COVID-19 has been reducing people’s well-being, as shown by a rapid increase in people’s burnout or distress across different countries. Many mental health services aim to help people at the epicenter, following the principle of the ‘ripple effect’ as in the epidemics of severe acute respiratory syndrome and Ebola. Yet, drawing from psychological typhoon eye theory, the unprecedented scale of the COVID-19 pandemic prompts us to suspect that individuals’ well-being might deteriorate over their distance from the epicenter (i.e., the center of an epidemic area). Identifying the vulnerable regions where individuals are more likely to suffer from well-being issues helps direct attention towards the more vulnerable groups during an ongoing pandemic.

To help better screen for such vulnerable groups of people during the COVID-19 crisis, we examine typhoon eye theory and at which conditions it is useful. Specifically, we submit that the typhoon effect was useful among younger adults and those with a certain family status. We sent a survey to 410 working adults staying in various cities in China during 20–21 February 2020. The survey assessed their sex, age, education, family status, job status, location, and the Satisfaction With Life Scale. Among the 308 of those who responded, we used their locations to calculate their distance to Wuhan, the COVID-19 epicenter in China, ranging from 0 to 2126 km. We used multiple linear regression to predict life satisfaction (Table 1).

Women experienced higher life satisfaction than did men (β = 0.30, 95% confidence interval [CI], 0.15 to 0.45; P < 0.001). Adults who worked from home (β = −0.23, 95%CI, −0.42 to 0.15; P = 0.018) or had their work suspended during COVID-19 (β = −0.36, 95%CI, −0.56 to −0.16; P < 0.001) were less satisfied than those who continued working in their workplace.

The association between the distance to the epicenter and life satisfaction depended on age and family status. As illustrated in Figure S1a, this association was less negative among the older adults (β = 0.02, 95%CI, 0.001 to 0.04; P = 0.033). Margin analysis shows that the coefficients were significantly negative for those aged 20 years (β = −0.60, 95%CI, −1.05 to −0.14; P = 0.011), 30 years (β = −0.41, 95%CI, −0.73 to −0.09; P = 0.011), and 40 years (β = −0.22, 95%CI, −0.45 to <0.00; P = 0.048). The association was not significant for those aged 50 years or above.

The negative association between the distance to the epicenter and life satisfaction also depended on family status, as illustrated in Figure S1b. The negative association (i.e., the typhoon eye effect) was significant among singles (β = −0.47, 95%CI, −0.92 to −0.17; P = 0.042) and those married with one child (β = −0.42, 95%CI, −0.72 to −0.12; P = 0.006). The association between the distance to the epicenter and life satisfaction was positive for those who were divorced or widowed (β = 1.02, 95%CI, 0.51 to 1.54; P < 0.001). The association was insignificant for the remaining groups.

Practically, our findings combine geographical and demographic information of participants to help identify vulnerable individuals. We revealed that the typhoon eye effect (i.e., the further people are away from the epicenter, the lower their life satisfaction) was significant only for adults who were younger or had smaller families. Our results suggest that mental health services cannot use the typhoon eye effect as the only geographical information to identify those with low life satisfaction.

This study focuses on a single epicenter, which is often but not always the case for an epidemic. Wuhan was the clear epicenter of COVID-19 in China. Yet, South Korea simultaneously had several epicenters. Future research may explore epidemics with multiple epicenters, exploring the effect of the minimum, median, maximum, or average (weighted by cases) distance from multiple epicenters.

In sum, this study provides insights on using typhoon eye theory and its boundary conditions to identify people more vulnerable to well-being impairment during the COVID-19 pandemic. Our research calls for a more nuanced understanding of how to use geographical and demographic information to identify vulnerable individuals during the COVID-19 pandemic.

Acknowledgment

The data collection was funded by the Chinese National Funding of Social Sciences (Grant number: 1509093).

Disclosure statement

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure.pdf and declare: no support from any organization for the submitted work; no financial relationships with any organizations that might have an interest in the submitted work in the previous 3 years; and no other relationships or activities that could appear to have influenced the submitted work. The authors declare that they have no competing interests.

References

1. Jahanshahi AA, Dinani MM, Madavani AN, Li J, Zhang SX. The distress of Iranian adults during the Covid-19 pandemic: More distressed than the Chinese and with different predictors. Brain Behav. Immun. 2020; 87: 124–125.
2. Sun Y, Bao Y, Lu L. Addressing mental health care for bereaved during COVID-19 pandemic. Psychiatry Clin. Neurosci. 2020; 74: 406–407.
Table 1  Life satisfaction by sex, age, education, family status, marriage status, and the distance to the epicenter

| Variables                        | No. (%) or Mean ± SD | Parameter estimates (95% CI) | P-value |
|----------------------------------|----------------------|-------------------------------|---------|
| Sex                              |                      |                               |         |
| Male                             | 168 (54.5%)          | Refernce                       |         |
| Female                           | 140 (45.5%)          | 0.300 (0.146 to 0.453)         | <0.001  |
| Age (years)                      | 38.50 ± 9.26         | −0.005 (−0.027 to 0.018)       | 0.676   |
| Family status                    |                      |                               |         |
| Single                           | 171 (32.3%)          | Refernce                       |         |
| Married without children         | 15 (2.8%)            | −0.232 (−1.095 to 0.630)       | 0.596   |
| Married with one child           | 177 (33.5%)          | −0.355 (−0.289 to 1.000)       | 0.279   |
| Married with more than one child | 150 (28.4%)          | 0.123 (−0.579 to 0.824)        | 0.731   |
| Divorced/widowed                 | 16 (3.0%)            | −1.238 (−1.864 to −0.611)      | <0.001  |
| Education                        |                      |                               |         |
| Elementary school                | 4 (1.3%)             | Refernce                       |         |
| Middle school                    | 31 (10.1%)           | 0.091 (−0.532 to 0.714)        | 0.774   |
| High school                      | 39 (12.7%)           | 0.149 (−0.457 to 0.754)        | 0.630   |
| Vocational school                | 55 (17.9%)           | 0.287 (−0.331 to 0.906)        | 0.361   |
| Bachelor                         | 119 (38.6%)          | 0.104 (−0.508 to 0.717)        | 0.738   |
| Master                           | 49 (15.9%)           | 0.315 (−0.313 to 0.943)        | 0.324   |
| Doctorate                        | 11 (3.6%)            | 0.546 (−0.134 to 1.227)        | 0.115   |
| Job status                       |                      |                               |         |
| Usual work routine               | 99 (32.1%)           | Refernce                       |         |
| Home office                      | 132 (42.9%)          | −0.231 (−0.422 to −0.039)      | 0.018   |
| Work suspended                   | 77 (25.0%)           | −0.361 (−0.561 to −0.161)      | <0.001  |
| Distance to the epicenter (in 1000 km) | 0.81 ± 0.41         | −1.138 (−1.919 to −0.357)      | 0.004   |
| Distance to the epicenter × Age  |                      | 0.019 (0.001 to 0.036)         | 0.033   |
| Distance to the epicenter × Family status |               |                               |         |
| Distance to the epicenter × Single|                    | 0.826 (−0.110 to 1.761)        | 0.084   |
| Distance to the epicenter × Married without children |     |                               |         |
| Distance to the epicenter × Married with one child | | 0.047 (−0.511 to 0.605) | 0.868 |
| Distance to the epicenter × Married with more than one child | | 0.346 (−0.363 to 1.055) | 0.338 |
| Distance to the epicenter × Others (e.g., divorced/widowed) | | 1.492 (0.825 to 2.160) | <0.001 |

CI, confidence interval.

Supporting information
Additional Supporting Information may be found in the online version of this article at the publisher’s web-site:

Figure S1. (a) Association between distance to the epicenter and life satisfaction by individual’s age. (b) The association between distance to the epicenter and life satisfaction by individual’s family status.

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Received 7 May 2020; revised 27 June 2020; accepted 9 July 2020.