Practice Concepts

Eleanor S. McConnell, RN, PhD, Editor

The Gerontologist
Vol. 42, No. 2, 273–277

In the Public Domain

Exercise Prescribing: Computer Application in Older Adults

Reto W. Kressig, MD,[1] and Katharina V. Echt, PhD[2]

Purpose: The purpose of this study was to determine if older adults are capable and willing to interact with a computerized exercise promotion interface and to determine to what extent they accept computer-generated exercise recommendations. ***Design and Methods:*** Time and requests for assistance were recorded while 34 college-educated volunteers, equal numbers of men and women, ranging in age from 60 to 87, interfaced with a health promotion tool. The computerized exercise promotion tool's ease of use and the acceptability of the exercise recommendations made were rated by the participants. ***Results:*** On average, completion of the items on the computer took 33 min and each participant made 3 requests for assistance, of which only 22% were mouse related. The system's ease of use and the exercise prescription acceptability ratings were high and independent of prior experience with computers. ***Implications:*** User friendliness of computerized health promotion tools will determine if, and how, health providers integrate these new technologies into daily practice. The participants in the study were able to complete the computerized items within a reasonable amount of time and with minimal assistance from the provider. These data support the potential of interactive technology in health promotion among the expanding older population.

Key Words: Aging, Elderly, Computer technology, Usability, Expert system, Exercise counseling

New approaches to health promotion for the growing geriatric population are needed (Smith, 1988). The potential of interactive technology in health promotion has been convincingly demonstrated in younger individuals (Ben-Said, Consoli, & Jean, 1994; Street, Voigt, Geyer, Manning, & Swanson, 1995). Little is known about the use of computer technology in health promotion with older adults. A plethora of computer products for patient education and health promotion is emerging (Kieschnick, 1996). These software packages are intended to facilitate the prevention efforts of health providers; however, a number of issues remain unresolved. Are older adults, who often have considerably less computer experience than younger individuals, able and willing to use health promotion software programs? Are they accepting of computer-generated recommendations to improve their health behavior? No, or little, information is available to inform caregivers regarding the usability and acceptability of such products among older adults.

There are a number of reasons to expect that using interactive technology for health promotion with older adults will be feasible and advantageous. First, data suggest that increasing numbers of older individuals are enthusiastic users of computers and the World Wide Web in particular for self-initiated access to health information (Marwick, 1999; Morrell, Mayhorn, & Bennett, 2000). Secondly, by analyzing a wealth of personal, behavioral, and environmental factors for each individual, computer-based health edu-

This research was supported by a Core Developmental Grant from the Atlanta Veterans Affairs Rehabilitation Research and Development Center. Dr. Kressig was supported by a research training grant provided by Geneva University Hospitals, Switzerland. We are grateful to Joseph G. Ouslander, MD, and William De l'Aune, PhD, for valuable comments on an earlier version of this article. We also acknowledge Lisa Boyette for the opportunity to evaluate the Computerized Exercise Expert System. We thank Adrienne Lloyd for assistance with participant recruitment.

Address correspondence to Katharina V. Echt, PhD, Atlanta VA Rehabilitation Research and Development Center, Mail Code 151/R, 1670 Clairmont Rd., Decatur, GA 30033. E-mail: kecht@emory.edu

[1]Department of Geriatrics, Geneva University Hospitals, Switzerland.

[2]Rehabilitation Research and Development Center, Atlanta VA Medical Center, Decatur, GA.

cation software can tailor health promotion interactions to an extent that is impossible with another medium (Kieschnick, 1996). Highly personalized health recommendations are most likely to impact a change of health behavior (Bandura, 1986). Finally, the use of interactive technology might motivate more health providers to engage in health promotion practice with their older clients by addressing some of the most cited barriers to doing so: time constraints, absence of insurance reimbursement, and general lack of experience (Young, Gray, & Ennis, 1983).

The purpose of this study was to examine if older adults are capable and willing to complete a computerized questionnaire and to what extent they accept computer-generated exercise recommendations. We chose, therefore, an exercise expert system (Boyette, Boyette, Lloyd, Manuel, & Echt, 2001) as an exemplar of interactive technology developed for health promotion. We then evaluated older adults' (a) time and assistance requirements while completing a computerized questionnaire on this system to generate an exercise prescription, (b) ability to interface successfully with the software using a mouse, and (c) subjective ease of use and prescription acceptability ratings.

Methods

Participants

We recruited 36 community-dwelling adults aged 60 and older from an ongoing strength-training project at the Atlanta VA Rehabilitation Research and Development Center and from a local senior center. We screened participants to approximate the profile of future users of the Exercise Expert System evaluated in this study. We included participants if they were 60 years of age and older and without medical contraindication for exercise. Furthermore, to complete the computer task, the participants required intact manual dexterity (ability to dial a phone number) and intact near vision (ability to read a newspaper). The Exercise Expert System itself includes prescreening procedures (i.e., Functional Reach Test, Get Up and Go Test, Orientation and Memory Concentration Test [OMCT], and Mood Scale Score) to ensure that participants are at minimal risk for falls and demonstrate normal cognitive function and normal mood. Of the 36 screened participants, we enrolled 34 in the study; two participants did not meet the inclusion criteria because of medical contraindications for exercise (cardiac surgery within the last 3 months). The resulting sample consisted of 17 female and 17 male older adults ($n = 34$) and ranged in age from 60 to 87 years ($M = 70.4 \pm 6.9$). Thirty-three of the 34 participants had some college education or more, and 15 of 34 had no or very little computer experience. For 11 of 34 participants, annual income ranged between $10,000 and $39,999, for 17 of 34 it was $40,000 and higher, 6 participants did not want to say. The sample's cognitive function as measured by the OMCT ranged from 0 to 10 (indicating normal cognitive function) with most of the participants (30 of 34) scoring between 0 and 2. The Human Investigations Committee approved the project, and we obtained written informed consent before testing.

Materials and Measures

Exercise Expert System.—Developed by Boyette and colleagues (2001), this software generates individualized exercise prescriptions for older healthy individuals based on responses given by clients and their practitioners to three different questionnaires. These computerized questionnaires pertain to medical history, mood, functional status, mental status, and specific preferences, or determinants, which are known to influence initiation of exercise behavior and maximize subsequent adherence. These factors are taken into account by the software in generating the resulting exercise prescription.

Computer and Exercise Expert System Training Manual.—We developed an illustrated training manual similar to that used by Echt, Morrell, and Park (1998) to provide older adults, regardless of computer skill level, with elementary mouse training and general instructions for interaction with the Exercise Expert System. This manual provided step-by-step illustrated instructions for the procedures required to use the mouse and to complete the computerized questions. Briefly, participants were seated in front of the computer and left alone with the illustrated manual until they were ready to start the computerized questionnaire. We measured the time needed to review the training manual and encouraged the participant to ask questions once their review of the manual was completed.

Practicality.—We measured system practicality by having participants independently complete the 81-item computerized questionnaire and obtaining objective and subjective measures. We measured performance using time and requests for assistance. We chose these measures because in practice the time required by the patient and the time expended by staff providing assistance are a critical aspect to determining if health promotion software such as this system is practical. We classified requests for assistance as either mouse related or non-mouse related. The Ease-of-Use Questionnaire was a subjective measure of practicality and consisted of five dichotomous items (Yes/No) concerned with different aspects of the participants' impressions of the usability of the system. We implemented this measure because subjective impressions of older patients are equally critical for evaluating the practicality of implementing a system like the Exercise Expert System in practice. In this manner, we were able to determine (a) whether the older adults tested could use the software, and (b) whether they thought the software was easy to use or not.

Acceptability.—We measured prescription acceptability using a six-item Likert-type questionnaire (1 = not at all satisfied to 4 = very satisfied). Items were concerned with the overall degree of satisfaction with the customized exercise prescription form and the specific prescriptions for aerobic, resistance, and flexibility exercise.

Equipment.—We administered the computerized questionnaire in a typical office setting using a Dell PC with 17-inch monitor. The software recorded responses to the computerized items and subsequently generated each prescription for review with the participant.

Procedure.—Following the completion of the screening, we gave each participant as much time as needed to read the Exercise Expert System Training Manual and, when ready, to respond as independently as possible to the computerized questionnaire. We recorded time and requests for assistance and completed the ease-of-use evaluation. We then printed the exercise prescription and explained it using a standardized exercise counseling protocol. Lastly, we completed the prescription acceptability questionnaire.

Results

We used descriptive statistics to summarize the findings and Pearson *r* to determine relationships between the demographic and primary dependent measures. Thirty-three of the 34 participants completed the protocol, one male participant aged 65 with some college education was unable to complete all of the computerized items because of fatigue. We excluded this participant's data from the analyses.

Computer and Exercise Expert System Training

The average time needed to review the illustrated training manual was 3.76 min (ranging from 1 to 7 min, Median = 3.00, SD = 1.5). The participants asked no questions after review of the manual, and we noted no difficulties during the training session.

Time and Requests for Assistance

It took the participants an average of 33 min (ranging from 12 to 79 min, Median = 28, SD = 15.57) to answer the computer questions. On average, three requests for assistance were made (ranging from 0 to 9, Median = 2, SD = 2.5); 5 participants completed the questions without any assistance. The majority (78%) of these requests were because of non-mouse-related difficulties and included difficulties with question presentation (i.e., Can I mark more than one response? How do I continue?), wording, or content (i.e., My answer to the question is not one of the options listed). Mouse-related difficulties (how to click, how to point, or coordination) only accounted for 22% of the total requests for assistance (see Table 1).

Ease-of-Use and Prescription Acceptability

Ease-of-use ratings could range from 0 (low) to 5 (high) and included both computer-related ease of use and expert system-related ease of use. The participants' scores ranged from 3–5 (M = 4.58, Median = 5, SD = .66). Acceptability ratings of the exercise prescription were also very high (M = 21.45, Median = 22, SD = 2.24) with scores ranging from 15–24 on a scale from 6 (low) to 24 (high; see Table 1).

Table 1. Descriptives: Dependent Measures

Measure	*M*	*SD*	Min./ Max.
Training time (Min)	3.76	1.50	1–7
Completion time (Min)	32.58	15.57	12–79
Requests for assistance	3.03	2.49	0–9
Mouse-related	.67	1.16	0–5
Non-mouse-related	2.36	1.90	0–8
Ease-of-use score (0–5)[a]	4.58	.66	3–5
Prescription acceptability score (6–24)[a]	21.45	2.24	15–24

[a]Range possible on measure.

Correlational Analyses

Age was directly related to the number of requests for assistance made (r = .53, $p < .01$) and in particular to non-mouse-related requests for assistance (r = .49, $p < .01$). There was no significant relationship between age and the time required answering the items. Thus, although the older participants, on average, made more requests for assistance, they did not take longer to answer the questions overall. Computer experience, not education level or OMCT score, was significantly related to shorter response time and fewer requests for assistance ($r = -.46$, $p < .01$; see Table 2). Ease-of-use ratings were negatively correlated to response time and requests for assistance. Participants who took longer and required more assistance, especially for non-mouse related difficulties, rated the system less easy to use than those with shorter questionnaire times and less assistance. No association was found for prescription acceptability ratings, time, and requests for assistance. Regardless of time and assistance needs, the exercise prescription was highly accepted (see Table 3).

Discussion

Increasingly, health information is disseminated via technologies such as the World Wide Web and Expert Systems, but often without considering the older audience that would benefit most (Marwick, 1999). It is commonly assumed that older people do not like computers, but there is growing evidence that they are readily able and even eager to acquire and retain computer skills (Lawhorn, Ennis, & Lawhorn, 1996), particularly for acquiring health information (Morrell et al., 2000).

This study demonstrates that (a) a highly-educated, healthy, volunteer sample of older adults was able to complete the questionnaire on the computer within a

Table 2. Pearson Correlations and p Values for Objective Performance Measures

Objective Measures	Total Time	Total Assistance	Mouse-Related	Non-Mouse-Related
Age	.314 (.750)	.532 (.001)*	.338 (.054)	.491 (.004)*
Computer experience	−.456 (.008)*	−.389 (.025)*	−.303 (.086)	−.325 (.065)
Education	.049 (.785)	−.116 (.521)	−.227 (.203)	−.013 (.944)
OMCT score	.218 (.222)	.081 (.654)	−.089 (.622)	.161 (.371)
Income	−.248 (.164)	−.204 (.256)	−.139 (.442)	−.182 (.310)
Ease-of-use score	−.481 (.005)*	−.427 (.013)*	−.311 (.079)	−.370 (.034)*
Prescription acceptability score	−.008 (.967)	−.057 (.754)	.100 (.579)	−.136 (.451)

Note: OMCT = Orientation and Memory Concentration Test.
$^*p < .05$.

reasonable amount of time and with minimal assistance to get an individualized exercise prescription, (b) the computer mouse did not hinder the participants, and (c) the subjective ratings of the system and exercise prescriptions were high.

The finding that virtually all of these healthy older adults were able to interact successfully with the computerized questionnaire interface supports the idea that computerized health promotion systems have much potential in daily practice with older individuals. Clearly, compared to younger individuals, older adults take longer and make more errors when performing computer tasks (Echt et al., 1998). Thus, time issues might play a greater role in the applicability of interactive technology with older adults because older adults tire more easily. However, half an hour seems to be a reasonable time amount for the healthy, well-educated, older individuals to interact with a computerized questionnaire in a practice setting. The tested sample of older volunteers needed minimal assistance to complete the computer session; however, higher age and little computer experience were significantly related to higher assistance need. Minimal or no staff assistance should be required to preserve the health provider's resources and time. The use of elder-friendly interfaces and designs (Echt, 2002; Holt & Morrell, 2002) may help to reduce time and assistance constraints of emerging health promotion technologies.

Coordination of a computer mouse has been described as a potential source of difficulty for older individuals and, therefore, a concern to those hoping to implement technology in daily practice (e.g., Hutchinson, Eastman, & Tirrito, 1997). The results of this study replicate those of Echt and colleagues (1998), who suggest that older adults are able, without too much difficulty, to acquire the skills necessary to use a computer mouse. Newer technologies, such as touch screen, are promising (Buxton, White, & Osoba, 1998), but not as readily available.

Older adults' acceptability of computer-generated health recommendations are at least as important for a successful implementation of interactive health promotion technology as the older adults' ability to interface with a computer system. The finding that the study participants, regardless of time need or requests of assistance, found the health recommendation highly acceptable supports previous reports about older adults' positive attitude toward computer technology (Lawhorn et al., 1996). The overall high mean values of the ease-of-use ratings stress further the elders' positive attitudes toward computer technology. However, participants who took longer and needed more assistance to complete the computer session rated the questionnaire's ease of use substantially lower.

The question of how computers should be applied in medicine has been raised (Winker & Silberg, 1998). The results of this study indicate that interactive computer technology may be a practical tool for promoting healthier exercise behaviors in older individuals. More research is needed to examine the extent to which such technology is able to promote the initiation of and adherence to healthier behaviors in older adults. This is the case particularly for older individuals who experience a variety of barriers to health promotion program access. In terms of the Exercise Expert System evaluated here, studies are currently underway to evaluate the system's effect on older adults' exercise behavior compared to more traditional exercise promotion methods.

The small sample size, the overall high education level, and the generally higher motivation of study volunteers (Halbert, Silagy, Finucane, Withers, & Hamdorf, 1999) make these data exploratory and not necessarily representative of older adults in general. Clearly, the high education level and the volunteer nature of this sample threatens the generalizability of the findings reported here to other older adults who may participate in and benefit from health promotion programs such as this one. Nevertheless, the results of

Table 3. Pearson Correlations and p Values for Subjective Performance Measures

Subjective Ratings	Ease of Use	Prescription Acceptability
Age	−.493 (.004)*	.004 (.981)
Computer experience	.287 (.105)	−.182 (.310)
Education	−.254 (.154)	−.218 (.223)
OMCT score	.057 (.753)	.272 (.126)
Income	.017 (.927)	.225 (.208)

Note: OMCT = Orientation and Memory Concentration Test.
$^*p < .05$.

this study provide some first insights into the potential of interactive technologies as tools for health promotion in the growing geriatric population. Studies with larger and more diverse samples are needed to explore the impact of this technology on the health behavior and well being of older people.

References

Bandura, A. (1986). *Social foundations of thought and action. A social cognitive theory.* Englewood Cliffs, NJ: Prentice Hall.

Ben-Said, M., Consoli, S., & Jean, J. (1994). A comparative study between a computer-aided education (ISIS) and habitual education techniques for hypertensive patients. In S. Oxbold (Ed.), *Proceedings of the Annual Symposium on Computer Applications in Medical Care* (pp. 10–14). Philadelphia: Hanley & Belfus.

Boyette, L. W., Boyette, J. E., Lloyd, A., Manuel, S., & Echt, K. V. (2001). Development of an exercise expert system for older adults. *Journal of Rehabilitation Research and Development, 38*, 79–81.

Buxton, J., White, M., & Osoba, D. (1998). Patients' experiences using a computerized program with a touch-sensitive video monitor for the assessment of health-related quality of life. *Quality of Life Research, 7*, 513–519.

Echt, K. V. (2002). Designing web-based health information for older adults: Visual considerations and design directives. In R. W. Morrell (Ed.), *Older adults, health information, and the World Wide Web* (pp. 61–87). Mahwah, NJ: Erlbaum.

Echt, K. V., Morrell, R. W., & Park, D. C. (1998). Effects of age and training formats on basic computer skill acquisition in older adults. *Educational Gerontology, 24*, 3–25.

Halbert, J. A., Silagy, C. A., Finucane, P., Withers, R. T., & Hamdorf, P. A. (1999). Recruitment of older adults for a randomized, controlled trial of exercise advice in a general practice setting. *Journal of the American Geriatrics Society, 47*, 477–481.

Holt, B. J., & Morrell, R. W. (2002). Guidelines for website design for older adults: The ultimate influence of cognitive factors. In R. W. Morrell (Ed.), *Older adults, health information, and the World Wide Web* (pp. 109–129). Mahwah, NJ: Erlbaum.

Hutchinson, D., Eastman, C., & Tirrito, T. (1997). Designing user interfaces for older adults. *Educational Gerontology, 23*, 497–513.

Kieschnick, T. (1996). Product overview: Existing and emerging computer products for patient education, health promotion, and informed patient decision making. In T. Kieschnick, L. J. Adler, & H. B. Jimison (Eds.), *1996 Health informatics directory* (pp. 1–21). Baltimore: Williams & Wilkins.

Lawhorn, T., Ennis, D., & Lawhorn, D. C. (1996). Senior adults and computers in the 1990s. *Educational Gerontology, 22*, 193–201.

Marwick, C. (1999). Cyberinformation for seniors. *Journal of the American Medical Association, 281*, 1474–1477.

Morrell, R. W., Mayhorn, C. B., & Bennett, J. (2000). A survey of World Wide Web use in middle-aged and older adults. *Human Factors, 41*(2), 175–182.

Smith, D. L. (1988). Health promotion for older adults. *Health Values, 12*, 46–51.

Street, R. L., Voigt, B., Geyer, C., Manning, T., & Swanson, G. P. (1995). Increasing patient involvement in deciding treatment for early breast cancer. *Cancer, 76*, 2275–2285.

Winker, M. A., & Silberg, W. M. (1998). Computers, the internet, and the practice of medicine. *Journal of the American Medical Association, 279*, 66.

Young, A., Gray, J. A., & Ennis, J. R. (1983). Exercise medicine: The knowledge and beliefs of final-year medical students in the United Kingdom. *Medical Education, 17*, 369–373.

Received October 18, 2000
Accepted October 17, 2001
Decision Editor: Eleanor S. McConnell, RN, PhD