Preventive Medicine Reports 20 (2020) 101246

Contents lists available at ScienceDirect

Preventive Medicine Reports

journal homepage: www.elsevier.com/locate/pmedr

Short communication

Mindfulness and engagement in COVID-19 preventive behavior

Ilana Haliwa [a,*], Jerin Lee [b], Jenna Wilson [a], Natalie J. Shook [b]

[a] West Virginia University, Morgantown, WV, USA
[b] University of Connecticut, Storrs, CT, USA

ARTICLE INFO

Keywords:
Coronavirus
COVID-19
Mindfulness
Preventive health behavior
Social distancing

ABSTRACT

The novel coronavirus disease 2019 (COVID-19) pandemic represents a significant risk to population health. Health organizations worldwide have recommended numerous preventive health behaviors to slow the spread of COVID-19. Yet, considerable variability exists in individual-level adherence to these recommendations. Mindfulness has been associated with greater engagement in health promotive behavior (e.g., physical activity, healthy eating), and may serve as an individual difference factor that encourages adherence. However, no study to date has examined the extent to which mindfulness is associated with preventive health behaviors during a global pandemic. The purpose of the present study was to assess the relations between mindfulness and recommended preventive health behaviors for COVID-19. A national U.S. sample ($N = 353$; $M_{age} = 41.47$ years, range: 19–84; 50.2% female) completed an online survey via Amazon's Mechanical Turk from April 3rd to 15th, 2020, including measures of mindfulness and frequency of avoiding touching one's face, handwashing, disinfecting/cleaning frequently used surfaces, social distancing, and self-quarantining. Personality, health risk, and demographic factors were also assessed to test the unique association between mindfulness and preventive health behaviors. Mindfulness was significantly correlated with greater engagement in all of the COVID-19 preventive health behaviors. However, when accounting for demographics, health risk, and personality, mindfulness was only uniquely associated with engagement in social distancing. This research highlights mindfulness as an individual-level characteristic associated with engagement in COVID-19 preventive health behavior and may inform future prevention efforts aimed at improving adherence to recommendations for curbing the spread of infectious disease.

1. Introduction

The novel coronavirus disease 2019 (COVID-19) represents a significant population health threat. As of October 7, 2020, there were 35,970,265 diagnosed cases and 1,052,105 deaths globally (Johns Hopkins University, 2020). With no current vaccine, behavior change is the primary means of reducing viral spread. Health organizations have recommended several preventive health behaviors (e.g., handwashing, social distancing; Centers for Disease Control and Prevention, 2020). Despite national-level measures taken to encourage the adoption of such behavior (e.g., closing non-essential businesses, stay-at-home orders), variability remains in individual-level adherence to COVID-19 preventive health behaviors. In order to develop strategies to encourage behavior change and curb the pandemic, it is crucial to identify modifiable determinants of adherence to preventive health behaviors.

Mindfulness, or non-judgmental attention to and awareness of internal and external experiences as they occur (Kabat-Zinn, 2006), may be one such factor. Individuals reliably differ in propensity to be mindful on a regular basis (i.e., dispositional mindfulness; Baer et al., 2006). However, a state of mindfulness can also be cultivated through practice, which over time increases dispositional mindfulness (Kiken et al., 2015). Greater mindfulness is associated with health promotive behaviors, such as better diet (Fanning et al., 2018), more physical activity (Roberts and Danoff-Burg, 2010), and smoking cessation (Brewer et al., 2011). These patterns may extend to the context of infectious disease. Greater mindfulness has been associated with less risky sexual behavior among those at risk for sexually transmitted infections (Roberts and Danoff-Burg, 2010) and greater antiviral medication adherence among individuals with HIV (Kerrigan et al., 2018). As such, mindfulness may also be associated with greater engagement in COVID-19 preventive health behaviors. However, no study to date has examined this connection.

The present study sought to assess the relations between mindfulness and COVID-19 preventive health behaviors. As a number of personality,

* Corresponding author.
E-mail address: ih0010@mix.wvu.edu (I. Haliwa).

https://doi.org/10.1016/j.pmedr.2020.101246
Received 10 June 2020; Received in revised form 11 October 2020; Accepted 8 November 2020
Available online 25 November 2020

health risk, and demographic factors have previously been linked to preventive health behaviors and/or mindfulness (e.g., Hanley and Garland, 2017; Hampson et al., 2007), we included a range of covariates to isolate the independent association between mindfulness and preventive health behaviors. We hypothesized that greater mindfulness would be uniquely associated with greater engagement in preventive health behaviors.

2. Method

2.1. Participants and procedure

Participants ($N = 374$) were U.S. residents recruited from April 3rd to April 15th, 2020, via Amazon's Mechanical Turk (MTurk), a commonly used online platform that provides access to a large national sample of U.S. adults (Levay et al., 2016). MTurk is a valid and reliable source for data collection, comparable to other methods (e.g., Buhrmester et al., 2011). Twenty-one participants were excluded due to duplicate or incomplete survey entries. The final sample comprised 353 individuals (59.8% women; 75.6% White; $M_{age} = 41.47$ years, $SD = 12.49$, range: 19–84; $Income_{Mdn}$ = $50,000–$59,000; see Supplemental Materials for more detailed sample description). After providing electronic consent, participants completed an online survey with measures presented in a random order, except for health history and demographics which appeared last. Participants were compensated $5.00. This study was approved by the University's Institutional Review Board.

3. Measures

Cognitive and Affective Mindfulness Scale – Revised (CAMS-R; Feldman et al., 2007). This 12-item measure assesses dispositional mindfulness. Participants rated each item on a scale from 1 (*rarely/not at all*) to 4 (*almost always*). After reverse scoring appropriate items, all items were summed. Higher scores reflect greater mindfulness. The CAMS-R has good internal consistency ($\alpha = 0.74$ - 0.85) and convergent validity (Feldman et al., 2007).

Preventive Health Behaviors.[1] Participants indicated frequency of preventive health behaviors on a scale from 1 (*not at all*) to 7 (*multiple times a day*) (see Supplemental Material for item wording). Single items assessed handwashing and avoidance of face touching. Three items assessed cleaning/disinfecting. These items were averaged.

Four items assessed social distancing. One item assessed the extent to which participants engaged in social distancing (i.e., reducing contact with others to avoid contracting COVID-19) in the past week, on a scale from 1 (*not at all*) to 5 (*a great deal*). Participants also responded to three items indicating the frequency with which they avoided specific contact with others (i.e., hugging, kissing, hand-shaking) in the past week, on a scale from 1 (*not at all*) to 7 (*multiple times a day*). Items were standardized and averaged to create a composite score. Higher scores indicate more social distancing.

Participants were asked to indicate on how many days (1–7) in the past week they had self-quarantined. Scores ranged from 0 to 7 days.

Personality. The 44-item Big Five Inventory (John et al., 1991) was used to assess personality traits: openness, conscientiousness, neuroticism, agreeableness, and extraversion. Participants rated their agreement to each statement on a scale from 1 (*disagree strongly*) to 5 (*agree strongly*). After reverse scoring appropriate items, item responses for each trait were averaged. Higher values indicate stronger identification with that trait.

COVID-19 Risk. To determine whether participants were at risk for complications from COVID-19, participants were presented with a list of 46 medical conditions and asked to indicate whether they have or previously had each condition. Twenty-three of the medical conditions were identified by the CDC as risk factors for complications from COVID-19 (e.g., diabetes, cirrhosis; CDC, 2020). Participants also indicated whether they were taking any immunosuppressive medication and if female participants were pregnant. A dichotomous variable was created to indicate risk of complications from COVID-19. Participants who endorsed at least one of the conditions identified by the CDC, taking immunosuppressive medication, or being pregnant were coded as 1 ("high risk"). Participants who did not meet any of these criteria were coded as 0 ("low risk").

A single item also assessed participants perceived likelihood of contracting COVID-19 on a scale from 1 (*not at all likely*) to 5 (*extremely likely*).

Demographics. Participants reported age, sex, relationship status, ethnicity/race, income, education, political orientation, and sexual orientation.

4. Results

Overall, participants were adhering to recommended preventive health behaviors (see Table 1 for means and standard deviations and Supplemental Material for percent breakdown by response option). Most participants reported avoiding touching their face at least 5–6 times a week (58%), washing their hands for at least 20 s daily or multiple times a day (79.9%), and social distancing "*a great deal*" (72.0%). Frequency of disinfecting/cleaning surfaces was lower with most participants reporting engaging in these behaviors twice a week or less (56.6%). Finally, 79.6% of the sample reported self-quarantining, spending on average 6.28 days out of the past week in self-quarantine. Of note, avoiding touching one's face, handwashing, and self-quarantining were negatively skewed (skew ratios = 4.23–14.82). Transformation normalized avoiding touching one's face, but handwashing and self-quarantining remained negatively skewed. Analyses were conducted with transformed and non-transformed variables. The pattern of results was generally consistent, so results are reported with the non-transformed variables.

To determine whether mindfulness was significantly associated with COVID-19 preventive health behaviors, bivariate correlations were estimated (see Table 1). Overall, greater mindfulness was significantly associated with greater avoidance of touching one's face, handwashing, disinfecting/cleaning of frequently used surfaces, social distancing, and self-quarantining.

To determine whether mindfulness uniquely predicted engagement in COVID-19 preventive health behaviors, five linear regression analyses were conducted, controlling for demographic variables, personality, perceived likelihood of contracting COVID-19, and health risk for COVID-19 complications (see Table 2). For social distancing, the model was significant, $F(16, 334) = 6.96$, $p < .001$ ($R^2\Delta = 0.25$, $p < .001$), and greater mindfulness was uniquely associated with greater social distancing ($\beta = 0.17$, $p = .02$). Mindfulness did not significantly predict avoidance of touching one's face, handwashing, disinfecting/cleaning surfaces, or self-quarantining.

5. Discussion

The present study examined the extent to which mindfulness was associated with adherence to COVID-19 preventive health behavior. Bivariate correlations indicated that mindfulness was positively

[1] An item also assessed frequency of antiviral facemask wearing. This item was not included in the hypotheses and primary analyses, as it did not align with CDC recommendations at the time. On April 3, 2020, the day that the survey was released, the CDC started recommending that the general public wear cloth facemasks (CDC, 2020). Prior to this date, the CDC had not recommended the use of facemasks by the general public, except if individuals had COVID-19 (CDC, 2020). Furthermore, the CDC specifically dissuaded the use of antiviral masks to prevent supply shortages. However, for transparency, frequency of antiviral facemask wearing was not associated with mindfulness ($r = -0.01$, $p = .876$).

Table 1
Descriptive Statistics and Bivariate Correlations for Study Variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Mindfulness													
2. Avoid touching your face	0.19***	–											
3. Wash your hands for at least 20 s	0.13*	0.40***	–										
4. Disinfect/clean frequently used surfaces	0.15**	0.44***	0.28***										
5. Social distancing	0.25***	0.32***	0.22***	0.49***	–								
6. Self-quarantining	0.12*	0.19**	0.17**	0.15*	0.16**	–							
7. Health risk for COVID-19	−0.06	0.10	0.22***	0.02	0.15**	0.10	–						
8. Perceived Risk for COVID-19	−0.13*	0.07	−0.02	0.12*	0.16**	−0.04	0.09	–					
9. Extraversion	0.36***	0.12*	0.02	0.28***	0.29***	0.04	−0.14**	−0.01	–				
10. Agreeableness	0.39***	0.16**	0.21***	0.16**	0.28***	0.11	0.06	−0.09	0.25***	–			
11. Conscientiousness	0.59***	0.14*	0.19***	0.09	0.17**	0.08	0.01	−0.18**	0.21***	0.42***	–		
12. Neuroticism	−0.70***	−0.14*	−0.03	−0.06	−0.16**	−0.05	0.15**	0.21***	−0.36***	−0.47***	−0.54***	–	
13. Openness	0.18**	0.14**	0.26***	0.14*	0.12*	0.07	0.04	0.03	0.31***	0.24***	0.17**	−0.12*	–
M / %	34.48	4.69	6.12	3.7	0.00	6.29	0.82	2.52	2.95	3.83	4.04	2.6	3.58
SD	6.54	2.21	1.5	1.8	0.80	1.14	0.39	1.00	0.98	0.78	0.76	1.01	0.83
Cronbach's alpha	0.87	–	–	0.84	0.81	–	–	–	0.87	0.84	0.88	0.9	0.89

Note: Self quarantine (0 = N, 1 = Y), health risk (0 = N, 1 = Y). *** $p < .001$, ** $p < .01$, * $p < .05$.

associated with engagement in several recommended precautions. However, after controlling for personality, perceived and objective health risk for COVID-19, and demographics, mindfulness only uniquely predicted engagement in social distancing. Still, social distancing has been critical in reducing hospitalizations and deaths due to COVID-19 (Matrajt and Leung, 2020). These findings highlight a potential target for health promotion strategies to curb the spread of COVID-19, or other infectious diseases.

Of all individual-level variables that were significantly associated with social distancing (i.e., mindfulness, age, gender, extraversion, agreeableness, perceived risk, and health risk), mindfulness represents the most promising target for intervention. Personality is largely stable throughout adulthood (Terraciano et al., 2010), and characteristics such as sex and health risk for COVID-19 are generally not modifiable. Similarly, perceived risk for COVID-19 is influenced by stable characteristics including political orientation, personality, and trust in the government (Dryhurst et al., 2020). Brief mindfulness practices (e.g., 8-minute meditation) can induce a state of mindfulness (Bravo et al., 2018), which may impact health behavior. During times of social isolation or distancing, effective mindfulness exercises can be accessed remotely using smartphone applications (Wen et al., 2017). Thus, mindfulness training may be easily incorporated into preventive health interventions.

Mindfulness was not significantly associated with avoidance of touching one's face, handwashing, disinfection/cleaning of frequently used surfaces, or self-quarantining, when controlling for personality, demographics, and COVID-19 risk. Handwashing, self-quarantining, and avoiding touching one's face were negatively skewed, representing a potential ceiling effect and limiting the ability to detect predictors of individual differences in behavior (Cramer and Howitt, 2004). All three behaviors were assessed with single items, which may be more vulnerable to measurement error and interpretation bias (Churchill, 1979). Future work should utilize multi-item measures.

The association between mindfulness and social distancing may stem in part from prosocial motivations. Greater mindfulness is associated with greater engagement in behavior that benefits others (e.g., Luberto et al., 2018). Social distancing inherently occurs in the presence of others, who may serve as cues for prosocial behavior. Concern for others', as well as one's own, health may strengthen the association between mindfulness and social distancing specifically. In contrast, avoidance of touching one's face, handwashing, disinfection of frequently used surfaces, or self-quarantining may occur largely in isolation, in the absence of these social cues.

The present study has limitations. The MTurk participant pool is not nationally representative (Levay et al., 2016), and our sample was primarily White, limiting generalizability. However, our sample demographics were similar to U.S. adult demographics (i.e., 50.8% female, 76% White, Age_{mdn} = 38.4 years, $Income_{Mdn}$ = \$60,000; U.S. Census Bureau, 2019), and we controlled for demographic variables in the regression analyses (Levay et al., 2016). All measures were self-report, which raises concerns about inaccurate recall of health behaviors or social desirability bias (Kristiansen and Harding, 1984). The response scale for the preventive health behaviors lacked precision, potentially contributing to skewed distribution. Future work should utilize objective behavioral measures with more precise scoring.

6. Conclusions

Understanding determinants of preventive health behavior is critical, especially when individual-level behavior may drive population-level outcomes amidst a pandemic. The present study suggests that mindfulness is associated with engagement in COVID-19 preventive health behaviors. Further work is needed to replicate these findings among more nationally representative and diverse samples, and experimentally test the effect of mindfulness practice on preventive health behavior. Mindfulness may represent a potential target for future interventions

Table 2
Linear Regression Models Predicting COVID-19 Preventive Health Behavior.

Predictor Variable	Outcome Variable				
	Avoid touching one's face	Handwashing	Disinfecting/cleaning frequently used surfaces	Social distancing	Self-quarantine
Age	−0.02	0.03	−0.08	0.13*	0.05
	(−0.003, 0.01)	(0.003, 0.01)	(−0.01, 0.01)	(0.01, 0.003)	(0.004, 0.01)
Gender	0.1	0.13*	0.09	0.14**	−0.04
	(0.46, 0.25)	(0.38, 0.16)	(0.33, 0.20)	(0.22, 0.08)	(−0.10, 0.15)
Race	−0.03	0.004	−0.05	−0.09	0.02
	(−0.14, 0.31)	(0.02, 0.20)	(−0.24, 0.24)	(−0.17, 0.10)	(0.05, 0.19)
Education	−0.01	−0.10	−0.15**	−0.10	0.01
	(−0.02, 0.09)	(−0.10, 0.06)	(−0.18, 0.07)	(−0.05, 0.03)	(0.01, 0.05)
Sexual Orientation	−0.07	0.03	−0.05	−0.03	−0.04
	(−0.55, 0.44)	(0.15, 0.28)	(−0.33, 0.35)	(−0.08, 0.15)	(−0.17, 0.27)
Political Orientation	0.14*	0.08	0.07	0.01	0.07
	(0.28, 0.11)	(0.10, 0.07)	(0.11, 0.09)	(0.01, 0.04)	(0.07, 0.07)
Relationship Status	−0.003	−0.08	−0.03	−0.03	−0.03
	(−0.01, 0.27)	(−0.24, 0.17)	(−0.11, 0.21)	(−0.04, 0.09)	(−0.07, 0.16)
Income	−0.02	0.12	0.07	0.04	0.03
	(−0.02, 0.05)	(0.06, 0.03)	(0.04, 0.04)	(0.01, 0.02)	(0.01, 0.03)
Extraversion	0.03	−0.10	0.24***	0.23***	0.02
	(0.06, 0.13)	(−0.14, 0.09)	(0.45, 0.11)	(0.19, 0.05)	(0.02, 0.08)
Agreeableness	0.08	0.13*	0.12	0.18**	0.08
	(0.22, 0.18)	(0.24, 0.11)	(0.27, 0.14)	(0.19, 0.06)	(0.12, 0.11)
Conscientousness	0.01	0.1	0.020	0.00	−0.030
	(0.03, 0.20)	(0.19, 0.13)	(0.04, 0.16)	(0.004, 0.07)	(−0.04, 0.12)
Neuroticism	−0.07	0.08	0.12	0.09	0.09
	(−0.16, 0.19)	(0.12, 0.12)	(0.19, 0.15)	(0.07, 0.06)	(0.10, 0.11)
Openness	0.05	0.23***	0.04	−0.02	0.01
	(0.14, 0.16)	(0.41, 0.10)	(0.08, 0.13)	(−0.02, 0.05)	(0.02, 0.10)
Health Risk for COVID-19	0.1	0.14**	0.02	0.13*	0.08
	(0.56, 0.32)	(0.54, 0.21)	(0.10, 0.25)	(0.29 0.11)	(0.24,0.21)
Perceived Risk for COVID-19	0.09	−0.04	0.12	0.20***	−0.05
	(0.20, 0.12)	(−0.06, 0.08)	(0.21, 0.09)	(0.16, 0.04)	(−0.06, 0.07)
Mindfulness	0.12	0.07	0.12	0.17*	0.13
	(0.04, 0.03)	(0.02, 0.02)	(0.03, 0.02)	(0.02, 0.01)	(0.02, 0.02)

Note. Sex (male = 0, female = 1), race/ethnicity (White = 1, non-White = 0), education (1 = less than/some high school to 8 = graduate studies/professional degree), sexual orientation (straight/heterosexual = 0, homosexual, bisexual, other = 1); political orientation (1 = very conservative to 5 = very liberal), relationship status (married = 1, not married = 0), income (1 = less than $10,000 to 12 = more than $150,000), health risk (1 = high, 0 = low). *** $p < .001$, ** $p < .01$, * $p < .05$.

aimed at increasing adherence to health recommendations and curb the spread of COVID-19, or other infectious diseases.

CRediT authorship contribution statement

Ilana Haliwa: Data curation, Writing - original draft, Writing - review & editing. **Jerin Lee:** Investigation, Data curation, Writing - review & editing. **Jenna Wilson:** Data curation, Writing - review & editing. **Natalie J. Shook:** Conceptualization, Methodology, Investigation, Resources, Writing - review & editing, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgement

This work was supported by a Rapid Response to Examine Social and Behavioral Implications of COVID-19 grant from the University of Connecticut Institute for Collaboration on Health, Intervention, and Policy.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.pmedr.2020.101246.

References

Baer, R., Smith, G., Hopkins, J., Krietemeyer, J., Toney, L., 2006. Using self-report assessment methods to explore facets of mindfulness. Asses 13 (1), 27–45. https://doi.org/10.1177/1073191105283504.

Bravo, A.J., Pearson, M.R., Wilson, A.D., Witkiewitz, K., 2018. When traits match states: Examining the associations between self-report trait and state mindfulness following a state mindfulness induction. Mindfulness 9, 99–211. https://doi.org/10.1007/s12671-017-0763-5.

Brewer, J.A., Mallik, S., Babuscio, T.A., Nich, C., Johnson, H.E., Deleone, C.M., Rounsaville, B.J., 2011. Mindfulness training for smoking cessation: results from a randomized controlled trial. Drug Alcohol Depend 119 (1–2), 72–80. https://doi.org/10.1016/j.drugalcdep.2011.05.027.

Centers for Disease Control and Prevention. (2020). How to protect yourself and others. Coronavirus Disease 2019 (COVID-19). https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html.

Buhrmester, M, Kwang, T, Gosling, S.D., 2011. Amazon's Mechanical Turk: A New Source of Inexpensive, Yet High-Quality, Data? Perspectives on Psychological Science.

Churchill, G.A., 1979. A paradigm for developing better measures of marketing constructs. J. Mark Res. 16, 64–73. https://doi.org/10.2307/3150876.

Cramer, D., Howitt, D.L., 2004. The SAGE Dictionary of Statistics: A Practical Resource for Students in Social Sciences. SAGE Publications Ltd, London.

Dryhurst, S., Schneider, C.R., Kerr, J., Freeman, A.L.J., Recchia, G., Van der linden, S., 2020. Risk perceptions of COVID-19 around the world. J. Risk Res. https://doi.org/10.1080/13669877.2020.1758193.

Fanning, J., Osborn, C.Y., Lagotte, A.E., Mayberry, L.S., 2018. Relationships between dispositional mindfulness, health behaviors, and hemoglobin A1c among adults with type 2 diabetes. J. Behav. Med. 41, 798–805. https://doi.org/10.1007/s10865-018-9938-3.

Feldman, G., Hayes, A., Kumar, S., Greeson, J., Laurenceau, J.P., 2007. Mindfulness and emotion regulation: The development and initial validation of the Cognitive and Affective Mindfulness Scale-Revised (CAMS-R). Journal of Psychopathology and Behavioral Assessment,.

Hampson, S.E., Goldberg, L.R., Vogt, T.M., Dubanoski, J.P., 2007. Mechanisms by which childhood personality traits influence adult health status: educational attainment and healthy behaviors. Health Psychol. 26, 121–125. https://doi.org/10.1037/0278-6133.26.1.121.

Hanley, A.W., Garland, E.L., 2017. The mindful personality: a meta-analysis from a cybernetic perspective. Mindfulness 8, 1456–1470. https://doi.org/10.1007/s12671-017-0736-8.

https://www.cdc.gov/coronavirus/2019-ncov/need-extra-precautions/people-with-medical-conditions.html.

Johns Hopkins University. (2020). Coronavirus Resource Center. COVID-19 Dashboard by the Center for Systems Science and Engineering at Johns Hopkins. https://coronavirus.jhu.edu/map.html.

John, O.P, Donahue, E.M., Kentle, R.L., 1991. Big Five Inventory (BFI). APA PsycTests.

Kabat-Zinn, J., 2006. Mindfulness-based interventions in context: Past, present, and future. Clin. Psychol. 10, 144–156. https://doi.org/10.1093/clipsy.bpg016.

Kerrigan, D., Grieb, S.M., Ellen, J., Sibinga, E., 2018. Exploring the dynamics of ART adherence in the context of a mindfulness instruction intervention among youth living with HIV in Baltimore, Maryland. AIDS Care 30, 1400–1405. https://doi.org/10.1080/09540121.2018.1492699.

Kiken, L.G., Garland, E.L., Bluth, K., Palsson, O.S., Gaylord, S.A., 2015. From a state to a trait: Trajectories of state mindfulness in meditation during intervention predict changes in trait mindfulness. Pers Individ. Differ 81, 4–46. https://doi.org/10.1016/j.paid.2014.12.044.

Kristiansen, C.M., Harding, C.M., 1984. The social desirability of preventive health behavior. Public Health Rep. 99, 384–388.

Levay, K.E., Freese, J., Druckman, J.N., 2016. The demographic and political composition of Mechanical Turk samples. SAGE Open 6, 1–17. https://doi.org/10.1177/2158244016636433.

Luberto, C.M., Shinday, N., Song, R., Philpotts, L.L., Park, E.R., Fricchione, G.L., Yeh, G. Y., 2018. A systematic review and meta-analysis of the effects of meditation on empathy, compassion, and prosocial behaviors. Mindfulness 9, 708–724. https://doi.org/10.1007/s12671-017-0841-8.

Matrajt, L., Leung, T., 2020. Evaluating the effectiveness of social distancing interventions to delay of flatten the epidemic curve of the Coronavirus. Emerg. Infect. Dis. 26 https://doi.org/10.3201/eid2608.201093.

Roberts, K.C., Danoff-Burg, S., 2010. Mindfulness and health behaviors: is paying attention good for you? J. Am. Coll. Health 59, 165–173. https://doi.org/10.1080/07448481.2010.484452.

U.S. Census Bureau (2019). Population. Retrieved from [https://www.census.gov/data.html].

Terraciano, A., McRae, R.R., Costa, P.T., 2010. Intra-individual change in personality stability and age. Journal of Research in Personality.

Wen, L., Sweeney, T.E., Welton, L., Trockel, M., Katznelson, L., 2017. Encouraging mindfulness in medical house staff via smartphone app: a pilot study. Acad. Psychiatry 41, 646–650. https://doi.org/10.1007/s40596-017-0768-3.