# Factors associated with openness to research participation in an aging community: The importance of technophilia and social cohesion

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*J.R. Steinerman, R.B. Lipton, B.D. Rapkin, B.R. Quaranto, C.E. Schwartz. Factors associated with openness to research participation in an aging community: The importance of technophilia and social cohesion. Gerontechnology 2013;11(4):504-512;* doi:10.4017/gt.2013.11.4.012.00 **Background** As technological advances modify the standard implementation approaches for health-related research, it becomes increasingly necessary to be comfortable with computers and the internet, to be able to participate in research. We sought to investigate how inclination toward technology (technophilia) and openness to research participation (ORP) co-vary, and what patient factors relate to technophilia. We focus on attitudes regarding research participation and technology in a diverse urban community. **Methods** 214 residents over age 50 participated in a community interview survey. Unidimensionality of the technophilia and ORP constructs was evaluated via factor analysis, and scores were calculated using the weighted sum of factor loadings. Among the subgroup with any reported computer experience, linear regression evaluated predictors of technophilia. Hierarchical modeling assessed predictors of ORP, including technophilia. **Results** The sample included African-American (58%), White (27%), and Hispanic (12%) participants with a mean age of 70.9 years; 77% were female, and 57% had a college education. 131 individuals (61%) reported "any experience with computers", among whom univariate predictors of technophilia were younger age (p=0.001), higher education (p=0.03), not being widowed (p=0.04), and better self-reported health (p=0.003). Multivariate modeling demonstrated that technophilia and one's sense of social cohesion were consistent predictors of ORP. **Conclusions** Technophilia was a consistent predictor of ORP, and social cohesion added additional predictive ability. Aging research which incorporates technology could be more efficiently recruiting participants by measuring and considering technophilia and social cohesion.

**Keywords: Technophilia, community-based research, elderly, feasibility, social cohesion**

Involving a broad range of patients in health-related research is critical to the external validity of study findings. Older adults are a particularly important cohort to include, and there is a body of research documenting factors associated with elderly non-participation in research. A recent review by Fudge and colleagues documented that barriers to involving older people in research included cultural divisions, language barriers, research skills capacity, ill health, and time and resources[1]. As technological advances modify the standard implementation approaches for health-related research, it becomes increasingly necessary to be comfortable with computers and the internet, to be able to participate in research. One wonders how much inclination toward technology (technophilia) and openness to research participation (ORP) co-vary, and what patient factors relate to technophilia. Although the scholarly and general literature occasionally mention the term technophilia, its theoretical basis is underdeveloped and the construct is seldom measured directly. Considering both technophilia and ORP is important in a practical sense to increase the efficiency of technology-enabled research. In particular, recruitment and longitudinal retention processes may be informed by measures of technophilia and ORP.

Efforts to promote healthy brain aging could also benefit from technology-enabled assessment or intervention, while expanding access and reducing costs[2]. Research in these areas will require large-study populations, long-term follow-up, and recruitment of pre-symptomatic and at-risk individuals[3]. Repeated laboratory or clinical evaluation creates unwelcome expense and subject burden, whereas including research procedures at home promotes clinical trial participation among potential study participants and caregivers[4]. For these reasons, disease prevention trials are likely to incorporate community- and home-based assessment technologies[5].

Data collection in community settings often prioritizes ecological validity at the expense of precision. In contrast, by deploying technologies which conform to individual's lifestyle and environment, clinical and translational investigations can benefit from intensive, unobtrusive measurement[6,7] in naturalistic settings with increased precision, reliability, and statistical power[8]. In addition, these methods should improve participant satisfaction and retention. Despite the methodological, analytical, and economic advantages of implementing these systems, practical considerations have limited their adoption in aging cohort studies and clinical trials.

By assessing technophilia and ORP we hope to bolster these efforts, facilitating the achievability and sustainability of disease prevention in aging populations. In this context, our primary study questions were: (i) How does technophilia relate to ORP; (ii) What demographic characteristics, health status indicators, or social factors inform the outcomes and relationship; and (iii) Can this research be used to optimize participation in technology-enabled community studies?

## Methods

### Sample and procedure

The Community Brain Health Survey was conducted in Co-op City, Bronx, New York, a large, urban cooperative housing development, using street-intercept interviews and temporary interview stations at community-based organizations. Eligibility criteria included age over 50, residence in Co-op City, and ability to understand and respond in English. Prior to initiating this project, a series of focus groups were held to ensure clarity of survey items, and to determine that final survey content was of community interest. We specifically received feedback that all or most interested Hispanic residents would be bilingual, and that Spanish translation and interviewers would not likely add to survey feasibility or generalizability in this community.

### Measures

Survey content was developed to inform the design and execution of future community-tailored preventative interventions. Items were selected from existing measures to assess research participation attitudes[9], community social cohesion[10], knowledge about Alzheimer's disease symptoms[11] and attitudes toward computers[12,13]. We also created new items to assess technology use and likelihood of participation in future brain health programming in Co-op City. Social cohesion was measured by four Likert-scaled items with response options ranging from 'strongly agree' (4) to 'strongly disagree' (1): People around here are willing to help their neighbors; This is a close-knit neighborhood; People in the neighborhood can be trusted; People in this neighborhood generally don't get along with each other (reverse coded). Items were summed to yield a scale score where high scores reflect higher reported social cohesion (theoretical range 4-16). Factor analysis supported the unidimensionality and internal consistency of the scale ($\alpha$=0.75).

Standard survey items were used to assess general health and demographic information. Education was defined as a binary variable of high school or less versus some college or greater. This divided the sample into two approximately equal parts, and allowed us to use only one dummy variable in the multivariable modeling.

### Statistical analyses

*Descriptive analyses*

Prior to analysis, data were cleaned and missing data were coded. To ensure that created variables were intuitively understandable, we recoded selected items so that higher scores reflected higher levels on the construct of interest. Descriptive statistics were used to examine item distributions, and to generate summary statistics on the demographic characteristics of the sample.

*Composite scores and regression modeling*

Factor analysis was used to evaluate the dimensionality of items related to technophilia and ORP and created factor scores. To assess predictors or correlates of technophilia, we examined univariate regressions to identify relevant covariates, and then ran one final model to identify covariates which had an independent association with technophilia. We then addressed our primary research questions using hierarchical linear regression modeling. This framework began with univariate regressions on ORP to select statistically important covariates by domain (sociodemographic, health-related, and social factors), using a type I error rate of 0.10 for variable selection for subsequent models. We then evaluated the independent contribution of those selected covariates in a multivariable model to evaluate the relationship between technophilia and ORP, after adjusting for significant covariates from each domain, and then with all significant covariates for all domains represented. In this multivariable model, a type I error rate of 0.05 was used. Finally, we examined the interaction of main effects with technophilia in predicting ORP.

## Results

### Sample

The sample included 214 individuals, with a mean age of 70.9 years (SD=9.57, range 50-94 years). Respondents lived in Co-op City for an average of 25 years (SD=13.0, range 1-43 years). 77 percent of the sample was female, and the ethnicity of the sample was diverse, including 58% African-Americans, 27% White, 12% Hispanic. The sample included 93 persons with a high school education or less (43%), and 121 with some college education or greater (57%); 29 percent were diabetic.

Approximately 61% (n=131) of the sample reported any experience with computers. Per protocol, only individuals with computer experience were asked the items that went into the technophilia index. Those participants reporting that they had experience with computers were more likely to be younger; college educated; not widowed; and have a higher body mass index. The two subsamples were comparable on all other measured factors (*Table 1*).

### Technophilia and ORP

206 participants of the overall sample had complete data for research participation items. Of the 131

*Table 1. A comparison of the group with and without computer experience. Means are shown for continuous variables, proportions for dichotomous/dummy ones; SD=Standard deviation; *: 0=High school or less, 1=Some college or more; AD=Alzheimer's disease; CI=Confidence Interval*

| Parameter | All participants | | Computer experience: With | Computer experience: Without | Test | Test statistic | Odds ratio (OR) | P of OR | 95% CI of OR |
|---|---|---|---|---|---|---|---|---|---|
| | Mean±SD | 95% CI of mean | Mean±SD | Mean±SD | | | | | |
| ***Demographics*** | | | | | | | | | |
| Age, years | 70.91±9.57 | 69.62-72.20 | 67.52±8.40 | 72.30±8.90 | F | 0.00 | 0.89 | 0.00 | 8.86-0.93 |
| Gender: 1=♂, 2=♀ | 1.77±0.42 | | 1.78±0.42 | 1.76±0.43 | $X^2$ | 0.74 | 1.12 | 0.74 | 0.58-2.14 |
| Education* | 0.57±0.50 | | 0.66±0.47 | 0.41±0.49 | $X^2$ | 0.00 | 2.85 | 0.00 | 1.61-5.03 |
| ***Ethnicity*** | | | | | | | | | |
| Caucasian | 0.28±0.03 | | 0.24±0.43 | 0.33±0.47 | $X^2$ | 0.16 | 0.46 | 0.38 | 0.08-2.56 |
| Afro-American | 0.57±0.03 | | 0.60±0.49 | 0.53±0.50 | $X^2$ | 0.29 | 0.72 | 0.70 | 0.13-3.86 |
| Hispanic | 0.12±0.22 | | | | | | 0.64 | 0.63 | 0.10-3.95 |
| ***Marital status*** | | | | | | | | | |
| Married/cohabiting | 0.26±0.44 | | 0.25±0.44 | 0.27±0.44 | $X^2$ | 0.86 | 0.52 | 0.17 | 0.21-1.32 |
| Separated/divorced | 0.24±0.43 | | 0.30±0.46 | 0.14±0.35 | $X^2$ | 0.01 | 1.13 | 0.82 | 0.42-3.05 |
| Widowed | 0.34±0.47 | | 0.25±0.43 | 0.48±0.50 | $X^2$ | 0.00 | 0.28 | 0.01 | 0.11-0.67 |
| ***Health status*** | | | | | | | | | |
| Body mass index | 28.01±5.22 | 27.29-28.72 | 28.97±5.48 | 26.48±4.39 | F | 0.00 | 1.11 | 0.00 | 1.04-1.18 |
| Global health | 3.16±0.99 | 3.03-3.30 | 3.24±0.97 | 3.04±1.01 | F | 0.13 | 1.24 | 0.13 | 0.94-1.65 |
| Last year health changes | 3.18±0.93 | 3.06-3.31 | 3.27±0.95 | 3.05±0.88 | F | 0.00 | 1.30 | 0.10 | 0.96-1.70 |
| Has diabetes | 0.20±0.45 | 0.23-0.35 | 0.30±0.46 | 0.27±0.45 | $X^2$ | 0.60 | 1.16 | 0.64 | 0.62-2.10 |
| ***Social factors*** | | | | | | | | | |
| Social cohesion | 11.80±1.73 | 11.57-12.00 | 11.80±1.68 | 11.72±1.82 | F | 0.50 | 1.06 | 0.53 | 0.53-1.20 |
| Living in Co-op city, yrs | 24.90±13.03 | 23.16-26.60 | 24.90±12.50 | 24.88±13.85 | F | 0.90 | 1.00 | 0.97 | 0.98-1.00 |
| ***AD factors*** | | | | | | | | | |
| AD Risk | 3.90±1.91 | 3.7-4.21 | 4.0±1.93 | 3.86±1.90 | F | 0.50 | 1.04 | 0.55 | 0.90-1.20 |
| AD | 8.80±2.52 | 8.54-9.22 | 8.90±2.46 | 8.77±2.63 | F | 0.60 | 1.03 | 0.62 | 0.92-1.10 |

with computer experience, 129 had complete data for the technology use and attitude items. These data were used for factor analysis, as detailed below.

**Factor structure**

The factor analysis of ORP items suggested two possible options for creating subscale scores. The unrotated factor solution had two factors with eigenvalues greater than 1.0, with all 8 items loading >0.30 in the first factor which explained 68% of the variance, and 5 of the 8 items loading >0.30 in the second factor which explained 32% of the variance. A Varimax rotation yielded two factors, each with three items loading >0.30: factor 1 appeared to reflect perceived benefits of research and explained 51% of the variance, while factor 2 appeared to reflect perceived intrusiveness of research and explained 41% of the variance. We decided to utilize only the first unrotated factor as the ORP score because it seemed to reflect the theoretical content best (i.e., utilized all of the items) and it explained a substantial amount of variance. This scale score demonstrated strong internal consistency ($\alpha$=0.73), and no item substantially reduced the scale's internal consistency reliability, and all the items appeared to contribute meaningfully to the total scores, with item-test correlations ranging from 0.53-0.66. Mean score was 12.9 with a standard deviation of 1.6 (range 7.7-16.7).

The unrotated factor analysis of the technophilia items supported the unidimensionality of the combined technology use and attitude construct, with only one factor having an eigenvalue greater than one. A Varimax rotation yielded two factors which appeared to distinguish technology use from attitude, albeit imperfectly. The scale derived from the unrotated factor solution contained 10 items that were internally consistent ($\alpha$=0.72), and all items appeared to contribute meaningfully to the total scores, with item-test correlations ranging from 0.25-0.63. Further, the deleted alpha coefficients revealed that two items substantially reduced the scale's internal consistency reliability when removed: the items related to using the internet to access health information and email use. Mean technophilia

*Table 2. Factor structure for the research participation and technophilia scales*

| Scale items | Response options and range | Factor loading |
|---|---|---|
| ***Research participation scale – Eigenvalue 2.297*** | | |
| Being a research participant takes too much time | Strongly agree (1) to strongly disagree (4) | 0.4705 |
| Researchers ask people to take too many tests and answer too many questions | Strongly agree (1) to strongly disagree (4) | 0.5042 |
| Research is an invasion of privacy | Strongly agree (1) to strongly disagree (4) | 0.4456 |
| Research can help improve healthcare and other services people receive | Strongly agree (4) to strongly disagree (1) | 0.7058 |
| Research benefits your community | Strongly agree (4) to strongly disagree (1) | 0.7240 |
| If it might benefit me personally, I would encourage community organizations and researchers to share my personal information with each other | Strongly agree (4) to strongly disagree (1) | 0.4964 |
| If healthy-brain aging programs are offered in Co-op city, how likely are you to participate? | Very likely (4) to very unlikely (1) | 0.4526 |
| If a 5 min. memory screening test for Alzheimer's is offered in Co-op City, how likely are you to participate? | Very likely (4) to very unlikely (1) | 0.3860 |
| ***Technophilia scale – Eigenvalue 2.065*** | | |
| I feel comfortable with computers | Strongly agree (4) to strongly disagree (1) | 0.6192 |
| Learning about computers is a worthwhile and necessary activity | Strongly agree (4) to strongly disagree (1) | 0.4636 |
| In the past, computers have made my everyday life far simpler | Strongly agree (4) to strongly disagree (1) | 0.4492 |
| I usually get frustrated when using a computer | Strongly agree (1) to strongly disagree (4) | 0.3555 |
| How often do you search for health information on the internet? | Every day (5) to never (1) | 0.6048 |
| How often do you communicate with a healthcare provider by email or internet? | Every day (5) to never (1) | 0.4871 |
| How often do you use email? | Every day (5) to never (1) | 0.4143 |
| How often do you use a digital camera? | Every day (5) to never (1) | 0.3062 |
| How often do you use a PDA or mobile device? | Every day (5) to never (1) | 0.3665 |

score was 10.5 with a standard deviation of 2.8 (range 6.5-16.5) (*Table 2*).

*Table 3. Descriptive statistics of research participation and technophilia scale scores*

| Statistic | Research participation (n=206) | Technophilia (n=129) |
|---|---|---|
| Mean ± standard deviation | 12.9±1.6 | 12.0±3.1 |
| Median (range) | 12.93 (7.74-16.74) | 12.58 (6.05-19.24) |
| Skewness | 0.16 | -0.03 |
| Kurtosis | 3.25 | 2.19 |
| Alpha reliability | 0.73 | 0.71 |
| Average inter-item correlation | 0.25 | 0.18 |

**External validity**

In addition to the transparent face validity of the scales, we sought to confirm the external validity of the ORP and technophilia scales. We thus examined Pearson correlation coefficients among variables that would be expected to co-vary with each construct (convergent validity) or not be related to the variable (divergent validity) (*Table 3*).

*External validity hypotheses for ORP*

We expected that scores on the ORP scale would be moderately correlated (i.e., a moderate size effect) with one's reported likelihood of participating in lifestyle intervention programs (sum of lifestyle program items). Finally, we expected that people with higher reported social cohesion would also score higher on the ORP scale, but that this association would be small as these are different constructs. These hypotheses were confirmed, with a moderate correlation ($r=0.36$, $p\leq 0.001$) between ORP and reported likelihood of lifestyle intervention program participation, and small associations with reported social cohesion ($r=0.24$, $p\leq 0.001$).

*External validity hypotheses for technophilia*

We expected that technophilia would be moderately and positively associated with having access to a computer at home, and negatively associated with not having access to a computer. We expected that it would be uncorrelated with social cohesion as the two constructs are not theoretically related. Our analyses also provided preliminary support for the construct validity of the technophilia scale. Technophilia was moderately associated with having access to a computer at home ($r=0.50$, $p\leq 0.001$), negatively associated as a small effect with having no access to a computer ($r=-0.21$, $p=0.02$), and unrelated to social cohesion ($r=0.09$, $p=0.36$). There was a small association between technophilia and reported likelihood of participating in lifestyle intervention programs ($r=0.18$, $p=0.04$), specifically with participating in physical exercise programs.

**Correlates of technophilia**

Univariate regression modeling revealed that technophilia was associated with younger age, not being widowed, having a college education, and having better overall health (*Table 4*). In a multivariate model with all of these significant covariates considered simultaneously, only

*Table 4. Construct-validity correlations for both research participation and technophilia scales; ****=p<0.0001; ***=p<0.001; **=p<0.01; *=p<0.05; -=p>0.10 (not significant)*

| Construct-validity parameter | | r |
|---|---|---|
| ***Correlations with research participation*** | | |
| Willingness to participate in brain-health lifestyle activities (sum) | | 0.36**** |
| Willingness to participate in a brain-health intervention program consisting of… | Thinking or memory training | 0.23*** |
| | Physical exercise | 0.26*** |
| | Nutrition | 0.22*** |
| | Social activities | 0.32**** |
| Likelihood of participating in research involving… | Only healthy behaviors (physical activity, nutrition, social engagement) | - |
| | Taking medications | - |
| | Medication to prevent or delay Alzheimer's | 0.22*** |
| | Social cohesion | 0.24*** |
| ***Correlations with technophilia*** | | |
| Typically used a computer at home | | 0.52**** |
| Does not have access to a computer | | -0.23** |
| Internet purchase of health related goods or services | | 0.26** |
| Frequency of using social networking tool (Facebook, Twitter, etc.) | | 0.27** |

younger age (p=0.02) and better self-reported health (p=0.01) remained statistically significant.

**Technophilia's relation to ORP**

Univariate regressions predicting ORP suggested that the sociodemographic factors associated with ORP were younger age, female gender, and having a college education; the correlated health status factors were better overall health and better health compared to a year ago; and the correlated social factors were having a stronger sense of social cohesion and a shorter duration of living in Co-op City (*Table 5*). Technophilia was positively associated with ORP in the univariate regression model (ß=0.12, p=0.02), accounting for about 3% of the variance (first model of *Table 6*).

Results of the hierarchical multivariable model suggested that gender, health change from a year ago, social cohesion, and duration of living in Co-op city were significant covariates in the domain-specific models, but when entered together in the full model, only social cohesion remained significant (Adjusted $R^2$=0.15) (*Table 6*). Further, the hierarchical modeling suggested that the relationship between ORP and technophilia was

*Table 5. Univariate regressions of factors in the prediction of technophilia*

| Factor | | β | $R^2$ | Adj-$r^2$ | t | 95% Confidence Interval | p | n |
|---|---|---|---|---|---|---|---|---|
| ***Demographics*** | | | | | | | | |
| Age | | -0.10 | 0.07 | 0.06 | -3.08 | -0.16- -0.03 | 0.003 | 129 |
| Gender | | -0.34 | 0.00 | -0.01 | -0.52 | -1.65-0.96 | 0.602 | 129 |
| Ethnicity | Caucasian | 0.28 | 0.01 | -0.01 | 0.32 | -1.47-2.03 | 0.750 | 129 |
| | Afro-American | 0.68 | | | 0.89 | -0.84-2.21 | 0.375 | 129 |
| Marital status | Married/cohabiting | -0.12 | 0.06 | 0.03 | -0.14 | -1.73-1.49 | 0.887 | 128 |
| | Separated/divorced | -0.50 | | | -0.63 | -2.06-1.07 | 0.530 | 128 |
| | Widowed | -1.90 | | | -2.33 | -3.52- -0.29 | 0.022 | 128 |
| Education | | 1.08 | 0.03 | 0.02 | 1.89 | -0.05-2.22 | 0.062 | 129 |
| ***Health status*** | | | | | | | | |
| Body mass index | | -0.06 | 0.01 | 0.00 | -1.18 | -0.16-0.04 | 0.239 | 126 |
| Global health | | 0.63 | 0.04 | 0.03 | 2.27 | 0.08-1.18 | 0.025 | 129 |
| Last year's health changes | | 0.36 | 0.01 | 0.00 | 1.25 | -0.21-0.92 | 0.214 | 129 |
| Diabetes | | -0.15 | 0.00 | -0.01 | -0.26 | -1.34-1.03 | 0.797 | 129 |
| ***Social factors*** | | | | | | | | |
| Social cohesion | | 0.22 | 0.01 | 0.01 | 1.33 | -0.11-0.56 | 0.188 | 121 |
| Years in Co-op city | | -0.01 | 0.00 | -0.01 | -0.28 | -0.05-0.04 | 0.780 | 128 |
| ***Alzheimer's disease (AD) related factors*** | | | | | | | | |
| Risk knowledge | | -0.11 | 0.01 | 0.00 | -0.80 | -0.40-0.17 | 0.424 | 129 |
| Disease knowledge | | -0.03 | 0.00 | -0.01 | -0.31 | -2.26-0.19 | 0.756 | 129 |
| Family member has AD | | -1.32 | 0.04 | 0.04 | -2.39 | -2.42- -0.23 | 0.018 | 128 |
| Educational interest | Memory training | 0.35 | 0.00 | -0.01 | 0.44 | -1.22-1.91 | 0.664 | 129 |
| | Physical exercise | 0.81 | 0.01 | 0.00 | 1.23 | -0.49-2.10 | 0.220 | 129 |
| | Nutrition | 0.32 | 0.00 | -0.01 | 0.49 | -0.98-1.62 | 0.627 | 129 |
| | Social activities | 0.88 | 0.02 | 0.01 | 1.42 | -0.35-2.10 | 1.420 | 129 |
| ***Computer access*** | | | | | | | | |
| At home | | 3.77 | 0.27 | 0.26 | 6.86 | 2.68-4.86 | 0.000 | 129 |
| At friend's/family member's home | | -1.14 | 0,01 | 0.00 | -0.80 | -3.95-1.67 | 0.424 | 129 |
| At work | | -0.45 | 0.00 | 0.00 | -0.77 | -1.62-0.71 | 0.441 | 129 |
| At library | | 0.35 | 0.00 | -0.01 | 0.36 | -1.59-2.30 | 0.719 | 129 |
| No regular access | | -4.68 | 0.05 | 0.04 | -2.64 | -8.20- -1.17 | 0.009 | 129 |
| ***Health and leisure related technology use*** | | | | | | | | |
| Purchasing health-related goods or services | | 1.27 | 0.07 | 0.06 | 3.09 | 0.46-2.08 | 0.002 | 129 |
| Social networking | | 0.33 | 0.07 | 0.06 | 3.10 | 0.12-0.54 | 0.002 | 129 |

*Table 6. Univariate regressions of factors in the prediction of research participation*

| Factor | | β | $R^2$ | Adj-$r^2$ | t | 95% confidence interval | p | n |
|---|---|---|---|---|---|---|---|---|
| ***Demographics*** | | | | | | | | |
| Age | | -0.02 | 0.02 | 0.01 | -2.00 | -0.04-0.00 | 0.047 | 206 |
| Gender | | 0.62 | 0.03 | 0.02 | 2.40 | 0.11-1.12 | 0.017 | 206 |
| Ethnicity | Caucasian | -0.54 | 0.01 | 0.00 | -1.55 | -1.22-0.15 | 0.124 | 206 |
| | Afro-American | -0.26 | | | -0.85 | -0.88-0.35 | 0.397 | |
| Marital status | Married/cohabiting | 0.15 | 0.01 | 0.00 | 0.43 | -0.54-0.83 | 0.670 | 205 |
| | Separated/divorced | 0.50 | | | 1.44 | -0.19-1.19 | 0.151 | |
| | Widowed | 0.17 | | | 0.52 | -0.48-0.82 | 0.520 | |
| Education | | 0.38 | 0.01 | 0.01 | 1.74 | -0.05- -0.05 | 0.083 | 206 |
| ***Health status*** | | | | | | | | |
| Body mass index | | 0.00 | 0.00 | -0.01 | -0.10 | -0.04-0.04 | 0.924 | 201 |
| Global health | | 0.23 | 0.02 | 0.02 | 2.09 | 0.01-0.44 | 0.038 | 206 |
| Last year's health changes | | 0.27 | 0.03 | 0.02 | 2.37 | 0.05-0.50 | 0.019 | 206 |
| Diabetes | | -0.22 | 0.00 | 0.00 | -0.91 | -0.69-0.25 | 0.365 | 205 |
| ***Social factors*** | | | | | | | | |
| Social cohesion | | 0.21 | 0.06 | 0.05 | 3.40 | 0.09-0.34 | 0.001 | 192 |
| Years in Co-op city | | -0.02 | 0.02 | 0.02 | -2.27 | -0.04-0.00 | 0.025 | 205 |
| ***Alzheimer's disease related factors*** | | | | | | | | |
| Risk knowledge | | 0.14 | 0.03 | 0.02 | 2.45 | 0.03-0.25 | 0.015 | 206 |
| Disease knowledge | | 0.13 | 0.04 | 0.04 | 2.98 | 0.04-0.21 | 0.003 | 206 |

not mediated by any of the sociodemographic, health status, or social factors covariates. That is, it remained significant despite adding these classes of covariates to the model[14]. The relationship was, however, slightly attenuated by these factors, with the parameter estimate somewhat smaller when these covariates were added to the model (ß=0.10 as compared to 0.12, $p<0.05$ as compared to 0.02). The interaction between social cohesion and technophilia was not statistically significant (ß=-0.01, p=0.75).

## Discussion

In this community survey of adults over age 50, we assessed aging adults' inclination to use, value, and desire technology (technophilia), as well as openness to participate in research related to healthy brain aging. We found that technophilia was a consistent predictor of ORP, and that while a number of demographic and health-related factors were related to both technophilia and research participation, only social cohesion added additional predictive ability in our final multivariate model. These findings have implications for recruitment, feasibility, and understanding bias in disease prevention trials, as well as other clinical studies involving older adults and technology.

We expected technophilia to relate to ORP, as each may reflect common neurobehavioral inclinations within individuals, for example novelty-seeking, early-adoption, and trust in progress. Although we are not aware of any studies which directly evaluate the neural basis underlying these traits, we speculate the involvement of motivation-reward and habit-formation systems. As neuroscience progresses to elucidate such brain-behavioral associations, we suggest that further empirical study of technophilia and ORP can translate into real-world benefits.

In the context of disease prevention, our results suggest that studies requiring technology use may attract individuals who are also open to research participation. Our study suggests that an effective way to optimize participation in technology-enabled community studies would be to enhance the social cohesion of a community as a way to support large-scale community-based studies. Thus, for example, introducing organized activities and groups such as group lectures, craft groups, religious services, group excursions to cultural exhibits, etc. would help to build social cohesion which might be a useful precursor to implementing a more health-focused intervention. Conversely, aging communities which foster or aspire toward social cohesion, including retirement and assisted-living residences, would be appropriate engagement partners. Initial outreach could include a baseline community survey including measures of technophilia and ORP.

This study provides useful data for supporting technology-enabled research. It does have some limitations, however, which should be recognized. First, the convenience sample interviewed may not be representative of Co-op City as a whole, much less other aging communities or aging individuals not affiliated with organizational or communal structures. On the other hand, given the consistent association between technophilia and ORP, potential selection biases created by technology-related inclusion criteria may overlap with those routinely created by enrolling individuals open to research participation, per se. There are significant disparities among ethnic and socioeconomic groups in terms of research participation, and similar concerns apply to access to health technologies which play an increasingly prominent role in the healthcare landscape. Although we did not find that ethnicity was related to technophilia or ORP in our Co-op City sample, our findings may be used to address potential sources of health disparities among some underrepresented constituencies.

For example, a targeted intervention to overcome specific barriers to research participation may have an amplified effect in those with higher technophilia, and perhaps should be delivered using contemporary communication technologies. Moreover, if education regarding the potential benefits of research participation was integrated with the efforts and significant resources allocated to expand access to health technologies, broader and more inclusive study samples may be achieved.

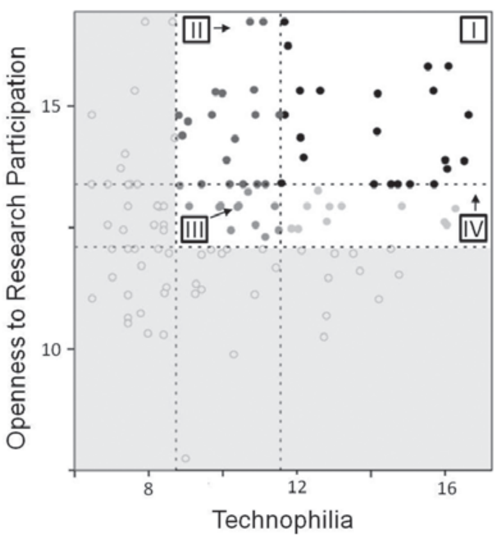


*Figure 1. Scatterplot of Openness to Research Participation (ORP) and technophilia; Segmentation using tertile cutoffs identifies subgroups hypothesized to have distinct likelihoods to enroll and complete a technology-enabled disease prevention protocol. Quadrant I: best candidates for ORP; Quadrant II: a technology adoption intervention should be offered; Quadrant III: need for both technology-adoption and research-promoting interventions; Quadrant IV: educational media highlighting research benefits and other inducements are needed. Shaded area: Individuals remain eligible to enroll in a research project but are not targeted specifically*

Figure 1 outlines a data-driven recruitment and retention strategy based on baseline technophilia and ORP scores. For a technology-enabled study, individuals in quadrant I are ideal candidates. For those in quadrant II, interventions to promote technophilia may be effective in increasing participation. Those in quadrant IV could be induced to participate by highlighting the benefits of research and addressing potential concerns. In this framework, targeted interventions could increase the likelihood of enrolling and completing a technology-enabled protocol. This approach also focuses study resources on individuals more likely to participate.

Second, our technophilia and ORP scale is relatively early in its development. Future research might develop more items using focus groups and community feedback to cover a broader spectrum of technology use and types of research. We believe our instruments could be further improved by expanding the attitude items to address technologies other than computers. We also anticipate that it will be increasingly important to focus specifically on health technologies, i.e. use of generic technologies for the express purpose of health promotion, communication, or education, as well as hardware and software solutions designed specifically for health. Exploratory factory analyses (not shown) suggest that technology use and attitude could be ascertained as distinct constructs. While the unified technophilia construct incorporates both and may be relevant as a reliable correlate of ORP, differential technology adoption interventions may be appropriate for those whose technophilia is limited specifically by either low technology use or negative attitude. Similarly, it appears that there may be dissociable factors underlying ORP; namely, overall perceived benefit of research could be distinguished from acceptability of increasing intrusiveness of biomedical procedures with more-than-minimal risk and other study demands. These possibilities would be best studied empirically with refined questionnaires in a larger-scale nationwide study that uses a sampling method to ensure representation across ethnic groups and socioeconomic status.

While it is expected that applications of technology can confer tangible health benefit, it should be recognized that they can also have neutral or negative effects on health and behavior. One could anticipate interventions for maladaptive technophiles who could benefit from specific adoption of health technologies or technology-related goal setting. Research participation itself could have beneficial effects on health outcomes, at least from the societal point of view. Thus, refined technophilia and ORP measures would enable investigators to personalize efforts to promote health through technology, including improving research participation. The work presented herein is applicable to aging research in particular, but can also inform studies and applications of technology to generate broad clinical and public health value.

## Conclusion

Technophilia was a consistent predictor of ORP; and while a number of demographic and health-related factors were related to both technophilia and research participation, only social cohesion added additional predictive ability in our final multivariate model. An effective way to optimize participation in technology-enabled community studies would be to enhance the social cohesion of a community as a way to support large-scale community-based studies. Introducing organized activities and groups would thus not only help to build social cohesion, but might also facilitate health-focused interventions and research.

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