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Sources of Increases in Time Alone during the COVID Pandemic: Evidence from the American Time Use Survey

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Abstract

The 2020 coronavirus pandemic was associated with a substantial increase in time spent alone. This paper uses US time-diary data to examine the extent to which changes in activities were associated with increases in time alone and to what extent time alone increased within activities, and also examines the effect of pandemic severity and government policies. Increases in work at home were a substantial contributor to the increase in time spent alone, although increases in time alone at the workplace also played a role. Reallocation of leisure toward fewer social activities was another contributor. Higher state Covid rates increased time alone for single-person households, while government policies did little. There is some evidence that increases in time alone were associated with increases in activities that are substitute for social activity.

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The coronavirus (COVID-19) pandemic has had far-reaching effects on life in the United States and around the world. The activities people engage in have been constrained both by their desire to protect themselves and loved ones as well as policies to slow the spread of the virus. Accordingly, one would expect how people use their time to be substantially affected by the pandemic. Social distancing would also affect with whom—if anybody—persons spend their time. Hamermesh (2020a, 2020b) has pointed out that the pandemic would be expected to increase the time spent alone, at least for single people. Time spent alone is a particular concern because of its potential negative effect on happiness and life satisfaction. Previous research using the Well-Being Module of the American Time Use Survey (ATUS) has found an association between time spent alone and lower levels of life satisfaction (Hamermesh 2020a, Lam and Garcia-Roman 2020). Moreover, time spent alone has been increasing since 2003, and this increase may contribute to increases in inequality in well-being (Atalay 2022).

Published results from ATUS data collected from May 10, 2020 through the end of 2020¹ (Bureau of Labor Statistics 2021) show that for persons ages 15 years and older, time spent alone increased by approximately an hour per day relative to the corresponding period in 2019, and by over an hour and a half for persons living alone. The purpose of this paper is to further analyze this increase, including data from the first part of 2021. To what extent is it associated with changes in activities—for example, watching television instead of going to parties--and to what extent with changes in time spent alone for particular activities—for example, working alone instead of with others? Do government policies to stem the pandemic or local rates of infection

¹ The ATUS was not fielded between March 17 and May 10 of 2020 due to the pandemic.

affect time spent alone? Do people who spend more time alone than previously substitute social contact by other means, such as phone calls or e-mails?

Data

The ATUS is a single-day time-diary survey that is administered to a sample of individuals in households that have recently completed their participation in the Current Population Survey, the main labor force survey for the United States. In the time diary portion of the interview, ATUS respondents are asked to sequentially report their activities on the previous day, along with information on the start and stop time, and where the respondent was. Of most relevance for the present paper, for most activities the respondent is asked who if anybody was in the room with them (if at home or someone else's home) or who accompanied them (if away from home).² If a respondent is in a public space, the “who accompanied you?” question is intended to capture people they know (e.g., family who accompanied the respondent to a store). “Who with” information is not collected for times during which respondents report sleeping, grooming, or personal/private activities, nor when respondents do not remember what they did or refuse to answer. I refer to time where “who with” information is available as “eligible time” below.

To supply context for the increase in time spent alone during the pandemic, Chart 1 shows the average number of (eligible) hours spent alone for ages 18 and above for each quarter from 2010 to 2021.³ (Prior to 2010 “who with” was not collected for time at work.) The series is shown for all households and for one-person and multiple-person households separately. The increase in 2020 is immediately apparent in all series. While not as prominent, all series also

² For further description of the ATUS, see Hamermesh, Frazis and Stewart (2005) and Frazis and Stewart (2007).

³ As implied by fn. 1, the mean for the first quarter of 2020 does not include the period after March 17 and the mean for the second quarter of 2020 does not include the period before May 10.

show a small positive trend in the years prior to the pandemic. This finding is compatible with Atalay (2022), who finds a positive trend in time spent alone outside of work using ATUS data from 2003-2019. Time alone declined in the last two quarters of 2021, while still substantially above pre-pandemic levels. In order to capture the period when time spent alone was at its peak, in the remainder of this paper I focus on the comparison between 2018-2019 and the period from May 10, 2020 to May 9, 2021. I refer to the latter period as “May 2020 – May 2021” hereafter. (To give a better idea of overall trends without seasonal variation, I show annual data from 2010-19 and May 2020 – May 2021 in Chart 2.)

Decomposition of changes in time alone

For ages 18 and older, an average of 6.2 hours were spent alone in 2018-19 compared to 7.1 hours in the peak pandemic period May 2020-May 2021. For single-person households time alone increased from 9.7 to 11.2 hours, while for multiple-person households time alone increased from 5.5 to 6.3 hours.

To what extent is the difference between the periods due to increases in time spent in types of activities more frequently done alone, and to what extent is it due to differences in time alone for the same categories of activities? Consider the following decomposition, in the spirit of the familiar Oaxaca procedure:

$$(1) T_{2021} - T_{1819} = \sum_k (T_k^{2021} a_k^{2021} - T_k^{1819} a_k^{1819})$$

$$= \sum_k [T_{1819}^k (a_{2021}^k - a_{1819}^k) + a_{1819}^k (T_{2021}^k - T_{1819}^k) + (T_{2021}^k - T_{1819}^k)(a_{2021}^k - a_{1819}^k)]$$

where T_p is time alone (during eligible time) in period p , T_k^p is time in period p spent in (eligible) activity k , and a_k^p is the fraction of time in activity k that is spent alone in period p (for the

population as a whole).⁴ The first term represents the effect of changing probabilities of spending time alone in an activity holding the time in activities at their 2018-19 level. The second term represents the effect of changes in time in activities holding the probability of spending time alone in activities at their 2018-19 level, and the third term is an interaction term. Note that the second term will take the sign of $(T_{2021}^k - T_{1819}^k)$, whether or not a_{1819}^k is above the overall mean. To capture the idea that time alone will increase (decrease) when time is reallocated toward activities with greater (lesser) than mean time alone, I modify (1) by subtracting mean time alone in 2018-19 from a_{1819}^k in the second term:

$$(1)' \quad T_{2021} - T_{1819} = \sum_k [(T_{1819}^k (a_{2021}^k - a_{1819}^k) + (a_{1819}^k - \bar{a}_{1819})(T_{2021}^k - T_{1819}^k) + (T_{2021}^k - T_{1819}^k)(a_{2021}^k - a_{1819}^k)]$$

where $\bar{a}_{1819} = \sum_k a_{1819}^k T_{1819}^k / 1440$ is mean time alone in 2018-19 (measuring T_{1819}^k in minutes and setting a_{1819}^k equal to zero for ineligible activities). Note that $\sum T_p^k = 1440$ and hence $\sum \bar{a}_{1819}(T_{2021}^k - T_{1819}^k) = 0$. Taking the terms for each activity k in (1)' separately and ignoring the interaction, increases between periods in a^k will increase $T_{2021} - T_{1819}$ while the direction of the effect of increases in T^k will depend on whether a_{1819}^k is greater or lesser than the 2018-19 mean.

I divide activities into the following major categories: Eating and Personal Maintenance,⁵ Care for Household Members, Household Production, Market Work, Leisure and Exercise, Travel, and Other. A fuller description of the categories in terms of ATUS activity codes is given in Appendix Table 1.

⁴ The ATUS diary does not distinguish periods within the same activity where different people are with the respondent, so for individual respondents a_k^p will equal 0 or 1 for activities done only once on the diary day.

⁵ This category consists of eating and drinking as well as personal care activities aside from sleeping and grooming. Eating accounts for over 90 percent of the time spent in this category.

Decomposition results are given in Table 1. The first four columns show average time spent by activity and average time alone for each activity for the two time periods 2018-19 and May 2020 - May 21, while the fifth column shows the difference between the periods in time alone by activity. The sixth column shows $(T_{2021}^k a_{2021}^k - T_{1819}^k a_{1819}^k - \bar{a}_{1819}(T_{2021}^k - T_{1819}^k))$, the change in time spent alone in each activity, adjusted as in (1)'. The last two columns are each activity's contribution to the first and second terms of (1)'. The interaction term in (1)' is generally small and is not shown.

As single-person households would be expected to spend substantially more time alone than persons in multiple-person households, Table 1 shows results for both households as a whole and separately for single- and multiple-person households.

For all households, time alone increased by 60 minutes. Of this, work accounted for 35 minutes, by far the largest contribution of the major categories. Leisure contributed the next largest change, 17 minutes. In both cases the vast majority of the change was due to changes in time alone in the category rather than changes in the fraction of time in the category.

Single-person households show a larger increase time alone of 90 minutes. As with households as a whole, work and leisure contribute the most to this increase at 44 and 30 minutes respectively, with the greatest percentage coming from within-category increases in time alone. For multiple-person households work contributed 30 minutes out of the 53 minute increase in eligible time spent alone, all of which was due to the change in time spent alone within the work category.

To further examine the sources of the increase in time alone for work and leisure, Tables 2 and 3 show the results for subdivisions of the categories. Note that changes in time alone that at the category level show up as changes in time alone within the category may be due to

changes in time spent within different subcategories. For example, changes in leisure time alone may reflect less time at parties and more time watching television.

One obvious source of changes in time alone within work is the change from working at a workplace to working from home. Accordingly, Table 2 divides work into categories for working from home and working in other places.⁶ For households as a whole, the reallocation of work away from home, which has a relatively low proportion of time spent alone, to work from home, which has a relatively high proportion, accounts for the majority of the increase in time spent alone associated with work. Note that in our accounting decreases in time spent in categories with below-mean percentages of time alone will show up as a positive effect on time alone, so the shift between categories in effect shows up twice—once as an increase in an activity with above-average time alone, and once as a decrease in an activity with below-average time alone. There is also an appreciable increase in time alone—11 minutes—attributable to an increase in time spent alone within the work away from home category, so the shift to working from home is not the source of the entire increase due to work. Both single-person households and multiple-person households follow the same general pattern, with most of the effect on time alone due to work attributable to the shift to working from home but a substantial amount due to increases in time alone while working away from home.

One possible explanation for the observed increase in the proportion of time alone for work away from home is that occupations who remained in the workplace after the pandemic were disproportionately those where a large proportion of time is spent alone. To test this explanation, I divided major occupations into two groups based on the proportion of time spent

⁶ I do not distinguish between work at a workplace and work at other places aside from home.

alone in 2018-19.⁷ The low-time-alone group averaged 88 minutes alone during work away from home in 2018-19, while the high-time-alone group averaged 98 minutes. This division did little to reduce the change in time spent alone within the work-away-from-home category. The sum of the increase in time spent alone for work away from home within the occupation categories accounts for a very large proportion of the increase in time spent alone within the work-away-from-home category overall.

One limitation of the results regarding working from home is that social contact through teleconference meetings, phone calls, etc. is not observed in our data. Since work is not broken down into separate activities in the ATUS diary, brief in-person contact is also probably not usually recorded.

Table 3 shows results for subcategories of leisure. I divide leisure into TV, exercise, social gatherings, relaxation, games, reading, and miscellaneous leisure. Both for households as a whole and for single-person and multiple person households, reallocation of leisure time among subcategories and increases in time alone within subcategories account for roughly equal amounts of the total increase in time alone. No single subcategory stands out as the primary contributor to this reallocation effect. The 15 minute increase in time alone attributable to leisure for multiple-person households has similar sources to households as a whole. For single-person households the 30 minute increase in time alone attributable to leisure is roughly equally divided between reallocation among subcategories and increases in time alone within subcategories.

⁷ The low-time-alone occupations are business and financial operations; architecture and engineering; healthcare practitioners and technicians; production; sales and related occupations; education, training, and library occupations; computer and mathematical science; life, physical, and social science occupations; healthcare support; food preparation and serving; and personal care and service occupations. The high-time-alone occupations are Transportation and material moving; protective services; legal occupations; installation, maintenance, and repair; farming, fishing, and forestry; building and grounds cleaning and maintenance; community and social service occupations; office and administrative support; arts, design, entertainment, sports, and media occupations; management; and construction and extraction.

About one-third of the total increase is attributable to watching TV, also approximately equally divided between increases in time alone while watching TV and increases in TV watching.

Effect of pandemic severity and government policies

It is likely that the increase in time spent alone at least partially reflects constraints on behavior during the pandemic. Accordingly, one might expect that time alone would be affected by measures by government intended to slow the spread of COVID and by the severity of the pandemic. To investigate this question, I merge the ATUS data with data on state-level social distancing measures from Fullman et al. (2020) and with COVID data from the *New York Times* and the COVID Tracking Project available through Economic Tracker of Opportunity Insights (Chetty et al. 2020).

The Fullman et al. data include starting and (if ended) ending dates for specific state policies, thus enabling ATUS diary dates to be associated with a specific set of policies. State governments typically instituted several different measures at the same time to slow the progress of the pandemic. I compiled an index of policy stringency (similar to Hershbein and Holzer 2021) by summing the restrictions in effect in each state for a given day. The policies included are 1) gathering restrictions, 2) stay-at-home orders, 3) non-essential business closures, 4) isolation of infected persons or persons in proximity to the infected, 5) restriction on bars, 6) restrictions on restaurants, and 7) closing or substantial reduction of businesses other than bars and restaurants. For gathering restrictions, recommendations are counted as one point in the index while mandatory restrictions are counted as two points. To represent the severity of the pandemic I use the state per-capita rate of new cases per day from COVID over the previous seven days.⁸ As an

⁸ In results not shown, using death rates instead of case rates yielded non-significant results, although death rates yielded larger and statistically significant coefficients when the data were restricted to 2020..

additional control, I also include the state vaccination rate, lagged two weeks to account for the lag in acquiring immunity.

I regress minutes of eligible time alone on the policy index, the state COVID case rate, and the lagged state vaccination rate. I include a vector of control variables including age, age squared, and indicators for female, nonwhite, Hispanic, four levels of education, and dummies for state and calendar month.⁹ I take into account household composition by including household size (top-coded at 7), number of own household children less than 18 (top-coded at 4), and indicators for single-person household, married, age of youngest child less than or equal to 5 and age of youngest child less than or equal to 12. I estimate separate regressions for weekdays and weekends; Table 6 shows estimated minutes per day combining the weekday and weekend regressions.

The inclusion of state and month fixed effects implies that identification of the policy, case-rate, and vaccination coefficients comes from within-state variation across time, uncorrelated with national trends. Accordingly, estimated coefficients on these variables are not biased by national trends or stable cross-state differences in time spent alone.

Selected descriptive statistics are given for this and the regression analysis in the next section in Table 4. Regression results are shown in Table 5. There is evidence that the severity of the pandemic influences time spent alone, as the case rate coefficient is positive and significant at the 1 percent level for single-person households. However, there is little evidence of a case rate effect for multiple-person households. Mean May 2020 – May 2021 cases are 26 cases per 100,000, so moving from zero cases in 2018-19 to the May 2020 – May 2021 mean

⁹ I include separate indicators for May 2020 and May 2021.

implies an increase of 29 minutes for single-person households, approximately one-third of the increase in time alone of 88 minutes of such households.

The effect of policy measures is less clear. The coefficient on the policy index is not significant at conventional levels for either household type or for the sample as a whole. In results not shown, entering each policy included in the index as a separate variable yields imprecise estimates, and the coefficients on the policy variables were never jointly significant at the 5 percent level.¹⁰ The coefficients for the vaccination rate were also not significant. The lack of evidence for effects of restrictions is consistent with the small effects found on consumer behavior in Goolsbee and Syverson (2020) and J.P. Morgan Chase and Co. Institute (2021).

While the Covid case rate has a substantial estimated effect on time alone for single-person households, the case rate combined with government policy do not appear to account for most of the increase in time alone even for those households. One could speculate that persons are relatively slow to change their habits in response to what could be transitory movements in the case rate, or that the pandemic led to permanent changes in behavior such as increases in working from home that are not affected by such movements.¹¹ Conversely, the state level data may miss local variation in Covid severity (or government policy) that may drive behavior, leading to an underestimate of the true effects of these variables. I leave these topics for further research.

To what extent are the effects of COVID case rates associated with changes in time devoted to particular activities, and to changes in time alone during particular activities? To

¹⁰ I also ran a less stringent specification substituting indicators for Census divisions in place of states. Standard errors for the policy index were reduced by about one-third (standard errors for the other variables were similar to those for the state specification). While there are substantial differences in the policy index coefficients between the state and division specifications, the estimates for the division specification are also not significant at conventional levels.

¹¹ See Barrero et al. (2020) for an argument on the permanence of the shift to working from home.

investigate this question, I regressed the amount of time spent in given activities and the fraction of time spent alone while performing these activities on the same variables used to generate the estimates in Table 5.

Results are shown in Table 6. For both the amount of time in an activity and the fraction of time alone in an activity, some activities show case rate coefficients that are statistically significant at conventional levels. However, overall the results indicate that the case rate effect is not explained by changes in either total time spent or the fraction of time spent alone in a few particular activities. While a few coefficients are significant at the 5 percent level, the joint hypothesis that the effect of case rates on the fraction of time alone in each activity is zero for all activities cannot be rejected at conventional levels for any sample examined, as shown in the bottom row of each panel of Table 6. However, for both the sample as a whole and for single-person households, the joint hypothesis that the effect of case rates on changes in time in activities is zero for all activities is rejected at the 5 percent level.

The coefficients for case rates shown in Table 6 can be combined into totals showing the effect of case rates on time alone through changes in activity durations and the effect through changes in time alone within activities. To estimate the effect of the case rate on time alone through the duration of activities, I estimate $\sum_k \beta_k a_k$, where β_k is the coefficient on case rates for duration in activity k and a_k is the proportion of time alone within activity k , as above. Analogously, to estimate the effect of case rates on time alone through changes in time alone within activities, I estimate $\sum_k \gamma_k T_k$, where γ_k is the coefficient on case rates for the fraction of time spent alone in activity k and T_k is time in the activity as above. The results are shown in the row in Table 6 labeled “Total weighted effect on time alone”. It can be seen that for single-person households, changes in activity durations are the predominant channel for the effect of

case rates, and the total effect through this channel is significant at the 1 percent level. Note that case rates has an estimated negative effect on work, which has a relatively low proportion of time spent alone (55 percent), and positive effects on leisure and “other”, which have high proportions (86 and 87 percent respectively). While case rates affect the allocation of time across activities, no single activity stands out as being the predominant channel through which they affect time spent alone.

Substitution of other forms of social contact

In response to constraints on physical social contact, people may substitute other forms of socializing or companionship. I now investigate whether the increase in time alone during the pandemic was associated with an increase in phone calls¹² with friends and family and household and personal e-mail and messages. The latter category may include e-mail related to household management, but also includes instant messaging and does not include, for example, using the computer to pay bills, so it seems reasonable on the whole to include it as a form of socializing. As shown in Table 7, for ages 18 years and older, the amount of time spent on social phone calls increased from 3.6 minutes per day in 2018-19 to 5.2 minutes in the period May 2020 – May 2021¹³, while time spent on social e-mail increased from 1.2 minutes to 1.5 minutes over the same periods.

What is the relation between the increases in time alone documented above and increases in social phone calls and e-mails? In what follows, I combine these two categories into “social communication”. It may appear natural to regress time in social communication on time alone to answer this question. However, as pointed out in Frazis and Stewart (2012), regressions of activity durations on other activity durations from single-day time diaries are impossible to

¹² This category includes video calls through computers (see Bureau of Labor Statistics 2020).

¹³ I top-code total time for both phone calls and e-mail at 240 minutes.

interpret. This is because there are two sources of variation in activity duration in short-term time-diary data: variation in long-term averages across individuals, and variation around long-term averages within individuals. One can accordingly define long-run regression coefficients relating the long-term averages of different activities, and corresponding short-run coefficients relating the deviations around these averages. Regression coefficients for regressions of diary time in an activity on diary time in another activity are weighted averages of the long-term and short-term regression coefficients. Since the weights are unknown, such coefficients are uninterpretable.

To isolate the long-term relation between time alone and time in social communication, I perform the following regression

$$(2) \quad \Delta \hat{y} = \alpha + \beta \Delta \hat{x} + e ,$$

where $\Delta \hat{y} = (\hat{y}_{2021} + \hat{\delta}_{2021}z) - (\hat{y}_{1819} + \hat{\delta}_{1819}z)$, the change in predicted values between 2018-19 and 2020-21 from a regression of time in social communication on a vector of control variables z representing permanent characteristics, and $\Delta \hat{x}$ is the analogous change in predicted values for time alone. This specification estimates the extent to which persons with the characteristics associated with changes in time alone between 2018-19 and 2020-21 also show increases in time in social communication. (Note that although the ATUS is not a panel dataset, the repeated cross-section allows us to estimate expected changes between periods for persons with a given set of observable characteristics.) The vector z includes the control variables from the previous section, excluding the Covid-related variables and using indicators for Census division rather than state.

It is possible that persons with different demographic characteristics and living arrangements may have different reactions to the pandemic that in turn cause different changes in

social communication independent of changes in time alone. I noted above that working from home is associated with much of the increase in time alone between 2018-19 and May 2020–May 2021. To supply stronger identification, in addition to the variables mentioned in the previous paragraph, I also include variables relating to working from home in z . These additional variables include an indicator for the suitability of the respondent’s occupation for work from home, using the classification scheme in Dingel and Neiman (2020). In addition, in previous work, Dey et al. (2020) showed that in occupations where telework is feasible, the proportion of workers who actually teleworked (the “takeup rate”) was particularly high prior to the pandemic for workers in management, professional, and sales occupations—over 20 percent in all three groups--in the ATUS and the National Longitudinal Survey of Youth, while takeup rates in all other occupational groups were 10 percent or less. A similar difference in takeup rates, though at much higher levels, is apparent in the Current Population Survey in 2020 (Dey et al. 2021). Accordingly, I include an indicator for management, professional, and sales occupations.¹⁴ I also include an indicator for employment. It is plausible that once demographic characteristics and living arrangements have been accounted for, changes in work from home have their primary impact on social communication through changes in time alone.

The first row of each panel in Table 8 shows estimated coefficients for predicted time alone using (2), excluding the entire vector of control variables from the right-hand side of the regression. The second row of each panel shows coefficients from a specification including the control variables z in the right-hand side of the regression with the exception of the telework and employment variables in the previous paragraph, using variation in the increase in time alone due

¹⁴ Respondents who are not currently employed are coded as zero for the telework variables.

to variation in the increase of telework. For the specification using the entire sample, predicted values are estimated separately for single-person and multiple-person households.

The results excluding all control variables from the regression indicate that for the sample as a whole and for multiple-person households, predicted changes in time alone has a small but statistically significant association with predicted change in time spent in social communication, with every additional hour spent alone associated with a .035 hour increase in social communication for households as a whole and a .054 hour increase for multiple-person households. There is no evidence of an association for single-person households. Including the control variables with the exception of the telework and employment variables reduces the estimated coefficients somewhat, and the coefficient for households as a whole is only significant at the 10 percent level. However, the results are qualitatively similar across specifications.

The category “social communication” is reasonably narrow, and there might be other activities that are reasonable substitutes for direct social contact. To investigate this possibility, I broaden the list of substitutes by adding “playing games” and “pet care” (including walking and playing with pets) to social communication. Respondents to an online survey reported in Barr and Copeland-Stewart (2022) reported an increase in time devoted to video games and that socializing via multiplayer games was one motivation for gaming. With regards to pet care, the American Society for the Prevention of Cruelty to Animals reported that nearly one in five households adopted a pet during the pandemic (Bogage 2022), and companionship is a common motivation for such adoptions (Packer et al. 2021). I also added mail (which includes household mail such as bills) and phone calls aside from those already included in social communication. These additions to social communication make the resulting category intentionally quite broad.

Note that it also includes activities with no contact with other people or animals, such as solitaire games (which in ATUS are not possible to distinguish from multi-player games played remotely). It is intended to represent an upper bound on substitutes for human contact and is accordingly labeled “broad substitutes for social contact” in Tables 7 and 8.

The bottom part of Table 7 shows time spent in “broad substitutes for social contact” and its components. The categories additional to social communication account for 14.0 minutes in 2018-19 and 18.2 minutes in May 2020 – May 2021, with games and pet care accounting for most of this. Games accounted for 4.0 out of the 4.2 minute increase in time spent in the additional categories.

Results for the broader measure are shown in the second column of Table 8. The estimates are for the most part larger but follow the same pattern as the first column. There is a statistically significant association for multiple-person households but not for single-person households, and a somewhat larger effect is found with no control variables in the regression rather than excluding just the employment and telework variables. The largest association found is for multiple-person households, with a point estimate of .13 minutes of increased social communication for every minute of increased time alone for the specification with all control variables excluded. The upper bound of the one-sided 95 percent confidence interval is .19 minutes for this specification. Thus, even using a broad definition of activities that are substitutes for time spent with others, the data rule out increases in such activities that are more than a small proportion of the increase in time spent alone. The absence of evidence for a substantial effect on substitute activities for single-person households is also striking in view of the larger increase in time alone for such households and their greater responsiveness to pandemic severity.

Conclusion

Comparison of ATUS data from 2020 and 2021 with that from previous years shows that the COVID-19 pandemic was associated with a substantial increase in time spent alone, especially for persons living alone. This paper examined time spent alone to see if the increase was associated with specific activities or with reallocation of activities, looked at the effect of pandemic severity and policy measures, and investigated whether other activities such as phone calls or e-mail with friends and family substituted for in-person contact.

Analysis of specific activities shows that the increase was partly due to the increase in work at home, but also due to increases in time spent alone in the workplace, and to increases in time alone during leisure. The latter increase in turn was partly due to a shift from social activities to TV watching, but also to increases in time alone among subcategories of leisure. Time spent alone increases with the COVID case rate for persons living alone, but does not have a strong association with policy measures. The effect of the case rate on time alone is estimated to be more due to changes in time spent in different categories of activities than to changes in the fraction of time spent alone within categories.

Inferring long-term associations between time spent alone and substitutes for social contact such as phone calls or e-mails presents statistical issues due to the short-term nature of time-diary data. I use differences across different groups to estimate whether characteristics associated with changes in time spent alone are associated with characteristics associated with changes in time spent in substitutes for social contact, and find evidence of a positive association for multiple-person households. However, even using a broad definition of substitutes for social contact including such things as pet care and computer games, changes in time devoted to substitute are a small proportion of changes in time spent alone. Both the association of time

alone with the case rate and the evidence that other forms of contact increase with time alone suggest that people are responding to the constraints of the pandemic, balancing safety with the desire to socialize, though the lack of a policy effect and the absence of substitution found for single-person households cuts against this to some extent.

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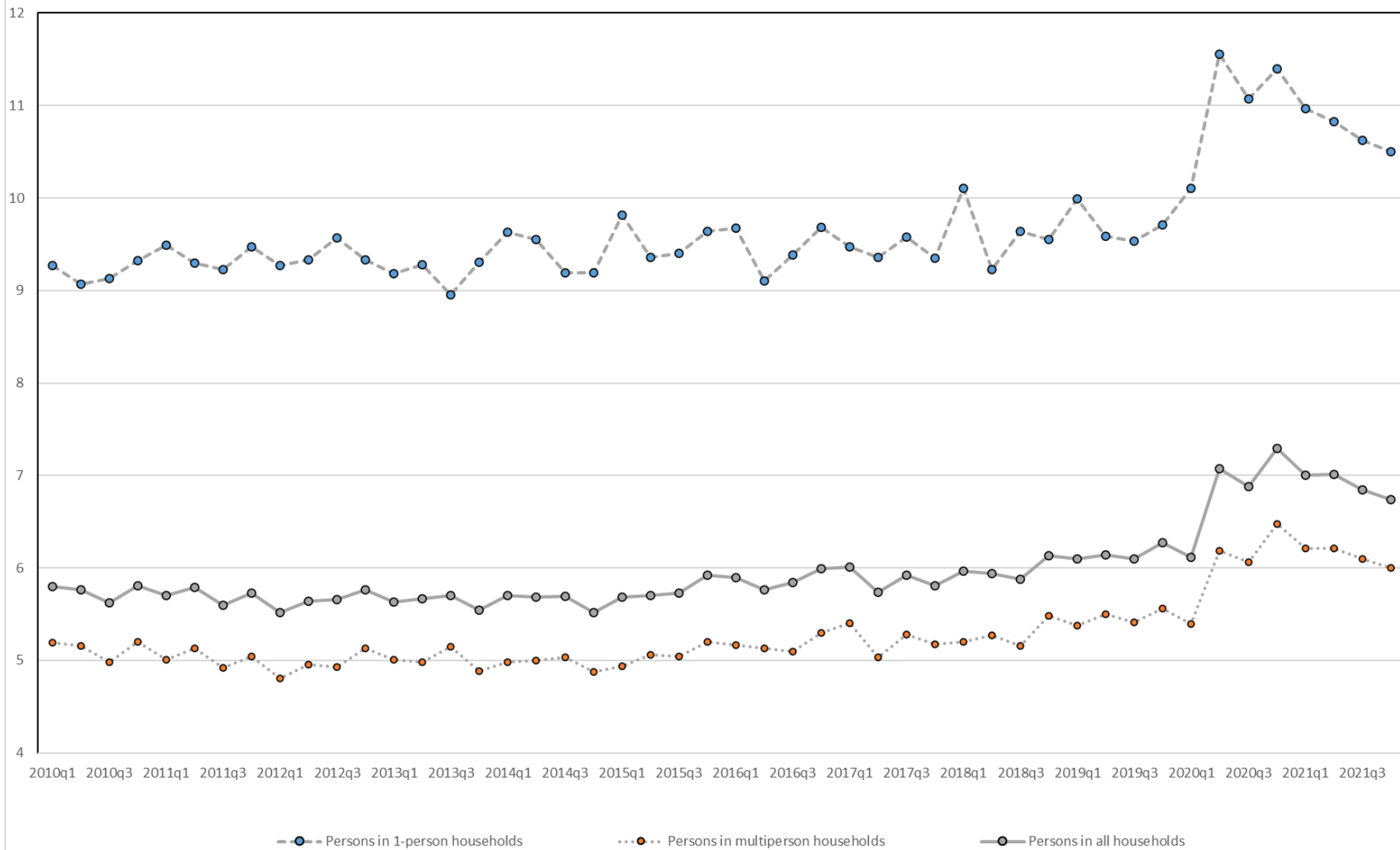
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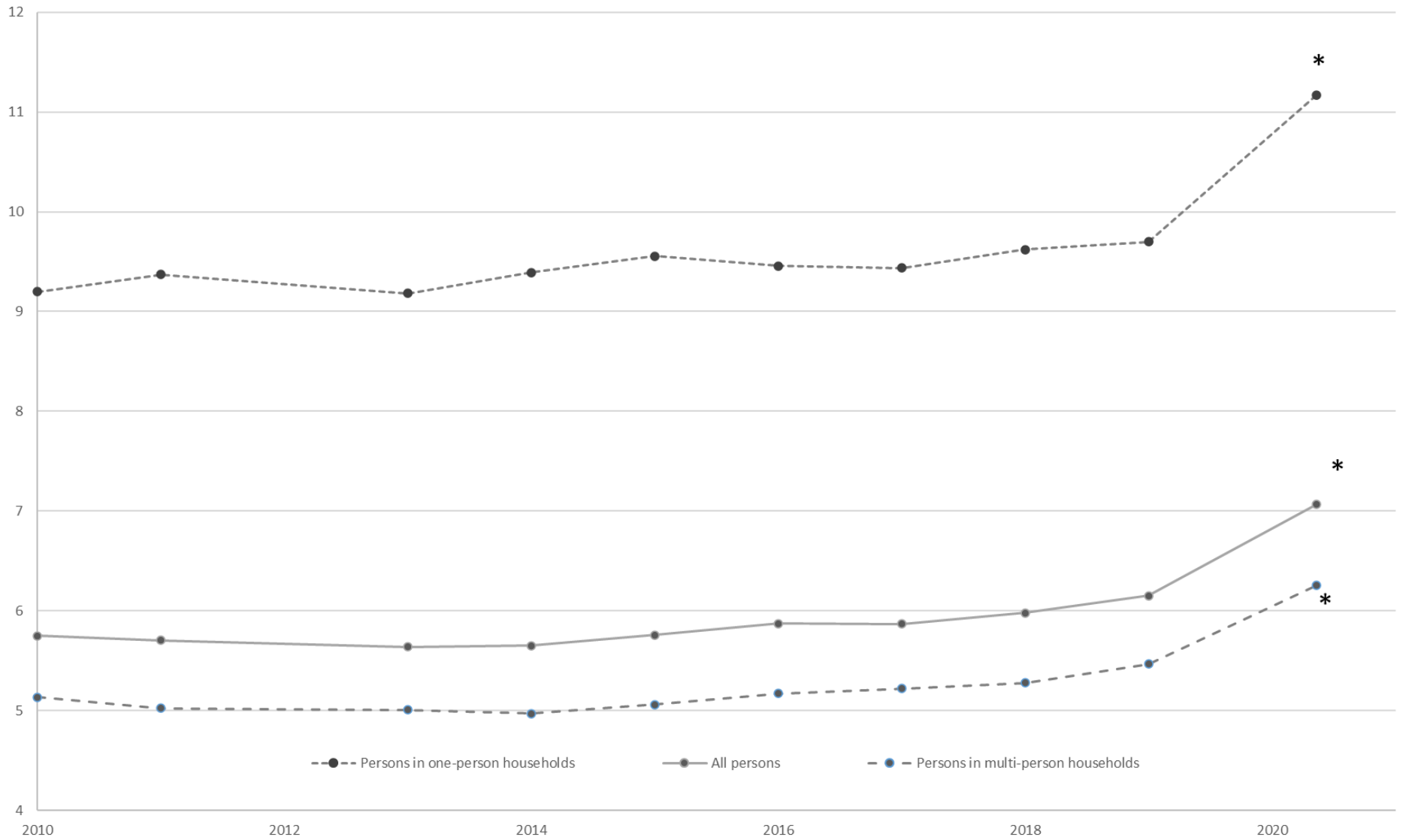
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Chart 1
 Quarterly average hours per day spent alone by household type, 2010-21



Note: Time excludes sleeping, grooming, personal/private activities, or times respondent does not remember or refuses to answer. Q1 2020 excludes March 18-31. Q2 2020 excludes April 1 - May 9.
 Source: American Time Use Survey

Chart 2
Annual average hours per day spent alone by household type, 2010-May 2021



Note: Time excludes sleeping, grooming, personal/private activities, or times respondent does not remember or refuses to answer. Source: American Time Use Survey
* May 10, 2020 - May 9, 2021

Table 1

Decomposition of Changes in Time Spent Alone, 2018-19 to May 2020-May 2021, Minutes per Day

(Standard errors in parentheses)

Activity	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
All households								
Personal Care	68.2 (0.5)	21.3 (0.4)	68.6 (0.7)	23.9 (0.5)	2.7*** (0.6)	2.6*** (0.5)	0.0 (0.1)	2.5*** (0.5)
Care of Household Members	26.3 (0.6)	1.2 (0.1)	26.8 (0.8)	1.3 (0.1)	0.1 (0.2)	-0.1 (0.3)	-0.1 (0.2)	0.0 (0.2)
Household Production	146.5 (1.4)	84.5 (1.1)	155.1 (1.8)	92.3 (1.5)	7.8*** (1.8)	5.6*** (1.4)	2.8*** (0.7)	2.7** (1.1)
Work	206.4 (2.5)	55.9 (1.5)	194.6 (3.3)	87.7 (2.4)	31.8*** (2.7)	34.8*** (2.4)	-0.2** (0.1)	37.1*** (2.5)
Leisure	299.3 (1.9)	139.1 (1.6)	320.9 (2.6)	162.0 (2.4)	22.9*** (2.9)	17.4*** (2.5)	4.6*** (0.7)	12.0*** (2.2)
Travel	72.6 (0.8)	39.5 (0.5)	48.2 (0.8)	26.5 (0.5)	-13.0*** (0.8)	-6.8*** (0.7)	-7.1*** (0.3)	0.4 (0.9)
Other	48.6 (1.1)	23.4 (0.8)	46.9 (1.6)	31.4 (1.4)	7.9*** (1.5)	8.4*** (1.1)	-0.4 (0.5)	9.1*** (0.9)
N	18,511		9,911					

Table 1 continued

Activity	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
Single-person households								
Personal Care	67.7 (1.2)	44.0 (1.0)	64.1 (1.4)	49.8 (1.3)	5.8*** (1.7)	7.2*** (1.2)	-0.9* (0.5)	8.6*** (1.0)
Household Production	144.5 (2.6)	115.5 (2.2)	155.2 (3.1)	128.3 (2.7)	12.8*** (3.4)	8.5*** (2.3)	4.2*** (1.5)	4.0** (1.8)
Work	171.7 (4.7)	48.1 (2.7)	160.1 (7.0)	87.5 (5.4)	39.3*** (6.0)	44.0*** (4.6)	1.4 (1.0)	45.6*** (4.8)
Leisure	368.9 (4.0)	294.3 (4.2)	384.3 (5.7)	330.4 (5.7)	36.1*** (7.3)	29.9*** (4.8)	6.1** (2.9)	22.9** (2.8)
Travel	62.9 (1.5)	46.2 (1.2)	41.2 (1.7)	31.8 (1.2)	-14.5*** (1.8)	-5.7*** (1.3)	-7.2*** (0.8)	2.3 (1.6)
Other	46.0 (1.8)	32.1 (1.5)	49.3 (3.4)	42.7 (3.1)	10.6*** (3.5)	9.3*** (2.1)	0.9 (1.2)	7.8*** (1.1)
N	5,270		2,628					

Table 1 continued

	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
Multiple -person households								
Activity								
Personal Care	68.3 (0.6)	16.9 (0.4)	69.5 (0.8)	18.8 (0.5)	1.9*** (0.6)	1.7*** (0.6)	0.0 (0.0)	1.6*** (0.6)
Care of Household Members	31.4 (0.8)	1.5 (0.1)	32.1 (1.0)	1.6 (0.2)	0.1 (0.2)	-0.1 (0.3)	-0.1 (0.2)	0.1 (0.2)
Household Production	146.9 (1.6)	78.5 (1.2)	155.1 (2.1)	85.2 (1.6)	6.7*** (2.0)	4.9*** (1.6)	2.5*** (0.8)	2.2 (1.3)
Work	213.0 (3.0)	57.3 (1.8)	201.4 (3.7)	87.7 (2.8)	30.3*** (3.2)	32.9*** (2.8)	-0.5** (0.2)	35.4*** (2.9)
Leisure	286.0 (2.3)	109.1 (1.8)	308.4 (2.9)	128.7 (2.6)	19.5*** (3.0)	14.5*** (2.7)	3.5*** (0.6)	10.2*** (2.4)
Travel	74.5 (0.9)	38.1 (0.6)	49.6 (1.0)	25.4 (0.6)	-12.7*** (0.9)	-7.1*** (0.8)	-7.2*** (0.4)	0.1 (1.0)
Other	49.1 (1.3)	21.8 (0.9)	46.5 (1.8)	29.1 (1.5)	7.4*** (1.7)	7.9*** (1.3)	-0.6 (0.5)	9.0*** (1.1)
N	13,241		7,283					[2021 included]

* p < .10

** p < .05

*** p < .01

Table 2

Decomposition of Changes in Fraction of Work Time Spent Alone by Location of Work, 2018-19 to 5/20 - 5/21

	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
All Households								
Work at home	20.1 (0.8)	15.8 (0.7)	62.4 (2.0)	51.7 (1.8)	35.9*** (1.9)	25.2*** (1.5)	22.6*** (1.4)	0.8** (0.4)
Work away from home	186.3 (2.5)	40.1 (1.5)	132.2 (3.1)	35.9 (1.8)	-4.1* (2.3)	9.6*** (2.0)	2.1*** (0.4)	10.6*** (2.5)
Work away from home--low time alone occ.	88.1 (2.2)	13.0 (0.8)	59.4 (2.3)	12.6 (1.1)	-0.3 (1.2)	6.9*** (1.2)	3.0*** (0.4)	5.8*** (1.6)
Work away from home--high time alone occ.	97.9 (2.0)	27.1 (1.3)	72.6 (2.5)	23.3 (1.4)	-3.8** (1.9)	2.6* (1.5)	-0.6** (0.3)	4.3** (1.8)
N	11,457		6,475					
Single-person households								
Work at home	17.6 (1.5)	15.2 (1.4)	58.1 (4.3)	54.9 (4.3)	39.7*** (4.6)	23.4*** (2.8)	18.7*** (2.7)	1.4** (0.7)
Work away from home	154.1 (4.6)	33.0 (2.3)	102.0 (5.6)	32.6 (3.3)	-0.4 (3.9)	20.6*** (3.5)	9.8*** (1.5)	16.2*** (4.5)
Work away from home--low time alone occ.	73.3 (3.6)	13.0 (1.7)	45.1 (3.8)	9.8 (1.6)	-3.2 (2.1)	8.2*** (2.3)	6.4*** (1.3)	3.0 (2.6)
Work away from home--high time alone occ.	80.3 (3.5)	20.0 (1.8)	57.0 (4.2)	22.8 (2.8)	2.8 (3.4)	12.2*** (2.9)	3.6*** (1.0)	12.1*** (3.7)
N	5,270		2,628					

Table 2, continued

Multiple -person households	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
Activity								
Work at home	20.6 (0.9)	16.0 (0.8)	63.3 (2.3)	51.1 (2.1)	35.1*** (2.2)	25.6*** (1.8)	23.4*** (1.6)	0.7 (0.5)
Work away from home	192.4 (2.9)	41.4 (1.7)	138.1 (3.5)	36.6 (2.1)	-4.8* (2.6)	7.4*** (2.3)	0.5 (0.4)	9.6*** (2.9)
Work away from home-- low time alone occ.	90.9 (2.5)	13.0 (0.9)	62.2 (2.7)	13.2 (1.2)	0.2 (1.4)	6.7*** (1.4)	2.3*** (0.4)	6.3*** (1.9)
Work away from home-- high time alone occ.	101.3 (2.3)	28.4 (1.5)	75.7 (2.9)	23.3 (1.6)	-5.1** (2.1)	0.7 (1.8)	-1.4*** (0.4)	2.8 (2.1)
N	13,241		7,283					[2021 included]

* p < .10

** p < .05

*** p < .01

Table 3

Decomposition of Changes in Leisure Time Spent Alone by Subcategory of Leisure, 2018-19 to May 2020 – May 2021

Activity	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
All households								
TV	171.5 (1.7)	87.0 (1.3)	185.2 (2.3)	95.0 (1.7)	7.9*** (2.1)	4.5** (1.8)	3.5*** (0.7)	0.9 (1.6)
Exercise	16.5 (0.6)	7.1 (0.4)	19.7 (0.8)	9.1 (0.5)	2.1*** (0.6)	1.2** (0.5)	0.6*** (0.2)	0.6 (0.5)
Social gathering	37.4 (0.8)	0.8 (0.1)	30.6 (0.8)	0.7 (0.1)	-0.1 (0.2)	1.7*** (0.3)	1.6*** (0.3)	0.1 (0.2)
Relaxation	19.5 (0.6)	11.1 (0.4)	24.0 (0.9)	14.5 (0.8)	3.3*** (0.8)	2.2*** (0.6)	1.4*** (0.3)	0.6 (0.5)
Games	14.4 (0.6)	8.4 (0.5)	18.8 (1.0)	12.4 (0.8)	4.0*** (1.0)	2.9*** (0.8)	1.4*** (0.4)	1.2*** (0.4)
Reading	16.4 (0.4)	11.6 (0.4)	19.8 (0.8)	14.1 (0.7)	2.6*** (0.8)	1.7*** (0.6)	1.5*** (0.4)	0.2 (0.3)
Misc. Leisure	23.5 (0.6)	13.2 (0.6)	22.8 (1.0)	16.3 (0.8)	3.0*** (1.0)	3.2*** (0.8)	-0.2 (0.4)	3.5*** (0.6)
N	18,511		9,911					

* p < .10

** p < .05

*** p < .01

Table 3 continued

	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
Single-person households								
Activity								
TV	226.3 (3.5)	206.6 (3.6)	236.2 (5.3)	220.4 (5.2)	13.8** (6.6)	9.8** (4.0)	5.0 (3.5)	4.6*** (1.6)
Exercise	16.4 (0.8)	9.7 (0.6)	18.6 (1.2)	12.9 (1.1)	3.3*** (1.3)	2.4*** (0.8)	0.4 (0.3)	1.7*** (0.7)
Social gathering	36.3 (1.2)	1.3 (0.2)	26.5 (1.8)	1.5 (0.4)	0.2 (0.4)	4.2*** (0.9)	3.6*** (0.8)	0.8 (0.5)
Relaxation	23.2 (1.2)	20.8 (1.2)	29.6 (2.2)	28.2 (2.2)	7.4*** (2.4)	4.9*** (1.5)	3.1** (1.2)	1.4*** (0.4)
Games	15.4 (1.0)	11.3 (0.9)	18.4 (1.7)	15.4 (1.6)	4.1** (1.8)	2.9*** (1.1)	1.0 (0.7)	1.6*** (0.6)
Reading	24.7 (1.1)	24.0 (1.1)	28.5 (1.5)	27.8 (1.5)	3.8** (1.9)	2.3** (1.1)	2.2** (1.1)	0.1 (0.2)
Misc. Leisure	26.5 (1.2)	20.7 (1.2)	26.6 (1.8)	24.2 (1.8)	3.5 (2.2)	3.5** (1.4)	0.0 (0.8)	3.5*** (0.7)
N	5,270		2,628					

Table 3 continued

	Time in activity, 2018-19	Time alone in activity, 2018-19	Time in activity, 5/20 - 5/21	Time alone in activity, 5/20 - 5/21	Difference in time alone in activity, 5/20 - 5/21 and 2018-19	Adjusted difference in time alone in activity, 5/20 - 5/21 and 2018-19	Contribution of changes in time in activity	Contribution of changes in fraction of activity time spent alone
Activity								
TV	161.0 (2.0)	63.9 (1.4)	175.1 (2.6)	70.1 (1.7)	6.2*** (2.1)	3.0* (1.8)	2.4*** (0.6)	0.5 (1.6)
Exercise	16.5 (0.7)	6.6 (0.5)	19.9 (0.9)	8.4 (0.6)	1.8** (0.7)	1.0* (0.6)	0.6*** (0.2)	0.4 (0.5)
Social gathering	37.7 (0.9)	0.6 (0.1)	31.4 (1.0)	0.5 (0.1)	-0.1 (0.2)	1.3*** (0.3)	1.3*** (0.3)	0.0 (0.2)
Relaxation	18.8 (0.7)	9.3 (0.5)	22.9 (1.0)	11.8 (0.8)	2.5*** (0.9)	1.6** (0.7)	1.1*** (0.3)	0.4 (0.5)
Games	14.3 (0.7)	7.8 (0.6)	18.9 (1.1)	11.8 (0.9)	4.0*** (1.2)	3.0*** (0.9)	1.5*** (0.4)	1.1** (0.5)
Reading	14.8 (0.4)	9.2 (0.4)	18.1 (0.9)	11.4 (0.8)	2.3*** (0.9)	1.5** (0.7)	1.3** (0.4)	0.2 (0.4)
Misc. Leisure	22.9 (0.7)	11.8 (0.6)	22.1 (1.0)	14.7 (0.9)	2.9*** (1.1)	3.1*** (0.9)	-0.2 (0.4)	3.4*** (0.7)
N	13,241		7,283					

* p < .10

** p < .05

*** p < .01

Table 4

Selected Descriptive Statistics

Variable	Mean	Std. Deviation
Time alone (minutes)	423.93	296.75
State COVID case rate per 100K	25.82	23.14
Policy index	5.54	1.73
State vaccination rate per 100K (2 wk. lag)	2.42	6.44
Single-person household	0.17	0.37
Household size	2.81	1.43
Married	0.59	0.49
# own household children	0.48	0.92
Age youngest child <=5?	0.12	0.33
Age youngest child 6-12?	0.08	0.27
Female	0.52	0.50
HS Graduate	0.29	0.45
Some College	0.24	0.43
College graduate	0.38	0.49
Hispanic	0.16	0.37
Nonwhite	0.19	0.39
Age	48.14	18.21

Table 5

Coefficient of Pandemic Variables on Eligible Time Spent Alone, May 2020 – May 2021
(Minutes per day)

	Total	Single- person household	Multiple- person household
Prev. week state Covid case rate per 100K	0.39* (0.22)	1.12*** (0.40)	0.15 (0.26)
Policy Index	-0.13 (3.57)	1.85 (6.56)	-0.08 (4.21)
Lagged state vaccination rate per 100K	0.41 (1.89)	-2.14 (3.43)	0.79 (2.18)
N	6,475	1,667	4,808

* $p < .10$

** $p < .05$

*** $p < .01$

Table 6

Coefficients on State Covid Case Rate in Last 7 Days per 100,000 for Time in Activity (Minutes per Day) and Fraction of Time Spent Alone in the Activity

Activity	Coefficient, time in activity	Coefficient, conditional fraction of time alone in activity
All Households		
Eating and Personal Maintenance	0.000 (0.006)	0.011** (0.005)
Care of Household Members	-0.001 (0.008)	0.002 (0.005)
Household Production	-0.029* (0.016)	0.012* (0.006)
Work	-0.004 (0.029)	-0.005 (0.010)
Leisure	0.037 (0.029)	0.001 (0.004)
Travel	-0.016* (0.009)	0.016* (0.008)
Other	0.048** (0.024)	0.016* (0.009)
Total weighted effect on time alone	0.155** (0.077)	0.242 (0.193)
P value, coefficients for each activity = 0	0.047	0.152
P value, coefficients equal across activities		0.346

Table 6 continued

Activity	Coefficient, time in activity	Coefficient, conditional fraction of time alone in activity
Single-Person Households		
Eating and Personal Maintenance	-0.016 (0.010)	0.023** (0.009)
Household Production	-0.037 (0.035)	-0.004 (0.010)
Work	-0.080 (0.054)	0.008 (0.023)
Leisure	0.082* (0.049)	0.008 (0.006)
Travel	-0.015 (0.015)	0.003 (0.014)
Other	0.147** (0.059)	0.007 (0.015)
Total weighted effect on time alone	0.707*** (0.225)	0.279 (0.369)
P value, coefficients for each activity= 0	0.012	0.286
P value, coefficients equal across activities		0.443
* p < .10		
** p < .05		
*** p < .01		

Table 6 continued

Activity	Coefficient, time in activity	Coefficient, conditional fraction of time alone in activity
Multiple-person Household Eating and Personal Maintenance	0.004 (0.006)	0.009 (0.006)
Care of Household Members	0.005 (0.009)	0.002 (0.005)
Household Production	-0.027 (0.018)	0.015** (0.007)
Work	0.011 (0.033)	-0.006 (0.011)
Leisure	0.020 (0.030)	-0.001 (0.006)
Travel	-0.015 (0.010)	0.019** (0.009)
Other	0.020 (0.021)	0.011 (0.012)
Total weighted effect on time alone	0.037 (0.076)	0.206 (0.239)
P value, coefficients for each activity = 0	0.479	0.284
P value, coefficients equal across activities		0.392

* $p < .10$ ** $p < .05$ *** $p < .01$

Table 7

Mean time in substitutes for social contact, 2018-19 and May 2020 – May 2021 (minutes per day)

	2018-19	5/20 - 5/21
Substitutes for social contact	4.8	6.7
Social phone calls	3.6	5.2
Social e-mail	1.2	1.5
Broad substitutes for social contact	18.8	24.9
Games	7.8	11.8
Pets	5.1	5.3
Mail	0.6	0.4
Non-social phone calls	0.9	1.4

Table 8

Coefficient on 2018-19 to May 2020 – May 2021 change in predicted time alone for change in predicted social contact substitutes (minutes per day)

	Social Communication	Broad Substitutes
All households		
No covariates	0.035*** (0.013)	0.108*** (0.025)
Covariates, employment and telework excluded	0.020* (0.012)	0.069* (0.037)
Single-person households		
No covariates.	-0.008 (0.018)	0.055 (0.033)
Covariates, employment and telework excluded	-0.008 (0.034)	-0.024 (0.077)
Multiple-person households		
No covariates	0.054*** (0.020)	0.132*** (0.035)
Covariates, employment and telework excluded	0.026** (0.012)	0.082** (0.040)

* $p < .10$

** $p < .05$

*** $p < .01$

Appendix Table 1

ATUS Codes for Activity Variables

Category	ATUS Codes
Eating and Personal Maintenance	0103 (Health-relate Self Care), 0104 (Personal/Private Activities) , 0105 (Personal Care Emergencies), 0199 (Personal Care n.e.c), 11 (Eating and Drinking)
Child and Household Care	03 (Caring For & Helping Household Members)
Household production	02 (Household Activities), 04 (Caring For & Helping NonHH Members), 07 (Consumer Purchases), 08 (Professional & Personal Care Services), 09 (Household Services)
Leisure	12 (Socializing, Relaxing, and Leisure), 13 (Sports, Exercise, and Recreation)
Travel	18 (Travel)
Work	0501 (Work), 0502 (Work-related activities)
Other	0503 (Income Generating Activities), 0504 (Job Search and Interviewing), 0599 (Work and Work-Related Activities, not elsewhere classified), 06 (Education), 10 (Government Services & Civic Obligations), 14 (Religious and Spiritual Activities), 15 (Volunteer Activities), 16 (Telephone Calls)