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Original Report

Older Adults' Daily Activity and Mood Changes Detected During the COVID-19 Pandemic Using Remote Unobtrusive Monitoring Technologies

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Abstract

Background and Objectives: The coronavirus disease 2019 (COVID-19) pandemic has limited older adults' access to in-person medical care, including screenings for cognitive and functional decline. Remote, technology-based tools have shown recent promise in assessing changes in older adults' daily activities and mood, which may serve as indicators of underlying health-related changes (e.g., cognitive decline). This study examined changes in older adults' driving, computer use, mood, and travel events prior to and following the COVID-19 emergency declaration using unobtrusive monitoring technologies and remote online surveys. As an exploratory aim, the impact of mild cognitive impairment (MCI) on these changes was assessed.

Research Design and Methods: Participants were 59 older adults (41 cognitively intact and 18 MCI) enrolled in a longitudinal aging study. Participants had their driving and computer use behaviors recorded over a 5-month period (75 days pre- and 76 days post-COVID emergency declaration) using unobtrusive technologies. Measures of mood, overnight guests, and frequency of overnight travel were also collected weekly via remote online survey.

Results: After adjusting for age, gender, and education, participants showed a significant decrease in daily driving distance, number of driving trips, highway driving, and nighttime driving, post-COVID-19 as compared to pre-COVID-19 ($p < .001$) based on generalized estimating equation models. Further, participants spent more time on the computer per day post-COVID-19 ($p = .03$). Participants endorsed increases in blue mood ($p < .01$) and loneliness ($p < .001$) and decreases in travel away from home and overnight visitors ($p < .001$) from pre- to post-COVID-19. Cognitive status did not impact these relationships.

Discussion and Implications: From pre- to post-COVID-19 emergency declaration, participants drove and traveled less, used their computer more, had fewer overnight visitors, and reported greater psychological distress. These results highlight the behavioral and psychological effects of stay-at-home orders on older adults who are cognitively intact and those with MCI.

Translational Significance: The present study found that older adults drove less, used their computer more, spent less time outside the home and hosting others overnight, and reported greater psychological distress following the national COVID-19 emergency declaration in the United States on March 13, 2020. These findings highlight the behavioral and psychological effects of stay-at-home orders among older adults, as well as hint at the utility of unobtrusive, technology-based tools in monitoring independence and mental health in this population.

Keywords: Alzheimer's disease, COVID-19, Mild cognitive impairment, Remote monitoring, Technology

Background and Objectives

During the coronavirus disease 2019 (COVID-19) pandemic, the need to provide remote, technology-based clinical care for the older adult population has become more apparent than ever before (Beattie et al., 2020). Not only are older adults at a higher risk for developing more serious complications from COVID-19 due to underlying medical conditions (Centers for Disease Control and Prevention, 2021), but they are also particularly vulnerable to the consequences of nationwide lockdowns and in-home confinement including decreased physical activity, reduced social support, and increased mental health symptoms (Krendl & Perry, 2021). Notably, these lifestyle changes might accelerate progression from normal cognitive aging to mild cognitive impairment (MCI), the prodromal stage of dementia (Di Santo et al., 2020). Nearly a third of Alzheimer's disease (AD) cases are attributable to modifiable risk factors (i.e., physical inactivity, depression), which play an important role in the conversion from MCI to dementia (Cooper et al., 2015). Identifying early changes in cognitive status and subtle declines in an individual's ability to complete instrumental activities of daily living (IADLs) would potentially allow for intervention sooner in the disease course, thereby reducing health care costs and allowing patients to maintain a high level of functional independence (Kaye et al., 2011).

Due to recent technological advances, real-world assessment approaches have allowed researchers to continuously monitor and passively assess cognitively demanding IADLs in older adults' home environments as they age independently (Kaye et al., 2011). These techniques capture subtle changes in daily functioning over time in order to help identify abnormal activity patterns predictive of MCI (Lussier et al., 2019). Of these activities, driving and computer use have both demonstrated promise in detecting conversion to MCI. Research has found that computer use is a cognitively demanding activity and may be a useful indicator of cognitive functioning (Bernstein et al., 2021; Kaye et al., 2014). Using in-home computer monitoring software, past work suggests that in comparison to cognitively intact older adults, those with cognitive impairments demonstrate less frequent at-home computer use, more day-to-day use variability, spend less time using e-mail and word processing applications, and endorse lower confidence in their computer use abilities (Bernstein et al., 2021; Kaye et al., 2014). Further, researchers have found that less daily computer use is associated with smaller hippocampal brain volumes, which may serve as an early predictor of AD pathology (Silbert et al., 2016). With regard to driving, in-vehicle sensor technology has been leveraged to help show that older adults with cognitive impairment spend less time driving on the highway, have fewer day-to-day fluctuations in their driving habits, and drive fewer miles than cognitively intact drivers (Seelye et al., 2017). Adverse driving outcomes (e.g., crashes, speeding) are also linked to aspects of cognitive dysfunction (Anstey et al., 2006), In particular, executive function (e.g., task-switching, inhibition) is strongly associated with driving safety in older adult cohorts (Asimakopulos et al., 2012). These real-world assessment techniques are used in conjunction with neuropsychological cognitive tests in order to infer that IADL changes are due to cognitive decline, rather than physical functional decline. In-home, remote assessment can be a safer approach to assess changes in daily functioning and provide care for older adults who are at risk of COVID-19-related morbidity and mortality.

Computer usage and driving are two common everyday activities for older adults to connect to others and obtain essential information and errands. These activities might be uniquely affected by COVID-19 safety recommendations (i.e., social distancing). However, few studies have examined computer use and driving patterns in older adults during the pandemic and only one study has examined changes in older adults' driving during this period (Roe et al., 2020). Roe and colleagues (2020) used a cognitively healthy sample of older adults and found that these older adults decreased the number of trips they took and the number of days they drove after the COVID-19 lockdown in the United States. While this is useful information, Roe and colleagues (2020) did not assess more cognitively complex driving habits (i.e., highway driving, nighttime driving) and their monitoring period was rather short (i.e., 41 days). It is also unclear if older adults with MCI had similar or different driving patterns in response to the stay-at-home orders during the pandemic. Should older adults' (with and without MCI) driving patterns change relative to prior to the pandemic, these behaviors may have implications for other IADLs that partially rely on driving, such as reduced social interaction, lower attendance at in-person doctor's visits and other appointments, fewer employment/volunteering opportunities, and reduced grocery shopping trips (Curl et al., 2014; Qin et al., 2020).

Older adults' mental health is also another aspect of functioning to examine in relation to the pandemic. While some studies have found that older adults are more resilient than younger adults during the COVID-19 pandemic (Bruine de Bruin, 2021), other studies have found that the pandemic had immediate negative impacts on older adults' mental health (Krendl & Perry, 2021). Further, limited studies have observed the effects of the COVID-19 pandemic on older adults' mental health with MCI (Di Santo et al., 2020), especially considering depression is a risk factor for the conversion from MCI to dementia (Ismail et al., 2017), poor quality of life, earlier institutionalization, and increased mortality (Lanctôt et al., 2017). Yet, most studies on mental health or life changes during the COVID-19 pandemic used questionnaires that are episodic in administration, which limits the ability to observe changes over time. In fact, existing work suggests that weekly online reporting (i.e., remote online surveys filled out by older adults) of mental health symptoms and life events (e.g., medication changes, emergency room visits, travel away from the home) affords a way to collect valuable information and alert clinicians to those who are at risk for health changes in real time (Kaye et al., 2011). Using the weekly online reporting approach, we can better understand how older adults' mood and life events have been affected by the pandemic, especially among a broader population of older adults (i.e., individuals with and without MCI).

The primary aim of the present study was to assess driving, computer use, mood, and life events before and after the COVID-19 national declaration in a sample of older adults (both cognitively intact and MCI) using novel assessment approaches. Given prior research on the negative effects of the pandemic on older adults who are at increased risk of dementia (Di Santo et al., 2020), a secondary aim was to examine the impact of MCI on changes in the outcome measures compared to those who were cognitively intact. We hypothesized that following the COVID-19 national declaration, older adults would be driving and traveling less to avoid leaving their homes for "non-essential" trips, using their computers more to stay connected to the outside world, inviting fewer visitors to their home to socially distance, and experiencing heightened levels of mood symptoms. Due to the goals of this study, we elected to examine the effects of the COVID-19 national declaration on each of these outcome variables separately, rather than associations among outcome variables or their interaction. The current study may have important implications for the future adoption of in-home assessment and its' ability to provide proactive, personalized care for older adults who have been impacted by the COVID-19 pandemic.

Research Design and Methods

Participants

All participants provided written informed consent and the protocol was approved by the relevant institutional review boards. Participants were 59 community-dwelling older adults (41 cognitively intact and 18 MCI) recruited through targeted letters and advertising. Inclusion criteria were 65 years of age and older, living independently in their home, having a broadband internet connection, using a computer at least once per week, actively driving and being the sole driver of their vehicle, being relatively healthy for age, and having no cognitive test scores indicative of clinically significant global cognitive impairment based on validated measures (Montreal Cognitive Assessment [MoCA] sex, age, and education adjusted z scores <−2 or global Clinical Dementia Rating Scale [CDR] score >.05 [Morris, 1993]) or a dementia diagnosis. Participants were classified by an interdisciplinary team (i.e., clinical neuropsychologist, psychometrist, and research assistants) using established clinical research measures (e.g., CDR, MoCA, Functional Activities Questionnaire [FAQ; Pfeffer et al., 1982], Everyday Cognition Questionnaire [ECog; Farias et al., 2008) and a neuropsychological battery consistent with the National Institute on Aging and Alzheimer's Association workgroup criteria for MCI (Albert et al., 2011). These criteria include: (a) concern regarding a change in cognition (we use the CDR, FAQ, and the ECog to inform this), (b) impairment in one or more cognitive domains (we use the neuropsychological test data and the National Alzheimer's Coordinating Center's Uniform Data Set (NACC UDS) normative data to inform test results 1–1.5 *SD* below mean normative data), (c) preservation of independence in basic functional activities (we use the CDR, FAQ, and the ECog to inform this), and (d) no evidence of dementia (we use all of the above measures as well as the MoCA cutoff z score of −2 *SD* below normative data to inform this).

Clinical Assessment Procedures

Participants completed a battery of clinical and cognitive measures including an informant-rated functional questionnaire, mental health measures, and validated neuropsychological tests as part of the study protocol. MoCA (Nasreddine et al., 2005) and global cognition z scores were calculated using group mean and *SD*s from the NACC UDS clinically normal cognitive group (Weintraub et al., 2018).

In-Home Activity Monitoring Platform and Installation

Continuous activity data and weekly reports of mood symptoms and life events were collected over 5 months (December 2019–May 2020) using a well-established unobtrusive in-home activity assessment platform installed in the home and automobile vehicles of each study participant (Beattie et al., 2020). A hub computer device (Raspberry Pi 3 Model B) received and transferred all deidentified sensor data collected (driving monitoring and computer use), via secure VPN connection, to our secure research servers. The hub computer broadcasted a wireless network in the home, acted as a client to a wireless or wired router, and checked in with the research server to ensure it was up to date and the device was properly identified. The activity data went straight to the research server every day and were deleted from the device after transmission. Hub computers were linked to unique participant ID numbers. Study devices (such as computer use monitoring software, passive driving monitoring sensor, and the health update form, described in detail in the following sections) were purchased and maintained by research personnel. If technical difficulties arose, research personnel repaired or replaced technology within 1–2 weeks. Thus, participant effort and burden were low due to the passive nature of the data collection. All data were separated into two time periods: 75 days pre- and 76 days post-COVID-19 national emergency declaration (March 13, 2020).

Computer Use and Driving

Thirty-six participants had computer use monitoring software (Worktime Corporate, Toronto, Ontario, Canada) installed on their home computer. This commercially available software is compatible with PCs only and collects information about the number and duration of participant computer sessions. This software does not record keystrokes, passwords, e-mails, chats, documents content, or screen content. Advanced encryption standard encrypted data (FIPS 140-2 compliant) were transmitted to research servers via transmission control protocol connection. A subset of the sample (N = 23) did not have their computer use monitored because the computer monitoring software used in the present study was not compatible with macOS-based computers, tablets, or smartphones.

Fifty-five participants had a passive driving monitoring sensor (Automatic Pro sensor, Automatic Labs, San Francisco, CA, USA) plugged into their vehicle's On-board diagnostics II data port by research personnel (Beattie et al., 2020). This device is compatible with most vehicles (gas and electric/hybrid) sold in the United States beginning with the 1996 model year. This device obtained data regarding daily driving distance, number of driving trips, and frequency of highway and nighttime driving. Unprocessed driving data were obtained electronically from each device, processed via integrated 3G wireless, transmitted to commercial servers, and then uploaded to secure research servers. Research programmers used freely available application programming interface to write software to confidentially read the unprocessed data and develop our variables of interest. Locations or destinations traveled, driving safety or ability (e.g., adherence to speed limit or traffic stops), or accidents were not collected. Participants were not able to interact directly with the driving sensor and it remained out of sight, posing no obvious risks to participants. A subset of the sample (N = 4) did not transmit driving data due to sensor malfunctions or an incompatibility between the vehicle data port and the model/make of the participant's vehicle.

Health Update Form

All participants completed a brief web-based 13-item survey (Kaye et al., 2011) on a weekly basis throughout the study period. The survey asked questions about events and behaviors that could affect in-home monitoring activity patterns (i.e., health changes, depression, changes to living space). This survey was administered via the Qualtrics Survey Platform and research personnel contacted participants through a phone call if they did not complete the survey or to troubleshoot any technical difficulties to ensure data capture and quality. All participants were required to use a computer at least once per week and these surveys could be taken on a computer, tablet, or smartphone, which made it easy for participants to complete remotely. For the purpose of the current study's aims, the following four yes/no questions about loneliness ("In the past week I felt lonely"), low mood ("Have you felt downhearted or blue for three or more days in the past week?"), travel away from home ("In the past week, have you been away from home overnight?"), and overnight visitors ("In the past week, have you had visitors who stayed with you in your home for a night or more?") were analyzed.

Statistical Analysis

All driving and computer use variables were recorded as continuous variables except for daily highway and nighttime driving, which were coded as yes/no due to low frequencies. Highly skewed continuous outcome measures were log-transformed to obtain normal distributions. We used generalized estimating equations (GEEs; SAS Proc GEE and Glimmix) models to investigate differences in daily activity and mood changes pre- and post-COVID after adjusting for age, gender, cognitive status, and education. As this study aimed to examine which outcome variables changed from pre- to post-COVID-19 lockdown, each outcome variable was entered in a separate model, and associations among outcome variables (e.g., mood and driving) were not explored.

Results

Participant Characteristics

Baseline demographic data for the total sample and for cognitive status groups are presented in Table 1. The total sample consisted of primarily White (n = 51, 86%) participants with an average age of 73.5 years (SD = 5.8) and 15.7 years of education (SD = 2.8). Average individual earnings fell in the range of $25,000–$34,999. The MCI group had significantly lower MoCA total scores, higher FAQ scores (lower functional performance), and lower global cognitive z scores compared to the cognitively intact group; there were no group differences in demographic or mood measures.

Computer Use and Driving Sensor-Monitored Activity

The GEE model for daily computer use revealed a significant increase in use post-COVID-19 (β = 0.11, p = .03; see Supplementary Table 2 and Figure 1). Regarding driving sensor data, there was an overall significant decrease in daily driving distance (in meters) (β = −0.50, p < .001), number of driving trips (β = −0.26, p < .001), highway driving (odds ratio = 0.49, p < .001), and nighttime driving (odds ratio = 0.11, p < .001), post-COVID-19 (see Figure 1). There were no significant main effects of cognitive status (Table 2).

Self-Reported Mental Health and Travel Events

Overall participants reported higher prevalence of blue mood (odds ratio = 3.27, p < .01) and loneliness (odds ratio = 4.76, p < .001) post-COVID-19. Overall participants reported lower prevalence of travel away from the home (odds ratio = 0.22, p < .001) and overnight visitors (odds ratio = 0.24, p < .001) post-COVID-19. There were no significant main effects of cognitive status.

Discussion and Implications

The COVID-19 pandemic has disproportionately impacted the well-being and everyday activities of older adults, and we were able to monitor these changes using novel assessment approaches. Traditional assessment methodologies and data collection approaches can be severely limited in their ability to capture day-to-day alterations in important real-world activities and behaviors for older adults, such as driving, computer use, travel, and mood from pre- to post-COVID-19. It is critical to explore the impact of

Table 1. Baseline Characteristics Overall and by Cognitive Status

	Total (N = 59)	MCI (n = 18)	Cognitively intact (n = 41)	
Variable	Mean (SD) or n (%)	Mean (SD) or n (%)	Mean (SD) or n (%)	p value
Age, in years	73.53 (5.84)	75.35 (7.71)	72.74 (4.69)	.12
Sex: male	33 (56%)	9 (50%)	24 (59%)	.58
Education, in years	15.66 (2.82)	15.22 (3.49)	15.85 (2.49)	.43
Race: White	51 (86%)	15 (83%)	36 (88%)	—
Earnings: individual[a]	5.72 (2.46)	5.94 (2.22)	5.63 (2.58)	.67
Living situation: lives alone	26 (44%)	8 (44%)	18 (44%)	.99
FAQ total score	0.36 (1.36)	1.00 (2.35)	0.07 (0.26)	.015
GDS-15 raw score	0.93 (1.31)	0.89 (1.49)	0.95 (1.24)	.87
GAD-7 raw score	1.36 (1.49)	1.50 (1.43)	1.29 (1.54)	.63
MoCA total score	25.27 (2.65)	23.06 (2.13)	26.24 (2.25)	<.001
Global cognition z score	−0.05 (0.41)	−0.37 (0.36)	0.09 (0.36)	<.001
Pre-COVID summary measures				
Daily computer usage, in minutes	58.3 (48.7)	40.5 (29.6)	64.2 (52.7)	.26
Daily driving time, in minutes	62.5 (21.3)	65.2 (19.7)	61.2 (22.2)	.41
Prevalence of ever reporting mood/event				
Blue mood	8 (14%)	2 (11%)	6 (15%)	1.0
Loneliness	6 (10%)	2 (11%)	4 (10%)	1.0
Travel away from home	32 (54%)	12 (67%)	20 (49%)	.20
Overnight visitors	22 (37%)	6 (33%)	16 (39%)	.68

Notes: COVID-19 = coronavirus disease 2019; FAQ = Functional Activities Questionnaire; GAD-7 = General Anxiety Disorder-7; GDS-15 = Geriatric Depression Scale-15; MCI = mild cognitive impairment; MoCA = Montreal Cognitive Assessment. Driving and computer use are from pre-COVID (baseline). Mood/event reports are the prevalence of ever reporting each event during baseline. Chi-square comparisons with expected counts with <5 were excluded from analysis. Mean and SD or percentages are presented (N = 59).

[a]Participants were asked how much they earned (earnings [individual]) before taxes and other deductions, during the past 12 months (for reference, 1 = <$5,000, 2 = $5,000–$11,999, 3 = $12,000–$15,999, 4 = $16,000–$24,999, 5 = $25,000–$34,999, 6 = $35,000–$49,999, 7 = $50,000–$74,999, 8 = $75,000–$99,000, 9 = ≥$100,000).

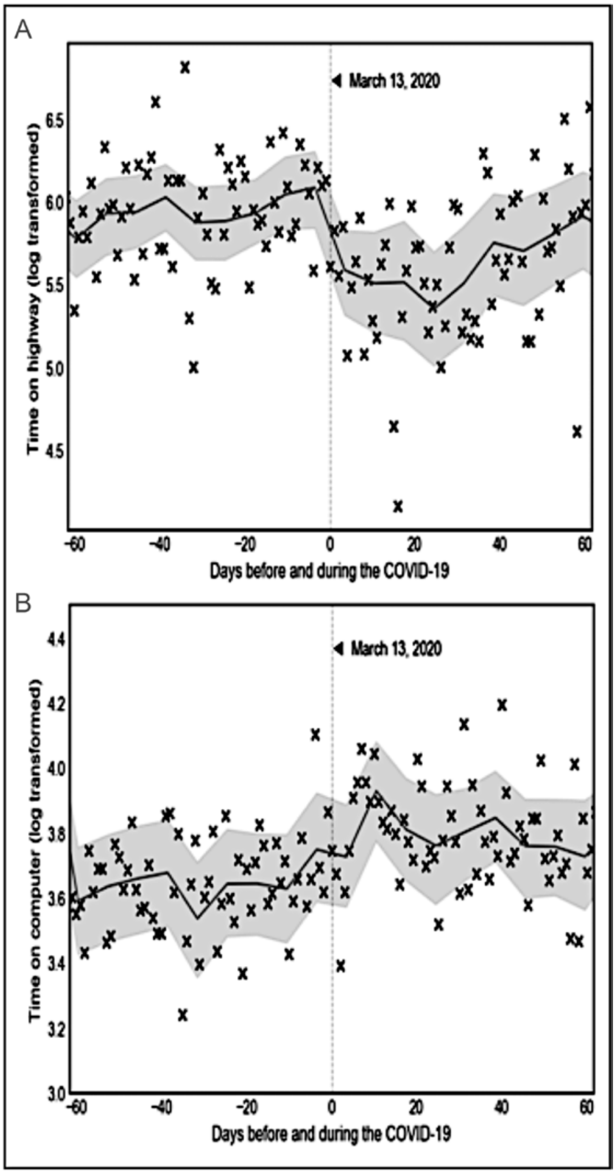

Figure 1. Daily mean scatter plot and weekly line plot for highway driving and computer use (95% CI). COVID-19 = coronavirus disease 2019.

COVID-19 safety recommendations on daily activities and behaviors among cognitively heterogenous older adults, including older adults with MCI who are at risk for particularly negative effects of the pandemic.

Consistent with current literature (Roe et al., 2020), this study found that participants broadly reduced the number of trips and daily miles driven from prior to the pandemic. As this study's period of during-lockdown driving monitoring was nearly twice as long as Roe and colleagues' (75 days vs 41 days), these driving frequency changes appeared to persist well beyond the initial month that the national emergency was declared. Building on Roe and colleagues, this study also found that participants decreased time spent driving at night and on highways. The former finding may be attributable to decreased opportunities for in-person social interaction during the evenings. The latter result likely reflects participants' limiting their driving to essential destinations and may explain why Roe found that older adults engaged in less speeding from pre- to post-COVID-19. Collectively, the breadth and persistence of these changes hint at more global and long-term alterations to older adults' driving behaviors than have been previously reported. Such findings are particularly concerning, given the strong impact that reductions in driving may have for functional independence and mental health in older adult populations (Chihuri et al., 2016; Unsworth et al., 2007). Should these trends continue despite broader societal efforts to resume daily activities and driving behaviors, targeted interventions to promote older adults' comfort and willingness to return to the roads may be warranted.

In addition, this study found that participants used their computers for longer periods of time than prior to the pandemic. These results are consistent with self-report literature (Werneck et al., 2021) and provide preliminary, objective evidence of increased computer use in older adults. A variety of factors could explain increases in computer use, including a desire to use social media to connect with others in the absence of in-person social connection (Mukhtar, 2020), increased reliance on telemedicine (Li & Zhang, 2021), and boredom (Yan et al., 2021). Future studies assessing specific functions completed while using the computer (e.g., computer applications interacted with) would provide greater understanding of why older adults used technology during the pandemic.

The present study also reported decreased frequency of travel away from the home and less frequent overnight visitors. The former finding is in parallel with the driving frequency results noted previously, while both the former and latter likely reflect increased social distancing efforts in this cohort. Consistent with other studies (Parlapani et al., 2020), participants also reported increases in low mood and loneliness since prior to the pandemic onset. Notably, the present study did not explicitly evaluate the relationship between changes in mood and IADLs, limiting capacity to comment on the correspondence of these variables during the pandemic. Future investigations are warranted to investigate these relationships.

Despite changes in several everyday activities from pre- to post-COVID, cognitive status was not associated with changes in any outcome variables (No MCI × Pre–post COVID interactions). The lack of observed driving and computer use differences by cognitive status is noteworthy, given that older adults with and without MCI have been shown to differ in these regards during nonpandemic circumstances (Kaye et al., 2014; Seelye et al., 2017), and suggest that the pandemic does not appear to have exacerbated these contrasts. The absence of computer use group differences also indicates that computers are viable options for older adults with and without MCI to access care and maintain social contact during a pandemic. Finally, while previous studies have highlighted that those with MCI may report greater loneliness and depression during

Table 2. Generalized Estimating Equations Models to Examine Changes in Daily Activities and Mood Before and During the COVID-19 Pandemic (*N* = *59*)

Outcome	Variable	Estimate	Odds ratio	95% CI	*p* value
Daily distance (meters)[a]	Post- vs pre-COVID	−0.50		−0.62, −0.38	<.0001
	Age	−0.01		−0.03, 0.00	.09
	Female vs male	−0.18		−0.40, 0.04	.10
	Education	0.00		−0.04, 0.04	.98
	MCI vs cognitively intact	0.13		−0.07, 0.33	.19
Daily number of trips[a]	Post- vs pre-COVID	−0.26		−0.33, −0.18	<.0001
	Age	0.00		−0.01, 0.01	.57
	Female vs male	−0.05		−0.15, 0.06	.41
	Education	0.01		−0.02, 0.03	.68
	MCI vs cognitively intact	0.07		−0.07, 0.20	.34
Daily computer use time (minutes)[a]	Post- vs pre-COVID	0.11		0.01, 0.21	.03
	Age	−0.04		−0.09, 0.01	.12
	Female vs male	0.04		−0.51, −0.60	.88
	Education	0.05		−0.04, 0.15	.29
	MCI vs cognitively intact	−0.10		−0.67, 0.46	.73
Daily highway driving (yes/no)	Post- vs pre-COVID		0.49	0.42, 0.57	<.0001
	Age		0.99	0.92, 1.06	.74
	Female vs male		0.72	0.32, 1.65	.44
	Education		1.10	0.95, 1.28	.20
	MCI vs cognitively intact		1.06	0.44, 2.51	.90
Daily nighttime driving (yes/no)	Post- vs pre-COVID		0.08	0.06, 0.09	<.0001
	Age		1.01	0.96, 1.06	.93
	Female vs male		0.66	0.37, 1.20	.17
	Education		1.03	0.93, 1.15	.57
	MCI vs cognitively intact		0.93	0.50, 1.73	.81
Low mood (yes/no)	Post- vs pre-COVID		3.68	1.79, 7.59	<.001
	Age		0.95	0.87, 1.05	.32
	Female vs male		3.94	1.25, 12.49	.02
	Education		1.04	0.83, 1.31	.72
	MCI vs cognitively intact		0.90	0.26, 3.13	.87
Loneliness (yes/no)	Post- vs pre-COVID		3.44	1.56, 7.61	<.01
	Age		0.97	0.84, 1.12	.68
	Female vs male		7.02	1.06, 46.41	.04
	Education		1.62	1.04, 2.55	.03
	MCI vs cognitively intact		1.73	0.29, 10.53	.55
Travel away from home (yes/no)	Post- vs pre-COVID		0.22	0.14, 0.35	<.0001
	Age		0.97	0.90, 1.04	.37
	Female vs male		1.02	0.46, 2.25	.97
	Education		1.28	1.09, 1.51	<.01
	MCI vs cognitively intact		1.50	0.63, 3.56	.36
Overnight visitors (yes/no)	Post- vs pre-COVID		0.24	0.13, 0.46	<.0001
	Age		1.03	0.94, 1.12	.53
	Female vs male		0.61	0.22, 1.70	.34
	Education		1.16	0.96, 1.41	.13
	MCI vs cognitively intact		1.33	0.44, 3.99	.61

Notes: CI = confidence interval; COVID-19 = coronavirus disease 2019; MCI = mild cognitive impairment.
[a]Item was log-transformed.

the pandemic due to their comparatively high rates of comorbid conditions (Di Santo et al., 2020), this study did not identify either to be the case. These results suggest that cognitive status did not play a role in the observed changes in older adults' everyday activities during the pandemic.

Limitations

This study recruited a small sample that was relatively homogeneous in terms of age, education, race, and sex. Use of other types of technology beyond home desktop or laptop computer (e.g., smartphones, tablets) could also not be assessed given limitations of the computer monitoring software, which prevents a more comprehensive understanding of changes in technology use. Due to the limitations of the computer monitoring software and the vehicle data port, we failed to capture every participant's computer use and driving data. Future studies should develop monitoring software and driving sensors that are compatible across all platforms, operating systems, and devices so that all data are captured. Regarding computer proficiency, future studies should also collect data on participants' prior computer proficiency especially in participants with MCI because this may contribute to differential outcomes. The self-report measures of mood symptoms and life events were single-item, nonstandardized measures, which have been used previously (Kaye et al., 2011) and allowed for brief, repeated assessment but also lack the psychometric properties characteristic of established clinical measures. Additionally, given the goals of the study and small cell sizes, we did not examine the interplay between mood and other IADL measures (e.g., driving); however, future work should explore this issue. Further, the activities monitored in the present study (driving and computer use) likely shifted for all adult age groups and activities such as leaving the house and driving less were in direct compliance with stay-at-home orders issued nationwide. No younger adult comparison group was recruited in the current study so we cannot be sure that similar trends would not be found in younger adult cohorts. We also acknowledge that other factors aside from those examined in the present study (i.e., stress, fear, frequent media exposure) likely influenced older adults' behaviors.

Conclusion

Relative to prior to the COVID-19 lockdown, participants drove less, used their computers more, endorsed less time outside the home and hosting others overnight, and reported greater psychological distress following the national emergency declaration. Cognitive status did not impact these relationships. The pandemic appeared to have a significant effect on several facets of older adults' everyday activities as well as their mood. These findings have important implications for the future adoption and implementation of in-home monitoring technologies in this population.

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Conflict of Interest

None declared.

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