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INTRODUCTION

Access to the Internet has flourished in the United States over the past 2 decades with Internet usage increasing to 86% of adults in 2013.¹ Recent trends indicate significant differences in adult Internet use, with whites (87%), younger age (98%), higher educated (97%), and higher income (97%) populations significantly more likely to use the Internet than their counterpart population groups.¹ However, even populations reporting only a high school education (78%) or earning less than $30,000 per year (75%) report high Internet use.¹

The federally subsidized Special Supplemental Nutrition Program for Women, Infants and Children (WIC) includes a nutrition education component, most often implemented in-person at WIC agencies. Since 1998, states have been offering online nutrition education options for low-risk clients. As Internet-based nutrition education becomes more common, it is increasingly important to understand the technologies most often used by WIC clients, and how they are used, in order to create nutrition education programs that capitalize on the use of these technologies in the most beneficial way.

Studies have shown WIC and other similar populations have access to the Internet and experience success with online nutrition education. A study in Indiana found 50% of adults on a supplemental nutrition program had a computer in their homes and 68% had a cell phone. The study also found within this population it was most common for younger (age 18 to 30), White, and higher educated adults to have better access to computers in their homes.² Online nutrition education programs for WIC clients have been found to be an effective way for promoting behavior change, with well over half of all users accessing the Internet from either home or work.³⁻⁴ Other studies have highlighted the effectiveness of Internet-based education strategies for reaching other underserved communities, including rural communities, pregnant women
enrolled in midwife programs, underserved pregnant women, and families with young children.\textsuperscript{5}

Even older adults, who in the past have been the age group least comfortable with Internet use,\textsuperscript{8} have found Internet-based health behavior programs to be effective.\textsuperscript{9}

Internet-based programs are an effective way to reach geographically diverse low-income populations with similar needs or barriers to behavior change. These programs can be as effective as in-person nutrition education to improve nutrition-related behaviors\textsuperscript{10}, and have been found to be effective at changing both nutrition and physical activity beliefs and behaviors.\textsuperscript{11-12}

Videos, communication via electronic media, and combinations of Internet programs with in-person meetings have also been used as elements to enhance behavior change programs for low income and minority parents.\textsuperscript{13-15} However, the variety of elements that make up Internet behavior change programs vary widely and research about the effectiveness of different combinations of elements is currently lacking.\textsuperscript{16}

The current study addresses the need for better understanding WIC client use of technology, technologies clients prefer, and how technology preferences change across WIC populations in the western region states. Principles from the diffusion of innovation theory, shown to be an effective predictor of Internet-related health behavior,\textsuperscript{17} can show how these trends may be indicators of broader WIC client technology use. Current use of technologies by innovative WIC clients can serve as the basis for eventual diffusion among the rest of the WIC population. Technology use examined included both hardware (computer and cell phone use) and software (applications and social media sites, such as email, text messaging, instant messaging, and Facebook). In addition, preferences of WIC clients for interacting with WIC nutrition education were identified.

\textbf{METHODS}
An online survey, comprised of 43 items pertaining to technology use and created with input from western region state WIC staff serving on a WIC electronic technologies steering committee, was implemented in all 14 western region WIC states, commonwealths, and territories (AK, AS, AZ, CA, GU, HA, ID, ITCA, ITCN, MP, NV, OR, WA, Navaho Nation) in November and December, 2011. Survey items consisted of Likert, select-all-that-apply, and yes-no type questions measuring demographics (15), cell phone use (6), Internet use (5), Facebook use (3), current WIC services (4), and future WIC services (10). Numerical values were assigned to items with Likert scaled response options (1=not useful, 2=somewhat useful, 3=very useful). All items were tested for comprehension using cognitive interception interviews with 19 WIC participants at 1 WIC clinic site. Following the comprehension testing, a usability test was conducted with 11 WIC participants from volunteer agencies in 2 western region clinics. Eight survey items were modified based on the test phase.

The survey was translated into Spanish and reviewed by California WIC staff prior to being implemented online in both Spanish and English. It was linked from several sources, including www.wichealth.org, an online nutrition education program currently being used in 25 WIC states across the U.S. (including 5 of the western region states), an Internet-based nutrition education system used in Oregon, and via direct connection by means of a web address advertised in local WIC agencies. Various methods were used by WIC agencies to advertise the study, including providing clients with access to a computer in the clinic, direct email and texts, and a web banner on the participating clinics’ websites. Participants who completed the survey were entered into a drawing for a $100 gift card for each of the western region states and territories.
All western region WIC clients with access to the Internet were targeted in this study. A cross-sectional convenience sample was derived by participants who voluntarily self-administered the online survey. Results were weighted to the expected sample size based on the percentage of WIC clients in each of the western region states. Data were weighted by using an expected sample size derived from statistical power calculations to estimate a population proportion, divided by the actual survey response sample. The resultant variable was an added variable for each individual respondent.

Participants were either WIC clients themselves or caregivers who received nutrition education on behalf of children enrolled in the WIC program. Chi square statistical analysis was performed using relative frequency of self-reported quantitative data. Frequencies and percentages were calculated for categorical variables and means and standard deviations for continuous variables. Age was divided into 3 groups: younger (15-19), millennial (20-31), and older (32+) with specific focus on the millennial group as this age group comprises the majority of WIC clients and has been subjected to previous technology use studies. The Western Michigan University Human Subjects Institutional Review Board determined human subjects approval was not required for this study.

RESULTS

Most of the 8,144 survey respondents in this study were from the millennial generation (62%), and the mean age was 29 years old, with a standard deviation of 6.9 years and a range of 17 to 73 years old. Nearly half (47%) of the respondents indicated their ethnicity as Hispanic. In contrast to federal definitions of ethnicity and race, most of these respondents did not report their race but rather assumed Hispanic applied to both ethnicity and race. Of the remaining, over half
57% of respondents were White, 7% African American, 7% American Indian/Alaskan native, 6% Asian, 3% Native Hawaiian/Pacific Islander, and 20% either other or missing.

Half (51%) of the survey respondents indicated they accessed the Internet on a computer device (desktop, laptop, or tablet), 23% accessed via cell phone, and 25% used computerized devices and cell phones equally, with 1% of the data missing. The majority (92%) of survey respondents indicated they owned a cell phone, with 95% of respondents in the millennial group reported owning a cell phone. Over half (58%) of all cell phones owned were smart phones. However, only 31% of respondents with smart phones reported using their smart phone apps for parent and health-related information. Age was associated with the way in which respondents reported accessing the Internet, with younger respondents more likely to use a cell phone than a desktop computer, laptop, or tablet to connect to the Internet. The change in device used to access the Internet occurred around age 25 and older. As age increased, the use of a computerized device to access the Internet increased while at the same time the use of cell phone for Internet access decreased. Respondents in the millennial group used their cell phones for a variety of tasks, shown in Table 1.

The top 3 communication technologies reported to be used were email (92%), text messaging (86%), and Facebook (80%). The reported lesser used applications were instant messaging (57%) and Twitter (17%). However, there were differences in the ways technology was used among demographic groups. As expected, a significant difference (p>0.05) with regard to Facebook use occurred between age groups, with the millennial (83%) and younger (82%) groups more likely than older (77%) respondents to report use. Those identifying themselves as American Indian/Alaskan Natives with a less than high school education or living in Indian
Tribal Organizations used Facebook the least (73%), as compared to the rest of the sample (80-84%), with a significant (p<0.05) difference reported among groups.

There was an interest among respondents to increase the ways other technologies could be used to support nutrition education and breastfeeding support. With regard to nutrition education, 60% of respondents reported both text messaging ($M=2.42; SD=0.76$) and email ($M=2.51; SD=0.67$) would be very useful ways for receiving this type of education. Cell phone users with unlimited text messaging capability and unlimited data plans were significantly (p<0.05) more likely than other cell users to report it would be very useful to receive nutrition education via text messaging and email. Currently, only 21% of respondents reported accessing WIC related nutrition education on the Internet, while 75% of the respondents reported receiving nutrition education via 1-on-1 direct contact with WIC staff, even though an online education web link was a primary recruitment avenue for the project. However, 59% were interested in receiving WIC related nutrition education via the Internet in the future.

Respondents were interested in expanding the ways in which they can receive nutrition education, as 87% thought nutrition education via email would be very useful or somewhat useful and 82% thought nutrition education via text message would be very useful or somewhat useful, while only 25% thought nutrition education via Twitter ($M=1.39; SD=0.71$) would be very useful or somewhat useful. In addition, there was an increased interest in receiving future education using the Internet (21% current use, 59% interest in future use) and decreased interest in 1-on-1 education via a nutritionist or WIC staff (75% current use, 59% interest in future use). Respondents with the lowest levels of education (1st-6th and 7th-9th grade) reported significantly (p<0.05) higher preference (53% and 38%, respectively) than other education levels for group
education classes. As the education level of respondents increased, a significant (p<0.05)
increase in the percentage who indicated they would prefer Internet classes was observed.

Most respondents thought it would be useful or somewhat useful to be able to use video
chat to interact with nutritionists (76%; M=2.20, SD=0.79), breastfeeding educators (59%;
M=1.94, SD=0.85), or other WIC staff (72%; M=2.13, SD=0.79), with higher education groups
significantly (p<0.05) more likely to desire this option. In particular, 33% of pregnant women
and breastfeeding mothers were especially interested in video chatting with a breastfeeding
educator. As expected, these were both significantly (p<0.05) higher than those of women who
were neither pregnant (15%) nor breastfeeding (13%).

With regard to social support, 25% of respondents had joined an Internet group for
parents or moms, and 57% indicated they would join an online or virtual WIC group. Many were
interested in groups that were not created only for the developmental age of their own children,
but were interested in groups around other developmental ages (see Table 2). For example,
pregnant respondents were most interested in joining groups about pregnancy, breastfeeding, and
newborns, while respondents with an infant less than 12 months old were most interested in
joining groups about infants, parenting, and toddlers. Respondents with a toddler older than 12
months were also most interested in joining groups about toddlers and parenting, as well as
healthy eating, exercise and preschoolers. Respondents also reported interest in discussion
forums either on a site for WIC moms (46%) or a Facebook group (38%). In contrast, 32%
reported they were not interested in either form of online support and 1% would prefer using
another social media site.

Respondents were interested in a number of services that could be provided via various
technologies, including appointment scheduling and reminders, a smart phone authorized food
UPC scanning app, online recipes and cooking demos, and online authorized store locator (see Table 3). Many respondents reported receiving appointment reminders by phone (67%). In contrast, only 1% of respondents reported using the Internet to schedule WIC appointments, even though 70% of respondents reported using the Internet to schedule other (non-WIC) appointments. Nearly 2 out of 3 respondents indicated it would be “very useful” to schedule WIC appointments online, making the Internet a useful way for clients to schedule appointments. Almost all (95%; $M=2.80$, $SD=0.47$) respondents indicated checking electronic benefits transfer (EBT) values online would be somewhat or very useful for them. Using technology to check EBT card balance was identified as the WIC service perceived as being the most useful to respondents (see Table 3).

**DISCUSSION**

The reported use of technology by participants in this study was similar to other reported trends about differences in technology use by age, race, geographic location, and education level, with the strongest predictors of Internet use being age, education level, and household income. However, this study shows that even among low-income WIC recipients, Internet and other technology application use is high and varied in its implementation. This is supported by another study that found Facebook was an appropriate way to recruit low-income women for online nutrition education. Barriers can vary between ethnic groups, however. This is apparent in reaching Latina WIC recipients. Due to the barriers many Latino WIC recipients face, just having bilingual material is not enough to encourage use of Internet programming. Issues around culture, access to the Internet, and computer literacy are also important considerations.

Cell phone ownership was higher among the WIC participants than in a similar study among adult participants in the U.S. Department of Agriculture’s Supplemental Nutrition
Assistance Education Program and with other recently reported cell phone trend data.\textsuperscript{2,21} This may be a reflection of the age difference between the populations, or because the western region WIC survey was implemented online, thus participants may have been more familiar with technology use in general. As such, the technology use of this sample may be higher than the rest of the WIC population.

There was an interest among participants to interact with WIC using the Internet, especially in ways to find support from WIC staff and other moms, and through innovative ways to receive nutrition education. This is similar to other studies, where pregnant women used the Internet for health information and support during their pregnancy, reporting increased confidence and positive health behaviors related to physical activity.\textsuperscript{22} Many participants were interested in video chat options with various WIC staff based on their child’s developmental stage. For example, breastfeeding and pregnant women were interested in chatting with breastfeeding educators, while participants with older children were interested in chatting with other WIC staff. In addition, participants interested in online support group options had different opinions about joining topical interest groups based on their child’s age. This demonstrates the need to tailor available services to the needs of the client. One avenue that might be an appropriate option for engaging WIC clients in online support groups is Facebook, due to the reported high utilization of this social media site. The high interest in online support groups among respondents, coupled with the high use of social media platforms (e.g., Facebook) that can be delivered to these groups provides opportunities for expanding breastfeeding and nutrition education and support. This is supported by previous findings that demonstrated peer support, counselor support, and phone/email support increase the exposure of online behavior change programs.\textsuperscript{23}
Even though some WIC agencies are already providing some technology applications for WIC services (e.g., online nutrition education, text messaging appointment reminders), participants in this study confirmed the need to continue and expand on these services. Participants were interested in changing the ways they make appointments with WIC clinics and being able to use technology to improve their utilization of services, such as checking EBT balances online. They were interested in making appointments using text messaging or the Internet, and were interested in receiving nutrition education through an online site, text messaging, or emails. Because many WIC clients use smart phones, mobile applications allowing them to better utilize their WIC benefits (e.g., being able to access WIC shopping guides or check if foods are WIC eligible) would likely be a beneficial service. However, not all areas served by WIC have the same level of access to the Internet, thus online approaches should be adopted with consideration of the local needs of clients and staff.

There are 3 likely limitations to this study. Participants completed the online survey on a computer, and as such, may have been more inclined to use technology or may use technology different than other WIC clients. However, this limitation was anticipated, as the population under study was considered to be comprised primarily of innovators. In addition, data were collected from a 2011 survey. It is likely that increased Internet and cell phone use has occurred since data collection, resulting in a possible underestimation of current WIC client technology use. Finally, although a weighted sample was used, not all states within the western region were equally represented, limiting the ability to generalize across the entire western region. However, the findings in this study are relevant to providing direction for WIC services, as the clients who participated in this study do represent a defined group of WIC clients that exist within every state in the western region.
IMPLICATIONS FOR RESEARCH AND PRACTICE

This study is useful to nutritionists, public health workers, and WIC staff for developing technology applications for reaching WIC populations, especially in the western region states. The following high priority technologies should be considered as ways for improving WIC services: (1) text messaging for appointment reminders and nutrition education, (2) online scheduling and nutrition education; (3) smart phone applications to locate nearby WIC offices and WIC vendors, access WIC approved food lists, and scan WIC foods at the store; and (4) a stronger Facebook presence for interacting with WIC clients and supporting breastfeeding. A number of avenues exist for expanding on the findings reported in this study. Future studies should examine the ways in which application of technologies could be cost-saving for WIC agencies, the efficacy of current WIC technology use, how existing infrastructures can be built upon, and identification of the barriers to and opportunities for implementation of new technologies in WIC programs. Also, because programs that are enhanced, or include additional elements, may not necessarily improve the health outcomes of the program, analysis is needed to quantify the effects of different technology applications and combinations thereof. This is especially true due to the current lack of research surrounding which elements of Internet-based behavior change programs are most effective, as well as the interest in a variety of Internet services for enhancing interaction with WIC reported in the present study.
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