typical 65 year old American in 1950 might have been wearily and warily anticipating retirement. Today the comparable individual might realistically be considering a new career, or simply an active and productive long life.

The potential downside of greater longevity for any individual may be many more years spent contending with the rigors of chronic illness. For example, the National Diabetes Fact Sheet 2005 identifies 10.3 million persons aged 60 years and older as diabetic; a prevalence of 20.9%. [3] Thus a 65 year old female with Diabetes Mellitus will need to manage that disease for the remainder of her projected 85 year life span. High blood pressure has an even higher prevalence in this population than diabetes, and prevalence increases with age. Field et al. estimated that 27.3 million people aged 65 and older were hypertensive. [4] Looking across all chronic diseases, almost 3 in 4 older adults have at least one chronic illness and half have two or more chronic diseases. [5]

Increasing life expectancy combined with other demographic trends is altering the composition of the U.S. population. As published in the 2000 U.S. Census, the population aged 65 and older numbered 35.0 million which represented 12.4% of total population.

By 2020, demographers estimate that there will be 54.6 million people in this segment (16.3% of total), growing to 80.0 million in 2040 (20.4% of total). [6] If we juxtapose this trend line to the estimated expenditures for health care, we can foresee a crisis. According to the Centers for Medicare and Medicaid Services, 34.3% of total personal health care spending in this country (in 2004) was for the care of people 65 years and older. [7]

With more than 1/3 of total personal health care spending already going for the care of elders, this cohort is projected to double by 2030. These forecasts imply that more health care provider hours will be consumed examining, diagnosing and treating elders. Yet even without factoring in the anticipated growth of the 65 and older community, we are already facing nursing shortages with predicted physician shortages to follow. [8]

In an overview of the debate regarding the size of the doctor shortage, Wilson gives credence to the forecast of an 85,000 physician deficit by 2020, [8] while others argue that the gap may widen to 200,000. A more immediate problem with special relevance to the care of the chronically ill is the dearth of trained nurses. The American Hospital Association report issued in 2006 tabulated that approximately 118,000 registered nurses (RN) would be needed to fill all vacant positions nation-wide – an 8.5% vacancy rate. Auerbach et al, predict that the deficit of RNs will increase to 340,000 by 2020. [9]

The disproportionately high health care spending for the elderly is largely a function of chronic illness. It is estimated that the average 75 year old American suffers from three chronic conditions and takes 4-5 medications.[10] Yet, there is broad agreement that much

of this chronic illness can be prevented or at least delayed in onset through lifestyle changes.

The Centers for Disease Control and Prevention (CDC) advisory on healthy aging states the following: "People who are physically active, eat a healthy diet, do not use tobacco and practice other healthy behaviors reduce their risk for chronic diseases and have half the rate of disability of those who do not."[11] In the specific case of Diabetes Mellitus, Benjamin et al take the position that "Type 2 Diabetes is almost entirely preventable by eating less and exercising more."[12]

While research must continue, results from studies already completed appear to support these positions. In a randomized controlled trial of 44 overweight adults with hypertension, an intervention group was placed on a low-salt, low-calorie version of the Dietary Approach to Stop Hypertension (DASH) diet and participated in a regimen of regular aerobic exercise. Outcomes for the intervention group included significant reductions in blood pressure, weight, total cholesterol and low-density lipoproteins.[13] Another study of overweight persons, 65 years or older, found a 58% reduction in the incidence of diabetes for those who followed a low-fat diet and did 30 minutes of moderate exercise on most days.[14]

Similar lifestyle changes can often have the complementary benefit of lowering the cost of health care when prevention of, or reduction in disease and disability result in less medication use, reduced hospitalization and fewer physician appointments. Several studies mentioned in the issue briefing, A New Vision of Aging [14] suggest that lifestyle

changes and active involvement in disease-management will reduce health care costs. For example, a trial of 952 adults (average age 65) with various chronic conditions utilized The Chronic Disease Self-Management Program in the intervention group. These participants had fewer hospitalizations and an estimated two-year medical savings of between $390 and $520 per participant.

Lifestyle change implied by the studies mentioned above need more than short-term participation in a randomized controlled trial to make lasting differences. This degree of change is facilitated by enhanced awareness, education, supportive environment, and behavior modification that will turn words into action. But there are obstacles to making change, and these exist for all the variety of chronic disease. For example, Delamater writes in Clinical Diabetes, "Disease-related knowledge and skills may be lacking, or patients may have inappropriate health beliefs and attitudes. Specific environmental barriers may adversely affect patients' ability to perform appropriate self-care. Patients may be socially isolated or have conflicted family relationships that undermine diabetes management."[15] Facilitating change is where health coaching can play an important role.

This research addresses health coaching that is directed toward a target population with the following profile: The individuals are 65 years or older with at least one chronic illness and they are concerned and activated regarding cognitive health. They live at home and want to maintain their independence with the help of a supportive family and social network. They are familiar with computer technology and have identified areas of health concern beyond cognitive heath.

Why focus attention on the 65 year and older segment? The demographics and economics that we face as a society, encourages us as researchers to look for the largest problem and greatest opportunity. This target population fulfills both since all the following apply: Approximately 80% have at least one chronic illness and 50% have at least two [16] chronic conditions, yet many chronic illnesses can be mitigated by changes in health behaviors. [11] Most elders want to remain in their own homes [1] where they can live and be supported in the most cost effective manner given that the largest portion of health care spending goes for the care of this segment. [7] Also, health coaching can be done by non-clinician coaches, making this a potentially inexpensive intervention.

Previous Work

Reflecting on the trends cited earlier, it appears likely that there will be insufficient nurses and physicians available in the future to provide care at the level currently afforded, for the growing population of seniors. Health coaches, however, could be utilized to assist older adults in making behavioral changes that could lessen the health and economic impact of chronic illnesses. To clarify what is meant by the term health coach, we offer the definition put forward by Butterworth who describes health coaching as "a behavioral health intervention that facilitates participants in establishing and attaining health-promoting goals in order to change lifestyle-related behaviors, with the intent of reducing health risks, improving self-management of chronic conditions, and increasing health-related quality of life."[17]

Establishing the working definition for this study was necessary since the label "health coach" has been equally applied to physical fitness training, weight-loss & nutrition

programs, smoking cessation workshops, stress management and other areas of health concern. Our study specifically asked coaches to apply their skills to facilitate behavioral changes that included the following: getting more regular exercise, engaging in activities to keep the mind active, and adopting habits that promote good sleep quality. To be able to stimulate change, a health coach must possess an understanding of what is required to motivate an individual first to contemplate change and then to take action to effect and maintain a change in behavior

The questions then arise: Is it feasible to provide health coaching extensively to a growing and aging population? Can that coaching be effectively provided by coaches who are remote from their clients? Will members of this target population be open to the use of computer or similar technology for the purpose of receiving coaching advice? Hypothesizing affirmative answers to these questions, it is encouraging to note that a significant percentage of the population of interest is familiar with using computers and the Internet. The Pew Internet Project [18] found that 66% of those online had at some time looked for health or medical information, and the number of seniors who were online grew 47% from 15% to 22% between 2000 and 2004. With soon-to-be seniors (those 50-64 years old) exhibiting a 58% Internet usage, the online percentage for the 65+ segment will continue to climb quickly. Of the older online computer users, 35% play computer games, just slightly below the participation rate of the general public.

As part of the Automated Health Coaching Project, Jimison [19] conducted focus groups with older adults and their caregivers (this work was supported by grants from the Intel Corporation.) They found that patients would like to receive health coaching regarding

physical exercise, diet, cognition and mood. There was a clear desire to become activated about those things that would improve quality of life and preserve independence, while medical issues per se were of less interest. Cognitive health had primacy amongst the participants with some comments specifying the importance of "brain before body." The architecture for computer-based health coaching proposed by the researchers assumes that the health-care provider supports patients with a robust Electronic Health Record (EHR) and a patient portal – i.e. a Personal Health Record (PHR) program. Communication between patient, health coach, family members and care givers would be computer based utilizing the PHR resources. Participants in this study endorsed the use of computer technology to keep people motivated, mentally active, socially connected, and feeling useful.

The first intervention under test in the Automated Health Coaching Project is cognitive health coaching. Using computer games developed by OHSU and Spry Learning as part of a NIST grant, subjects are challenged and stimulated by a variety of games which allow for continuous cognitive monitoring in the home environment. A crucial benefit of the cognitive game monitoring is to enable a daily assessment of cognitive abilities, which may lead to early discovery of illness where cognitive loss is a primary indicator. The coach encourages regular game play activity by promoting the potential value to the client and by removing or resolving obstacles that impede the participation of the patient.

Individuals in the patient population of interest have indicated that cognitive health concerns (i.e. thinking, memory) are of primary interest. When the other areas of health

concerns (physical exercise, sleep quality, nutrition) are addressed, the goal of positively impacting cognitive health is implicit in the improvement of those health behaviors.

Tailored Messaging

Tailored messaging was incorporated into this study based upon earlier work indicating such communication was likely to be more effective and more efficient than either targeted or generic messages. Strecher and McPheeters define tailored messages as those which "are created on the basis of each individual's particular needs, concerns, behavioral motivators and challenges … take into account individual's particular stressors, challenges, and life situations, delivering a different response to each person." [20] The intent of this project was to tailor health coaching messages based upon all identified parameters which were known and stored within a patient profile.

The efficacy and feasibility of systems using tailored messaging has been well supported. Macri [21] et al discuss a "scalable approach for generating tailored…health messages." In their system, a "prompt" is a piece of information related to a single concept, such as an educational message or a care guideline. For each patient there is a state representation whose parameters describe past and current health status. All of the prompt content resides in a single table which incorporates logic for rules of content selection. Thus, tailored communication for an individual patient is a compilation of prompts relevant to the patient's state representation. One project using this model provided decision support to physicians tailored to individual patients for over 82,000 patient encounters.

In another study, Rothert et al [22] reported results of a randomized controlled trial comparing web-based tailored messaging with general weight management information. Overweight and obese patients were randomized to receive either tailored expert system (HealthMedia Inc.) advice or information using only web-based weight management materials. Subjects in the tailored system lost a mean of 3 +/- 0.3% of baseline weight compared to a weight loss of 1.2 +/- 0.4% of baseline weight in the information only group.

In their paper comparing tailored and targeted health communication Kreuter and Wray [23] stated "tailored messages appear to stimulate greater cognitive activity than do messages that are not tailored....Tailoring is a proven approach to enhancing message relevance, ..." Tailored messaging has been tested in multiple health domains and has been associated with positive changes in intention and behavior. Examples of studies where tailored messaging appears to be efficacious include the following:

- Reduced fat consumption, increased fruit & vegetable intake (Brug, Campbell & Van Assema, 1999; Brug, Steenhuis, Van Assema & de Vries, 1996; Campbell 1994)
- Smoking cessation (Dijkstra, de Vries & Roijackers, 1998, Strecher et al, 1994)
- Losing weight (Kreuter, Bull, Clark & Oswald, 1999)
- Obtaining mammogram (Rakowsky et al., 1998; Skinner, et al., 1994)
- Early discovery of cancer (de Nooijer, Lechner, Candel & de Vries, 2004) [24]

Purpose of Evaluation and Research Hypotheses

Automated remote health coaching may offer a cost-effective means to aid older adults in maintaining cognitive function and promoting other aspects of active life, and thus avoid

the disproportionate health care costs resulting from increased disability. However, it was unclear at the outset of this study whether automated tailored messaging would be efficient for the health coaches and effective for the elder clients.

The research question posed here was:

Is it feasible to develop an automated (see Table 1) health messaging tool which would enable health coaches to be more effective in the on-line coaching of older adults than they would be using conventional Internet tools only?

The research hypotheses for this study were as follows:

1. The time required for health coaches to complete a sequence of coaching scenarios for a panel of patients using a simulated automated tailored health messaging system will be significantly less than the time required for coaches using conventional Internet tools only.
2. The quality of the coaching messages will not be significantly changed.

Evaluation Method

Because this was a feasibility study, it was predicated upon the needs of a population of interest similar to that in the ORCATECH Living Lab which was available. After further investigation, this group was found to be too uniformly healthy, and thus would not exhibit the same behavioral challenges present in that population of interest. The investigator attempted to replicate the health issues of a more general population of this age (average age 81 years) with a selection of chronic conditions typically found, such as diabetes, arthritis, obesity and cognitive decline. (Appendix A).

The health coach population was defined as those who were 1) experienced in being a health coach; and 2) familiar with communicating with and coaching subjects on-line. One health coach had some clinical background but this was not a requirement.

The simulated patient population of interest had the profile given in the following table:

Category	Cohort Profile
Demographics	Age: 65 years and older
Health status	Some chronic illness, but able to conduct Activities of Daily Living (ADL) and Instrumental Activities of Daily Living (IADL)
Social	Living independently (i.e. at home)
	Supportive family and social network
Computer use	Familiar with computers, using email, Internet
Health concerns	Cognitive health (across all members of the cohort)
	Chronic illness (i.e., the particular condition impacting the individual)
Additional areas of health interest	Physical exercise / sleep quality / brain games
Readiness to change	Action or Maintenance
Literacy level	Inferred by education level
Cognitive level	Measured through participation in cognitive game play

The simulated population was over the age of 64 years with a mean age of approximately 80. While all members of the cohort had some level of chronic illness, all were able to function at home in conducting the typical activities of daily life. Where they differ from the general population of this age is that they were all comfortable in using a computer

for email and for seeking information on the Internet. Without performing any specific tests, the individual level of literacy was inferred based upon the level of education attainment. The cognitive measure to be used would be a dynamic measure extracted from the cognitive game metrics. In the present study there was no distinction made in messaging based upon either literacy or cognitive level.

To exemplify this profile, the case study of a typical patient participant is given.

Case study – Ellen Doe is a 67 year old woman with multiple health challenges.

Health status

- Vision limited by macular degeneration.
- Hearing loss in one ear.
- Shortness of breath due to partial removal of lung (cancer).

Current status

- Lives on her own at home,
- Has supportive family in the area.
- Wants to remain mentally active – highest priority.
- Willing to do something about concerns including exercise and nutrition.

Ellen's introduction to health coaching

- Uses optional module in PHR to identify areas of health concern
- Starts playing computer games for cognitive stimulus
- Receives information from health coach

The Simulator

As a feasibility study being conducted under the umbrella of the Automated Health Coaching project, the objective was to quickly construct a tool that would allow for the testing of the automated remote coaching concept, within budget and time constraints.

Building upon earlier work done in summer 2007, the initial focus was on a human computer interaction that would enable a health coach to immediately see on one computer screen all information necessary to inform him or her about a patient under review. In an early PowerPoint formulation (see Figure 1) it was assumed that the health coach had already selected a patient (Ellen Doe) from the group in his or her care.

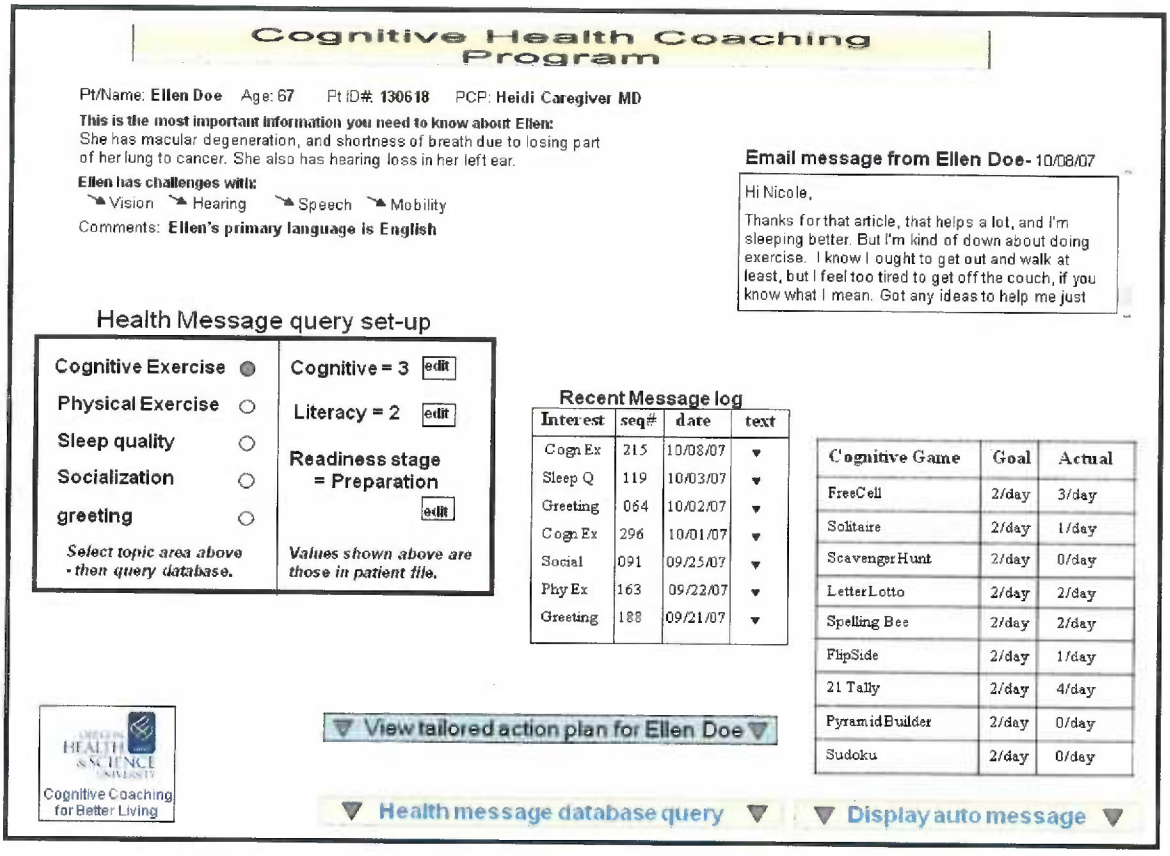


Figure 1 – Early PowerPoint design of Simulator interface

In creating the simulator for this study, there was an implicit goal of developing a user interface (UI) that would allow the health coach subject to concentrate on the coaching task rather than devote time to navigating through a confusing interface. Following basic HCI principles, the user's eye can reasonably flow from upper left to lower right and scan

the relevant patient information. However, the task of formulating a coaching message to Ellen Doe compelled the coach to navigate away from the page where the essential information is being displayed, since the message function was on a separate screen. This deficiency resulted in a new layout of the coaching screen integrating a text box in which the coaching message could be composed (see Figure 2). Looking ahead to the distinct elements of the proposed coaching message, radio buttons (option buttons) were added to the left of the "Proposed message" text box. These allowed the health coach to select the portion of the message currently being written. This structure overcame many limitations of the prior screen and provided an opportunity to edit out those aspects of the model that had been excised to simplify the study.

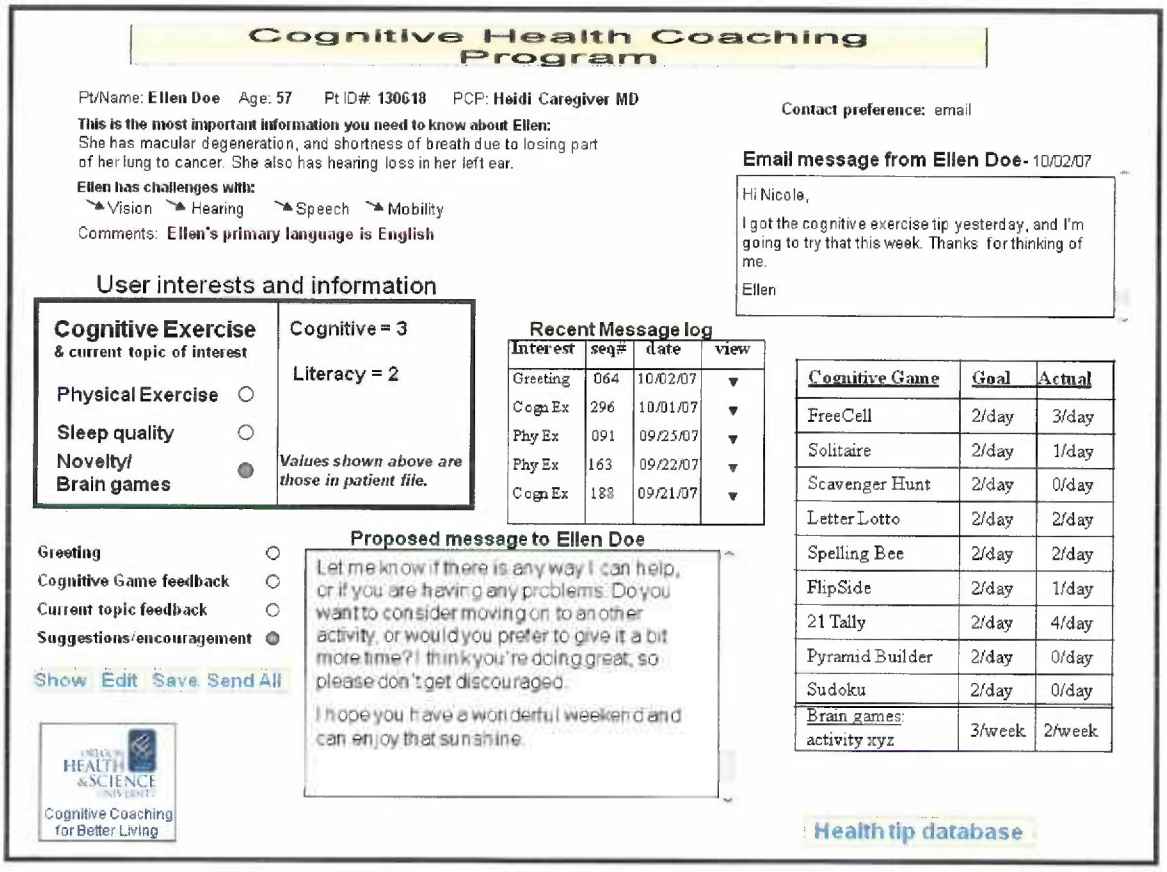


Figure 2 – PowerPoint design of Simulator with message text box

The new screen, however, introduced a different problem; reserving the text box for only one segment of the message at a time gave the health coach no convenient, time-efficient way to review the entire message before emailing it off to the client. Thus in a subsequent modification, the text box was greatly expanded in size (see Figure 3) and now comprised the largest single item on the coach screen. In return, the all-encompassing design of the text box permitted the radio buttons to be eliminated. In their place, small descriptive signs identify the purpose of each sector of the text box. In parallel to the visual changes taking place, behind the screen aspects of the simulator evolved. In order to allow the inputs of the coach/subject to be captured, Visual Basic code was added to the PowerPoint to support a pre-stored "automated" message (Auto message button) and a post-edit storage of text created by the health coach (Save button).

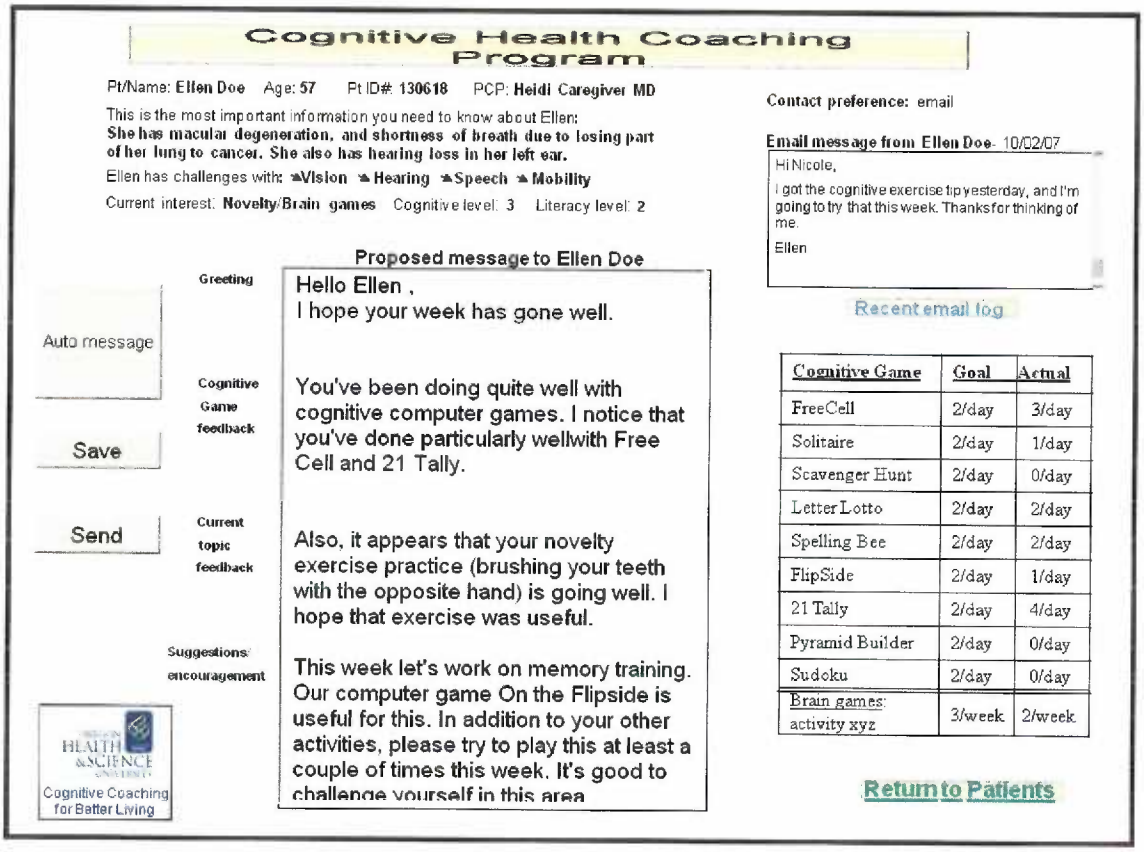


Figure 3 – Simulator with auto message and edit implemented in Visual Basic

Figure 4 is a screen shot of the simulator as it was actually used in this study. Comparing this to the earlier renderings, all of the essential information has been maintained, but the emphasis has changed to concentrate on serving the needs of the user, i.e. the health coach. This edition is written in Visual Studio's Visual C# Express 2008 (see Appendix B). Here the patient panel has been pulled into the coach screen eliminating another source of inefficiency. After the coach has sent an email to a patient, that individual's name is checked off to assist the coach in knowing when the entire panel is complete.

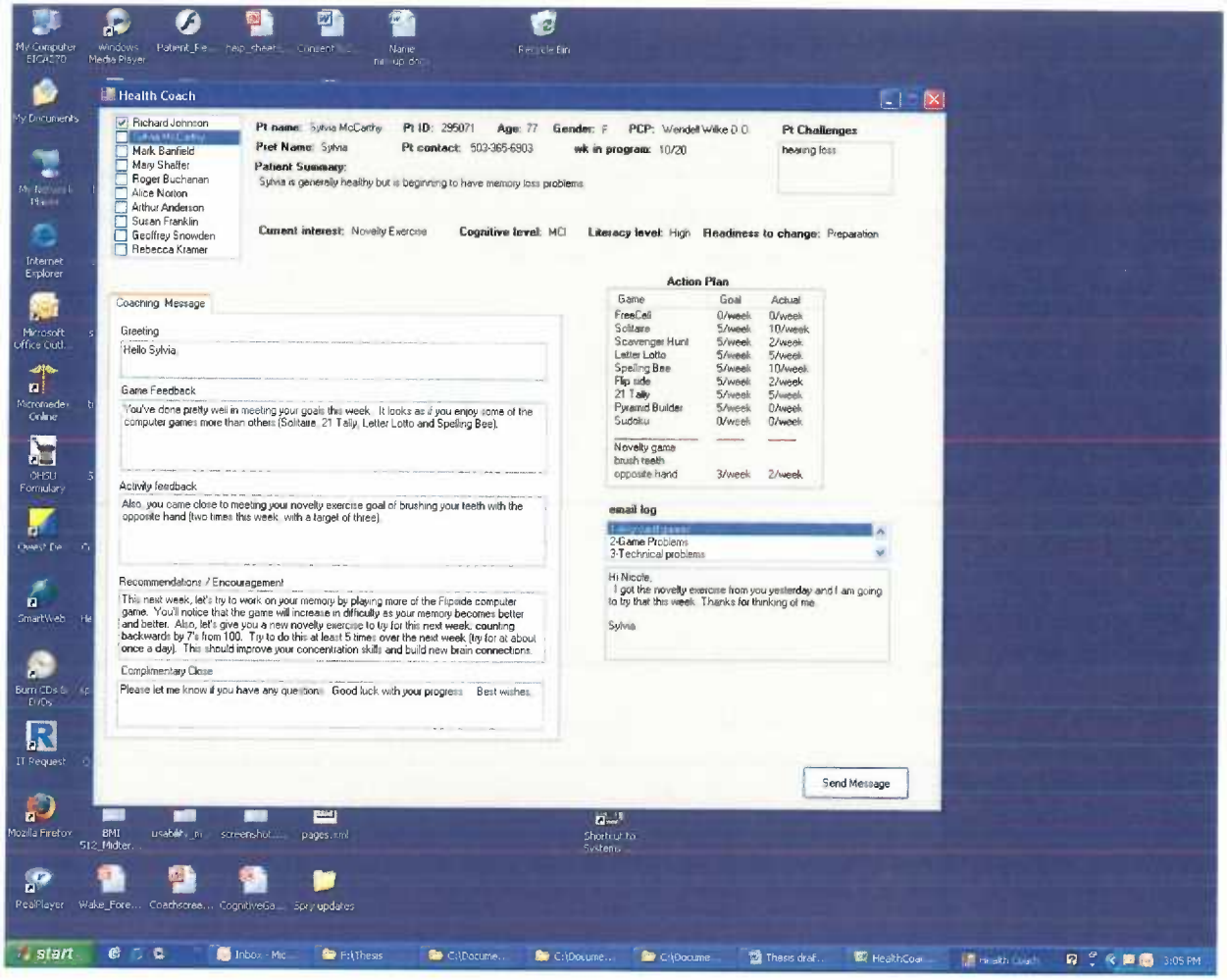


Figure 4 – Simulator as used in the study implemented in Visual C# Express 2008

Procedure

Health coaching subjects were given individual training (see Appendix C), approximately 1 hour in length, to explain the background and motivation for the proposed study. This session briefly covered the ongoing Cognitive Health Coaching Study, gave an overview of the cognitive computer games including both game play and potential cognitive impact, and provided an introduction to the coaching simulator that he or she would be using in the test.

In order to set some boundary conditions and expectations, the subjects were given a scenario that, in part, read as follows:

> You have been invited to be a Health Coach for a population of older adults who are dealing with chronic illnesses as well as some degree of cognitive decline. Each of your patients is in a 20 week Health Awareness program and is participating, or should be participating, in playing cognitive computer games. In addition to the cognitive games, each patient has chosen an area of current health interest from among the following:
>
> - Physical Exercise (example: brisk walk for 20 minutes per day)
> - Sleep Quality (example: discontinue caffeinated beverages after 4 PM)
> - Novelty/brain games (example: brushing teeth with non-dominant hand)
>
> Corresponding to the patient's current health interest, the individual will have an activity to work on (examples provided) which may support or supplement their cognitive health.
>
> You are responsible to provide coaching to 200 patients on a weekly basis, with a scheduled frequency of once per week. Keeping in mind that your patient load will average 40 per day, your task will be to craft a message to each patient based upon the information provided to you on the coaching screen. You will want to try to personalize your message to reflect the unique set of information presented for that individual…

The subjects were told, later in the scenario, that the patient-coaching aspect of the theoretical job represented only half of his or her professional duty therefore it would be prudent to spend no more than about 4 working hours per day in this activity. Conversely, as health professionals, it would be incumbent on them to strive for the most personalized and productive contact possible within those few minutes per patient per week.

In carrying out the study, health coaches provided remote coaching to each member of a panel of 10 elder patients using one of two coaching systems, manual or semi-automated. Coaches were divided by random assignment into two groups and alternated between two coaching systems over the course of 4 coaching sessions. A comparison of the systems is given in Table 1.

Manual System	Automated System
Create his/her own message	Provided automated message which could be used verbatim or edited to further tailor the message to the patient
Access to the Internet	
Knowledge of patient's areas of health concern	
Patient's current health status	
Patient's performance to goals in cognitive game play	
Patient's literacy/cognitive level	
Patient's current health behaviors against action plan	

Table 1. Comparison of manual coaching system to automated system.

It should be noted that at the coach's prerogative, the automated message could be discarded in its entirety and replaced by a message of his or her creation.

The health coaching screen (see Figure 5) allows the coach access to all relevant information with which to support the coaching task. This screen illustrates the capabilities provided by the semi-automated system, that is, when a patient is selected from the panel (upper left) the segments of the coaching message are filled with

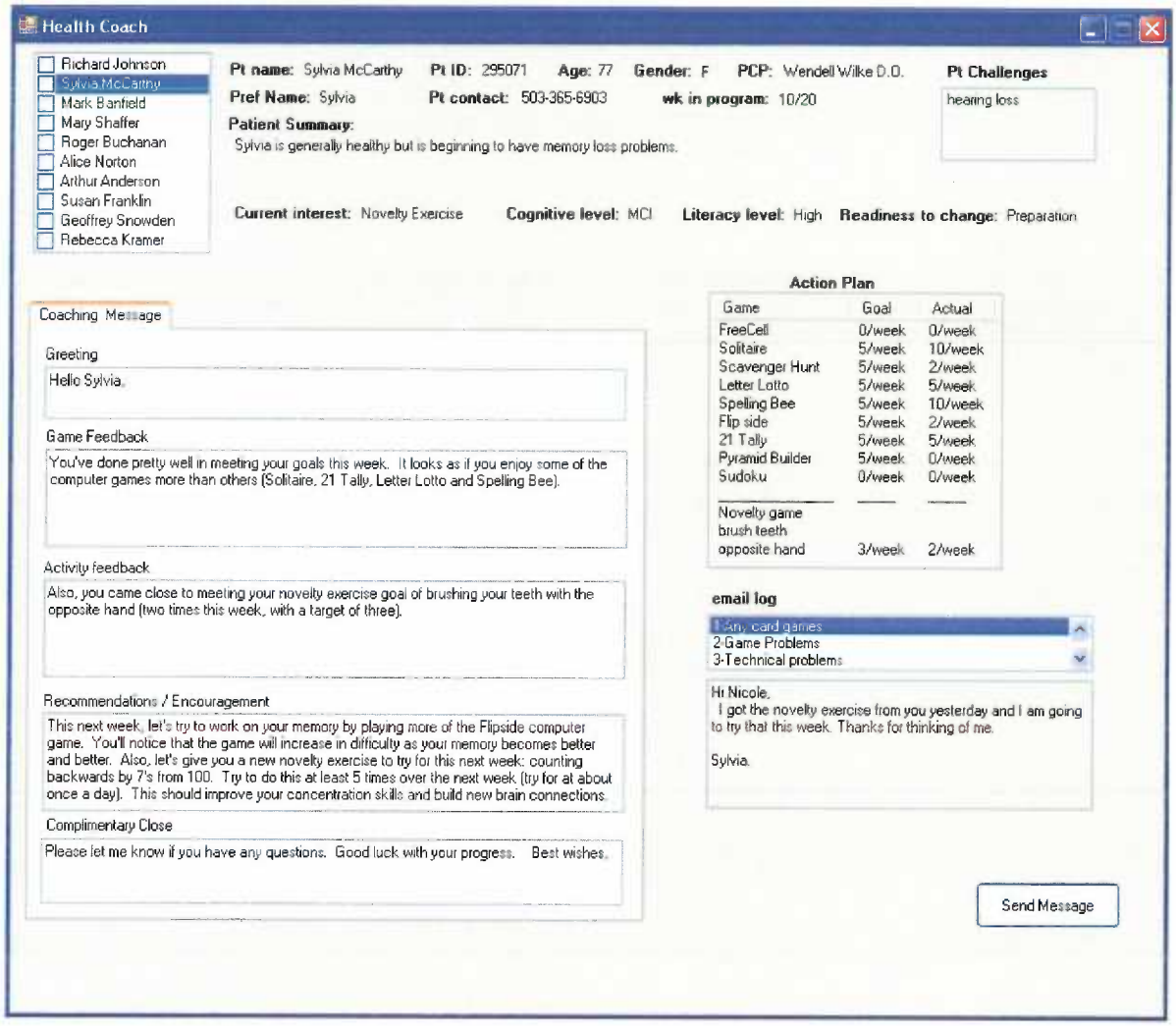


Figure 5 – Health Coaching Screen / Coaching Simulator

suggested wording appropriate to the information presented. When the manual version of the system is in use, the selection of a patient from the panel causes the patient data to be displayed. However the coaching message will remain blank awaiting inputs from the health coach.

The coaching experiment consisted of 4 coaching sessions as outlined here using the use case model. (In the use case model the actor has the primary role of interacting with the system. The use case describes what the actor is trying to accomplish with the system.)

Coaching Session Use Case

- Actor: health coach
- Secondary actor: patient

Coach produced a message or used the automated message to provide the following elements for each of 10 patients:

- Greeting
- Feedback on participation in cognitive game play
- Feedback on participation in activity in topic of chosen interest
- General encouragement and suggestions for additional activity
- Complimentary closing.

Assumptions: For each patient, coach had access to the following information:

- Demographics: name, gender, age
- Health status: As provided by patient to his or her personal health record.
- Current health behaviors:
  - Cognitive Exercise – cognitive computer games activity
  - Other behaviors determined by individual interest – self reported
- Areas of health interest:
  - Cognitive Exercise (assumed) and one of the following:
    - Physical Exercise
    - Sleep quality
    - Novelty / brain games
- Cognitive level: (healthy or mild cognitive impairment MCI)
- Literacy level: (high, medium or low)
- Readiness to change: (action or maintenance)
- Recent email message from patient to health coach

By random selection half of the coaches were assigned to begin the experiment using the semi-automated system; half using the manual system. For the first coaching session each coach in the first group used the semi-automated system to provide coaching to each patient in the panel. Similarly each coach in the second group used the manual system to complete the parallel task. For each subsequent coaching session, the coaches were crossed over to use the alternative system so that at the end of the four coaching sessions, each coach subject had used the semi-automated and manual systems twice.

For the first coaching session, the 10 patient profiles were distributed so that one patient was shown to be in each of the first 10 weeks of the 20 week cognitive health program. In the second coaching session, the snapshot of each patient was taken to be a fortnight further along in the program. Similarly, for session 3, all patients were moved an additional 4 weeks along, and finally for session 4, the panel was viewed 3 weeks hence. So, for example, the patient 'Alice Norton' appeared initially in week 3, then in week 5, next in week 9, lastly in week 12 of the 20 week program.

Evaluation Measures

As stated in the research hypotheses, we were anticipating that the health coach subjects would be able to accomplish the coaching task for a panel of patients more efficiently using the automated system. We predicted that this efficiency would occur with no significant change in message quality. Thus the evaluation measures chosen were efficiency and quality.

Efficiency – how long did it take a coach to generate messages for 10 patients? This was the primary measure, with the expectation that the time required for coaching using the automated tailored system would be shorter than the time required to use the manual method.

Quality – as judged by health coach subjects – using a numerical scale on which a rating of 0 indicates that the coaching message was unsatisfactory, 5 signifies that the message was adequate, and 10 indicates the message was excellent. Each coach/subject was asked to rate the messages created for six of the patients in one of the four coaching sessions. The coaching message created by the coach doing the rating was excluded from consideration, so only 5 of 6 messages were rated. The assignment of coaches to the patient/session combinations was done using the following pseudo-random process: no coach rater was ever assigned to a particular patient more than once, and each rater was assigned to rate messages at least once in each of the four coaching sessions. Only 36 of the total 40 combinations (10 patients x 4 coaching sessions) were rated, in order to insure that each coach rater was equally represented in the process.

Quality – as judged by patients – using the same numerical scale as the health coaches, with a rating between 0 and 10. Patients from the Living Lab / Cognitive Health Coaching project were recruited to act as surrogates for the hypothetical patients employed in the study.

Both the patients and a health coaches were asked to base their judgment, in part, on how well the coaching matched the individual needs of each patient. The health coaches were

requested to formulate the rating in light of their training and experience as a health coach. The Living Lab participants were asked to put themselves into the role of one patient from the panel being coached, and judge how satisfied they would be with the coaching advice given.

Coach satisfaction with the coaching systems.

With the goal of gaining knowledge and insights from the individual experiences of coach subjects in this experiment, qualitative interviews with the coaches were conducted using open ended semi-structured questions. These questions were formulated, in part, based upon feedback given by each coach following the completion of each test session.

Which system (auto or manual) did they prefer? When did they reach steady state? Was automated prompting helpful? What else could have helped? Did you perceive that it made you more efficient? What would have made it better?

Analysis

The measure of coaching efficiency was the mean time taken by each subject (coach) to formulate a coaching message to a patient in each of four coaching sessions. Examination of the mean values over the sequence of the four tests found that with one exception, each coach demonstrated an improvement, that is, a reduction in mean time from the first test to the second test in both the manual and the semi-automated systems. For the one coach/subject who did not exhibit this learning trend, there was a delay of three weeks

between the first two and last two sessions. It appears that this coach had to "re-learn" the systems when the testing resumed.

The study also looked for indications of a learning effect to see if the coaches were more time efficient in the second exposure to a system versus the initial trial. Furthermore, the results within a session (i.e. one coach completing coaching for 10 patients) were reviewed to look for a change in efficiency over the course of a session.

Results

This section discusses our results for the quantitative evaluation of coach efficiency and for the quantitative assessment of message quality by both coaches and older adults. We also describe the finding from the qualitative debriefings with coaches at the conclusion of the study.

Quantitative Evaluation – Efficiency

Comparing the mean time taken by each coach subject to complete the coaching task for the simulated patients in each coaching session resulted in a mean time of 4:59 minutes for the manual system versus a mean time of 3:14 minutes for the automated system, a difference of 1:45 minutes. Using a Paired T-test, pairing the mean times for each coach using the 12 automated tests to the mean times of the 12 manual tests, it was determined that this difference was statistically significant with a 2-sided p value of .009. supporting research hypothesis. (see Table2)

	Coach		auto	manual		difference
These coaches used auto system first	C1- trial 1/2	Mean	5:49	8:45		2:56
		SD	1:27	4:29		4:10
	C1- trial 3/4	Mean	4:42	3:53		-0:49
		SD	1:03	0:51		1:16
	C3- trial 1/2	Mean	3:16	4:44		1:28
		SD	2:18	1:47		0:59
	C3- trial 3/4	Mean	1:13	4:34		2:21
		SD	0:52	1:06		0:44
	C5- trial 1/2	Mean	5:40	4:05		-1:35
		SD	1:58	0:48		1:27
	C5- trial 3/4	Mean	3:13	3:25		0:12
		SD	0:36	0:34		0:41
These coaches used manual system first	C2- trial 1/2	Mean	1:38	3:45		2:07
		SD	0:57	0:50		0:48
	C2- trial 3/4	Mean	1:17	3:45		2:28
		SD	0:34	0:58		0:59
	C4- trial 1/2	Mean	2:39	6:50		4:11
		SD	1:06	1:44		2:00
	C4- trial 3/4	Mean	2:59	7:31		4:32
		SD	1:09	1:39		2:24
	C6- trial 1/2	Mean	3:58	5:00		1:12
		SD	1:04	1:31		1:23
	C6- trial 3/4	Mean	2:30	3:31		1:01
		SD	0:42	0:42		1:16
	All trials 1&2	Mean of Means	3:50	5:31		1:41
		SD of Means	1:40	1:55		
	All trials 3&4	Mean of Means	2:39	4:26		1:47
		SD of means	1:19	1:34		
	All trials (n=12)	Mean of Means	3:14	4:59		1:45
		SD of Means	1:33	1:45		
		Comparing the automated trials to the manual trials using Paired t-test determined difference was significant p <.01				

Table 2 – Comparison of means using automated and manual systems
(All times minutes and seconds)

Comparing the means of the earlier trials to that of the later trials, there is a clear indication of a learning effect, and much time was invested to examine the impact of this effect. From the perspective of efficiency, the effect of the intervention increased from

1:41 minutes in the first two tests to 1:47 minutes in the subsequent two tests, but sample size was insufficient to determine if this direction was significant.

Examination of individual coach efficiency revealed some contrary data. In the 3rd and 4th coaching session, Coach C1 took longer using the automated system than the manual system, and along the same line, coach C5 took almost as long with the automated system as with the manual system. We will return to this data in discussion of the quality ratings.

Table 3 displays the learning effect mentioned above in which all coaches with the exception of coach C4 are more efficient in the second test with a system compared with the initial test. Also it shows that independent of the learning effect, there is a large effect size associated with the automated intervention. Comparing the two automated assisted tests to the two manual only system tests, the mean time for the coaches to complete a panel was 3:14 (3 minutes: 14 seconds) in the automated system versus 4:59 (4 minutes: 59 seconds) using the manual system.

Another form of learning effect was apparent as the coach/ subjects progressed in the session from the first through the tenth patient. Not surprisingly, the first patient in most coaching sessions was the one that took the longest to complete a message for, as a coach recalled how the system functioned. Secondly, the trend over any one session was toward greater efficiency (i.e. shorter time), although this was not uniformly so. Thirdly, the variability in time it took an individual coach/subject to clear a patient from the panel, as measured by the coefficient of variation (standard deviation divided by the mean), decreased along with the means. This comparison is also shown in Table 3.

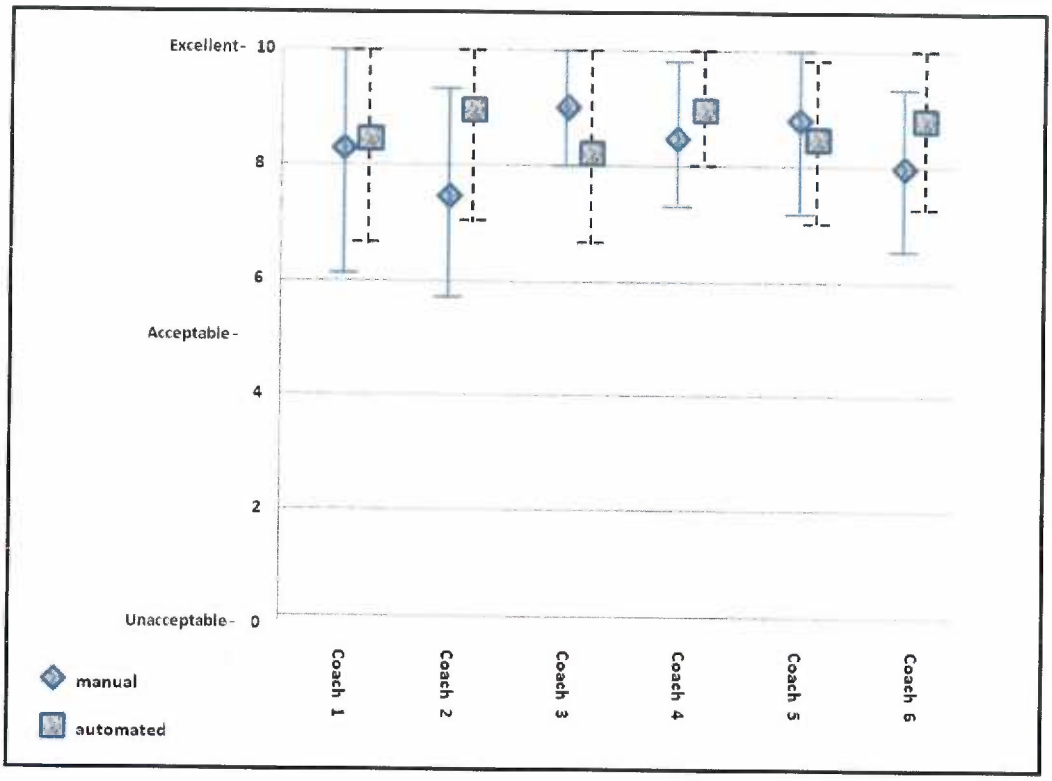
			1st auto	2nd auto	Difference	1st manual	2nd manual	Difference
These coaches used automated system first	C1	Mean	5:49	4:42	-1:07	8:45	3:53	-4:52
		SD	1:27	1:03		4:29	0:51	
		SD of diff			1:55			4:23
		SD/mean	.2493	.2234	-.0259	.5124	.2189	-.2935
	C3	Mean	3:16	1:13	-2:03	4:44	4:34	-0:10
		SD	2:18	0:52		1:47	1:06	
		SD of diff			1:38			0:56
		SD/mean	.7041	.7123	.0082	.3768	.2409	-.1359
	C5	Mean	5:40	3:13	-2:27	4:05	3:25	-0:40
		SD	1:58	0:36		0:48	0:34	
		SD of diff			1:40			0:55
		SD/mean	.3471	.1865	-.1606	.1959	.1659	-.0300
			1st auto	2nd auto	Difference	1st manual	2nd manual	Difference
These coaches used manual system first	C2	Mean	1:38	1:17	-0:21	3:45	3:45	0:00
		SD	0:57	0:34		0:50	0:58	
		SD of diff			0:57			1:09
		SD/mean	.5816	.4416	-.1400	.2222	.2578	.0356
	C4	Mean	2:39	2:59	0:20	6:50	7:31	0:41
		SD	1:06	1:09		1:44	1:39	
		SD of diff			1:14			1:35
		SD/mean	.4151	.3855	-.0296	.2537	.2195	-.0342
	C6	Mean	3:58	2:30	-1:28	5:00	3:31	-1:29
		SD	1:04	0:42		1:31	0:42	
		SD of diff			1:21			1:19
		SD/mean	.2689	.2800	.0111	.3033	.1991	-.1042
All coaches		Mean	3:50	2:39	-1:11	5:31	4:26	-1:05

Table 3 Mean time comparisons 1st test to 2nd test in each system (All times minutes and seconds)

Quantitative Evaluation – Quality

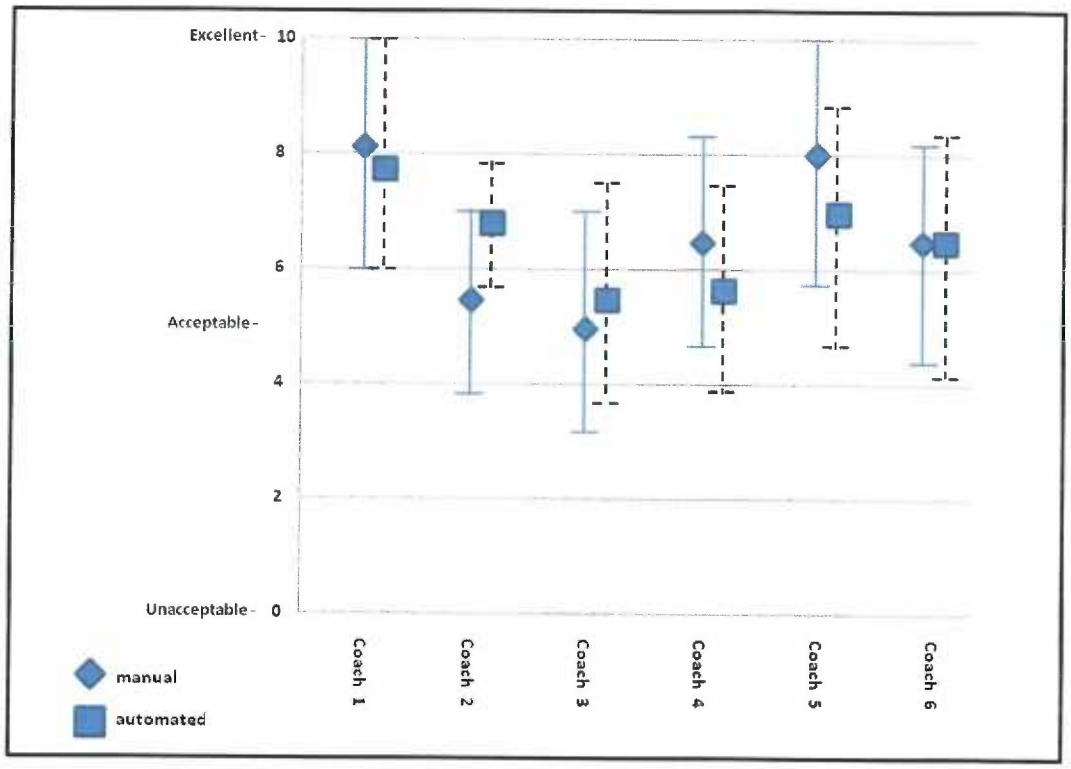
The quality ratings done by the coaches themselves and by the Living Lab participants not surprisingly showed a divergence of opinion. Examination of individual messages

and the ratings associated with that message illustrated, for example, that a message rated highly by coaches for its thoroughness was rated less favorably by the surrogate patient who found the coaching message to be overly long. In general, as shown in Graph 1, the patients found the messages to be of good quality within a relatively narrow range. The ratings done by the health coaches occupied a much wider range between acceptable and very good (see Graph 2).



Graph 1- Quality of coaches messages – as judged by patients

Error bars show +/- one standard deviation in ratings for that coach



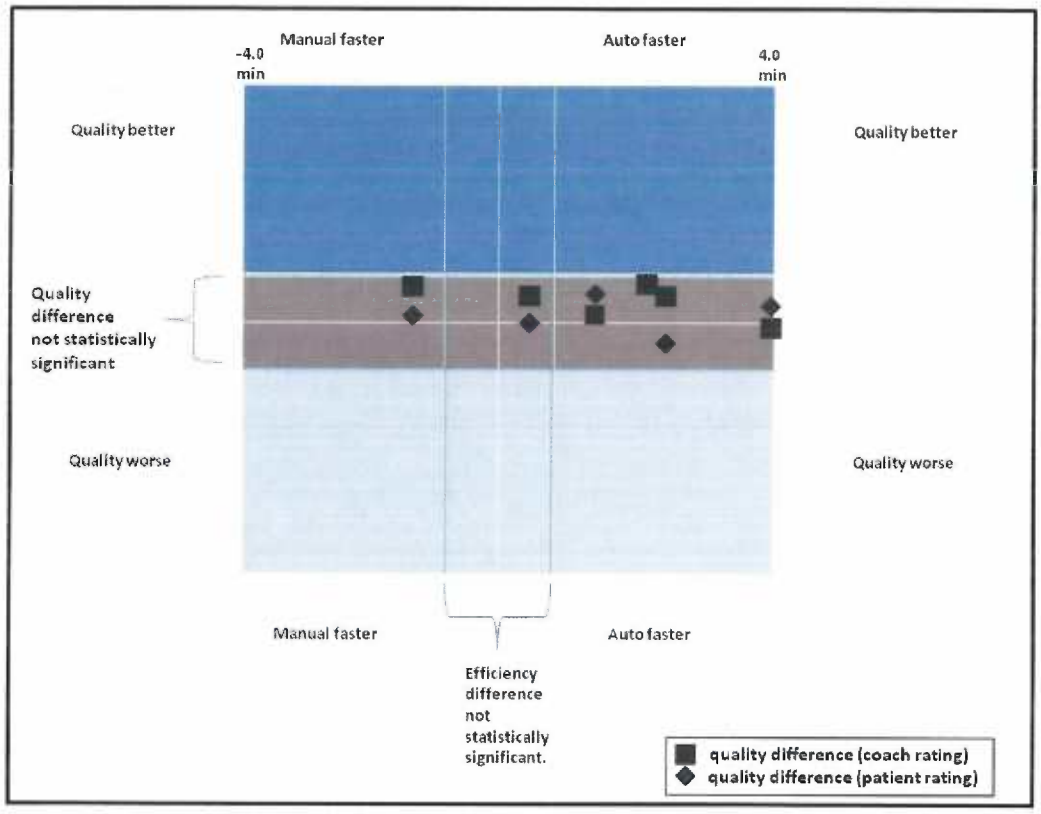
Graph 2- Quality of coaches messages – as judged by fellow coaches

Error bars show +/- one standard deviation in ratings for that coach

The quality ratings from each group of raters have been divided according to whether the messages were manually generated or created with the aid of the automated system. From the patients' point of view, 4 of 6 coaches are given higher ratings for the messages that resulted from use of the automated system. The coaches however found that only two of their fellow coaches did better with the assistance of the automated tool. Regardless, the overall quality results, when comparing messages rated by both rater groups, demonstrated no statistically significant difference between messages created using the two systems.

Summarizing the quantitative data, use of the automated system resulted in a significant improvement in efficiency. While not every individual coach reflected an improvement in efficiency by use of the automated system, these differences enlightened the post-

experiment discussion with the coaches. As displayed in Graph 3, there was no significant change in quality resulting from use of the automated system.



Graph 3 – Efficiency and Quality Differences by Coach Subject

Qualitative Evaluation

After completion of the coaching study, the coach/subjects participated in feedback meetings and responded to semi-structured open-ended questions regarding the process that they went through. Their inputs concentrated on how the system could be improved to make it more usable and useful, and, despite the stated deficiencies, there was consensus that an automated system would be seen as potentially valuable.

How the system could be improved

The issues raised here surfaced within the first or second testing session, and were voiced throughout the study. The strongest negatives came from those aspects (tone) which went against the principles and practice learned and used within methods of coaching, such as Motivational Interviewing. The more positive suggestions (customize, tailored) revolved around working with the automated messaging so that individual coaching vocabulary and style could be accommodated, and more personal ways to tailor messages so that one-on-one communication could be sustained.

Tone

- The messages shouldn't be framed in a negative way; rather, say something like "you met 60% of your goals… good job." Always be positive.
- Focus on accomplishments, not on failures.

Customize (for the coach)

- I'd be more efficient if "the words were correct," (meaning in their own style with the right framing)
- One felt that the system would work well if she had been involved in the design of the messages.
- (Liked the use of templates). Wanted it to be my template.

Tailored / Personal

- Extent to which messages are formulaic is a problem.
- Recommendation / suggestion section needs more personalized response.
- People are more forgiving for being late than they are for being impersonal
- I would like an opportunity to say something personal in the opening and closing

Structure

- Currently the system feels one-sided
- The key to success in these interventions is that the coach listens (need to make sure that it's not just outgoing messages)
- It would be helpful to use speech recognition software to automatically transcribe what the coach says into written emails.
- To keep "control of session" it helps to set an agenda, have a 2 minute warning, be directive, and keep bringing them back.
- 1 face-to-face session is plenty at the start. It can be short, 15-20 minutes.

Working around the system

The comments listed in this section relate back to the topics covered above under how the system could be improved. These observations express how the coaches either did work around the system or would have liked to work around the constraints of the simulator. In some cases the coaches described breaking "out of the box" they were placed in.

Wording

- I changed the wording
- With auto version found herself deleting everything – issues with wording.
- I ended up replacing "should" with "could" in every message

Making it up

- Wanted to customize the messages according to old emails. Made up stories.
- Was making stuff up – as if someone had been emailing me.
- Pretended she had other information – felt very much removed (from patient).

Personalize

- Relationships develop through this process. Messages can't appear formulaic.
- I tried to relate mobility (in the upper right) to the goal of brisk walking.
- Noticed that a subject with osteoporosis was being advised to take a warm bath for sleep management…, Felt that might be dangerous

Breaking out of the system

- I know you kept encouraging us to "think inside the box" but I kept trying to stretch the box.
- "Poked holes in the box. Punched our arms through the holes."

Automated system as a potential aid with coaching

As the study progressed and the level of comfort with the automated system increased, more feedback was articulated as to how this type of system could be of benefit in the real world environment of health coaching. Training was the first topic to be mentioned, with the assumption that a system like the one being used in the study would be a training aide that might be discarded after the trainee became an experienced coach. Beyond

training, the coaches saw value in increased efficiency that would accrue with the structured, automated system.

Training

- Especially at first, it's easier to have something (automated text) in front of you.
- When you're learning, you're not sure of the tone to take with people, or exactly what to say
- It teaches you about the appropriate content.
- Learning curve was quick – excellent training tool.
- Prompts are absolutely helpful in the beginning

Provides Structure

- It's good to give that initial summary of what has happened over the week (the way the automated system does).
- "I hate typing. I like the template, although I would like to have my own personal template."
- Having the protocols built in (to the auto messaging) helped.
- The first sections (feedback on game play, activity) could be automated.
- The fact that you can tweak these prompted messages is an "ideal middle ground"

Efficiency

- Participants perceived that they were more efficient with automated assistance
- When I typed from scratch, it took me 1 hour (to do a whole panel of patients), but with the assistance, I could get it down to ½ hour.
- Then the prompts were an excellent time saver and reminder of what to say.
- It doesn't take much time to tweak these messages.

Suggestions for future development

Comments listed under this heading reiterate the expressed need to maintain certain operating principles that the health coaches value. They also delve into some more wide-ranging ideas about how an automated tailored system could be modified and adapted to fit the requirements of the coaches from their perspective and meet the needs of the prospective client. Consequently, these suggestions range from fundamental core values to be integrated into the message protocol to structural questions about functionality.

Core Values

- Need to build self-confidence & self efficacy
- People want a chance to be heard, validated.

Tools for Coaches

- I need a list of early reinforcing words to choose from; early, mid-stage, late-stage words etc.
- I need about 8-10 ways to praise someone
- Some quantitative feedback phrases – e.g. good job; you've reached 60% of your goal already.
- Access to other information – without it being on the main coaching screen.
- It's helpful to have voice delivery of message over the phone to get the inflection and emphasis
- You need to relate why you'd want them to do any particular activity

Tools for Patient (& Coach)

- Patients could communicate with one another – as in a support group.
- It would be helpful to have the interactive IM (Instant Messaging) with the patient while they were on the computer. Also it could be helpful for the coach to be able to "take over the computer" to view the screen in order to help out.
- It's ideal if the patient can choose the communication modality
- Patient communication preference (Healthy Aging project) 30% phone, 70% email

More Information

- Some sort of history chart.
- Being able to see history, whether person was improving, and what happened earlier.
- Would need more input about the patient and situation to do the messages right.
- It helps to know about a person's hobby or interests in order to make a better connection with them

Other area for improvement

- The summary could be automated, but the recommendations should be more personal.
- You need to use the phone when people are really struggling.
- It's important to have real time interaction with them. It's a different level of interaction.
- The customizable portion is most important
- Taking a canned message and tweaking it – possible middle ground.
- Really need to make it more personal – one time on the telephone.
- Timeliness

Concerns and Comments

The items covered here do not fit in prior categories but reflect the range of the discussion that took place during the feed-back meetings. The coaches were clearly interested in whether the implementation of a production automated coaching system would lead to improved outcomes. They also brought out aspects of the coach – client communication that were evident to them but were not necessarily comprehended in the design of this study. The following set of comments reflects concerns that arose during the discussions with the health coaches.

Other concerns /issues

- By answering questions, the patients evaluate the information and absorb it themselves
- By going through the process the patients "get heard"
- These types of systems have to save time and reduce costs. The more efficient the better
- It would be interesting to see if the automated (versus hand crafted) would make a difference in patients' behavior.
- Need to make this cost effective.
- There are emotional dimensions to every aspect of these interventions
- It affects the ability of people to make lasting behavior change
- It's most important for the patients to be heard and validated. After that, to be understood and responded to personally.
- It's important that they think "This person cares about me"
- The relationship is doomed if you tell them to do brisk walking when they just broke their ankle.

Problems encountered with the simulator

As with any piece of new software, especially new non-commercial software, the simulator had bugs and encountered some unanticipated problems such as those noted.

- The first time I accidentally erased everything and had to rewrite it.
- Wanted to go back and edit – not supported.
- Occasionally I wanted to go back and change or add something to a previous message. I could have cut and pasted something from my current message. Couldn't do that.

Coach learning process

Comments listed below provided insights into how the coaches saw their own learning experience evolve during the course of the study. This knowledge should provide helpful guidance in carrying out further research or in the development of other automated tools.

- The experience shaped how I did successive sessions
- I didn't notice what was in the upper right for a while
- Did not look (up) at patient challenges until the 4th session.
- I was still learning up until the 4th time
- I approached this not feeling like a health coach; I was always self analytical
- The process felt good the last time
- It took me forever to create all of these messages the first time (didn't have automated system), but then I got faster and faster with each session.
- Cut and pasted.

Additional Comments

The comments that follow did not group with any of the previous topics, but are included here in order to fully report the feedback received from the coaches.

- Everyone says things different ways
- The automated part doesn't need to take away from the experience
- These interventions are important.
- You can read our created messages to get suggestions for how to improve the messaging.
- Real time interactions are great
- Some people just need more touch.
- Complexity of health behavior: what is going on in their lives impacts ability to make lasting behavior change
- To maintain control (and not allow a few people to soak up all the resources) set agenda, time check, being directive, structured.

Discussion

We found that our health coaches were more time efficient with the aid of the automated system, with no significant difference in perceived quality of the messages. Our coach subjects were receptive to automation of some aspects of the coaching task, but wanted greater flexibility in the system to better maintain a human connection.

Feasibility considerations determined that this would be a constrained study. It was decided early on that our health coach subjects would not be utilizing motivational interviewing principles. For similar reasons the concept of readiness to change was not one of the parameters used in formulating the individual tailored messages.
Clearly the reliance on fictional patients removed a potential dimension of interaction from the coaching experience.

The constraints on this study enabled a concentration of attention on the core functions of a health coach delivering messaging to clients for a very circumscribed set of activities. By avoiding the complications of a more complex tool, the task of implementing a working prototype, though still difficult and time-consuming, was kept manageable. This relatively simple simulator combined with the limited set of presumed client activities avoided the likely prospect of the training regimen and the health coach learning process consuming an untenable amount of time and resources.

Yet these limitations cited above facilitated a focus which enabled insights into, from the health coach perspective, what worked and what was problematic. If health coaches had

been employed to create the inventory of messages which were invoked by the automated system, then certainly many of the concerns voiced in the qualitative feedback would not have arisen. But working outside the usual boundaries of the health coaching environment also may have opened some of the health coaches eyes into what was both feasible and perhaps desirable through informatics.

Limitations of the study

There is no single definition of health coach and the term is widely used in non-academic venues to mean whatever is helpful to the promotion of product or services. The definition cited earlier conforms well to the intent of the Automated Health Coaching project.

The question of definition leads to the second limitation which is who is considered a health coach and qualified to be a health coach. There are several organizations which grant health coach certification and future studies in this area would need to consider these as a basis for recruiting subjects. An equally challenging area for discussion is what constitutes a "good" coaching message, and this question would need to be addressed in the process of constructing a production version of the coaching simulator.

A related limitation of the study was the limited availability of health coaches for the experiment and for the process of rating the quality of messages. In an effort to conserve the health coach resource, they were not utilized in the development of coaching messages that were output by the automated system. As a consequence, there was some level of dissatisfaction with the messages they were given during the course of the study,

and this was reflected in the coach feedback. It should be noted however that the patient raters gave higher ratings than the coaches in general, and tended to rate the automated messages higher than the manual ones. The health coach resource limitation forced us to use the coach/subject as the coach/raters, which may be a confounding factor in our quality results.

The artificiality of the study makes it difficult to extend conclusions beyond the establishment of positive feasibility for an automated coaching study. Our 'patient' cohort was made up to provide a reasonable mixture of elder profiles when the real people available were not sufficiently compromised by illness or cognitive loss. Without real patients to work with there was no opportunity for feedback and interactive communication that would be expected even with the use of a remote, semi-automated system.

The simulator had limitations and bugs that would not be tolerated in a production tool. It lacked basic spell check capability, did not allow coaches to revisit messages once they had been 'emailed', and it hung up once or twice and needed to be restarted.
Lastly, it is not entirely clear that the learning effect was complete, although the verbal inputs from the subjects showed that all had reached a level of comfort, if not expertise with the system.

Future Research

An expansion of this study which addressed two areas of concern voiced by health coaches could be undertaken. The apprehensions regarding the tone and language to be

used with coaching clients should be resolved by using certified health coaches to craft or at least approve all messages. The capability for increased personalization of messages, and for templates customizable to individual coach vocabulary and stylistic differences, would greatly enhance coach satisfaction, and merits further attention.

A larger study with actual patients from the population of interest would provide that missing dimension and let the health coaches do "field testing" of this type of coaching tool. Future studies that look at patient outcomes would follow once the bugs and shortcomings of this initial effort were overcome. The lack of realism in the current study was a necessary but difficult limitation, and thus left unanswered many underlying aspects of the coaching experience as well.

Conclusions

A semi-automated system having the capabilities of simulator used in the study, modified to address the objections of the subjects, would enable health coaches to be significantly more time efficient. Adapting to the constraints as well as the benefits of the automation enabled greater efficiency without sacrificing quality of the message.

Health coaches appear to be open to the automation of certain tasks, but would insist upon the ability to personalize the communication when this was appropriate. They view certain facets of the coach – client communication to be sufficiently routine to be compatible with a higher level of automation. However, the coaches did not feel that the current system helped them to maintain the human connection.

A hybrid system which could incorporate highly professional and standard coaching messages while at the same time be customizable to accommodate the individual characteristics of each coach is more likely to be viewed strongly positively and be therefore be accepted for regular use.

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Appendix A: Patient Profiles

Patient Last name	Johnson
Patient First name	Richard
Preferred Name	Rich
Health status	Rich has macular degeneration and chronic asthma. He was a two-pack per wk smoker for 25 years.
Current interest	sleep quality
Cognitive level	healthy
Literacy Level	medium
Readiness to change	contemplate
challenges-1	vision
challenges-2	shortness of breath
challenges-3	mobility

week in program	6	of 20	8	of 20	12	of 20	15	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	15	10	10	10	15	10	15
Solitaire	10	5	10	10	10	5	10	10
Scavenger Hunt	10	2	10	0	10	10	10	15
Letter Lotto	10	10	10	15	10	20	10	15
Spelling Bee	10	10	10	10	10	5	10	15
Flip Side	10	5	10	10	10	15	10	20
21 Tally	10	20	10	20	10	10	10	15
Pyramid Builder	10	2	10	10	10	5	10	5
Sudoku	10	5	10	10	10	5	10	15
Activity								
meditation exercise	3	2						
meditation exercise			5	4				
meditation exercise					5	5		
sleep inducing bedtime snack							3	4

Appendix A: Patient Profiles

Patient Last name	McCarthy
Patient First name	Sylvia
Preferred Name	Sylvia
Health status	Sylvia is generally healthy but is beginning to have memory loss problems.
Current interest	novelty games
Cognitive level	MCI
Literacy Level	high
Readiness to change	Preparation
challenges-1	hearing loss
challenges-2	
challenges-3	

week in program	10	of 20	12	of 20	16	of 20	19	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	5	10	10	15	5	15	15
Solitaire	10	15	10	10	10	15	10	15
Scavenger Hunt	10	2	10	5	10	10	15	10
Letter Lotto	10	10	10	10	10	5	10	15
Spelling Bee	10	15	10	20	10	10	15	15
Flip Side	10	5	10	5	10	2	10	10
21 Tally	10	10	10	15	10	10	15	10
Pyramid Builder	10	5	10	10	10	5	10	10
Sudoku	10	2	10	2	10	10	10	10
Activity								
Brush teeth opposite hand	3	2						
Count down from 100 by 7			5	3				
Days/ week alphabetical order					5	3		
Eat meal with opposite hand							4	4

Appendix A: Patient Profiles

Patient Last name	Banfield
Patient First name	Mark
Preferred Name	Mr. Banfield
Health status	Mr. Banfield has COPD and needs supplemental oxygen. He is also pre-hypertensive.
Current interest	physical exercise
Cognitive level	Healthy
Literacy Level	Low
Readiness to change	Action
challenges-1	shortness of breath
challenges-2	balance issues
challenges-3	

week in program	9	of 20	11	of 20	15	of 20	18	of 20
Game	goal	actual	Goal	actual	goal	actual	goal	Actual
Free Cell	10	10	10	5	10	10	15	15
Solitaire	10	10	10	10	10	15	10	10
Scavenger Hunt	10	2	10	2	10	2	10	10
Letter Lotto	10	5	10	10	10	15	15	20
Spelling Bee	10	15	10	15	10	10	10	15
Flip Side	10	5	10	10	10	5	10	5
21 Tally	10	15	10	20	15	15	15	20
Pyramid Builder	10	5	10	0	10	10	10	10
Sudoku	10	5	10	10	10	5	10	10
Activity								
Moderate walk 20 minutes	3	2						
Brisk walk 20 minutes			5	5				
Brisk walk 30 minutes					5	4		
Brisk walk w/weight 15 minutes							3	3

Appendix A: Patient Profiles

Patient Last name	Shaffer
Patient First name	Mary
Preferred Name	Mary
Health status	Mary had Diabetes Mellitus and is overweight.
Current interest	novelty exercises
Cognitive level	healthy
Literacy Level	medium
Readiness to change	Pre-contemplate
challenges-1	mobility
challenges-2	
challenges-3	

week in program	2	of 20	4	of 20	8	of 20	11	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	10	15	15	15	20	15	15
Solitaire	10	10	10	10	10	5	10	10
Scavenger Hunt	10	2	10	5	10	10	10	15
Letter Lotto	10	15	10	15	10	10	10	15
Spelling Bee	10	5	10	10	10	5	10	5
Flip Side	10	5	10	10	10	5	10	10
21 Tally	10	5	10	0	10	10	10	10
Pyramid Builder	10	10	10	15	10	10	10	15
Sudoku	10	2	10	0	10	5	10	10
Activity								
Count down from 100 by 7	3	2						
Eat meal with opposite hand			4	5				
Days/week alphabetical order					3	3		
Days/week alphabetical order							5	5

Appendix A: Patient Profiles

Patient Last name	Buchanan
Patient First name	Roger
Preferred Name	Buck
Health status	Buck has arthritis in his hands which limits his daily use of the computer.
Current interest	sleep quality
Cognitive level	MCI
Literacy Level	Low
Readiness to change	Preparation
challenges-1	Arthritis
challenges-2	medication reminder?
challenges-3	

week in program	8	of 20	10	of 20	14	of 20	17	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	10	10	10	10	5	10	10
Solitaire	10	5	10	10	10	15	15	20
Scavenger Hunt	10	2	10	2	10	0	10	10
Letter Lotto	10	15	10	20	10	15	10	15
Spelling Bee	10	15	10	20	10	15	15	20
Flip Side	10	5	10	2	10	15	15	15
21 Tally	10	5	10	10	10	5	10	10
Pyramid Builder	10	2	10	0	10	10	10	15
Sudoku	10	10	10	15	10	20	15	15
Activity								
No caffeinated drink past 4PM	3	2						
No caffeinated drink past 4PM			5	5				
Sleep inducing bedtime snack					4	3		
Sleep inducing bedtime snack							5	5

Appendix A: Patient Profiles

Patient Last name	Norton
Patient First name	Alice
Preferred Name	Alice
Health status	Alice is obese and is on a special diet and medication to treat hypercholesterolemia.
Current interest	physical exercise
Cognitive level	healthy
Literacy Level	high
Readiness to change	Action
challenges-1	vision
challenges-2	mobility
challenges-3	

week in program	3	of 20	5	of 20	9	of 20	12	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	15	15	20	15	20	15	20
Solitaire	10	5	10	5	10	0	10	10
Scavenger Hunt	10	2	10	10	10	5	10	5
Letter Lotto	10	10	10	15	10	10	10	15
Spelling Bee	10	10	10	5	10	10	15	15
Flip Side	10	5	10	10	10	5	10	15
21 Tally	10	10	10	5	10	10	15	15
Pyramid Builder	10	2	5	5	10	10	10	5
Sudoku	10	2	10	2	10	0	10	10
Activity								
Brisk walk 15 minutes	3	2						
Brisk walk 20 minutes			5	5				
Brisk walk 30 minutes					4	4		
Brisk walk w/weight 15 minutes							5	6

Appendix A: Patient Profiles

Patient Last name	Anderson
Patient First name	Arthur
Preferred Name	Art
Health status	Art has limited vision in his right eye due to an industrial accident, and he has Type II Diabetes.
Current interest	physical exercise
Cognitive level	healthy
Literacy Level	high
Readiness to change	Maintenance
challenges-1	shortness of breath
challenges-2	
challenges-3	

week in program	5	of 20	7	of 20	11	of 20	14	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	15	10	15	10	10	10	15
Solitaire	10	5	10	10	10	5	10	5
Scavenger Hunt	10	2	10	10	10	5	10	10
Letter Lotto	10	15	10	10	10	15	10	15
Spelling Bee	10	2	10	5	10	0	10	10
Flip Side	10	5	10	0	10	10	10	15
21 Tally	10	10	10	15	10	20	15	15
Pyramid Builder	10	2	10	2	10	0	10	10
Sudoku	10	10	10	15	15	20	15	20
Activity								
Moderate walk 15 minutes	3	3						
Brisk walk 15 minutes			5	6				
Brisk walk 20 minutes					5	5		
Brisk walk 30 minutes							5	5

Appendix A: Patient Profiles

Patient Last name	Franklin
Patient First name	Susan
Preferred Name	Sue
Health status	Sue has osteoporosis and uses a walker.
Current interest	Sleep quality
Cognitive level	healthy
Literacy Level	low
Readiness to change	Pre-contemplate
challenges-1	mobility
challenges-2	worried about falling
challenges-3	

week in program	1	of 20	3	of 20	7	of 20	10	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	15	10	20	10	15	10	15
Solitaire	10	5	10	10	10	5	10	10
Scavenger Hunt	10	15	10	10	10	15	10	15
Letter Lotto	10	2	10	10	10	5	10	15
Spelling Bee	10	5	10	0	10	10	10	15
Flip Side	10	5	10	10	10	15	10	10
21 Tally	10	20	10	20	15	15	15	20
Pyramid Builder	10	5	10	10	10	15	15	20
Sudoku	10	10	10	10	10	5	10	10
Activity								
Warm bath 1/2 hr. before bed	3	2						
Warm bath 1/2 hr. before bed			4	3				
Meditation / relaxation					4	3		
Meditation / relaxation							5	5

Appendix A: Patient Profiles

Patient Last name	Snowden
Patient First name	Geoffrey
Preferred Name	Jeff
Health status	Jeff was treated for prostate cancer which is in remission.
Current interest	novelty exercises
Cognitive level	MCI
Literacy Level	medium
Readiness to change	Contemplate
challenges-1	vision
challenges-2	memory
challenges-3	

week in program	7	of 20	9	of 20	13	of 20	16	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	10	15	15	15	10	15	15
Solitaire	10	15	10	10	10	15	10	15
Scavenger Hunt	10	10	10	15	10	10	10	15
Letter Lotto	10	5	10	0	10	10	10	15
Spelling Bee	10	2	10	10	10	15	10	10
Flip Side	10	5	10	5	10	2	10	10
21 Tally	10	10	10	15	10	15	10	20
Pyramid Builder	10	2	10	10	10	5	10	5
Sudoku	10	10	10	15	10	10	10	15
Activity								
Brush teeth w/opposite hand	4	4						
Getting dresses w/eyes closed			4	4				
Count down from 100 by 7					4	4		
Eat meal with opposite hand							5	5

Appendix A: Patient Profiles

Patient Last name	Kramer
Patient First name	Rebecca
Preferred Name	Becky
Health status	Becky has rheumatoid arthritis but tries to remain active.
Current interest	physical exercise
Cognitive level	healthy
Literacy Level	medium
Readiness to change	Maintenance
challenges-1	mobility
challenges-2	hearing loss
challenges-3	

week in program	4	of 20	6	of 20	10	of 20	13	of 20
Game	goal	actual	goal	actual	goal	actual	goal	actual
Free Cell	10	15	10	10	10	15	10	15
Solitaire	10	5	10	10	10	5	10	10
Scavenger Hunt	10	5	10	2	10	5	10	10
Letter Lotto	10	10	10	10	10	15	10	10
Spelling Bee	10	10	10	10	10	5	10	10
Flip Side	10	5	10	10	10	15	15	20
21 Tally	10	15	10	15	10	10	10	15
Pyramid Builder	10	2	10	10	10	5	10	5
Sudoku	10	5	10	10	10	5	10	10
Activity								
Moderate walk 15 minutes	4	4						
Moderate walk 30 minutes			5	6				
Brisk walk 15 minutes					3	3		
Brisk walk 20 minutes							4	5

Appendix B: Visual C# Express 2008 Code for Health Coaching Simulator

```
using System;
using System.Collections.Generic;
using System.ComponentModel;
using System.Data;
using System.Drawing;
using System.Linq;
using System.Text;
using System.Windows.Forms;

namespace HealthCoach
{
   public partial class MainWin : Form
   {
      MiniDB db;
      string current_patient;
      bool fDirty = false;

      public MainWin()
      {
         InitializeComponent();
      }

      private void chkPtList_SelectedIndexChanged(object sender, EventArgs e)
      {
         if (current_patient != null && fDirty)
         {
            save();
         }
         current_patient = chkPtList.SelectedItem.ToString();
         load();
      }

      public void load()
      {
         db = new MiniDB(current_patient);

         txtGreetingMini.Text = db.GetField("GreetingMini");
         txtGameFeedBackMini.Text = db.GetField("GameFeedbackMini");
         txtActivityFeedbackMini.Text = db.GetField("ActivityFeedbackMini");
         txtEncouragementMini.Text = db.GetField("EncouragementMini");
         txtComplimentaryCloseMini.Text = db.GetField("ComplimentaryCloseMini");
         txtEmailContent.Text = "";
         lblName.Text = db.GetField("Name");
```

```
    lblPref.Text = db.GetField("Pref");
    lblContact.Text = db.GetField("Contact");
    lblID.Text = db.GetField("ID");
    lblAge.Text = db.GetField("Age");
    lblGender.Text = db.GetField("Gender");
    lblPCP.Text = db.GetField("PCP");
    lblWeeks.Text = db.GetField("Weeks");
    lblPatientSummary.Text = db.GetField("PatientSummary");
    lblCurrentInterest.Text = db.GetField("CurrentInterest");
    lblCognitiveLevel.Text = db.GetField("CognitiveLevel");
    lblLiteracyLevel.Text = db.GetField("LiteracyLevel");
    lblReadiness.Text = db.GetField("Readiness");
    db.GetListView("GameScores", lvGameScores);
    db.GetList("Challenges", lstChallenges);
    db.PutField("PatientSelectedTimeStamp", txtGreetingMini.Text);
    lstEmailSubject.Items.Clear();
    foreach (string subject in db.FillEmail())
    {
      lstEmailSubject.Items.Add(subject);
    }
    fDirty = false;
}

public void save()
{

    db.PutField("SaveGreetingMini", txtGreetingMini.Text);
    db.PutField("SaveGameFeedbackMini", txtGameFeedBackMini.Text);
    db.PutField("SaveActivityFeedbackMini", txtActivityFeedbackMini.Text);
    db.PutField("SaveEncouragementMini", txtEncouragementMini.Text);
    db.PutField("SaveComplimentaryCloseMini", txtComplimentaryCloseMini.Text);
}

private void MainWin_FormClosing(object sender, FormClosingEventArgs e)
{
    save();
}

private void lstEmailSubject_SelectedIndexChanged(object sender, EventArgs e)
{
    if (db == null) return;
    txtEmailContent.Text = db.GetEmail(lstEmailSubject.SelectedItem.ToString());
}

private void btnSend_Click(object sender, EventArgs e)
{
```

```
            if (current_patient == null) return;
            //save();
            chkPtList.SetItemChecked(chkPtList.SelectedIndex, true);
            MessageBox.Show("Email Sent");
            if (chkPtList.SelectedIndex >= chkPtList.Items.Count - 1)
            {
               chkPtList.SelectedIndex = 0;
            }
            else
            {
               chkPtList.SelectedIndex += 1;
            }
            chkPtList_SelectedIndexChanged(sender, e);
        }

        private void label12_Click(object sender, EventArgs e)
        {
        }

        private void txtGreetingMini_TextChanged(object sender, EventArgs e)
        {
            fDirty = true;
        }

    }
}
```

Appendix C: Health Coach Training

Health Coaching Study – Training

Michael Shapiro

Oregon Health & Science University

Department of Medical Informatics &

Clinical Epidemiology

Health Coaching Study Background

This study is being conducted as part of a larger Cognitive Health Coaching Study funded by the Intel Corporation.

Patients in the cognitive health coaching study are older adults (average age around 80) who are concerned about memory and thinking skills. They are playing cognitive computer games on-line at home. The games have embedded metrics which provide data to help answer the questions:

- Can monitoring computer game play assist in the early detection of cognitive decline?
- Can cognitive exercise delay or remediate this decline?

Health Coaching Study Background

The study you are about to join is part of my research (MS Medical Informatics) looking at the feasibility of an automated tailored health coaching system for managing a large group of older adults.

You have been asked to be a study participant. At the conclusion of this study, we will ask for your feedback and advice, and we will provide you with a full report on the results of the study.

Your participation in this study will help address the feasibility of a semi-automated coaching tool. Following this study, your role would be as a consultant in the larger health coaching study.

Health Coaching Study – Scenario

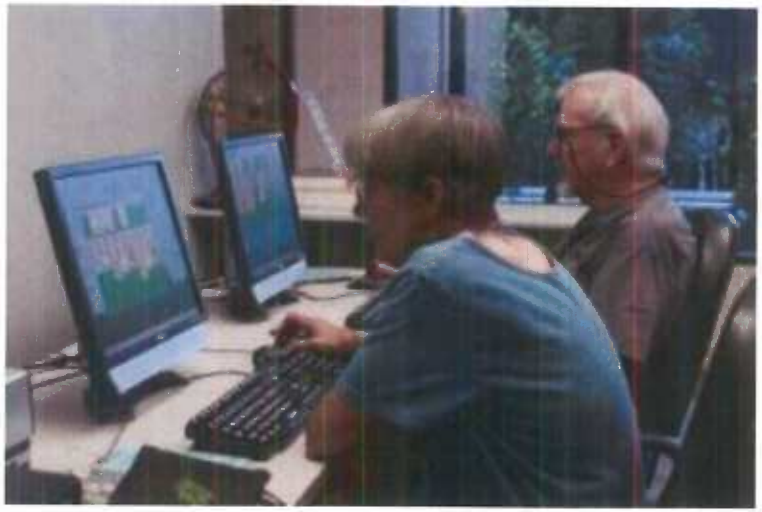
You are a health coach for a population of older adults who are dealing with chronic conditions and are concerned about possible cognitive decline. These individuals are living independently and are motivated to continue to do so, and they want to maintain good cognitive function.

Each of your patients is taking part in a 20 week Cognitive Health program and is participating or should be participating in playing cognitive computer games.

In addition to the cognitive computer games, each patient has chosen an area of current health interest from among the following:

- Physical Exercise (example: take a brisk walk for 20 minutes per day)
- Sleep Quality (example: discontinue caffeinated beverages after 4 PM)
- Novelty / brain games (example: brush teeth with opposite hand)

Cognitive Health Coaching Program



OREGON HEALTH & SCIENCE UNIVERSITY

Cognitive Coaching for Better Living

The cognitive computer games are shown on the following slides

OREGON HEALTH & SCIENCE UNIVERSITY
Cognitive Coaching for Better Living

21 Tally – Divided Attention

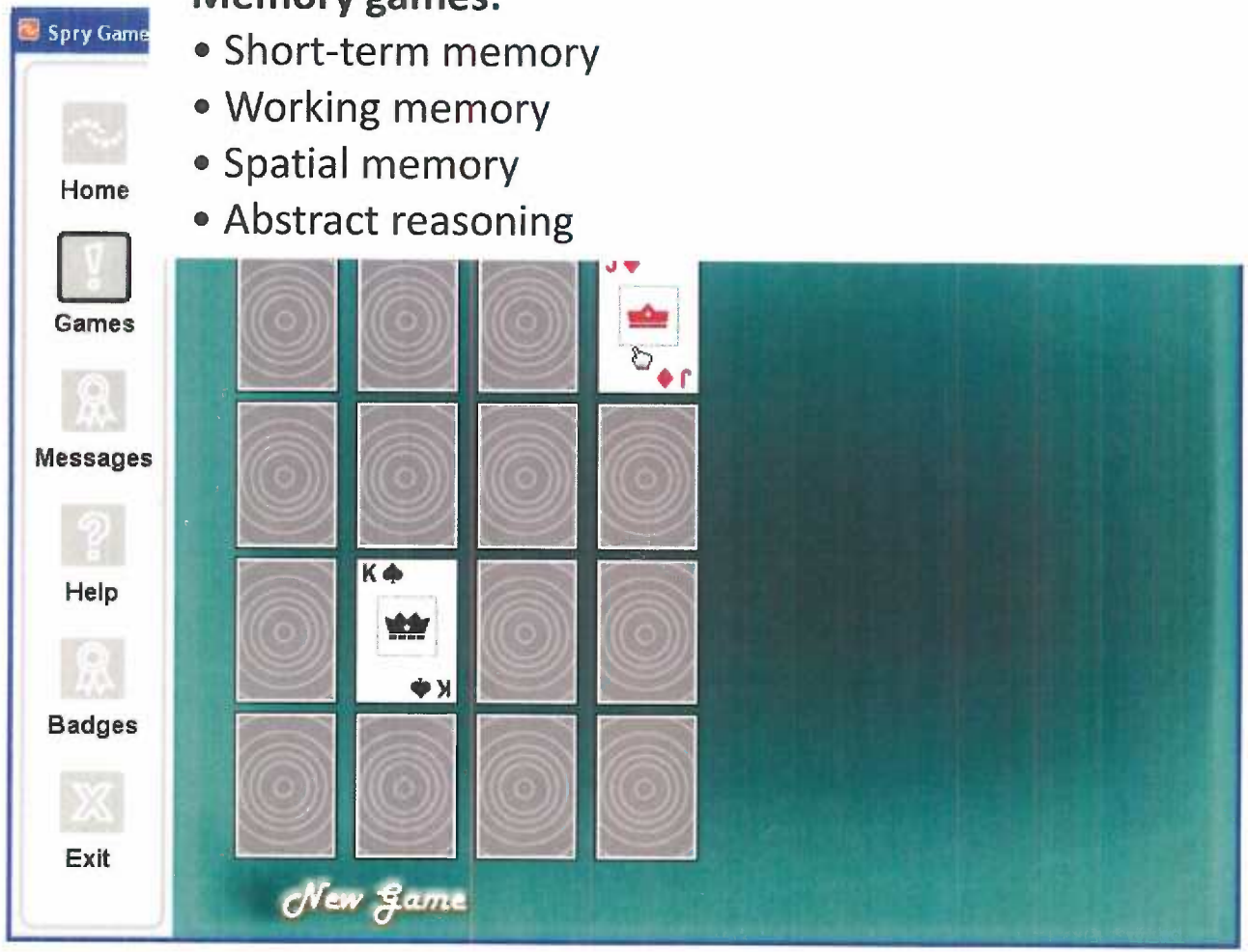
Dual Task games:

- Divided attention
- Working memory
- Spatial memory

On the Flipside - Memory

Memory games:

- Short-term memory
- Working memory
- Spatial memory
- Abstract reasoning

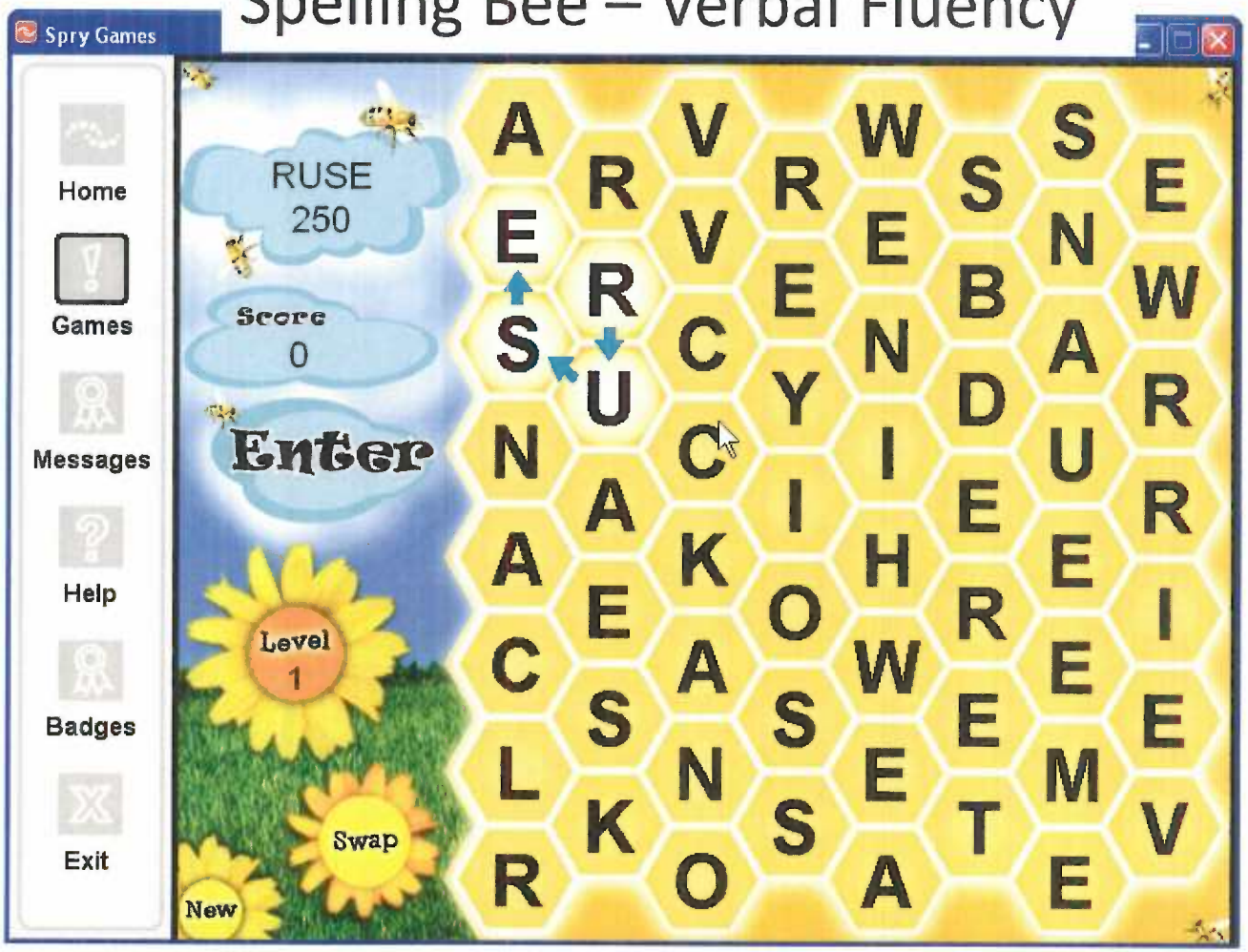


Letter Lotto – Verbal Fluency

Word games:

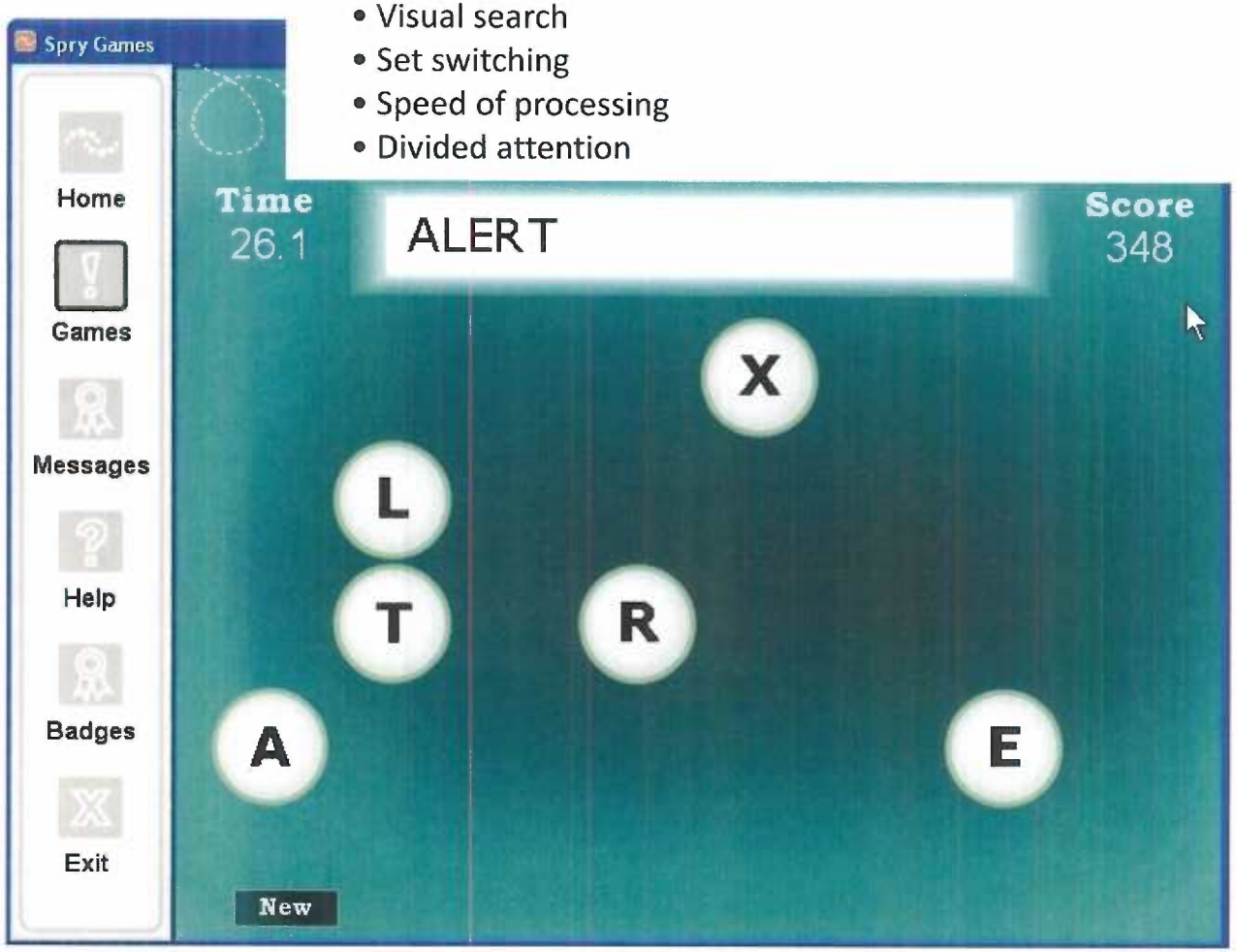
- Word length
- Word complexity
- Speed of word generation
- Total number of words

Spelling Bee – Verbal Fluency

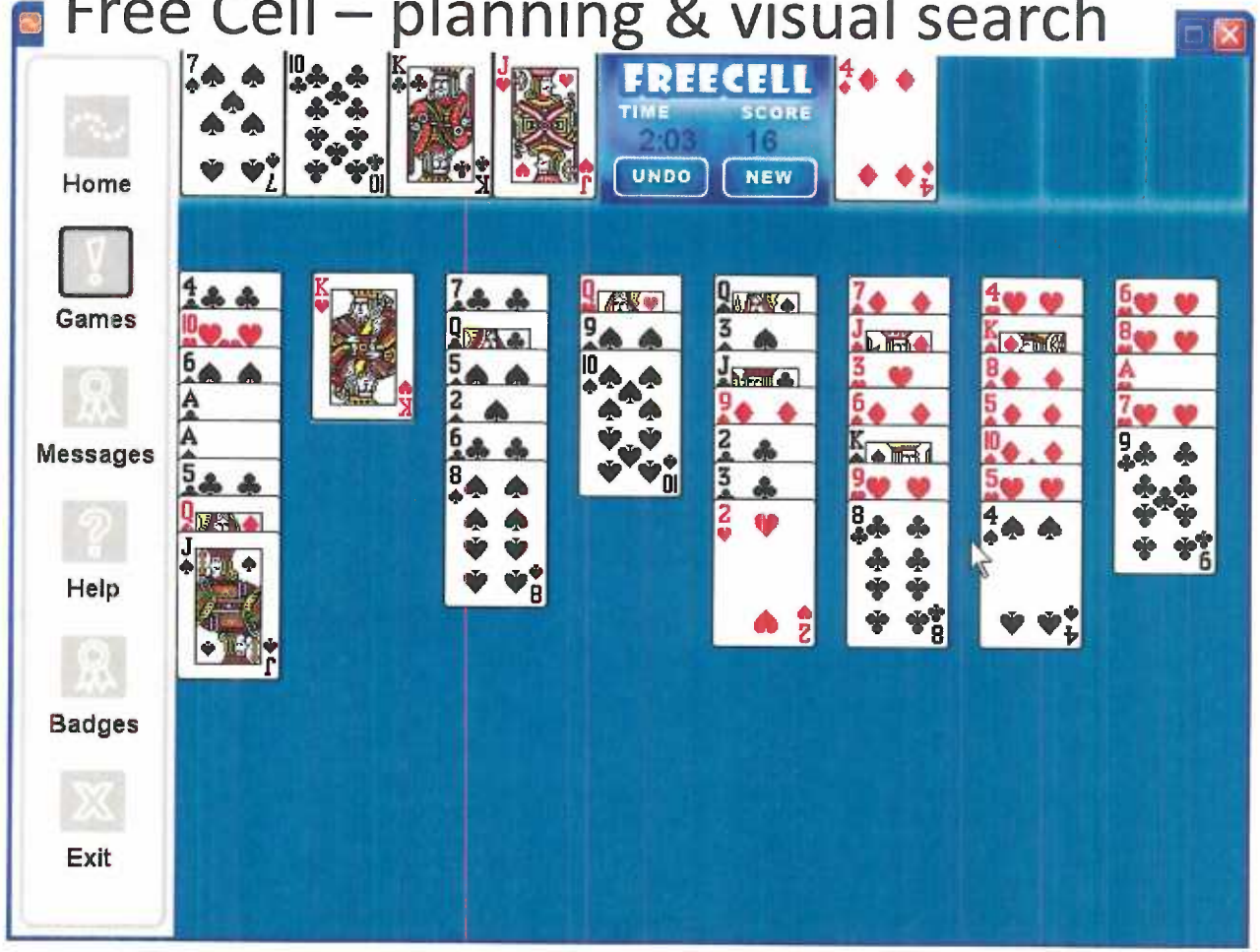


Scavenger Hunt - Rapid movement games:

- Motor speed
- Visual search
- Set switching
- Speed of processing
- Divided attention



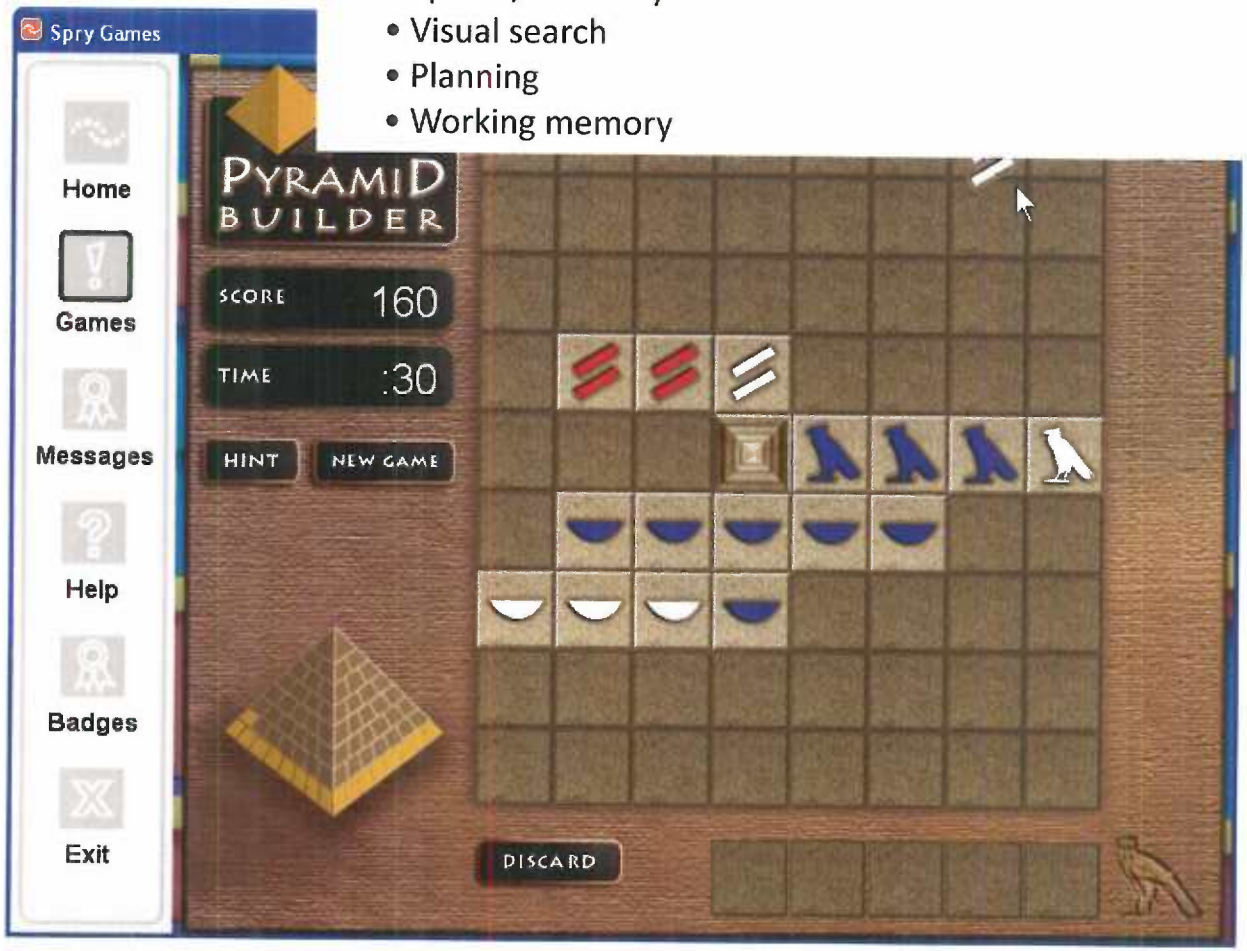
Free Cell – planning & visual search



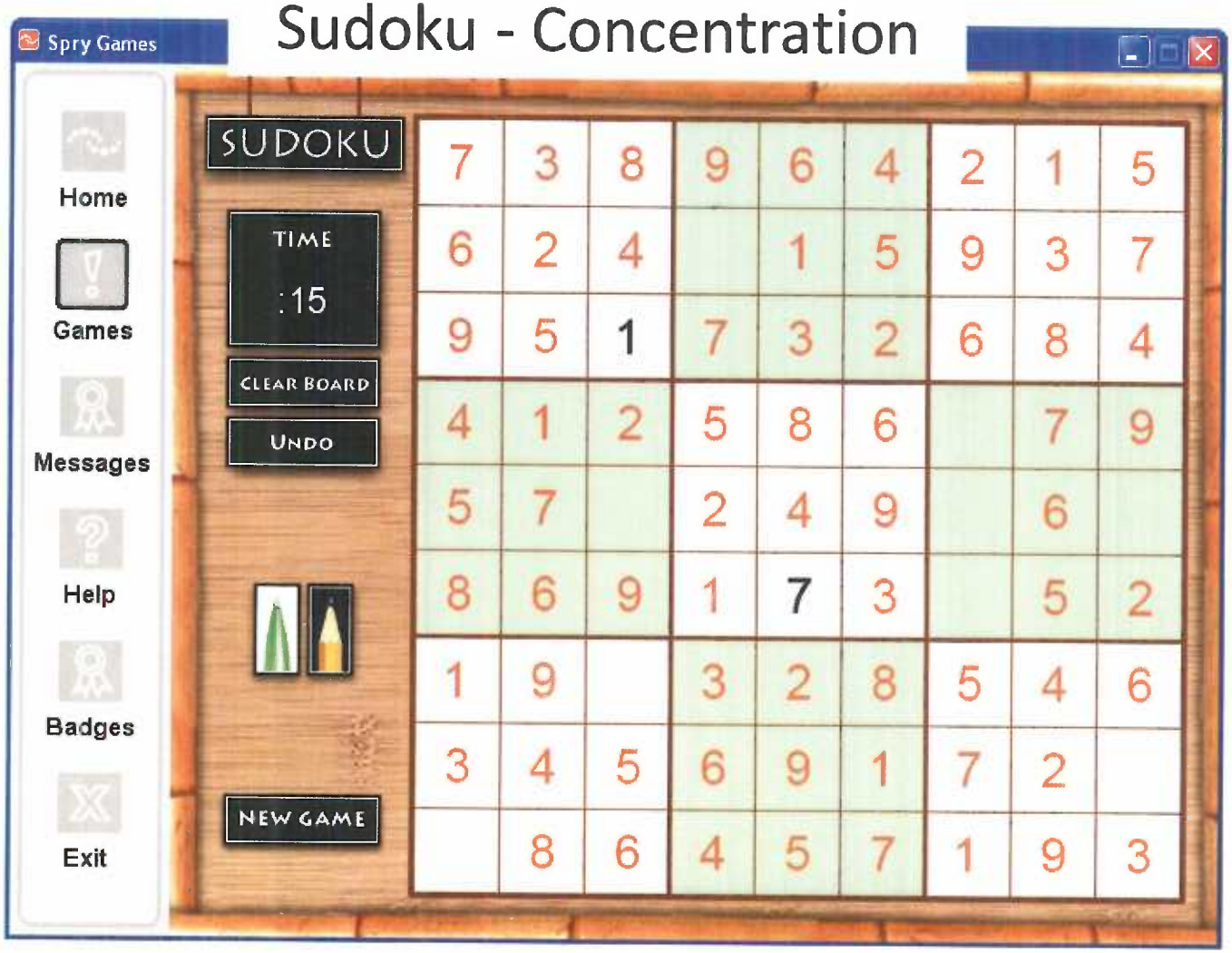
Pyramid Builder - Color / Shape matching

Divided attention

- Speed / accuracy
- Visual search
- Planning
- Working memory



Sudoku - Concentration



Health Coaching Study – Scenario continued

You are responsible for providing coaching to 200 patients with a scheduled frequency of once per week.

Keep in mind that your patient load will average 40 per day and that this is only half your professional duties. Your task will be to craft a messages for a 10 patient panel based upon the information provided on the coaching screen.

- Give feedback on the patients accomplishments in the current week.
- Give encouragement and recommendations for the coming week.

Health Coaching Study

The next slides show the view from the patient portal – prototype system

- Home – recommendation from health coach
- Games – history of cognitive game activity
- Messages – access to recent messages
- Help – sending questions back to the health coach
- Badges – scoreboard for gave activity

Cognitive Coaching – Patient Portal

Spry Games

Home

Games

Messages

Help

Badges

Exit

Mr Michael Shapiro

OHSU

Greetings Michael, You're now in week 28 of the Coaching program. You've done pretty well in meeting your goals this week. It looks as if you enjoy some of the computer games more than others. -Sudoku This next week, let's try to work on your memory skill by playing the Flipside computer game about twice / day. You'll notice that the game difficulty increases as your memory improves. Do let me know if you run into any problems. Hang in there. Bye for now, Gaye

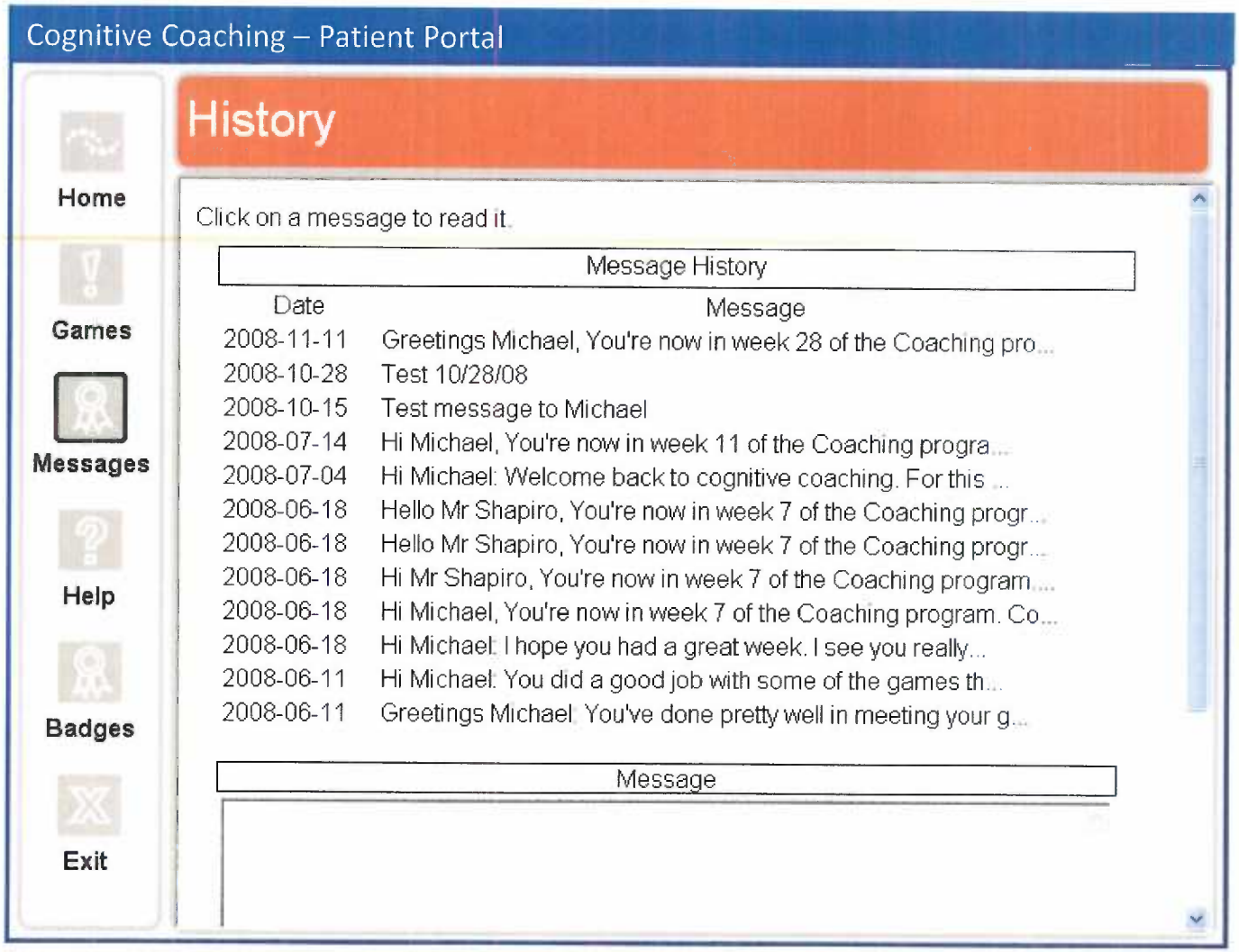
For this week we recommend these games:

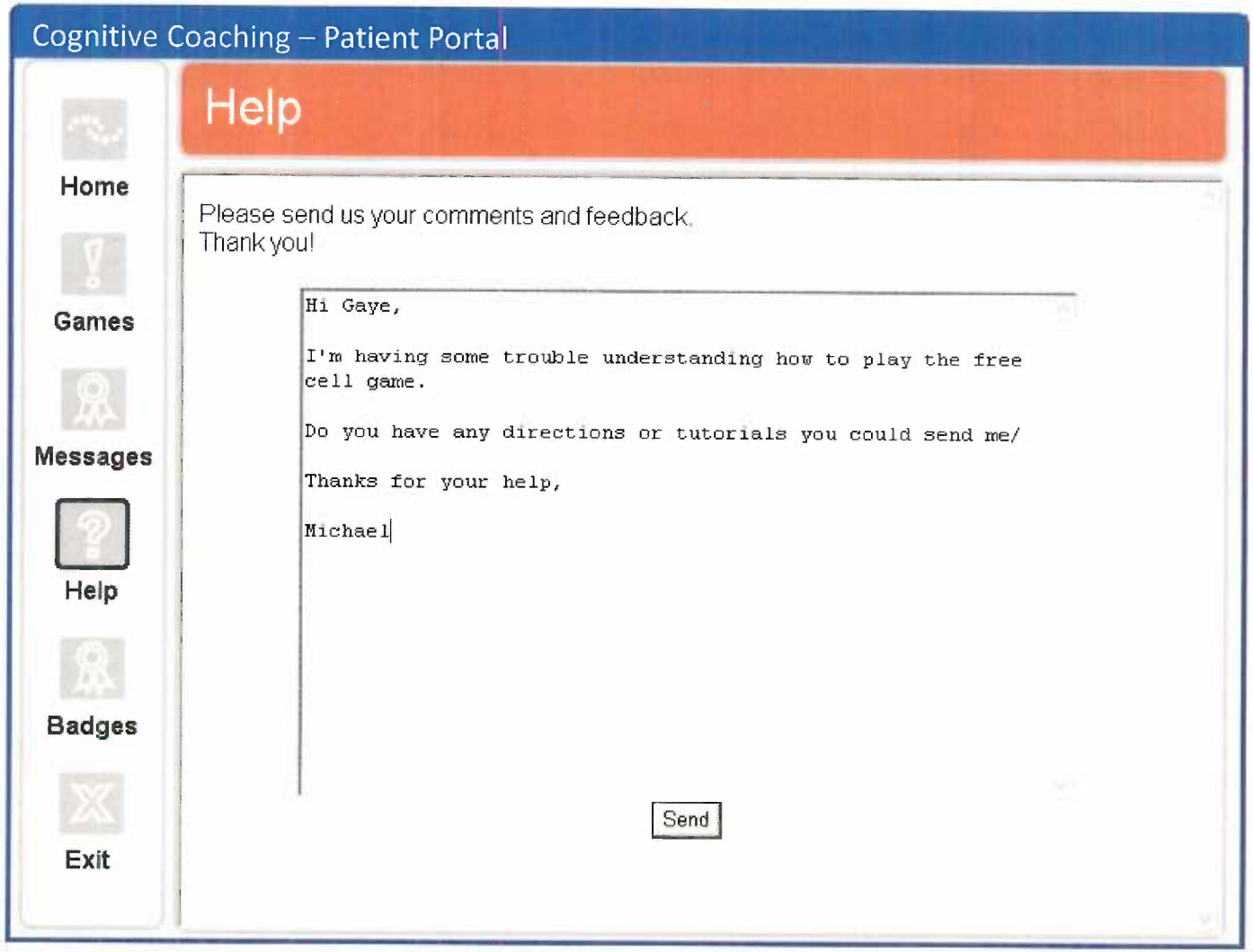
Sudoku

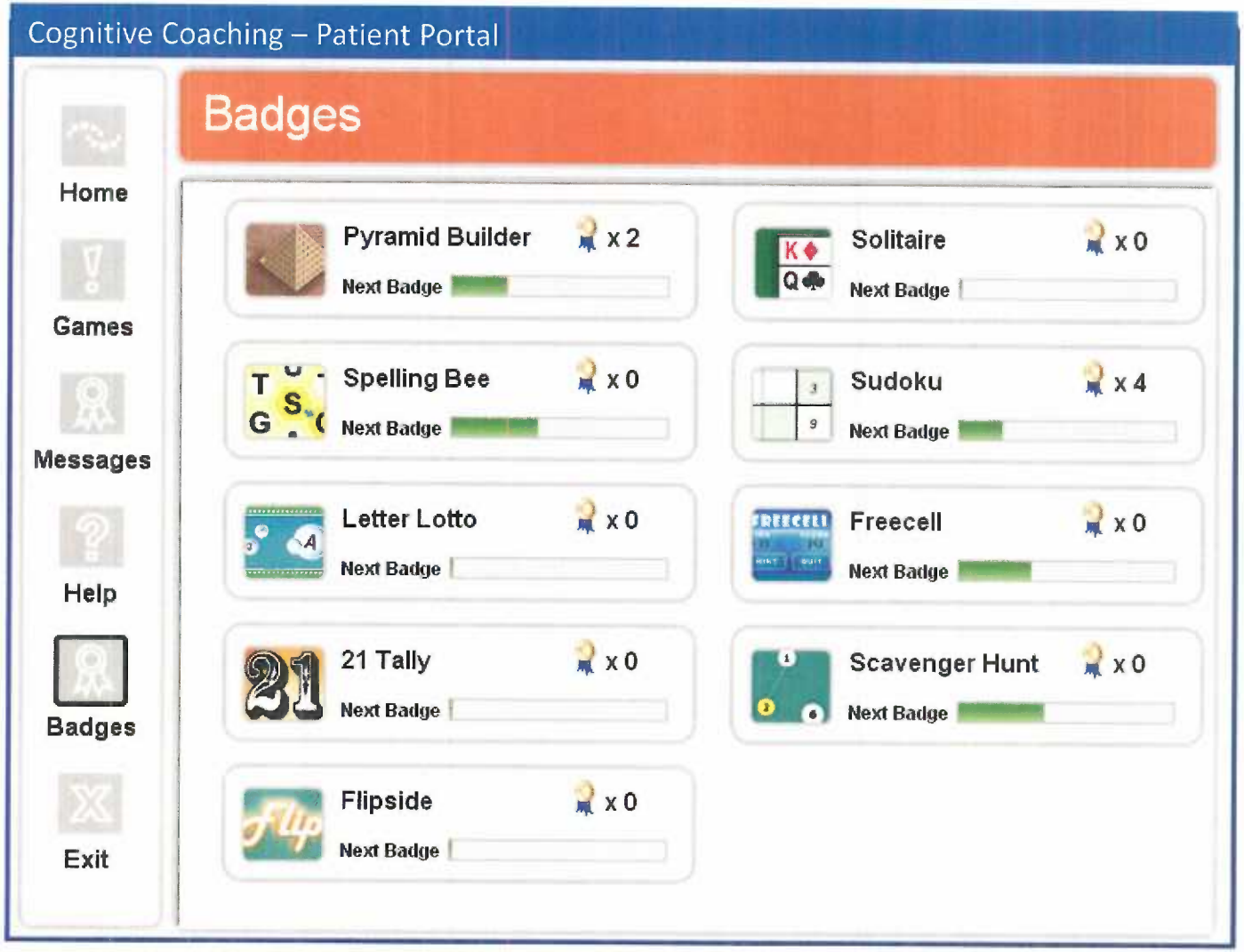
Pyramid Builder

Letter Lotto


Cognitive Coaching – Patient Portal
Home
Games
Messages
Help
Badges
Exit
Games
Pyramid Builder
Solitaire
Spelling Bee
Sudoku
Letter Lotto
FreeCell
21 Tally
Scavenger Hunt
On The Flipside
Saved Games
Sudoku:
In progress...
Pyramid Builder:
160 pts
FreeCell:
16 pts
Scavenger Hunt:
348 pts
Flipside:
In progress...
21 Tally:
In progress...
Spelling Bee:
250 pts


Cognitive Coaching – Patient Portal
Home
Games
Messages
Help
Badges
Exit
History
Click on a message to read it.
Message History
Date
Message
2008-11-11 Greetings Michael, You're now in week 28 of the Coaching pro...
2008-10-28 Test 10/28/08
2008-10-15 Test message to Michael
2008-07-14 Hi Michael, You're now in week 11 of the Coaching progra...
2008-07-04 Hi Michael: Welcome back to cognitive coaching. For this ...
2008-06-18 Hello Mr Shapiro, You're now in week 7 of the Coaching progr...
2008-06-18 Hello Mr Shapiro, You're now in week 7 of the Coaching progr...
2008-06-18 Hi Mr Shapiro, You're now in week 7 of the Coaching program....
2008-06-18 Hi Michael, You're now in week 7 of the Coaching program. Co...
2008-06-18 Hi Michael: I hope you had a great week. I see you really...
2008-06-11 Hi Michael: You did a good job with some of the games th...
2008-06-11 Greetings Michael: You've done pretty well in meeting your g...
Message


Cognitive Coaching – Patient Portal
Home
Games
Messages
Help
Badges
Exit
Help
Please send us your comments and feedback.
Thank you!
Hi Gaye,
I'm having some trouble understanding how to play the free cell game.
Do you have any directions or tutorials you could send me/
Thanks for your help,
Michael
Send


Cognitive Coaching – Patient Portal
Home
Games
Messages
Help
Badges
Exit
Badges
Pyramid Builder
x 2
Next Badge
Solitaire
x 0
Next Badge
Spelling Bee
x 0
Next Badge
Sudoku
x 4
Next Badge
Letter Lotto
x 0
Next Badge
Freecell
x 0
Next Badge
21 Tally
x 0
Next Badge
Scavenger Hunt
x 0
Next Badge
Flipside
x 0
Next Badge

Health Coaching Study

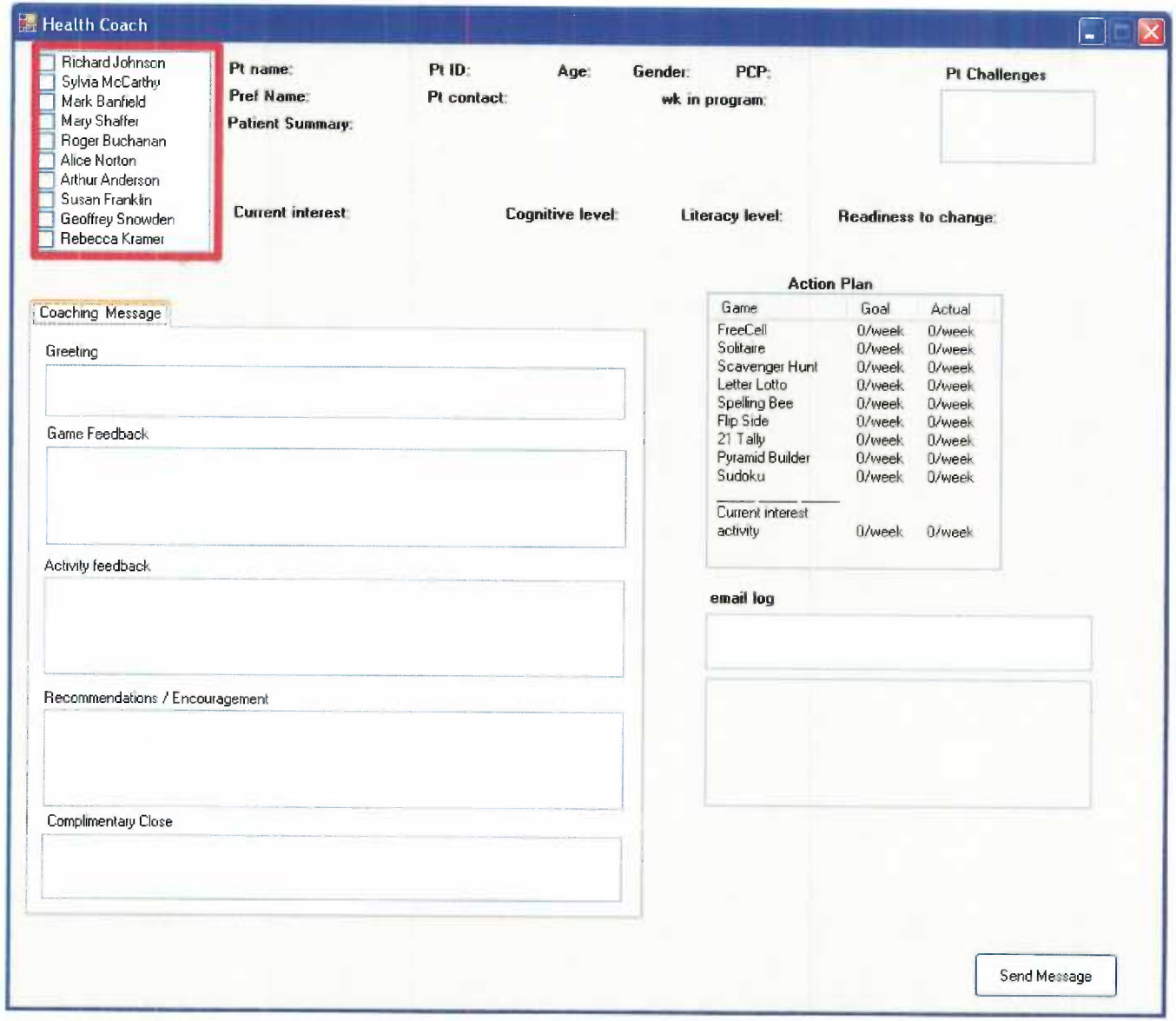
This is what you will know about a patient:

- Name / preferred name / age/ gender
- Cognitive level (Healthy or mild cognitive impairment)
- Literacy level (high, medium or low)
- Current health status / challenges
- Current adherence to action plan
- Current area of health interest
- Week # in 20 week program

Health Coaching Study

The next slides are of the health coaching screen –

- Patient panel
- Patient data
- Action plan for the week
- Automated message
- Coach generated message
- Email messages from patient
- Send message
- Email sent / patient checked


Health Coach
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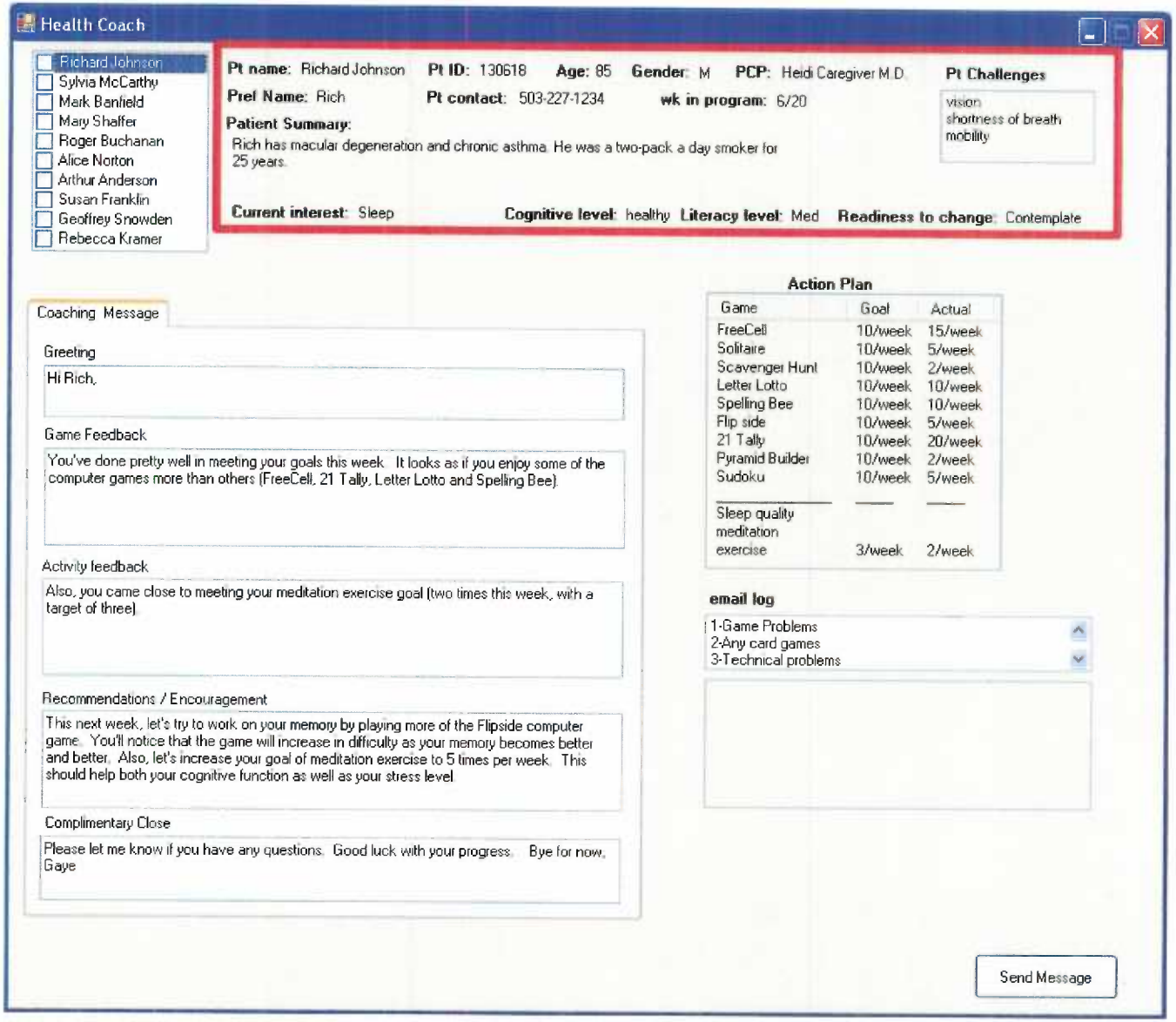
Rebecca Kramer
Pt name:
Pt ID:
Age:
Gender:
PCP:
Pref Name:
Pt contact:
wk in program:
Patient Summary:
Pt Challenges
Current interest:
Cognitive level:
Literacy level:
Readiness to change:
Action Plan
Game
Goal
Actual
FreeCell 0/week 0/week
Solitaire 0/week 0/week
Scavenger Hunt 0/week 0/week
Letter Lotto 0/week 0/week
Spelling Bee 0/week 0/week
Flip Side 0/week 0/week
21 Tally 0/week 0/week
Pyramid Builder 0/week 0/week
Sudoku 0/week 0/week
Current interest activity 0/week 0/week
Coaching Message
Greeting
Game Feedback
Activity feedback
Recommendations / Encouragement
Complimentary Close
email log
Send Message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Pt name: Richard Johnson
Pt ID: 130618
Age: 85
Gender: M
PCP: Heidi Caregiver M.D.
Pref Name: Rich
Pt contact: 503-227-1234
wk in program: 6/20
Patient Summary:
Rich has macular degeneration and chronic asthma. He was a two-pack a day smoker for 25 years.
Pt Challenges
vision
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mobility
Current interest: Sleep
Cognitive level: healthy
Literacy level: Med
Readiness to change: Contemplate
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Complimentary Close
Please let me know if you have any questions. Good luck with your progress. Bye for now,
Gaye
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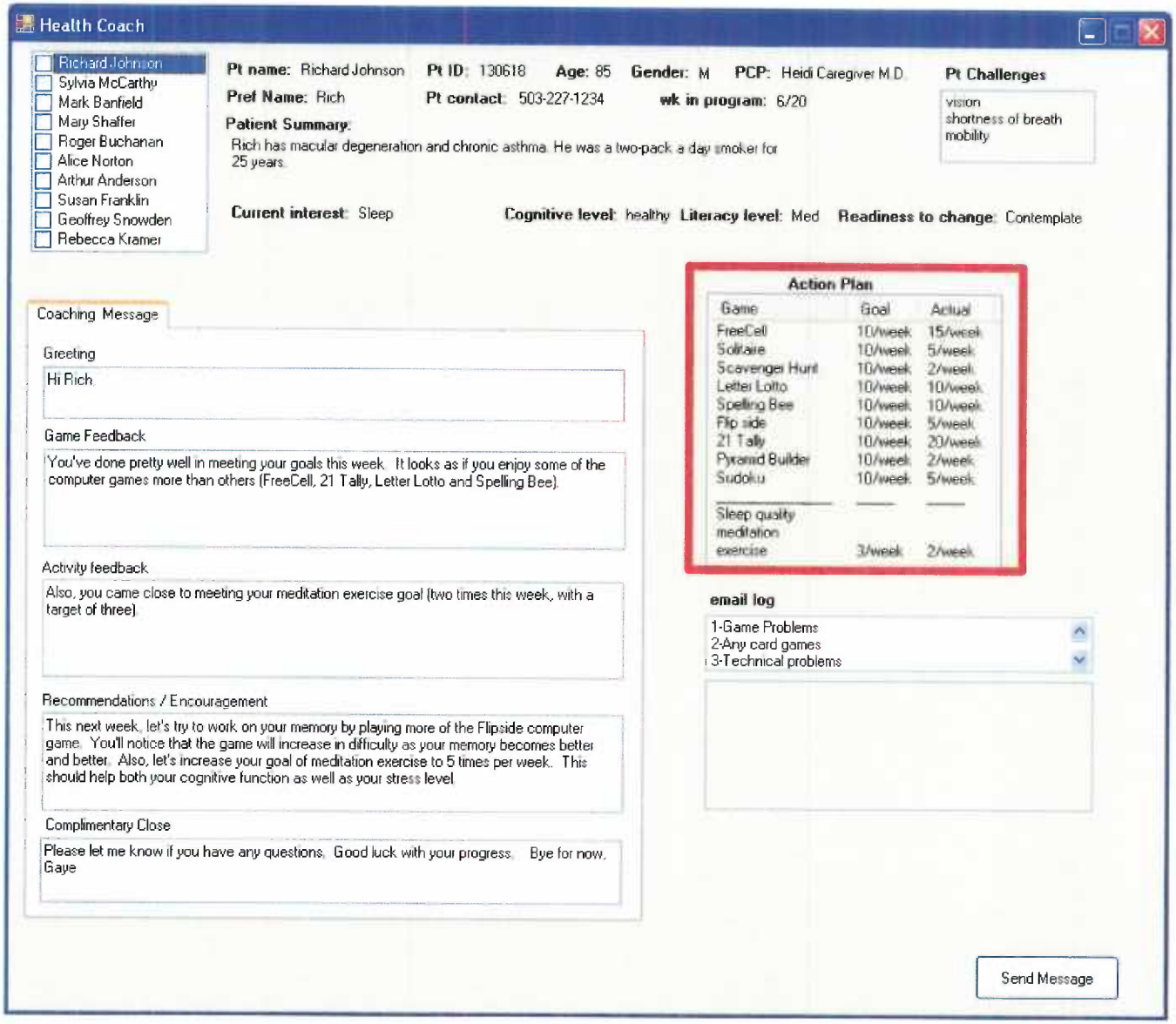
Sudoku | 10/week | 5/week
Sleep quality
meditation
exercise | 3/week | 2/week
email log
1-Game Problems
2-Any card games
3-Technical problems
Send Message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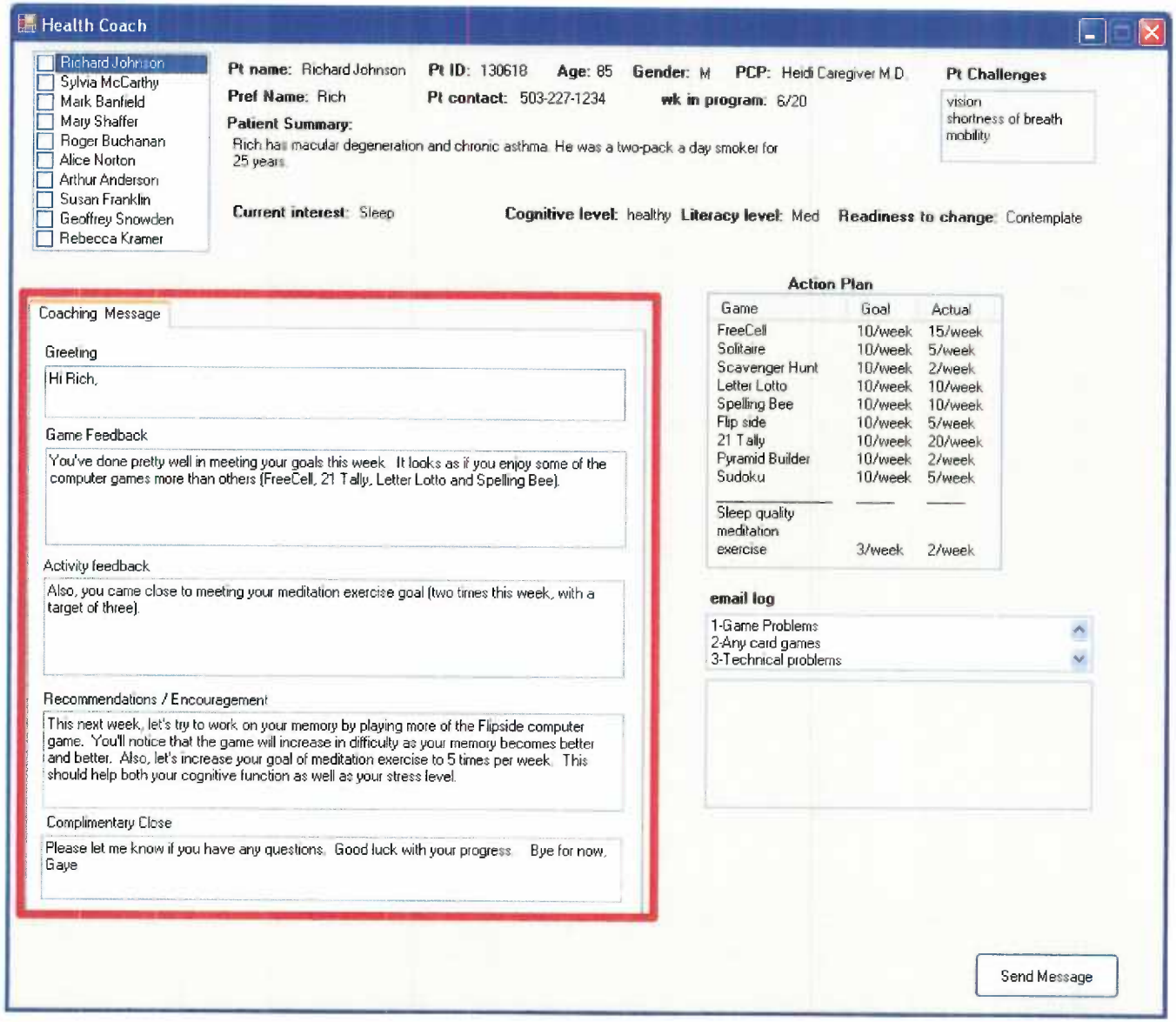
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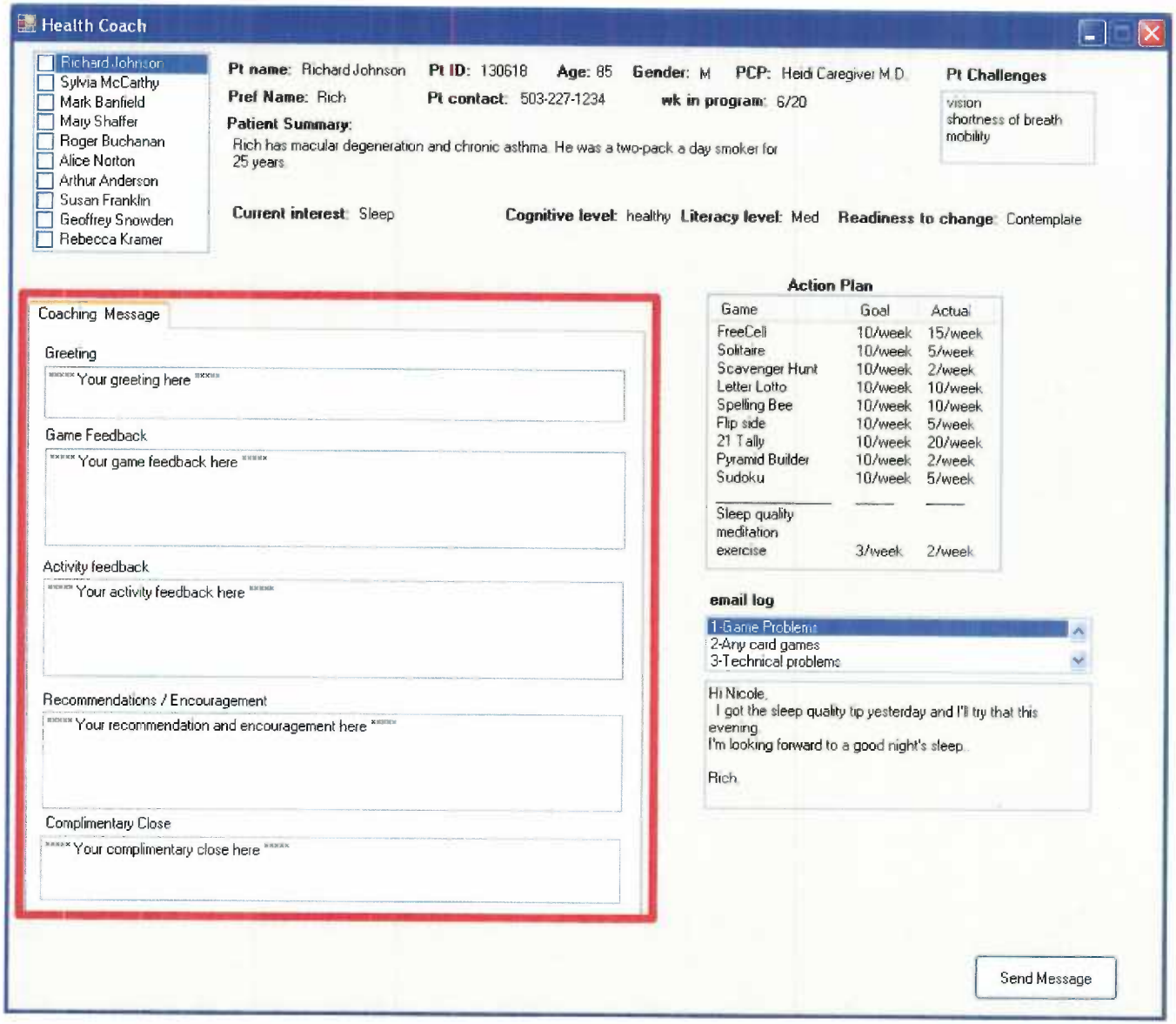
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Greeting
***** Your greeting here *****
Game Feedback
***** Your game feedback here *****
Activity feedback
***** Your activity feedback here *****
Recommendations / Encouragement
***** Your recommendation and encouragement here *****
Complimentary Close
***** Your complimentary close here *****
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Rich
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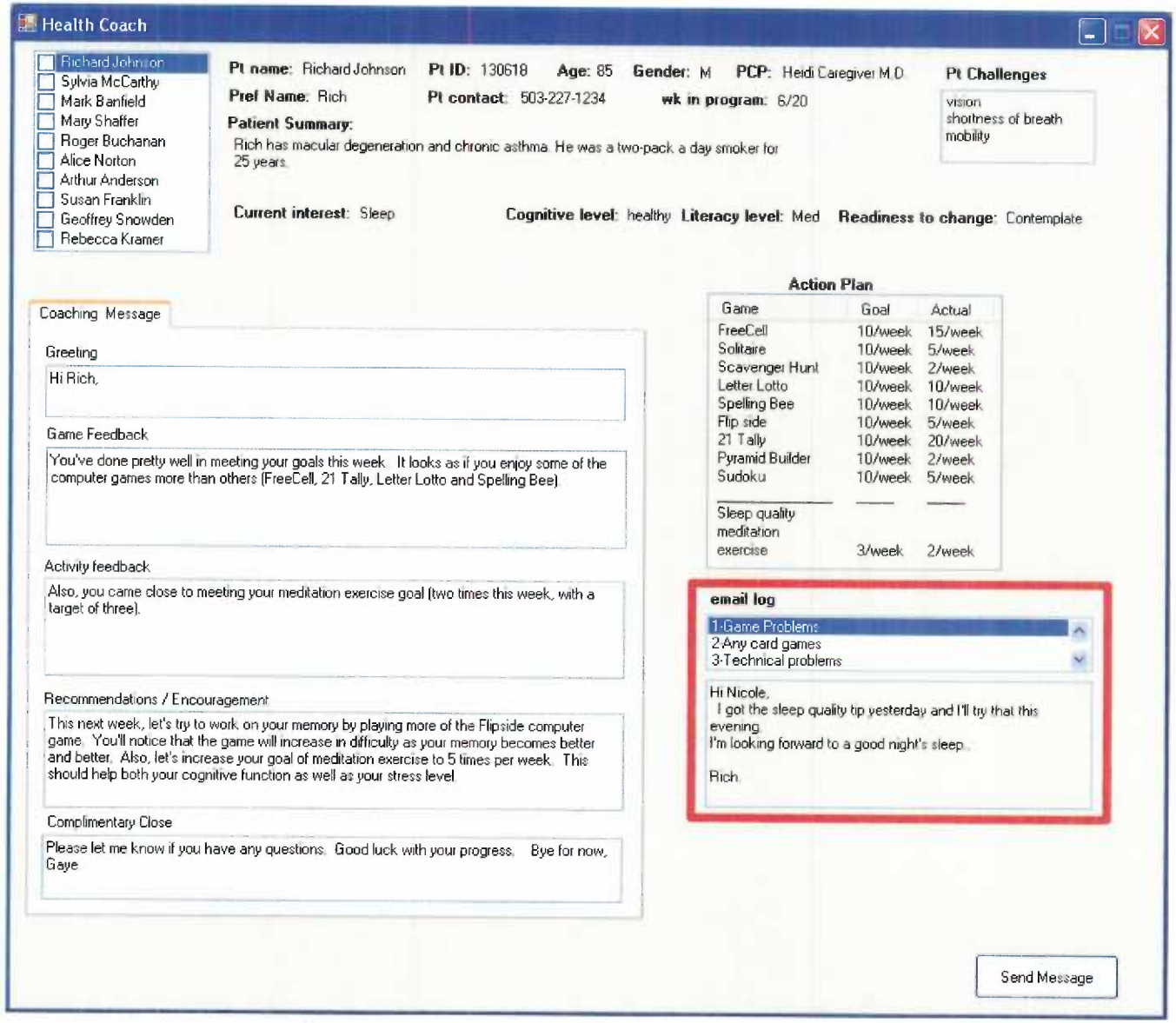
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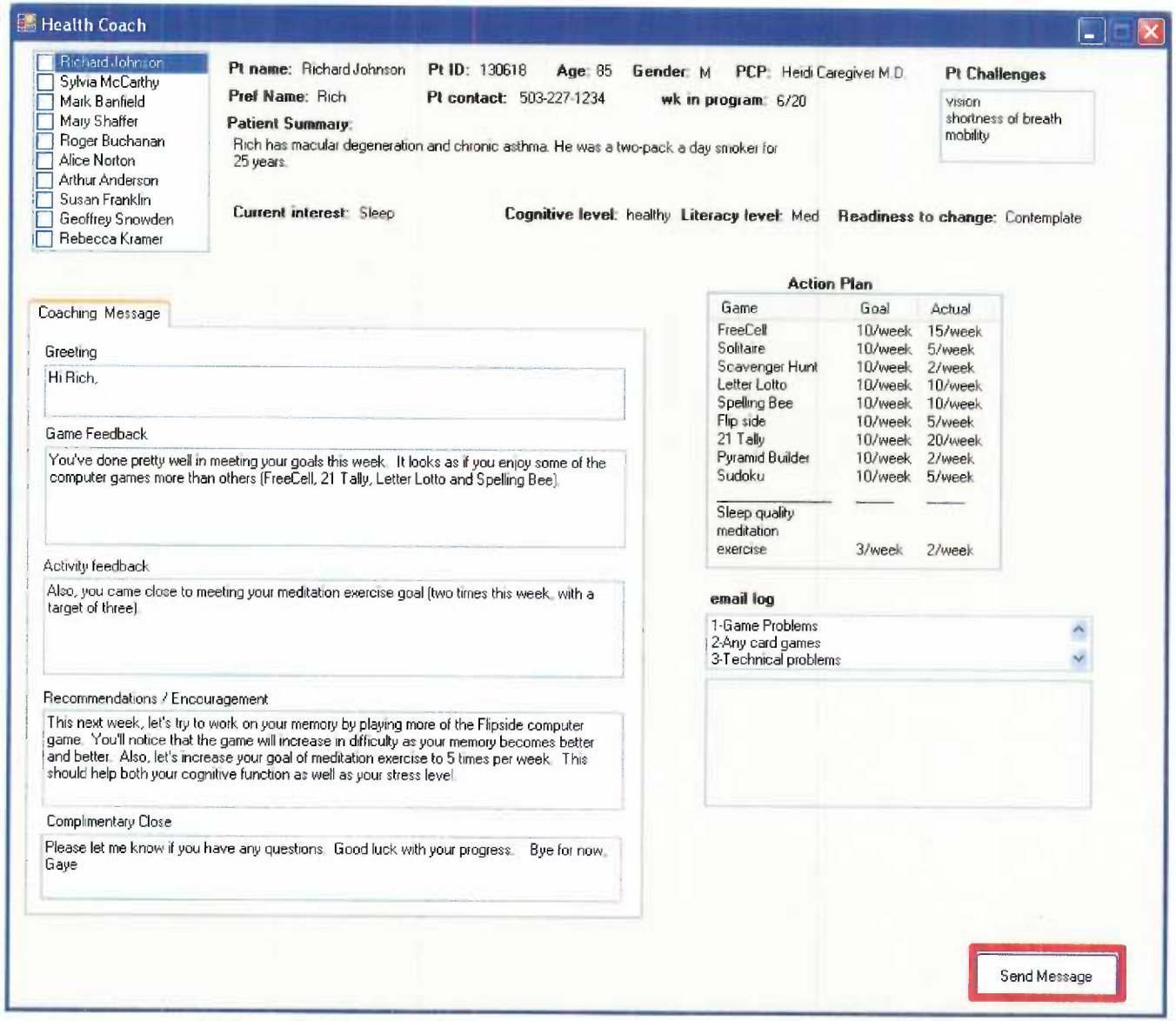
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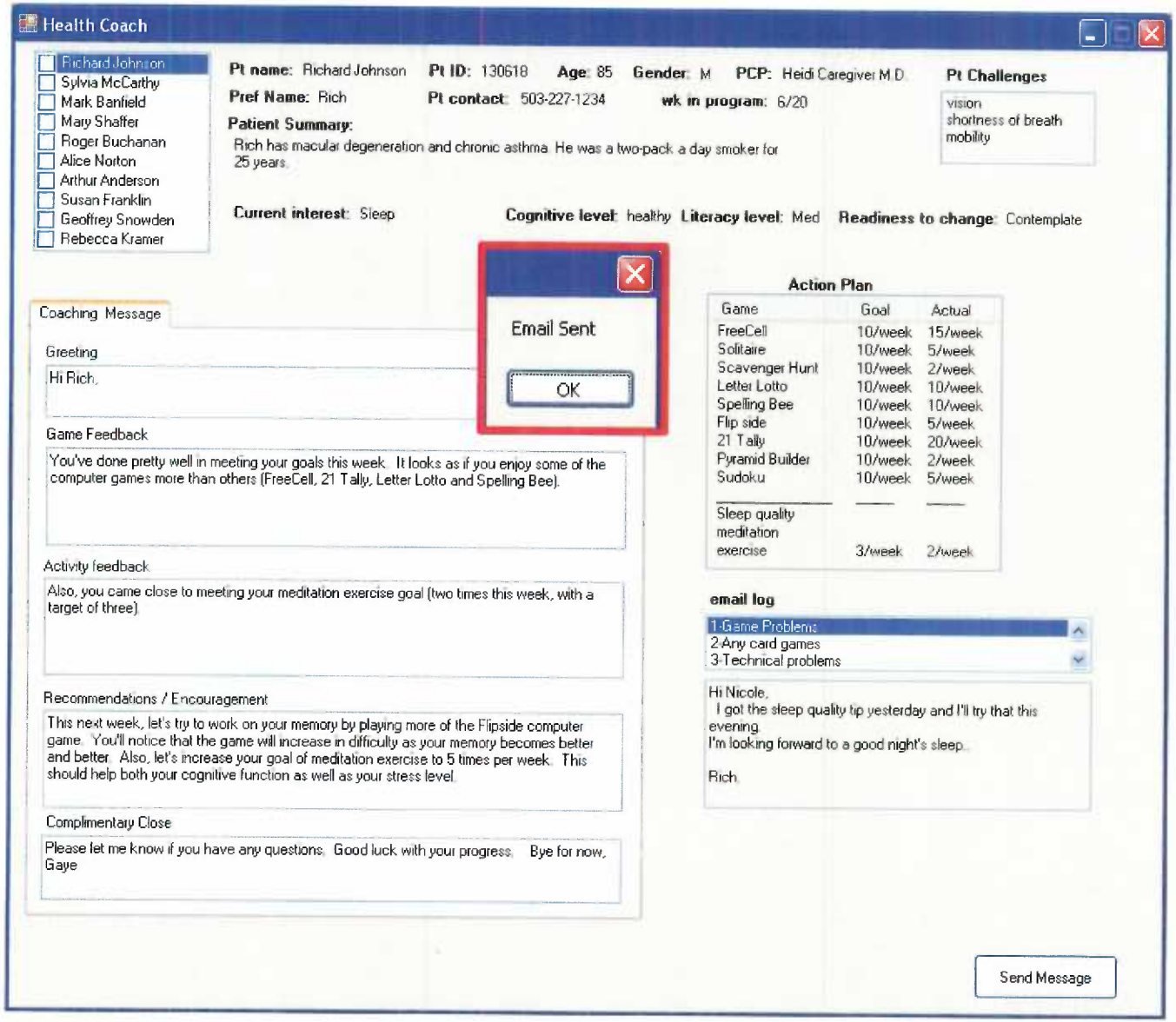
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mobility
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Email Sent
OK
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I'm looking forward to a good night's sleep.
Rich
Send Message

Health Coaching Study

We understand that readiness to change and motivational interviewing are important coaching issues – however this is a constrained study.

Here we assume that this information is not available – so we ask you to function with "half of your coaching brain tied behind your back."

You will be asked to go through the process of sending messages (which you create or edit) to 10 patients at 4 different points in time.

For 2 of these sessions, you will create messages with no automated assistance.
For 2 of these sessions the system will display a suggested message which you may accept as is or edit as you deem appropriate.

The following slides show you the guidelines for cognitive game play and selected health activity that have been set up for this system.

Current health interest – optional activities

Physical Exercise	Time per day	Time per day	Time per day
Moderate walking	15 min	20 min	30 min
Brisk walking	15 min	20 min	30 min
Brisk walk w/weight	15 min	20 min	30 min

Sleep Quality			
No caffeine after 4 PM	3x/week	4x/week	5x/week
Meditation / relaxation	3x/week	4x/week	5x/week
Warm bath before bedtime	3x/week	4x/week	5x/week
Sleep inducing bedtime snacks	3x/week	4x/week	5x/week

Novelty Games			
Brushing teeth non-dominant hand	3x/week	4x/week	5x/week
Counting down from 100 by 7	3x/week	4x/week	5x/week
Eating meal with non-dominant hand	3x/week	4x/week	5x/week
Recite days of week in alphabetical order	3x/week	4x/week	5x/week
Calculate sum of birthdate (dd/mm/yy) for you and for other family members.	3x/week	4x/week	5x/week

Cognitive Health Coaching – Physical exercise Protocol

If goal is met → move to the next column in table

If goal is exceeded → move to next row in table

Mod 15 -> (minimum)	Mod 20 ->	Mod 30 ->	Brisk 15 (see next row)
Brisk 15 ->	Brisk 20 ->	Brisk 30 ->	BriskW 15 (see next row)
BrskW 15 ->	BrskW 20 ->	BrskW 30 (maximum)	

Key: Mod – moderate walk for 15, 20 or 30 minutes.
Brisk – brisk walk for 15, 20 or 30 minutes.
BrskW – brisk walk carrying 5 lb weight 15, 20, 30 minutes.

Cognitive Health Coaching Study - protocol for sleep quality activity.

Sleep Quality			
No caffeine after 4 pm	3x/week	4x/week	5x/week
Meditation / relaxation	3x/week	4x/week	5x/week
Warm bath before bedtime	3x/week	4x/week	5x/week
Sleep friendly bedtime snack	3x/week	4x/week	5x/week

Review which activity the patient is doing at what frequency and how the patient performed against the goals for the week.

If goals were met or exceeded, increase frequency level. If already performing at maximum frequency, then choose a new activity.

Examples

No caffeine after 4 PM, 3X/week -→ No caffeine after 4 PM, 4 or 5x/week
Meditation/relaxation, 5x/week -→ Warm bath before bedtime, 3x/week

If goals have not been met, maintain the same frequency level in activity.
If patient is not being successful with current activity, choose new activity.

Cognitive Health Coaching Study - protocol for novelty exercise activity.

Novelty Games			
Brush teeth non-dominant hand	3x/week	4x/week	5x/week
Count down from 100 by 7's	3x/week	4x/week	5x/week
Eat meal w/ non-dominant hand	3x/week	4x/week	5x/week
Recite days/week alphabet. Order	3x/week	4x/week	5x/week
Calculate sum of birthdate (dd/mm/yy) for you and family	3x/week	4x/week	5x/week

Review which activity the patient is doing at what frequency and how the patient performed against the goals for the week.

Move patient to the next activity.

Cognitive Health Coaching Study - protocol for cognitive computer games.

People are either advised to play FreeCell or Solitaire, not both. Some will start out on Solitaire and will be encouraged to move on if not MCI and when good at it. All will have a target of at least 5/wk of all games except Sudoku (that's set when they already know the other games or if they play it on their own initiative). Targets will go up above 5/wk for specific games

When working on memory (set Flipside +5 from current actual level)
When working on divided attention (set 21 Tally +5 from current actual level)
When working on planning (set FreeCell +5 from current level)

Sudoku	0	0	5	5	5	5
Pyramid Builder	5	5	5	5	5	5
21 Tally	5	5	5	5	10	5
Flipside	5	5	5	5	5	10
Spelling Bee	5	5	5	10	5	5
Letter Lotto	5	5	5	10	5	5
Scavenger Hunt	5	5	5	5	5	5
Solitaire	5	0	0	0	0	0
Free Cell	0	5	5	5	5	5
	MCI	LL	HL1	HL2	HL3	HL4

In setting the initial targets for your simulated patients, use column 1 for all MCI patients and some health low literacy patients; column 2 for other cognitively healthy low literacy pts; and randomize HL1-4 for the high literacy patients. Beyond this, there can be variety in any non-zero cell, but not over 20.