

Original Research Article

Uses and Gratifications Sought From Mobile Phones and Loneliness Among Japanese Midlife and Older Adults: A Mediation Analysis

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Abstract

Background and Objectives: Mobile phone use is increasing among older adults, yet few studies have examined how the various purposes for which mobile phones are used affect loneliness and through what mechanisms. This study aims to address the gap by examining if different uses and gratifications of mobile phone are associated with loneliness and whether there is a mediation effect through face-to-face social interaction.

Research Design and Methods: Participants included 1,318 mobile phone users drawn from a national probability sample of Japanese middle-aged (65% aged 40–64 years) and older adults (35% aged 65 years or older) in 2011. Ordinary Least Squares regression and mediation analyses were used.

Results: Regression analyses revealed that using a mobile phone for sociability purposes was associated with decreased loneliness ($b = -0.10, p < .001$), while using it for the purposes of entertainment/passing time was associated with increased loneliness ($b = 0.04, p < .01$); some effects varied by age and mobile phone feature use. Further, sociability was associated with increased face-to-face social interaction, which was, in turn, associated with reduced loneliness. Passing time, however, was related to reduced face-to-face interaction and, in turn, an increased sense of loneliness.

Discussion and Implications: Although it is not possible to determine causality from this cross-sectional design, it is possible that the various purposes for which mobile phones are used (specifically sociability and passing time) partially affect loneliness through their effects on either increasing or decreasing face-to-face social interaction. Recommendations for enhancing positive and reducing negative effects of mobile phone usage are discussed.

Translational significance: Whether mobile phones are mitigating or exacerbating a sense of loneliness among midlife and older adults may depend on how they are using their phones. Midlife and older adults who use mobile phones for social reasons report lower levels of loneliness, in part due to greater face-to-face social interaction. In contrast, midlife and older adults who use mobile phones to pass time report higher levels of loneliness. We should pay attention to the functions of mobile phones that may distract from quality social interaction, which might increase levels of loneliness among middle-aged and older adults.

Keywords: Consumer preferences, Information technology, Loneliness, Social isolation

Recent decades have witnessed the rapid development and proliferation of mobile phone use in far reaches of the globe. As technology plays an increasingly central role in facilitating social connections and social cohesion, the question arises: Does mobile phone use enrich the lives of older adults by facilitating better interpersonal relationships or does it facilitate social isolation and loneliness? The answer remains widely debated. Turkle (2012) and Rotondi, Stanca, and Tomasuolo (2017) suggest that the intrusiveness of many mobile devices can reduce the quality and level of satisfaction people attribute to face-to-face social interaction. However, others have suggested that mobile phones facilitate social interaction (albeit non-face-to-face) and therefore can reduce loneliness, particularly for socially isolated older adults (Cacioppo, Cacioppo, Capitanio, & Cole, 2015; Petersen, Thielke, Austin, & Kaye, 2016). Although older adults as a subpopulation may be viewed generally as late adopters to technology, they have been obtaining mobile phones at growing rates over time (Joe & Demiris, 2013).

There is a need for research that disentangles this paradox of being more connected than ever yet feeling alone, specifically by way of understanding the mechanisms through which mobile phone use is associated with loneliness (Chopik, 2016; Jin & Park, 2013). The gap in research is particularly salient among midlife and older adults, as most studies focus on younger adults and adolescents (Hoffner, Lee, & Park, 2016; Öztunç, 2013). Japan offers an excellent opportunity to explore questions around mobile phone use and loneliness among older adults. Not only is Japan known for its trailblazing technology adoption, but it is also one of the world's most rapidly aging societies and has been highlighted in popular media as facing a growing loneliness epidemic (Onishinov, 2017).

First, with regard to technology, the mobile phone, or "*keitai denwa*" (*keitai* for short), is indispensable in Japanese society today and has been since the mid-nineties. The term "mobile phone" can refer to a broad range of wireless handheld devices from the basic mobile phone, which is a device typically only capable of voice calling and text messaging, to the smartphone, which refers to iPhone and Android-type handheld computers. From 1999 until recently, Japan has been the world leader in mobile phone technology, when the Web-service/portal known as "i-mode" first appeared on Japanese *keitai* (Akimoto, 2011; Funk, 2001). I-mode is a mobile phone service that enables users to view Web pages, send e-mail, and offers a variety of services including online banking, social media, news updates, airline and concert ticket reservations, and restaurant reviews. Thus, the mobile phone culture in Japan in the early 2000's was far more advanced than the mobile phone culture in the United States and Europe at that time. In fact, it took some time for smartphones to take off in Japan, as i-mode-compatible phones already had a lot

of the functions of smartphones (Akimoto, 2011; Smith, 2015). Minagawa et al. (2014) report that in 2010, 78% of Japanese adults between the ages of 60 and 64 owned a cell phone, however, these authors do not differentiate between the types of phone owned.

Second, when it comes to the issue of aging and loneliness, despite the overall exceptional physical health of older adults in Japan relative to other developed nations (see Murray, 2011), a confluence of cultural, social, and demographic factors place Japanese elders at particularly high risk of suffering from feelings of loneliness. These factors include declining marriage rates, a shift away from intergenerational households, an emerging social norm of independence in old age, and the peculiarities of a corporate system that often requires people to live lives of solitude (Minagawa et al., 2014; Tiefenbach & Kohlbacher, 2017). Existing research in Japan reports that the prevalence of loneliness among Japanese older adults ranges between 10% and 29% (Saito, Kai, & Takizawa, 2012). While there are many other cultures that also face high loneliness rates (e.g., Yang & Victor, 2011), Japan has also seen increasing rates of *kodokushi* or "solitary death", where elderly people in particular die alone in their homes, leading to widespread fear and anxiety around being alone (Tiefenbach & Kohlbacher, 2017).

While some research has examined associations between mobile phone use and *depressive symptoms* among Japanese older adults (Minagawa et al., 2014), no study to date has examined associations between particular uses and gratifications of mobile phones with *loneliness* among the Japanese older adult population. Thus, the current study uses a sample of 1,318 mobile phone users drawn from a national probability sample of Japanese middle-aged (age 40–64) and (age 65 or older) older adults in 2011 to accomplish three primary goals. First, to examine the different ways in which Japanese midlife and older adults use mobile phones (i.e., uses and gratifications). Second, to explore relationship between how individuals use mobile phones and loneliness, and whether this relationship differs for middle-aged and older adults. Third, the authors assess whether face-to-face social interaction mediates these relationships. Building on literature about technology use among older adults, this study offers a novel perspective by integrating considerations of uses and gratifications of the mobile phone, with the goal of understanding how the use of such devices can potentially be detrimental toward, or protective of, middle-aged and older adults' subjective sense of loneliness.

Empirical and Theoretical Framework

Loneliness and Age

Yang and Victor (2011), in a study across 25 different countries, found that the prevalence of loneliness increases with age. As individuals age, the risk of loneliness may increase when adult children move away or socially withdraw, a

role transition (such as retirement) occurs, or friends and spouses become institutionalized, too physically limited to engage in meaningful interaction, or die (Queen, Stawski, Ryan, & Smith, 2014). An increasing body of knowledge on social isolation and loneliness suggests social relationships represent an integral part of older adults' overall health and well-being (Coyle & Dugan, 2012; Luo, Hawkey, Waite, & Cacioppo, 2012), even suggesting that social isolation carries a mortality risk similar to that of heavy smoking (Holt-Lunstad, Smith, & Layton, 2010). However, it is important to point out that loneliness, which is the focus of the current study, has less to do with the actual state of being alone and more to do with perceived gaps between actual and desired social integration. Feeling alienated by others or a lack of intimacy in one's close relationships, for example, may contribute to a pervasive sense of loneliness, thus social isolation and loneliness represent distinct concepts.

Mobile Phone Use Among Middle-Aged and Older Adults

While the generational divide in mobile phone adoption may be shifting (Gilleard, Jones, & Higgs, 2015; Taipale, Wilksa, & Gilleard, 2018), age remains strongly, negatively correlated with technology adoption, including when comparing middle-aged adults' use with older adults' use (Carr, Gotlieb, Lee, & Shah, 2012; Van Deursen & Van Dijk, 2014). Magsamen-Conrad, Dowd, Abuljadail, Alsulaiman, and Shareefi (2015) found that, compared with older adults, middle-aged adults are more active users of tablets to track healthy lifestyle habits, maintain social communication, prevent accidents, and seek information. Compared with their younger counterparts, older adults are also less likely to be active users of the Internet (Friemel, 2016; Zickuhr, 2013). This research is in line with a more general body of research that has pointed to older adults' general aversion to, and negative attitudes about, technology relative to their younger counterparts (Chen & Chan, 2011).

Another body of literature, however, suggests that older adults are not, in fact, technology averse and hold technologies in high regard under certain circumstances (Conci, Pianesi, & Zancanaro, 2009; Kohlbacher & Hang, 2011). This discrepancy may be related to the fact that older adults do not maintain universal perspectives about technology; their attitudes seem to be dependent on how a given technology is leveraged to shape their daily life. In fact, a recent study suggests that typologies of attitudes toward technologies emerge for older adults based on values, usage, and sociodemographics (Vicente & Lopes, 2016).

Nonetheless, when it comes to mobile phone use in particular (as opposed to technology more broadly), compared with younger users, older adults tend to be more likely to use mobile phones for their original design purpose—that is, making calls for instrumental reasons such as arranging plans and other instrumental activities rather than playing games, surfing the internet, or using auxiliary applications (Magsamen-Conrad et al., 2015).

Uses and Gratification Theory

Uses and Gratifications Theory is a theory rooted in the communication studies literature that has been applied widely to many different types of media and technology. It provides a useful framework around why and how people actively seek out specific media to satisfy specific needs, in the case of this study, how individuals use their mobile phones (Katz, Blumler, & Gurevitch, 1973). Uses and Gratifications Theory posits that individuals are active agents (rather than passive recipients) of technology and media, that they deliberately choose technology that will satisfy certain desires and needs for gratification (e.g., knowledge, relaxation, social interactions/companionship, diversion, or escape), and they play an active role in interpreting and integrating technology into their own lives (McQuail, 2010; Severin & Tankard, 2000).

Previous uses and gratifications research has suggested several uses of mobile phones. Mobile phones serve instrumental purposes, such as facilitating business transactions or business-related conversations, as well as sociability purposes, where usage is motivated by the desire to socialize and connect with friends and family (Grellhesl & Punyanunt-Carter, 2012). Mobile phone usage can also be motivated by entertainment-seeking, passing time, or escaping an undesirable situation or event (Chen, Chan, & Tsang, 2014; Magsamen-Conrad et al., 2015). They may also be used for information-seeking (Papacharissi, 2011), organization of time, documents, and information (Ku, Chu, & Tseng, 2013); and for purposes of reassurance, whereby users maintain a sense of security and safety in case of an emergency (Gonzales, 2014; Leung & Wei, 2000). In this way, technology and more traditional means of communication and knowledge seeking (e.g., in-person social interactions) may compete against each other as means of satisfying individuals' desires and needs for gratification, however, the theory also clarifies that the needs served by a given technology constitutes but a segment of the wider range of human needs, and the degree to which they can be adequately met through the medium varies (Katz et al., 1973).

Compared with research focused on young adults, research about uses and gratifications of mobile phones specifically for older adults is more limited (Chen et al., 2014). Kubik (2009) found that usefulness and security are the two main motivators for mobile phone use among older adults. Building on the uses and gratifications of mobile phones, Kurniawan (2008) suggests that when used for purposes of organization, mobile phone features such as address books, alarm clocks, and reminders can be particularly useful for older adults as a way to retrieve phone numbers and addresses and as a reminder to take medications and to attend appointments. Nevertheless, research notes that it is important to acknowledge that older adults often use mobile phones as a means to serve multiple gratifications at once (Klimova & Maresova, 2016).

Social Interaction and Mobile Phone Use

There is an emerging body of literature examining the effects of the use of technology on face-to-face social interaction. Research has found that using mobile devices has a negative effect on both the quality and quantity of face-to-face social interaction (Drago, 2015; Elsobeihi & Abu Naser, 2017), and phone use leads to distraction, which undermines benefits of social interaction (Dwyer, Kushlev, & Dunn, 2017). However, Ictech (2014) found that smartphones can both disrupt and facilitate face-to-face social interaction, depending on how they are used and in what context. In summary, though there is evidence of both positive and negative effects of mobile phone usage on social connections, it is likely that some forms of use enhance, while others undermine the gratifications of face-to-face social interaction.

Based on the above theoretical and empirical evidence, the authors propose the following research questions: Do the uses and gratifications of mobile phones differ for Japanese midlife and older adults? How are the uses and gratifications of mobile phones related to loneliness; Do these relationships differ for Japanese midlife and older adults? And, is the relationship between certain uses and gratifications and loneliness explained by frequency of face-to-face social interaction?

Method

Data and Sample

Data for this study were derived from a 2011 national mail survey that collected data on cyber psychology, consumer behavior, and social networking in Japan among individuals aged 40 years and over. Survey developers contracted Central Research Services, a well-established Tokyo-based market and public-opinion survey firm to collect the data. Accessing the Japanese household registration data through local administrations, a nationwide mail survey was conducted using a two-stage stratified random sampling procedure. To ensure a good response rate, first prenotifications were sent by postcard, followed by a reminder postcard. A 500 JPY (USD 5) book coupon was sent as an incentive. The survey questionnaires were initially sent on February 24, 2011 and by March 11, 758 questionnaires were returned. Due to a major earthquake/tsunami that occurred on March 11, the questionnaire was resent on April 27. See discussion of this issue in the analytic strategy section. All questionnaires were collected by May 31, 2011.

A total of 1,575 completed surveys out of 5,000 mailed questionnaires were obtained for a response rate of 31.5%, which represents a higher than average response rate for a mail survey (Pew Research Center, 2015), particularly for one targeting older adults, given fears of scams and junk mail in this population (Sudbury & Simcock, 2010). The questionnaire was initially developed in English and then translated into Japanese. For a description of questionnaire pretest procedures and sample characteristics of the full sample, see Cheron and Kohlbacher (2018).

The respondents who reported that they own at least one mobile phone were included in the final sample, yielding a final sample size of 1,318 for the current analyses.

Measures

Dependent variable

A slightly adapted version of the De Jong Gierveld short loneliness scale (De Jong Gierveld & Van Tilburg, 2010) was used to measure loneliness in this study. This measure has been tested as a reliable and valid measurement instrument that is suitable for large surveys of the Japanese population (Broek, 2017; De Jong Gierveld et al., 2010). Items include: (1) there are many people I can trust completely, (2) there are enough people I feel close to, (3) I experience a general sense of emptiness, (4) I often feel rejected, (5) I miss having people around, and (6) there are plenty of people I can rely on when I have problems. In order to increase consistency within the survey and avoid answering fatigue, the survey developers chose to modify the original scale's response options to range from 1 (strongly disagree) to 7 (strongly agree), which were reverse scored as needed, and then averaged so that higher scores indicate higher levels of loneliness ($\alpha = .80$). Given that the original scale included three response options (no; more or less; yes) that were dichotomized to no = 0 and more or less/yes = 1 and then summed, the authors also tried dichotomizing response options in various ways, but found the Cronbach's α of such a scale to be weak at $\sim .63$, thus the average score approach was retained.

Independent variables

Key independent variables are the uses and gratifications of mobile phones and age group. Four uses and gratifications were derived from prior literature (Dimmick, Sikand, & Patterson, 1994; Leung & Wei, 2000; Mathur & Moschis, 1999) by the survey developers due to their potential relevancy to older adults and their applicability to mobile phones. These uses and gratifications included (1) *pass time* indicated the respondent uses their mobile phone for passing time, relaxation, or entertainment purposes; (2) *sociality* indicated the respondent uses their mobile phone to keep in touch with friends or relatives, or to get to know other people; (3) *reassurance* indicated the respondent uses their mobile phone to feel safe and secure in case of an emergency, and to be available to families and friends; and (4) *instrumentality* indicated the respondent uses their mobile phone to obtain news and information, schedule appointments, and coordinate activities. The response options for each item ranged from 1 (strongly disagree) to 7 (strongly agree), indicating the extent to which the respondent agreed that they used their phone in that way. Some of the uses and gratifications of mobile phones mentioned in the literature that were not included in the current survey are fashion/status, mobility, immediate access, and escape (Grellhesl & Punyanunt-Carter, 2012; Leung & Wei, 2000).

The authors were interested in comparing midlife adults and older adults in this study, and defined age as 40–64 and age 65 and over, respectively. Age 65 and older is the World Health Organization's definition of old age, which is widely accepted in Japan, and samples in research are often split at age 65 (Prieler & Kohlbacher, 2015). Also, the lifespan theory suggests that midlife begins at age 40, thus this age was adopted as our lower threshold (Lachman, 2015).

Mediator

Face-to-face social interaction was measured as an average of two statements: (1) I often get together with friends, neighbors or relatives and do things like go out together or visit in each other's homes, and (2) I often attend meetings or programs of groups, clubs or organizations that I belong to. These items were adopted from the Americans' Changing Lives Survey (ACL) and have been used in studies of the Japanese population (Sugisawa, Shibata, Hougham, Sugihara, & Liang, 2002). Responses were rated from 1 (strongly disagree) to 7 (strongly agree), with higher scores indicating more frequent contact. This was an adaptation from the original response scale which had ranged from 0 (none) to 10 (more than once a week). Again, this was done to increase consistency within the survey and to avoid answering fatigue.

Controls

Sociodemographic control variables included gender (0 = male, and 1 = female), education (0 = high school or less, 1 = college or more), marital status (0 = single/divorced/widowed, 1 = married), health conditions (0 = 0–1 chronic conditions, 1 = 2 or more number of chronic conditions), whether the participant has children (0 = has one or more child, 1 = no children), work status (0 = not working, 1 = currently working), and household income (1 = less than 2 million Yen, 1 = 2–4 million Yen, 2 = 4–6 million Yen...9 = more than 20 million Yen).

Three variables that characterize respondents' mobile phone use were included in analyses: (1) a dummy variable indicating whether respondents were *smartphone (iPhone/Android) users* or not, (2) a variable indicating how many *minutes per day respondents spend using their mobile phone*, with the following categories: less than 10 min (reference), 10–50 min, and 1 hr or more, and (3) a *mobile phone feature use index*. The index was created using questions that asked about the extent to which respondents use 14 different features of a mobile phone including: phone/calling, e-mail, website viewing, downloads, navigation, music, TV, games, voice/text, data transfer, pictures/movies, alarm clock/stopwatch, pedometer, and health apps. Response options included: 0 (never/phone does not have this feature), 1 (sometimes), 2 (1 day a week), 3 (2 to 3 days a week), 4 (every day). Responses were averaged to create an index for multivariate analyses that ranges from 0 to 4 with higher scores indicating more frequent use of a greater number of features. For the purposes of descriptive

and bivariate statistics, however, each of the 14 features are presented separately.

Finally, to assess whether the relationships being tested in the current paper were affected by the earthquake/tsunami mentioned prior, we included a dummy variable indicating whether the respondent *completed the survey before or after March 11 ("3-11")* in all analyses.

Analytic Strategy

First, the authors performed univariate analyses to assess the descriptive characteristics of the sample. Second, the authors conducted bivariate analyses (*t*-tests and chi-square analyses) to explore whether there were differences between midlife and older adults in the sample for all of the study variables. Next, Ordinary Least Squares (OLS) regression models were estimated to examine the relationship between the four uses and gratifications of mobile phones and loneliness, followed by a model where interaction terms between age group and uses and gratifications variables were added to test whether age moderated these relationships. Finally, to assess the mediating effect of face-to-face social interaction, direct and indirect effects were estimated using seemingly unrelated regression (SUR) models which estimate multiple regression models simultaneously, allowing all equations' error terms to be correlated. Per Zhao, Lynch, and Chen's (2010) mediation testing procedure, the models estimated simultaneously included: (1) a model where face-to-face social interaction (the mediator) was regressed on the focal uses and gratifications variable and (2) a model where loneliness was regressed on the focal use and gratification variables and face-to-face social interaction (the mediator). The coefficients from these models were then used to calculate indirect effects using the product of coefficients method (Zhao et al., 2010). Where *a* was the unstandardized coefficient of the predictor variable on the mediator and *b* was the unstandardized coefficient of the mediator on the outcome variable, the indirect effect was calculated as the product of these two terms ($a \times b$). The total effect was the sum of the indirect effects and the direct effect of the predictor variable on the outcome variable (i.e., $a \times b + c'$, where c' was the unstandardized coefficient of predictor variable on the outcome). The percentage of the overall effect that is direct or indirect is presented.

All independent variables, with the exception of 0/1-coded dummy variables, were grand mean centered for analysis, a practice that produces more stable estimates, helps to reduce multicollinearity, and provides consistency across models. All analyses were conducted using Stata IC 15.1.

Sensitivity analyses

A variety of sensitivity analyses were undertaken to be sure that models were properly specified. In order to do this, first, we tested two- and three-way interactions between the use and gratification variables and all control variables

included in models to explore whether the relationship between uses and gratifications and loneliness varied as a function of these variables. Only statistically significant interactions were included in final models.

Second, we wanted to test whether the relationships being tested in the mediation models were affected by the occurrence of the earthquake/tsunami (3–11), thus the authors ran all models described above separately for those respondents who were surveyed prior to the event occurring and those surveyed after. Also, given prior literature suggesting that antecedents of loneliness are known to differ between men and women (Dong & Chen, 2017), that childlessness may affect Japanese older adults' loneliness (Broek, 2017), and that the ways in which individuals use their phones (e.g., the type of phone, how often use phone, and extent of feature use) may affect levels of social interaction, uses and gratifications and loneliness, we stratified models by each of these variables to explore whether results varied. Finally, the authors tested whether results differed if loneliness was operationalized as two separate outcomes using the social and emotional loneliness subscales of the loneliness measure compared with the full scale as well as if face-to-face social interaction was measured using each item contained in the scale separately compared with the average of the two items. Results did not substantively differ from analyses presented (all results are available upon request).

Handling of missing data

For the variables used in the study, missing data ranged from 0.0% (age, gender) to 7% (household income). The multivariate imputation by chained equations (MICE) method (Van Buuren, Boshuizen, & Knook, 1999) of multiple multivariate data imputation was implemented to produce 20 complete data sets for the purposes of analyses. Results of multivariate analyses were combined using Rubin's rules.

Results

As can be seen in Table 1, the sample was majority female (51%), over half (59%) had an education of high school or less, 81% were married, 88% had at least one child, 66% were working, and almost half (48%) had at least one chronic condition. Seventy percent were age 40–64 and 30% were 65 or older. The average annual household income was 3.24, which falls between the 4–6 and 6–8 million Yen categories (equivalent to about \$52k–78k and \$78k–\$104k USD in 2011). All participants owned a mobile phone. About 4% of the sample were specifically smartphone users, over half the sample (54%) reported using their phone between 10 and 50 min per day, and the most frequently used mobile phone features were phone calls ($M = 2.74$), e-mail ($M = 2.42$), the alarm feature ($M = 1.54$), and pictures/movies ($M = 0.98$).

Bivariate analyses were performed (see Table 1) to examine whether there were age differences with regard to the study variables. Middle-aged adults were significantly more likely to report using their mobile phones for sociability and passing time than older adults in this sample, however there were no age differences in the extent to which they used mobile phones for reassurance or instrumentality purposes. Compared to the middle-aged sample, those aged 65 years and older had more frequent face-to-face social interaction, were more likely to be male, have lower levels of education, to have children, to not be working, to have lower household income, and to have more chronic conditions. Finally, older adults reported using their phone less time per day, and using all mobile phone features except for the pedometer (older adults used this more) and health apps (no significant difference) less frequently than their middle-aged counterparts.

Next, multiple regression analysis was used to explore whether any of the four uses and gratifications of mobile phones were associated with perceptions of loneliness (see Table 2, Model 1). Results indicated that using mobile phones for sociability purposes was negatively associated with loneliness ($b = -0.07$, $p < .001$) while using mobile phones for passing time purposes was positively associated with loneliness ($b = 0.04$, $p < .01$). However, there were no significant relationships between using mobile phones for reassurance or instrumentality purposes and loneliness. In the second model, interaction effects were added between use and gratifications variables and age group (see Table 2, Model 2). There was a significant interaction between sociability and age ($b = 0.07$, $p < .05$), indicating that sociability had a stronger negative effect on loneliness for midlife adults than for older adults. The interaction terms for passing time, reassurance, and instrumentality and age were not significant, however. Sensitivity analyses explored whether any of the control variables moderated relationships between uses and gratifications and loneliness and only one was found to be significant: the interaction between instrumentality and mobile phone feature use (also show in Table 2, Model 2). This interaction indicates that instrumentality was associated with greater loneliness when feature use was low and less loneliness when feature use was high.

Finally, mediation analyses were conducted to explore whether the relationship between certain use and gratification and loneliness was accounted for by frequency of face-to-face social interaction (see Table 3). Findings show that using mobile phones for passing time is associated with increased loneliness, $b = 0.06$, $p < .001$, and with decreased face-to-face social interaction, $b = -0.07$, $p < .01$. The effect of passing time on loneliness was reduced after controlling for face-to-face social interaction, $b = 0.04$, $p < .01$, with a significant indirect effect ($p < .01$) indicating partial mediation (31%). Using mobile phones for sociability was found to be associated with decreased loneliness, $b = -0.09$, $p < .001$, through its effect on increased face-to-face social

Table 1. Descriptive Statistics of Study Variables, by Age Group

	Full sample		Age 40–64	Age 65 and above	Test statistics
	%/Mean (SD)	Range	%/Mean (SD)	%/Mean (SD)	
Loneliness	3.09 (0.85)	1–7	3.11 (0.88)	3.04 (0.76)	
Sociability ^a	5.74 (1.23)	1–7	5.88 (1.08)	5.40 (1.45)	$t = 6.55^{***}$
Reassurance ^b	5.14 (1.48)	1–7	5.09 (1.47)	5.26 (1.50)	
Pass time ^c	2.48 (1.68)	1–7	2.72 (1.74)	1.88 (1.34)	$t = 8.43^{***}$
Instrumentality ^d	4.51 (1.66)	1–7	4.54 (1.63)	4.44 (1.73)	
Face-to-face social interaction	3.63 (1.31)	1–7	3.41 (1.27)	4.13 (1.29)	$t = -9.37^{***}$
Age					
40–64 years old	69.80%		-	-	
65 plus years old	30.20%		-	-	
Gender					$\chi^2 = 8.80^{**}$
Male	49.32%		46.63%	55.53%	
Female	50.68%		53.37%	44.47%	
Education					$\chi^2 = 59.86^{***}$
High school or less	58.91%		52.02%	75.00%	
College or more	41.09%		47.98%	25.00%	
Marital Status					
Single/divorced/widowed	18.98%		18.63%	19.80%	
Married	81.02%		81.37%	80.20%	
Childlessness					$\chi^2 = 29.75^{***}$
Has children	87.54%		84.28%	95.15%	
Does not have children	12.46%		15.72%	4.85%	
Work Status					$\chi^2 = 271.32^{***}$
Not currently working	34.20%		20.07%	67.18%	
Currently working	65.80%		79.93%	32.82%	
Household Income ^e	3.24 (1.75)	1–9	3.44 (1.75)	2.80 (1.67)	$t = 5.93^{***}$
Health					$\chi^2 = 87.01^{***}$
0 chronic conditions	51.91%		58.56	35.95	
1 chronic conditions	28.78%		28.38	29.73	
2 or more chronic conditions	19.32%		13.06	34.32	
Smartphone owner	4.25%		4.92%	2.65%	
Time/day using phone					$\chi^2 = 15.31^{***}$
Less than 10 min	21.14%		19.35%	25.33%	
10–50 min	54.37%		53.28%	56.92%	
1 hr or more	24.49%		27.36%	17.75%	
Extent to which use mobile phone feature ^f					
Phone/Calling	2.74 (1.41)	0–4	2.93 (1.30)	2.28 (1.56)	$t = 7.73^{***}$
E-mail	2.42 (1.62)	0–4	2.83 (1.45)	1.46 (1.57)	$t = 15.28^{***}$
Website Viewing	0.75 (1.30)	0–4	1.01 (1.44)	0.15 (0.58)	$t = 11.52^{***}$
Downloads	0.23 (0.61)	0–4	0.31 (0.69)	0.06 (0.28)	$t = 6.85^{***}$
Navigation	0.36 (0.77)	0–4	0.46 (0.85)	0.13 (0.44)	$t = 7.24^{***}$
Music	0.17 (0.62)	0–4	0.22 (0.70)	0.06 (0.36)	$t = 4.45^{***}$
TV	0.39 (0.81)	0–4	0.51 (0.89)	0.13 (0.51)	$t = 7.93^{***}$
Games	0.25 (0.78)	0–4	0.34 (0.90)	0.05 (0.27)	$t = 6.33^{***}$
Voice/Text	0.65 (1.13)	0–4	0.79 (1.22)	0.33 (0.78)	$t = 7.00^{***}$
Data Transfer	0.27 (0.62)	0–4	0.33 (0.65)	0.14 (0.51)	$t = 5.06^{***}$
Pictures/Movies	0.98 (0.83)	0–4	1.08 (0.85)	0.75 (0.74)	$t = 6.59^{***}$
Alarm Clock	1.54 (1.80)	0–4	1.89 (1.85)	0.69 (1.36)	$t = 11.54^{***}$
Pedometer	0.47 (1.21)	0–4	0.33 (1.05)	0.78 (1.47)	$t = -6.24^{***}$
Health Apps	0.04 (0.35)	0–4	0.04 (0.33)	0.06 (0.40)	
Mobile Phone Feature Use Index	0.82 (0.53)	0–4	0.94 (0.53)	0.51 (0.39)	$t = 13.86^{***}$
Timing of survey					
Before 3–11	48.56%		48.37%	48.99%	
After 3–11	51.44%		51.63%	51.01%	

Note: The descriptive and bivariate results are based on raw data.

^aExtent to which respondent uses their mobile phone to keep in touch with friends or relatives, or to get to know other people; ^bextent to which respondent uses their mobile phone to feel safe and secure in case of an emergency, and to be available to families and friends; ^cextent to which respondent uses their mobile phone for passing time, relaxation, or entertainment purposes; ^dextent to which respondent uses their mobile phone to obtain news and information, schedule appointments, and coordinate activities. ^e1 = less than 2 million Yen, 1 = 2–4 million Yen, 2 = 4–6 million Yen...9 = more than 20 million Yen, 1 USD = approximately 77 Yen in 2011. ^f0 = never/phone does not have this feature, 1 = sometimes, 2 = 1 day a week, 3 = 2–3 days a week, 4 = every day.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2. OLS Regression of Loneliness on Uses and Gratifications of Mobile Phone ($N = 1,318$)

	Loneliness	
	Model 1	Model 2
	<i>b</i> (SE)	<i>b</i> (SE)
Sociability ^a	-0.07 (0.02)***	-0.10 (0.02)***
Reassurance ^b	-0.01 (0.01)	-0.01 (0.01)
Pass time ^c	0.04 (0.01)**	0.04 (0.01)**
Instrumentality ^d	0.01 (0.01)	-0.01 (0.01)
Age 65 plus (ref = age 40–64)	-0.04 (0.06)	-0.02 (0.06)
Female (ref = male)	-0.22 (0.04)***	-0.22 (0.04)***
College or more (ref = high school or less)	-0.07 (0.04)	-0.07 (0.04)
Married (ref = single/divorced/widowed)	-0.10 (0.06)	-0.09 (0.06)
Currently working (ref = not working)	-0.09 (0.05)	-0.10 (0.05)
Household Income	-0.03 (0.01)*	-0.03 (0.01)*
Health (ref = no chronic conditions)		
1 chronic conditions	0.07 (0.05)	0.07 (0.05)
2 or more chronic conditions	0.12 (0.06)*	0.12 (0.06)*
Face-to-face social interaction	-0.28 (0.02)***	-0.28 (0.02)***
Smartphone owner (ref = nonsmartphone owner)	-0.05 (0.11)	-0.01 (0.11)
Time/day using phone (ref = less than 10 min)		
10–50 min	-0.08 (0.06)	-0.10 (0.06)
1 hr or more	-0.08 (0.07)	-0.09 (0.07)
Frequency of Feature Use	-0.13 (0.05)*	-0.08 (0.05)
Does not have children (ref = has children)	0.03 (0.07)	0.03 (0.07)
After 3–11 (ref = before 3–11)	0.03 (0.04)	0.03 (0.04)
Sociability × Age 65 plus		0.07 (0.03)*
Instrumentality × Feature Use		-0.09 (0.03)**
Constant	3.38 (0.10)***	3.42 (0.10)***

Note: Continuous predictor variables are grand mean centered. Results are from seemingly unrelated regression (SUR) models using 20 imputed datasets for each, where results were combined using Rubin's rules.

^aExtent to which respondent uses their mobile phone to keep in touch with friends or relatives, or to get to know other people; ^bextent to which respondent uses their mobile phone to feel safe and secure in case of an emergency, and to be available to families and friends; ^cextent to which respondent uses their mobile phone for passing time, relaxation, or entertainment purposes; ^dextent to which respondent uses their mobile phone to obtain news and information, schedule appointments, and coordinate activities.

* $p < .05$; ** $p < .01$; *** $p < .001$.

interaction, $b = 0.07$, $p < .05$. Finally, the uses and gratifications of reassurance and instrumentality were not found to be significantly associated with loneliness when all other factors and uses and gratifications are accounted for; thus there was no effect to be mediated.

Discussion

A growing body of research suggests that loneliness and social isolation are risk factors for mortality and physical ailments such as increased risk of impaired immune function, inflammatory disease, pain, depression, decreased physical activity, and increased risk of mortality (Hawkey & Cacioppo, 2010; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Newall, Chipperfield, Bailis, & Stewart, 2013). There is contradicting evidence, with some research suggesting that loneliness does not impact physical health, cognition, or risk of mortality over the age of 70 (see Stessman et al., 2014). Increasingly, communication

technologies such as mobile phones are used as conduits for social connection among users of all ages, including older adults. With the ubiquity of mobile phones penetrating the subpopulation of older adults, guided by Uses and Gratifications Theory (Katz, Blumler, & Gurevitch, 1973), this study offers insight into how older adults use mobile phones and how using them for certain functions might contribute to loneliness among older adults in Japan. Results from this study elucidate these relationships, and also point to one mechanism through which mobile phone use may influence loneliness among midlife and older adults—face-to-face social interaction.

First, there was some evidence indicating that the uses and gratifications sought through mobile phones differed for Japanese midlife and older adults. Older adults were less likely than midlife adults to agree that they use their mobile phone for sociability or to pass time. With regard to reassurance and instrumentality there was no significant difference by age. These findings are aligned with previous

Table 3. Direct and Indirect Effects of Uses and Gratifications of Mobile Phones on Loneliness (*N* = 1,318)

	<i>b</i> (<i>SE</i>)	% of total effect mediated
Sociability^a		
Total effect of sociability on loneliness (path c)	-0.09 (0.02) ^{***}	23.86%
Effect of sociability on face-to-face social interaction (path a)	0.07 (0.03) [*]	
Effect of face-to-face social interaction on loneliness (path b)	-0.28 (0.02) ^{***}	
Direct effect of sociability on loneliness (path c')	-0.07 (0.02) ^{***}	
Indirect effect of sociability on loneliness (a × b)	-0.02 (0.01) [*]	
Reassurance^b		
Total effect of reassurance on loneliness (path c)	-0.03 (0.02)	
Effect of reassurance on face-to-face social interaction (path a)	0.05 (0.03) [*]	
Effect of face-to-face social interaction on loneliness (path b)	-0.28 (0.02) ^{***}	
Direct effect of reassurance on loneliness (path c')	-0.01 (0.01)	
Indirect effect of reassurance on loneliness (a × b)	-0.01 (0.01) [*]	
Pass Time^c		
Total effect of pass time on loneliness (path c)	0.06 (0.02) ^{***}	30.76%
Effect of pass time on face-to-face social interaction (path a)	-0.07 (0.02) ^{**}	
Effect of face-to-face social interaction on loneliness (path b)	-0.28 (0.02) ^{***}	
Direct effect of pass time on loneliness (path c')	0.04 (0.01) ^{**}	
Indirect effect of pass time on loneliness (a × b)	0.02 (0.01) ^{**}	
Instrumentality^d		
Total effect of instrumentality on loneliness (path c)	-0.02 (0.02)	
Effect of instrumentality on face-to-face social interaction (path a)	0.07 (0.02) ^{**}	
Effect of face-to-face social interaction on loneliness (path b)	-0.28 (0.02) ^{***}	
Direct effect of instrumentality on loneliness (path c')	0.01 (0.01)	
Indirect effect of instrumentality on loneliness (a × b)	-0.02 (0.01) ^{**}	

Note: Results are from seemingly unrelated regression (SUR) models using 20 imputed datasets for each, where results were combined using Rubin's rules. Control variables were included in all models.

^aExtent to which respondent uses their mobile phone to keep in touch with friends or relatives, or to get to know other people; ^bextent to which respondent uses their mobile phone to feel safe and secure in case of an emergency, and to be available to families and friends; ^cextent to which respondent uses their mobile phone for passing time, relaxation, or entertainment purposes; ^dextent to which respondent uses their mobile phone to obtain news and information, schedule appointments, and coordinate activities.

* *p* < .05 ** *p* < .01 *** *p* < .001.

research, suggesting that older adults tend to be more passive users of technology compared with their younger counterparts (Hazer & Sanli, 2010; Nasir, Hasson, & Jomhari, 2008).

Second, the authors found that using mobile phones for sociability purposes was negatively associated with loneliness, which aligns with previous research linking increases in social exchanges with increases in subjective sense of connectedness and therefore, decreases in loneliness (Cacioppo et al., 2015). The authors also found that using the mobile phone to pass time was positively associated with loneliness—a finding that extends previous research suggesting that boredom (in this case, using the phone to pass time out of boredom) and loneliness can often go hand in hand (Thomas, 1996).

The authors further explored the moderating role of age in the relationship between uses and gratifications of mobile phones and loneliness, finding that using mobile phones for sociability was more strongly associated with reductions in loneliness among middle age adults than older adults. This may be explained by the fact that technology is more embedded into the social fabric of midlife adults' lives, and

that given its centrality, they are more reliant on, and savvy with, mobile phones and technology compared with older adults. In this way, it is plausible that midlife adults' sense of loneliness may be more dependent on their use of mobile phones. Younger and midlife white-collar workers in Japan have been shown to depend on their mobile devices during their daily lives, which may accentuate the negative or positive effects of mobile phone use (Nakamura, 2006). Despite these differences, users across age groups did not report significantly different levels of loneliness in relation to using mobile phones for reassurance, passing time or instrumentality, suggesting a universal effect on user's well-being with respect to these two aspects of mobile phone use.

Perhaps the most interesting findings of this paper were the mediation results. Basically, the authors found that sociability was associated with increased face-to-face social interaction, and, in turn, reduced loneliness. However, pass time was associated with reduced face-to-face social interaction, and, in turn, an increased sense of loneliness. Based on Uses and Gratifications Theory, which suggests that individuals are active agents that deliberately choose technology that will satisfy certain desires and needs for

gratification and that technology competes with more traditional means of communication and knowledge seeking (e.g., in-person social interactions) but also that a given technology cannot adequately or fully meet individual's needs alone, it is possible that some uses of mobile phones may be serving as a *substitute* for face-to-face social interaction and others as a *facilitator* of face-to-face social interaction. For those midlife and older adults using mobile phones for passing time (e.g., playing games for entertainment), phones may be serving as a substitution for face-to-face social interaction, thus decreasing the likelihood of face-to-face interaction and, in turn increasing a sense of loneliness. For example, an individual who might have asked their spouse to play a game of cards to pass time, might chose to browse Facebook with that time instead. On the other hand, for those midlife and older adults using mobile phones for sociability (e.g., making phone calls to keep in touch) purposes, mobile phones may be serving to facilitate face-to-face social interaction, thus increasing the likelihood of face-to-face social interaction and, in turn decreasing a sense of loneliness. For example, one might make a phone call to catch up with a friend (sociability) and subsequently make plans with that friend to meet up.

Interestingly, only a small percentage of the total effect of using mobile phones for sociability and passing time purposes on loneliness was mediated by face-to-face social interaction (24% and 31%, respectively). This might indicate that there are additional complexities at play here that should be explored in future studies. For example, using one's phone for sociability purposes may encompass a variety of behaviors including phone calls, email, text or social media. These behaviors can certainly facilitate increased face-to-face social interaction (e.g., texting someone to see if they are available to have coffee), but can also open up possibilities for people to connect with others during times when face-to-face meetings are not possible, thus expanding one's social network. Conversely, using mobile phones for sociability can sometimes serve to degrade the sense of intimacy between people while in a face-to-face social interaction (e.g., when one person begins to text message someone outside of the face-to-face encounter). *Ictech* (2014), drawing on symbolic interactionist theory, calls this "cross-talk" and it has been associated with reduced closeness, connection, and conversation quality (Przybylski & Weinstein, 2013). Further, there is a growing body of research indicating that that use of social media can increase a sense of loneliness and depression (Mats, Annika, & Sara, 2011; Minagawa & Saito, 2014). These research findings are especially important among midlife and older adults in Japan, who might be influenced by the widespread use of mobile devices and thus need to balance the potential effects on their social lives.

Limitations and Future Directions

The strengths of this study include being one of few studies to look at uses and gratifications as they relate to outcomes

and a relatively large, nationally representative sample of midlife and older adults in Japan. However, there are some limitations to note. First, this is cross-sectional, thus, no casual conclusions can be drawn about the direction of the effects. For instance, it is plausible that using a phone to pass time could cause individuals to feel lonelier, or individuals who use mobile phones to pass time may be more likely to be lonely to start with. It is important to interpret the directionality of these effects with caution and subsequent research should explore the possibility of reverse causality. Second, the uses and gratifications variables were limited in that the questions referred to respondents' mobile phones generally, rather than the uses and gratifications of specific functions (i.e., texting, calls, social media). Also, there were some potential uses and gratifications of mobile phones that were not assessed here, such as mobility and immediate access. Future research examining the uses and gratifications of different functions of mobile phones would provide more nuanced information.

Third, the data in the study were collected in 2011, which raises questions about whether the relationships under study may have changed with the rapid advancement in mobile phone technology that has occurred since. As noted earlier, mobile phones in Japan in 2011 had more advanced features than the mobile phones in the United States and other countries at that time. Therefore, it is likely that the majority of respondents in this study more closely resemble smartphone users in terms of the uses and gratifications sought from their mobile phones than they do basic mobile phone users. Future research should attempt to replicate these results using more recent data.

A final limitation is the fact that this was a mail survey, which is subject to nonresponse bias, and may limit generalizability of the study's findings to the broader population of midlife and older mobile phone users. However, the response rate was relatively high for a mail survey, at over 30%, and survey administrators worked to ensure ample representation of the different regions within Japan. Future studies that are nationally representative and that explore these relationships in other developed countries will serve as important next steps.

Implications for Practice

With regard to implications, the findings build on previous research promoting mobile communication technologies as conduits for reducing loneliness among older adults, but also offer some potential cause for concern. More specifically, using mobile phones for purposes of sociability was associated with reductions in loneliness. This builds on previous research that suggests that social exchange is critical to reducing loneliness and that midlife and older adults may have much to gain, socioemotionally, from mobile phone use if they are using it to facilitate an active social life. However, if entertainment/passing time is a major use and

gratification for an older person, it may be detracting from their engagement in important face-to-face social interaction, like talking with their friends, children or spouse, or engaging in community activities. These findings suggest that not only is it important to be sure that there are opportunities for building and strengthening social ties for individuals as they age (e.g., work and volunteer opportunities, social gatherings at local community centers and housing complexes, etc.; see productive aging research: [Morrow-Howell, Hinterlong, & Sherraden, 2001](#)) but it is also important to have strong public health messages that emphasize the dangers of excessive technology use (e.g., no walking while looking at a phone) and encourage choosing people over screens (e.g., device-free dinners, putting down your phone campaigns).

It is also important to keep in mind that more older adults are using mobile phones than ever before, many of whom have chronic conditions that may contribute to social isolation. Thus, designers of mobile technologies can enhance the user-friendliness and accessibility of features that older adults are less likely to use but that appear to facilitate social interaction (i.e., sociability-related usages). Devices or apps can aim to serve multiple uses and gratifications simultaneously that could be beneficial to older adults. For instance, developers have an opportunity to help design socially-networked mobile health applications (such as MyFitnessPal, which tracks multiple health measures and can connect with social contacts) or deliver health promotion programs via popular mobile applications like WhatsApp and LINE, which can improve both health and social outcomes simultaneously.

It is inevitable that new forms of mobile technologies and artificial intelligence will continue to be developed for a range of uses and gratifications, many of which will undoubtedly emerge from, and be used within Japan. While face-to-face social encounters clearly provide a great sense of intimacy and are a key protective factor when it comes to loneliness, mobile technologies may serve a vital function in facilitating social interactions that would not be possible to have face-to-face. Understanding the mechanisms through which mobile phone use influences outcomes among older adults is crucial to learning how to better leverage such devices to improve the health and well-being of people as they age.

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Conflict of Interest

None reported.

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