

Use and Reliability of the World Wide Web Version of the Block Health Habits and History Questionnaire with Older Rural Women

LINDA S. BOECKNER, PhD, RD;¹ CAROL H. PULLEN, EDD, RN;²

SUSAN NOBLE WALKER, EDD, RN, FAAN;² GERALD W. ABBOTT, MSN, RN;³ TORIN BLOCK⁴

¹University of Nebraska Panhandle Center, Scottsbluff, Nebraska 69361;

²University of Nebraska Medical Center, College of Nursing, Omaha, Nebraska 68198-5330;

³University of Nebraska Medical Center, College of Nursing, Mitchell, Nebraska 69337;

⁴Block Dietary Data Systems, Berkeley, California 94709

ABSTRACT

Objective: To estimate the parallel forms reliability of the paper and pencil and World Wide Web versions of the 1998 Block Health Habits and History Questionnaire (HHHQ) and to examine the feasibility of older women using the Web version.

Design: Within a 2-week period, participants completed both the paper and pencil and Web versions of the HHHQ and pre- and postsurveys about their comfort level and experience in using the computer.

Subjects: A convenience sample of 31 white women, aged 58.2 ± 6.3 years, from a rural location were recruited via direct mail, public service announcements, and public posters.

Variables Measured: The parallel forms reliability of the HHHQ administered in two different ways and the perceptions of the women on their computer use were measured.

Analysis: Dietary data were analyzed using Pearson correlations and paired *t* tests. Alpha significance level was set at $P \leq .05$.

Results: The Web HHHQ had adequate reliability when compared with the paper and pencil version; paired sample correlations approximated acceptable coefficients ($r > .70$), with only vitamin C ($r = .54$) and iron ($r = .65$) falling below the acceptable standard. Eleven women indicated initial discomfort with the computer, but after the study, only three said they were uncomfortable completing the on-line survey.

Implications: Internet dietary assessment tools could be a feasible assessment tool for older women to self-administer.

KEY WORDS: dietary assessment, women, food frequency questionnaire

(*J Nutr Educ Behav.* 2002;34:S20-S24.)

INTRODUCTION

Since people are living longer, improving the quality of life for older adults is becoming an area of increasing interest.^{1,2} Diet is a key factor that affects disease risk and cause of death from chronic disease³ and is included among the Healthy People 2010 objectives established by the US Department of Health and Human Services.⁴ Consequently, older audiences are important targets for dietary assessment and accompanying educational programs to address dietary behaviors.⁵

Because their life expectancy is longer, women are more vulnerable than men to the effects of disabilities and chronic diseases.⁶ With limited health care access, rural older women are at particular risk for health problems compared with their urban counterparts.^{7,8} National dietetic associations in the United States and Canada direct nutrition professionals to use health promotion activities and services that help women adopt desirable nutrition practices for optimum health,⁹ but finding ways to reach older women in more remote, rural areas remains a challenge.

The idea that computers and the Internet may offer an innovative method for reaching the older adult has captured the attention of health researchers and World Wide Web designers alike, who are exploring ways to ease older adults into using the Internet.¹⁰ A US Department of Commerce report identified that, in 2000, only 26.9% of people over age 50 years used the Internet; however, from 1998 to 2000, persons over age 50 years experienced the highest rates of growth in Internet use of all age groups.¹¹ Furthermore, older adults in computer courses that were designed for them have demonstrated that they are willing to learn about computers and able to improve their basic computer skills.¹² Czaja and

Address for correspondence: Linda S. Boeckner, PhD, RD, University of Nebraska Panhandle Center, 4502 Ave I, Scottsbluff, NE 69361; Tel: (308) 632-1256; Fax: (308) 632-1365; E-mail: LBoeckner1@unl.edu.

©2002 SOCIETY FOR NUTRITION EDUCATION

Sharit also found that actual experience with computers can modify attitudes toward computers in positive ways, irrespective of age or gender.¹³ Thus, the possibility of using this technology to provide dietary assessment for older adults in rural areas is becoming more promising, but valid and reliable measures will be required before moving forward.

Diet records, 24-hour dietary recall, food frequency questionnaires, and diet histories are all traditional methods for collecting dietary information. Each has its benefits and limitations.¹⁴⁻²³ The Block Health Habits and History Questionnaire (HHHQ) (Block Dietary Data Systems, Berkeley, Calif) is a widely used quantitative food frequency questionnaire that has been validated against other dietary assessment methods.²⁴⁻²⁷ A Web version of this questionnaire has been made available, but its reliability as compared with the traditional paper and pencil version is unknown.

The investigators initiated this study to estimate the parallel forms reliability of paper and pencil and Web versions of the 1998 HHHQ and to examine the feasibility of administering it via the Internet to older rural women for dietary assessment.

STUDY DESIGN

Sample A convenience sample of 31 rural, community-dwelling/noninstitutionalized women aged 50 to 69 years was recruited for participation in this study. This sample size had a power of .88 to .99 to avoid Type II error for the correlations found (.54-.86). Their mean age was 58.2 ± 6.3 years, mean height was 64.8 ± 2.8 inches, mean weight was 158.2 ± 32.3 pounds, and mean body mass index was 26.6 ± 5.6 . Twenty women (64%) indicated that they were in excellent or very good health, 9 (29%) were in good health, 1 (3%) was in fair health, and 1 (3%) did not indicate her health status. All of the women were white.

The investigators recruited women for this project through local organizations, local media public service announcements, posters in retail and grocery stores, and a local Cooperative Extension Service office. Criteria for inclusion in the study were (a) female between the ages of 50 and 69 years; (b) no presence of chronic disease such as diabetes or confirmed heart disease that would affect eating patterns; (c) able to read, write, and speak English; (d) community dwelling/noninstitutionalized; (e) responsible for their own food choices; and (f) willing to complete both paper and pencil and Web-based versions of the HHHQ. The investigators obtained informed consent according to procedures approved by an Institutional Review Board.

Procedures for Data Collection The HHHQ contains a listing of food entries from all of the major food groups. The development of the paper and pencil version and validation against one-day to multiple-day food records have been reported elsewhere.^{19,24,26} Validity has been evaluated at the individual and group levels via interview and self-admin-

istered techniques.^{15,26} The 1998 HHHQ was used for this study in both the paper and pencil and Web forms. It was developed from the Third National Health and Nutrition Examination Survey (NHANES III) food intake data.²⁸ The food list was developed to ensure the inclusion of major food contributors for African American, Hispanic, and white populations. Fat-modified food items were included to improve nutrient estimates of fat intake.²⁹

The content of both the paper and pencil and Web versions of the HHHQ is identical. Each food entry contains nine frequency ranges, from two or more per day to never or a few times per year, as well as a choice of serving sizes. Pictures of serving sizes are given as a point of reference to assist in filling out the portion size section of both the paper and pencil and Web questionnaires. Although the order of food entries on the paper and pencil and Web versions is identical, users access the Web version in four sections and submit responses for each section via the Internet after they complete each section. In the Web version, "drop-down" boxes are used for each food item so that the user can "click" the correct frequency and serving size for each item.

To each participant, the investigators mailed the paper and pencil HHHQ, an instruction sheet for completing the questionnaire, and a baseline computer use survey to assess participants' ownership of, access to, and experience with a computer. The participants marked the questionnaires with a confidential identification number so that the investigators could match the paper and pencil and Web questionnaires by participant.

After participants completed the paper and pencil version, they made an appointment and attended a computer laboratory at a local Cooperative Extension site to complete the Web version. All participants completed the Web version from 1 to 2 weeks after completing the paper and pencil version. As each woman arrived for her appointment, investigators collected the paper and pencil HHHQ and the baseline computer use survey. After a brief orientation session to cover computer fundamentals, each participant used a computer to complete the demographic data at the beginning of the Web version of the HHHQ. Women who successfully entered demographic information using the computer mouse were allowed to continue filling out the remainder of the questionnaire without further orientation. The investigators provided additional orientation to any woman who had difficulty using the computer and computer mouse to answer the demographic section before they continued completing the Web questionnaire. No women were dropped from the study at this point.

After each woman completed the Web version of the HHHQ, she completed a brief follow-up survey regarding her comfort level in completing the food questionnaire by computer. Investigators recorded the time required to complete the Web HHHQ and made anecdotal notes about participants' questions and reactions while using the computer.

Data Analysis The investigators mailed completed paper and pencil questionnaires for all participants to Block

Dietary Data Systems for scanning, computer editing, and analysis. Each participant, however, submitted her own responses to the Web questionnaire as they were completed on the Internet. Block Dietary Data Systems conducted the analysis of the questionnaires off-line to obtain nutrient and food group values and returned the results to the investigators on diskette for further statistical analyses.

The investigators removed the dietary data of 2 women from statistical analysis because of scores outside acceptable ranges that were provided by Block Dietary Data Systems, leaving dietary data from a sample of 29 women for estimating the parallel forms reliability. The investigators analyzed the dietary data using SPSS (Statistical Package for the Social Sciences).³⁰ Nutrient values were square root transformed as needed to improve the bivariate normality of skewed distributions.³¹ Parallel forms reliability was estimated using Pearson correlations to assess individual level agreement between the paper and pencil and Web versions of the HHHQ. Paired *t* tests allowed comparisons of the group means for energy and nutrients between the paper and pencil and Web versions. Alpha significance level was set at $P \leq .05$. The investigators calculated frequencies for the items on the baseline and follow-up computer surveys and reviewed and summarized anecdotal notes of the computer sessions.

FINDINGS AND DISCUSSION

Parallel Forms Reliability Table 1 provides Pearson product moment correlations between the Web version of the HHHQ and the paper and pencil version. Pearson correlation coefficients are shown for selected measures of energy, macronutrients, minerals, vitamins, and daily food group servings. Coefficients ranged between .54 and .86 for all dietary variables (median $r = .80$). These correlations between the paper and pencil and Web-based versions of the HHHQ for most of the energy and nutrient measures approximated acceptable reliability coefficients ($\geq .70$) per Nunnally³² and were statistically significant at $< .05$.

Paired *t* test values for measures of energy, macronutrients, minerals, vitamins, and daily food group servings are shown in Table 2. There were no significant differences in means between the paper and pencil and Web versions, further supporting the parallel forms reliability of the Web-based version.

Ease of Computer Use Twenty of the 31 women (64%) who were recruited for the study had a computer at home, 26 (84%) had access to a computer, and 27 (87%) had previously used a computer. At study baseline, 20 women (64%) reported being comfortable or very comfortable with the computer, whereas 11 (36%) were not comfortable. Following their experience with completing the HHHQ on the Internet, only 3 women (10%) indicated that they would not use the computer at another time to complete a survey. This experience increased 8 women's interest (26%) in using computers, whereas interest stayed the same for 21 women

(68%) and declined for 2 women (6%). All of the women thought the computer instructions prior to the session were either helpful or very helpful. The usual length of time to complete the Web version of the HHHQ was 45 to 50 minutes, with a range between 30 and 90 minutes.

Many of the participants appeared to become more comfortable with the computer through this computer experience. Anecdotal notes indicated that the women were generally able to complete the questionnaire with minimal assistance from the researchers. The most evident difficulties in completing the questionnaire were with the "drop-down" boxes and with hand-eye coordination (eg, "clicking" in the wrong spot or difficulty in keeping track of location).

The Web version of the HHHQ appears to offer an acceptable electronic method for gathering dietary information from older women in more remote rural areas rather than administering the paper and pencil version by mail or telephone interview. The correlation coefficients for nearly all variables were acceptable (between .54 and .86) and compared favorably to other reproducibility studies that used food frequency or diet history questionnaires.^{17,18,33} The only nutrients for which the correlation coefficients were below an acceptable standard ($r = .70$) were iron ($r = .65$) and vitamin C ($r = .54$), with only vitamin C being markedly below. These correlations, coupled with the results of the paired *t* tests, indicate that data obtained using the Web version of the HHHQ were not statistically different from that obtained using the paper and pencil version. The validity

Table 1. Pearson Correlations for 1998 Health Habits and History Questionnaire: Paper and Pencil versus Web Version (n = 29)

	Pearson Correlation Coefficient	P Value
Energy and Nutrients		
Energy, kcal	.79	.0001
Protein, g	.84	.0001
Carbohydrates, g	.81	.0001
Fat, g	.76	.0001
Saturated fat, g	.81	.0001
Calcium, mg	.84	.0001
Iron, mg*	.65	.0001
Vitamin A, IU*	.86	.0001
Thiamine, mg*	.75	.0001
Riboflavin, mg	.73	.0001
Niacin, mg*	.74	.0001
Vitamin C, mg	.54	.003
Food Group Servings		
Grains	.80	.0001
Fruits	.69	.0001
Vegetables*	.68	.0001
Meats*	.84	.0001
Dairy*	.84	.0001
Fat/sweets	.76	.0001

*Square root transformation was performed.

Table 2. Paired *t* Tests for Dietary Factors from Paper and Pencil and Web Versions of the 1998 Health Habits and History Questionnaire (*n* = 29)

	Paper and Pencil Mean \pm SD	Web Mean \pm SD	<i>t</i> *	Sig (2-Tailed)
Energy and Nutrients				
Energy, kcal	1572 \pm 635	1605 \pm 633	-0.440	0.66
Protein, g	62.6 \pm 25.7	63.8 \pm 25.5	-0.460	0.649
Carbohydrates, g	204.6 \pm 94.4	207.3 \pm 96.8	-0.249	0.805
Fat, g	59.2 \pm 28.7	61.5 \pm 25.0	-0.631	0.533
Saturated fat, g	16.9 \pm 8.6	17.8 \pm 8.0	-0.908	0.372
Calcium, mg	716 \pm 392	723 \pm 408	-0.153	0.880
Iron, mg†	14.5 \pm 8.3	14.8 \pm 8.9	-0.231	0.819
Vitamin A, IU†	14894 \pm 12450	13195 \pm 9669	1.073	0.292
Thiamin, mg†	1.3 \pm 0.6	1.4 \pm 0.7	-0.522	0.606
Riboflavin, mg	1.7 \pm 0.9	1.8 \pm 0.9	-0.588	0.561
Niacin, mg†	19.7 \pm 8.3	20.8 \pm 10.5	-0.656	0.517
Vitamin C, mg	108.2 \pm 58.9	106.4 \pm 52.8	0.181	0.857
Food Group Servings				
Grains	4.3 \pm 2.4	4.1 \pm 2.1	0.564	0.577
Fruits	1.6 \pm 0.9	1.8 \pm 1.1	-1.226	0.230
Vegetables†	3.7 \pm 2.4	3.4 \pm 1.7	0.872	0.391
Meats†	1.7 \pm 1.0	1.8 \pm 0.9	-1.148	0.261
Dairy†	1.3 \pm 1.1	1.2 \pm 1.1	0.014	0.989
Fat/sweets	2.3 \pm 1.5	2.4 \pm 1.4	-0.965	0.343

**t* statistic for paired differences between means (paper and pencil, Web).

†Square root transformation was performed.

and reliability of the paper and pencil HHHQ have been previously established, and the instrument is accepted and widely used for determining dietary intakes.^{26,34}

Nearly all of the women indicated that they had some experience using computers and/or the Internet. Most women indicated that they had a positive experience with completing the Web-based HHHQ and would consider doing a similar exercise in the future. These findings were similar to a study that showed that midlife to older rural women were able to use the Internet to complete a questionnaire.³⁵ Three participants, however, noted that they would prefer not to complete another food questionnaire using the computer, and two of those participants were the individuals who had to be dropped from the dietary analysis sample because they missed answering large numbers of questions on the Web questionnaire. Thus, there are older adults for whom the computer might not be a reasonable tool to use in home or health care settings for assessment purposes.

IMPLICATIONS FOR RESEARCH AND PRACTICE

The convenience sampling for this study may have resulted in a greater number of participants who were already interested in using computers. Random sampling of women in

this age category might yield women who are not as familiar with or able to use the computer easily. For future work in research or practice, orientation sessions should be extended to women who are not computer literate to bring them to a suitable comfort and skill level. The orientation should provide sample questions that allow the women to practice all of the skills needed to fill out the questionnaire before they are allowed to complete the full survey.

One of the key problems identified by women in this study was the use of the "mouse." Although none of the participants in this study had significant disabilities, such as debilitating arthritis of the hand, data input by touching the computer screen should be considered for a wider audience.

It might be useful for Web-based food frequency questionnaires such as the HHHQ to include some type of mechanism to ensure that all questions are completed. The Web version could prompt participants when specific questions need to be completed before any responses are accepted.

The Internet has become a part of the health care system. Today's health consumers, including older adults, are becoming more adept at searching the Internet for information. As more older rural women become familiar with and have access to the Internet, feedback from Internet dietary assessment tools such as the one used in this study could provide individualized dietary information.

REFERENCES

1. Kerschner H, Pegues JM. Productive aging: a quality of life agenda. *J Am Diet Assoc.* 1998;98:1445-1448.
2. Schweitzer S, Atchison K, Luggen J, Mayer-Oakes S, De-Jong F, Matthias R. Health promotion and disease prevention for older adults: opportunity for change or preaching to the converted. *Am J Prev Med.* 1994;10:223-229.
3. McGinnis J, Foege W. Actual causes of death in the United States. *JAMA.* 1993;270:2207-2212.
4. US Dept of Health and Human Services. Nutrition: Healthy People 2010 objectives. Available at: <http://web.health.gov/healthypeople/Document/tableofcontents.htm>. Accessed June 1, 2000.
5. Morris VM, Rorie JL. Nutritional concerns in women's primary care. *J Nurse Midwifery.* 1997;42:509-519.
6. Youngkin E, Davis M. *Women's Health: A Primary Care Clinical Guide.* 2nd ed. Stanford, Conn: Appleton & Lange; 1998.
7. Himes D, Rutrough T. Differences in the use of health services by metropolitan and nonmetropolitan elderly. *J Rural Health.* 1994;10:80-88.
8. Mainous A, Kohrs F. A comparison of health status between rural and urban adults. *J Community Health.* 1995;20:423-431.
9. Position of the American Dietetic Association and the Canadian Dietetic Association. Women's health and nutrition. *J Am Diet Assoc.* 1995;95:362-366.
10. Vastag B. Easing the elderly online in search of health information. *JAMA.* 2001;285:1563-1564.
11. US Department of Commerce. Falling through the net: toward digital inclusion. A report on Americans' access to technology tools. October 2000. Available at: <http://www.ntia.doc.gov/ntiahome/fttn00/Falling.htm>. Accessed April 9, 2001.
12. Buck NT. *Older Adult Learners and Their Acquisition of Basic Computer Skills and Internet Use* [dissertation]. Ames, Iowa: Iowa State University; 1999.
13. Czaja S, Sharit J. Age differences in attitudes toward computers. *J Gerontol B Psychol Sci Soc Sci.* 1998;53:329-340.
14. Bingham SA, Gill C, Welch A, et al. Comparison of dietary assessment methods in nutritional epidemiology: weighed records v. 24 h recalls, food-frequency questionnaires and estimated-diet records. *Br J Nutr.* 1994;72:619-643.
15. Block G, Thompson FE, Hartman AM, Larkin FA, Guire KE. Comparison of two dietary questionnaires validated against multiple dietary records collected during a 1-year period. *J Am Diet Assoc.* 1992;92:686-693.
16. Block G. Human dietary assessment: methods and issues. *Prev Med.* 1989;18:653-660.
17. Coates RJ, Eley JW, Block G, et al. An evaluation of a food frequency questionnaire for assessing dietary intake of specific carotenoids and vitamin E among low-income black women. *Am J Epidemiol.* 1991;134:658-671.
18. Feskanih D, Rimm EB, Giovannucci EL, et al. Reproducibility and validity of food intake measurements from a semiquantitative food frequency questionnaire. *J Am Diet Assoc.* 1993;93:790-796.
19. Mares-Perlman JA, Klein BE, Klein R, Ritter LL, Fisher MR, Freudenheim JL. A diet history questionnaire ranks nutrient intakes in middle-aged and older men and women similarly to multiple food records. *J Nutr.* 1993;123:489-501.
20. Munger RG, Folsom AR, Kushi LH, Kaye SA, Sellers TA. Dietary assessment of older Iowa women with a food frequency questionnaire: nutrient intake, reproducibility, and comparison with 24-hour dietary recall interviews. *Am J Epidemiol.* 1992;136:192-200.
21. Potosky AL, Block G, Hartman AM. The apparent validity of diet questionnaires is influenced by number of diet-record days used for comparison. *J Am Diet Assoc.* 1990;90:810-813.
22. Zulkifli S, Yu S. The food frequency method for dietary assessment. *J Am Diet Assoc.* 1992;92:681-685.
23. Block G, Hartman AM. Issues in reproducibility and validity of dietary studies. *Am J Clin Nutr.* 1989;50:1133-1138.
24. Block G, Hartman AM, Dresser CM, Carroll MD, Gannon J, Gardner L. A data-based approach to diet questionnaire design and testing. *Am J Epidemiol.* 1986;124:453-469.
25. Block G, Hartman AM, Naughton, D. A reduced dietary questionnaire: development and validation. *Epidemiology.* 1990;1:58-64.
26. Block G, Woods M, Potosky A, Clifford C. Validation of a self-administered diet history questionnaire using multiple diet records. *J Clin Epidemiol.* 1990;43:1327-1336.
27. Sobell J, Block G, Hoslowe P, Tobin J, Andres R. Validation of a retrospective questionnaire assessing diet 10-15 years ago. *Am J Epidemiol.* 1989;130:173-187.
28. National Center for Health Statistics. *Plan and Operation of the Third National Health and Nutrition Examination Survey, 1988-1994.* Washington, DC: US Government Printing Office; 1994. DHHS (PHS) publication 94-1308, Series 1, 32.
29. Vandenlangenberg GM, Mares-Perlman JA, Brady WE, et al. Incorporating fat-modified foods into a food frequency questionnaire improves classification of fat intake. *J Am Diet Assoc.* 1997;97:860-866.
30. *SPSS Base 9.0 User's Guide.* Chicago, Ill: SPSS Inc. Headquarters; 1999.
31. Tabachnick BG, Fidell LS. *Using Multivariate Statistics.* 3rd ed. New York, NY: Harper Collins College Publishers; 1996.
32. Nunnally JC. *Psychometric Theory.* 2nd ed. New York, NY: McGraw-Hill; 1978.
33. Hartman AM, Block G, Chan W, et al. Reproducibility of a self-administered diet history questionnaire administered three times over three different seasons. *Nutr Cancer.* 1996;25:305-315.
34. Block G, Subar AF. Estimates of nutrient intake from a food frequency questionnaire: the 1987 National Health Interview Survey. *J Am Diet Assoc.* 1992;92:969-977.
35. Ickler K. The feasibility of using the Internet for health assessment surveys by rural older women. Omaha, Neb: University of Nebraska Medical Center; 1998.