

Article

Differences in Anxiety, Altruism, and Pandemic Mitigation: Secondary Analyses of Two US Surveys

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Abstract

The COVID-19 pandemic resulted in historically high levels of psychological distress. Significant age differences in distress were consistently observed, and they present an opportunity to identify the mechanisms driving the prosocial decision-making underlying pandemic mitigation behaviors. As predicted by the cascade model of individual and age differences in prosocial motivation, re-analyses of the data from two previous surveys revealed the positive role of prosocial motivation in pandemic decisions as well as the negative roles played by neuroticism, anxiety, and depression. Social distancing was altruistically motivated, as evidenced by its positive associations with both altruism and sympathy measures. Moreover, the increases in distancing with age and concern for close others suggests that distancing was not primarily driven by concerns regarding the personal consequences of infection. Multiple age-related positivity effects were observed in which concerns and risk assessments decreased with age. Concern for others decreased with age less than concerns for oneself, suggesting a possible basis for age-related increases in altruism. Taken together, these findings suggest theoretical linkages between the cascade model and socioemotional selectivity theory, linkages that may have implications for prosocial public health messaging.

Keywords: COVID-19 pandemic; aging; altruism; social distancing; positivity effect; cascade model

1. Introduction

During the COVID-19 pandemic, psychological distress exceeded historic levels. This was unsurprising because the pandemic was putting people's lives at risk. What was surprising was that distress increased far more in younger adults' than in older adults [1–4] despite the fact that it was obvious from the beginning that older adults were much more vulnerable to the consequences of SARS-CoV-2 infections than younger adults [5–7].

Our first survey of pandemic decision-making not only confirmed the age differences in distress, it also revealed significant age differences in mitigation behaviors, particularly social distancing [8]. Moreover, social distancing was significantly associated with concerns regarding the effects of the pandemic on others with whom one was close, but not with concern for oneself. Taken together, these findings suggested people did not engage in mitigation behaviors simply for self-protection, and that therefore public health messages should not simply consist of “fear appeals” either; rather, they should also include prosocial messages emphasizing the benefits that target behaviors could have for others [9,10].

The observed pattern of age differences in distress and distancing also called our attention to what we termed an “altruistic paradox” [11]. That is, older adults (as well as



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others who are especially vulnerable to the consequences of infection with the SARS-CoV-2 virus) are dependent on others not to infect them. The problem is that social distancing is an altruistic act in that one gives up the pleasures of social interaction so as to benefit others by reducing their risk of infection. This could be problematic because there is growing evidence that younger adults are less altruistic than older adults [12,13].

Taken together, these findings provided the basis for our recently proposed cascade model of age-related changes in neuroticism, distress, and compassion [14]. According to the model, younger adults have higher levels of neuroticism, which leads to greater reactivity to stressors in general [15,16], and thus to more selfish pandemic decisions [11]. Thus, younger adults tend to be more distressed, but as they get older, their neuroticism decreases [17], and they become more altruistic and trusting and more likely to engage in mitigation behaviors that benefit others as well as themselves. Indeed, multiple longitudinal studies have now documented the age-related decrease in neuroticism assumed by the cascade model [18,19] and age-related positivity effects originally observed in cross-sectional studies have been replicated longitudinally [20].

Now, more than half a dozen years since the beginning of the pandemic and several years since the end of the federal Public Health Emergency enacted in response, people are still considering what we have learned from what, early on, was recognized as an important natural experiment [21]. It should be noted, of course, that we have been here before [22], and that despite warnings, the world (and the United States in particular) struggled with how to respond to the COVID-19 pandemic. One important lesson we all hopefully learned was that many of the issues we struggled with the most were psychological.

As for what our research group learned, we have come full circle. As already noted, our first study [8] revealed people's mitigation efforts were associated with their concerns for others close to them but not their concerns for their own well-being, which suggested there was an ethical component to mitigation behavior. Further consideration of the ethical aspects of pandemic decision-making led us to propose what we described as a cascade model of age-related changes in neuroticism, distress, and compassion [14].

However, although our first pandemic survey distinguished between participants' concern for the effect of the COVID-19 pandemic on themselves and their concern for close others, our subsequent studies of pandemic decision-making averaged participants' various concerns in order to minimize multicollinearity as well as to obtain a general measure of pandemic concerns. Unfortunately, this left unclear the extent to which our previous results, which had been key to our development of the cascade model, were replicable.

Furthermore, we had created other compound variables for use in subsequent studies for similar statistical reasons. Most notably, Distress averaged anxiety and depression from the Hospital Anxiety and Depression Scale [23], and Compassion averaged the altruism and sympathy facets of Agreeableness from the IPIP NEO. Although our statistical concerns were clearly valid, the results of our first survey suggested that it might be useful to decompose these compound measures and see if examination of their components provided further insight into the processes associated with pandemic mitigation behaviors we had observed at a higher level where they appeared to be well described by the cascade model.

Accordingly, we reanalyzed the data from our two largest previous samples [11,24], subsequently referred to as the 2021 Survey and the 2022 Survey. Whereas the 2021 Survey data allowed us to examine the relation of Neuroticism to the components of distress, our 2022 Survey data allowed us to examine the relation of these components to the components of Compassion. At issue throughout our analysis of the two surveys is the question of the extent to which age differences need to be considered in public health messaging, and more specifically, whether observed age-related differences in altruism suggest that increased

attention should be paid to prosocial appeals to promote disease mitigation behaviors in general.

2. General Method

2.1. Participants

Participants for both the 2021 and the 2022 Surveys were recruited using the online platform Mechanical Turk (Mturk). After indicating their consent online, MTurk workers provided their responses and received payment after their participation. Both Surveys were approved by the Institutional Review Board of Washington University in St. Louis.

2.2. Procedure

The 2021 and 2022 Surveys each consisted of multiple parts, many of which were relevant to the surveys' original purposes (e.g., comparing mitigation behaviors with vaccination decisions) but not to issues relevant to the cascade model, the focus of the current investigation. The relevant measures that the two surveys had in common that were reanalyzed for the current investigation were questions designed to assess pandemic mitigation (i.e., reductions in the frequency of specific behaviors as recommended by the Centers for Disease Control and Prevention (CDC)), questions about current levels of psychological distress taken from the Hospital Anxiety and Depression Scale (HADS) [23], questions about concerns regarding the effects of the pandemic on participants themselves as well as on others, and questions about the risks of infection with COVID-19 and subsequent hospitalization. Finally, participants were presented with items from the IPIP-NEO (International Personality Item Pool-Neuroticism, Extraversion, Openness) personality test. On the 2021 Survey, the personality test items were those from the Neuroticism scale, whereas on the 2022 Survey the items were those that loaded on the Altruism, Sympathy and Trust facets of Agreeableness.

Further details regarding the measures used on the surveys include, for each measure, the number of items, the scoring procedures and the range of possible scores as well as samples of the question(s) asked. For example, the surveys began with participants being asked a single question about the approximate number of times they had engaged in a behavior that might expose one to infection in the past week and another question about the number of times in a typical week before the pandemic. The specific behaviors were being "in close proximity (i.e., closer than 6 feet) to someone they do not live with," making "physical contact with someone they do not live with, and being "in an enclosed public space." If the number for a typical week before the pandemic minus the number in the past week was greater than zero, then they were scored as having engaged in that mitigation behavior (i.e., the number of behaviors had decreased as recommended by the CDC). For the 2021 Survey, questions were asked about all three of these behaviors [11] whereas for the 2022 Survey questions were asked only about the first and third of the behaviors [24]. Although participants were asked about use of face masks, the data were not analyzed because they depended on local mandates.

Assessment of mitigation was followed by the HADS, a 14-item questionnaire designed to screen for symptoms of anxiety and depression. It contains seven items measuring anxiety and seven measuring depression, with each rated on a 4-point scale (0 to 3) based on feelings over the past week [23]. Total scores could range from 0 to 21. Sample anxiety and depression items were "Worrying thoughts go through my mind (Only occasionally, occasionally, a lot of the time, or a great deal of the time), and "I still enjoy the things I used to enjoy (Definitely as much, not quite so much, only a little, or hardly at all)." To assess participants' levels of different concerns regarding the pandemic, participants were asked to "rate on a scale of 1 (Not at all concerned) to 7 (Extremely concerned) the chance that the

participant will be affected personally by a COVID-19 infection” and to “rate on a scale of 1 (Not at all concerned) to 7 (Extremely concerned) the chance that someone close to the participant will be affected by a COVID-19 infection. To assess participants’ estimates of the risks posed by the COVID-19 pandemic they were asked two questions: “Rate on a scale of 1 (No chance) to 7 (Very likely) the chance that the participant will contract COVID-19 within the next 30 days,” and “Rate on a scale of 1 (No chance) to 7 (Very likely) the chance that the participant will need to be hospitalized due to a COVID-19 infection” [11,24].

Finally, participants were asked to answer items from the IPIP-NEO (International Personality Item Pool-Neuroticism, Extraversion, Openness) personality test [25]. On this test, participants are presented with a behavioral statement or phrase and asked to rate the extent to which it describes them on a 5-point scale. For the 2021 Survey, the personality test items assessed Neuroticism, whereas on the 2022 Survey the items were those that loaded on the Altruism, Sympathy and Trust facets of Agreeableness [26]. For example, items from the Neuroticism scale include the phrases “Worry about things” and “Am not easily bothered by things.” Items from the facets of Agreeableness include “Anticipate the needs of others” for the Altruism facet, “Suffer from others’ sorrows” for the Sympathy facet, and “Believe that others have good intentions” for the Trust facet. Each facet consisted of 10 items and possible scores ranged from 5 to 50. Neuroticism consisted of 6 facets, and thus possible scores 60 to 300.

Although Altruism and Sympathy have been identified as separate facets of Agreeableness, it is frequently argued that both sympathy and empathy appear to be fundamental components of altruistic behavior [27–29]. Accordingly, for our final analysis, we used participants’ mean Z-score from the Altruism and Sympathy facets as a measure of altruism. It may be noted that this composite measure was termed Compassion in previous analyses of the 2022 survey to distinguish it from the Altruism facet alone [24].

2.3. Analysis

A similar approach was taken for the analyses of both surveys. It should be noted that in reporting their results, the abbreviation of a variable’s name was the first four letters of that name (e.g., decreases in close proximity interactions were labeled Prox, decreases in physical contact were labeled Cont, and decreases in visits to public spaces were labelled Publ).

We began by examining the correlations among the various measures to see if, as predicted by the cascade model, distress (anxiety and depression) decreased as a function of participants’ age and whether or not such decreases were accompanied by increases in mitigation behaviors (e.g., close proximity interactions with non-household members and visits to enclosed public spaces). Next, because our mitigation measures were binary (i.e., did the frequency of distancing decrease and did the frequency of hand hygiene increase as recommended by the CDC) we conducted logistic regression analyses to determine whether, as predicted by the cascade model, concern for oneself was negatively associated with distancing while concern for close others was positively associated.

Further, we measured altruism in two different ways—first, on both surveys we used the difference between concerns for close other and concerns for oneself, and second, on the 2022 Survey, we assessed two IPIP-NEO facets of Agreeableness: Altruism and Sympathy, which provided an opportunity to validate our difference score measure. Although there are a variety of definitions of altruism from different perspectives (e.g., intentionalist and consequentialist; [30]). The problem is that the goal of these definitions is to distinguish between what is altruistic and what is not. In contrast, our goal was to treat altruism as a dimension and measure how altruistic a participant was. We took an intentionalist perspective based on the assumption that participants’ concerns regarding the effects of

the pandemic functioned as their intentions [31]. Thus, we took *concern for close others* as a measure of someone's intention to act so as to benefit others and their *concern for themselves* as a measure of their intention to avoid externally produced aversive stimuli. Thus, our difference measure asked to what extent did a participant want to benefit others minus the extent to which they wanted to avoid aversive stimuli (illness).

Because the results of the logistic regression analyses of the two surveys only partially agreed (concern for close others was consistently positively associated with distancing as whereas concern for oneself was negatively associated on only the 2021 survey), we addressed the issue of altruism directly using linear regression in the case of the 2022 survey (an approach that was not possible with the 2021 Survey).

Finally, we compared the results of the two surveys, focusing on the 'negative' positivity effects observed on both surveys in which negative measures (e.g., anxiety, risk of hospitalization) decreased as a function of age. Examination of these effects suggested a possible mechanism underlying the increase in altruism as a function of age, and led us to compare the extent to which the two kinds of concerns (Self and Close) decreased as a function of Age on both surveys to determine whether Self decreased more rapidly (see Appendix A).

3. 2021 Survey

3.1. Participants

For the 2021 Survey, respondents were recruited between 16 April and 1 May 2021. After indicating their consent online, 852 MTurk workers provided their responses and received \$1.50 payment after their participation. The submitted surveys were then screened for age and valid IP addresses associated with internet providers in the United States of America. They were also screened based on survey completion time so as to exclude those whose times were less than that which a fast, expert reader would require to read the survey questions. Based on these criteria, data from 42 individuals were excluded from our analyses, leaving data from 809 participants for analysis (Table 1).

Table 1. Demographics of the sample for the 2021 Survey.

Age	N	Age: Mn (SD)	% Female	% W, Non-H	Income (Mdn)
20–29	95	26.0 (2.59)	49.5	65.3	66,527
30–39	209	33.8 (2.59)	33.0	63.3	65,464
40–49	129	45.3 (3.08)	43.5	69.0	68,234
50–59	207	54.9 (2.82)	67.1	81.2	64,417
60–69	127	64.1 (2.97)	69.3	86.6	65,766
70–80	42	71.9 (2.45)	52.3	92.9	61,802

Note. W, non-H refers to White, non-Hispanic participants.

The income reported for each age group was calculated based on the adjusted gross income reported by the Internal Revenue Service for the zip code in which each participant in that age group was residing at the time of the survey. We used this value under the assumption that while household incomes might fluctuate as older participants retired, the income for the zip codes in which they resided could provide a more stable indicator of their socioeconomic status. With this measure, the median income for each age group was in the second quartile of the US population in 2021 (i.e., between \$31K and \$65K). Individual incomes were not significantly related to any of the three social distancing behaviors (all $ps > 0.10$).

3.2. Results

Our first analysis of the 2021 Survey data focused on the Anxiety and Depression components of our Distress measure and their relation to Age, Emotional Stability (i.e., Neuroticism), and three social distancing measures as well as Hand Hygiene, another mitigation behavior recommended by the CDC (Table 2). Because the article in which the cascade model was proposed referred to Emotional Stability as Neuroticism, we continue to use that term to refer to it here. As predicted by the cascade model, the correlations among Age, Anxiety, Depression, and Neuroticism were all strong. Moreover, even when Age was statistically controlled, the (partial) correlations of Neuroticism with Anxiety and Depression were still strong (i.e., absolute r s = 0.682 and 0.638, respectively), indicating that the observed relations between these measures remained strong across the adult lifespan.

Table 2. Correlations (Pearson's, point-biserial, and phi) among variables in the 2021 Survey.

	Anxi	Depr	Stab	Prox	Publ	Cont	Hand
1. Anxi	—						
2. Depr	0.637 ***	—					
3. Stab	−0.708 ***	−0.653 ***	—				
4. Prox	−0.238 ***	−0.234 ***	0.220 ***	—			
5. Publ	−0.193 ***	−0.163 ***	0.157 ***	0.394 ***	—		
6. Cont	−0.239 ***	−0.194 ***	0.195 ***	0.399 ***	0.375 ***	—	
7. Hand	−0.046	−0.088 *	0.054	0.093 *	0.121 ***	0.129 ***	—
8. Age	−0.297 ***	−0.183 ***	0.274 ***	0.205 ***	0.199 ***	0.133 ***	0.018

Note. p values: * < 0.05, ** < 0.01, *** < 0.001. Anxi = Anxiety, Depr = Depression, Stab = Emotional Stability, Prox = Decrease in close proximity interactions; Publ = Decrease in visits to enclosed public spaces; Cont = Decrease in physical contacts with non-household members. It should be noted that because Emotional Stability is the Neuroticism scale reverse-scored, correlations of Neuroticism with other measures in Table 2 are obtained by simply reversing the sign (e.g., the correlation of Age and Neuroticism is −0.274).

Our second analysis focused primarily on two of the components of the compound measure of pandemic concerns used in our previous analysis: concerns regarding the effects of the COVID-19 pandemic on oneself and its effects on close others [11]. At issue was whether the latter concerns were positively associated with prosocial pandemic decisions (i.e., the three social distancing measures) whereas the former were not. This issue was addressed using logistic regression and controlled for Age, Anxiety, and Depression (Table 3), each of which was also associated with distancing, as revealed by the preceding correlational analyses. Consistent with the cascade model, but contrary to the finding of our first survey [8], concern for close others was significantly positively associated with all three distancing measures whereas concern for oneself was significantly negatively associated.

Table 3. Logistic regression analyses predicting three measures of social distancing.

(A) Prox					
	Estim.	SE	z	W	p
Intercept	0.358	0.418	0.857	0.735	0.391
Self	−0.274	0.074	−3.697	13.669	<0.001
Clos	0.253	0.072	3.516	12.366	<0.001
Age	0.024	0.006	3.948	15.584	<0.001
Anxi	−0.041	0.024	−1.719	2.956	0.086
Depr	−0.073	0.025	−2.917	8.510	0.004
(B) Publ					
	Estim.	SE	z	W	p
Intercept	−0.287	0.393	−0.731	0.535	0.465

Table 3. *Cont.*

(B) Publ					
	Estim.	SE	z	W	p
Self	−0.167	0.069	−2.408	5.796	0.016
Clos	0.222	0.067	3.304	10.916	<0.001
Age	0.024	0.006	4.064	16.515	<0.001
Anxi	−0.051	0.023	−2.248	5.054	0.025
Depr	−0.028	0.024	−1.162	1.351	0.245
(C) Cont					
	Estim.	SE	z	W	p
Intercept	0.576	0.402	1.431	2.049	0.152
Self	−0.178	0.070	−2.539	6.444	0.011
Clos	0.249	0.068	3.665	13.429	<0.001
Age	0.010	0.006	1.657	2.747	0.097
Anxi	−0.086	0.023	−3.708	13.748	<0.001
Depr	−0.030	0.024	−1.247	1.555	0.212

Note. Self = concerns regarding effects of the pandemic on oneself, Clos = concerns regarding effects on close others. Other abbreviations are given in the Note to Table 2.

4. 2022 Survey

4.1. Participants

For the 2022 Survey, respondents were recruited between March 1 and March 14, 2022. After indicating consent online, 806 MTurk workers provided survey responses and received \$2.00 after completing their participation. Submitted surveys were again screened for age and valid IP addresses associated with internet providers in the United States of America as well as for completion times less than that those a fast, expert reader would require to read the survey questions. As a result, 50 respondents were excluded from analysis, leaving data from 755 participants ranging in age from 18 to 80 years of age for analysis (Table 4).

Table 4. Demographics of the sample for the 2022 Survey.

Age	N	Age: Mn (SD)	% Female	% W, Non-H	Income (Mdn)
18–29	149	25.8 (2.08)	48.0	71.1	\$31,000–\$65,000
30–39	194	33.3 (2.71)	32.5	66.5	\$31,000–\$65,000
40–49	121	43.2 (2.57)	40.5	53.7	\$31,000–\$65,000
50–59	73	56.0 (3.15)	41.1	80.8	\$31,000–\$65,000
60–69	173	64.0 (2.63)	64.7	83.8	\$31,000–\$65,000
70–84	45	73.5 (3.38)	57.1	89.0	\$31,000–\$65,000

Note. W, non-H refers to White, non-Hispanic participants. Total N = 810 (one participant did not report their age). For the income measure, participants were asked which of four categories described their household; the income column gives the median category for each age group.

4.2. Results

Our first analysis of the 2022 Survey data again focused on the Anxiety and Depression components of Distress and their relation to Age and two of three social distancing measures used in the previous survey as well as Hand Hygiene, another mitigation behavior recommended by the CDC (Table 5). In addition, we examined the Altruism and Sympathy components of the Compassion measure used in previous analyses [14] as well as Trust, another facet of Agreeableness.

As observed on the 2021 Survey and consistent with the cascade model, the correlations among Age, Anxiety, and Depression were all significant (Table 5). All three measures

decreased significantly with age on the 2022 Survey, and these decreases were accompanied by age-related increases in social distancing (Prox and Publ). As on the previous survey, the decrease in anxiety was greater than the decrease in depression. Indeed, the rates of decline differed significantly [32,33] on both surveys (both $ps < 0.001$). As on the previous survey, hand hygiene was not correlated with Age, suggesting that although the CDC recommended various mitigation behaviors, these behaviors could be divided into two kinds: those that were age-sensitive and those that were not (i.e., hand hygiene on both surveys analyzed here). Notably, on both surveys the correlations among the age-sensitive behaviors were approximately three times their correlation with Hand, even when Age was statistically controlled. While unaffected by participants' age, Hand hygiene was sensitive to participants' level of anxiety and depression on both surveys, with the likelihood of hand hygiene decreasing significantly as participants' distress increased.

Table 5. Correlations (Pearson's, Point-biserial, and Phi) among variables in the 2022 Survey.

	Anxi	Depr	Altr	Symp	Trust	Prox	Publ
1. Anxi	—						
2. Depr	0.663 ***	—					
3. Altr	−0.588	−0.502 ***	—				
4. Symp	−0.500 **	−0.413 ***	0.768 ***	—			
5. Trust	−0.392 ***	−0.407 ***	0.430 ***	0.355 ***	—		
6. Prox	−0.178 ***	−0.134 ***	0.286 ***	0.214 ***	0.079 *	—	
7. Publ	−0.150 ***	−0.085 *	0.251 ***	0.200 ***	0.072	0.467 ***	—
8. Age	−0.369 ***	−0.216 ***	0.473 ***	0.430 ***	0.145 ***	0.092 *	0.088 *

Note. *, **, and *** indicate $ps < 0.05$, < 0.01 , < 0.001 , respectively. Altr = Altruism, and Symp = Sympathy. Both measures (as well as Trust) represent scores on facets of Agreeableness from the IPI-NEO. For other abbreviations, see the Notes for Table 2.

Consistent with our approach to the analysis of the 2021 Survey data, logistic regression analysis was again used to assess the contributions of the psychological measures to social distancing behaviors (see Table 4). Once again, as had been observed with the 2021 Survey, concern for the effects of the COVID–19 pandemic on others with whom one was close were significant predictors of both decreases in close proximity encounters with non-household members (Prox) and decreases in visits to enclosed public spaces (Publ). Unlike the results on the previous study, however, concern for the pandemic's effects on oneself was not significant. It should be noted, however, that this same pattern of results was observed on our first survey [8]. Indeed, it was that finding (the significant relation between distancing and concern for close others) that inspired the cascade model as well as the present study examining the components of compound measures.

Curious about the differences between the results of the two 2021 and 2022 surveys (and inspired by the curiosity of an interested reviewer), we conducted further analyses of the 2022 survey data using multiple linear regression. These analyses took advantage of the fact that the later survey included measures of Altruism and Sympathy, both of which were continuous measures as well as significant predictors of our social distancing measures (see Table 3), which were binary measures requiring logistic regression analyses. As may be seen in Tables 5–7, our linear regression analyses were similar in spirit to our logistic regression analyses and again separated the two components of psychological distress (Anxiety and Depression) as well as the two of the kinds of concerns people had regarding the effects of the pandemic (i.e., effects on themselves and on others close to them). Whereas the cascade model predicted that both components of distress negatively affect both aspects of compassion, it also predicted that the two kinds of concerns would have different effects on compassion. As may be seen in Table 6, the results provided only partial support for these predictions.

These linear regression analyses, like the logistic regression analyses of the 2021 Survey, suggest that concerns regarding oneself and concerns regarding close others play opposing roles in mitigation behaviors. However, adding Age to the regression model reintroduced a discrepancy, at least in the case of Sympathy, although notably not in the case of Altruism (see Table 8).

Table 6. Logistic regression analyses predicting mitigation behaviors. Data are from the 2022 Survey.

(A) Prox					
	Estim.	SE	z	W	p
(Intercept)	0.205	0.383	0.536	0.287	0.592
Self	−0.001	0.073	−0.016	0.0003	0.987
Clos	0.213	0.070	3.055	9.332	0.002
Age	0.004	0.005	0.691	0.478	0.489
Anxi	−0.090	0.024	−3.722	13.853	<0.001
Depr	−0.015	0.026	−0.558	0.311	0.577
(B) Publ					
	Estim.	SE	z	W	p
(Intercept)	−0.105	0.377	−0.278	0.077	0.592
Self	0.103	0.072	1.436	2.062	0.151
Clos	0.159	0.068	3.335	5.450	0.020
Age	0.005	0.005	1.048	1.097	0.295
Anxi	−0.102	0.024	−4.253	18.086	<0.001
Depr	−0.014	0.026	0.523	0.274	0.601

Note. The abbreviations for these variable names are given in the Note to Table 2.

Table 7. Linear regression models of the components of Compassion: Altruism and Sympathy.

(A) Altruism				
Variable	Coeff.	SE	t	p
Intercept	42.777	0.068	63.235	<0.001
Anxi	−0.699	0.061	−11.459	<0.001
Depr	−0.366	0.070	−5.248	<0.001
Clos	0.865	0.183	4.719	<0.001
Self	−0.465	0.190	−2.450	0.015
(B) Sympathy				
Variable	Coeff.	SE	t	p
Intercept	39.594	0.702	56.374	<0.001
Anxi	−0.556	0.063	−8.786	<0.001
Depr	−0.258	0.072	−3.566	<0.001
Clos	0.645	0.190	−3.386	<0.001
Self	−0.513	0.197	2.602	0.009

Note. The abbreviations for variable names are given in the Note to Table 2.

In light of the discrepant effects of concern for oneself in these analyses, we were concerned about the possibility that multicollinearity had made it difficult to discriminate the effects of the two kinds of concerns in our models. In order to reduce this problem we resorted to a tactic commonly recommended in such situations, combining conceptually related variables into a single measure. Our choice was limited, however, because we were actually interested in the difference between the components of distress as well as the difference between the two kinds of concern regarding the pandemic's effects. However, we were not interested in the difference between possible components of altruism. Factor analyses had revealed distinct facets of Agreeableness but, as noted previously,

various authors had argued that two of those facets were both actually components of altruism [27,28], and in fact, we had previously combined them into a single measure that we called Compassion simply to avoid confusion with the Altruism facet of Agreeableness [24].

Table 8. Further regression models of Altruism and Sympathy.

(A) Altruism				
Variable	Coeff.	SE	<i>t</i>	<i>p</i>
Intercept	35.400	0.964	36.713	<0.001
Anxi	−0.528	0.060	−8.858	<0.001
Depr	0.394	0.066	−6.010	<0.001
Self	0.351	0.179	−1.967	0.050
Clos	0.761	0.172	4.414	<0.001
Age	0.134	0.013	10.162	<0.001
(B) Sympathy				
	Coeff.	SE	<i>t</i>	<i>p</i>
(Intercept)	32.816	1.016	32.299	<0.001
Anxi	−0.400	0.063	−6.358	<0.001
Depr	−0.284	0.069	−4.110	<0.001
Self	−0.408	0.188	−2.169	0.030
Clos	0.549	0.182	3.021	0.003
Age	0.123	0.014	8.860	<0.001

Note. The abbreviations for variable names are given in the Note to Table 2.

Accordingly, we then conducted multiple regression analyses of Compassion, measured as in previous studies, as the Mean Z of our Altruism and Sympathy facet variables. With this one source of multicollinearity eliminated, the multiple linear regression results were consistent with the predictions of the cascade model (Table 9) and accounted for 45.2% of the variance in Compassion.

Table 9. Linear regression model of the composite Compassion (Altruism plus Sympathy) measure.

	Coeff.	SE	<i>t</i>	<i>p</i>
Constant	−0.120	0.125	−0.961	0.337
Age	0.018	0.002	10.504	<0.001
Anxi	−0.065	0.008	−8.361	<0.001
Depr	−0.047	0.009	−5.554	<0.001
Clos	0.091	0.022	4.080	<0.001
Self	−0.053	0.023	−2.298	0.022

Note. The abbreviations for variable names are given in the Note to Table 2.

It should be noted, of course, that these results based on the composite Compassion measure demonstrate the limits to the approach of decomposing composite variables. Clearly there are such limits, particularly in cases of multicollinearity like that induced by the general distress arising from the COVID-19 pandemic. However, the prediction of the opposing roles of concerns for oneself versus close others is also consistent with the finding that the difference between participants' concern for close others and concern for themselves on the 2022 Survey (i.e., Clos minus Self) was significantly correlated with scores on both the Altruism and Sympathy facets of Agreeableness ($r_s = 0.222$ and 0.194 , respectively; both $p_s < 0.001$). Further support for the cascade model is provided by the fact that the difference between the two kinds of concerns was an increasing function of Age on both the 2021 and 2022 surveys.

5. General Discussion

For the most part, the measures included in the 2021 and 2022 Surveys overlapped, the primary procedural difference being that only the former included the Neuroticism scale of the IPIP-NEO whereas only the latter included the Altruism, Sympathy, and Trust facets of the Agreeableness scale. It should also be noted that the former survey included three measures of social distancing whereas the latter included only two. Overall, the pattern of correlations on the 2021 and 2022 Surveys was quite similar (compare Tables 1 and 3), and generally consistent with the cascade model. More specifically, the two distancing measures common to the two surveys (i.e., close proximity encounters, Prox, and visits to enclosed public spaces, Publ) both increased as age increased, and they both decreased as anxiety, Anxi, and depression, Depr, increased.

It is well-established that the function of the adult immune system declines with age, leading to age-related increases in both the chance of contracting COVID-19 and the chance of hospitalization with the disease, not to mention increased mortality (for a review, see [34]). Therefore, the fact that social distancing, a preventive measure, was an increasing function of age was a good thing, whereas the fact that adults' concern regarding the effects of the pandemic on themselves decreased as a function of age was not. Indeed, the latter finding could pose real public health problems because it suggests that older adults may be less likely to respond to traditional 'fear appeals' and also perhaps less likely to engage in appropriate mitigation behaviors. In contrast, the relative stability of adults' concern for the effects of the pandemic on those with whom they were close appears to be another good thing that, according to the cascade model, may have contributed to the positive relation between age and social distancing.

Importantly, although both kinds of concerns were negatively correlated with age, the absolute value of the correlation of age with concerns for oneself was always greater than the absolute value of the correlation of age with concerns for close others (Figure 1). Further evidence of the robustness of this finding is the fact that although on both surveys the percentage of females in the older age groups tended to be higher than the percentage in the younger age groups, the same pattern of differences was observed in the partial correlations of concern with age when gender was statistically controlled: partial r s of Self with Age on the 2021 and 2022 Surveys = -0.191 and -0.197 , respectively; partial r s of Clos with Age on the 2021 and 2022 Surveys = -0.135 and -0.123 , respectively; all four p s < 0.001 .

Because of the strong correlations between the variables Anxiety and Depression and between Self and Clos (i.e., concerns for oneself and for close others), we compared both pairs of variables in more detail to evaluate the need for separate indices (Table 10). Note that each comparison involved a pair of variables that were measured in similar ways (i.e., 7 items for each construct on the HADS and 1 item each on for concerns on the two surveys). Despite the fact that for each pair of variables the correlation between them was greater than 0.60, the value of p was < 0.001 for all four comparisons (2 variable pairs $\times$ 2 surveys), indicating that these highly correlated variables measured different constructs.

As already noted, comparison of the correlation matrices for the two surveys reveals multiple similarities. At a higher level, however, perhaps the most important similarity between the results of the two surveys was the presence of multiple examples of age-related decreases in participants' perceptions of negative experiences (e.g., risks and concerns) on both surveys, results we term 'negative positivity effects' (Table 11). Studies of age-related positivity effects typically compare processing of positive and negative information and find a bias for the former in older adults [35,36]. In contrast, the present 'negative positivity effects' focus specifically on evaluation of negative information. Thus, "positivity"

here refers specifically to a decrease in negativity, as in age-related decreases in concern regarding the effects of the COVID-19 pandemic on oneself and others.

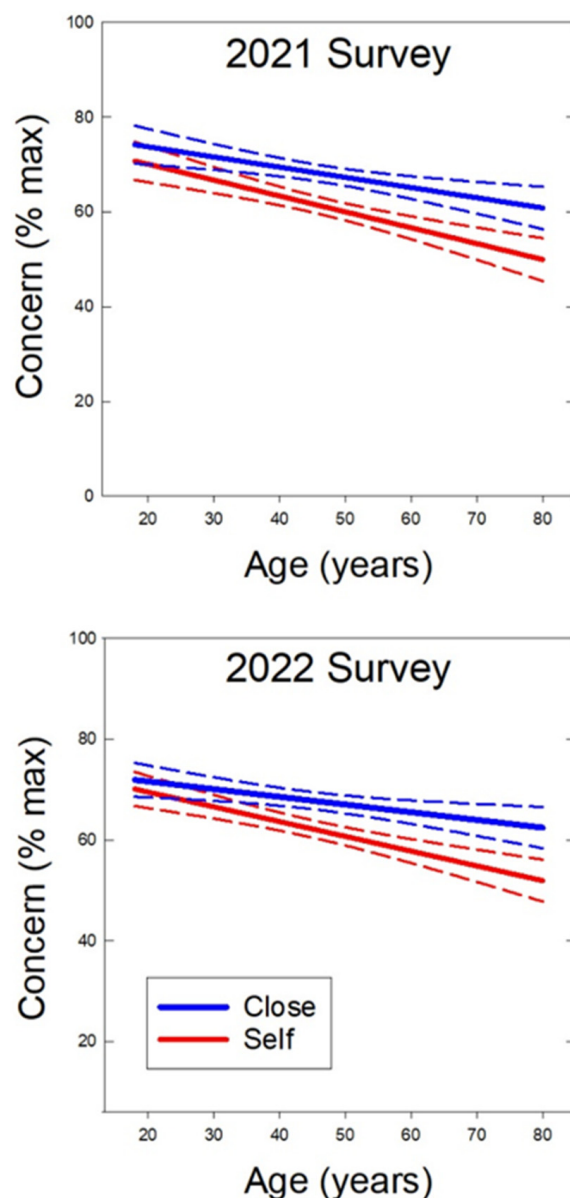


Figure 1. Concerns regarding the effects of the COVID-19 pandemic on oneself (Self) and on others with whom one is close (Close) plotted as a function of age. Solid lines are the linear functions that best fit the 2021 and 2022 Survey data, and the dotted lines are the confidence intervals.

Table 10. Comparisons of Self vs. Close and Depression vs. Anxiety on the 2021 and 2022 Surveys.

Survey	2021		2022		2021		2022	
Variable	Self	Clos	Self	Clos	Anxi	Depr	Anxi	Depr
Valid	807	809	754	756	810	810	756	756
Mn	4.274	4.758	4.354	4.745	7.548	6.105	8.966	6.627
SD	1.824	1.788	1.720	1.680	4.744	4.170	4.941	4.004
CV	42.68	37.58	39.50	35.41	78.29	67.44	55.11	60.42
<i>t</i> (df)	10.71 (806)		8.80 (753)		17.20 (809)		17.06 (755)	
<i>p</i>	<0.001		<0.001		<0.001		<0.001	

Note. CV stands for the coefficient of variation (standard deviation as a percentage of the mean). All other abbreviations are provided in the Note to Table 2.

Although the observed pattern of negative positivity effects could reflect a bias against processing negative information that increases with age, it is less obvious how it could reflect a preference for processing positive information. The power (and occasional unreasonableness) of the negative positivity effect is exemplified by the negative correlations of age with the two risk estimates. In particular, it has been well known from the onset of the COVID-19 pandemic that older adults were more likely to experience serious consequences from infection with the SARS-CoV-2 virus [37], yet participants' estimates of the risk of hospitalization decreased significantly as a function of Age.

Table 11. Correlations between age and other variables in the 2021 and 2022 Surveys.

Survey	2021		2022	
	<i>r</i>	Partial	<i>r</i>	Partial
Anxi	−0.297 ***	−0.376 ***	−0.369 ***	−0.289 ***
Depr	−0.183 ***	−0.217 ***	−0.216 ***	−0.165 ***
Infe	−0.290 ***	−0.408 ***	−0.414 ***	−0.263 ***
Hosp	−0.121 **	−0.302 ***	−0.306 ***	−0.102 ***
Self	−0.182 ***	−0.195 ***	−0.195 ***	−0.173 ***
Clos	−0.119 **	−0.127 ***	−0.107 **	−0.115 ***

$p < 0.05$, * $p < 0.01$, ** $p < 0.001$ ***. Note. Partial = r with Gender and Race/Ethnicity controlled. Anxi = Anxiety, Depr = Depression, Infe = infection risk, Hosp = hospitalization risk, Self = concern for oneself, Clos = concern for close others.

Whereas the difference between concerns for oneself and concerns for close others may have important public health implications, it may also be important theoretically as it suggests a mechanism, captured by the cascade model, that could explain why altruism increases as people become older [13]. On the 2022 Survey, the difference between the two kinds of concerns (i.e., Clos—Self) was not only an increasing function of participants' age ($r = 0.131$, $p < 0.001$), it was also positively correlated with scores on the Altruism facet of Agreeableness ($r = 0.222$, $p < 0.001$). Further evidence that the difference between the two kinds of concerns is associated with altruism is provided by the significant correlation of the Close—Self difference with scores on the Sympathy facet ($r = 0.194$, $p < 0.001$), as it has been argued that sympathy and empathy are fundamental components of altruistic behavior [27,28]. Finally, Altruism scores were significantly correlated with both distancing measures (Prox and Publ) on the 2022 Survey (see Table 3).

Altruism is usually defined as behavior that is intended to benefit another, and which is not performed with the expectation of personal benefits or to avoid negative consequences [30]. Thus, based on the cascade model, it might be expected that increases in altruistic behavior would reflect increases in the extent to which participants' concerns for others exceeds the participants' concerns for themselves. It should be noted, however, that this difference could increase for several different reasons. One possible reason for such an increase would be because of an increase in concern for others, whereas another reason would be because of a decrease in concern for oneself. On our 2021 and 2022 surveys, however, both kinds of concerns decreased significantly with age. Moreover, comparing the strengths of these correlations with age suggests that the reason the difference between concerns for others and for oneself increases is because concern for oneself decreased more markedly than concern for close others.

Importantly, both the 2021 Survey and the 2022 Survey show the same pattern of differences that decline with age, suggesting that this finding is not only of theoretical interest, it is also robust. As may be seen in Figure 1, the extent to which participants' concern for close others exceeded their concern for themselves increased systematically with age. Indeed, the correlation of age with concern for oneself on the 2022 Survey differed

significantly [32,33] from the correlation of age with concern for close others ($Z = -2.53$, $p = 0.011$). In light of its potential theoretical importance, we revisited the data from the 2021 Survey to assess its reliability. Indeed, these two correlations also differed significantly ($Z = -3.35$, $p < 0.001$). Thus, simply put, altruism appears to increase with age because although people show ‘negative positivity effects’ in general, a closer look reveals that their concern for their own wellbeing decreases more rapidly than their concern for those with whom they are close.

6. Conclusions

From the beginning of the COVID-19 pandemic, it was clear to many researchers [21] that the pandemic represented an important natural experiment in which, for psychologists especially, the major independent variable was the increase in psychological distress that accompanied the pandemic. One important characteristic of natural experiments, however, is that they are often one-shot events, which can make them difficult to evaluate scientifically because it precludes assessment of the replicability of findings. Notably, however, the data from our 2021 survey included responses to items concerning the frequency with which participants engaged in multiple kinds of social distancing behaviors (decreases in close proximity interactions, decreases in visits to enclosed public spaces, and decreases in physical contact with non-household members), and replicated the first two of these mitigation behaviors in our 2022 survey. The current findings, therefore, not only provide evidence of replication of both age-related differences in social distancing but also evidence of the roles that psychological distress and concerns for oneself and for close others played in these age differences. Importantly, the difference in the magnitude of age-related decreases in the two kinds of concerns also replicated, and this difference provides a potential explanation of age-related differences in altruism. It remains unclear, however, why different concerns decrease at different rates, and further research on this apparently robust finding is clearly needed.

The COVID-19 pandemic resulted in high levels of psychological distress, which was not surprising because of the threat it posed to people of all ages, particularly older adults, as was evident early on [5–7]. What was surprising, however, was that older adults consistently reported experiencing less psychological distress than younger adults [1,2,4,38]. As we have seen, however, older adults were more likely to engage in mitigation behaviors like social distancing despite the fact that their personal concerns regarding COVID-19 were lower than those of younger adults.

In an effort to explain the paradoxical pattern of these findings, and in the hope of providing guidance for public health messaging, we pointed to the fact that neuroticism has been observed to decrease with age in both cross-sectional and longitudinal studies [17,39], and that this decline was associated with decreases in both anxiety and depression, the components of most measures of psychological distress [2]. Anxiety and depression, meanwhile, appear to interfere with social distancing (although, interestingly, not with vaccination decisions) [24]. On the other hand, agreeableness (which includes altruism and sympathy facets) has been reported to be associated with prosocial behaviors and to buffer against mental distress [40,41].

Recently, ref. [14] proposed a cascade model in an attempt to capture the larger pattern among these measures and their ethical implications. According to this model, aging is not only associated with a decrease in neuroticism (sometimes referred to as an increase in emotional stability), but also with an increase in altruism [13]. Furthermore, whereas neuroticism is positively associated with distress, as was clearly evident during the COVID-19 [42], it is also negatively associated with altruism, which is positively associated with distancing.

Taken together, these age-related changes describe the relations among age, distress, and distancing, but in order to provide further information about the underlying mechanisms, it seemed useful to examine relations among measures at a lower level, not just the relations among the higher-level compound measures that had inspired the model. Accordingly, we looked back at previous surveys that had assessed what we hypothesized were the components of altruism: participants' concerns regarding the effects of the pandemic on others to whom they were close and concerns regarding its effects on themselves. Whereas both types of concerns decreased with age, the difference between them increased significantly with age, and as expected based on the cascade model, the difference between them was positively correlated with both altruism and sympathy, which in turn were correlated with social distancing.

These findings provide support for the cascade model, with implications for public health messaging. As is well known, one of the keys to effective communication is understanding one's audience. In the case of the COVID-19 pandemic, older adults were an especially important part of the audience because of their greater susceptibility to serious consequences should they contract COVID-19. As a result, a large part of understanding the audience may be understanding relevant aspects of the psychology of aging, and one especially important aspect turned out to be age-related positivity effects [36,43], and the negative positivity effects reported here in particular.

Although the similarity of the results from both Surveys is encouraging, researchers should bear in mind potential limitations of the present findings. One issue concerns the representativeness of online samples, particularly samples of older adults, while another concerns the reliability of certain measures (i.e., concern for oneself and close others). While the two measures were clearly distinct, with former decreasing as a function of age at a significantly faster rate than the latter, the two were highly correlated ($r_s > 0.70$) on both surveys. This multicollinearity makes it a challenge to assess them independently. In addition, Altruism and Sympathy were the most highly correlated of the measures in the present investigation ($r = 0.768$). Finally, while the cascade model was proposed in longitudinal terms, the current investigation can only test the implications of the model for age differences. Accordingly, where results are reported as a measure having increased or decreased as a function of age, it should be noted that this is a description of a mathematical relation and should not be interpreted as reporting significant longitudinal change. Similar, the term "age-related" is intended to indicate that age is not (and cannot be) a direct cause of changes reflected in observed age differences.

With respect to the representativeness of older samples, this is a long-standing issue and is not peculiar to online studies [44]. Although recruiting online samples is perhaps better than the old practice of comparing college students with convenience samples of older adults, it is clear that problems remain [45], and longitudinal studies provide a better basis for assessing the source of age-related differences, including positivity effects [20]. Of course, pandemics obviously do not lend themselves to longitudinal designs, but fortunately, there is now good longitudinal evidence for age-related decreases in neuroticism and increases in agreeableness, the trait that includes altruism [18,19,39,46]. Nevertheless, the distinction between longitudinal and cross-sectional studies is a fundamental one; the good news is that the longitudinal database is growing and that so far it appears to support the assumptions made by the cascade model.

Importantly, such investigations have not only provided strong support for lifespan personality development, taken together, they also support what has been termed the 'maturity principle' (i.e., increases in personality traits positively correlated with interpersonal and occupational functioning as well as with health) [18,19,47]. Notably, these traits include agreeableness, particularly its prosocial facets [46], and emotional stability, as evidenced by

declines in neuroticism. The present findings regarding age-related increases in altruism and age-related decreases in neuroticism are also consistent with the maturity principle, which was implicit in the assumptions of the cascade model and which, like reciprocal altruism, has clear implications for public health messaging.

Taken together, the present findings appear consistent with the cascade model and with the association of age-related decreases in neuroticism with age-related decreases in distress (which in turn were associated with age-related increases in altruism). Moreover, the observed increase in altruism turned out to reflect a difference in the strengths of negative positivity effects (i.e., decreases in concerns and risk estimates with age), and more specifically the fact that decreases in concern for oneself were greater than decreases in concern for those to whom one is close. This is not necessarily to say that altruism was responsible for this differential decrease, as one could also view it as a manifestation of altruism rather than a cause.

Although the differential decrease in concerns as a function of age appears to be a robust phenomenon, further research is now needed to assess its generality. We would note that in addition to its theoretical implications, such research could have important practical and clinical applications because it appears to offer three targets for messages and manipulations intended to increase altruism—one focused on increasing or broadening one’s concern for others, another focused on decreasing concern for oneself, and a third focused on decreasing psychological distress in general. Finally, as our findings suggest that decreasing people’s distress may make them more compassionate in general and may be key to increasing their prosocial attitudes and behavior [14].

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Data Availability Statement: The data from Myerson et al. [2022; 2023] as well as the names of the repository/repositories and accession number(s) can be found at: osf.io/jmykd/ (accessed on 30 July 2026).

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Appendix A

Table A1. Data dictionary with field name (column label), variable name, description, type of measurement scale, and minimum and maximum possible scores.

Field Name	Variable	Description	Type	Min Max
1. Anxi	Anxiety	Nervousness	Interval	0–21
2. Depr	Depression	Sadness	Interval	0–21
3. Stab	Emotional Stability	Reverse-scored Neuroticism	Interval	10–50
4. Prox	Proximity	Decrease in close proximity interactions	Binary	0–1

Table A1. Cont.

Field Name	Variable	Description	Type	Min Max
5. Publ	Public	Decrease in visits to enclosed public spaces	Binary	0–1
6. Cont	Contact	Decrease in physical contact with nonhousehold members	Binary	0–1
7. Hand	Hand	Increase in hand hygiene	Binary	0–1
8. Age	Age	Years since birth	Ratio	18–85
9. Self	Self	Concern for effect of pandemic on self	Ordinal	1–7
10. Clos	Close	Concern for effect of pandemic on close others	Ordinal	1–7
11. Altr	Altruism	Unselfish helping behavior	Interval	10–50
12. Symp	Sympathy	Sorrow for another's misfortune	Interval	10–50
13. Trus	Trust	Believe others are honest	Interval	10–50
14. Infe	Infection	Estimated chance of infection	Ordinal	1–7
15. Hosp	Hospitalization	Estimated chance of hospitalization	Ordinal	1–7

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