

## Arriving Prepared: Automated Telephone Messages Improve Appointment Adherence

Daniel G. Morrow PhD

University of Illinois Institute of Aviation, Aviation Human Factors Division, Willard Airport, #1 Airport Rd, Savoy IL, 244-8757, USA  
e-mail: dgm@uiuc.edu

William E. Menard BA

Department of Psychology, University of New Hampshire, Durham NH, USA

Heather E. Ridolfo BA

Department of Psychology, Brandeis University, USA

Von O. Leirer PhD

Los Altos CA, USA

*D.G.Morrow, W.E.Menard, H.E.Ridolfo, V.O.Lehrer. Arriving prepared: automated telephone messages improve appointment adherence. Gerontechnology 2003;2(3):247-254. Objectives.* Appointment nonadherence increases health care costs and reduces treatment efficacy. Nonadherence not only involves failure to show up for appointments, but failure to follow pre-appointment procedures. We examined the impact of automated telephone messages on adherence to pre-appointment procedures by younger, middle-aged, and older adults who were participating in a study in our lab. **Methods.** The evening before their appointment for a study, all participants received an automated reminder message that included the appointment date and time (Basic message). For half of the participants, the message also included a reminder about the pre-appointment procedure that all participants were required to perform (Enhanced message). Adherence to this pre-appointment procedure was measured when participants arrived at the lab, as well as their reactions to the automated message. **Results.** The enhanced automated message improved adherence to the pre-appointment procedure, compared to the message that did not contain the pre-appointment information, for all age groups. Participants in both conditions rated the messages as easy to understand and as generally useful. There was some evidence that middle-aged adults were less adherent, regardless of type of message received. **Conclusions.** Automated messages may improve treatment efficacy and reduce health care costs by instructing patients on how to arrive prepared for their appointments as well as by reducing no-show rates.

**Keywords:** missed appointments, aging, automated voice messaging, health communication

Appointment nonadherence is a critical health care problem in the United States, with estimates of no-show rates ranging from 5 to 40%<sup>1</sup>. Nonadherence reduces efficacy of preventative and treatment services and costs the nation billions of dollars each year. Evidence for the impact of patient age on appointment attendance is mixed, with some studies showing that older adults are more adherent than younger

adults (for review see<sup>2</sup>). Nonetheless, even a lower rate for older than for younger adults may translate into larger health care costs because older adults require a disproportionate amount of health care services requiring appointments.

Nonadherence involves more than simply failing to show up for appointments. For example, patients not only must know

when and where the appointment is, but what they must do in order to arrive prepared. Such 'pre-appointment procedures' include a variety of fasting regimens or arranging for transportation after procedures that temporarily impair vision. Thus, appointment attendance can be viewed as a complex self-care behavior similar to taking medication or monitoring symptoms of chronic illness. As such, it requires understanding and integrating information into a plan of action and remembering to implement the plan at the appropriate time(s). Self-care behaviors are increasingly important for maintaining health in current health care delivery systems<sup>3</sup>. This is especially important for older, chronically ill patients who often must manage their own complex health care needs at home in between visits to providers.

Computer technology such as the internet can support patients' self-care behaviors<sup>4,5</sup>. However, many patients, particularly older adults, still rely on the telephone for remote health care consultation and education. Automated voice messaging is often used to deliver health care services by telephone. Automated telephone messages remind patients about appointments, support patients' decision-making, and promote self-care practices<sup>6</sup>. They also support older adults' self-care behaviors such as symptom monitoring<sup>7-8</sup>.

We examined the impact of automated messages on adherence to pre-appointment procedures by younger, middle-aged, and older adults. Appointment keeping is a time-based prospective memory task, requiring people to remember to do something at a particular time. Such tasks are more difficult than event-based tasks, where memory is supported by environmental cues, particularly for older adults<sup>9</sup>. Not surprisingly, people tend to convert time-based into event-based tasks by using reminders<sup>10</sup>. While mail and telephone reminders can reduce appointment no-show rates<sup>1</sup>, we do not know whether such

reminders improve adherence to pre-appointment procedures that are essential to successful care.

Messages that inform patients about different components of appointment attendance such as pre-appointment procedures should improve multiple facets of adherence, in part by providing a more precise reminder of the target event<sup>11</sup>. For example, appointment keeping in one study increased when patients received telephone messages addressing cognitive, affective, and practical barriers to adherence<sup>12</sup>.

Our earlier work provides a foundation for designing automated telephone messages that address multiple facets of adherence. We found that older and younger adults have similar preferences for organizing appointment information such as date, time, location, and pre-appointment procedures. For example, they prefer messages with appointment date and time mentioned before pre-appointment procedures. Automated messages that match this "appointment schema" are better understood and remembered<sup>6,13</sup>. Thus, well-organized messages should help patients create a complete and accurate adherence plan. They should also improve prospective memory by helping patients implement their adherence plan if delivered close to the appointment time. An earlier simulated appointment adherence study investigated the impact of automated messages on adherence<sup>6</sup>. Over a one-month period, participants called our automated system at appointed times and reported what they would need to know to actually attend the appointment. Participants who received automated reminders the evening before their appointments were more likely to call on time compared to those who did not receive reminders. They also mentioned more information when calling, including pre-appointment procedures, suggesting that the automated messages improved

prospective memory for appointments. Thus, our previous studies suggest that well-organized automated messages help people create and implement plans to attend appointments.

### THE PRESENT STUDY

We investigated whether automated messages improve pre-appointment adherence by reminding people to perform the procedures. Participants were younger, middle-aged, and older adults scheduled to come into our laboratory for an unrelated study. All participants received an automated reminder message the evening before their appointment (see Appendix 1). The messages included the date, time, purpose of the appointment and whom to call with questions. In addition, messages for half of the participants reminded them to bring target information to the lab (pre-appointment procedure). We tested the following predictions:

- (i). Automated messages with pre-appointment information (Enhanced Messages) improve adherence to the pre-appointment procedure relative to messages without this information (Basic Messages). However, it is possible that enhanced messages will be less effective because they are longer than the basic messages and thus less likely to be remembered<sup>13</sup>.
- (ii). Older participants are less likely to adhere to pre-appointment procedures in the absence of cuing because of age-related declines in self-initiated processing<sup>14</sup>. Enhanced messages may especially benefit older participants by reducing need for self-initiated retrieval of adherence plans (Age X Message Condition interaction). In addition, as in earlier research<sup>6</sup>, we examined if participants find automated messages easy to use.

### METHODS

#### Participants

Participants were young (Y: ages 25-40 yrs), middle-aged (M: 50-59) and older (O:

60-75) adults who came to our lab to participate in a study of aging and memory. Eighty-four adults (Y=33, M=26, O=25) participated in the Enhanced Message condition and 84 adults (Y=27, M=24, O=33) participated in the Basic Message condition. Table 1 shows that the age groups did not differ in terms of self-reported health,  $F(2,161)=1.2$ ,  $p < .01$ . Older adults were somewhat less educated,  $F(2,160)=3.3$ ,  $p < .05$ , but showed the typical advantage on a test of vocabulary knowledge<sup>15</sup>,  $F(2,161)=25.5$ ,  $p < .01$ .

Working memory was measured by a listening and reading sentence span test, which tapped the ability to simultaneously store and manipulate verbal information in memory. Participants responded true or false to progressively larger sets of spoken or printed sentences (2-8 sentences) and then recalled the final word of each sentence in the set. The span score is the size of the largest set of sentences for which participants could recall all final words (for details on materials and scoring<sup>16</sup>). Speed of mental processing was measured by the Letter Comparison and Pattern Comparison tasks<sup>17</sup>. In these paper-and-pencil tests, participants decided as rapidly as possible whether pairs of letters or line patterns were the same or different.

Age declines often occur for both the working memory and processing speed tests, and these declines account for age-related variance on a variety of verbal memory tasks<sup>17-19</sup>. Participants in our study experienced age declines on both tests (sentence span:  $F(2,161)=17.6$ ,  $p < .001$ ; processing speed:  $F(2,161)=39.6$ ,  $p < .001$ , see Table 1). The Enhanced and Basic Message groups did not significantly differ in education, health, or on the cognitive ability tests.

#### Automated Messages

Participants in the Basic Message group received an automated appointment reminder message composed of two sec-

Table 1. Mean Scores for Demographic and Cognitive Ability Variables

	Enhanced Message Condition			Basic Message Condition		
	Young (N=33)	Middle (N=26)	Old (N=25)	Young (N=25)	Middle (N=23)	Old (N=33)
Health (7=perfect)	6.0	5.8	5.4	5.9	5.8	5.8
Education (years)	17.6	16.7	15.7	17.4	17.1	16.8
Vocab <sup>i</sup>	19.4	25.5	25.7	17.8	25.5	25.5
Working Memory <sup>ii</sup>	4.4	3.9	3.3	4.2	4.0	3.6
Processing Speed <sup>iii</sup>	32.6	27.8	23.3	32.4	28.3	26.0

i Advanced Vocabulary Test from the Kit of Factor-Referenced Cognitive tests<sup>15</sup>  
 ii Mean of span score (largest sentence set with correct final word recall) for the listening and reading versions of the sentence span test<sup>16</sup>  
 iii Mean of Letter and Pattern Comparison tasks<sup>17</sup>

tions: a) appointment section, organized according to the schema identified in our earlier studies<sup>6</sup>; b) concluding section that allowed participants to confirm or cancel the appointment and to repeat the message. Each response to the concluding section led to an appropriate concluding message (Appendix 1).

Participants in the Enhanced Message group received the same basic message. In addition, the appointment section included a reminder to bring the target information to the lab (written record of occupations during the past 5-10 years; this information was not necessary for completing the primary study). The pre-appointment procedure information was presented in the order specified by the appointment schema.

The messages were recorded and presented by the TeleMinder Model IV system. This system was composed of three components: a) a standard microcomputer, b) specialized hardware that interfaces with the public telephone system in order to place calls, and c) software that controls the calling operations. All messages were digitally recorded with normal conversational into-

nation and a speech rate typical of automated messages. To maximize contact, the system was programmed to leave the messages in the event that an answering machine picked up, or to call back every 30 min up to five times if there was a busy signal or no answer.

**Procedure**

Research participants in our lab are routinely sent automated reminders about their appointments, providing an opportunity to study the impact of messaging on performing pre-appointment procedures for actual appointments. Basic automated reminder messages were sent to participants for a study the evening before their appointment. Half of the participants received messages that included a reminder about the pre-appointment procedure (Enhanced Message Group). All participants were told about this procedure (to bring target information to the lab) when they first made their appointment. Thus, the automated messages served to remind rather than to provide a new prospective memory task. Once at the lab, participants were asked whether they had brought the required information. After completing the primary

study, they also completed a brief questionnaire about reactions to the automated message.

**RESULTS**

**Automated messaging and adherence**

As in other studies investigating the impact of automated reminders on high functioning adults (e.g.<sup>20</sup>), appointment attendance was high, with 11.6% no-shows (the proportion of no-shows did not differ for the two message conditions). The focus of the present study was adherence to pre-appointment procedures rather than the no-show rates.

Participants in the Enhanced Message condition were more likely than those in the Basic Message condition to arrive for their appointment with the requested information (Enhanced=79.8%, Basic=64.6%;  $\chi^2(1)=4.7, p < .05$ , see Figure 1), showing that the more specific automated message improved adherence to the pre-appointment procedure. Because of scheduling demands for the primary study, the interval between when the appointment was made and when the appointment occurred varied unsystematically (although it did not differ by age or message groups,  $F's < 1.0$ ). Because longer intervals are often associated with higher no-show rates<sup>1</sup>, we analyzed % adherence while controlling for this variable (although the relationship between this interval and adherence was not significant in the present study,  $r=.13, p > .10$ ). Information about this interval was missing for 22 participants, who were eliminated from the analysis. An ANCOVA with Age and Message Condition as factors and Time Interval as a co-variate revealed greater adherence in the Enhanced Message-condition,  $F(1,138)=4.8, p < .05, MSE=.186$ . Because there were unequal numbers of participants in the age groups within the two message conditions, the ANOVA was re-run with Message Condition as a between-groups variable and chronological age as a covariate. The message effect

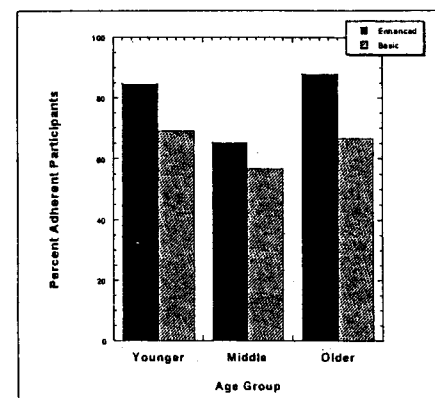


Figure 1. Adherence to the pre-appointment procedure, by age group

remained significant in this analysis ( $p < .05$ ).

**Aging and adherence**

We found little evidence that elders were less adherent than younger adults were on this appointment-keeping task. The ANOVA revealed a marginally significant effect of age,  $F(2,138)=2.5, p < .10$ . However, Figure 1 shows that the middle-aged adults were least adherent and the oldest adults were most adherent (Bonferroni contrast for middle-aged vs. older group,  $p=.08$ ). The Condition X Age interaction was not significant ( $F(2,138) < 1.0$ ), suggesting that the enhanced automated message did not differentially benefit older adults.

**Ease of using messages**

Table 2 shows participants in both message conditions rated the messages as easy to understand and as generally useful (Condition and Age  $F's < 1, MSE= 0.840$ ). Middle-aged adults rated the messages as less useful than the other age groups did,  $F(2,113)=3.6, p < .05, MSE= 1.690$ ; Bonferroni contrast for middle-aged vs older group  $p < .05$ . The usefulness rating did not differ by message condition,  $F < 1$ . Participants in the Enhanced and Basic message groups did not differ in terms of how often messages were unanswered or

Table 2: Mean Score for Age, Message Variables and Message Types

Message Condition	Enhanced			Basic		
	Young	Middle	Old	Young	Middle	Old
Ease (1=very easy)	1.4	1.6	1.6	1.7	1.4	1.6
Useful (5=very useful)	3.2	3.2	3.9	3.8	3.1	4.0
% Repeated Messages	20	33	18	21	29	12
% Answering Machine	49	31	24	44	13	24

repeated when answered. More specifically, the percentage of messages left on answering machines did not differ by group (Enhanced=35%, Basic=27%;  $\chi^2(1) = 1.4$ ,  $p > .10$ ) and the same percentage of messages were repeated by participants in the two groups (Enhanced=24%, Basic=21%;  $\chi^2(1) = 1.8$ ,  $p > .10$ ). Age was unrelated to percentage of repeated messages,  $\chi^2(2) = 2.5$ ,  $p > .10$ , but there was an age-related decrease in percentage of messages left on answering machines,  $\chi^2(2) = 9.9$ ,  $p < .01$ . Finally, adherence to pre-appointment procedures was not related to whether messages were left on answering machines or answered directly ( $\chi^2(1) < 1.0$  for both Enhanced and Basic message conditions). The answering machine variable also did not moderate participants' ratings of the usefulness of the messages. Nonetheless, the potential impact of answering machines versus direct interaction with automated messages on health care behaviors should be addressed by larger-scale studies.

## DISCUSSION

Previous studies have found that automated messages reduce appointment no-show rates<sup>5</sup>. Automated messages in the present study also increased adherence to pre-appointment procedures. This benefit may reflect either improved prospective memory or retrospective memory for the procedure. Although retrospective memory was not

assessed in the present study, our earlier simulation study found that automated messages improved appointment adherence but not retrospective memory for appointment information<sup>6</sup>. This suggests that the automated messages increased adherence by improving prospective memory.

Although we predicted an age-related decline in adherence to pre-appointment procedures, we found little evidence that elders were less adherent than younger adults were. This is consistent with other realistic prospective memory tasks<sup>21</sup>. Indeed, there was some evidence that middle-aged adults were the least adherent age group in the present study. Park and her colleagues have found similar results for medication adherence<sup>22</sup>. The age difference in our study did not reflect differences in cognitive ability because cognitive scores did not predict adherence for any age group. Perhaps middle-aged adults lead busier lives than the other groups, and their complex schedules interfere with the time-monitoring or planning components of prospective memory<sup>22</sup>. Older adults, on the other hand, may have beliefs that are more compatible with adherence tasks, and have the flexibility to structure daily routines around such tasks.

Although older adults in our study were very adherent, it should be noted that they

were in the "young-old" age range (60-75 years). Other studies have found that more advanced age is associated with reduced adherence to daily tasks. For example, adults in their mid-70's and older have been found to be less adherent than young-old adults on measures of medication<sup>23</sup> and appointment adherence<sup>6</sup>. Thus, the impact of automated messages on pre-appointment adherence should be investigated over a wide age range.

## Implications for automated messaging and health care

Although the present study investigated the impact of reminders on appointments for a research study, the findings should generalize to health care applications because several cognitive components of appointment keeping should be similar across domains, including comprehension of appointment task requirements and time-based prospective memory (of course, there are also differences; for example our participants were healthy). Therefore, the present study suggests the value of automated messaging for improving multiple facets of adherence to self-care tasks for young and older adults. Automated messages may improve patient health and reduce health care costs not only by reducing appointment no-show rates, but by improving adherence to essential pre-appointment procedures, so that patients arrive prepared for their appointments.

The present study only examined the impact of automated messages on simple pre-appointment procedures. These messages may be even more important for complex pre-appointment procedures. For example, preparing for a gall bladder diagnostic imaging procedure requires eating nonfatty meals and taking a specific medication over a three-day period. Precise, patient-centered automated messages may especially help patients create and implement effective adherence plans for such complex procedures.

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### Appendix 1: Automated Appointment Message

#### *[Appointment Section]*

Hello, this is (xx) calling from the Applied Cognitive Research Lab with a message for (xx)  
 You have an appointment on (xx) at (xx) to participate in a research project.

#### *(Pre-appointment procedure, only heard in Enhanced Message condition)*

Please remember to bring a record of your last 5 jobs with you to the appointment.  
 You may call us at (xx) if you have any questions about the appointment.

#### *[Concluding Section]*

Press 1 if you will be able to make the appointment.  
 Press 3 if you will not be able to make the appointment

Press 5 if you would like to hear this message again before making your decision.

*If 1:* We look forward to seeing you on (xx) at (xx).

This completes our call. Again, if you have any questions, please feel free to contact us at (xx). Thank you for your time.

*If 3:* I am sorry to hear you will not be able to make the appointment. I will contact you at a later date. This completes our call. Again, if you have any questions, please feel free to contact us at (xx). Thank you for your time.

*If 5:* Repeat message, and options 1 and 3 of concluding section.