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Research Article

Caregivers' Willingness to Pay for Technologies to Support Caregiving

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Abstract

Purpose of the Study: We report the results of a study designed to assess whether and how much informal caregivers are willing to pay for technologies designed to help monitor and support care recipients (CRs) in performing kitchen and personal care tasks.
Design and Methods: We carried out a web survey of a national sample of adult caregivers (age 18–64) caring for an older adult (N = 512). Respondents completed a 25 min online survey that included questions about their caregiving situation, current use of everyday technology, use of specific caregiving technologies, general attitudes toward technology, and questions about technologies designed to help them monitor and provide assistance for CRs' kitchen and self-care activities.
Results: About 20% of caregivers were not willing to pay anything for kitchen and self-care technologies. Among those willing to pay something, the mean amount was approximately $50 per month for monitoring technologies and $70 per month for technologies that both monitored and provided some assistance. Younger caregivers, those caring for a person with Alzheimer's disease, and caregivers with more positive attitudes toward and experience with technology were willing to pay more. Most caregivers feel that the government or private insurance should help pay for these technologies.
Implications: Caregivers are receptive and willing to pay for technologies that help them care for their CR, although the amount they are willing to pay is capped at around $70 per month. The combination of private pay and government subsidy may facilitate development and dissemination of caregiver technologies.

Keywords: Caregiving, Technology, Willingness to pay, Aging, Disability, Personal care, Kitchen assistance

Advances in digital technology in the last three decades have fundamentally changed the lives of individuals of all ages. The shift from analog electronic and mechanical devices to digital technology has fostered the development of computers, smartphones, the internet, robots, and a myriad of sensing and actuating devices that have revolutionized communication, health care, mobility, and the everyday lives of most humans throughout the world. Digital technologies have become increasingly important for older individuals and their family caregivers because of their potential to maintain and improve the health, functioning, safety, and psychological well-being of older individuals (Schulz et al., in press; Schulz, Lustig, Handler, & Martire, 2002).

Over the last several decades, scholars, designers, and practitioners have sought to identify factors that influence technology acceptance and adoption in general (Czaja et al., 2006; Davis, 1989), and the acceptability and uptake of consumer health technologies in particular (Center for

Technology and Aging, 2010; Rogers & Mead, 2004). To varying degrees, existing models of technology acceptance have focused on: (a) abilities, needs, and preferences of end users; (b) features of the technology; and (c) societal factors, including social and health policy, and the regulatory environment (Schulz et al., 2014). For example, the original technology acceptance model (Davis, 1989) broadly argued that perceived usefulness and ease of use were key to predicting intent and actual technology use. Technology acceptance models have evolved to include additional predictors, including individual differences such as age, gender, prior experience with technology, and price/value, as presented in the unified theory of acceptance and use of technology (Venkatesh, Thong, & Xu, 2012). Our own work on technology uptake draws attention to implicit cost-benefit calculations carried out by end-users, including costs such as loss of privacy, expense, reduced efficiency, reduced social interaction, stigma, and training and maintenance requirements and benefits such as enhanced functioning, increased autonomy/independence, reduced burden on others, better health, and enhanced safety (Schulz, 2013).

A central feature of all uptake models is the monetary cost of the technology. Research by Mahoney, Mutschler, Tarlow, and Liss (2008), Bradford, Kleit, Krousel-Wood, and Re (2005), Venkatesh, Thong, and Xu (2012), and Schulz et al. (2014) suggests that a key limiting factor for technology adoption may be cost. In a recent study of a nationally representative sample of U.S. baby boomers and older adults, Schulz and colleagues (2014) found low levels of willingness to pay for technologies that might improve their own functioning and independence. Nearly one third of respondents were not willing to pay anything for technology that would help them with kitchen tasks or personal care when asked to assume that they needed help in these areas. Those willing to pay something were on average willing to pay about $28.00 per month for technology-based assistance with kitchen tasks and $31.00 per month for personal care assistance. The median amount they were willing to pay for both types of technologies was $25 per month.

Our goal in this study was to collect similar data from a national sample of caregivers who were asked about their willingness to pay for such technologies in order to better monitor the everyday activities of their care recipients (CRs). We focused on caregivers because they are a potentially large market for monitoring and assistive technologies. Several large corporations including Intel, General Electric, and Philips have developed home monitoring systems which have the potential of keeping the caregiver informed of the daily activities of the CR (Adler & Mehta, 2014). Based on existing models of technology uptake, we focused on three classes of variables thought to be important predictors of willingness to pay: (a) demographic characteristics of caregivers; (b) caregiving context variables; and (c) attitudes toward and prior experience with technology. We hypothesized that caregivers would be more willing to pay for such technologies than baby boomers or older adults because they had existing as opposed to hypothetical needs which the technology could address, and that that younger caregivers and those with prior technology use and experience would be willing to pay more. In addition, we predicted that caregivers in more demanding caregiving situations (e.g., providing more hours of care per week; caring for someone with Alzheimer's disease [AD]) would be willing to pay more for caregiving technology. Finally, in exploratory analyses we sought to gauge whether or not caregivers felt that these technologies should be an entitlement and, therefore, paid for by the government. Since state and Federal agencies are increasingly involved in providing support to caregivers, we felt it important to assess caregiver expectations with regard to technology for caregivers.

Methods

Procedures

Participants completed an online survey with a total of 160 items that took an average of 25 min to complete. The majority of the questions used simple yes/no or structured scale formats, or asked for a single numeric estimate. The survey included questions about their caregiving situation, current use of everyday technology, use of specific caregiving technologies, general attitudes toward technology, caregiver health status, and several types of caregiver support technologies, including technologies aimed at helping the caregiver monitor and provide assistance for kitchen and personal care tasks. The study was approved by the University of Pittsburgh Institutional Review Board.

Sample

Participants were 512 informal (unpaid) family caregivers age 18–64 recruited by Survey Sampling International (SSI) Inc. (www.surveysampling.com) using the *SSI Dynamix™ Sampling Platform*. This online panel methodology allows targeting of specific demographic and health-related characteristics self-reported by respondents when they sign up for the panel. SSI online also links to social media, online communities, and affiliate partner organizations to include respondents who may not wish to join a research panel. Potential respondents (both SSI panelists and those recruited from other sources) are sent an invitation to come to the survey platform where they are presented with 10 "refinement" questions related to surveys that SSI is currently fielding. Based on their responses to the refinement questions (plus stored demographic information), respondents are randomly selected for routing to specific surveys that apply to them. This dynamic real-time profiling is meant to provide broad access to the most relevant participants while also enhancing respondent engagement and data quality. Panel members and other survey respondents earn incentives for survey participation, and SSI is responsible for quality control. SSI limits the number of survey invitations to panel members within specific time periods and authenticates and de-duplicates responses using digital fingerprinting, third party database matches, and other techniques, to avoid frequent or "professional responder" problems. Data quality checks include timestamps to detect "speeders," and flags to identify "straight-liners" (i.e., individuals who provide the same response to all items).

For this survey, the relevant refinement question used by SSI was: "*Please select all of the statements from the list below that apply to you: (1) Caregiver for an elderly parent; (2) Professional home caregiver; (3) Certified Nurses Aid (CNA); (4) Registered Nurse (RN); (5) Licensed Practical Nurse (LPN)/Licensed Vocation Nurse (LVN); (6) None of the above.*" Those choosing option 1—*Caregiver for an elderly parent*—were routed to this survey. However, the lag between answering the refinement question and taking our survey varied from none (instantaneous routing) to a month or two later (routed to other SSI surveys first). Given this lag, the somewhat ambiguous wording used by SSI (caregiving for AN elderly parent, not YOUR elderly parent), along with our interest in informal caregivers in addition to those taking care of a parent, we confirmed eligibility with the following screener question: "*Just to confirm, are you currently providing informal care to a parent, other family member or friend?*" The data were collected March 13–18, 2013. The SSI technology does not track the number of "invitations" to a specific survey, so a traditional response rate calculation is not possible. SSI reported that 618 individuals started the survey, for a completion rate of 82.8% (512/618). The final sample was split evenly by gender (51% female), with a median age of 40 years (range 18–64). The sample was also diverse in terms of race/ethnicity, with 61% non-Hispanic white, 18% Hispanic (any race), 9% non-Hispanic African American, and 8% non-Hispanic Asian. The sample was more educated than the general population (46% college degree), and 30% reported annual income of $75,000 or higher (26% reported < $30,000). In terms of the caregiving situation, 78% reported caring for a parent, 10% cared for a spouse, and 12% cared for another family member/friend. Over half (56%) reported living with the CR, and another 35% lived within a 20-min drive. CRs had a variety of health conditions that led to the need for care, including dementia or AD (23%), diabetes (13%), heart disease (13%), cancer (10%), arthritis (10%), and stroke (9%). Over one fourth (27%) of the sample reported providing care 40 or more hours per week, whereas 20% provided 8 hr per week or less. Over 80% of the sample had been providing care for 5 years or less, with 32% having become a caregiver within the past year.

Statistical Weighting Adjustment

The SSI online methodology is efficient and cost effective but produces a nonprobability sample. Although diverse in terms of demographic variables and caregiving situation, our sample is not a "representative" probability sample of the larger family caregiver population. All respondents had access to the internet and had agreed to complete surveys online. In addition, the sample had fairly high rates of use of caregiving technologies. Nearly two thirds (66%) reported current use of at least one of the following for caregiving: an emergency response system; an electronic device that sends information to a health care provider; an electronic safety sensor; or a website or software for health tracking. This was more than double the 29% rate found in the nationally representative National Alliance for Caregiving (NAC) survey conducted by the NAC and American Association of Retired Persons (AARP) (2009). In order to adjust for this and other potential biases associated with a nonprobability panel, we used the NAC/AARP 2009 study—the most recently available nationally representative sample of family caregivers—as the calibration survey to construct poststratification weights using iterative proportional fitting "raking" methodology. We used the *"ipfweight"* raking algorithm in STATA (version 12) and included age, sex, race, and current use of any caregiving technologies (yes/no as described above) as adjustment factors. We used NAC/AARP estimates for the subset of 18–64 years old caregivers to be consistent with our sample. Raking adjusts sample estimates in order to make the survey's marginal distributions on the included variables "mirror" the population to the greatest extent possible. Thus, the weighting adjustment results in our sample having similar age, sex, race, and technology use distributions as the corresponding NAC/AARP sample. This technique reduces the impact of selection biases on the key survey outcomes, including likelihood of use and willingness to pay out-of-pocket for the emerging technology. All analyses in this paper are weighted unless otherwise stated.

Measures

To provide context for the respondents, the section on caregiver support technologies was introduced as follows: "*This section asks questions about technologies that may be useful in helping to care for another person, but they are still being developed. Although they are not yet available, we want to get current family caregivers' reactions to them. These technologies involve intelligent systems that will be capable of learning about and monitoring a person's abilities, needs, and preferences and then automatically providing personalized assistance when needed.*" This was followed by specific questions about kitchen and personal care technologies.

Kitchen

"*Assume your care recipient needed help with KITCHEN ACTIVITIES and that technology was available to help with things like meal preparation and washing dishes. This technology could consist of 'smart' sensors or mobile robots that would monitor your care recipient's behavior in the kitchen, sense when he/she needed help with cooking* *and washing dishes, and provide assistance as needed. The assistance could range from offering simple, step-by-step instructions to actually performing kitchen tasks.*"

Respondents were then told to "*Assume the technology monitored, provided feedback, and also helped your care recipient perform kitchen tasks. What is the most you would be willing to pay EACH MONTH out of your own pocket for the technology?*" The next question asked respondents to "*assume the technology only monitored your care recipient's kitchen activity and provided you with feedback about how well they were performing kitchen tasks, what is the most you would pay EACH MONTH out of your own pocket for the technology?*" These questions were open-ended, allowing the respondent to enter any dollar amount.

Personal Care

"*Assume your care recipient needed help with PERSONAL CARE and that technology was available to help with things like getting in and out of bed, dressing, eating, bathing, and toileting. This technology could involve sensors and robots that would monitor your care recipient's personal care behavior throughout the home, sense when he/she is in need of help, and provide assistance as needed. The assistance could range from offering simple, step-by-step instructions to actually performing personal care tasks.*" The two follow-up questions were identical to those asked for kitchen tasks with the exception that "personal care" was substituted for kitchen tasks.

We also explored the possibility that respondents might feel that these types of technology support services should be *paid for by the government*. To that end, we asked the following open-ended question for each type of technology after respondents completed the willingness to pay questions: "*What percentage of the cost of this type of technology do you think the government should pay?*" Respondents were free to enter any percentage between 0% and 100%. This was a single question for kitchen and personal care technology and no distinction was made between technology that monitors only versus technology that monitors and provides support.

Caregiving Situation

Standard items were used from the NAC/AARP 2009 survey asking about relationship to the CR, primary CR health problem, hours per week providing care, duration of caregiving, and caregiver–CR coresidence.

Current Technology Use to Aid Caregiving

These items, also taken from the NAC survey, focused on use of the internet to find information on caregiving, including frequency and specific types of information gathered. The frequency of use of the internet for caregiving information ("sometimes" and "often" vs. "never") was used in the analyses. Also, use of the following technologies to aid caregiving was assessed with a series of yes/no questions: (a) Any device that electronically sends information to a doctor or care manager to help manage his/her health care, like a device that transmits blood sugar or blood pressure readings; (b) An emergency response system, such as Lifeline; (c) A website or computer software to keep track of his/her personal health records; and (d) An electronic sensor that can detect safety problems in the home and take steps to help, like when someone falls, wanders away, or leaves the stove on. A simple count of the number of the four technologies currently used for caregiving was used for analysis as well as in the weighting adjustment described above.

Current Use of Everyday Technology

Respondents were asked about use of 25 everyday technologies (e.g., smartphone, tablet, video camera, video game console, DVD, home security system, ATM) with a series of yes/no questions. This measure was developed by Czaja and colleagues for use in the Center for Research and Education on Aging and Technology Enhancement (CREATE; Czaja et al., 2006), and is scored as the simple sum of the 25 technologies used.

General Technology Attitudes

These were measured with 10 items presenting general statements about positive and negative characteristics of technology (five items each). Items were prefaced with "To what extent do you believe that technology…" A 10-point rating scale was used for each item, with 1 labeled "Not at all," and 10 labeled "Completely." Positive statements included "makes life easy and convenient," "makes life more comfortable," "gives people control over their daily lives," "increases personal safety and security," and "brings people together." Negative statements included "reduces privacy," "makes people dependent," "makes life stressful," "makes people isolated," and "makes life complicated." Positive and negative items were alternated in the scale. Separate positive and negative general technology attitude scales were constructed by computing the mean of the five positive and the mean of the five negative items. Cronbach's α was .83 for the positive scale and .87 for the negative scale.

Statistical Analysis

Descriptive statistics and bivariate analyses of relationships between caregiver demographic and caregiving context variables and willingness to pay for *kitchen technology* and *personal care technology* to monitor the CR are presented first. Next, for each type of technology we test three multiple regression models using amount willing to pay monthly as the dependent variable. The first model includes only demographic characteristics as predictors; the second model adds caregiver context variables; and the third adds technology-related indicators as predictors. We present only the models for amount willing to pay for monitoring in the tables since the pattern of results for technologies that *monitor and support* are similar. However, we do present text-based results for the monitor and support technologies. The dollar amount willing to pay monthly out of pocket included those willing to pay nothing (i.e., included "0" scores); was truncated at a maximum value of $500 to reduce the impact of outliers; and a natural logarithmic transformation (base 10) was done prior to analyses to address skew. We also explored predictors of the percentage respondents believed that the government should pay for kitchen and personal care technologies.

Missing Data

The multivariate models were run on the subset of participants that had valid data on all model variables (n = 437–442 valid; n = 70–75 missing). Missing data occurred primarily on income and use of current caregiving technologies variables. A sensitivity analysis showed no significant differences between missing and valid cases on the key outcome variables for amount willing to pay ($) or percent the government should pay for either kitchen or personal care technologies. There were also very few differences on the sociodemographic and caregiving context predictor variables between missing and valid cases. However, younger caregivers (18–29) were more likely to be missing from the personal care willingness to pay model; and African Americans and Hispanics were more likely to be missing from the percent government should pay models. In addition, those with less positive attitudes toward technology in general were more likely to be missing from the willingness to pay models. There were no significant differences between valid and missing cases on any other sociodemographic or caregiving context variables.

Results

Sample Descriptive Statistics

Unweighted sample characteristics are presented in Tables 1 and 2 (column 1). The weighted sample, designed to mirror the national NAC survey, was slightly more female and less Asian and Hispanic, had more cases in the 45–64 age range and fewer in the 18–29 age range, and had slightly lower income. All bivariate comparisons and multivariate modeling analyses were done with the weighted sample. The analyses were also run without weights and the results were similar.

Willingness to Pay Some Versus None, and Amount Willing to Pay

For kitchen monitoring technology 21.6% of caregivers were not willing to pay anything out of pocket, whereas 78.4% were willing to pay at least something (see Table 1). For personal care monitoring technology the percentages were 22.1 (none) and 77.9 (some amount) (see Table 2). Overall, caregivers were willing to pay a mean of $49 and a median of $24 per month for *kitchen* monitoring technology. For kitchen technology that both monitored and helped, the amount caregivers were willing to pay was higher (mean = $69; median = $50). Caregivers were willing to pay a little more for *personal care* technologies that monitored (mean = $50; median = $25; see Table 2) and provided assistance (mean = $73; median = $50).

At the bivariate level, there were statistically significant associations between any willingness to pay for *kitchen* monitoring and gender, race, age, income, hours per week providing care, duration of caregiving, and whether or not the CR had AD, as shown in Table 1. Males were more willing to pay something than females; Asians, African Americans, and Hispanics were more willing to pay something than whites or others; younger respondents were more willing to pay than older respondents; respondents with mid-level incomes ($30,000–$99,000) were more likely to pay than persons with lower or higher level incomes; long time caregivers (>5 years) and those providing high (>40 hr per week) or low levels (<8 hr per week) of care per week were less likely to pay anything. The same variables were also significantly related to the mean and median $ amount willing to pay for kitchen monitoring technology (although the race and gender differences on the medians were not statistically significant; Table 1). The pattern of bivariate associations for *personal care* monitoring technology and willingness to pay were similar (see Table 2). We present only the bivariate results for monitoring technologies because, other than the higher absolute values for willingness to pay noted above, associations with each of the predictor variables were essentially identical for technologies that both monitored and provided assistance.

Amount Willing to Pay—Multiple Regression Analyses

For each type of monitoring technology, we tested three separate multiple regression models using the amount caregivers were willing to pay for monitoring technology as the dependent variable (see Tables 3 and 4). As shown in Table 3 (column 1), demographic characteristics explained 10.9% of the variance in the amount caregivers were willing to pay. Significant predictors included African Americans, who were willing to pay more than whites, and younger respondents who were willing to pay more than older respondents. When we add caregiving context variables to the model (column 2), the amount of variance explained increases to 17.5%. Significant effects were found for CRs' disease and amount of time spent caregiving. Caregivers for CRs with AD were willing to pay more than caregivers for CRs with other conditions, and caregivers providing 9–39 hr of care were willing to pay more than those providing less than 9 hr of care per week. Finally, variables assessing technology attitudes and use explain an additional 10.9% of the outcome variance (column 3). Positive attitudes toward technology, everyday

Table 1. Descriptive Statistics and Bivariate Analyses of Relationships Between Caregiver Demographic and Caregiving Context Variables and Willingness to Pay for *Kitchen Technology* to Monitor Care Recipient

Variable	Descriptive statistics % (*n*) (Unweighted)	% Willing to pay at least something	% Willing to pay nothing	Mean $ (*SD*) Willing to pay per month (including $0)[a]	Median $ Willing to pay per month (including $0)[a]
Total sample	*n* = 512	78.4	21.6	49 (79)	24
Gender					
Female	51.0 (261)	75.5	24.5	41 (59)	20
Male	49.0 (251)	84.1	15.9*	65 (105)*	30
Race					
White	60.9 (312)	75.6	24.4	44 (68)	20
Black	8.8 (45)	87.9	12.1	60 (106)	20
Asian	7.6 (39)	90.9	9.1	85 (133)	36
Hispanic	18.0 (92)	84.6	15.4	59 (88)	25
Other	4.7 (24)	55.6	44.4*	41 (83)*	10
Age					
18–29	25.2 (129)	95.6	4.4	98 (138)	36
30–44	31.4 (161)	84.4	15.6	48 (69)	20
45–54	23.6 (121)	64.1	35.9	34 (59)	10
55–64	19.7 (101)	76.9	23.1**	41 (56)**	25*
Income					
< $20,000	12.3 (62)	74.1	25.9	62 (108)	25
$20,000–$29,999	13.3 (68)	71.0	29.0	47 (69)	25
$30,000–$49,999	18.6 (95)	87.9	12.1	47 (60)	25
$50,000–$74,999	19.1 (98)	84.0	16.0	36 (59)	20
$75,000–$99,999	15.2 (78)	84.5	15.5	63 (82)	50
≥ $100,000	14.8 (76)	71.0	29.0*	54 (83)	22**
Alzheimer's CG					
Yes	23.0 (118)	84.9	15.1	52 (69)	25
No	77.0 (394)	76.3	23.7*	48 (82)*	20*
Caring for parent					
Yes	78.3 (401)	80.0	20.0	46 (70)	21
No	21.3 (109)	71.3	28.7	59 (106)	25
Hours per week CG					
≤8 hr	20.1 (103)	66.3	33.7	48 (100)	20
9–19 hr	29.3 (150)	87.1	12.9	51 (73)	25
20–39 hr	22.9 (117)	85.6	14.4	62 (75)	50
≥40 hr	26.8 (137)	74.2	25.8**	40 (70)**	15**
CG tenure					
≤ 3 months	7.0 (36)	86.7	13.3	77 (124)	42
4–12 months	24.6 (126)	88.2	11.8	64 (106)	25
13–24 months	26.4 (135)	84.9	15.1	56 (65)	33
25 months to 5 years	23.8 (122)	74.1	25.9	36 (63)	20
>5 years	17.8 (91)	64.8	35.2**	37 (61)**	16**
CR lives with CG					
Yes	55.5 (284)	74.9	25.1	52 (86)	25
No	43.9 (225)	81.9	18.1	46 (72)	20

Note: Descriptive statistics are unweighted. Not all percentages add to 100% due to missing data. All other analyses are weighted (see text for explanation). ANOVA = analysis of variance; CG = caregiver; CR = care recipient.

[a]Amount willing to pay (WTP) per month ($) truncated at $500. The natural logarithm (base 10) transformation was applied to mean $ WTP prior to all tests of significance.

*$p < .05$. **$p < .01$ in χ^2 or one-way ANOVA tests of association between predictor variable and WTP ($); and *K*-sample tests of differences between medians.

technology use, using the internet for caregiving, and caregiving technology use were all significantly positively associated with the amount caregivers were willing to pay. The final model with willingness to pay for kitchen technology that *monitors and provides support* explained 23.7% of the variance. Significant ($p < .05$) predictors of willingness to pay higher amounts (when first entered into the model) included younger (18–29) caregivers, having a CR with AD,

Table 2. Descriptive Statistics and Bivariate Analyses of Relationships Between Caregiver Demographic and Caregiving Context Variables and Willingness to Pay for *Personal Care Technology* to Monitor Care Recipient

Variable	Descriptive statistics % (*n*) (Unweighted)	% Willing to pay at least something	% Willing to pay nothing	Mean $ (*SD*) Willing to pay per month (including $0)[a]	Median $ Willing to pay per month (including $0)[a]
Total sample	*n* = 512	77.9	22.1	50 (78)	25
Gender					
Female	51.0 (261)	76.1	23.9	44 (62)	25
Male	49.0 (251)	81.8	18.2	63 (103)	25
Race					
White	60.9 (312)	75.6	24.4	46 (71)	25
Black	8.8 (45)	87.9	12.1	60 (93)	46
Asian	7.6 (39)	90.9	9.1	87 (115)	58
Hispanic	18.0 (92)	81.5	18.5	62 (99)	30
Other	4.7 (24)	55.6	44.4*	50 (92)*	21
Age					
18–29	25.2 (129)	94.1	5.9	100 (145)	34
30–44	31.4 (161)	82.0	18.0	50 (69)	25
45–54	23.6 (121)	65.5	34.5	36 (52)	20
55–64	19.7 (101)	77.7	22.3**	43 (56)**	25
Income					
< $20,000	12.3 (62)	71.9	28.1	68 (110)	31
$20,000–$29,999	13.3 (68)	71.0	29.0	38 (64)	20
$30,000–$49,999	18.6 (95)	84.1	15.9	51 (63)	30
$50,000–$74,999	19.1 (98)	85.8	14.2	41 (60)	20
$75,000–$99,999	15.2 (78)	87.1	12.9	69 (92)	45
≥ $100,000	14.8 (76)	72.6	27.4*	50 (67)	38**
Alzheimer's CG					
Yes	23.0 (118)	87.4	12.6	52 (64)	30
No	77.0 (394)	74.7	25.3**	51 (84)*	25
Caring for parent					
Yes	78.3 (401)	79.2	20.8	48 (70)	25
No	21.3 (109)	72.3	27.7	61 (108)	30
Hours per week CG					
≤8 hr	20.1 (103)	73.3	26.7	56 (105)	25
9–19 hr	29.3 (150)	83.5	16.5	47 (68)	25
20–39 hr	22.9 (117)	82.0	18.0	61 (73)	50
≥40 hr	26.8 (137)	74.2	25.8	45 (74)*	20**
CG tenure					
≤3 months	7.0 (36)	93.3	6.7	78 (130)	30
4–12 months	24.6 (126)	87.3	12.7	66 (109)	25
13–24 months	26.4 (135)	76.5	23.5	51 (61)	35
25 months to 5 years	23.8 (122)	78.9	21.1	41 (62)	25
>5 years	17.8 (91)	64.8	35.2**	42 (65)**	23
CR lives with CG					
Yes	55.5 (284)	74.4	25.6	52 (87)	25
No	43.9 (225)	81.5	18.5	50 (72)	26

Note: Descriptive statistics are unweighted. Not all percentages add to 100% due to missing data. All other analyses are weighted (see text for explanation). ANOVA = analysis of variance; CG = caregiver; CR = care recipient.

[a]Amount willing to pay (WTP) per month ($) truncated at $500. The natural logarithm (base 10) transformation was applied to mean $ WTP prior to all tests of significance.

$^*p < .05$. $^{**}p < .01$ in χ^2 or one-way ANOVA tests of association between predictor variable and WTP ($); and *K*-sample tests of differences between medians.

providing between 9 and 39 hr of care per week, having more positive attitudes toward technology, greater everyday technology use, more use of the internet for caregiving, and more caregiving technology use.

Although the overall pattern of results was slightly different for personal care monitoring technologies (see Table 4), the effects for indicators assessing technology attitudes and use were very similar, explaining an additional 11.7% of

Table 3. Multiple Regression Analysis of Amount ($) Willing to Monthly Pay Out of Pocket by Caregivers for *Kitchen Technology* to Monitor Care Recipient (n = 438)

	Model 1		Model 2		Model 3	
Variable	Beta (*SE*)	*p* value	Beta (*SE*)	*p* value	Beta (*SE*)	*p* value
CG demographics						
Gender						
Male	.066 (0.073)	.363	.068 (0.073)	.357	.062 (0.070)	.377
Race[a]						
Black	.218 (0.106)	.041	.175 (0.107)	.101	.133 (0.101)	.188
Asian	.219 (0.258)	.397	.277 (0.253)	.274	.215 (0.239)	.369
Hispanic	–.023 (0.107)	.832	–.001 (0.106)	1.00	–.103 (0.103)	.318
Other	–.049 (0.281)	.862	.052 (0.275)	.852	.100 (0.260)	.700
Age[b]						
18–29	.332 (0.125)	.008	.238 (0.132)	.072	.061 (0.129)	.638
30–44	.154 (0.093)	.099	.055 (0.099)	.575	–.068 (0.096)	.478
45–54	–.195 (0.095)	.040	–.260 (0.096)	.007	–.251 (0.091)	.006
Income[c]						
< $20,000	–.009 (0.137)	.947	.058 (0.137)	.675	.259 (0.133)	.051
$20,000–$29,999	–.097 (0.135)	.474	–.011 (0.138)	.934	.109 (0.131)	.407
$30,000–$49,999	.157 (0.118)	.184	.214 (0.120)	.075	.302 (0.114)	.008
$50,000–$74,999	–.045 (0.118)	.701	–.035 (0.117)	.765	.072 (0.111)	.519
$75,000–$99,999	.199 (0.129)	.123	.193 (0.127)	.128	.245 (0.120)	.042
CG context						
Alzheimer's CG			.214 (0.082)	.009	.163 (0.078)	.037
CG for parent			.136 (0.093)	.143	.135 (0.087)	.122
Hours/week CG[d]						
9–19 hr			.247 (0.108)	.022	.225 (0.101)	.027
20–39 hr			.270 (0.119)	.023	.194 (0.113)	.088
≥40 hr			.132 (0.114)	.245	.131 (0.108)	.225
CG tenure[e]						
≤3 months			.097 (0.173)	.577	.088 (0.164)	.592
4–12 months			.167 (0.113)	.140	.148 (0.109)	.175
13–24 months			.204 (0.107)	.057	.180 (0.102)	.078
25 months to 5 years			–.031 (0.101)	.757	–.034 (0.097)	.727
CR lives with CG			–.048 (0.084)	.566	–.054 (0.080)	.503
Technology attitudes and use						
Positive tech attitudes					.080 (0.025)	.001
Negative tech attitudes					–.003 (0.017)	.871
Everyday tech use					.022 (0.008)	.007
"Sometimes" use internet for CG					.229 (0.085)	.008
"Often" use internet for CG					.164 (0.094)	.084
CG tech use					.107 (0.032)	.001
R^2 change	.109**		.066**		.109**	
Model total R^2	.109		.175		.283	

Note: All analyses are weighted (see text for explanation). Amount willing to pay (WTP) per month ($) truncated at $500. The natural logarithm (base 10) transformation was applied to $ WTP for regression analyses. CG = caregiver; CR = care recipient.
Reference groups as follows: [a]White non-Hispanic; [b]Age 55–64; [c]Income $100,000 or more; [d]8 hr or less per week; [e]>5 years.

the outcome variance. The final model with willingness to pay for personal care technology that *monitors and provides support explained 18.6% of the variance.* Significant predictors of willingness to pay higher amounts (when first entered into the model) included younger (18–44) caregivers, having a CR with AD, having more positive attitudes toward technology, greater everyday technology use, and more use of the internet for caregiving.

Should the Government Pay for These Technologies—Exploratory Analysis?

Respondents believed that the government should pay about half of the cost for both kitchen (M = 53.9%, SD = 34.2%; Mdn = 50.0%) and personal care (M = 54.1%, SD = 34.4%; Mdn = 50.0%) technologies. The distribution of responses also had three peaks. About 15% of respondents said 0%, 20% of respondents said the government should pay

50%, and another 16% felt the government should pay for 100%. The remaining responses were distributed in the 1%–49% and 51%–99% ranges (see Table 5). Also note that the majority of responses (about 30%) were in the 51%–99% range. We explored various methods for modeling demographic and caregiving factors as predictors of how much the government should pay, and the pattern of results was similar across multiple different methods. Results from multiple logistic regressions in which the dependent measure was defined as the government should pay more than 50% (coded 1) versus 50% or less (coded 0) for kitchen and personal care technologies are shown in Table 6. Female caregivers, African Americans, caregivers providing more hours of care per week, and those

Table 4. Multiple Regression Analysis of Amount ($) Willing to Monthly Pay Out of Pocket by Caregivers for *Personal Care Technology* to Monitor Care Recipient (n = 437)

	Model 1		Model 2		Model 3	
Variable	Beta (*SE*)	*p* value	Beta (*SE*)	*p* value	Beta (*SE*)	*p* value
CG demographics						
Gender						
Male	.006 (0.075)	.937	.017 (0.077)	.828	.008 (0.073)	.917
Race[a]						
Black	.238 (0.109)	.029	.198 (0.111)	.077	.170 (0.105)	.107
Asian	.159 (0.265)	.549	.188 (0.264)	.477	.116 (0.249)	.643
Hispanic	−.103 (0.110)	.349	−.072 (0.111)	.520	−.188 (0.108)	.082
Other	−.024 (0.287)	.933	.057 (0.288)	.842	.028 (0.271)	.917
Age[b]						
18–29	.307 (0.128)	.017	.252 (0.138)	.068	.047 (0.135)	.727
30–44	.120 (0.095)	.210	.067 (0.103)	.514	−.052 (0.100)	.604
45–54	−.202 (0.097)	.038	−.233 (0.100)	.020	−.218 (0.095)	.023
Income[c]						
< $20,000	−.033 (0.141)	.817	−.002 (0.144)	.990	.165 (0.138)	.235
$20,000–$29,999	−.182 (0.138)	.186	−.114 (0.143)	.427	.034 (0.136)	.801
$30,000–$49,999	.080 (0.121)	.510	.129 (0.125)	.301	.251 (0.119)	.036
$50,000–$74,999	−.013 (0.121)	.917	−.013 (0.122)	.914	.098 (0.116)	.400
$75,000–$99,999	.215 (0.132)	.104	.202 (0.133)	.128	.259 (0.125)	.039
CG context						
Alzheimer's CG			.221 (0.086)	.010	.151 (0.081)	.062
CG for parent			.054 (0.097)	.580	.059 (0.091)	.515
Hours/week CG[d]						
9–19 hr			.069 (0.112)	.539	.056 (0.106)	.596
20–39 hr			.110 (0.124)	.374	.040 (0.118)	.732
≥40 hr			.054 (0.119)	.653	.036 (0.113)	.747
CG tenure[e]						
≤3 months			.165 (0.180)	.358	.081 (0.170)	.637
4–12 months			.206 (0.118)	.081	.157 (0.114)	.169
13–24 months			.081 (0.111)	.469	.028 (0.106)	.792
25 months to 5 years			.035 (0.105)	.739	.003 (0.101)	.976
CR lives with CG			−.081 (0.088)	.356	−.056 (0.084)	.506
Technology attitudes and use						
Positive tech attitudes					.044 (0.026)	.099
Negative tech attitudes					.019 (0.018)	.281
Everyday tech use					.022 (0.009)	.009
"Sometimes" use internet for CG					.376 (0.089)	<.001
"Often" use internet for CG					.424 (0.098)	<.001
CG tech use					.071 (0.033)	.034
R^2 change	.095**		.033		.117**	
Model total R^2	.095		.128		.245	

Note: All analyses are weighted (see text for explanation). Amount willing to pay (WTP) per month ($) truncated at $500. The natural logarithm (base 10) transformation was applied to $ WTP for regression analyses. CG = caregiver; CR = care recipient.

Reference groups as follows: [a]White non-Hispanic; [b]Age 55–64; [c]Income $100,000 or more; [d]8 hr or less per week; [e]>5 years.

Table 5. Responses to Questions Regarding "What percentage of the cost of this type of technology do you think the government should pay?" for Kitchen and Personal Care Technologies (Unweighted)

Percent government should pay	Kitchen technologies: % (*N*) $N = 479^a$	Personal care technologies: % (*N*) $N = 486^a$
0%	14.8 (71)	15.4 (75)
1%–49%	19.2 (92)	17.5 (85)
50%	19.2 (92)	20.4 (99)
51%–99%	30.4 (146)	30.0 (146)
100%	16.3 (78)	16.7 (81)

[a]Missing data $n = 33$ for kitchen technologies and $n = 26$ for personal care technologies.

providing care for a parent were significantly more likely to say that the government should pay more than 50% of the costs for kitchen and personal care technologies. On the other hand, those caring for a recipient with AD were *less likely* to believe the government should pay more than half. Interestingly, beliefs about how much the government should pay for kitchen and personal care technologies was not correlated with individual amount willing to pay ($) for these technologies (Pearson correlations ranging from .00 to −.07).

Discussion

A primary goal of this study was to assess whether and how much family caregivers are willing to pay for technologies designed to help monitor and support CRs in performing kitchen and personal care tasks. About 20% of caregivers were not willing to pay anything for these technologies, and among those willing to pay something, the mean amount was approximately $50 per month for monitoring technologies and $70 per month for technologies that both monitored and provided some assistance. Although these data may be discouraging to technology developers and entrepreneurs, they stand in sharp contrast to findings reported in an earlier paper where we showed that nearly one third of all baby boomers and older individuals are not willing to pay anything for technology that would help them with kitchen tasks or personal care, and among those who are willing to pay, the mean amount was only $28 per month (Schulz et al., 2014). Thus, caregivers are more receptive and a potentially better market for these types of technologies than older individuals who might purchase them for themselves. An important difference between caregivers and the general population of baby boomers and older adults is that caregivers are experiencing current needs for assistance with caregiving, whereas baby boomers and older adults are responding to hypothetical needs for assistance in the future.

A second goal of this study was to identify factors associated with willingness to pay for caregiver technology. In multivariate models we explored three categories of variables: demographic characteristics, caregiving context variables, and attitudes toward and prior experience with technology. When all three categories of variables were examined simultaneously, we found that younger caregivers, those with medium and high incomes, AD caregivers, caregivers providing fewer hours of care per week, and caregivers with positive attitudes toward technology and those with more experience with technology were willing to pay more. These findings only partially confirmed our predictions. As expected, younger caregivers and persons with higher incomes were willing to pay more, but it is important to note that the significant age effect is not explained by younger persons having more positive attitudes toward or experience with technology since these variables were controlled in the multivariate model. It may be that younger caregivers have higher expectations of paying for technology.

We also expected that more intense caregiving demands would be associated with greater willingness to pay, but support for this prediction was mixed. AD caregiving is generally viewed as more demanding and stressful when compared with caregiving for other chronic conditions (Ory, Hoffman, Yee, Tennstedt, & Schulz, 1999), and as expected AD caregivers were willing to pay more than non-AD caregivers. However, using hours of care as a metric of the intensity of caregiving demands, we found that providing fewer hours of care was associated with greater willingness to pay. These apparently disparate findings may have a common underlying explanation. Caregivers may have thought that monitoring and assistive technologies were uniquely suited to AD caregiving because of the tracking and vigilance demands of AD caregiving (Mahoney et al., 2003), and because they viewed systems that might provide guidance, coaching, and reminding as particularly useful for patients with AD. In a similar vein, caregivers providing fewer hours of care are probably caring for individuals with lower levels of impairment who might benefit from technology more that persons with high levels of impairment. In both cases caregivers appear to be responding to the likely benefit of these technologies to the unique status of their CRs.

Consistent with prior findings, caregivers with positive attitudes toward and prior experience with general and caregiving technology were willing to pay more for caregiving technology, even after controlling for demographic and caregiving context variables. As experience with and familiarity with technology increases among successive cohorts of caregivers, willingness to pay is likely to increase as well. That said, it is important to keep in mind that cost is only one of many factors that determine technology uptake. As noted in the *Introduction*, acceptance of technology involves a complex calculus in which factors such as privacy, efficiency, impact on social interaction, stigma,

Table 6. Logistic Regression Analysis of Beliefs That Government Should Pay At Least 50% of the Cost of Kitchen and Personal Care Technologies (vs. <50%)

Variable	Kitchen technology (*n* = 437)		Personal care technology (*n* = 442)	
	Odds ratio (95% CI)	*p* value	Odds ratio (95% CI)	*p* value
CG demographics				
Gender				
Male	0.58 (0.37, 0.89)	.014	0.50 (0.32, 0.78)	.002
Race[a]				
Black	2.41 (1.20, 4.84)	.014	3.22 (1.55, 6.69)	.002
Asian	0.88 (0.22, 3.61)	.860	0.87 (0.21, 3.56)	.844
Hispanic	0.83 (0.44, 1.57)	.566	0.61 (0.31, 1.17)	.135
Other	6.06 (0.69, 53.17)	.104	2.27 (0.38, 13.62)	.369
Age[b]				
18–29	0.83 (0.38, 1.84)	.648	1.03 (0.47, 2.28)	.940
30–44	1.39 (0.76, 2.54)	.281	1.40 (0.77, 2.56)	.275
45–54	0.93 (0.53, 1.65)	.802	1.15 (0.64, 2.05)	.649
Income[c]				
< $20,000	2.02 (0.87, 4.68)	.103	1.89 (0.81, 4.38)	.139
$20,000–$29,999	1.36 (0.61, 3.05)	.453	1.09 (0.49, 2.44)	.829
$30,000–$49,999	1.21 (0.59, 2.51)	.603	1.37 (0.67, 2.82)	.392
$50,000–$74,999	0.86 (0.43, 1.74)	.680	0.84 (0.42, 1.68)	.614
$75,000–$99,999	0.71 (0.33, 1.51)	.374	0.52 (0.24, 1.12)	.097
CG context				
Alzheimer's CG	0.57 (0.35, 0.93)	.025	0.55 (0.33, 0.92)	.021
CG for parent	1.95 (1.12, 3.38)	.018	2.07 (1.18, 3.63)	.011
Hours/week CG[d]				
9–19 hr	1.21 (0.65, 2.24)	.556	0.74 (0.40, 1.39)	.351
20–39 hr	1.59 (0.79, 3.18)	.195	1.89 (0.93, 3.83)	.079
≥40 hr	2.80 (1.40, 5.58)	.003	1.95 (0.98, 3.88)	.057
CG tenure[e]				
≤3 months	1.37 (0.53, 3.59)	.517	1.47 (0.54, 3.97)	.447
4–12 months	0.88 (0.45, 1.72)	.701	0.83 (0.42, 1.64)	.585
13–24 months	1.27 (0.67, 2.43)	.466	1.60 (0.83, 3.06)	.159
25 months to 5 years	1.20 (0.66, 2.20)	.556	1.35 (0.74, 2.47)	.334
CR lives with CG	0.67 (0.41, 1.11)	.120	0.73 (0.44, 1.22)	.233
Model total R^2	.137		.101	

Note: All analyses are weighted (see text for explanation). CG = caregiver; CR = care recipient.
Reference groups as follows: [a]White non-Hispanic; [b]Age 55–64; [c]Income $100,000 or more; [d]8 hr or less per week; [e]>5 years.

and training and maintenance requirements, in addition to cost, are balanced against potential benefits such as improved functioning, increased autonomy/independence, reduced burden, better health, and enhanced safety. Future research in this area should explore the multiple cost-benefit tradeoffs caregivers make when evaluating a particular technology.

We also explored the possibility that caregivers may feel that access to these types of technologies is an entitlement and, therefore, should be paid for by the government. Prior research suggests that the majority of caregivers think that the government should be responsible for supporting the chronically disabled who are cared for at home (Adamek, 1992). The expansion of government-funded long-term care services will likely create expectations that caregiving technology be paid for as well. About 85% of respondents felt that the government should pay something, and about two thirds felt that the government should pay at least half of the cost of these technologies. Female caregivers, African Americans, caregivers providing more hours of care, and those providing care for a parent were significantly more likely to say that the government should pay more than 50% of the costs for kitchen and personal care technologies. AD caregivers were less likely to say that the government should pay for these technologies. The finding regarding adult children suggests that they may have a weaker sense of personal obligation to provide care when compared with spousal caregivers. Caregivers who provide intensive care (40 or more hours per week) are likely caring for CRs with severe chronic illness and disability and feel that the care of these patients is a government responsibility. The data also suggest that females and African Americans have a stronger sense of entitlement but the data do not tell us why this might be the case. Clearly, more research is needed to address these questions. On the whole, these data indicate that caring for an older individual is a shared responsibility between families and the government, a perspective that will likely become more prevalent with the aging of the baby boomers and their children. This view is consistent with a collectivist perspective on social policy for caregiving which argues that the government bears some responsibility for reducing the burden on caregivers (Keefe and Rajnovich, 2007). That said, obtaining government support for caregiving technologies will likely require strong evidence of cost-effectiveness. Should such technologies be shown to delay or obviate long-term care placement, the Centers for Medicare & Medicaid Services could realize substantial savings by paying for caregiving technologies.

Monitoring and assistive technologies to support caregiving are already widely available and will become increasingly important as the prevalence and challenges of family caregiving increase and the sophistication of intelligent systems evolves. The impending decline of the dependency ratio—that is, the number of people who need care relative to the number available to provide it—will increase the pressure to find technological solutions to support caregiving. As new technologies come on line, it will be important that they address not only issues of cost and caregiver burden, but also esthetics, how engaging and easy they are to learn to use and maintain, their safety and reliability, as well as possible legal or liability issues (Chan, Campo, Estève, & Fourniols, 2009; Decker, 2008). Successful technologies will also be sensitive to users' privacy concerns and the extent to which a technology might undermine individual autonomy, control, and dignity (Beach et al., 2009). These issues are only tangentially related to the thrust of this paper—caregivers' willingness to pay—but are important to understanding the broader context within which monetary cost is one of many factors that determine whether or not a technology is adopted.

This study was designed to add to the growing literature on technologies for older persons and their caregivers. Although it has some limitations, including the use of a nonprobability web panel sample and missing data for some indicators, we addressed these shortcomings by using calibration weights from the NAC caregiver survey in an attempt to adjust for unknown sampling biases, and conducting sensitivity analysis which showed minimal differences between valid and missing cases.

Our data shed light on some questions in this important research but leave others unanswered.

Future research in this area should explore how willingness to pay is driven by specific caregiver needs, the ability of technology to address those needs, and how cost figures into the broader cost-benefit calculations made by caregivers. Inasmuch as caregiver technologies are interpersonal, in most cases requiring the consent of two parties for their use, it will be also be important to learn how much and what types of monitoring information the care receiver is willing to share with the caregiver as well as how much information the caregiver wants.

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