Loneliness from Young Adulthood to Old Age: Explaining Age Differences in Loneliness

Louise C. Hawkley[*,1], **Susanne Buecker**[2], **Till Kaiser**[2], **Maike Luhmann**[2]

[1]Academic Research Centers, NORC at the University of Chicago, 1155 E. 60th Street, Chicago, IL 60637.

[2]Department of Psychology, Ruhr University, Bochum, Germany

Abstract

Prior research in non-U.S. samples has found a complex nonlinear relationship between loneliness and age. This research has shown that established predictors of loneliness – poor health, being unmarried, living alone, and having infrequent social interactions – help to explain age differences in loneliness. However, while some variables were found to be universal predictors of loneliness at all ages, others were relevant in specific age groups only. In this study, we describe age differences in frequency of loneliness from age 18 to 89+ years in the U.S., and examine age differences in predictors of loneliness from age-specificity and age-normative perspectives. We used cross-sectional nationally representative data from the General Social Survey (N = 2,477) and found a nonlinear relationship between age and loneliness that closely resembles prior research. However, we found no evidence for age-specific predictors of loneliness. Household income, household size, marital status, health, and frequency of socializing were "universal" predictors of loneliness; their associations with loneliness did not differ in strength with age. Our hypothesis that individuals who deviated from age-specific norms would experience more intense loneliness was not supported. Implications for research and loneliness interventions are discussed.

Loneliness is often considered a problem of the elderly, but loneliness can affect people of all ages. Studies that have explored the prevalence and frequency of lonely feelings across the life course have found, contrary to popular wisdom, that loneliness is highest in young adults and then declines throughout adulthood until oldest old age, at which time it increases and can surpass the prevalence and frequency seen in young adults (e.g., Cigna, 2018; Perlman, 1990; Pinquart & Sörensen, 2003; Qualter et al., 2015). However, these data have been drawn primarily from studies conducted in different birth cohorts and different periods, each of which included only certain age groups and not the entire adult age range. Only recently have large-scale national surveys been undertaken to measure loneliness across adulthood at the same point in time. The General Social Survey (GSS) regularly collects data from a nationally representative sample of adults living in households in the United States (U.S.), and in 2014 became, to the best of our knowledge, the first U.S. survey to assess loneliness across the adult age range. In the present study, we use GSS data to examine the age distribution of loneliness in U.S. adults aged 18 years and older.

[*]Corresponding Author.

Given a growing interest in alleviating the burden of loneliness in Western societies, it is important to identify the sources of loneliness and how they differ across the adult age range. This could inform how interventions are best targeted for specific age groups. Loneliness interventions for older adults tend to dominate the literature (Fakoya, McCorry, & Donnelly, 2020; Masi, Chen, Hawkley, & Cacioppo, 2011; O'Rourke, Collins, & Sidani, 2018), although recent reports have summarized intervention studies used among children and adolescents (Eccles & Qualter, 2020), and among "non-elderly" 18-64 year-olds (Bessaha et al., 2020). Given the prevalence of loneliness in young adults (Barreto, Victor, Hammond, Eccles, Richins, & Qualter, 2020), this is an age group for which loneliness interventions are in need of greater attention. Whether loneliness interventions developed for older adults also work for young adults depends, among other things, on whether the sources of loneliness in young adults are the same as in older adults. If not the same, different age groups may require different interventions.

Prior literature has identified a range of risk factors for loneliness, factors that may differ in prevalence at different ages. A recent study found that higher levels of loneliness in oldest old age than in younger age groups of a German nationally representative sample were attributable to the greater prevalence of low income and more severe functional impairments in older adults than in young and middle-aged adults; moderately high levels of loneliness in middle adulthood were attributable to the higher rates of singlehood in this age group than in younger and older adults (Luhmann & Hawkley, 2016). The same study also identified the differential effects of common risk factors for loneliness at different ages. For instance, being single had a larger association with loneliness in middle-aged than young adults. Thus far, however, it is not clear whether these findings can be generalized to other countries. In the present study, we examine the extent to which risk factor prevalence and age-specific effects contribute to age differences in loneliness in a nationally representative sample of U.S. adults. The findings of the present study can be used for comparisons with previous studies conducted using samples from other countries. Understanding the comparability of predictors of loneliness across countries, and in each age group, could facilitate learning from, adapting and implementing each country's intervention efforts.

In addition, we posit that individual deviations from age-typical norms will be associated with loneliness. The finding that singlehood had a larger association with loneliness in middle-aged than young adults (Luhmann & Hawkley, 2016) is consistent with the age-normative perspective in that having a spouse or partner is more the norm among middle-aged than young adults. In the present study, and for the first time, we explicitly test age-normative explanations for age differences in loneliness by examining whether individual deviations from central tendencies at specific ages contribute to loneliness. Specifically, we wish to understand general principles that underlie risk for loneliness and use an age normative perspective as a lens through which to examine reasons for age differences in loneliness and thus, age differences in the kinds of loneliness interventions that might be effective.

Background

Age differences in loneliness: A review of prior research

In a study of loneliness across adulthood in the United Kingdom (UK), Victor and Yang (2012) found a U-shaped distribution in which those under 25 and over 55 years of age reported more frequent loneliness than those in the 25-44-year age group. This distribution differed somewhat between men and women; for women, the increase in loneliness began earlier in life (at about age 55) than for men (after age 75). A more recent report from the UK's Office of National Statistics in 2018 largely replicates the U-shaped age distribution in loneliness frequency (Pyle & Evans, 2018). In an extension of this work in 25 European nations that participated in the European Social Survey in 2006-7, Yang and Victor (2011) found that the age distribution of loneliness differed among northern, southern, and eastern regions of Europe. The regions most similar to the U.S.(i.e., Germany, the Netherlands, UK, Norway) exhibited relatively infrequent loneliness across adulthood until about age 70.

Care must be taken in comparing loneliness across these countries, however, because loneliness measures differ. Studies such as those above relied on a single face-valid item asking about loneliness, a measure that is likely to elicit a socially desirable response, whereas multi-item indirect measures of loneliness that avoid the use of the terms "lonely" and "loneliness" are thought to produce less biased estimates (Victor, Grenade, & Boldy, 2005). A recent privatelyfunded study of more than 20,000 American adults aged 18 years and over (Cigna, 2018) used a 20-item loneliness scale and found that loneliness levels were greatest in young adulthood (18-22 years old) and gradually decreased with age such that the lowest levels of loneliness were found in older adults (72+ years old). However, the sample was not nationally representative and the study was conducted solely via an internet-based survey, limiting the generalizability of their findings. A recent study used a 4-item UCLA loneliness scale to compare loneliness among individuals residing in more than 200 countries differing in individualism and collectivism; this study found a decrease in loneliness with age across the entire sample and this decrease was somewhat larger in collectivistic than individualistic countries (Barreto et al., 2020). In a study of a nationally representative sample of over 16,000 German adults (Luhmann & Hawkley, 2016), a 3-item loneliness scale was used and showed that loneliness levels trended downward between age 20 and 75, with small peaks at age 30 that decreased to age 40, then increased to age 60, and then decreased to a second low level at about age 75. After age 75, loneliness levels exhibited a steep increase. Using the same scale, a nationally representative sample of U.S. adults limited to those aged 50 years and older found that loneliness decreased from 50-75 years of age, after which it increased into oldest old age (Hawkley, Wroblewski, Kaiser, Luhmann, & Schumm, 2019). A similar pattern was found in a large population-based sample of Norwegian adults aged 40 to 80 years, with some variation depending on whether the analyses used a single loneliness item or a multi-item indirect measure of loneliness (von Soest, Luhmann, Hansen, & Gerstorf, 2020). In the present study, we seek to replicate the patterning of the age distribution of loneliness in the U.S. using, for the first time to our knowledge, a nationally representative U.S. sample across the entire adult age range.

Explaining age differences in loneliness

Certain factors have been robustly associated with loneliness in older adults. Metaanalyses have shown that, in this population, female gender, low socioeconomic status, being unmarried, having physical health problems, having little social contact, and having poor quality social relationships are reliably associated with loneliness (Pinquart & Sorenson, 2003). In prior work, these variables have been conceived as constituents of a filtration model in which distal predictors filter down through tiers of explanatory variables that are conceptually increasingly proximal to loneliness (i.e., they are theoretically most capable of influencing loneliness directly) (Hawkley et al., 2008). Demographic variables such as gender and race-ethnicity are ascribed characteristics of individuals, and associations between demographic variables and loneliness (i.e., women and minorities tend to be lonelier than men and white adults in the US, respectively) have been explained at least in part through the associations of demographic characteristics with socioeconomic status (Hawkley et al., 2008; 2019; Visser & Fakiri, 2016). Socioeconomic differences, in turn, influence or are reflected in choices in marriage, parentood, and living arrangements (Blossfeld, 2009; Cherlin & Fomby, 2005; Letablier, Greulich, Math, & Thevenon, 2008) which are themselves associated with loneliness (Greenfield & Russell, 2011; Stack, 1999). Marriage is associated with better health (Waite & Lehrer, 2004), the next filter in the model. And finally, because better health is associated with the capacity for more frequent and diverse social activity (Bennett, 2005), social activity, including religious engagement, is the last, and most proximal filter in the model. Social activity and engagement are associated with loneliness (Carmichael, Reis, & Duberstein, 2015). Religious service attendance is relatively prevalent in the US, particularly in older adults, and its association with loneliness has been explained by increased social integration and social support (Rote, Hill, & Ellison, 2013). The filtration model is not a causal model, but it provides a structured and empirically informed framework that justifies including each of these categories of predictors when attempting to understand age differences in loneliness.

Most research has not explicitly examined whether the pattern of associations of risk factors with loneliness is similar across age groups, but a recent review identified risk factors in young and middle adulthood that are also seen in older adults (Qualter et al., 2015). For instance, lack of intimate friendships and lack of a romantic relationship were associated with greater loneliness across the adult age range, suggesting that these factors have universal relevance across age. Similarly, Luhmann and Hawkley (2016) identified some "universal" factors related to loneliness across the adult age range. Number of friends, frequency of social contact with friends and relatives, social engagement in community, religious, and volunteerism groups, and number of functional limitations were associated with loneliness across adulthood, from young to old age.

Taking another approach to understanding age differences in the correlates of loneliness, Luhmann and Hawkley (2016) examined whether the age distribution of mean loneliness levels was altered after statistical control for gender, socioeconomic status, work status, household size, relationship/marital status, functional limitations, social engagement, number of friends, and social contact frequency. Adjusting for these covariates reduced the late life increase in loneliness in oldest age (75+ years) and revealed somewhat higher

levels of loneliness in midadulthood (35-70 years) than were observed in the raw data. These changes in the age distribution of loneliness were attributable to age differences in, respectively, the prevalence of low income and high functional limitations in older adults and the prevalence of being single in middle adulthood. These data indicate that age differences in loneliness may arise from differential population exposure to known risk factors (i.e., prevalence of risk).

Age-specific effects.—Age differences in loneliness may also arise from age differences in the magnitude of associations of loneliness with known risk factors (Nicolaisen & Thorsen, 2017; Nyqvist, Victor, Forsman, & Cattan, 2016). For instance, young adults were shown to have more frequent contact with friends than older adults, and contact was more strongly related to loneliness in younger than older adults (Nicolaisen & Thorsen, 2017). In the German study (Luhmann & Hawkley, 2016), relationship status (i.e., having a partner) mattered more for the loneliness of middle-aged (30-65 years) than young (<30 years) and older adults (>65 years). Also, work status (i.e., working full-time vs. not at all) mattered more for middle-aged than young adults and not at all for older adults. What these results suggest is that certain factors are more relevant than others at certain ages.

These results were adjusted for age group differences in the prevalence of being married and working full-time and are therefore also consistent with an age-normative perspective, where failure to achieve sociocultural norms for a particular age and developmental stage is likely to increase risk for loneliness (Luhmann & Hawkley, 2016). However, these analyses did not directly assess individual deviations from age-specific norms.

Age-normative effects.—The age-normative perspective corresponds to a developmental perspective on loneliness, whereby loneliness is posited to peak when physical and psychological changes are met by unique societal expectations (Qualter et al., 2015). For instance, loneliness is highly prevalent in late adolescence and young adulthood when individuals are undergoing puberty and establishing their own identity, traditionally society's age-normative expectation for this age group. Loneliness is also highly prevalent in old age, when individuals are facing social losses (e.g., widowhood) and losing physical functioning. During this time, the age-normative goal might be described as a societal expectation that the older adult recover from and adapt to social losses such as bereavement (Costa, Hall, & Stewart, 2007) and rely on the support of others as functional limitations increase in severity. Although social support typically enhances perceived control (Gerstorf, Röcke, & Lachman, 2010), receiving social support can also foster a perception of low control over one's life (Malhotra & Ang, 2016), where low perceived control is a risk factor for loneliness (Drewelies, Wanger, Tesch-Römer, Heckhausen, & Gerstorf, 2017).

Adult development has been viewed from a variety of theoretical perspectives, and the age at which phases of development begin and end has varied accordingly. Typically, these theories consider the age and timing of life transitions in adulthood, such as completing an education, getting married, starting a family, and retiring from work. Our theoretical interest is in cohorts of adults who are exposed to shared societal norms in roughly comparable phases of adult development. Social norms, in turn, are posited to influence people's behavior (Kallgren, Reno, & Cialdini, 2000. That said, social norms appear to have become more

relaxed over the past several decades (Jackson, Gelfand, De, & Fox, 2019), so it is not clear whether they have the influence they might once have had. In addition, we do not have data on what people actually believe others expect from them (i.e., injunctive norms), so we rely on descriptive norms to capture what the majority of the population actually does (Perelli-Harris & Bernardi, 2015). We posit that the behavior of the majority of one's peer group is a reference for individual behavioral decisions. Statistical norms describe the most frequent or prevalent attitude, behavior, or other outcome in a particular age group, and we test whether deviations from statistical norms are associated with loneliness.

The present study

In this study, we address three research goals. First, we extend prior research that has provided data on the age distribution of loneliness in Germany (Luhmann & Hawkley, 2016) and in older adults in the U.S. (Hawkley et al., 2019), by estimating the age distribution of loneliness across the adult age range using the same loneliness measure in a nationally representative sample of adults in the U.S.

Second, we examine whether age differences in loneliness can be explained by differences in education, income, employment status, marital status, living arrangements, health, and social activity, predictor variables that have been associated with loneliness in prior research. To the extent these predictors account for age differences in loneliness, the shape of the adjusted age distribution of loneliness should change.

Third, we probe whether there is evidence for age-specific and age-normative effects. Support for age-specific effects will come from evidence that the strength of the association between a predictor variable and loneliness varies significantly with age. Support for age-normative effects will come from evidence that deviations from normative values on predictor variables are associated with greater loneliness.

Given ongoing scientific and media interest in presumed burgeoning rates of loneliness, secondary goals are to determine whether mean loneliness levels changed between 2014 and 2018 in the U.S., whether mean changes are evident at each age or age group, and whether changes can be explained by differences in sample characteristics.

Methods

Sample

The General Social Survey (GSS) is designed primarily as a repeated cross-sectional survey that began as an annual survey in 1972 and has been conducted biennially since 1994 (Marsden & Smith, 2016). For each GSS, the National Opinion Research Center at the University of Chicago (NORC) draws a nationally representative sample of U.S. households (i.e., excluding institutionalized and group housing), with a target population of adults age 18 and older. In-person interviews are the preferred data collection mode, and are largely administered using computer-assisted personal interview (CAPI) techniques. Telephone interviews are used as a backup mode of data collection. Like many national surveys (Groves & Peytcheva, 2008), GSS response rates on the full probability sample have been

declining since about 2000. In 2014, the response rate was 69% and in 2018 it was 60% (Smith, Davern, Freese, & Morgan, 2019, Appendix A).

The loneliness measure was administered to GSS subsamples in 2014 and 2018. In 2014, the loneliness measure was included in the last consecutive survey administered to a Replicate Core, a subsample of respondents who were assessed at each of three consecutive surveys (2010, 2012, 2014); 1,304 respondents were administered the loneliness measure in 2014. In 2018, the loneliness measure was administered with the International Social Survey Programme (ISSP) module to 1,173 respondents.

For the present study, we used data from both 2014 and 2018 to maximize the sample size and statistical power for our analyses ($N = 2,477$). Limiting our sample to those respondents who had provided their age and valid responses to each of the loneliness items, our total working sample size was $N = 2,440$ (53.9 % female, 18-89 years, $M_{age} = 50.16$, $SD_{age} = 17.06$). The 2014 and 2018 samples differed significantly on a number of variables (see Table 1 for details). Compared to the 2014 sample, the 2018 sample was characterized by younger average age; higher average household-adjusted income; higher proportions of participants who were male, ethnic minorities, and had never married; and lower proportions of participants who were married, lived with children, and lived in 3+ person households. Furthermore, the 2018 sample was on average less lonely than the 2014 sample. The samples did not differ significantly in terms of education, health, religious engagement, and the frequency of spending time with friends, relatives, or neighbors.

Measures

Loneliness.—Loneliness was measured with the 3-item short version of the UCLA Loneliness Scale developed specifically for use in large-scale surveys (Hughes et al., 2004) and validated for use in the German Socioeconomic Panel (Hawkley, Duvoisin, Ackva, Murdoch & Luhmann, 2015). Participants reported how often they "felt that they lacked companionship," "felt isolated," and "felt left out" on 4-point response scales in 2014 (*never*, *rarely*, *sometimes*, *often*; Cronbach's $\alpha = .78$) and on 5-point response scales in 2018 (*never*, *rarely*, *sometimes*, *often*, *very often*; Cronbach's $\alpha = .81$). To ensure that loneliness was measured on the same scale in the entire sample, we collapsed the response options *often* and *very often* in the 2018 data (Cronbach's α after recoding: $\alpha = .81$). Responses were averaged across items such that higher scores reflected greater loneliness (possible range = 1-4).

Sociodemographic factors.—We examined sex (*male*, *female*), age at the time of the survey, and racial/ethnic minority group status (*non-Hispanic White*, *minority group*) as basic demographic predictors. Annual household income before taxes, years of education, and work status (*working fulltime or part time*, *temporarily without job or unemployed*, *retired*, *other [e.g.*, *school*, *housekeeping]*) were included as indicators of socioeconomic status. Annual household income was measured as a categorical variable (less than US$ 1,000; $1,000 to 2,999; …; $130,000 to 149,999; $150,000 or over). In 2014, the highest category was $150,000 or over. In 2018, this income range was represented in two categories: $150,000 to $169,000 and $170,000 or over. To ensure that income was

measured on the same scale in the entire sample, we collapsed the two highest response categories in the 2018 data; hence, the highest response category was now $150,000 or over in both waves. Following the approach by Stone et al. (Stone, Schneider, Krueger, Schwartz, & Deaton, 2018), we transformed this variable into a continuous variable by taking the mid-points of each response category. To adjust for household size, we divided these scores by the square root of household size (e.g., Johnson, Smeeding and Torrey, 2005). Finally, to normalize the skewed distribution, the adjusted scores were logtransformed.

Household size.—Household size was operationalized as the number of persons living in the household (*1 person*, *2 persons*, *3+ persons*). In addition, we considered whether children lived in the household (*no*, *yes*).

Marital status.—Respondents indicated their legal marital status using the response options *married*, *widowed*, *divorced*, *separated*, or *never married*. Because some response options were selected rarely or never in certain age groups, we recoded this variable into the four categories *married*, *separated or divorced*, *widowed*, *never married*.

Self-rated health.—Respondents indicated their perceived health status on a single item using the response options *excellent*, *good*, *fair*, or *poor*. The variable was recoded such that higher scores reflected better health.

Religious engagement.—Respondents reported how often they take part in religious activities other than attending services, using an 11-point response scale ranging from 1 = *never* to 11 = *several times a day*.

Contact frequency.—Respondents indicated how frequently they spend an evening with friends, neighbors, and relatives (separate items) on a 7-point scale ranging from 1 = *almost daily* to 7 = *never*. Responses were recoded such that higher scores reflected more frequent contact. These items were treated as separate predictor variables in the analyses.

Data analysis

Data preparation.—A planned missingness design had been applied to measures of self-rated health and frequency of contact with friends, neighbors, and relatives, meaning that these items were only administered to a subset of all respondents. We created five data sets in which missing values on these variables were imputed, using applied predictive mean matching implemented in the R package mice (van Buuren & Groothuis-Oudshoorn, 2011). All main analyses (see below) were conducted separately in each of the five imputed data sets and then pooled across data sets.

Main analytic models.—Following Luhmann and Hawkley (2016), we visualized the age distribution of loneliness by fitting a locally weighted scatterplot smoothing (LOESS) curve to the bivariate distribution of age and loneliness, using both observed scores of loneliness and loneliness residual scores adjusted for covariates. To examine whether the effects of loneliness predictors differ across age, we examined the interactions between each predictor and age and age^2, separately for each predictor, in moderated regression models. Age and all continuous predictors were centered on the grand mean (computed across the two waves)

prior to these analyses. Significant interactions indicated that the strength of the association between the predictor of interest varied as a function of age. In previous research, age has often been treated as a categorical variable (e.g., Victor & Yang, 2012). To check whether our findings were robust across these different methodological approaches, we also tested interactions between the predictors and categorical age groups (18-29 years, 30-64 years, 65 years and older; see Luhmann & Hawkley, 2016).

According to the age-normative perspective, deviations from typical or average scores on particular predictor variables should be associated with individual differences in loneliness. That is, not only a person's absolute score on a particular variable, but also the extent to which this score differs from what is normative in this age group should matter for loneliness. To examine age-normative effects we first computed a reference score for each variable and each person against which the person's individual score on this variable is compared. Here, the reference score was the median (for continuous variables) or mode (for categorical variables) on the predictor variable in an individual's demographic peer group which included all respondents who had participated in the same GSS wave, had the same sex and racial/ethnic minority status, and who were the respondent's age plus or minus 5 years. For respondents whose age was among the bottom or top 5 years in the distribution (e.g., 18-23 year-olds and 84-89 year-olds), the peer group included all respondents from the bottom (or top) age decade available in the data (e.g., everyone between 18 and 28 years or between 79 and 89 years, respectively).

Continuous predictor variables were recoded by computing the squared deviation from the respective peer-group median, and categorical predictor variables were transformed into dichotomous variables with 0 = not normative (not belonging to the modal group in this peer group) and 1 = normative (belonging to the modal group in this peer group). These age-normed predictor variables were then included as predictors in a multiple regression model.

Loneliness was standardized on the grand mean and standard deviation computed across both waves. Effects can therefore be interpreted in terms of standard deviation units. For the age-normative analyses, we additionally centered loneliness on the median loneliness score in the respective peer group. These analyses therefore indicate the association between deviations from age-specific norms on the predictor variables and deviations from age-typical loneliness levels. Sampling weights were applied in all analyses. To control for differences between the two waves, we included survey year as a covariate in all models and additionally included the interactions between survey year and all predictor variables to explore whether the associations between the predictor variables and loneliness differed by survey year. In addition, we re-ran all analyses separately for the two waves. For these analyses, continuous predictor variables were centered within the respective wave. R script files for all analyses are available on Open Science Framework (OSF; https://osf.io/6qced/?view_only=3ef5626f9de244c6b56f2175c700b642). The 2014 and 2018 data are publicly available via the main GSS website (http://gss.norc.org/get-the-data. The 2018 data are also available via the GSS Data Explorer (https://gssdataexplorer.norc.org/).

Results

Descriptive statistics for all variables are provided in Table 1 (see Table S1 supplemental online material for descriptive statistics by age groups). For variables with planned missingness, these statistics were highly similar for the original data and the imputed data, indicating that the imputation procedure worked well (see Table S2).

Age Distribution of Loneliness.

The age distribution of loneliness is displayed in Figure 1 (continuous line) for the total sample and in Figure 2 separately for the two waves. The distribution followed a complex, non-linear shape, with high loneliness levels among young adults (<30 years), middle age (ca. 50-60 years), and very old age (>80 years), and low loneliness levels among adults around age 40 and age 70. The shape was similar in the two waves; however, in 2018, loneliness levels tended to be higher among young adults and lower among older adults than in 2014. Notably, old adults tended to be the loneliest in 2014, but young adults tended to be the loneliest in 2018. These subtle differences notwithstanding, the findings show that the experience of loneliness is not restricted to old age, but can occur at all ages.

To examine whether the predictor variables studied in this paper accounted for age differences in loneliness, we regressed loneliness on all predictor variables (except age). The residuals obtained in this regression model reflect loneliness levels adjusted for the predictor variables. The adjusted distribution of loneliness is depicted in Figure 1 (dashed line). Similar to previous findings (Luhmann & Hawkley, 2016), adjusting for common predictors of loneliness accounted for higher loneliness levels among the oldest old and, here, also among young adults, but the shape and level of the age distribution remained largely intact in mid-adulthood.

To explore whether the associations between the predictor variables and loneliness differed between the two waves, we compared a regression model including all main effects of the predictor variables to a regression model where we added interactions between the predictor variables and survey year. Overall, the latter model explained significantly more variance, pooled $R^2 = .02$, pooled $p < .001$, indicating that at least some predictors differed in their association with loneliness between 2014 and 2018 (for full results, see Table S3). The simple effect of survey wave was no longer significant, indicating that the mean-level differences in loneliness between 2014 and 2018 are accounted for by differential associations between specific predictor variables and loneliness in these two years. Specifically, being retired or having "other" work status were associated with lower loneliness levels in 2018 than in 2014, and being separated/divorced or being never married were associated with higher loneliness levels in 2018 than in 2014. Wave-specific regression coefficients obtained by estimating these models separately for each wave are provided in Tables S4 and S5.

Age-Specific Effects

To investigate age-specific effects of the predictor variables on loneliness, we first analyzed a multiple regression model with standardized loneliness as the outcome and all covariates

(including age) as predictors (Table 2, Model 1). This model served as a baseline model against which we compared the subsequent models. Consistent with prior research, loneliness was higher among individuals who were not married (particularly among those who were widowed) than who were married, had a lower income, lived alone (as opposed to living in a 2+-person household), had poorer health, and spent fewer evenings with relatives or neighbors. In addition, there was a significant effect of wave such that loneliness levels were on average lower in 2018 than in 2014, controlling for all other covariates. Sex, education, work status, racial/ethnic minority status, living with kids, religious engagement, and frequency of spending evenings with friends were not significantly associated with loneliness.

To test whether the associations between these variables and loneliness differed as a function of age, we examined the linear and quadratic interactions of age and age^2 with each predictor, separately for each predictor, and compared this model to the baseline model using an F test. A significant F test indicates that including the interaction significantly increases the amount of explained variance (R^2). The full results for these model comparisons are provided in Table S6. Using a conventional level of significance of α = 5%, this test was significant for only one predictor (p = .035): household size. Specifically, we found weak significant interactions between age^2 and 2-person households, b = 0.001, p < .003, and between age^2 and 3-person households, b = < .0014, p = .044, indicating that the protective (negative) effect of living in a 2+-person household was attenuated among individuals who were either much younger or much older than average. However, we caution that these effects are weak and the p values are trending towards p = .05, so they might reflect false positive findings that can occur in such exploratory analyses. Indeed, neither this interaction nor any of the interactions with the other predictors were consistently significant (or not) when analyzing the two waves separately (see Tables S7 & S8) nor were any of these interactions statistically significant when treating age as a categorical instead of as a continuous variable. These findings suggest that for those predictors for which significant associations with loneliness were found, these associations did not differ in strength across age but rather were so-called universal predictors of loneliness.

Age-normative effects

Finally, we investigated whether deviating from one's age norm on a predictor variable accounted for deviations from one's age norm in loneliness. We first examined all age-normed predictors in one model (Table 2, Model 2). Statistically significant effects were found for income, work status, marital status, and health. For the continuous predictors income and health, the effects were positive, suggesting that greater deviations from the normative income or health level in one's peer group were associated with higher levels of loneliness, respectively. For the categorical predictors work status and marital status, the effects were negative, indicating that individuals with normative status on these variables (coded as 1) were, on average, less lonely than individuals with non-normative status on these variables (coded as 0). Altogether, these patterns are consistent with the age-normative perspective according to which being close to the norm is associated with less loneliness. Importantly, however, the regression coefficients of these variables were no longer statistically significant if the non-normed versions of these variables were also

included in the model (Table 2, Model 3), indicating that absolute levels on these variables are more predictive of loneliness than people's relative standing on these variables compared to their peer groups. This was also true when analyzing the two waves separately (Tables S7 & S8).

Discussion

Our study is one of the first, if not the first, to show how loneliness is distributed across the age range in a representative sample of the U.S. adult population. Additional research goals were to examine whether age differences are explained by well-established loneliness predictors, whether these predictors show age-specific effects, and whether deviating from one's age norm on any given loneliness predictor explains additional age-related variation in loneliness.

In line with earlier findings from Germany (Luhmann & Hawkley, 2016), we found that the age distribution of loneliness in the U.S. followed a non-linear trajectory with elevated loneliness levels in oldest old (>70 years) and young adults (<30 years) with an additional peak at around 50-60 years. Also consistent with earlier findings, the loneliness trajectory was characterized by two dips, one around age 40 and another around age 70. A striking finding was that young adults in the U.S., especially those under 25 years of age, are as lonely as the oldest adults and noticeably lonelier than their age peers in the German sample.

A recent prior study (Cigna, 2018) found that loneliness levels were highest in young adulthood and lowest in older adults. In the present study, we also identified young adulthood as a time of high loneliness levels, but older adults in our study also had high loneliness levels. We posit several reasons for the inconsistency. First, different loneliness measures were used; the Cigna study used a 20-item loneliness scale compared to our 3-item scale. Second, the Cigna study recruited respondents to a web-based survey (vs. in-person and telephone-based surveys in GSS), and this may have contributed to selection issues; only those individuals who were capable of and comfortable with this survey mode would have participated, and older adults are less likely to have been in this category. Finally, oldest older adults in the Cigna study sample were relatively under-represented, and this may have contributed to a lower loneliness level in their oldest age group (72+ years). Indeed, at around age 70, our data also show a dip in loneliness.

Other studies (Mund, Freuding, Möbius, Horn, & Neyer, 2019; Nicolaisen & Thorsen, 2017) have found a slightly U-shaped distribution over the adult age range and have not detected peaks and dips in loneliness from middle to older age, possibly due to the use of a single direct question about loneliness. Midlife variations in loneliness warrant additional research to identify sources of this variation that go beyond the variables considered in this study (e.g., children leaving home; geographic relocation; loss of wealth and/or challenges in financial preparation for retirement).

We note that minority racial-ethnic groups were increasingly under-represented across the adult age range, likely due, at least in in part, to selective mortality of historically underprivileged African American adults. Minority groups in the GSS also tended to be

lonelier, and loneliness itself increases risk for mortality (Holt-Lunstad et al., 2015). Our ability to explain age differences in loneliness is therefore biased toward survivors who are more likely to be white older adults. Interestingly, despite differences in the racial-ethnic composition of the U.S. and Germany, the age distribution of loneliness showed a remarkable similarity in these two countries. Additional research is needed to examine whether racial-ethnic groups differ in the age distribution of loneliness and in predictors of age-related differences in loneliness across adulthood.

Our second goal was to determine whether age differences in loneliness across the adult life span could be explained by variables known to be associated with loneliness. Age is a very broad construct that can be understood as a proxy for a variety of other things such as experiences (e.g., major life events), material resources (e.g., income) and non-material resources (e.g., health). Certain major life events that are known to be linked to loneliness, such as widowhood, occur more frequently at old age (Recksiedler et al., 2018), and resources such as income and health tend to decrease with age (Hansen, Slagsvold, & Moum, 2008). Indeed, the GSS data in this study showed that widowhood was most prevalent in older age, as was living alone, having no children in the household, and religious engagement.

In the present study, we showed that age was not significantly related to loneliness when controlling for a variety of covariates that differed in prevalence or mean levels across age, including household income, self-rated health, and social contact frequency. This implies that it is not age itself that influences loneliness, but rather that age differences in experiences and resources account for age differences in loneliness. That is, loneliness is unevenly distributed across the age range because predictor variables of loneliness are unevenly distributed.

Our third research goal was to examine evidence for age-specific and age-normative effects. We found no clear evidence for age-specific effects. The predictors of loneliness we examined showed comparably-sized associations with loneliness across all ages. For the identification of populations at risk for loneliness, marital status, household income, living alone, self-rated health, and frequency of social contact can be considered universal predictors and applied to people of all ages. We were limited, however, in the number and types of predictor variables we could consider, and it is possible that other variables, such as chronic health conditions, mobility limitations, and various forms of civic engagement, may exhibit differential associations with loneliness across age. This remains an issue for future research.

Age-normative effects were not detected. Absolute levels on a predictor variable (e.g., household income) were predictive of loneliness, but individuals' relative standing on this variable compared to their age group (e.g., more or less income than average in one's age group) did not add any predictive value. To our knowledge, this is the first time age-normativity has been examined explicitly in regard to loneliness. Our procedure of operationalizing deviations from statistical norms has the advantage of avoiding having participants self-report their perceptions of norms, but it may also have the disadvantage of norms being based on a group that might be an irrelevant comparison group for the

individual. Consider, for instance, someone who has lower financial resources than is the mean in his or her age group but has average financial resources compared to his or her friends. This persons' loneliness is unlikely to be affected by deviations from the general age norm but might be affected by relative standing compared to his or her friends (i.e., someone who has significantly less money than his or her friends might be lonelier because they cannot join them for costly activities). It remains a task for future research to look beyond statistical norms and focus instead on identifying the relevant (normative) group against which individuals compare their experience. Moreover, in the absence of information on the strength with which individuals hold norms around specific behaviors, we cannot rule out that weak social norms may have contributed to the absence of age-normative effects on loneliness (Jackson et al., 2019),.

Our final goal was to compare loneliness levels between 2014 and 2018 overall, and at each age. Across all ages, loneliness levels were lower in 2018 than in 2014. This varied by age, however: younger adults were lonelier in 2018 than in 2014, and older adults were lonelier in 2014 than in 2018. After adjustment for all predictor variables, loneliness levels were lower in 2018 than 2014, indicating that differences in the age distribution of the predictors contributed to loneliness differences between survey years. In addition, the difference in loneliness levels between survey years was explained by differences in associations of work status and marital status with loneliness in these two years. Being retired had a larger inverse association, and being separated/divorced or never married had a larger positive association, with loneliness levels in 2018 than in 2014. We had no *a priori* reason to expect associational differences, and recommend that these results be replicated in the future. In general, these secondary analyses did not provide support for an increase in loneliness over this 4-year interval, although age group differences point to the possibility that younger adults are at growing risk for loneliness. This is consistent with data showing that loneliness has been increasing in adolescents and young adults since approximately 2011 (Twenge, 2019).

Conclusion

This study replicates and extends previous findings on the age distribution of loneliness across the adult life span in a nationally representative U.S. sample. Loneliness in the U.S. is unevenly distributed across adulthood, and the patterning of age differences is similar to that observed in recent studies (Cigna, 2018; Luhmann & Hawkley, 2016). In addition, our results replicate prior research showing that some predictor variables commonly associated with loneliness have universal relevance across adulthood. Moreover, actual values on these variables are more important than relative values (compared to a statistical norm) in explaining loneliness differences. Future cross-national work is encouraged to identify the range of countries that share "universal" predictors across adulthood and thus improve the efficiency with which developed countries approach the challenges of preventing and resolving loneliness. In addition, research on the role of the sociocultural context is needed (Barreto et al., 2020). Interventions developed in one context may not translate easily in a different context. This may be of particular relevance when the sociocultural contexts differ in the strength with which individuals hold various social norms.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgements.

References

Barreto M, Victor C, Hammond C, Eccles A, Richins MT, & Qualter P (2020). Loneliness around the world: Age, gender, and cultural differences in loneliness. Personality and Individual Differences. Available online, https://www.sciencedirect.com/science/article/pii/S0191886920302555, accessed July 27, 2020.

Bennett KM (2005). Psychological wellbeing in later life: The longitudinal effects of marriage, widowhood and marital status change. International Journal of Geriatric Psychiatry, 20, 280–284. [PubMed: 15717334]

Bessaha ML, Sabbath EL, Morris Z, Malik S, Scheinfeld L & Saragossi J (2020). A systematic review of loneliness interventions among non-elderly adults. Clinical Social Work Journal, 48, 110–125

Blossfeld H-P. (2009). Educational assortative marriage in comparative perspective. Annual Review of Sociology, 35, 513–530.

Carmichael CL, Reis HT, & Duberstein PR (2015). In your 20s it's quantity, in your 30s it's quality: The prognostic value of social activity across 30 years of adulthood. Psychology and Aging, 30, 95–105. [PubMed: 25774426]

Cherlin AJ, & Fomby P (2004). Welfare, work, and changes in mothers' living arrangements in low-income families. Population Research and Policy Review, 23, 543–565.

Cigna US Loneliness Index (2018). Survey of 20,000 Americans Examining Behaviors Driving Loneliness in the United States. https://www.multivu.com/players/English/8294451-cigna-us-loneliness-survey/docs/IndexReport_1524069371598-173525450.pdf, accessed March 28, 2019.

Costa BM, Hall L, & Stewart J (2007). Qualitative exploration of the nature of grief-related beliefs and expectations. Omega, 55, 27–56. [PubMed: 17877080]

Drewelies J, Wagner J, Tesch-Römer C, Heckhausen J, & Gerstorf D (2017). Perceived control across the second half of life: The role of physical health and social integration. Psychology and Aging, 32(1), 76–92. [PubMed: 28182499]

Fakoya OA, McCorry NK, & Donnelly D (2020). Loneliness and social isolation interventions for older adults: A scoping review of reviews. BMC Public Health, 20, 129. [PubMed: 32054474]

Gerstorf D, Röcke C, & Lachman ME (2010). Antecedent–consequent relations of perceived control to health and social support: Longitudinal evidence for between-domain associations across adulthood. Journals of Gerontology: Psychological Sciences, 66B(1), 61–71, doi:10.1093/geronb/gbq077.

Greenfield E, & Russell D (2011). Identifying living arrangements that heighten risk for loneliness in later life: Evidence from the U.S. National Social Life, Health, and Aging Project. Journal of Applied Gerontology, 30, 524–534.

Groves RM, & Peytcheva E (2008). The impact of nonresponse rates on nonresponse bias: A meta-analysis. Public Opinion Quarterly, 72, 167–189.

Hansen T, Slagsvold B, & Moum T (2008). Financial satisfaction in old age: A satisfaction paradox or a result of accumulated wealth? Social Indicators Research, 89(2), 323–347.

Hawkley LC, Duvoisin R, Ackva J, Murdoch JC, & Luhmann M (2015). Loneliness in older adults in the USA and Germany: Measurement invariance and validation. Working Paper Series, NORC at the University of Chicago, Paper 2015-002.

Hawkley LC, Hughes ME, Waite LJ, Masi CM, Thisted RA, & Cacioppo JT (2008). From social structural factors to perceptions of relationship quality and loneliness: The Chicago Health, Aging, and Social Relations Study. Journal of Gerontology: Social Sciences, 63B, S375–S384.

Hawkley LC, Wroblewski K, Kaiser T, Luhmann M, & Schumm LP (2019). Are U.S. older adults getting lonelier?: Age, period, and cohort differences. Psychology and Aging, 34, 1144–1157. [PubMed: 31804118]

Holt-Lunstad J, Smith TB, Baker M, Harris T, & Stephenson D (2015). Loneliness and social isolation as risk factors for mortality: A meta-analytic review. Perspectives on Psychological Science, 10, 227–237. [PubMed: 25910392]

Hughes ME, Waite LJ, Hawkley LC, & Cacioppo JT (2004). A short scale for measuring loneliness in large surveys. Research on Aging, 26, 655–672. [PubMed: 18504506]

Jackson JC, Gelfand M, De S, & Fox A (2019). The loosening of American culture over 200 years is associated with a creativity-order trade-off. Nature Human Behaviour, 3, 244–250.

Johnson DS, Smeeding TM, & Torrey BB (2005). Economic inequality through the prisms of income and consumption. Monthly Labor Review, 128, 11–24.

Kallgren CA, Reno RR, & Cialdini RB (2000). A focus theory of normative conduct: When norms do and do not affect behavior. Personality and Social Psychology Bulletin, 26, 1002–1012.

Letablier M-T, Luci A, Math A, & Thévenon O (2009). The costs of raising children and the effectiveness of policies to support parenthood in European countries: A literature review. European Commission, Directorate-General for Employment, Social Affairs and Equal Opportunities, Unit for Social and Demographic Analysis. http://ec.europa.eu/social/BlobServlet?docId=2268&langId=en, accessed April 20, 2020.

Luhmann M, & Hawkley L (2016). Age differences in loneliness from late adolescence to oldest old age. Developmental Psychology, 52, 943–959. 10.1037/dev0000117. [PubMed: 27148782]

Malhotra R, & Ang SJW (2016). Social support for older adults – A bane or a boon for their health? Annals of the Academy of Medicine, 45, 172–173.

Marsden PV, & Smith TW (2016). Overview: The General Social Survey Project. GSS Project Report No. 31. Chicago: NORC. http://gss.norc.org/Documents/reports/projectreports/PR31%20-%20GSS%20Overview.pdf, accessed October 11, 2019.

Masi CM, Chen H-Y, Hawkley LC, & Cacioppo JT (2011). A meta-analysis of interventions to reduce loneliness. Personality and Social Psychology Review, 15, 219–266. PMCID: PMC3865701. [PubMed: 20716644]

Mund M, Freuding MM, Mobius K, Horn N, & Neyer FJ (2019). The stability and change of loneliness across the lifespan: A meta-analysis of longitudinal studies. Personality and Social Psychology Review. In press. https://osf.io/hysc3/, accessed Oct. 30, 2019.

Nicolaisen M, & Thorsen K (2017). What are friends for? Friendships and loneliness over the lifespan – from 18 to 79 years. The International Journal of Aging and Human Development, 84(2), 126–158. doi:10.1177/0091415016655166. [PubMed: 27357305]

Nyqvist F, Victor CR, Forsman AK, & Cattan M (2016). The association between social capital and loneliness in different age groups: A population-based study in Western Finland. BMC Public Health, 16, 542. [PubMed: 27400659]

O'Rourke HM, Collins L, & Sidani S (2018). Interventions to address social connectedness and loneliness for older adults: a scoping review. BMC Geriatrics, 18, 214. [PubMed: 30219034]

Perelli-Harris B & Bernardi L (2015). Exploring social norms around cohabitation: The life course, individualization, and culture. Demographic Research, 33, 701–732.

Perlman D (1990). Age differences in loneliness: A meta-analysis. Paper presented at the Annual Convention of the American Psychological Association. Document reproduction supplied by EDRS, https://files.eric.ed.gov/fulltext/ED326767.pdf, accessed Oct. 30, 2019.

Pinquart M, & Sorensen S (2003). Risk factors for loneliness in adulthood and old age—A meta-analysis. Advances in Psychology Research, 19, 111–143.

Pyle E, & Evans D (2018). Loneliness – What characteristics and circumstances are associated with feeling lonely? Office for National Statistics, UK. https://www.gov.uk/government/statistics/loneliness-what-characteristics-andcircumstances-are-associated-with-feeling-lonely, accessed July 27, 2020.

Qualter P, Vanhalst J, Harris R, Van Roekel E, Lodder G,...& Verhagen M (2015). Loneliness across the life span. Perspectives on Psychological Science, 10, 250–264. [PubMed: 25910393]

Recksiedler C, Loter K, Klaas HS, Hollstein B, & Perrig-Chiello P (2018). Social dimensions of personal growth following widowhood: A three-wave study. Gerontology, 64(4), 344–360. [PubMed: 29402839]

Rote S, Hill TD, & Ellison CG (2013). Religious attendance and loneliness in later life. The Gerontologist, 53, 39–50. [PubMed: 22555887]

Smith TW, Davern M, Freese J, & Morgan SL (2019). General Social Surveys, 1972-2018 [machine-readable data file]. Sponsored by National Science Foundation. NORC edition. 1 data file (64,814 logical records) + 1 codebook (3,758 pp.). National Data Program for the Social Sciences, no. 25. Appendix A. Accessed Oct. 30, 2019. http://gss.norc.org/documents/codebook/GSS_Codebook_AppendixA.pdf.

Stack S (1998). Marriage, family and loneliness: A cross-national study. Sociological Perspectives, 41, 415–432. 10.2307/1389484

Stone AA, Schneider S, Krueger A, Schwartz JE, & Deaton A (2018). Experiential wellbeing data from the American Time Use Survey: Comparisons with other methods and analytic illustrations with age and income. Social Indicators Research 136, 359–378. [PubMed: 29755178]

Twenge JM (2019). Why increases in adolescent depression may be linked to the technological environment. Current Opinion in Psychology, 32, 89–94. 10.1016/j.copsyc.2019.06.036 [PubMed: 31415993]

van Buuren S, & Groothuis-Oudshoorn K (2011). mice: Multivariate Imputation by Chained Equations in R. Journal of Statistical Software, 45(3), 1–67.

Victor C, Grenade L, & Boldy D (2005). Measuring loneliness in later life: A comparison of differing measures. Reviews in Clinical Gerontology, 15, 63–70.

Victor CR & Yang K (2012). The prevalence of loneliness among adults: A case study of the United Kingdom. The Journal of Psychology: Interdisciplinary and Applied, 146:1-2, 85–104, DOI:10.1080/00223980.2011.613875 [PubMed: 22303614]

Visser MA, & Fakiri FE (2016). The prevalence and impact of risk factors for ethnic differences in loneliness. European Journal of Public Health, 26, 977–983. [PubMed: 27497438]

von Soest T, Luhmann M, Hansen T, & Gerstorf D (2020). Development of loneliness in midlife and old age: Its nature and correlates. Journal of Personality and Social Psychology, 118(2), 388–406. [PubMed: 30284871]

Waite LJ, & Lehrer EL (2003). The benefits from marriage and religion in the United States: A comparative analysis. Population Development and Review, 29, 255–276.

Yang K & Victor C (2011). Age and loneliness in 25 European nations. Ageing and Society, 31, 1368–1388.

Loneliness Distribution Across Both Waves
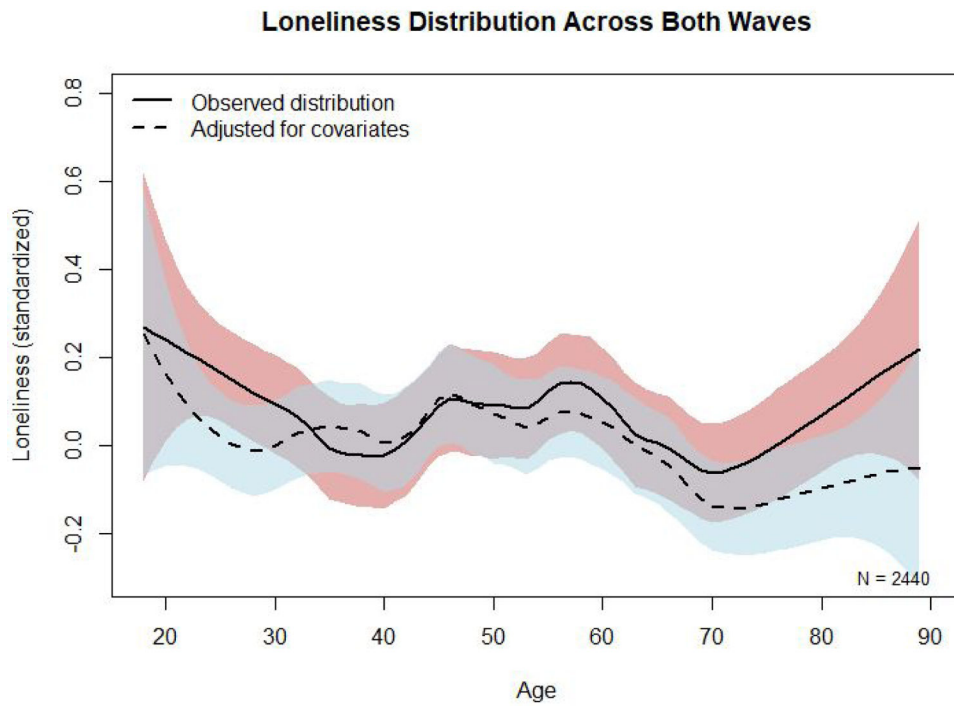
Figure 1.
Age distribution of loneliness (standardized) across both waves, for unadjusted scores (continuous line, red confidence band) and scores adjusted for covariates (dashed line, blue confidence band). Confidence bands depict 95% confidence intervals. $N = 2,440$.

Loneliness Distribution in 2014 and 2018

Figure 2.
Age distribution of loneliness (standardized, not adjusted for covariates) in the 2014 (N = 1,278) and 2018 (N = 1,162) GSS waves. Confidence bands depict 95% confidence intervals.

Table 1.

Descriptive statistics for all study variables in the total sample and by study wave.

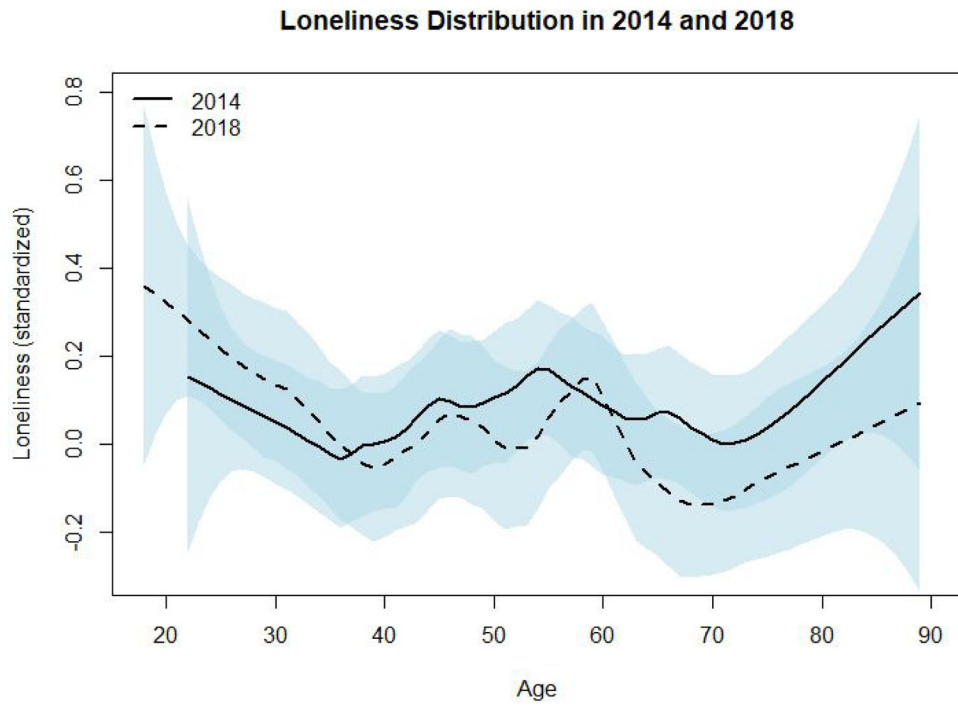| Variable	Total sample		2014		2018		Comparison between waves	
	M or n	SD or %	M or n	SD or %	M or n	SD or %	d or χ^2	p
Sex							4.90	0.027
male	1124	46.1	561	43.9	563	48.5		
female	1316	53.9	717	56.1	599	51.5		
Age	50.16	17.06	51.38	16.14	48.83	17.92	−0.15	<.001
Race-ethnicity							11.47	0.001
minority group	730	29.9	343.6	26.9	386.4	33.3		
non-Hispanic White	1710	70.1	934.4	73.1	775.6	66.7		
Household-size adjusted annual log-income	10.33	1.08	10.28	1.06	10.39	1.11	0.11	0.010
Years of education	13.92	2.89	13.99	2.87	13.84	2.92	−0.05	0.176
Work status							1.20	0.752
no job	142	5.8	71	5.6	71	6.1		
other	370.4	15.2	189	14.8	181.4	15.6		
retired	497	20.4	269	21.0	228	19.6		
with job	1430.6	58.6	749	58.6	681.6	58.7		
Household size							30.49	<.001
1 person	615	25.2	301	23.6	314	27.0		
2 persons	906	37.1	430	33.6	476	41.0		
3+ persons	919	37.7	547	42.8	372	32.0		
Children in household							42.95	<.001
with kids	597.2	24.5	382.8	30.0	214.4	18.5		
without kids	1842.8	75.5	895.2	70.0	947.6	81.5		
Marital status							12.85	0.005
married	1092.2	44.8	596.8	46.7	495.4	42.6		
widowed	204	8.4	111	8.7	93	8.0		
divorced or separated	516.4	21.2	280.2	21.9	236.2	20.3		
never married	627.4	25.7	290	22.7	337.4	29.0		
Self-rated health	2.87	0.82	2.86	0.81	2.89	0.82	0.04	0.432

| | Total sample | | 2014 | | 2018 | | Comparison between waves | |
Variable	M or n	SD or %	M or n	SD or %	M or n	SD or %	d or χ^2	p
Religious engagement	2.93	2.33	3.01	2.36	2.83	2.29	−0.08	0.059
Frequency of spending time with friends	3.96	1.56	3.98	1.54	3.94	1.58	−0.02	0.580
Frequency of spending time with relatives	4.57	1.72	4.58	1.72	4.56	1.72	−0.01	0.568
Frequency of spending time with neighbors	3.40	2.01	3.41	2.00	3.40	2.02	0.00	0.831
Loneliness	1.90	0.82	1.97	0.79	1.81	0.85	−0.19	<.001

Notes. $N = 2,440$. Descriptive statistics are pooled across five imputed data sets. Descriptive statistics for the original data with missing values are provided in the online supplemental material. For categorical variables, absolute frequencies (*n*) and percentages (%) are provided for each category. For continuous variables, means (*M*) and standard deviations (*SD*) are provided. Self-rated health was measured on a 4-point scale ranging from 1 (poor) to 4 (excellent). Religious engagement was measured on an 11-point scale ranging from 1 (never) to 11 (several times a day). Frequency of spending time with friends, relatives, neighbors were measured on a 7-point scale ranging from 1 (never) to 7 (almost daily). Loneliness was measured on a 4-point scale from 1 to 4 with higher scores reflecting greater loneliness. Significance tests for differences between the two waves are χ^2 tests for categorical variables and independent sample *t*-tests for continuous variables. For the latter, only effect sizes (Cohen's *d*) and *p* values are provided.

Table 2.

Regression models for absolute and age-normative predictors.

Predictor	Model 1				Model 2				Model 3			
	Estimate	95 % CI lower	95 % CI upper	p	Estimate	95 % CI lower	95 % CI upper	p	Estimate	95 % CI lower	95 % CI upper	p
(Intercept)	−0.08	−0.31	0.14	0.481	0.19	0.02	0.37	0.043	0.09	−0.17	0.35	0.505
Survey year: 2018	−0.16	−0.24	−0.09	< .001	0.24	0.16	0.32	< .001	0.26	0.18	0.34	< .001
Age	0.00	−0.01	0.001	0.164	0.00	−0.004	0.001	0.380	0.00	−0.01	0.002	0.431
Age²	0.00	−0.0002	0.0001	0.577	0.00	−0.0001	0.0001	0.911	0.00	−0.0004	−0.0001	0.001
Sex: female	0.00	−0.07	0.08	0.945	−0.05	−0.13	0.03	0.262	−0.07	−0.15	0.01	0.098
Race-ethnicity: non-Hispanic White	0.08	−0.01	0.16	0.073	0.06	−0.03	0.15	0.214	0.10	0.02	0.19	0.022
Adjusted annual income	−0.06	−0.10	−0.02	0.005					−0.07	−0.12	−0.01	0.021
Years of education	0.01	−0.01	0.02	0.340					0.01	−0.01	0.02	0.324
Work status: other	0.08	−0.10	0.25	0.391					0.10	−0.08	0.28	0.269
Work status: retired	−0.10	−0.30	0.09	0.289					0.05	−0.18	0.28	0.695
Work status: with job	−0.06	−0.21	0.10	0.461					−0.01	−0.22	0.19	0.899
Household size: 2 persons	−0.23	−0.35	−0.10	< .001					−0.24	−0.37	−0.11	< .001
Household size: 3+ persons	−0.12	−0.26	0.01	0.089					−0.16	−0.30	−0.01	0.041
Living without children	0.07	−0.05	0.18	0.301					0.06	−0.09	0.21	0.454
Marital status: widowed Marital status:	0.56	0.38	0.75	< .001					0.56	0.36	0.76	< .001
separated/divorced Marital status: never	0.35	0.24	0.47	< .001					0.33	0.19	0.47	< .001
married	0.39	0.28	0.51	< .001					0.36	0.24	0.49	< .001
Self-rated health	−0.20	−0.25	−0.15	< .001					−0.22	−0.27	−0.16	< .001
Religious engagement Frequency of spending time	0.01	−0.01	0.03	0.253					0.01	−0.02	0.04	0.517
with friends	0.00	−0.03	0.03	0.955					0.00	−0.03	0.03	0.939
Frequency of spending time with relatives	−0.06	−0.08	−0.04	0.001					−0.07	−0.09	−0.04	0.002
Frequency of spending time with neighbors	−0.03	−0.05	−0.01	0.038					−0.03	−0.05	−0.01	0.011
Deviation from normative adjusted annual income					0.02	0.004	0.036	0.017	−0.01	−0.03	0.01	0.587
Deviation from normative years of education					0.00	−0.004	0.001	0.373	0.00	−0.002	0.003	0.639
Normative work status					−0.09	−0.18	−0.01	0.036	−0.02	−0.16	0.12	0.758
Normative household size					−0.05	−0.13	0.03	0.208	0.00	−0.09	0.08	0.969

Predictor	Model 1				Model 2				Model 3			
		95 % CI	95 % CI			95 % CI	95 % CI			95 % CI	95 % CI	
	Estimate	lower	upper	p	Estimate	lower	upper	p	Estimate	lower	upper	p
Normative children-in-household status					−0.06	−0.15	0.04	0.253	−0.11	−0.24	0.01	0.085
Normative marital status					−0.28	−0.37	−0.19	< .001	−0.02	−0.12	0.08	0.649
Deviation from normative self-rated health					0.06	0.01	0.10	0.039	−0.02	−0.07	0.02	0.367
Deviation from normative religious engagement					0.00	−0.004	0.003	0.751	0.00	−0.01	0.01	0.979
Deviation from normative frequency of spending time with friends					0.00	−0.01	0.02	0.790	0.00	−0.01	0.01	0.912
Deviation from normative frequency of spending time with relatives					0.00	−0.01	0.01	0.906	−0.01	−0.02	−0.002	0.029
Deviation from normative frequency of spending time with neighbors					0.00	−0.01	0.01	0.829	0.00	−0.01	0.01	0.919

Notes. N = 2,440. Categorical variables were dummy-coded with 0 for 2014 (survey year), male (sex), minority group (race–ethnicity), no job (work status), 1-person household (household size), and married (marital status). Normative categorical variables were dummy-coded with 0 = non-normative status and 1 = normative status. Continuous predictors were centered on the on the grand mean (computed across the two waves) prior to these analyses. Normative continuous predictors reflect the squared deviation from the reference value. The outcome variable loneliness was standardized on the grand mean and grand standard deviation (computed across the two waves).