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Evaluating the feasibility of utilizing the Automated Self-administered 24-hour (ASA24) dietary recall in a sample of multiethnic older adults

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Abstract

The ASA24 is a web application which enables the collection of self-administered dietary recalls thus utilizing technology to overcome some of the limitations of traditional assessment methodologies. Older adults, particularly those from certain ethnic groups may have less access to and may be less receptive to technology. This research sought to determine the level of access to the internet as well as evaluate the feasibility of using a web-based alternative dietary data collection method in older, multiethnic adults. Participants completed three telephone administered diet recalls (n=347), and were asked to complete a one day recall via the ASA24. They were also asked to evaluate their experience with using the ASA24 system. Almost 60% of the participants reported no access to a computer or internet access, with African Americans and Latinos less likely than non-Hispanic Whites and Japanese-Americans to have access. Of those with access to the internet (n=100), 44% of the participants accessed the ASA24 system and 37% successfully launched the ASA24 program. However, most respondents preferred the traditional diet recall methodology over the ASA24. Further research is needed to investigate recruitment and use of electronic data collection methodologies in older adults.

Keywords

Multiethnic; ASA24; older adults; dietary intake; internet access

1. Introduction

The assessment of an individual's dietary intake is an important consideration in the field of nutritional epidemiology. Researchers in the field have developed and utilized many methods in the collection of food and beverage consumption data [1]. Dietary recalls, food frequency questionnaires (FFQs) and brief questionnaires have all been utilized to enable participants to recall foods consumed. As these tools all rely on self-report, it is important to design these methods to reduce the errors and burdens associated with self-report. The 24-hour dietary recall (24HDR) was designed to assess intake quantitatively [2,3] and may be

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more accurate than an assessment of remembered usual intake. However, this single day's intake is unlikely to describe an individual's usual diet. As such, researchers have concluded that more than one day of 24HDR may be needed to reliably measure intake and energy data [4,5].

The multiple-pass 24HDR technique is based on the premise that individuals will be better able to recall food eaten the previous day if provided with additional memory cues [6]. The current Automated Multiple Pass Method (AMPM) utilized by the United States Department of Agriculture (USDA) involves five steps: (1) the quick list which collects a list of foods consumed in the past 24 hours; (2) the forgotten food list which provides cues on nine categories of foods most often forgotten, including alcoholic and non-alcoholic beverages, breads and savory snacks; (3) time and occasion, provides the time and name of eating occasion; (4) detail and review; for detailed amounts, descriptions, as well as additions, and (5) the final pass or the final set of probes which provides another opportunity to recall foods [7]. This five-step multiple-pass method has been shown to increase the number of foods recalled [8], the average energy intake reported [7], as well as accurately estimate total energy intake when compared to a biomarker for energy [7,9].

An internet based automated self-administered 24-hour recall (ASA24) modeled after the AMPM, has since been developed [10]. The ASA24 is a free, web-based application which is envisioned to allow for the collection of dietary recalls from large samples of people, as well as the collection of data for multiple days. The tool utilizes an animated avatar and provides audio to guide respondents through the process of the 24HDR collection. Details of the automated system have been described elsewhere [10]. Utilizing this technology in large scale epidemiological research may ensure that dietary recall data are easier to collect, code and analyze. However there exists a paucity of research on the use of this internet based tool with certain subsets of the population, including elderly adults.

Computer and internet access are integral for an individual to utilize the ASA24 and the number of persons with access to the internet worldwide is increasing steadily. A PEW national survey estimated that 64% of adults ages 57–65 years owned a desktop computer; decreasing to 48% and 28% among counterparts ages 66–74 years and over 75 years, respectively [11]. Although a large percentage (79%) of American adults go online, these numbers decrease as the population ages. Results of another national survey reported that approximately 58% of adults between ages 65–73 years and 30% of adults 74 years and older go online. These age groups are also the least likely to have high speed internet access at home [12].

The study described here was conducted as an a priori add-on to the second calibration study of the FFQ used for the Multiethnic cohort (MEC). This sub study was undertaken to determine the extent of access to the internet by participants of the MEC and evaluate the feasibility and accuracy of using web-based alternative dietary data collection methods in the future. Access to the internet was defined as a positive response to the question, "Do you have access to a computer connected to the internet?" Feasibility included agreeing to complete the ASA24, acceptability of the online data collection methodology and

successfully accessing the ASA24. Accuracy was assessed by comparing dietary intake data from the ASA24 to a traditional 24HDR collected using the five-step multiple-pass method.

2. Methods

2.1. Study Design and Participants

The MEC Study of Hawaii and Los Angeles was established to examine lifestyle exposures, mainly diet, and its relation with cancer and other disease outcomes. The design of the prospective study has been detailed elsewhere [13]. Briefly, the cohort consists of over 215,000 men and women who were aged 45–75 years at the cohort's creation between 1993–1996. The cohort targeted five racial and ethnic groups: African Americans, Japanese Americans, Latinos, Native Hawaiians and Whites. Participants for this study were a subset of the second calibration study conducted in the MEC. Details of the first calibration study have been described previously [14]. For the second calibration study, the intent was to recruit 300 participants; 30 representing each sex-ethnic category from the MEC. Recruitment began among those persons who had participated in the first calibration study, with additional cohort members randomly selected to make up the desired sample. These individuals were mailed a letter of invitation, and then contacted by telephone to inquire about their interest. Those who indicated interest in participation were mailed a quantitative FFQ (QFFQ) with a consent form. The participants who returned the QFFQ and consent form completed three unannounced telephone-administered 24HDRs (TA-24HDR) after returning the QFFQ. Two weeks after completing the recalls, participants were mailed a second QFFQ.

During the initial recruitment call, participants, ages 56–80 years, were also asked their willingness to complete a dietary recall via the internet, i.e., the ASA24. Upon the return of the second QFFQ, participants who reported access to the internet and were willing to complete the online recall were mailed: (1) instructions detailing how to access the ASA24, (2) usernames and passcodes to access the system, and (3) an evaluation designed to assess their experiences with this new system. They were given two weeks to complete their one day diet recall. During those two weeks, staff provided no further reminders to complete the recall, complete the evaluation, or return the completed evaluation via mail. The study protocol was approved by the institutional review boards of the University of Hawaii and the University of Southern California.

2.2. Dietary Assessment Methods

The three TA-24HDRs were completed on randomly selected days of the week (2 weekdays and 1 weekend day) and spaced at least a week apart. As previously described [15], the recalls were collected by Registered Dietitians specifically trained in the USDA five-step multiple-pass method [16]. Recalls were conducted in English as well as Spanish, as this was the language preferred by some of the Latino participants. Recall data were entered using the specially designed program RapidCalc [15]. The food composition database associated with RapidCalc represents an extensive list of local foods consumed by the various ethnic populations of Hawaii, California, and the Pacific Region [17]. The list includes 1,530 single-item foods, as well as 1,113 recipes for commonly consumed

mixtures. The foundation of this database is the USDA Standard Reference [18] and staff from the University of Hawaii Cancer Center, Nutrition Support Shared Resources continually updates the database to reflect new foods and products as they are reported by study participants [17].

Participants were asked to complete a one day recall using the ASA24. At the time this research was conducted, participants had access to the beta version of the ASA24. The ASA24 uses the food codes, portion sizes and other such information from the USDA Food and Nutrient Database for Dietary Studies (FNDDS) [19]. The development, design and presentation of this online system has been outlined and described in full detail elsewhere [10,20,21,22]. The results of the QFFQ were not used as part of this analysis.

2.3. Evaluation

Participants were mailed a 6-item evaluation which provided them the opportunity to assess their experiences accessing and using the ASA24. Two statements allowed multiple responses. The first statement related to computer access, i.e., “I was unable to complete the ASA24 online system because…” (a) I do not own a computer; (b) I do not have internet access; (c) My computer does not have a high speed internet connection, such as cable or DSL; (d) My computer does not have the ability to play and hear audio through speakers or headphones; or (f) I was unable to find the website. The second statement related to usability of the ASA24, i.e., “I did part of the ASA24 online system, but did not finish because…” (a) It took longer than expected, (b) I found it difficult to use, or (c) Other (open ended response). An open-ended question asked “Did someone help you to complete the ASA24? If yes, please tell us who helped you” Two additional statements were accompanied with a five category ordinal response scale, i.e., ‘strongly agree’, ‘agree’, ‘no opinion’, ‘disagree’, and ‘strongly disagree.’ One statement related to perception about the ASA24, i.e., “I thought the ASA24 website was easy to understand.” The second statement related to preference about the ASA24, i.e., “I preferred using the ASA24 compared to completing a dietary recall over the phone.” The final open-ended question was “What, if anything, could have been different to make the recall easier to complete?” Returning the evaluation was considered an indicator of willingness to attempt to access the ASA24.

2.4. Statistical analysis

Statistical analyses were performed using IBM SPSS Statistics (version 20). Normal probability plots were used to ascertain adherence to a normal distribution and no variable needed transformation. Descriptive analysis included means, frequencies, and percents. Differences in age, ethnicity, body mass index (BMI), education and sex by completion status of the ASA24 were compared using chi-square analyses. For comparing the results of the two methods, energy (kcal), protein (g), total fat (g), cholesterol (mg), carbohydrate (g), total dietary fiber (g), calcium (mg), and sodium (mg) were used as whole values and energy adjusted. The common practice of using the naïve mean for energy and nutrient values of the three TA-24HDRs was determined as satisfactory for this analysis. The energy and nutrient intakes from the ASA24 and the mean of the TA-24HDRs were compared using two-tailed paired t-test, percent differences and a Bland Altman plot [23]. The 95% confidence intervals (CI) from the TA-24HDRs for energy and nutrients were also calculated. Ranking

similarities were examined using Pearson correlation coefficients. Differences with a P value <0.05 were considered statistically significant.

3. Results and Discussion

Factors of Participation and Completion

A total of 347 participants completed three TA-24HDR. The majority of the participants (60%, 208 out of 347) indicated that they had no access to the internet, while 11% (39 out of 347) either refused to answer the question or the response was not recorded by the interviewer (Table 1). In general, a greater proportion of African American and Latino participants reported no internet or computer access (P< .001). Older participants, aged 72–80 years (P=.001), as well as participants with an educational level at or below high school (P=.001) were also less likely to have internet or computer access. Approximately 29% of participants (100 out of 347) reported access to a computer connected to the internet and agreed to complete the ASA24. The characteristics of these individuals are in Table 1; the majority of whom were women, younger (ages 56–65 years), college educated, and mostly White or Japanese.

A total of 78 participants (78%) returned the evaluation and the characteristics of these participants did not differ significantly from the original group agreeing to complete the ASA24 (Table 1). Among the participants who returned the evaluation, 56% (44 out of 78) were able to successfully access the ASA24 system as evidenced by an identification number generated by the ASA24 system. However, as shown in Table 1, the younger age group was significantly more likely than the older age group to successfully gain access (P=.027). A successful launch of the ASA24 system was defined as entering enough dietary information to yield energy and nutrient values. Among those who accessed the ASA24 system, the majority (84% or 37 out of 44) were able to successfully launch the ASA24 program. The progression from completing the TA-24HDR to the final step of launching the ASA24 program can be found in Figure 1.

Age, education, and ethnicity were associated with having access to a computer and/or the internet (Table 1). Participants claiming access to a computer with internet and the participants demonstrating continued cooperation through returning the evaluation were similar with regards to their sex, age, ethnic group, BMI, or education as shown in Table 1. When comparing participants who returned the evaluation with those who successfully accessed the ASA24 system, there was a statistically significant difference by age group with the older participants less likely to successfully access the system. Thus, based on this sample, once access to the computer or internet was established, the reduction in participation was primarily associated with age.

User Experience of ASA24

Participants who returned the evaluation, but were unable to access the system cited reasons related to the usability of the system and problems logging into the ASA24 system. Twenty eight participants provided reasons for not completing the ASA24; 5 of these participants indicated that the system was difficult to use, 2 noted that it took longer than expected, and 7

indicated that the system was difficult to use and that it took longer than expected. One participant stated “Too time consuming for first time users. At times, my selected food did not transfer to the meal list when I double clicked or dragged. Other than these two problems it wasn’t too bad. It took me at least 45 minutes including tutorial” *Japanese American woman, age group 56–65*).

Although the majority of the participants (51%; 30 out of 59) agreed that they found the website easy to understand, almost one-half (48%; 29 out of 60) disagreed with a preference for using the ASA24 compared to a telephone administered diet recall (See Table 2). One participant indicated “I found it much more time consuming than a telephone interview because of all the searching for the appropriate food. And then the dilemma of how to report a food when you don’t find the exact match in the browse list. I got timed out once when I was actively using the system. Maybe I paused too long to think of the correct response… It was an interesting experience, but I would not want to do it many times. Talking to someone, even though often a pain to schedule, is just so much better for efficiently responding and being able to clarify any issues with how foods should be categorized and reported.” *White man, age group 66–71*) For the participants who received help to complete the online recall, a spouse was frequently cited as the person rendering assistance. “My wife did this for me. I am not that proficient on a computer. She is. She stated that she felt it would be hard for me.” *African American man, age group 66–71*).

Comparison of Results between TA-24HDR and ASA24

Comparing the energy derived from the ASA24 with the energy derived from the RapidCalc report yielded a statistically significant difference ($p<.01$) between the two methods (See Table 3). Results of the comparisons for selected nutrients are displayed in Table 3. Significant differences between the methods were also found for carbohydrate ($p<.01$) and total dietary fiber ($p<.05$). The differences in nutrient intakes between the two methods ranged from ±1% to ± 22%. Pearson correlation coefficients also yielded significance for all the nutrients (Table 3) as well as energy; however none of the correlations were high. Further analyses with a Bland Altman plot of these energy values revealed that there was no consistent bias of the ASA24 over the traditional method (RapidCalc) and vice versa (Figure 2). Despite the observed lack of bias, the limits of agreement were quite wide.

After adjusting for energy intake, a statistically significant difference was only observed for sodium, with higher sodium values for ASA24 than RapidCalc. The significant difference in sodium was unexpected since the database associated with the TA-24HDR has sodium content for foods not available in FNDDS. Nonetheless, the overall values between the TA-24HDR and the ASA24 were near unity after accounting for energy. The correlations for the majority of nutrients were reduced substantially and only carbohydrate and calcium remained statistically significant albeit modest in size. From the three days of TA-24HDR, the unadjusted carbohydrate and total dietary fiber values had a large variance which was less after accounting for energy which may explain the resulting unity with the ASA24 results for these two nutrients.

Six of the ASA24 reports had implausible energy intake values (17–534 kcal), whereas none of the days of the TA-24HDR results had an energy value in these ranges. This would

suggest that the presence of an interviewer may moderate the learning curve of a 24-hour dietary recall. The higher proportion of likely implausible intakes for energy from the one day of the ASA24 may imply that some type of online practice recall for day one would be useful.

Ideally, when comparing two dietary assessment methods, the two methods should have the same food composition database. In this instance, the databases used for the TA-24HDR and the ASA24 were different, with the RapicCalc utilizing the specially maintained database that incorporated ethnic foods [18] and the ASA24 utilizing the FNDDS [22]. Although both databases have the same origin of the USDA standard reference, some of the observed differences between the results from the two methods could be a result of the food composition tables. Several of the respondents noted on their evaluation of the ASA24, that “foods typically consumed in Hawaii” or “local foods” were not available for choices. Thus, the higher values for energy and nutrients (except cholesterol and sodium) from the TA-24HDR could also be a result of the availability of foods the respondents would be more likely to consume; diverse, ethnic foods which are less available in the FNDDS. This could be relevant to the likelihood of completion but would not affect computer and internet access which proved a barrier for the majority of the sample.

Another web-based dietary recall system has been tested previously by Arab and colleagues [24], where participants ranged in ages from 21 to 69 years and study completion rates were high (>90%). However, participants were recruited through a web site (Craigslist). This novel method of recruitment would be more likely to include persons with access to and familiarity with the internet. Thus, the ability to recruit a random population-based representative sample and obtain full cooperation with internet dietary data collection methods remains an open question.

This study is not without limitations. These participants were part of a larger study with additional demands which they fulfilled. As such, other than reporting no access to a computer or to the internet, we are unable to verify whether their refusal or claims of lack of access were exaggerated and should be considered a polite refusal for volunteering for additional tasks. A participant’s level of computer literacy was not determined prior to ascertaining their consent to complete the ASA24. Furthermore, participants were provided no telephone reminders to complete the one day ASA24 recall. Reminders may have aided in motivating further involvement, as prior research [24] has shown that such reminders not only enhanced participation, but also improved the involvement of the men in the study. The participants were also able to choose which day they completed the online recall, as such there may be the phenomenon of reactivity as well as possible introduction of a social desirability bias, with the *day* the participant eventually chose to share. Participants in this sample had access to the beta version of the web application. As such, we are unable to address whether use of the new (updated) ASA24 would have generated different results.

4. Conclusions

The ASA24 may provide researchers with an inexpensive, practical tool to enable the collection of large scale epidemiological data. However, for the older adults or in the case of

our sample those persons over 72 years of age, and minority populations including African Americans and Latinos, access remains a barrier to certain facets of technology. These findings reinforce prior research indicating adults under 65 years of age and White Americans were more likely to be internet users than their older or Hispanic and African American counterparts [25]. Current research also suggests that age (being 65 or older) along with other socio-demographic factors (education and income) are the "strongest negative predictors for internet use" [26], which is consistent with the findings of this study. To overcome these barriers, researchers may benefit from combining interview assisted methods with online data collection methods for reaching these disparate populations.

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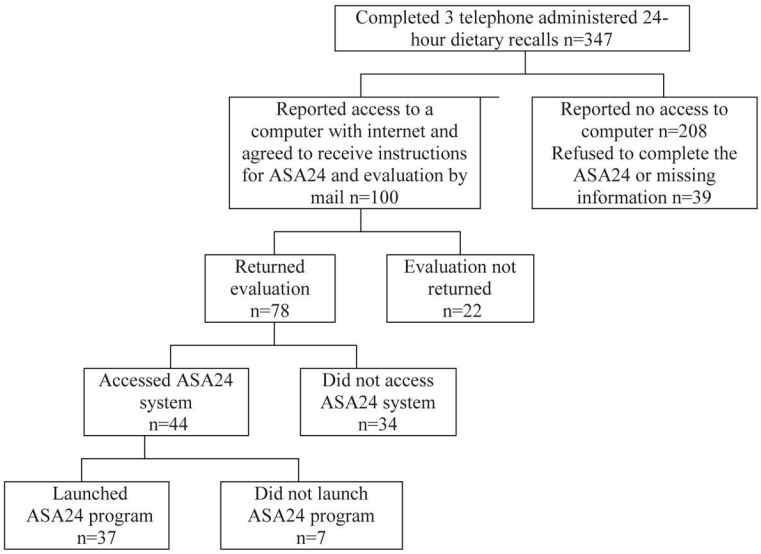

Fig. 1.

Progression from completing telephone administered 24-hour dietary recalls to launching the Automated Self-administered 24-hour dietary recall (ASA24) among the Multiethnic cohort calibration study participants.

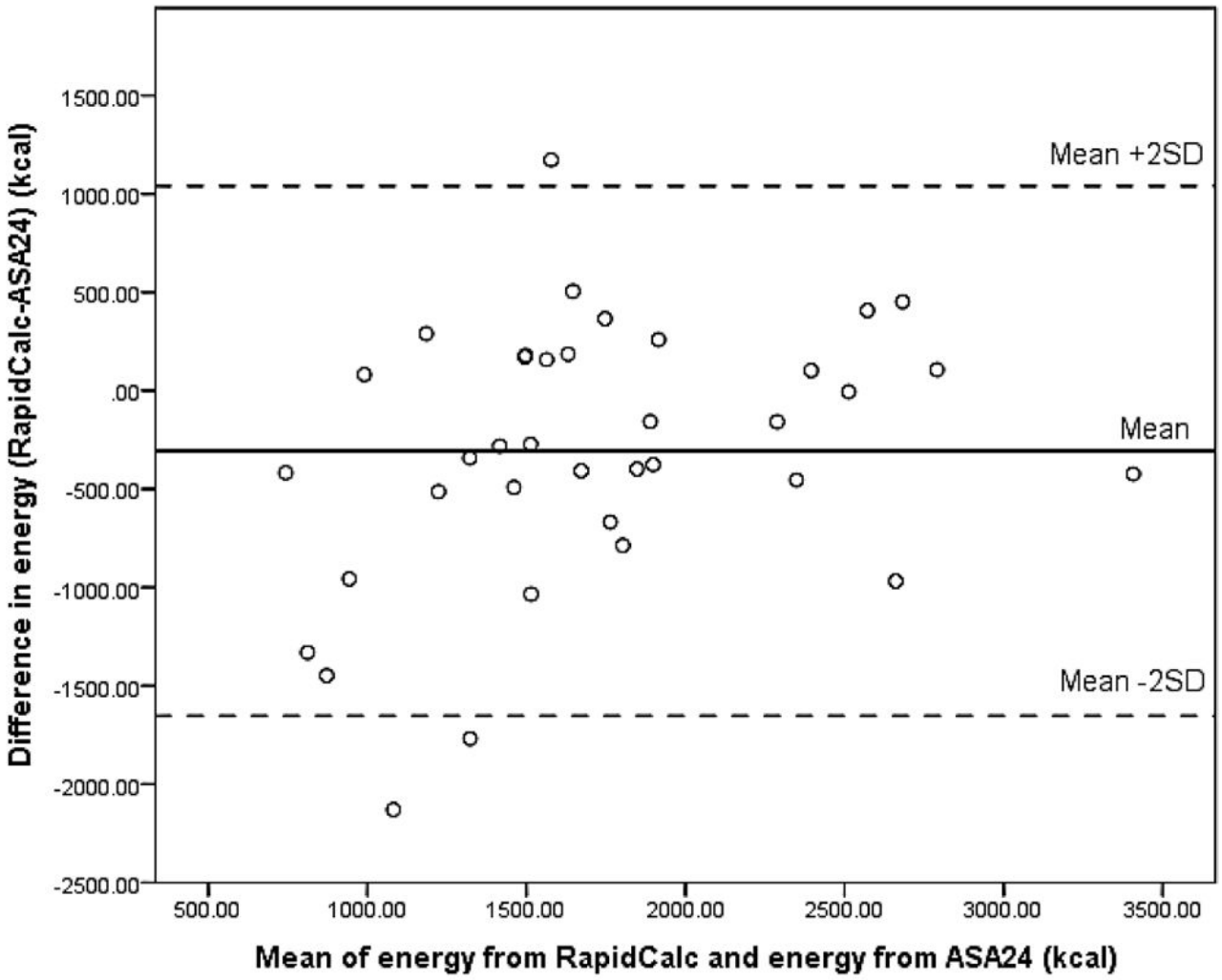

Fig. 2.

Bland Altman plot of differences against means of the telephone administered 24-hour dietary recalls (RapidCalc) and the Automated Self-administered 24-hour diet recall (ASA24)

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Table 1

Characteristics of study participants by those completing the TA-24HDR, reporting access to a computer with internet access, returning the evaluation, successfully accessing the ASA24 and generating energy values in ASA24

Characteristics	Completed three TA-24HDR n=347	Had access to a computer with internet n=100	Returned evaluation n=78	Accessed ASA24 successfully n=44	Generated energy values in ASA24 n=37
Sex	←		n (%)[a]	→	
Men	172 (50)	44 (44)	35 (45)	19 (43)	16 (43)
Women	175 (50)	56 (56)	43 (55)	25 (57)	21 (57)
Age group (years)		[b]		[c]	
56–65	114 (33)	45 (45)	37 (47)	26 (59)	24 (65)
66–71	120 (35)	36 (36)	30 (38)	15 (34)	11 (30)
72–80	113 (33)	19 (19)	11 (14)	3 (7)	2 (5)
Ethnic group		[d]			
White	72 (21)	33 (33)	25 (32)	15 (34)	11 (30)
Japanese American	62 (18)	25 (25)	22 (28)	13 (30)	12 (32)
Native Hawaiian	67 (19)	21 (21)	15 (19)	9 (21)	7 (19)
African American	76 (22)	12 (12)	11 (14)	5 (11)	5 (14)
Latino	70 (20)	9 (9)	5 (6)	2 (5)	2 (5)
Body mass index (kg/m^2)					
Normal/underweight (<25)	120 (35)	42 (42)	33 (42)	18 (41)	16 (43)
Overweight (25–30)	152 (44)	39 (39)	31 (40)	18 (41)	13 (35)
Obese(≥30)	75 (22)	19 (19)	14 (18)	8 (18)	8 (22)
Education		[b]			
High school or less	85 (25)	12 (12)	9 (12)	4 (9)	4 (11)
Vocational or some college	116 (34)	34 (34)	23 (30)	12 (27)	10 (27)

Characteristics	Completed three TA-24HDR n=347	Had access to a computer with internet n=100	Returned evaluation n=78	Accessed ASA24 successfully n=44	Generated energy values in ASA24 n=37
College graduate or more	144 (42)	54 (54)	46 (59)	28 (64)	23 (62)

TA-24HDR: Telephone administered 24-hour dietary recall, ASA24: The Automated Self-administered 24-hour dietary recall

[a] Percentages do not add up to 100 due to rounding.

[b] P=0.001 using Chi-square to compare participants completing 3 TA-24HDR to those reporting access to a computer with internet access.

[c] P=0.27 using Chi-square to compare participants who returned the evaluation with participants who successfully accessed the ASA24.

[d] P<0.0001 using Chi-square to compare participants completing 3TA-24HDR to those reporting access to a computer with internet access.

Table 2

Perceptions and preferences of those using the ASA24 system among the participants who returned the evaluation (n=78).

Statements[a]	Strongly agree or agree	No opinion	Disagree or strongly disagree
	← n (%)[b] →		
I thought the ASA24 website was easy to understand.			
All participants that responded (n=59)	30 (51)	8 (14)	21 (36)
Participants successfully accessing the ASA24 (n=36)	25 (69)	1 (3)	10 (28)
I preferred using the ASA24 compared to completing a dietary recall over the phone.			
All participants that responded (n=60)	19 (32)	12 (20)	29 (48)
Participants successfully accessing the ASA24 (n=36)	17 (47)	3 (8)	16 (45)

[a] Responses do not add up to 78 due to intentional skip patterns and missing responses

[b] Percentages do not add up to 100 due to rounding.

Table 3

Comparison of energy, selected nutrients, and energy adjusted nutrients between three telephone-administered 24-hour dietary recalls (RapidCalc) and one Automated Self-Administered 24-hour diet recall (ASA24) among participants generating nutrient values in the ASA24; n=37

Energy or nutrients	RapidCalc	ASA24	% Difference	Pearson correlation coefficient	95% confidence interval from RapidCalc
	mean±standard deviation[a]				
Total energy (kcal)	1883±599 **	1576±795	16	0.56 ***	[1683, 2083]
Protein (g)	79±24	71±44	10	0.57 ***	[71, 87]
Total fat (g)	75±29	67±41	11	0.45 **	[65, 85]
Cholesterol (mg)	255±133	258±213	−1	0.38 *	[211, 299]
Carbohydrate (g)	218±82 **	171±97	22	0.54 **	[190, 245]
Dietary fiber[b] (g)	18.1±8.7 *	14.6±8.7	19	0.47 **	[15.2, 21.0]
Calcium (mg)	645±313	547±318	15	0.38 *	[540, 749]
Sodium (mg)	2670±1156	2777±1590	−4	0.37 *	[2284, 3055]
Energy adjusted (nutrient/100 kcal):					
Protein (g)	4.4±1.1	4.3±2.0	2.2	0.22	[4.0, 4.7]
Total fat (g)	4.0±0.77	4.2±2.0	−5	0.21	[3.7, 4.2]
Cholesterol (mg)	13.7±5.8	15.2±12.7	−10.9	0.19	[11.6, 15.2]
Carbohydrate (g)	11.5±2.1	11.1±4.2	3.5	0.41 *	[10.8, 12.3]
Dietary fiber[b] (g)	0.96±0.34	0.95±.62	1.0	0.26	[0.86, 1.10]
Calcium (mg)	35±15	37±19	−6	0.35 *	[30, 40]
Sodium (mg)	142±39 *	173±61	−22	0.12	[129, 155]

[a] Difference by paired *t*-test

[b] Total dietary fiber

* $p<.05$,

** $p<.01$,

*** $p<.001$