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Research Letter

Changes in Older People's Activities During the Coronavirus Disease 2019 Pandemic in Japan

To the Editor:

The rapid spread of the coronavirus disease 2019 (COVID-19) pandemic has led state and local leaders to introduce social/physical distancing and self-isolation. Aggregated mobility data collected by private companies have been available to help understand the impact of such measures on population mobility patterns.[1] However, because the older population is not likely to be represented in such data, partly because of their technology adaptation issues,[2,3] we may not know how older adults have reacted to these community/policy messages.

We had access to a unique dataset comprising behavior logs of older adults living in a continuing care retirement community (CCRC), which enabled us to estimate the time spent in common areas and walking distance within the CCRC. We analyzed data from 114 residents aged 67 to 92 years, 70.4% female. All of them were residents in independent apartment units and carried a beacon transmitter daily as part of a research project since September 2018.[4]

During the follow-up period from January 1, 2020, until May 25, 2020, there were 2 major messages related to COVID-19 to senior residents: first, the CCRC announced the cancellation of all upcoming in-facility events/exhibitions and the closure of some common facilities as a precaution measure (February 24, 2020); subsequently, the state of emergency was declared by the prime minister, asking people to stay at home (April 7, 2020), and this was eventually lifted by the end of the follow-up period. Figure 1 shows daily time spent in common areas and daily walking distance over the follow-up period. According to our interrupted time series analysis,[5] the time spent in common areas decreased immediately

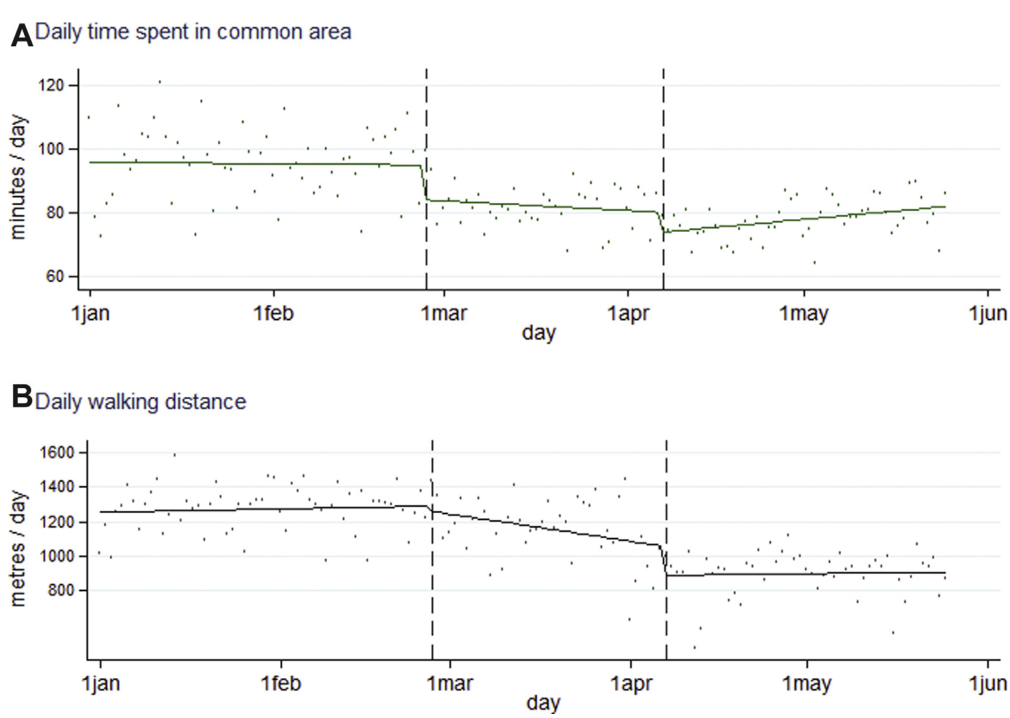

Fig. 1. Changes in levels and trends of older adults' activities during the COVID-19 pandemic. Means of daily time spent in (A) common area and (B) walking distance between January 1 and May 24, 2020. The left dotted line indicates the day when the CCRC announced the cancellation of all in-facility events and closure of some facilities (February 24, 2020), and the right dotted line represents the day when the state of emergency was declared (April 7, 2020).

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following the CCRC announcement by 12.7% (10.9 minutes [95% confidence interval (CI) −17.2, −4.5]). After the CCRC announcement until the state of emergency declaration, the time spent in common areas remained at a low level, while the walking distance gradually decreased at a rate of 0.5% [5.4 m/day (95% CI −10.4, −0.4)]. The state of emergency declaration had a further significant acute impact on the time spent in common areas by 7.8% decrease [6.5 min/day (95% CI −11.1, −1.8)] and the daily walking distance by 20.3% decrease [−186.8 m (95% CI −333.0, −40.6)] (Supplementary Table 1).

The time spent in common areas is likely to be related to face-to-face social interaction, which is usually an important aspect of healthy aging; however, such interaction is to be avoided during the COVID-19 pandemic. The data showed that older adults reduced their social time largely in response to the message from their immediate community, although there was no explicit request to avoid social contact. The state of emergency, which was not enforceable, had a further reducing effect on social time. A known characteristic of Japanese individuals quoted as "the government asked, people listened" has been suggested as one of the possible reasons for the relatively low mortality rate of COVID-19 as of July 15, 2020 in Japan without adopting draconian measures for tackling the virus.[6] Our study seems to support this hypothesis, applicable at least to the population most vulnerable to COVID-19. On the other hand, the reduction of walking distance over the period needs a different interpretation. It is a physical activity conducted individually or as a pair, and residents were under no restrictions in moving in and around the various buildings in the CCRC during the period. Psychological impact from COVID-19-related messages on people's behaviors should be addressed, and the possible health impact of these suppressing social and physical activities during the pandemic could be an important research issue in gerontology in the future.

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Supplementary Methods

Setting

This study was conducted in a CCRC built over 11 hectares on a hill in an isolated area of Kyoto, Japan. The community has a total of 361 units (335 apartment units and 26 assisted-living units) and 51 nursing care units, offering 24-hour healthcare at an onsite clinic, security services with built-in door and room sensors, and social and recreational activities. The residents typically move into the CCRC in their 70s and spend 10-15 years until death. Because of its location, it is not unusual for many residents to spend their day in the CCRC; thus, this is a nearly closed community where residents spend their everyday life from retirement until end of life.

Technical Instrument Used in Activity Program

We adopted a senior-friendly internet-of-things device, namely a beacon transmitter, for tracking the movement of residents. Beacons are small, wireless transmitters that use low-energy Bluetooth technology to send signals. The residents were simply asked to carry the 16-g card-sized beacon as they went around in their normal routines without requiring any extra operation. In total, 30 beacon receivers were positioned throughout the CCRC to detect information from the surrounding beacons, which broadcasted packets of data at regular intervals and forwarded these data to the server. With this internet-of-things system, exact entry and exit times for an area within a radius of 10 to 30 m from each of the 30 locations were accumulated in chronologic order for each resident. The locations of the receivers were carefully determined through a process of trial and error, so that we could estimate the approximate walking distances of residents in and around the CCRC and the approximate time spent around the receivers for social interaction.

Statistical Analysis

To assess whether the 2 messages related to COVID-19 [CCRC announcement of cancellation of all events and closure of some facilities (February 24, 2020) and governmental declaration of state of emergency (April 7, 2020)] resulted in changes in the level and trend of walking distance in m/day and time spent in common areas in min/day in relation to the premessage period, we conducted interrupted time series analyses using the itsa command in Stata (StataCorp. College Station, TX) (Linden 2015).[5] The assumption that the errors were not serially correlated was confirmed with the Cumby-Huizinga test for autocorrelation and Kernel density estimates. No lag was specified in the main analysis, and sensitivity analyses included a different specified lag. The main analysis employed regressions with Newey-West standard errors, and the Prais-Winsten autoregressive model was used in another sensitivity analysis. Postmessage trends were estimated. To adjust for the variability of weekdays, we included a dummy variable for week in the models.

Supplementary Table 1
Regression Results of Main and Sensitivity Analyses (N = 134)

	Model 1			Model 2			Model 3		
Time									
Baseline	86.84	79.31	94.36	86.84	78.31	95.36	86.98	79.21	94.75
Pre CA	−0.02	−0.20	0.16	−0.02	−0.22	0.18	−0.03	−0.21	0.16
(Time at CA)	85.68								
Post CA short term	−10.87 (=12.7% of 86.68)	−17.21	−4.52	−10.87	−17.48	−4.26	−10.47	−17.44	−3.51
Post CA long term	−0.08	−0.33	0.18	−0.08	−0.34	0.18	−0.08	−0.35	0.20
(Time at SE)	82.66								
Post SE short term	−6.46 (=7.8% of 82.66)	−11.13	−1.80	−6.46	−11.28	−1.65	−6.31	−11.30	−1.31
Post SE long term	0.27	0.06	0.48	0.27	0.06	0.48	0.28	0.05	0.51
Trend: CA	−0.10	−0.28	0.09	−0.10	−0.28	0.09	−0.10	−0.31	0.10
Trend: SE*	0.18	0.07	0.28	0.18	0.06	0.28	0.17	0.06	0.29
	$F(11,134) = 27.3$, $P < .000$			$F(11,134) = 27.4$, $P < .000$			$F(11,134) = 24.0$, $P < .000$ $R^2 = 0.62$, d statistic† = 1.95		
Walking distance									
Baseline	1097.23	1009.39	1185.06	1097.23	1000.11	1194.34	1096.31	1001.97	1190.66
Pre CA	0.64	−1.38	2.65	0.64	−1.58	2.86	0.65	−1.59	2.89
Distance at CA	1133.60								
Post CA short term	−37.70 (=3.3% of 1133.60)	−138.21	62.80	−37.70	−140.87	65.46	−34.00	−146.41	78.41
Post CA long term	−5.37	−10.39	−0.36	−5.37	−10.85	0.10	−5.51	−11.02	−0.01
Distance at SE	918.63								
Post SE short term	−186.79 (=20.3% of 918.63)	−333.01	−40.57	−186.79	−348.23	−25.35	−183.69	−341.39	−25.99
Post SE long term	5.61	0.40	10.82	5.61	0.05	11.18	5.70	−0.08	11.48
Trend: CA	−4.73	−9.34	−0.13	−4.74	−9.78	0.31	−4.86	−9.90	0.17
Trend: SE*	0.87	−1.68	3.43	0.88	−1.61	3.36	0.84	−2.03	3.70
	$F(11,134) = 38.3$, $P < .000$			$F(11,134) = 46.8$, $P < .000$			$F(11,134) = 29.6$, $P < .000$ $R^2 = 0.64$, d statistic = 1.97		

CA, CCRC announcement; *SE*, state of emergency.
Confidence intervals in brackets.
Model 1: Regression with Newey-West standard errors without lag indicated (main analyses).
Model 2: Model 1 with 1 day lag indicated.
Model 3: Prais-Winsten autoregressive model. Dummy variables for week are not shown in the tables.
Postintervention linear trend = _b [pre CA] + _b [post CA long term].

*Postintervention linear trend = _b [pre CA] +_b [post CA long term] + _b [Post SE long term].

†Durbin−Watson d statistic is an indicator of how well the model corrects for first-order autocorrelation; d can take on values between 0 and 4, and under the null hypothesis, d is equal to 2.