# Mindfulness Buffers the Impact of COVID-19 Outbreak Information on Sleep Duration

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**Abstract:** We examine whether a daily mindfulness practice can help people cope better with quarantine during the COVID-19 outbreak. We conducted a study in Wuhan, China between February 20th, 2020 and March 2nd, 2020. We randomly assigned participants to either a daily mindfulness practice or a daily mind-wandering practice. Mindfulness reduced daily anxiety. In addition, the sleep duration of participants in the mindfulness condition was less impacted by the increase of infections in the community compared with participants in the control condition. As the COVID-19 pandemic is ongoing and the number of cases reported in the community increase, our findings offer an evidence-based practice that may help people cope with news about an outbreak in the community.

**Main Text**

The global pandemic of COVID-19 caused by the Corona Virus has led to mass quarantine of communities across the globe. Such initiatives have a negative psychological impact causing stress, anger and confusion (1). Even as we prepare this manuscript the situation is evolving with daily news community outbreaks across the globe. Monitoring the news of daily cases reported is important as it prepares citizens to be aware of a possible outbreak in their community and taking necessary steps to mitigate their risk of infection. However, such news also causes anxiety which in turn may lead to sleep disturbance (2). In combination with isolation that comes from social distancing that is likely to be in place in such communities, people in these communities may experience poor mental health and other deleterious outcomes. The resulting sleep disturbance may end up hampering the immune response (3) that is so vital to fight diseases.

Mindfulness defined as non-judgmental awareness of the present moment (4) has been shown to lead to a number of positive outcomes in many domains such as physical health, mental health and behavioral regulation (5). Mindfulness has also been shown to lead to improved sleep outcomes (6). Based on this evidence, we sought to examine whether a mindfulness intervention would buffer the negative effect of exposure to daily news of confirmed cases on sleep in the backdrop of the COVID-19 outbreak. To examine this question, we recruited volunteers in Wuhan, China that were in the middle of the largest lockdown in human history to prevent the spread of the virus. We conducted a randomized control trial with two treatments over a ten-day period.

We recruited 97 adults ($M_{age}$ = 34.49 years, $SD$ = 5.03 years; 68.04% female) from Wuhan for a study testing effective ways of managing crisis (6). Eligible participants were

residents who were located in Wuhan during the lockdown starting from 23 January 2020 due to the Coronavirus breakout. The study was conducted for 12 days between 20 Feb to 2 March 2020, within a month of the lockdown. Participants were paid 100 RMB (approximately USD 15) upon completing the study. All procedures in the study were in accordance with the ethical standards of the institutional review board at the first author's institution. Informed consent was obtained from all individual participants included in the study. Each participant was assigned a subject ID to keep their identities anonymous.

Participants completed a baseline assessment on Feb 20th 2020 that asked for their demographic information and trait mindfulness a day before the intervention began. We used a design where participants in the mindfulness intervention condition engaged in a 10-minute mindfulness practice each morning and participants in the mind-wandering condition engaged in a 10-minute mind-wandering practice for 10 consecutive days from Feb 21st 2020 to March 1st 2020 (both days included). Each day, participants in both conditions completed a short morning survey that was sent via WeChat App in the morning (8 am) including audio instructions for the practice, a mindfulness manipulation check, sleep quantity, sleep quality, and caffeine intake in the previous day. Participants in both conditions completed a short evening survey (5 pm) that assessed their anxiety levels.

In a between-subjects design, we randomly assigned participants to one of the two 10-day smartphone-based intervention conditions: mindfulness condition or the mind-wandering condition. As all our participants were native Chinese speakers, we used audio instructions in Mandarin that were recorded by a professional mindfulness coach. These instructions were developed based on well-established English mindfulness programs (8). The audio instructions have been used in previous research and were effective in inducing mindfulness and mind-wandering in Chinese populations (9). To ensure that the two programs of the two conditions were comparable, the structure and voice tone of the recording in the mind-wandering condition paralleled those of the mindfulness induction, with two minutes of instruction followed by eight minutes of practice. In mindfulness condition, the audio instructed them to be present focus, aware of what was happening, and acceptance. Participants in the mind-wandering condition listened to instructions of unfocused attention, an induction that elicits baseline wakeful states and that is often used as a baseline condition in mindfulness research. Both of the files are available for researchers to download from the online repository.

Every morning around 8 am, after listening to the audio clip, participants rated their momentary mindfulness on four items on a 7-point Likert scale (1=not at all to 7=Completely) (10). The four items were "I focused on the present'' ''I thought about anything they wanted (reversed coded)", "I let my mind wander freely (reversed coded)", and "I was mindful of the present moment". Participants in the mindfulness condition reported high levels of mindfulness than those in the mind-wandering condition (B = .290, $p < .05$), indicating that our manipulation was successful. We measured sleep quantity with the following question (11). How many hours of *actual sleep* did you get last night? To record the number of confirmed cases in the community in Wuhan each day between 20 Feb to 1 March 2020, we used the official records of Chinese National Health Commission of the People's Republic of China. They update such information on their official website at 8am and 3pm each day. In addition to these measures, we measured anxiety on a 7-point Likert scale ranging from 1(not at all) to 7(completely) in every evening: "I felt anxious today".

Consistent with sleep research, we controlled for variables that may influence sleep quantity: sleep quality and daily caffeine intake (11). We measured sleep quality with an overall item on a 7-point Likert scale ranging from 1(very bad) to 7(very good): "How do you evaluate your night's sleep?". We measured daily caffeine intake with the question: Did you have beverage that contains caffeine (such as coke, coffee, etc.). We controlled for these two variables in predicting sleep quantity.

Furthermore, to check the robustness of our findings, we considered several other factors that were closely relevant to the relationship we predicted such as trait mindfulness, daily cumulative confirmed cases to that date, daily cases of death reported, and sleep quality and quantity on the previous day. Research has shown that poor sleep quality on one night can lead to longer sleep next night (12). Thus, when conducting the robustness check, we included sleep quantity and sleep quality from the previous night (i.e., lagged in time by 1 day), trait mindfulness, daily cumulative confirmed cases to that date, daily cases of death reported as control variables.

Descriptive statistics and intercorrelations are reported in Table 1. Given the nested nature of the data - daily observations nested within individuals, we used a multilevel modeling approach. Specifically, we analyzed the data with random coefficient modeling (13), in which we specified the within-individual-level relationship between the number of daily confirmed cases and sleep quantity as a random slope and used the between-individual-level mindfulness intervention to predict this slope.

To test our research question, we examined whether mindfulness would help people cope with the information about the outbreak in the city. In other words, we tested whether the mindfulness intervention would mitigate the effect of number of daily confirmed cases on sleep quantity. Indeed, as shown in Table 2, the mindfulness intervention positively predicted the random slope between daily confirmed cases and sleep quantity (B = .050, $p < .05$). To further probe into the effect of the mindfulness intervention, we plotted two separate slopes for the mindfulness treatment group and the mind-wandering treatment group. As shown in Figure 1, among people assigned to the mind-wandering treatment, the number of confirmed cases on a day was negatively associated with their sleep quantity on that day (B = -.037, $p < .01$). On average, they lost 39 minutes of sleep with every thousand confirmed cases reported in the city. In contrast, among people assigned to the mindfulness intervention condition, their sleep quantity was unaffected by the number of confirmed cases (B = .013, $p > .10$).

We then conducted a robustness check of results by controlling for trait mindfulness, daily cumulative confirmed cases to that date, daily cases of death reported, and sleep quality and quantity on the previous day. We found that our findings were robust with all these factors controlled for. None of the other factors had the impact on sleep that the number of daily cases reported had. The results of robustness checks can be found in supplementary materials (Table S1).

In addition, we examined whether a mindfulness intervention would lead to reducing anxiety level during 10 days. We conducted a fixed-factor repeated measures ANCOVA with dependent variables as the T1 to T10 measures of daily anxiety, within-subject factor as the time points T1 to T10, between-subject factor as experimental conditions, as well as trait anxiety, age, and gender as covariates revealed a significant between-subject effect of experimental conditions, indicating that daily anxiety level of participants in mindfulness condition was lower

compared to daily anxiety level of participants in mind-wandering condition, $F(1, 92) = 5.07$, $p < .05$, $d = .46$ (Figure 2).

We are in the midst of an unprecedented pandemic. As our ability to disseminate information about the pandemic periodically to the community has increased manifold. This comes with anxiety associated with the consumption of this information on an ongoing basis. Specifically, knowing that the virus is spreading in the community can have a negative impact on people. Given the boredom associated with social isolation and the lockdown many communities are facing, the tendency to ruminate over such information may affect sleep – the very antidote that can restore immunity to protect oneself if one were to catch the virus. Our study shows that a deliberate practice of mindfulness can help people increase the duration of sleep in the midst of the pandemic.

As a policy intervention, we suggest that administrators and citizen welfare groups organize mindfulness groups online where people can come together and engage in a short practice. This also perhaps has the benefit of creating a sense of belonging and mitigating the negative effects of social isolation that people may experience as humanity copes with the epidemic (14).

**References and Notes:**


(1) Brooks, S. K., Webster, R. K., Smith, L. E., Woodland, L., Wessely, S., Greenberg, N., & Rubin, G. J. (2020). The psychological impact of quarantine and how to reduce it: rapid review of the evidence. The Lancet.

(2) Fuller, K. H., Waters, W. F., Binks, P. G., & Anderson, T. (1997). Generalized anxiety and sleep architecture: a polysomnographic investigation. *Sleep*, *20*(5), 370-376.

(3) Irwin, M. (2002). Effects of sleep and sleep loss on immunity and cytokines. *Brain, Behavior, and Immunity*, *16*(5), 503-512.

(4) Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822-848.

(5) Brown, K. W., Ryan, R. M., & Creswell, J. D. (2007). Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychological Inquiry*, *18*(4), 211-237.

(6) We recruited a total of 110 participants. Nine participants dropped out of the study after the baselines study. Three participants did not adhere to the daily morning practice of mindfulness or mind-wandering. One participant was not located in Wuhan. Thus, our final sample consists of 97 participants.

(7) Howell, A. J., Digdon, N. L., & Buro, K. (2010). Mindfulness predicts sleep-related self-regulation and well-being. *Personality and Individual Differences*, *48*(4), 419-424.

(8) Kiken, L. G., & Shook, N. J. (2011). Looking up: Mindfulness increases positive judgments and reduces negativity bias. *Social Psychological and Personality Science*, *2*(4), 425-431.

(9) Schuh, S. C., Zheng, M. X., Xin, K. R., & Fernandez, J. A. (2019). The interpersonal benefits of leader mindfulness: A serial mediation model linking leader mindfulness,

leader procedural justice enactment, and employee exhaustion and performance. *Journal of Business Ethics*, *156*(4), 1007-1025.

(10) Long, E. C., & Christian, M. S. (2015). Mindfulness buffers retaliatory responses to injustice: A regulatory approach. *Journal of Applied Psychology*, *100*(5), 1409-1422.

(11) Lanaj, K., Johnson, R. E., & Barnes, C. M. (2014). Beginning the workday yet already depleted? Consequences of late-night smartphone use and sleep. *Organizational Behavior and Human Decision Processes*, *124*(1), 11-23.

(12) Banks, S., Van Dongen, H. P., Maislin, G., & Dinges, D. F. (2010). Neurobehavioral dynamics following chronic sleep restriction: dose-response effects of one night for recovery. *Sleep*, *33*(8), 1013-1026.

(13) Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods* (Vol. 1). sage.

(14) Lindsay, E. K., Young, S., Brown, K. W., Smyth, J. M., & Creswell, J. D. (2019). Mindfulness training reduces loneliness and increases social contact in a randomized controlled trial. *Proceedings of the National Academy of Sciences*, *116*(9), 3488-3493.

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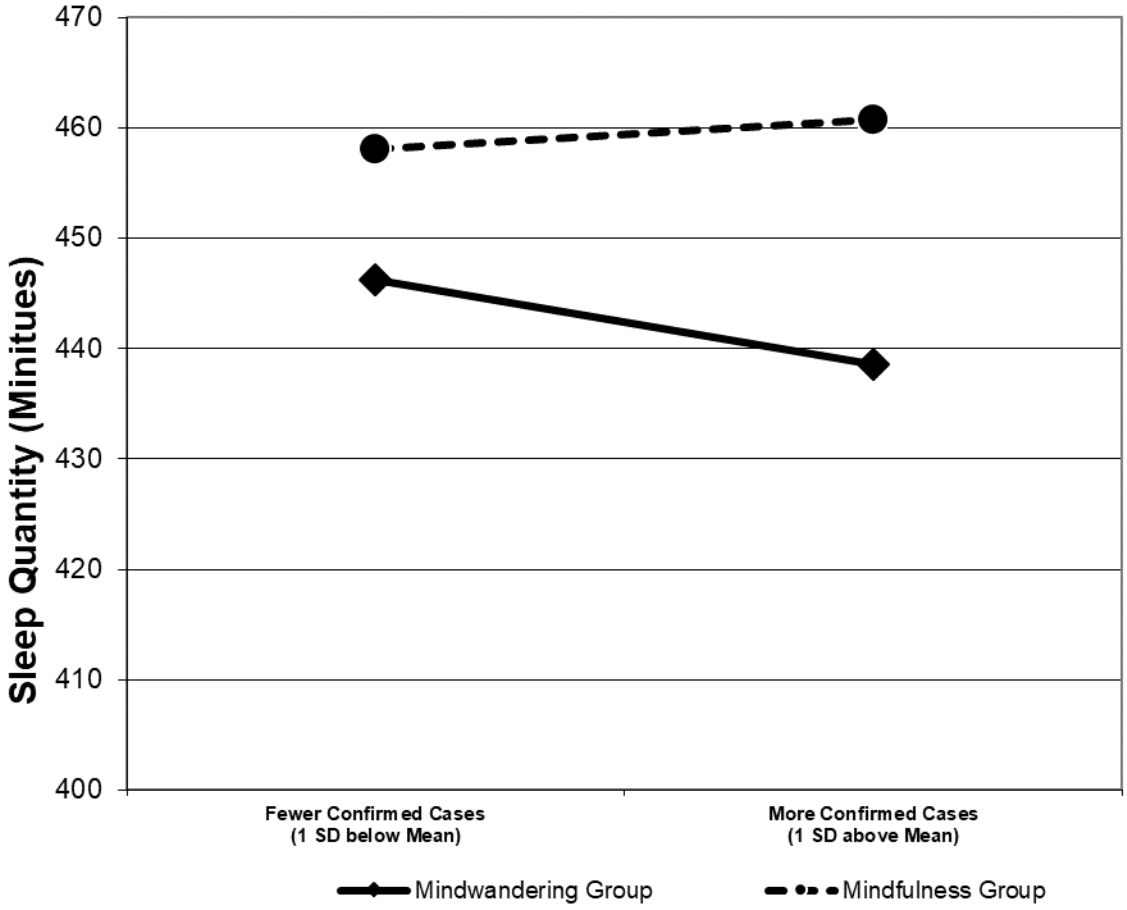


**Fig. 1.** This figure visually depicts how the mindful practice mitigated the relationship between daily confirmed cases and sleep quantity.

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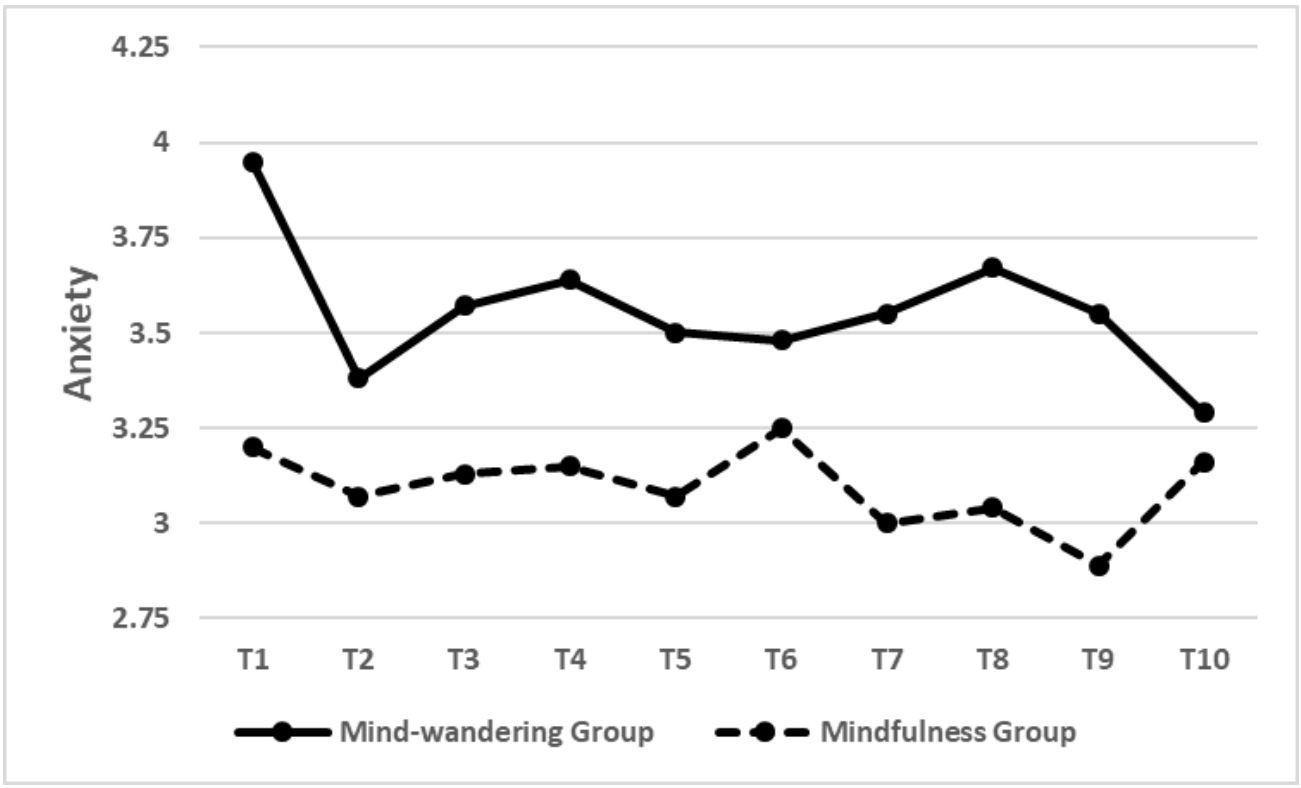


**Fig. 2.** This figure visually depicts the effect of mindfulness intervention on daily anxiety level.

| | *Mean* | *SD* | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.Age | 34.49 | 5.03 | - | | | | | | | | | |
| 2.Gender | 1.67 | 0.47 | .05 | - | | | | | | | | |
| 3.Years live in WH | 27.68 | 11.79 | .43** | .05 | - | | | | | | | |
| 4.Condition | .57 | .50 | .06 | -.22* | -.04 | - | | | | | | |
| 5.Trait Mindfulness | 4.81 | .69 | .06 | .03 | -.20* | .02 | - | | | | | |
| 6.Trait Anxiety | 3.65 | 1.06 | -.18 | .10 | -.06 | -.03 | -.24* | | | | | |
| 7.Daily Anxiety | 3.30 | 1.34 | -.12 | -.07 | -.09 | -.17 | -.23* | .56** | - | | | |
| 8.Sleep Quantity | 460.60 | 57.66 | .05 | -.07 | .14 | .15 | -.20 | -.02 | -.11 | - | | |
| 9.Sleep Quality | 4.67 | .98 | .07 | .05 | .20* | -.04 | .00 | -.37** | -.31** | .31** | - | |
| 10.Caffeine Abstinence | .73 | .36 | .10 | -.07 | -.15 | .08 | .16 | .02 | -.06 | .05 | .01 | - |

**Table 1. Means, Standard Deviations, and Correlations.** *Note.* $n$ =97 participants. Gender: 1 = male, 2 = female. Caffeine Abstinence: 0=taking caffeine, 1= no taking caffeine. Experimental condition: 0 = mind-wandering control group, 1 = mindfulness intervention group. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$. Two-tailed.

| Predictors | DV = Aggregated Sleep Quantity (Minutes) | | DV = Daily Sleep Quantity (Minutes) | | DV = Confirmed Cases-Sleep Quantity Slope | |
|---|---|---|---|---|---|---|
| | Estimate | SE | Estimate | SE | Estimate | SE |
| Intercept | 450.927** | 8.892 | 324.750** | 14.628 | -.012 | .029 |
| *Within-Individual Level* | | | | | | |
| Self-Perceived Sleep Quality | | | 26.409** | 2.232 | | |
| Caffeine Abstinence | | | 8.640 | 6.604 | | |
| *Between-Individual Level* | | | | | | |
| Experimental Condition | 17.000 | 11.671 | | | .050* | .025 |

**Table 2.** This table shows the results of the multilevel regression model. Caffeine Abstinence: 0 = taking caffeine, 1 = no taking caffeine. Experimental condition: 0 = mind-wandering control group, 1 = mindfulness intervention group. $^{**}p < .01$. $^{*}p < .05$.