

Feeling Gratitude is Associated with Better Well-being across the Life Span: A Daily Diary
Study during the COVID-19 Outbreak

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Abstract

Objectives

Numerous studies have shown that gratitude can improve mental health of people facing stressful events. However, most studies in this area have been based on laboratory experiments and retrospective surveys, rather than actual situations in which people are experiencing stress. Moreover, few studies have examined whether age moderates the benefits of gratitude. Coronavirus disease 2019 (COVID-19) has caused enormous psychological distress worldwide. Evidence-based strategies are needed to enhance well-being during this stressful time. This study attempted to fill these gaps by examining the benefits of feeling gratitude every day during the COVID-19 outbreak.

Method

A sample of 231 participants from mainland China aged 18 to 85 years participated in a 14-day daily diary study. After a pretest to collect demographic data, information on gratitude, daily positive and negative affect, perceived stress related to COVID-19, and subjective health were measured using daily questionnaires on 14 consecutive days. One month after the daily diary period, information on affective experiences, life satisfaction, and subjective health was collected as a follow-up survey.

Results

On days when individuals feel more gratitude than usual, they report more positive affect, a lower level of perceived stress related to COVID-19, and better subjective health on the concurrent day (Day N). Individuals also report a lower level of stress related to COVID-19 on the following day (Day N+1), when they feel more gratitude than usual on Day N. Higher levels of gratitude across the 14-day study period was associated with a higher level

of positive affect and a lower level of negative affect, but was not associated with life satisfaction or subjective health at the one-month follow-up assessment.

Discussion

These findings demonstrate the benefits of gratitude in a naturalistic situation that induced stress and anxiety.

Keywords: gratitude, age, well-being, stress, subjective health, COVID-19

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Gratitude has been found to be associated with all aspect of well-being (Wood et al., 2010). Most of these studies, however, examined gratitude as a personal trait which refers to “the willingness to recognize the unearned increments of value in one’s experience” (Bertocci & Millard, 1963, p. 389). In the social-cognitive model of gratitude, Wood et al. (2008) differentiate between trait gratitude and state gratitude. While trait gratitude can be considered a personal disposition, state gratitude refers to an affective state that occurs after individuals appraise the help they receive and that motivates reciprocity (Wood et al., 2008). Most previous studies of gratitude have focused on gratitude as a trait. These studies found that trait gratitude is associated with increased well-being (Emmons & McCullough, 2003), more prosocial behaviors (Bartlett & DeSteno, 2006), an increased sense of meaning (Kleiman, et al., 2013a), a lower level of suicidal ideation (Li et al., 2012), fewer self-reported physical symptoms (Hill et al., 2013), and better subjective sleep quality (Wood, et al., 2009). Relatively, a smaller number of studies have examined the effect of gratitude as an affective state on well-being (For exceptions, see Algoe, et al., 2010; Kashdan, et al., 2006; Nezlek, et al., 2019; Nezlek, et al., 2017; Sztachańska, et al., 2019; Zygar, et al., 2018). Few studies have examined whether the benefits of gratitude vary with age.

In addition, most studies in this area have been based on laboratory experiments and retrospective surveys, rather than actual situations in which people are experiencing stress. Coronavirus disease 2019 (COVID-19) has posed severe threats to physical and mental health worldwide (Bruine de Bruin, 2020; Evandrou et al., 2020; Jiang, 2020; Losada-Baltar et al., 2020; Qiu et al., 2020). Whereas most previous studies focused on the psychological consequences of COVID-19, few studies have examined the conditions that may mitigate the negative consequences. To fill these gaps, this study focused on gratitude as a daily affective state, and relied on a 14-day daily diary study with a one-month follow-up assessment to examine the association between gratitude, well-being, and subjective health in a lifespan

sample. In particular, I examined these relationships during the peak of the COVID-19 outbreak in China.

Daily Gratitude and Well-being

Although the majority of studies have focused on the role of trait gratitude in well-being, several recent studies have examined whether daily gratitude as a daily affective state may also be associated with well-being. Using the daily diary method, Nezlek et al. (2017) found that a greater level of daily gratitude was associated with higher levels of both hedonic well-being (i.e., a higher level of positive affect and a lower level of negative affect) and eudaimonic well-being (i.e., a greater sense of meaning in life and self-esteem) on the same day, and was associated with a higher level of hedonic well-being but not eudaimonic well-being on the next day. Among cohabiting couples, daily gratitude for a partner's actions was associated with greater relationship satisfaction and connectedness on the following day for both men and women (Algoe et al., 2010). Nezlek et al. (2019) found that daily gratitude moderated the relationship between stress and daily hedonic and eudaimonic well-being; specifically, the negative associations were weaker on days when participants felt more gratitude.

Most previous studies in this area have been either laboratory experiments that induced gratitude using manipulations or retrospective surveys after a stressful event. However, only a few studies have examined the role of gratitude in daily well-being when people face stress in real situations. Kashdan et al. (2006) found that daily gratitude was associated with better daily well-being in participants with and without post-traumatic stress disorder. In a sample of women with breast cancer, women who were asked to list reasons for feeling grateful reported better daily well-being than those who were not asked to do so (Sztachńska et al., 2019). Although these studies were based on a diary design, the stressors

(i.e., PTSD in Kashdan et al. (2006) and breast cancer in Sztachañska et al. (2019)) were prolonged. Individuals might have had time to cope with these prolonged stressors. No studies have examined whether the benefits of daily gratitude can be generalized to individuals facing sudden and significant stress in real settings. Such information, however, is important to understand the effectiveness of gratitude in promoting well-being in sudden and urgent situations.

The Role of Age

A few studies have examined whether the relationship between gratitude and well-being is moderated by age. Hill and Allemand (2011) found no age difference in the relationship between trait gratitude and well-being in a large sample of Swiss participants. Using two nationally representative samples from the United States and a large sample from 40 countries, Chopik and colleagues found that the association between trait gratitude and well-being was consistent in all age groups (Chopik et al., 2019). This pattern was consistent across all three samples. They explained these findings by arguing that trait gratitude and well-being may be closely related to each other throughout people's lives. Therefore, a higher level of gratitude enhances well-being throughout adulthood (Chopik et al., 2019). In contrast, in a meta-analysis of 158 independent samples, Portocarrero and colleagues found that the relationship between trait gratitude and well-being was stronger and the relationship between dispositional gratitude and negative affect was weaker in samples of older adults (Portocarrero et al., 2020). The authors explained these findings by arguing that individuals display more generativity as they age. Generativity is highly relevant and can be considered an extension of gratitude (Portocarrero et al., 2020). However, as the authors noted, this argument has not been supported by any empirical evidence. No studies have examined whether the relationship between gratitude as a daily affective state and daily well-being may be moderated by age. To better understand the relationship between gratitude as daily affect

and well-being across the life span, this study examined the moderating effect of age on the relationship between daily gratitude and daily well-being.

The Present Study

As of November 16, 2020, more than 54 million cases of COVID-19 have been confirmed worldwide. More than one million individuals have died. Because of its unprecedented impact, COVID-19 has caused enormous psychological distress worldwide (Bruine de Bruin, 2020; Evandrou et al., 2020; Jiang, 2020; Losada-Baltar et al., 2020; Qiu et al., 2020). Most previous studies have examined the biological, economic, health, and psychological consequences of COVID-19; few studies have examined the conditions that may mitigate the negative consequences. Such studies are of utmost importance, as COVID-19 has unique features that were not observed in previous pandemics, including stringent lockdown procedures and the possibility of multiple waves of infection. Evidence-based strategies to improve mental health during the COVID-19 pandemic are needed to enhance well-being during this stressful time and to prepare for the potential future waves of COVID-19 (Xu & Li, 2020). In addition, although older adults are considered as one of the most vulnerable groups during the COVID-19 pandemic (Remuzzi & Remuzzi, 2020), few studies have used samples representative of all age groups, which makes it difficult to compare among age groups. Among the few studies of older adults (Bruine de Bruin, 2020; Evandrou et al., 2020; Nikolich-Zugich et al., 2020), most, if not all, are based on single point surveys, and have not examined daily well-being among all age groups during the COVID-19 pandemic.

To examine whether daily feelings of gratitude are a buffer against the negative consequences of COVID-19 and whether any such effect varies across age groups, I conducted a 14-day daily diary study during the peak of the COVID-19 outbreak in China in

February and March 2020. Based on previous studies of gratitude, I hypothesized that on days individuals felt more gratitude than average, they would report better well-being (indexed by a higher level of positive affect and lower levels of negative affect and stress related to COVID-19) and better subjective health on both the current day (Day N) and the following day (Day N+1). I also hypothesized that that higher daily gratitude over the 14-day study would be associated with better well-being. Based on previous studies of age differences in the gratitude-well-being association (Chopik et al., 2019; Hill & Allemand, 2011), I hypothesized that age would not moderate the relationship between daily gratitude and its outcomes.

Method

Participants

The sample consisted of 231 Chinese participants aged from 18 to 85 years ($M_{age} = 44.74$ years, $SD_{age} = 17.54$ years; 69% female; 70% with a college degree; 41% in employment; 17% following a religion). The participants were recruited through advertisements posted on a university platform and on social media and with the assistance of community volunteers. All of the participants were born and raised in mainland China, and were living in mainland China during the 14-day daily diary period. They were from 23 of the 32 provinces, municipalities, and autonomous regions of mainland China. Two of the participants were from Hubei province, the center of the outbreak at that time. Their data were included in the analysis because deleting them did not change the result patterns. Three participants were excluded from the data analysis because they did not complete any daily assessment ($M_{daily\ assessment} = 13.80$, $SD_{daily\ assessment} = 1.18$). One of them was identified as a confirmed or suspected COVID-19 case during the questionnaire period but deleting the data did not change the pattern of the results. Two hundred and eleven of the 228 participants who

completed the pretest and daily diaries filled in the follow-up questionnaire. Descriptive information on the sample is presented in Table 1.

Procedure

The study was conducted during the peak of the COVID-19 outbreak in China. All of the questionnaires were completed online using the Wenjuan.com online survey system. After an introductory e-mail and a briefing session via WeChat, the participants were asked to complete a brief questionnaire on their demographic information. The daily diary period began on the second day after the first online survey and lasted for 14 consecutive days. A WeChat message containing a URL link to the online daily questionnaire was sent to the participants around 6 pm each day to remind them to complete the daily questionnaire, which included questions about their daily subjective health, daily actual affect, and daily stress related to COVID-19 (78% completed the questionnaire by 11:59 pm on the same day). They received another reminder via WeChat if they had not completed the questionnaire by 11 am the next morning. Four-weeks after the daily diary was finished, each participant was contacted and asked to fill-in a short questionnaire on his or her current life satisfaction and subjective health. All of the participants received a supermarket coupon valued at US\$25 in local currency upon completing all of the daily assessments. Ethical approval for the study was obtained by the Human Research Ethics Committee (HREC) of the Education University of Hong Kong (HREC number 2019-2020-0315).

Measures

Measures in the Daily Questionnaires

Gratitude. The participants were asked to rate the intensity of their experience of “gratitude” as an affective state each day on a 5-point scale, from 1 = *not at all* to 5 = *extremely* ($M = 3.23$, $SD = 1.03$; inter-class-correlation (ICC) = 63%). The question was “Please indicate the intensity to which you actually felt gratitude today on the 5-point scale.”

Positive and Negative Affect. The short version of the Affect Valuation Index (AVI) (Tsai et al., 2006) was used to assess daily affect. The participants were asked to indicate the intensity of their experience of each affective state on that day on a 5-point scale, ranging from 1 = *not at all* to 5 = *extremely*. In particular, positive affect was measured by the aggregate score of “enthusiastic,” “happy,” and “calm” ($M = 3.06$, $SD = 0.37$; ICC = 58%, between-person reliability estimate = .94, within-person reliability estimate = .55 (Cranford et al., 2006)). Negative affect was measured by the aggregate score of “anxiety,” “sad,” “angry,” and “dull” ($M = 1.77$, $SD = 0.72$; ICC = 58%, between-person reliability estimate = .96; within-person reliability estimate = .75 (Cranford et al., 2006)). The short version of AVI has been shown to be highly correlated with the full version of the AVI (Jiang et al., 2016).

Perceived Stress Related to COVID-19. The Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983) was adapted to measure the participants’ daily perceived stress related to COVID-19. The phrase “in the last month” in the original version was changed to “today” to measure daily stress. Three items related to unexpected life changes were used in the short daily questionnaire: “I was upset because of COVID-19 today,” “I felt that I was unable to control the important things in my life because of COVID-19 today,” and “Despite COVID-19, I felt confident in my ability to handle my personal problems.” The participants were asked to indicate how frequently they would agree with the statement, from

1 = *never* to 5 = *always* ($M = 2.36$, $SD = 0.76$; ICC = 67%; between-person reliability estimate = .97; within-person reliability estimate = .41 (Cranford et al., 2006)).

Subjective Health. The participants were asked to rate their daily subjective health on a scale from 1 = *very poor* to 6 = *perfect* ($M = 4.44$, $SD = 0.93$; ICC = 67%).

Measures in the Pretest and Follow-up Questionnaires.

Life Satisfaction. The 5-item Satisfaction with Life Scale (Diener et al., 1985) was used to measure life satisfaction in general (pretest) and in the previous month (follow-up questionnaire). The participants were asked to indicate their agreement with the five items using a 7-point Likert scale ranging from 1 = *strongly disagree* to 7 = *strongly agree* (pretest: $M = 4.29$, $SD = 1.12$, $\alpha = .84$; follow-up: $M = 4.87$, $SD = 1.11$, $\alpha = .90$).

Positive and Negative Affect. Positive and negative affect were measured using the set of items used in the daily questionnaire. The only difference was that the participants were asked to rate the frequency at which they had experienced each affective state in a typical week (pretest) or in the previous month (follow-up questionnaire) (positive affect: pretest: $M = 3.10$, $SD = 0.64$, $\alpha = .55$; follow-up: $M = 3.23$, $SD = 0.90$, $\alpha = .79$; negative affect: pretest: $M = 1.78$, $SD = 0.51$, $\alpha = .61$; follow-up: $M = 1.89$, $SD = 0.75$, $\alpha = .76$).

Demographic Information. The participants were asked to indicate their gender (0 = *male*, 1 = *female*), partner status (0 = *without partner*, 1 = *with partner*), education (0 = *did not finish college*, 1 = *finished college*), religion (0 = *no religion*, 1 = *has a religion*), subjective socioeconomic status (on a scale from 1 = *lowest* to 10 = *highest*) (Adler et al., 1994), and overall subjective health in the previous month (1 = *very poor* to 6 = *perfect*) in the pretest and follow-up assessments.

Data Analysis Strategy

I first examined the relationship between daily gratitude and its outcomes on the current day and the following day. Using hierarchical linear modeling (HLM; Raudenbush, 2004), positive affect, negative affect, daily levels of perceived stress, and subjective health were treated as the dependent variables. In the analyses that used variables of psychological well-being as the dependent variables (positive and negative affect and perceived stress), I controlled for gender, level of education, daily subjective health, socioeconomic status, mean level of gratitude across the 14 days, and overall subjective health because these variables have been found to be associated with daily affect. In the analyses that used daily subjective health as the dependent variable, I controlled for gender, level of education, socioeconomic status, and mean level of gratitude across the 14 days. The patterns of the major findings did not change when the covariates were removed from the models. I first conducted cross-sectional analyses by examining the association between daily gratitude and the dependent variables on the same day (Day N). Next, I conducted time-lagged analyses by examining the association between daily gratitude on Day N and the dependent variables on Day N+1. All of the continuous variables, such as daily gratitude and subjective health, were centered on the grand mean in the HLM analyses. Random slopes were included in the models. Finally, I examined the association between average gratitude across the 14-day daily diary period and changes in life satisfaction, positive and negative affect, and subjective health between the pretest and the follow-up questionnaire. The difference scores were obtained by subtracting the pretest scores from the follow-up assessment scores (with a higher score indicating a greater increase).

Results

The daily-level analysis revealed that, on days when individuals felt more gratitude than average, they reported more positive affect, ($B = 0.204$, $SE = 0.019$, $p < .001$), a lower level of COVID-19-related stress ($B = -0.037$, $SE = 0.015$, $p < .05$), and a higher level of subjective health ($B = 0.104$, $SE = 0.022$, $p < .001$) on the current day (Day N), but not the following day (Day N+1). When individuals felt more gratitude than average on Day N, they reported a lower level of perceived stress related to COVID-19 ($B = -0.036$, $SE = 0.017$, $p < .05$) on Day N+1. None of these relationships were moderated by age. Feeling more gratitude than average on Day N was not significantly associated with negative affect on either Day N ($B = -0.018$, $SE = 0.018$, $p = .317$) or Day N+1 ($B = 0.002$, $SE = 0.018$, $p = .929$). However, the negative association between gratitude and negative affect on Day N was stronger in younger adults than in older adults ($B = 0.002$, $SE = 0.001$, $p < .05$), but age did not moderate the association between gratitude and negative affect on Day N+1 ($B = 0.0001$, $SE = 0.001$, $p = .870$). Table 2 shows the detailed results of the HLM analyses. Results of supplementary analyses using daily entries that completed on the same day are reported in the Supplementary Materials.

Table 3 shows the results of the analyses on the follow-up assessment. Using hierarchical linear regression, feeling more gratitude was, in general, associated with greater positive affect increase ($B = 0.20$, $SE = 0.07$, $p < .01$) and negative affect decrease ($B = -0.13$, $SE = 0.06$, $p < .05$) in the one-month follow-up assessment. These associations were not moderated by age. Gratitude was not associated with changes in life satisfaction ($B = 0.11$, $SE = 0.09$, $p = .213$) or subjective health ($B = 0.11$, $SE = 0.07$, $p = .881$) in the follow-up assessment, and age did not moderate these relationships.

Discussion

In this 14-day daily diary study conducted during the COVID-19 outbreak, I examined the role of gratitude as a daily affective state on daily positive and negative affect, perceived stress related to COVID-19, and subjective health. I tested both the cross-sectional and time-lagged effects. I found that during the COVID-19 outbreak, feeling more gratitude than usual was associated with more positive affect and better subjective health on the concurrent, but not the following day. Feeling more gratitude than usual was associated with less stress related to COVID-19 on both the concurrent and following day. These relationships were not moderated by age. However, the negative relationship between daily gratitude and negative affect on the current day was stronger in younger than older adults. I also examined the effects of gratitude on well-being one-month after the daily diary period. Higher average gratitude levels in the 14-day diary study were associated with greater increase in positive affect and decrease in negative affect in the one-month follow-up. Age did not moderate these relationships.

Consistent with previous studies (Nezlek et al., 2017; Sztachańska et al., 2019), I found that gratitude had beneficial effects on daily positive affect. However, there was only significant cross-sectional relationship. Inconsistent with Nezlek et al. (2017), the time-lagged relationship between gratitude on Day N and positive affect on Day N+1 was not significant in this study. This inconsistency might be attributable to the fact that Nezlek et al. (2017) did not control for the average level of gratitude across the 14 days in the analysis. In a robustness test, I did not control for the average level of gratitude, and found a significant time-lagged effect of gratitude on positive affect the next day.

Previous studies have found limited evidence of the effect of gratitude on negative affect. The findings in this study were mixed. Daily gratitude was not associated with

negative affect on either the concurrent or the following day, but was associated with perceived stress related to COVID-19 on both days. These findings may suggest that stress related to COVID-19 was more salient than other negative emotions during the study period. It might also indicate that the magnitude of the benefits of gratitude might vary between outcome variables (McCullough et al., 2002). In addition, I found that gratitude was positively associated with daily subjective health. This finding is new in the literature.

McCullough et al. (2002) pointed out that the underlying mechanisms of the relationships between gratitude and its outcomes might be different. The findings of the present study seem also suggest that the magnitude of the benefits of gratitude and the underlying mechanisms may vary across different outcomes. Future studies should address this question directly.

The Moderating Role of Age

In this study, age did not moderate the relationships between gratitude and positive affect, perceived stress, or subjective health at the daily level. Neither did age moderate the relationship between gratitude and positive or negative affect in the follow-up assessment. These findings were consistent with previous studies that found that age did not affect these relationships (e.g., Allemand & Hill, 2016; Chopik et al., 2019). However, it is also possible that the null effects were driven by the facts that the power and measurement reliability were relatively low in this study. As I did not use methods, such as the Bayesian paradigm and the Generalized Fiducial Inference (see Isaacowitz, 2020; Lakens et al., 2020; Neupert & Hannig, 2020 for details), to detect the validity of these null effects, I do not know the reasons of the null effects of age. The ability of gratitude to attenuate negative affect was greater in younger than older adults in this study. This might be because younger adults reported a higher level of daily negative affect than older adults in this study. Again, these findings were based on

the frequentist paradigm and were not validated using methods under the Bayesian paradigm (Isaacowitz, 2020; Lakens et al., 2020; Neupert & Hannig, 2020). More studies are needed to validate the findings and to clarify the mechanisms underlying these relationships.

Mechanism underlying the relationship between gratitude and well-being

Wood et al. (2010) proposed four hypotheses to explain the mechanism underlying the positive relationship between gratitude and well-being: the schematic hypothesis, coping hypothesis, positive affect hypothesis, and the broaden and build hypothesis. Wood et al. (2010) pointed out that grateful individuals are likely to view help as more beneficial, costly, and altruistic than those who are less grateful (the schematic hypothesis) (Wood et al., 2008). Alternately, grateful people are more likely to seek support from others, and to use more proactive and adaptive coping strategies (the coping hypothesis). The positive relationship between gratitude and well-being may reflect the fact that gratitude itself is a positive emotion (the positive affect hypothesis). Based on the broaden-and-build theory (Fredrickson, 2001), which argues that positive emotions can broaden individuals' attention, thoughts, and behaviors, gratitude, as a positive emotion, may help individuals build social networks, and these networks may help them better cope with daily life during both stressful and non-stressful times (the broaden-and-build hypothesis) (Fredrickson, 2004). This hypothesis was supported by a recent study by Liao and Weng (2018), which found that social connectedness and the presence of meaning mediated the relationship between gratitude and well-being in a sample of college students. As this study focused on gratitude as a daily affective state, the coping hypothesis, the positive affect hypothesis, and the broaden-and-build hypothesis could all potentially explain its findings. People who experienced more gratitude might be able to better cope with the stress related to COVID-19 and more likely to seek support from others during the pandemic. However, this study did not directly examine the mechanism underlying

the relationship between gratitude as a daily emotion and its consequences. Future studies should address this important question.

This study has several limitations. First and as mentioned above, I did not examine the mechanism underlying the relationships between gratitude and the dependent variables. Understanding this process is important for developing strategies to promote better well-being during events such as the COVID-19 outbreak. Second, I used a single item to measure feelings of gratitude. Future studies could replicate the findings using a more comprehensive measure. Third, I examined the role of gratitude as a daily affective state, but did not measure the other forms of gratitude (e.g., gratitude as a trait). Previous studies have suggested that these components of gratitude also influence well-being (McCullough et al., 2004). Future studies could examine how gratitude as a trait affects well-being in stressful situations. Fourth, the sample in this study was more educated and well-off than the general population in mainland China. Although these variables were controlled for in the analyses, future studies should examine this question using a more representative sample from mainland China. Fifth, about 22% of the daily questionnaire was completed on the morning of the following day. There might be bias when the participants recalled their feelings of the previous day. Future studies could minimize such problems by using multiple reminders. Sixth, the within-person reliability estimate of daily stress related to COVID-19 was low in this study. Future studies should validate the findings in another sample or by using another measurement of stress. Seventh, it was unknown whether individuals' subjective interpretations of their affective states, especially their trait actual and ideal affect, were influenced by the pandemic. It was not known whether individuals' memory of their trait actual affect might be biased because of COVID-19 situation. This study was not able to answer these questions. However, this important question should be addressed in future studies.

Conclusion

In this 14-day daily diary study, I found that feeling more gratitude than usual on Day N was associated with a higher level of positive affect, a lower level of COVID-19-related stress, and a higher level of subjective health on the current day. Feeling more gratitude on the focal day was also associated with a lower level of perceived stress on the following day. In general, feeling more gratitude over the 14-day study period was associated with more positive affect and less negative affect in the one-month follow-up assessment. These relationships were not moderated by age. These findings suggest that interventions to promote gratitude may induce more positive affect and reduce stress during events such as the COVID-19 outbreak.

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Table 1

Descriptive Statistics of all study variables

	Pretest		Follow-up		<i>t</i> or χ^2
	Mean or %	SD	Mean	SD	
Age	44.74	17.54	44.75	16.19	.01
Subjective Socioeconomic Status	6.20	1.61	6.22	1.60	-.38
Sex (female %)	69%			69%	.67
Marital %	13%			13%	.54
Education (% college)	71%			70%	.01
Religion (% have a religion)	17%			18%	.27
Life Satisfaction	4.29	1.12	4.87	1.11	7.33***
Actual Positive Affect	3.10	0.64	3.23	0.90	2.14*
Actual Negative Affect	1.78	0.51	1.89	0.75	1.93
Subjective Health	4.19	0.93	4.62	0.90	7.34***
Daily Questionnaire					

	Weighted Mean	SD
Gratitude	3.23	1.03
Positive Affect	3.06	0.73
Negative Affect	1.77	0.72
Stress related to COVID-19	2.36	0.76
Health	4.44	0.93

Note. $N_{Pretest} = 231$, $N_{Follow-up} = 211$, $N_{Daily\ questionnaire} = 3067$.

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Table 2.

Hierarchical Linear Analysis Testing Whether the Link between Daily Gratitude and Psychological Well-being and Subjective Health is Moderated by Age.

	Positive Affect				Negative Affect				Perceived Stress				Subjective Health			
	Day N		Day N+1		Day N		Day N+1		Day N		Day N+1		Day N		Day N+1	
	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE	B	SE
<i>Intercept</i>	3.037	0.057	3.022	0.060	1.901	0.075	1.902 ***	0.078	2.432	0.088	2.477	0.089	4.576	0.095	4.587	0.097
	***		***		***				***		***		***		***	
<i>Level 1</i>																
<i>Gratitude</i>	0.204 ***	0.019	0.021	0.019	-0.018	0.018	0.002	0.018	-0.037*	0.015	-0.036*	0.017	0.104	0.022	0.001	0.018

<i>Daily Health</i>	0.075	0.020	0.002	0.019	-0.148	0.023	-0.027	0.019	-0.069	0.024	-0.032	0.018				
	***				***				**							
<i>Level 2</i>																
<i>Age</i>	0.0003	0.002	0.0001	0.002	-0.008	0.003	-0.009	0.003	-0.006	0.003	-0.007	0.003	-0.006	0.003	-0.006	0.003
					**						*					
<i>Gender</i>	0.067	0.062	0.073	0.065	-0.022	0.081	-0.056	0.085	-0.119	0.096	-0.121	0.097	0.196	0.104	0.235	0.106
<i>SES</i>	0.007	0.017	0.005	0.018	-0.044	0.023	-0.058 *	0.024	-0.036	0.027	-0.043	0.027	0.051	0.029	0.049	0.030
<i>Education</i>	0.031	0.071	0.033	0.074	-0.199	0.094	-0.214 *	0.097	-0.124	0.109	-0.161	0.111	-0.273	0.119	-0.309	0.121
					*								*		*	
<i>Health</i>	-0.041	0.032	-0.016	0.033	-0.001	0.042	-0.060	0.043	-0.053	0.049	-0.081	0.050	0.408	0.053	0.385	0.054

													***	***		
<i>Aggregated</i>	0.288	0.038	0.486	0.039	0.083	0.047	0.052	0.049	-0.137 *	0.054	-0.127	0.055	-0.001	0.060		
<i>Gratitude</i>	***		***								*					
<i>L1 x L2 Interaction</i>																
<i>Gratitude x Age</i>	-0.002	0.001	-0.0001	0.001	0.002	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	-0.001	0.001	0.001	0.001
					*											
<i>R</i> ²	0.789		0.599		0.201		0.120		0.220		0.136		0.333	0.297		

Note. *N* for level 1 variables is 2648-3067, and *N* for level 2 variables is 227. Day *N* = The concurrent day; Day *N*+1 = The following day. * $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3

Hierarchical Linear Regression Testing the Links between Average Gratitude and Differences between the Ratings on Psychological Well-being and Subjective Health at the Follow-up Assessment and the Pretest, and the Moderating Role of Age.

	Δ Positive Affect		Δ Negative Affect		Δ Life Satisfaction		Δ Subjective Health	
	B	SE	B	SE	B	SE	B	SE
Block 1								
<i>SES</i>	-0.05	0.06	-0.03	0.06	0.05	0.09	-0.04	0.07
<i>Education</i>	-0.76	0.14	0.22	0.13	0.18	0.19	-0.07	0.15
<i>Health</i>	0.25***	0.06	-0.08	0.06	-0.02	0.09		
	$\Delta R^2 = .075^{**}$		$\Delta R^2 = .022$		$\Delta R^2 = .007$		$\Delta R^2 = .004$	
Block 2								
<i>SES</i>	-0.09	0.06	0.01	0.06	0.02	0.09	-0.05	0.07
<i>Education</i>	-0.004	0.16	-0.08	0.15	0.25	0.22	-0.05	0.17

<i>Health</i>	0.23**	0.07	-0.12*	0.06	-0.03	0.09		
<i>Gratitude</i>	0.19**	0.07	-0.13*	0.06	0.12	0.09	0.01	0.07
<i>Age</i>	0.01	0.07	-0.23**	0.07	0.03	0.10	0.01	0.08
	$\Delta R^2 = .036^*$		$\Delta R^2 = .076^{***}$		$\Delta R^2 = .009$		$\Delta R^2 = .000$	
<i>Block 3</i>								
<i>SES</i>	-0.10	0.07	0.02	0.06	0.03	0.09	-0.05	0.07
<i>Education</i>	0.01	0.16	-0.09	0.15	0.24	0.22	-0.04	0.18
<i>Health</i>	0.23**	0.07	-0.12*	0.06	-0.03	0.09		
<i>Gratitude</i>	0.20**	0.07	-0.13*	0.06	0.11	0.09	0.01	0.07
<i>Age</i>	0.02	0.07	-0.24**	0.07	0.02	0.10	0.02	0.08
<i>Age X Gratitude</i>	0.08	0.07	-0.04	0.06	-0.02	0.09	0.03	0.07
	$\Delta R^2 = .005$		$\Delta R^2 = .002$		$\Delta R^2 = .000$		$\Delta R^2 = .001$	

Note. $N = 211$. * $p < .05$, ** $p < .01$, *** $p < .001$.

Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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