Solitary days, solitary activities and associations with wellbeing among older adults

Objectives.

Drawing on the activity theory of aging, we examined whether solitary activities may be associated with negative wellbeing, as they may reflect social isolation. Using American Time Use Surveys, with information on with whom individuals engaged during their activities over a 24-hour period, we created measures to capture solitary days and solitary activities to understand their prevalence and associations with wellbeing.

Method.

At the daily level, we examined the associations between solitary days and the proportion of the day spent in solitary activities with life satisfaction. At the activity level, we examined the associations between engaging in an activity alone versus engaging in an activity with others and the individual's emotional state during the activity.

Results.

Solitary days and a higher proportion of the day spent on solitary activities were associated with lower levels of life satisfaction. These associations were attenuated after controlling for individual covariates. Solitary engagement in activities was associated with lower levels of happiness and higher levels of sadness and pain during the activity. Furthermore, the association with happiness remained robust even after adjusting for covariates.

Discussion.

A sizable proportion of older adults report solitary days, and the proportion of the day spent in solitary activities increases by age. Thus, examining the lived experiences of older adults and the presence of others during activities could contribute to the research on social isolation.

KEYWORDS: Social isolation; solitary days; solitary activities; life satisfaction; time use

INTRODUCTION

The relationship between activity engagement and wellbeing in later life has been of interest to social gerontologists and a subject of research for a period of time (Lemon, Bengtson and Peterson 1972; Hoyt et al. 1980). This has brought about the notion of 'successful aging' (Rowe and Kahn 1997), which has been defined as remaining in active engagement, along with the absence of disease, and maintaining good cognitive and physical functioning. The activity theory of aging (Havighurst 1961; Knapp 1977) has proposed that the wellbeing of older adults is supported through their participation in social and leisure activities and may benefit through providing mental stimulation, a sense of routine and purpose, and it could contribute to self-esteem and self-efficacy (Wahrendorf et al. 2008).

Given the possible range of activities older adults could engage in, researchers have in turn classified the various dimensions and domains of activities, providing a deeper and more holistic understanding of engagement in later life (Lennartsson and Silverstein 2001; Litwing and Shiovitz-Ezra 2006; Menec 2003). Overall, researchers have categorized social and leisure activities into one of three broad types of activities, including formal, informal and solitary activities (Adams, Leibbrandt and Moon 2011). Formal activities include participation in groups and organizations, while informal activities include socializing with friends, family and neighbors. In contrast, solitary activities are activities such as watching television, reading, and other hobbies that are often carried out alone. Note that studies examining the links between activities and wellbeing tend to conclude that informal social activities rather than formal or solitary activities are related to positive wellbeing (Adams, Leibbrandt and Moon 2011). This underscores that in addition to being engaged, the context of the activity engagement may also be crucial. The definition of successful aging (Rowe and Kahn 1997) has emphasized the benefits of continual engagement with life through social and productive activities, though it

is unclear how solitary activities align with this definition. This is particularly the case, as a benefit of social and productive activities is the enabling of the maintenance of interpersonal relations (Rowe and Kahn 1997), which would be absent in many solitary activities. While some productive activities, such as paid or unpaid activities that create goods or services for economic value, may be carried out alone, we would expect that most productive activities of older adults, such as paid work, volunteering or caregiving, are conducted in the presence of others.

Given the framing of the literature around older adults' activities, it is unclear whether engagement in solitary activities could have potential negative consequences. Such a research question may have been overlooked given that solitary activities are often framed as leisurely rather than as something that could have a harmful effect on wellbeing, especially if it is experienced frequently (Litwing and Shiovitz-Ezra 2006; Menec 2003). As recent literature has indicated that associations between social isolation and loneliness tend to have poor outcomes (Leigh-Hunt et al., 2017; Luo & Waite, 2014; Rico-Uribe et al. 2018; Steptoe et al. 2013), this research question may be important to address.

The existing literature on the wellbeing correlates of solitary activity may also have at least one methodological shortcoming in that we often do not observe the *magnitude* of solitude in older adults (Agahi and Parker 2008; Lennartsson and Silverstein 2001). For instance, operationalization of solitary activities is often based on whether someone may have participated in an activity, or on the frequency of participation, with broad categories such as 'no', 'yes, sometimes' or 'yes, often' (Agahi and Parker 2008) or 'not at all,' 'sometimes' and 'often' (Lennartsson and Silverstein 2001). These categories are arguably vague, and they do not provide an in-depth view of the extent of solitude that may be experienced by certain groups of vulnerable older adults.

Capturing the extent of solitude may be better afforded by the use of rich datasets, such as time-use surveys, as they could provide a detailed view of all activities in which older people engage in over the course of a single day. Time-use surveys are increasingly used in social science research and typically require respondents to list out *all* activities undertaken over a 24-hour period, with additional information on where the activity took place, with whom the activity was engaged, the duration of the activity, and the perceptions of the level of enjoyment with the activity. The availability of time-use surveys could therefore allow for understanding both the relative amount of time per day older people may be in solitude, as well as allowing for an examination of its association with wellbeing.

In this study, we begin to address this gap in the literature by considering whether solitary activity may be of potential concern given that it could reflect social isolation and may be linked with worse wellbeing. This study therefore aimed to advance the existing literature in several ways. Theoretically, it critically engages with activity theory (Havighurst 1961), whereby the assumption is that participation in social and leisure activities is associated with better wellbeing. This study also explores the concept of successful aging, given that successful aging emphasizes active engagement, whereby social and productive activities could confer benefits through 'contacts and transactions with others, exchange of information, emotional support, and direct assistance' (Rowe and Kahn 1997, pp. 433-4). As solitary activities may not fit this definition of active engagement, it is unclear how they may be associated with the wellbeing of older adults. Further, it is unclear whether a high degree of solitary activities may be negatively correlated with wellbeing.

In addition to its theoretical contributions, this study advances the field methodologically by drawing on time-use diaries and capturing detailed experiences of older adults over a 24-hour period. In turn, we constructed and tested novel measures of solitary days and solitary activities. Given that we have information on all activities engaged in over a single

day, we were able to investigate whether solitude at the activity level and/or the aggregate daily level may be associated with worse wellbeing. The consideration of solitary activities and solitary days may also extend discussions of the measurement of social isolation and loneliness, as current scales do not capture how social isolation may operate on a daily level (Berkman & Syme 1979; de Jong Gierveld et al. 2015; Lubben et al. 2006). In turn, our measures of solitary days and activities may fill a gap in the literature, highlighting the middle ground between the psychological and cognitive factors that inform scales on loneliness and the indicators of social networks and relationships that inform social isolation scales, underscoring the social rhythms of older adults' daily lives – how they live and interact and whether in fact they are socially isolated via the presence or absence of other people.

ACTIVITY THEORY AND THE ROLE OF SOLITARY ACTIVITIES

Activity theory rests on the notion that remaining active and engaged is good for older people (Hout et al. 1980; Lemon et al. 1972; Reitzes, Mutran and Verrill 1995). As such, it has been argued that participation in social and leisure activities could promote wellbeing, as engagement enhances social integration and support (Aquino et al. 1996; Hagrety et al. 1996), encourages role continuity or role replacement (Atchley 1989; Lemon, Bengtson and Peterson 1972) and contributes to a sense of mastery (Holahan 1988; Lawton et al. 2002; Warr, Butcher and Robertson 2004).

While most studies have included solitary activity as a form of social and leisure activity, researchers often do not find an association between solitary activity and wellbeing (Knapp 1977; Lemon, Bengtson and Vern 1972; Longino and Kart 1982). This may, nevertheless, be consistent with expectations from the literature on successful aging (Rowe and Kahn 1998), as solitary activities do not fulfill the definition of being in sustained engagement with social and productive activities. An exception to this trend is a study by Menec (2003),

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which found that solitary activity, defined as "handwork hobbies," "music, art, theatre" and "reading or writing," is related to higher levels of happiness. However, the measurement of solitary activity in Menec (2003) is quite broad, as respondents were asked only whether they had participated in any of those activities within the past week, without an account of the relative duration or frequency of the activity. This operationalization of solitary activity is nevertheless the case for many of the studies examining solitary activity and wellbeing (Lennartsson and Silverstein 2001; Litwin and Shiovitz-Ezra 2006). Arguably, such an operationalization of solitary activity does not provide a full view of the potential solitude experienced. Furthermore, the categorization of solitary activity often *assumes* that those activities were performed alone, as activities (such as reading, writing or engaging in a hobby) are often defined as solitary *a priori* rather than an empirical capture of the presence or absence of other people during the activity (Lennartsson and Silverstein 2001; Litwin and Shiovitz-Ezra 2006; Menec 2003). A few exceptions include one study that examined the association between the presence of others during an activity and the wellbeing of a small sample of older adults in Berlin (n=81), and it found that being in the company of others is associated with more positive affect (Klumb 2004). Birditt and colleagues (2018) also found that solitude is associated with affect among 313 older adults (65+), albeit also contingent on the quality of their social networks, with solitude predicting less negative affect for those with more conflictual social networks. Nevertheless, these studies may be limited to the extent that they draw on smaller samples of older adults rather than from a national survey, and they were also unable to consider any effects of solitude in aggregate as they did not capture all activities over a sustained period of time.

As studies continue to investigate the importance of social and leisure participation for the health and wellbeing of older adults (Litwin and Shiovitz-Ezra 2006; Menec 2003), further discussion on operationalization and measures of forms of activities may be useful. The current

study therefore seeks to highlight whether solitary days and activities could be measured differently and tests whether it is negatively associated with wellbeing. Additionally, the consideration of solitary days may also be a factor in existing discussions concerning the social isolation and loneliness of older people.

SOCIAL ISOLATION, LONELINESS AND WELLBEING

Social isolation and loneliness in older adults are of interest to social scientists and policymakers as they have been found to be associated with a number of poor outcomes (Holt-Lunstad et al., 2010; Leigh-Hunt et al., 2017; Rico-Uribe et al., 2018; Steptoe et al., 2013). Studies generally show a positive relationship between loneliness and mortality (Holt-Lunstad et al., 2010; Leigh-Hunt et al., 2017; Luo & Waite, 2014; Rico-Uribe et al. 2018; Steptoe et al. 2013), with one study finding that the effect size is similar to the impact of smoking or having high blood pressure (Pantell et al., 2013). Cardiovascular disease and stroke are the outcomes most commonly linked with social isolation and loneliness in meta-analyses (Leigh-Hunt et al., 2017; Valtorta, Kanaan, Gilbody, Ronzi, & Hanratty, 2016). Increased inflammatory responses due to stress (Ong, Uchino, & Wethington, 2016; Rico-Uribe et al., 2018; Shankar, McMunn, Banks, & Steptoe, 2011) and the higher prevalence of unhealthy lifestyle behaviors, such as drinking (Ong et al., 2016; Pantell et al., 2013; Rico-Uribe et al., 2018; Shankar et al., 2011), are potential mechanisms through which loneliness and isolation are related to worse physical health. With regards to mental health, isolation and loneliness are associated with higher rates of depression, self-harm, suicide ideation and suicide (Brittain et al. 2015; Cornwell & Waite 2009a; Leigh-Hunt et al., 2017; Stolz et al., 2016).

Approximately 24% of community-dwelling older adults (65+) in the U.S. have been found to be socially isolated (Cudjoe et al. 2018). In a similar vein, the prevalence of frequent loneliness has been reported by 3-34% of older people (60-plus) across different European

countries (Yang & Victor 2011). Notably, key subgroups of older people have been reported to be at greater risk, including the unmarried, the oldest old, the less educated, those in poorer health and those living alone (Steptoe, Shankar, Demakakos, & Wardle, 2013).

However, there is no universal measure for capturing social isolation and loneliness as measures of isolation tend to draw on social network indicators, underscoring the quality, quantity and frequency of contact with one's network members, whereas loneliness is often a 'subjective' measure, where respondents are asked to report on their sense of loneliness. In a summary of systematic reviews published between 1950 and 2016, Leigh-Hunt et al. (2017) found that existing studies have used 62 different self-report instruments, with the most commonly used scales including the University of California, Los Angeles Loneliness Scale (Russell 1980), the De Jong Gierveld Loneliness Scale (de Jong Gierveld et al. 2015), the Berkman-Syme Social Network Index (Berkman & Syme 1979) and the Lubben Social Network Scale (Lubben et al. 2006).

While a range of measures have been created to capture social isolation and loneliness, to understand their associations with wellbeing (Berkman & Syme 1979; de Jong Gierveld et al. 2015; Lubben et al. 2006; Russell 1980), less is known about how social isolation may operate on a daily level. Furthermore, none of the existing scales provide a rich overview of the daily experiences of older adults. By assessing whether solitary days and solitary activities may be salient, this study can potentially inform whether additional components should be added to existing measures in future data collection efforts. Investigating the correlates of life satisfaction and emotional state also has the potential to explain variations in the wellbeing of older adults and inform interventions to improve these outcomes. For example, the literature finds that subjective wellbeing measures, such as life satisfaction, are salient indicators and have independent associations with various health outcomes, such as mortality and the onset of diseases (Collins, Goldman & Rodriguez 2008; Lyyra, Tormakangus, Read, and Rantanen

2006; Maier & Smith, 1999; Ostir, Markides, Black, and Goodwin 2000). A study by Collins and colleagues (2008) found that higher baseline life satisfaction was associated with fewer mobility limitations at follow-up, whereas a longitudinal study by Ostir and colleagues (2000) found positive affect at baseline to be associated with both functional limitations and mortality at a later time. Another study by Ostir and colleagues (2001) also found positive affect to be inversely associated with stroke incidence. Therefore, consideration of these wellbeing measures is justified in its own right. We acknowledge, however, that these outcomes may have shortcomings because, for example, happiness and positive affect are subject to changing rapidly in response to the immediate context (George 2010) even though life satisfaction, compared with other subjective wellbeing outcomes, is more stable.

Aims of the current study

This study incorporates the concept of successful aging and the activity theory of aging while drawing on studies on the social isolation and loneliness of older adults to consider the role and wellbeing correlates of solitary activities. First, solitary activities have arguably been overlooked in the literature on successful aging (Pruchno et al. 2010; Rowe and Kahn 2015), with the related literature focusing on the benefits of active engagement through social and productive activities. Second, studies drawing on activity theory (Havighurst 1961; Knapp 1977) have considered the role of solitary activities, framing these as leisurely activities, though much of the empirical findings report null associations with wellbeing (Knapp 1977; Lemon, Bengtson and Vern 1972; Longino and Kart 1982). As we have argued, however, the operationalization of solitary activity in prior studies may have shortcomings, and accordingly, we have aimed to advance this aspect in the current study. Third, studies on social isolation and loneliness of older adults have, thus far, found strong associations of social isolation and loneliness with lower levels of wellbeing. That said, these studies have yet to examine the role

of solitary days and activities, even as they reflect on social isolation. Thus, this study aims to build on and extend the existing research, to understand the prevalence and correlates of solitary days and solitary activities, and to investigate the associations of solitary days and solitary activities with subjective wellbeing. This study has four objectives: 1) to report the prevalence of solitary days among older adults, in which respondents have engaged in all of their activities alone over a 24-hour period, as well as understand the proportion of the day in which older adults engage in solitary activities; 2) to examine individual-level correlates that may be associated with solitary activities, unpacking potential vulnerability across different subgroups; 3) to investigate whether solitary days, as well as the proportion of days alone, are associated with lower life satisfaction; and 4) to investigate whether engaging in solitary activities is associated with more negative emotional valence during the activity. In addressing these questions, we hope to extend previous studies on social isolation and wellbeing, providing both a proximal and general investigation of the effects of solitude.

METHODS

Our data come from the American Time Use Survey (ATUS) and have been obtained from ATUS-X (Hofferth et al. 2015) that harmonizes the original data and provides microdata in a used-friendly format as well as with newly constructed variables. The ATUS is a nationally representative sample that captures information on respondents' time use by means of a diary where they report all of their activities over a 24-hour period. The survey has been conducted annually since 2003, and the sample is randomly selected from individuals who previously participated in the Current Population Survey (CPS). The CPS is a monthly U.S. household survey conducted jointly by the U.S. Census Bureau and the Bureau of Labor Statistics and whose main purpose is to collect information about labor market and labor force participation. One household member at least 15 years old in each selected household was asked to complete

a 24-hour diary with all of their activities during this period. Additional information from respondents and their households was also collected, such that although time-use information is available only for one member per household, there is information available on the characteristics of other family members and the respondents' living arrangements.

In the 24-hour diary, the respondents report the activity they are engaged in, when the activity starts and ends, the location of the activity, and with whom it is carried out. The reporting of engagement in a secondary activity is also possible and includes activities such as childcare or caring for an adult[1]. Moreover, specific modules are included in the questionnaire every year. In our study, we drew on data from the years 2012 and 2013 when a wellbeing module was included in the survey. The module includes additional measures that allow us to examine wellbeing as an outcome, including a measure of life satisfaction, whereby respondents were asked to indicate their life satisfaction on a scale from 0 (worst possible life) to 10 (best possible life)[2]. It also includes reports of mood for up to 3 randomly selected activity episodes in their diary, where they were asked how they feel on a scale from 0 (not at all) to 6 (very), in terms of pain, happiness, sadness, fatigue and stress[3].

In total, 12,443 respondents participated in the survey in 2012 and 11,385 in 2013. Of them, 11,359 and 10,378 completed the wellbeing module in each year, respectively. In this study, we selected respondents 65 years and older representing 4,414 individuals over the two years. Of them, we also have wellbeing information for 13,050 activity episodes over the 24-

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[1] Secondary childcare has been collected since the beginning of the survey in 2003, while secondary eldercare was introduced in 2011. In 2006-08 and 2014-16, there was a special module to gather information on secondary eating and drinking.

[2] The wording of the question is as follows: "Please imagine a ladder with steps numbered from zero at the bottom to ten at the top. The top of the ladder represents the best possible life for you, and the bottom of the ladder represents the worst possible life for you. If the top step is 10 and the bottom step is 0, on which step of the ladder do you feel you personally stand at the present time?".

[3] For activities to be eligible for selection, they must be at least five minutes in duration and may not include the following ACTIVITY codes: sleeping (0101xx), grooming (0102xx), personal activities (0104xx), refusal (500105), and don't know (500106). (Hofferth et al. 2017, www.atusdata.org).

hour diaries[4]. Appendix Table A reports on the composition of the sample according to the respondents' main sociodemographic characteristics.

Measures:

The information about *with whom* an activity is carried out allows us to examine the episodes of the diary when the respondent is alone. Using that information, we computed for each individual the minutes per day that they did not report being with others while carrying out their activities. Note that the '*with whom*' question is not asked for certain activities including sleeping, grooming and personal or private activities (such as using the bathroom or having sex). As such, we did not the compute time alone during those activities for which the 'with whom' question was not asked. For the remaining activities, however, we computed the total time alone as well as the percentage of time alone as a proportion of total time in those activities.

Control variables include self-rated health, which is an indicator that was recoded as 0 for excellent, very good or good health and 1 for fair or poor health. Age was aggregated into 3 groups: 65-74, 75-84 and 85 and over, and sex is an indicator that takes a value of 0 for men and 1 for women. The living arrangement is a combination of the variables regarding the presence of a partner in the household and the presence of other people in the household. This results in four categories: 1-living alone; 2-living only with a partner; 3 living with a partner and others; and 4 living without a partner, but with others. Race was recoded into 2 categories: 1 for white and 2 for nonwhite. Original educational attainment was recoded into 3 groups that correspond to 1- less than high school; 2- high school or some college; and 3-college degree or higher.

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[4] For some episodes, respondents did not report all mood measures, so the Ns in the table differ. However, the level of missing information is low, and there is no episode with all measures missing. Happiness is the measure with the highest percentage of missing values, with 1.46% of episodes missing. Missing episodes are random and not selected.

In Table 1, we first describe the average number of minutes respondents engage in their activities alone, by various characteristics. Additionally, we created and examined a measure of solitary days, whereby respondents reported that they engaged in *all* of their activities alone. Furthermore, we examined the differences in various characteristics by whether respondents reported their diary day as a solitary day. These estimates, and all other calculations computed in this paper except Appendix A, were weighted by the weights provided by the survey. All ATUS weights are probability weights created according to a methodology to ensure that the sums of the respondent weights add up to the appropriate number of weekday person-days and weekend person-days both for the population as a whole and for selected subpopulations (Hofferth et al., 2018).

Next, in Table 2, we move towards multivariate regression models. Given life satisfaction as a continuous measure, we drew on ordinary least squares (OLS) models, using the solitary day as an indicator and the proportion of the day engaged in activities alone as independent variables. First, as shown in Models 1 and 4, we computed a model including only the predictor variables. Next, in Models 2 and 5, we additionally included self-rated health as a control. Finally, in Models 3 and 6, we included the control variables that encompass sociodemographic characteristics of the respondents (including sex, age, living arrangement, race, and educational attainment[5]) and characteristics of the diary day (whether the diary day was a weekday or weekend and a subjective evaluation of how typical the diary day was compared to the respondent's 'usual' day[6]).

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[5] We have also estimated models, including individual-level variables such as marital status and employment status, but the inclusion of these measures did not contribute significantly to the models, in terms of changes in R-square, while the pattern of findings remained the same (not shown; available from authors). In the case of marital status, it is also highly correlated with living arrangement and provides less explanatory power than living arrangements in predicting variation in the outcome measures. Therefore, they were not included in the tables presented.

[6] The actual wording of the question is as follows: 'Thinking about yesterday (the diary day) as a whole, how would you say that your feelings, both good and bad, compared to a typical [fill day of the week]? Were they better than a typical [fill day of the week], the same as a typical [fill day of the week], or worse than a typical [fill day of the week]?'

Finally, as shown in Table 3, we performed the analysis at the activity level. Due to the nature of the data, we used multilevel models to take into account that the observations are not independent and that the activities may be clustered at the individual level. Following the same approach as Musick et al. 2018, we computed random intercept models for each measure of mood reported during the activity as the dependent variable and whether the respondent engaged in that activity alone (as opposed to with others) as the main predictor.

In all models, we also adjusted for covariates at the activity level, including the type of activity (out of 17 possible types of activities, see Appendix D) and the moment of the day when it starts. This is in addition to the control variables described above at the individual level. The moment of the day was categorized according to the time when the activity started and can take the following values: night (from 10 pm to 6 am, and it is the reference in the models), morning (6 am to 12 pm), afternoon (12 pm to 6 pm) and evening (6 pm to 10 pm).[7] Finally, we ran an additional analysis, stratified across different types of activities to tease out whether being engaged in certain types of activities alone may be more strongly associated with momentary mood.

RESULTS

As shown in Table 1, we found that the respondents in our sample reported an average of 454 minutes of engagement in activities alone during their diary day. This is out of a possible average of 856 minutes of activity engagement wherein it is possible to report the presence of another person (see Appendix D). Accordingly, it translates to approximately 53% of total time spent alone during those activities. We also found that in the order of frequency, for our sample as a whole, the next most common after engagement in activities alone was engagement in an

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[7] We have also estimated fixed-effect models to check the robustness of our findings, and our results were consistent with this alternative specification (not shown; available from authors). Fixed-effect models consider variations within individuals. In these estimations, all individual-level variables were dropped, and the model only included activity-level variation within the same individuals.

activity with the spouse followed by with 'other non-household members,' 'other household members,' the respondent's children, and finally the respondent's grandchildren (not shown; available from authors). We found that 12.2% of older adults reported having engaged in *all* of their activities alone during their diary day. As a comparison, we found that respondents younger than 65 reported an average of 301 minutes spent alone per day and only 4.4% of people younger than 65 reported that they were alone all day.

We found certain characteristics of the individual and of the day that were associated with a higher propensity to spend more time alone. For instance, older adults were more likely to report spending all day alone during weekdays than weekends. Respondents who evaluated their diary day as *better* than the typical day were more likely to spend approximately 100 minutes *less* in their activities alone than respondents who evaluated their diary days as the *same* as or *worse* than their typical day.

Regarding the sociodemographic characteristics of the respondents, older women on average reported spending approximately an hour more alone in their activities than older men do. A higher proportion of older women (14.9%) than men (10%) also spent all day alone. Time alone increased with age. Respondents in the age group 65-74 engaged in approximately 7 hours and 22 minutes of activities alone per day. For older adults in the age group of 75-84, this increased to 7 hours and 43 minutes, while for respondents 85 years old and over, this increased further to 8 hours and 24 minutes per day.

Time alone also significantly differs by individual characteristics, such that those with a college degree or higher (compared to those with less than a high school education) and whites (compared to non-whites) spend less time alone, while those who report fair or bad health (compared to those who report excellent, very good or good health) spend more time alone.

The most important differences in time alone, however, seem to be driven by respondents' living arrangements. Those who live alone spend almost twice as much time alone as those living with a partner. Respondents living by themselves report almost 11 hours of time alone in their activities, while those who live with a partner or with their partner as well as with others report spending approximately 5 hours and 50 minutes doing activities alone. Those living with another person who is not their partner report spending slightly more than 8 hours alone in their activities. It is especially relevant that approximately one-third (34%) of people who live alone engage in *all* of their activities alone during their diary day.

[Table 1 about here]

Being alone and life satisfaction

In this section, we report the results from models examining associations between an indicator of solitary day, a measure of the proportion of the day engaged in activities alone, and levels of life satisfaction. As shown in Model 1 in Table 2, we found an association between solitary day and lower levels of life satisfaction (-0.511; p<0.001). This implies a difference of 23% in the standard deviation between individuals who spent all day alone and those who did not spend all day alone. Similarly, in Model 4, we observe that a higher proportion of the day engaged in activities alone is also associated with lower levels of life satisfaction (-0.006; p<0.001). Note that the magnitude is noticeably smaller as the predictor here is each percent of the day alone versus the day with others. Nevertheless, when we translate this coefficient into a higher increment, the finding suggests a difference of approximately 3% of the standard deviation in life satisfaction across individuals who may report a 10% difference in the proportion of their day engaged in activities alone versus with others.

In Models 2 and 5, we further adjusted for a measure of self-rated health, which allowed us to account for the fact that health may influence whether older adults engage in activities

alone (versus with others), as well as their levels of life satisfaction. We note that while the size of the coefficients for both solitary day and the proportion of time engaged in activities alone become somewhat attenuated after controlling for self-rated health (-0.353; p<0.001 and -0.005; p<0.001, respectively), both measures remain strongly associated with life satisfaction.

Lastly, in Models 3 and 6, we also included in the models our list of control variables. Here, we observe that the coefficients for both of our main independent variables become further attenuated, whereby the association between solitary days and life satisfaction becomes nonsignificant (-0.072; n.s.) and the association for the proportion of the day engaged in activities and life satisfaction becomes marginally significant (-0.002; p<0.1).

[Table 2 about here]

Being alone and mood

At the bivariate, we found that being alone in daily activities is significantly associated with higher levels of pain and sadness and lower levels of happiness during the activity episode than being engaged in those activities with others (see Appendix Table B). In Table 3, we present the results from the random intercept models of older adults' mood, examining the association of mood with a measure of whether the respondent was engaged in the activity episode alone after first controlling for the activity-level variables (such as the type of activity out of 17 possible categories of daily activities, and the moment of the day when the episode started, see Models 1, 3, 5, 7 and 9) and subsequently including our control variables at the individual level (Models 2, 4, 6, 8 and 10).

As shown in the results, we found a significant association between engagement in activities alone and reports of happiness. Engagement in activities alone (versus with others) is associated with lower levels of happiness (-0.263; p<0.001; see Model 3). The relationships were slightly attenuated but remained statistically significant after we included the individual-

level control variables (-0.248; p<0.001; see Model 4). This translates into approximately a 15% standard deviation difference in happiness when engaged in an activity alone versus with others. As a point of comparison, note that compared with individuals in good or excellent health, individuals reporting being in fair or bad health report, on average, a happiness level of 0.623 units lower, i.e., 37% standard deviation, during activities. Respondents evaluated their mood on a scale from 0 to 6. Models with controls only at the activity level also show that being alone is associated with more pain and more sadness (Models 1 and 5). However, these estimates were not significant when the individual activity level controls are included (Models 2 and 6).

Lastly, we stratified and reran the analyses by the type of activity to explore whether the associations we found may vary contingent on the type of activity that was performed (see Appendix Table C). As some activities were more commonly reported than others (see Appendix Table D), we conducted these analyses only for the more commonly reported types of activities, for which we have sufficient cases (or activity episodes). These activities include 'household activities', 'eating and drinking', 'socializing, relaxing or leisure' and 'traveling'.

Here, we found that being alone is significantly associated with lower levels of happiness when the activity performed is eating and drinking (-0.503; p<0.001), socializing, relaxing or leisure (-0.451; p<0.001) or traveling (-0.230 p<0.01). Additionally, engaging in the firsts two types of activities alone are associated with higher levels of sadness for older adults than engagement in these activities in the presence of others. Note that we did not find an association between engagement in the activity alone and momentary mood when we restricted the activity to household activities. This lack of association suggests that the engagement in an activity alone or with others has differential associations with the reported mood of older adults, contingent on the specific type of activity that was carried out.

[Table 3 about here]

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DISCUSSION

Social isolation and loneliness are important concerns for older adults. In this paper, we developed new measures and examined the presence of other people as older adults engage in their activities over a 24-hour period, offering a new perspective on social isolation by highlighting how it may operate on a daily level. Our study draws on the concept of successful aging and the activity theory of aging when considering the implications of solitary activities, as researchers advancing these ideas have theorized how activities of older adults are related to wellbeing. Our study focuses on one specific form of activity, i.e., solitary activities, as these have received less attention in previous research. Our finding that solitary activities are associated with lower levels of happiness are consistent with expectations regarding successful aging, as the concept highlights social and productive aspects of activities to be conducive with wellbeing, something that would be missing from many activities that are carried out alone.

In underscoring solitary activities, we also critically engaged with the activity theory of aging (Havinghurst 1961; Lemon, Bengtson & Peterson 1972) to consider whether solitary activity, even as a form of leisure activity, may be associated with lower levels of wellbeing. Our study advances activity theory, and our findings suggest future research may wish to consider more fine-grained levels of engagement across the different forms of formal, informal and solitary activities. The availability of time-use data in recent years and other data sources containing detailed information regarding different forms of daily activities makes this possible. Our study also advances activity theory by underscoring that future research may consider activities at the aggregate as well as at the individual activity level. Thus far, studies drawing on activity theory have tended to examine frequencies of different forms of activities in the aggregate by investigating their correlates with a general measure of wellbeing. Future research could also consider momentary wellbeing correlates of individual activities, as well

as investigate associations related to the characteristics of the individual activities with variations in wellbeing. Future studies that consider whether momentary wellbeing may impact general wellbeing may also be helpful. This cross-level examination may produce new insights into understanding variations in later-life wellbeing.

In addressing our research questions, we also make several contributions to the existing knowledge regarding solitary activities. First, we offer a better understanding of the prevalence of solitary activities and the characteristics of older adults who are more likely to report solitary days or a higher proportion of their day in solitary activities. To our knowledge, this provides the first account of how much time older adults spend their day by themselves and the proportion of older adults who spend all day by themselves with an excellent dataset that draws from a national sample. We found that a nontrivial proportion, slightly more than 12 percent, of our sample of older adults reported having engaged in *all* of their activities by themselves over their diary day. Assessed as a proportion of all time considered, older adults on average spend approximately half of their day engaged in activities alone. The average time over the day engaged in activities alone increases with age. A number of individual characteristics are related to a greater amount of time spent in activities alone: we found those who live alone, women, non-whites, those with less education, and those in worse health spend more time engaged in activities alone. As many of these are markers of disadvantage, this suggests a link between social disadvantage and solitude.

The second contribution was beginning to investigate whether solitary days and solitary activities are associated with poorer wellbeing. We examined wellbeing measures both at a general level, with responses on life satisfaction, and at the activity level, with responses on mood during the activity, such as happy, tired, sad, stressed, etc. We found that both solitary days and higher proportions of the day engaged in activities alone were associated with lower levels of life satisfaction. These associations became attenuated, however, after adjusting for a

number of control variables. We have also run a number of sensitivity analyses, including each individual covariate one-by-one, and found that it is after the inclusion of one's living arrangement into the models that the associations were determined to be nonsignificant (not shown; available from authors). This emphasizes the fact that social isolation on a daily basis is strongly conditioned by living arrangements, particularly that of living alone. This underscores the value of considering living arrangements in future research on social isolation and loneliness, given older adults' proximal social contexts may facilitate or undermine engagement in social and productive activities. While prior research has shown that older adults who live alone are the most lonely (de Jong Gierveld, Dykstra and Schenk 2012), our findings suggest that this may be conditioned upon opportunities to engage in daily activities with others. We also found that older adults report lower levels of happiness and higher levels of sadness and pain while engaged in activities alone versus while engaged in activities in the presence of others. The association between solitary activities and lower levels of happiness remains even after adjusting for a number of control variables.

In summary, our results suggest that the total amount of time spent on solitary activities at the daily level may be confounded with individual-level characteristics; however, at the activity level, solitary activities are associated with more negative affect even after adjusting for individual characteristics. Given that emotional wellbeing and affect have also been linked with physical declines and stroke (Ostir et al. 2000, 2001), this implies future studies may wish to consider the effectiveness of programs and interventions that provide opportunities for older adults to spend more time with others (Korte and Gupta 1991). Future programs may also target particular groups of older adults that we found to be more likely to spend a greater amount of time alone, such as those who are less educated, non-white, living alone and in poorer health. For example, a review of the literature found that group interventions with focused educational input or interventions that provided support activities targeted at specific groups, such as

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women, care-givers, widows/ers, were the most effective in tackling social isolation and loneliness (Cattan, White, Bond and Learmouth 2005). An example is an intervention that encouraged tenants in a senior citizen apartment building to organize social activities (Arnetz and Theorell 1983). Reviews of social isolation interventions emphasize the need to involve older people across stages of planning, implementation and evaluation (Cattan et al. 2005, Findlay 2003).

Limitations

While our study begins to examine and explain the absence or presence of others in daily activities as a proxy for social isolation, some limitations remain. First, our measure of solitary days may be arguably imperfect as there were some activities, such as sleeping, grooming and private activities (such as using the bathroom, having sex and so on), where respondents were not asked whether they were alone or with others. Future data collection and research that consider information on an exhaustive list of activities may be useful; however, we do not expect such data substantively change our results because, with the exception of sleeping, these private activities do not compose a substantial amount of older adults' time given that, on average, we were able to account for 14.25 hours of activities out of a 24-hour day. Second, our measure of solitary activities may also be imperfect, as respondents may vary in whether they *interact* with others in particular activities. In other words, while we know whether our respondents were eating alone or with a friend, we do not have information as to the potential number of interactions the respondents might have had with *others*, such as with a stranger or with a server at a restaurant. Potentially, these interactions could be important, though again, we would require a dataset that contains such information to examine this possibility. Third, given the cross-sectional nature of the dataset that we draw on for analysis, we were also unable to rule out the possibility of reverse causation. In other words, it is possible

that those who were less satisfied with their life and those who were less happy and sadder may choose to engage in their daily activities by themselves, rather than with others. The possibility of this, however, is an empirical question to be tested. A modest interpretation of our findings would nevertheless suggest a stronger patterning of solitary activities and worse mood. Future data collection efforts and analysis, potentially utilizing a longitudinal study design, may be better positioned to tease out the direction of the associations. Lastly, there is also the possibility of unobserved confounding. Unmeasured factors, such as individual personality traits, may also influence both the likelihood of engaging in activities alone and subjective wellbeing. We are unable to account for preferences for solitude (Lay et al. 2018). Future data collection that includes these measures would be very helpful.

Notwithstanding these limitations, our study has begun to advance current knowledge of social isolation by exploiting a unique dataset of time diaries that contain information on all activities older adults engaged in over a 24-hour period and on whether they engaged in those activities alone or with others. While existing measures of social isolation attempt to capture constructs such as social network, frequency of contact with network members, number of relatives and friends, and other individual characteristics, these may be imprecise in that they do not help us understand what occurs on a day-to-day basis. Measures of loneliness are also subject to desirability bias. Our study attempted to shed light on the daily activities of older adults and provide a rich description of what occurs each day to help us understand the prevalence of isolation at the activity level. While we acknowledge potential weaknesses in our construct, a combination of various aspects of social isolation and loneliness could be considered in future data collection efforts (Cornwell & Waite 2009b). They could be inclusive of measures of social network, subjective reports of loneliness and information on the daily activities of older adults. The consideration of various different measures could allow for understanding the characteristics of older adults and their social relationships, how they

subjectively feel in terms of loneliness, and how this may operate through their activities on a day-to-day basis. The social isolation and loneliness of older adults have now been acknowledged as an important issue (Pantell et al. 2013; Steptoe et al. 2013). Continuing discussions on the best way to measure and operationalize these constructs should therefore be equally salient (Valtorta et al. 2016).

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Table 1. Time alone by main characteristics. Weighted averages

		Total	Sig		
Sex	Male	428	ref	10.0%	ref
	Female	476	***	14.9%	***
Age	65-74	442	ref	10.2%	ref
	75-84	463	**	13.5%	
	85+	504	***	20.4%	***
Living arrangement	Living alone	657	ref	34.0%	ref
	Only with partner	349	***	1.9%	***
	With partner and others	354	***	3.6%	***
	With others, without partner	497	***	9.8%	***
Race	White	449	ref	11.2%	ref
	Nonwhite	490	**	18.7%	***
Level of education	Less than HS	458	ref	15.5%	ref
	HS and some college	466		12.9%	
	College degree or higher	426	**	8.7%	***
Day of the week	Weekday	470	ref	11.6%	ref
	Weekend	415	***	13.5%	
Self-reported health	Excellent or good health	451	ref	10.8%	ref
	Fair or bad health	465	*	16.8%	***
Diary day was…	Better day	381	ref	6.7%	ref
	The same day	472	***	13.1%	***
	Worse	471	***	16.7%	***
All		454		12.2%	
Percentage time alone among all time considered		53.0%			

*** $p<0.001$, ** $p<0.01$, * $p<0.05$, + $p<0.1$

Source: Authors' calculations from 2012-13 American Time Use Survey Extract Builder
www.atusdata.org (Hofferth et al., 2017)

Table 2. Multivariate regression models for life satisfaction

		(Model 1) Life Satisfaction	(Model 2) Life Satisfaction	(Model 3) Life Satisfaction	(Model 4) Life Satisfaction	(Model 5) Life Satisfaction	(Model 6) Life Satisfaction
Alone all day		-0.511***	-0.353***	-0.072			
		(0.105)	(0.099)	(0.106)			
Percentage of time alone during diary's day					-0.006***	-0.005***	-0.002+
					(0.001)	(0.001)	(0.001)
Health (ref=Excellent or good)	Fair or bad		-1.639***	-1.604***		-1.642***	-1.605***
			(0.097)	(0.098)		(0.097)	(0.098)
Age (ref=65-74)	75-84			0.061			0.059
				(0.085)			(0.085)
	85+			-0.013			-0.016
				(0.136)			(0.136)
Living arrangement (ref= Living alone)	Living only with partner			0.559***			0.486***
				(0.088)			(0.099)
	Living with partner and others			0.288			0.214
				(0.179)			(0.187)
	Living with others, without partner			0.196			0.163
				(0.134)			(0.134)
Education (ref=Less than HS)	HS and some college			-0.247+			-0.240+
				(0.128)			(0.128)
	College degree and higher			-0.112			-0.108
				(0.135)			(0.136)
Race (ref=White)	Not white			0.210+			0.214+
				(0.112)			(0.112)
Sex (ref=Male)	Female			0.381***			0.377***
				(0.077)			(0.077)
Day of the week (ref=Dayweek)	Weekend			-0.041			-0.056
				(0.068)			(0.068)
Diary day was… (ref=The same)	Better			0.138			0.116
				(0.093)			(0.095)
	Worse			-0.657***			-0.659***
				(0.145)			(0.146)
Constant		7.616***	7.963***	7.543***	7.880***	8.198***	7.720***
		(0.042)	(0.042)	(0.154)	(0.080)	(0.076)	(0.184)
N		4,414	4,414	4,414	4,414	4,414	4,414
R2		0.006	0.109	0.133	0.009	0.112	0.134

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Source: Authors' calculations from 2012-13 American Time Use Survey Extract Builder www.atusdata.org (Hofferth et al., 2017)

Table 3. Random intercept models for mood during the episodes

		(Model 1) Pain I	(Model 2) Pain II	(Model 3) Happy I	(Model 4) Happy II	(Model 5) Sad I	(Model 6) Sad II	(Model 7) Tired I	(Model 8) Tired II	(Model 9) Stress I	(Model 10) Stress II
Alone during activity (ref=Not)	Yes	0.057*	0.046	-0.263***	-0.248***	0.064**	0.037	0.046	0.041	0.05	0.039
		(0.024)	(0.024)	(0.030)	(0.031)	(0.025)	(0.025)	(0.033)	(0.034)	(0.027)	(0.028)
Moment of the day (ref=night)	Morning	0.010	0.009	0.095	0.097	0.047	0.047	-0.414***	-0.414***	-0.037	-0.035
		(0.067)	(0.067)	(0.075)	(0.075)	(0.056)	(0.056)	(0.086)	(0.086)	(0.068)	(0.067)
	Afternoon	-0.066	-0.071	0.001	0.007	0.026	0.021	-0.054	-0.061	-0.060	-0.064
		(0.067)	(0.066)	(0.076)	(0.076)	(0.056)	(0.056)	(0.086)	(0.087)	(0.068)	(0.067)
	Evening	-0.124	-0.122	0.015	0.016	-0.011	-0.004	0.248**	0.252**	-0.144*	-0.134
		(0.068)	(0.068)	(0.078)	(0.078)	(0.059)	(0.059)	(0.092)	(0.092)	(0.071)	(0.070)
Health (ref=Excellent or good)	Fair or bad		1.296***		-0.623***		0.654***		1.120***		0.778***
			(0.065)		(0.051)		(0.051)		(0.061)		(0.054)
Age (ref=65-74)	75-84		-0.014		-0.010		-0.024		-0.035		-0.052
			(0.052)		(0.045)		(0.038)		(0.051)		(0.041)
	85+		0.074		0.023		0.022		0.052		0.009
			(0.083)		(0.071)		(0.064)		(0.086)		(0.068)
Living arrangement (ref= Living alone)	Living only with partner		0.024		0.068		-0.093*		0.079		0.026
			(0.054)		(0.048)		(0.039)		(0.055)		(0.044)
	Living with partner and others		-0.033		-0.053		-0.127		0.091		0.105
			(0.098)		(0.092)		(0.072)		(0.101)		(0.085)
	Living with others, without partner		0.019		0.017		0.085		0.100		0.168*
			(0.088)		(0.072)		(0.072)		(0.090)		(0.077)
Education (ref=Less than HS)	HS and some college		-0.156*		-0.197**		-0.212***		-0.007		-0.125*
			(0.076)		(0.063)		(0.061)		(0.075)		(0.063)
	College degree and higher		-0.212**		-0.232***		-0.285***		-0.031		-0.094
			(0.082)		(0.069)		(0.064)		(0.081)		(0.066)
Race (ref=White)	Not white		-0.103		0.268***		-0.001		-0.251***		-0.060
			(0.066)		(0.055)		(0.049)		(0.066)		(0.053)
Sex (ref=Male)	Female		0.289***		0.216***		0.029		0.271***		0.102**
			(0.048)		(0.044)		(0.035)		(0.048)		(0.039)
Day of the week (ref=Dayweek)	Weekend		-0.005		0.027		-0.034		-0.070		-0.088*
			(0.046)		(0.041)		(0.034)		(0.046)		(0.037)
Diary day was… (ref=The same)	Better		-0.038		0.180***		-0.010		0.088		0.017
			(0.056)		(0.049)		(0.040)		(0.058)		(0.045)
	Worse		0.802***		-1.024***		1.071***		0.935***		1.252***
			(0.102)		(0.084)		(0.095)		(0.095)		(0.093)
Constant		1.561***	1.163***	4.155***	4.361***	0.955***	0.895***	2.281***	1.755***	1.084***	0.788***
		(0.140)	(0.167)	(0.158)	(0.176)	(0.136)	(0.154)	(0.177)	(0.199)	(0.141)	(0.160)
Observations		13,016	13,016	12,860	12,860	12,980	12,980	12,986	12,986	13,012	13,012
Number of id		4,410	4,410	4,394	4,394	4,409	4,409	4,412	4,412	4,409	4,409
sigma_u		1.543	1.422	1.215	1.144	1.072	0.986	1.435	1.328	1.160	1.058
sigma_e		0.872	0.872	1.154	1.154	0.930	0.930	1.239	1.239	1.067	1.067
rho		0.758	0.727	0.526	0.496	0.571	0.529	0.573	0.535	0.542	0.496

Robust standard errors in parentheses
Control: detailed activity carried out. See Appendix D for a complete list of activities.
*** p<0.001, ** p<0.01, * p<0.05
Source: Authors' calculations from 2012-13 American Time Use Survey Extract Builder www.atusdata.org (Hofferth et al., 2017)

Appendix A. Sample composition

		Age			Total
		65-74	75-84	85+	
Sex	Male	42.7	37.4	32.4	40.0
	Female	57.3	62.6	67.6	60.0
Living arrangement	Living alone	42.3	55.2	72.3	49.4
	Only with partner	41	30.2	16.4	35.1
	With partner and others	7.8	5	2.4	6.4
	With others, without partner	8.9	9.6	8.9	9.1
Race	White	80.2	85.4	87.3	82.6
	Nonwhite	19.8	14.6	12.7	17.4
Level of education	Less than HS	12.9	17.6	20.2	15.1
	HS and some college	57.9	56.4	60.8	57.7
	College degree or higher	29.2	26	19	27.2
Day of the week	Weekday	49	50.6	53.3	49.9
	Weekend	51	49.4	46.7	50.1
Self-reported health	Excellent or good health	77.9	75.4	73.2	76.6
	Fair or bad health	22.1	24.6	26.8	23.4
Diary day was…	Better	22.3	18.4	15.3	20.3
	The same	69.5	74.2	77.7	71.8
	Worse	8.2	7.4	7	7.8
Life satisfaction	Mean	7.5	7.5	7.2	7.5
	SD	(2.1)	(2.2)	(2.3)	(2.2)
N		2,539	1,449	426	4,414

Source: 2012-13 American Time Use Survey Extract Builder www.atusdata.org (Hofferth et al., 2017)

Appendix B. Mood measures when respondent is alone or with others

	Alone	Not Alone	All episodes	sig (alone VS not alone)
Pain	1.26	1.08	1.18	**
	(1.8)	(1.7)	(1.8)	
Happiness	4.36	4.7	4.52	***
	(1.8)	(1.6)	(1.7)	
Sadness	0.73	0.55	0.65	***
	(1.5)	(1.3)	(1.4)	
Fatigue	1.83	1.74	1.79	
	(1.9)	(1.9)	(1.9)	
Stress	1	0.95	0.98	
	(1.6)	(1.6)	(1.6)	
N	8,099	4,951	13,050	

Standard deviation in parenthesis
Source: 2012-13 American Time Use Survey Extract Builder www.atusdata.org
(Hofferth et al., 2017)

Appendix C. Multivariate regression models for mood during episodes of selected activities

Activity	VARIABLES	Pain	Happiness	Sadness	Fatigue	Stress
Household activities	Alone during episode	-0.138	0.059	-0.110	-0.144	0.027
		(0.156)	(0.139)	(0.128)	(0.163)	(0.146)
	Observations	2,775	2,740	2,774	2,769	2,775
	R2	0.173	0.067	0.099	0.109	0.149
Eating and drinking	Alone during episode	0.160	-0.642***	0.173*	0.057	0.095
		(0.112)	(0.103)	(0.083)	(0.118)	(0.104)
	Observations	2,361	2,345	2,356	2,365	2,363
	R2	0.132	0.101	0.099	0.123	0.106
Socializing, relaxing, and leisure	Alone during episode	0.084	-0.431***	0.185*	-0.094	-0.009
		(0.096)	(0.111)	(0.083)	(0.128)	(0.089)
	Observations	3,425	3,372	3,405	3,404	3,421
	R2	0.158	0.068	0.106	0.089	0.103
Traveling	Alone during episode	0.006	-0.160	0.235*	-0.125	0.161
		(0.129)	(0.146)	(0.107)	(0.156)	(0.148)
	Observations	2,344	2,319	2,341	2,342	2,346
	R2	0.108	0.101	0.134	0.063	0.118

Control: health, age, sex, living arrangement, day of the week, evaluation of the day, education and race

Standard errors in parentheses

*** $p<0.001$, ** $p<0.01$, * $p<0.05$, + $p<0.1$

Source: Authors' calculations from 2012-13 American Time Use Survey Extract Builder www.atusdata.org (Hofferth et al., 2017)

Appendix D. Total time and time alone by activity (minutes per day); weighted means

Activity	Total time		Time alone	
	Mean	SE	Mean	SE
Caring for and helping household members	5	0.60	1	0.2
Caring for and helping non-household members	11	0.97	1	0.2
Consumer purchases	23	0.88	12	0.6
Eating and drinking	79	0.97	25	0.6
Educational activities	1	0.25	0	0.2
Government services and civic obligations	0	0.24	0	0.2
Household activities	151	2.93	116	2.6
Household services	1	0.21	0	0.0
Personal care	8	1.08	5	0.7
Telephone calls	8	0.43	7	0.4
Professional and personal care services	8	0.60	3	0.3
Religious and spiritual activities	14	0.73	6	0.4
Socializing, relaxing, and leisure	408	4.11	223	4.0
Sports, exercise, and recreation	17	1.02	8	0.5
Traveling	55	1.40	26	0.8
Volunteer activities	14	1.21	6	0.7
Working and work-related activities	49	2.99	16	1.7
Total	856	3.52	454	5.3

Source: 2012-13 American Time Use Survey Extract Builder www.atusdata.org (Hofferth et al., 2017)