

Encaged and Enraged: A Study of How Level of Aggression Relates to Perceived Crowdedness, Risk, and Boredom

Lap Yan Loⁱ
lylo@hksyu.edu

Wang On Liⁱ
woli@hksyu.edu

ⁱDepartment of Counselling and Psychology, Hong Kong Shue Yan University, Hong Kong, China

Vol. 17/2023

The IJCV

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Suggested Citation:

APA: Lo, L. Y., Li, W. O. (2023). Encaged and enraged: A study of how level of aggression relates to perceived crowdedness, risk, and boredom. *International Journal of Conflict and Violence*, 17 1-11. doi: 10.11576/ijcv-6291

Harvard: Lo, Lap Yan, Li, Wang On. 2023. Encaged and Enraged: A Study of How Level of Aggression Relates to Perceived Crowdedness, Risk, and Boredom. *International Journal of Conflict and Violence* 17: 1-11. doi: 10.11576/ijcv-6291



Encaged and Enraged: A Study of How Level of Aggression Relates to Perceived Crowdedness, Risk, and Boredom

Lap Yan Loⁱ
Wang On Liⁱ

ⁱDepartment of Counselling and Psychology, Hong Kong Shue Yan University, Hong Kong, China

Social distancing policies have been practiced in different regions around the world to minimize the number of cases of COVID-19. After an outbreak in mid-July 2020, the Hong Kong government adopted a series of administrative measures and strongly encouraged residents to stay at home. This lockdown period provided an opportunity to study variations in levels of aggression when people spend more time than usual in an overcrowded living environment. A total of 185 Hong Kong residents were recruited for this study. Their perceptions of the crowdedness of their living space, aggression level (measured using the BPAQ-SF), proneness to boredom (measured by the BFS-SF), and perceptions of risk regarding COVID-19 were collected via online questionnaires. Perceived crowdedness, proneness to boredom, and perceptions of susceptibility to COVID-19 were found to significantly predict the variance of different types of aggression in a regression model. In a mediation analysis, anger acted as a mediator of the relationship between proneness to boredom and different types of aggression. Participants' perceptions of their susceptibility to COVID-19 suggested an underlying worry about the contagiousness of the virus, which was in turn associated with feelings of uncertainty and a rise in aggression level.

Keywords: perceived crowdedness, boredom, risk perception, aggression

Due to the highly contagious nature of COVID-19 and its variants, from 2020 to 2021, people around the world were highly alert to the need to exercise different forms of social distancing measures towards strangers, and even family members, as one of the many practices that minimized the risk of infection. In 2022, individuals in some regions, such as China, were still following strict rules when going out or were barred from leaving their residential areas altogether. On one hand, these measures have successfully reduced the transmission rate of COVID-19. On the other hand, other struggles may arise at home when the personal space of family members is challenged.

Personal space generally refers to the spatial boundaries an individual requires to set himself or herself comfortably apart from others (Hayduk 1983). The concept of personal space can be shaped by culture and environment, starting from early childhood

(Beaulieu 2006; Paulus 2018). Any invasion or crossing of this invisible boundary could result in defensive or aggressive behaviors (Kennedy et al. 2009; Welsch, von Castell, and Hecht 2019). The effects of reduced personal space have been studied in a wide range of contexts (e.g., Galli et al. 2015; Gorrini et al. 2014; Lewis et al. 2017; Molenbroek, Albin, and Vink 2017). For example, passengers in airplanes or on trains may experience adverse emotions, including anger, when placed in a crowded seating environment surrounded by strangers (Evans and Wener 2007; Lewis et al. 2017). There is also a correlation between the degree of invasion of personal space and the likelihood of pedestrians displaying evasive walking patterns (Kim, Choi, and Tay 2014). The concept of personal space is not only found in the physical environment, but also extends to virtual contexts; the concern for personal space shown in a collaborative online context by par-

ticipants in a 2010 study was similar to what they experienced in the physical world, (Nassiri, Powell, and Moore 2010). Neurological research has also discovered a number of processing networks in the brain that suggest personal space has evolutionary significance (Bremmer et al. 2001; Makin, Holmes, and Zohary 2007). In another study conducted in 2014, more activations in the premotor cortex and parietal cortex were found when two human faces were shown close to each other than when cars or circles were presented in the same close proximity to each other (Holt et al. 2014). Besides feeling offended, it has been found that individuals feel stress and discomfort when their personal space is invaded (Szpak et al. 2015). Elevated cortisol levels were found even when strangers occupied seats next to participants in a public transportation study (Evans and Wener 2007). In general, unpleasant feelings are triggered even when personal space is only reduced for a short period of time in one-off situations. Imagine, then, what would happen if one's personal space is constrained for much longer.

A need for personal space is not only observed in humans, but also in other animals. A number of animal studies have found that aggression occurs when animals are kept in overcrowded areas for a long period of time (Beaver 2004; Miczek et al. 2001). Supportive findings are consistently reported across different contexts, including on farms and in animal laboratories (e.g., Bailoo et al. 2018; Jørgensen et al. 2009; Turner, Horgan, and Edwards 2001; Van Loo et al. 2001). All evidence suggests a positive correlation between aggression level and the crowdedness of animals' habitats. One may then ask whether this relationship can also be observed among humans.

In response to COVID-19, governments and medical experts recommended that people stay away from public areas and remain in their own homes as much as possible. The series of policies and advice issued seems to have effectively controlled the rate of infection in Hong Kong, but has also led to some unexpected consequences. An increase in domestic violence has been reported during the pandemic (Bradbury-Jones and Isham 2020; Sacco et al. 2020; H. Zhang 2022). Possible explanations for the rise in familial disharmony focus on a reduction in physical so-

cial connectedness (Deci and Ryan 2012) and the fuzziness of boundaries between work and personal life in a working-from-home environment (Kossek, Lautsch, and Eaton 2006). An overcrowded living environment may also be a contributing factor relating to aggression, a view supported by studies in prisons and psychiatric wards (Lawrence and Andrews 2004; Lester 1990; Ng et al. 2001). Prisoners who felt overcrowded in their cells were found to be more likely to interpret others' behaviors as violent and aggressive (Lawrence and Andrews 2004) and a positive relationship was found between the occupancy level of a psychiatric ward and the occurrence of different aggressive behaviors among patients (Ng et al. 2001). Hong Kong is famous for being overcrowded in terms of living space, with over 7.5 million people living in an area of 1,100 km². The present study speculated that there would be a significant positive relationship between crowdedness and aggression level during the COVID-19 pandemic, given that people had to stay inside for longer than usual in their overcrowded living areas, with other family members, so as to comply with social distancing policies.

1 The Present Study

From 2020 to 2021, many people around the world were strongly encouraged or even forced by social distancing policies to stay at home to work or study. During this period of time, family members spent more time than usual sharing the same living area. Compared with the average living space per person in other developed cities—for example, the average living space in London is 355 square feet per person (Cosh and Gleeson 2020) and that in Manhattan is 393 square feet per person (Kolomatsky 2020)—the average living space in Hong Kong is saliently smaller, around 140–170 square feet per person (W. Zhang 2022). Considering these small and overcrowded living environments shared by all family members, this study set out to develop a self-report measure to validate the relationship between aggression level and the crowdedness of one's living area using a sample in Hong Kong. As well as recording their actual living space, the participants' level of perceived crowdedness was also examined; this is an alternative measure used when examining the relationship between living

space and personal aggression (Lawrence and Andrews 2004).

During periods of lockdown, both the crowdedness of individuals' living spaces and other personal factors may relate to their levels of aggression. The initial stage of the development of vaccinations against COVID-19 provided people with hope, but there were still many uncertainties about the disease and vaccination programs in different corners of the world in those days. Perceptions of susceptibility to and the potential severity of COVID-19 could lead to a sense of uncertainty, which also elevates individuals' aggression levels (Martin et al. 2019). The current study adopted a questionnaire to measure participants' perceived risk of COVID-19 (Kwok et al. 2020), in order to investigate how this perceived risk contributed to variations in aggression level.

During lockdown, people tried to avoid or were forbidden from going out and physically interacting with others. This reduction in normal social interaction could lead to boredom, which may result in a rise in aggression (Dahlen et al. 2004). One study indicates that children who cannot cope with boredom are more likely to engage in bullying at school and in the family (Vasileia et al. 2017). People may also adopt forms of aggression as a way of decreasing monotony (Malkovsky et al. 2012). The present study therefore also speculated that there would be a negative relationship between participants' tolerance of boredom and their level of aggression.

2 Methodology

2.1 Participants

A total of 115 female (mean age = 26.40 years, SD = 6.78) and 70 male (mean age = 28.70 years, SD = 7.56) participants living in Hong Kong were recruited via snowball sampling from 21 August 2020 to 28 September 2020. A month before collecting the data, there was an outbreak of COVID-19 in Hong Kong. The number of confirmed cases rose steadily from dozens of new cases to over a hundred cases in mid-July. During this time, the Hong Kong government adopted different measures to discourage citizens from leaving their homes unnecessarily. Policies included suspending normal classes and strongly recommending that students stay at home and participate in online learn-

ing arranged by their schools. Dine-in catering services ceased from 6 pm until 7 am the next day. Most entertainment venues, including cinemas and sport stadiums, were closed and no social gathering of more than two people was allowed to take place in public. Working from home was also promoted. All citizens were strongly encouraged to stay at home as much as possible and avoid going out to engage in unnecessary social activities.

There were two phases of data collection in this study. The first phase started on 21 August 2020 and ran until 5 September 2020. The second phase started on 10 September 2020 and ran through to 28 September 2020. The first phase began with six initial undergraduate participants. Each of these six participants was asked to pass the questionnaire on to no more than 12 other participants who were also local residents aged over 18. The second phase started with 20 initial participants who were master's students. This group of participants was asked to pass the questionnaire on to no more than six other local adult residents. Both groups of initial participants were encouraged to try to distribute the questionnaires to an equal number of men and women.

2.2 Instruments

The composite questionnaire adopted in this study consisted of four parts: background information, the Buss-Perry Aggression Questionnaire-Short Form (BPAQ-SF: Webster et al. 2013), the Boredom Proneness Scale (BPS-SR: Vodanovich, Wallance, and Kass 2005), and the perceived risk of COVID-19 (Kwok et al. 2020).

Background Information

As well as sex and age, this section asked participants about their living space (in square feet) and the number of cohabitants sharing the same accommodation. All participants lived with their families. The ratio of living space in square feet to the number of cohabitants (including the participant) was calculated for each participant. The ratio was around 146.46 (SD = 74.95). In addition, the background information section of the questionnaire asked about the participants' subjective judgment of the perceived crowdedness of their living space, rated on a seven-point scale

with “1” representing the least crowded and “7” representing the most crowded.

The Buss-Perry Aggression Questionnaire Short Form, BPAQ-SF

The BPAQ-SF is a 12-item questionnaire, with no reverse coded items, measuring the level of different types of aggression (see Appendix 1). Participants were asked to evaluate how accurately each item described them on a five-point scale (from “1” = extremely uncharacteristic to “5” = extremely characteristic). This questionnaire can be used as an overall measure of aggression by adding together the scores for all items. The 12 items can also be divided into four subscales measuring physical aggression (PA: items 1–3), verbal aggression (VA: items 4–6), anger (items 7–9), and hostility (items 10–12). Reliability ranges from 0.71 to 0.92 for the different subscales and versions (Bryant and Smith 2001; Pechorro et al. 2016; Webster et al. 2013).

The Boredom Proneness Scale Short Form, BPS-SR

The BPS-SR is a 12-item questionnaire rated on a seven-point scale (ranging from “1” = strong disagreement to “7” = strong agreement) that has been used to measure proneness to boredom in different studies (e.g., Struk et al. 2015; Vodanovich, Wallance, and Kass 2005; see Appendix 2). It can be divided into two subscales indicating proneness to boredom derived from internal stimulation (items 1–6) and external stimulation (items 7–12). Reliability ranges from 0.74 to 0.89 (Sung, Lee, and Teow 2020; Vodanovich, Wallance, and Kass 2005). However, some studies have reported an exceptionally low reliability score of 0.5 and 0.59 for both subscales (Shaw et al. 2010).

The Perceived Risk of COVID-19

This is a set of five questions concerning perceived susceptibility to (i.e., items 1 and 2) and the potential severity of (the remaining three questions) COVID-19, recently developed by Kwok and colleagues (2020; see Appendix 3). Questions concerning perceived susceptibility are measured on a five-point scale (from “1” = very likely to “5” = very unlikely). The items concerning severity are also measured on a five-point scale (from “1” = very low to “5” = very high). In general, the

scores directly reflect the participants’ beliefs about their susceptibility to and the potential severity of COVID-19.

2.3 Procedures

Participants were recruited via snowball sampling from 21 August 2020 to 28 September 2020. All participants were invited to access a link that led to a questionnaire hosted on Google Drive. All of the items in the questionnaire were mandatory. There were no restrictions regarding the time taken to complete the survey and participants only needed to press a submit button after finishing the whole questionnaire to return their answers.

3 Results and Analysis

Descriptive findings are provided in Table 1. Reliability was checked for the three scales; the Cronbach’s alpha values for the BPAQ-SF and the BPS-SR were 0.85 and 0.71, respectively. For the BPAQ-SF, all subscales positively correlated with the scores of overall aggression level (all p-values were smaller than 0.05). Similarly, both subscales of the BPS-SR were positively and significantly correlated with the overall score for proneness to boredom. Despite the relatively low Cronbach’s value of the risk perception inventory (0.68), which was probably due to its small number of items, positive correlations among perceived susceptibility, perceived severity, and overall perceived risk were all found to be significant.

The analysis process was divided into two parts. First, the relationships between participants’ aggression level; psychological factors, including perceived crowdedness, proneness to boredom, and perceived risk; and background factors, including sex (“0” = female; “1” = male), age (in years), and the ratio of living space to the number of cohabitants, were examined. Second, a regression model was calculated to examine the effects of the predictors on the variance in participants’ aggression levels.

3.1 Sex, Age, and Living Space

On average, male participants ($M = 28.7$) were slightly older than their female counterparts ($M = 26.4$) in this study ($F(1, 183) = 4.59, p < 0.05$). A significant difference was found in overall aggression level among

male and female participants ($F(1, 183) = 10.82, p < 0.01, \eta_p^2 = 0.06$, observed power = 0.91). However, male participants were found to be more aggressive than female participants in relation only to physical aggression, not the other types of aggression measured (PA: $F(1, 183) = 19.87, p < 0.01, \eta_p^2 = 0.10$, observed power = 0.99). Furthermore, no significant correlation was found between either age or living space ratio and aggression (all p -values were larger than 0.05; see Table 2).

3.2 Perceived Crowdedness

Perceived crowdedness was found to be positively correlated with overall aggression level ($r = 0.205, p < 0.05$). Except for the anger subscale, perceived crowdedness was positively correlated with physical aggression ($r = 0.176, p < 0.05$), verbal aggression ($r = 0.193, p < 0.05$), and hostility ($r = 0.205, p < 0.05$). In addition, no significant difference between male and female

participants was found in regard to this attribute ($F(1, 183) = 0.15, p = 0.70$).

3.3 Proneness to Boredom

Overall proneness, as indicated by the BPS-SR total score, was found to be positively correlated with overall aggression ($r = 0.374, p < 0.05$) and the three subscales of the BPAQ-SF (VA: $r = 0.334$; Anger: $r = 0.241$; Hostility: $r = 0.423$; all p -values smaller than 0.05). Similar positive correlation patterns were also found for both subscales of the BPS-SR. No significant difference between male and female participants was found in relation to proneness to boredom ($F(1, 183) = 1.95, p = 0.17$).

3.4 Perceived Risk

In this study, perceived risk refers to perceived susceptibility to and the potential severity of COVID-19. No significant relationship was found between perceived severity and aggression. However, there were

Table 1: Descriptive findings between female and male participants

	Female participants ($N = 115$) M (SD)	Response range	Male participants ($N = 70$) M (SD)	Response range
Age (in years)	26.40 (6.78)	18 - 56	28.70 (7.56)	18 - 65
Ratio of living space (in square feet) to number of cohabitants	147 (83.68)	8 - 500	145.58 (58.39)	55.56 - 333.33
Perceived crowdedness	3.70 (1.56)	1 - 7	3.79 (1.56)	1 - 7
Overall aggression	27.37 (6.96)	12 - 45	31.03 (7.91)	12 - 48
Physical aggression	4.84 (2.02)	3 - 12	6.37 (2.62)	3 - 12
Verbal aggression	7.37 (2.51)	3 - 15	8.07 (2.58)	3 - 12
Anger	7.09 (2.42)	3 - 13	7.71 (2.72)	3 - 15
Hostility	8.08 (2.54)	3 - 15	8.87 (2.72)	3 - 14
Proneness to boredom	42.32 (8.87)	18 - 71	44.07 (7.20)	20 - 59
Proneness to boredom (external)	21.98 (6.08)	8 - 39	23.83 (5.37)	9 - 36
Proneness to boredom (internal)	20.34 (4.82)	9 - 32	20.24 (5.01)	11 - 32
Perceived susceptibility to COVID-19	6.77 (1.69)	3 - 10	6.94 (2.12)	2 - 10
Perceived severity of COVID-19	11.22 (2.25)	7 - 15	11.63 (2.34)	5 - 15

positive relationships between perceived susceptibility and overall aggression ($r = 0.15$, $p < 0.05$), physical aggression ($r = 0.17$, $p < 0.05$), and anger ($r = 0.19$, $p < 0.05$). Similarly, no significant difference between male and female participants was found in relation to either measure (susceptibility: $F(1, 183) = 0.36$, $p = 0.55$; severity: $F(1, 183) = 1.34$, $p = 0.25$).

3.5 Regression Model

A regression analysis was conducted to examine the extent to which participants' sex, age, living space ratio, perceived crowdedness, proneness to boredom, perceived susceptibility to COVID-19, and perceived severity of COVID-19 predicted the variance in their overall aggression levels. As shown in Table 3, a significant model explained 20.4% of the variance ($F(7, 177) = 7.72$, $p < 0.05$, adjusted $R^2 = 0.20$). Other than age, living space ratio, and perceived severity of COVID-19, all of the other variables were significant predictors of the variance in overall aggression. Similar regression analyses were conducted using the physical aggression, verbal aggression, anger, and hostility subscale scores as outcome variables. In general, perceived crowdedness and proneness to boredom were the two major predictors contributing to the variance in most of the subscale scores. Perceived susceptibility was only found to be significant in predicting the physical aggression and anger scores, while participants' sex was only significant in regard to the variation in physical aggression. These findings are consistent with the earlier finding that male participants were more physically aggressive than their female counterparts but did not score higher on the other aggression subscales.

4 Discussion

The present findings generally indicate a positive relationship between perceived crowdedness and aggression. In the regression analysis, proneness to boredom, together with participants' perceptions of their susceptibility to COVID-19, were also found to significantly contribute to the variance in level of aggression.

4.1 Aggression and Space

The predictive role of perceived crowdedness in the current regression model is consistent with findings of previous studies (e.g., Lawrence and Andrews 2004; Ng et al. 2001). Threats to individual space result in the deterioration of a wide range of psychological attributes (e.g., Evans and Wener 2007; Szpak et al. 2015) and a heightened level of aggression (Kennedy et al. 2009; Welsch, von Castell, and Hecht 2019). Perceived crowdedness in one's living environment is also associated with both aggressive and withdrawal behaviors (Regoeczi 2008). Withdrawal behaviors could act as a block that stops the onset of further aggressive actions. During the pandemic, official policies either strongly advised people to stay at home or prevented them from going out. With fewer chances to withdraw from overcrowded living environments, a rise in level of aggression and behaviors in response to crowdedness is foreseeable. The current findings show a positive relationship between perceived crowdedness and variance in level of aggression. However, without a proper pre- and post-test comparison, the mechanism of this effect can only be assumed; further verification with additional empirical evidence is required.

The nonsignificant relationship between perceived crowdedness and anger identified in this study likely occurred because the latter was measured as a dispositional factor. Anger, as measured by the BPAQ-SF, focuses mainly on how likely the respondent is to have a quick temper (e.g., item 7: "I flare up quickly but get over it quickly"). One's temper can be considered to be dispositional (Mitchell 2009), and so is usually stable over time and unlikely to be altered by external context (Harris and Teasdale 2017). These findings may explain the nonsignificant predictive effect of perceived crowdedness, which was derived from living environment, on the variance in anger scores in this study.

Finally, male participants were found to be more aggressive in terms of overall score, which was probably skewed by a huge difference in the scores measuring physical aggression (mean score for male participants: 6.37; mean score for female participants: 4.84), but not in verbal aggression, anger, or hostility.

Table 2: Correlations among the measured variables

	Age	Ratio	PC	OA	PA	VA	Anger	Hos	OB	Bext	Bint	PSu	PSe
Age	1.00	-0.03	-0.01	0.01	0.08	0.02	0.02	-0.09	-0.11	-0.14	-0.03	-0.05	0.01
Ratio		1.00	-0.47*	-0.05	-0.07	-0.02	0.07	-0.12	-0.15*	-0.08	-0.15*	-0.01	0.07
PC			1.00	0.21*	0.18*	0.19*	0.04	0.21*	0.12	0.09	0.10	-0.06	-0.17
OA				1.00	0.69*	0.77*	0.80*	0.71*	0.37*	0.32*	0.25*	-0.15*	0.06
PA					1.00	0.31*	0.52*	0.26*	0.10	0.11	0.04	-0.17*	-0.03
VA						1.00	0.51*	0.46*	0.33*	0.27*	0.25*	-0.06	0.16
Anger							1.00	0.37*	0.24*	0.19*	0.18*	-0.19*	0.04
Hos								1.00	0.42*	0.37*	0.28*	-0.04	-0.01
OB									1.00	0.82*	0.72*	-0.04	0.14
Bext										1.00	0.18*	0.06	0.14
Bint											1.00	-0.13	0.07
PSu												1.00	0.31*
PSe													1.00

Note 1: Ratio=living space ratio, PC = perceived crowdedness, OA = overall aggression, PA = physical aggression, VA = verbal aggression, Hos = hostility, OB = overall proneness to boredom, Bext = proneness to boredom (external), Bint = proneness to boredom (internal), PSu = perceived susceptibility to COVID-19, PSe = perceived severity of COVID-19.

Note 2: * $p < 0.05$.

Table 3: Unstandardized and standardized regression coefficients for the model of overall aggression (N = 185)

Variable	B	SE B	β
Sex (0 = female; 1 = male)	3.04	1.04	0.20*
Age (in years)	0.01	0.07	0.01
Ratio of living space to cohabitants	0.01	0.01	0.09
Perceived crowdedness	0.98	0.37	0.20*
Proneness to boredom	0.30	0.06	0.33*
Perceived susceptibility to COVID-19	-0.64	0.28	-0.16*
Perceived severity of COVID-19	0.23	0.23	0.07

Note: * $p < 0.05$, adjusted $R^2=0.20$. A significant model explained 20.4% of the variance.

4.2 Monotony

Proneness to boredom in this study was found to significantly contribute to the variance in level of aggression in the regression analysis. Boredom has been described as an aversive motivational state (Pfattheicher et al. 2020). It can be triggered by a lack of internal or external stimulation, which elevates one's drive to make changes to the present situation. The means of making such changes may include violent actions toward others (Dahlen et al. 2004; Pfattheicher et al. 2020) or oneself (Wilson et al. 2014). Furthermore, a mediation path has been proposed, in which trait anger is a mediator of the positive relationship between proneness to boredom and aggression (Cao and An 2019). Individuals with a high level of trait anger frequently experience anger in a wide range of contexts, which results in a number of negative affective outcomes (Kassinove et al. 2002). In the State-Trait Anger Inventory measure, trait anger is characterized by individuals having a quick/hot temper (Ode, Robinson, and Wilkowski 2008). Considering that the BPAQ-SF used in this study also measured the extent to which participants had a quick temper, as discussed above, it may therefore be speculated that the level of anger found in this study might also mediate the relationship between proneness to boredom and different aggression levels. Using the Hayes Process v3.5 with a bootstrap sample of 5,000, anger was shown to have significant indirect effects, as a mediator, on the positive relationships between proneness to boredom and verbal aggression (indirect effect: 0.04, SE = 0.011, 95% CI (0.013, 0.057)) and hostility (indirect effect: 0.02, SE = 0.008, 95% CI (0.007, 0.039)). This significant indirect effect suggests an additional perspective is needed to interpret the relationship between proneness to boredom and aggression. Based on this mediation model, being less able to tolerate boredom might directly result in an elevation of aggression level. At the same time, the effect of proneness to boredom might also increase anger levels, which could lead to more aggression. Given that only correlational findings were obtained in this study, further experimental evidence is needed in order to test the mediating effect of a dispositional state of anger on different aggression levels.

Boredom is considered to be a state of inadequate stimulation, whereas solitude is regarded as the state

of being alone. Although there are cultural differences in understanding this psychological state in a social context (Long and Averill 2003), solitude has been found to be effective in enhancing several psychological qualities (Leary, Herbst, and McCrary 2003). During lockdown, most people spent more time than usual at home with family members, which may have resulted in fewer opportunities for solitude and a corresponding deterioration in psychological attributes. Future studies should include a measure of preference for solitude in order to provide a broader perspective on how people handle simultaneous feelings of boredom and the need to be alone during periods of lockdown or similar situations.

4.3 The Highly Contagious Nature of COVID-19

According to the World Health Organization, the fatality rate of COVID-19 among reported cases is about 1% on average based on the accumulated cases (WHO 2022). While this percentage itself may be low compared to the fatality rate of other diseases, such as SARS (11–15%; Department of Communicable Disease Surveillance and Response 2013), the infection rate of COVID-19 is worrying. The findings of the present study suggest participants are concerned about the highly contagious nature of COVID-19. Although there was a significant correlation between participants' perceived susceptibility to and severity of COVID-19, only the former predicted variance in aggression level. The highly contagious nature of COVID-19 could be regarded as a constant threat to everyone in daily life. A high degree of uncertainty is not naturally preferred by human beings (Grupe and Nitschke 2011); resulting unpleasant feelings may be transformed or expressed in an aggressive way. An additional measure or control of participants' tolerance of uncertainty is strongly recommended to be included in future studies of people's perceptions of pandemic situations.

4.4 Limitations of the Current Study

Although participants' aggression levels were found to be related to their perceptions of crowdedness, proneness to boredom, and perceived susceptibility to COVID-19, these findings should still be interpreted with caution. Due to concerns about the unpre-

dictable changes in lockdown policy, control over the types of initial informants and the number of referrals was not well managed in this study. All of the initial participants in the snowball sampling process were undergraduate or master's students, which limited the diversity of the sample. The average age of both female and male participants ranged from 26 to 29 years, with a standard deviation of seven to eight years. This relatively narrow age range suggests that the present findings are not representative of older or younger populations. Furthermore, participants were only asked to report whether they lived with their families, without giving details of their family structure (e.g., whether they lived with parents or their own children). Family structure may moderate the relationships among levels of aggression, perceived crowdedness, proneness to boredom, and perceptions of COVID-19. Future research examining this potential moderating effect with a more diverse sample is therefore warranted.

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Declarations

Funding: There was no funding involved in this manuscript.

Conflict of interest: Authors of this manuscript have no conflict of interest to be declared.

Data availability: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Appendices

Appendix 1: Buss-Perry Aggression Questionnaire Short Form, BPAQ-SF

1. Given enough provocation, I may hit another person.
2. There are people who pushed me so far that we came to blows.
3. I have threatened people I know.
4. I often find myself disagreeing with people.
5. I can't help getting into arguments when people disagree with me.
6. My friends say that I'm somewhat argumentative.
7. I flare up quickly but get over it quickly.
8. Sometimes I fly off the handle for no good reason.
9. I have trouble controlling my temper.
10. At times I feel I have gotten a raw deal out of life.
11. Other people always seem to get the breaks.
12. I wonder why sometimes I feel so bitter about things.

Appendix 2: Boredom Proneness Scale Short Form, BPS-SR

1. It is easy for me to concentrate on my activities.
2. I find it easy to entertain myself.
3. I get a kick out of most things I do.
4. In any situation I can usually find something to do or see to keep me interested.
5. Many people would say that I am a creative or imaginative person.
6. Among my friends, I am the one who keeps doing something the longest.
7. Having to look at someone's home movies or travel slides bores me tremendously.
8. Many things I have to do are repetitive and monotonous.
9. It would be very hard for me to find a job that is exciting enough.
10. Unless I am doing something exciting, even dangerous, I feel half-dead and dull.
11. It seems that the same old things are on television or the movies all the time; it's getting old.
12. When I was young, I was often in monotonous and tiresome situations.

Appendix 3: Risk Perception of the Community toward COVID-19

1. How likely you will be infected?
2. How likely your families will be infected?
3. Seriousness of your possible symptoms caused by COVID-19, if you are infected?
4. Your chance of having COVID-19 cured, if you are infected?
5. Your chance of survival if infected with COVID-19?