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Assessing the psychological condition among general people of Bangladesh during COVID-19 pandemic

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ABSTRACT

COVID-19 has been termed as “coronaphobia” due to the overwhelming negative universal impact. The rapid transmission of the responsible novel coronavirus has compelled the situation worse day by day. Bangladesh is one of the hardest hit countries in this pandemic. This cross-sectional study intended to evaluate the psychological condition among general people of Bangladesh throughout the pandemic. The convenient and snowball sampling technique was applied to collect the responses through rapid online survey. The linear regression models were employed to demonstrate the association between DASS 21 subscales and responses. Respondents were observed with the prevalence of normal depression (38.68%) followed by moderate (21.41%) and severe depressions (16.82%). The prevalence of anxiety and stress among the participants was also normal and moderate. Students and female respondents were observed significantly higher risk of adverse mental health complications. Respondents who were confident and satisfied in their current living place and society were less likely to be affected by mental health complications during the pandemic. Respondents concerned about their earning and mental health were identified with more mental health complications. This study can pave the way for relevant organizations to respond to and prepare for ongoing and future pandemic.

KEYWORDS

Infectious disease; COVID-19; mental health; developing settlement; lockdown

Introduction

On March 11, 2020, The World Health Organization (WHO) declared Coronavirus disease 2019 (COVID-19) as pandemic (Hua & Shaw, 2020; Zhang & Shaw, 2020; Zhong et al., 2020). This infectious disease was first reported in Wuhan, China in December, 2019 (Deng, 2020; Hayat et al., 2020; Hua & Shaw, 2020; Zhang & Shaw, 2020; Zhong et al., 2020). The responsible coronavirus has been rapidly transmitted from China, Europe, the United States, Brazil, and South-East Asia (Johns Hopkins Coronavirus Resource Center, 2020). As of October 16, 2020, the total globally confirmed COVID-19 cases were 39,068,667

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where 1,100,364 were reported dead due to this infectious disease (Johns Hopkins Coronavirus Resource Center, 2020). Along with the morbidity and mortality, many countries' health sectors have struggled to battle against this pandemic (Zhou et al., 2020). Developing countries with the fragile healthcare facilities have botched to cope with the ominous situation (Arshad Ali et al., 2020; Hayat et al., 2020; Lai et al., 2020). Not only the health sector, COVID-19 poses one of the biggest potential threats to all sectors across the world. Countries have followed both therapeutic and non-therapeutic preventive measures to reduce the casualties (Anwar et al., 2020). Thus, this pandemic has become the top socio-economic, behavioral, psychological, governance, and technological issues (Zhang & Shaw, 2020), and it can be considered now as one of the worst disasters in human history which has diverse impact across the world.

During and after any disaster, whether it is pandemic or other disasters, it has been observed the ignorance of psychological impact on both directly and indirectly affected victims (Goldmann & Galea, 2014; Herrman, 2012; Norris et al., 2002; Van Ommeren et al., 2005). Psychological condition of these affected victims may not be treated in the same way which was for physical impact. However, disaster and its consequence on mental health have strong relationship which becomes important field of research (Goldmann & Galea, 2014; Herrman, 2012; Van Ommeren et al., 2005). Historically, infectious diseases like COVID-19 have caused psychological impact on many societies. 600,000 people fled the city of Surat, India in one night during the outbreak of bubonic plague (Ramalingaswami, 2001). Many survivors during Ebola outbreak in the Democratic Republic of the Congo were observed with adverse mental health condition (Roo et al., 1998). 3% populaces suffered from severe depression during Legionnaires Disease outbreak in Japan (Tsuruta et al., 2005). Post-traumatic Stress Disorder (PTSD) was observed in 76% of people during Ebola outbreak in Sierra Leone (Jalloh et al., 2018). In the case of Severe Acute Respiratory Syndrome (SARS) outbreak in Hong Kong, 25.6% of infected people were identified with PTSD and 15.6% had depressive disorders, and some victims suffered from adverse mental health conditions for long time after the infection (Mak et al., 2009). Many non-infected folks also showed significant psychiatric morbidities during SARS outbreak (Sim et al., 2010).

Like other pandemic, COVID-19 has also become one of the utmost poignant infectious diseases in human history. Many countries have enforced lockdown to control the rapid coronavirus transmission. It has not only caused the overwhelming devastation in most sectors around the world, it has also triggered the adverse universal psychological impact termed universally as "coronaphobia" (Dubey et al., 2020). Several studies have already identified the impact of COVID-19 based on national and international perspectives (Dubey et al., 2020; Wang et al., 2020). This ongoing pandemic-induced psychological impact requires urgent response (Wang et al., 2020; Xiang et al., 2020) from not only health sectors but also other organizations.

Bangladesh has become one of the hardest COVID-19 hit countries (Johns Hopkins Coronavirus Resource Center, 2020). As of October 16, 2020, total of 386,086 confirmed COVID-19 cases were detected in this developing country where 5,623 death cases were reported already (Johns Hopkins Coronavirus Resource Center, 2020). It has already crossed China long before, the first affected country, regarding the confirmed number of COVID-19 cases. At this period, the nearest neighboring country India had second largest number of COVID-19 cases after the United States (Johns Hopkins Coronavirus Resource

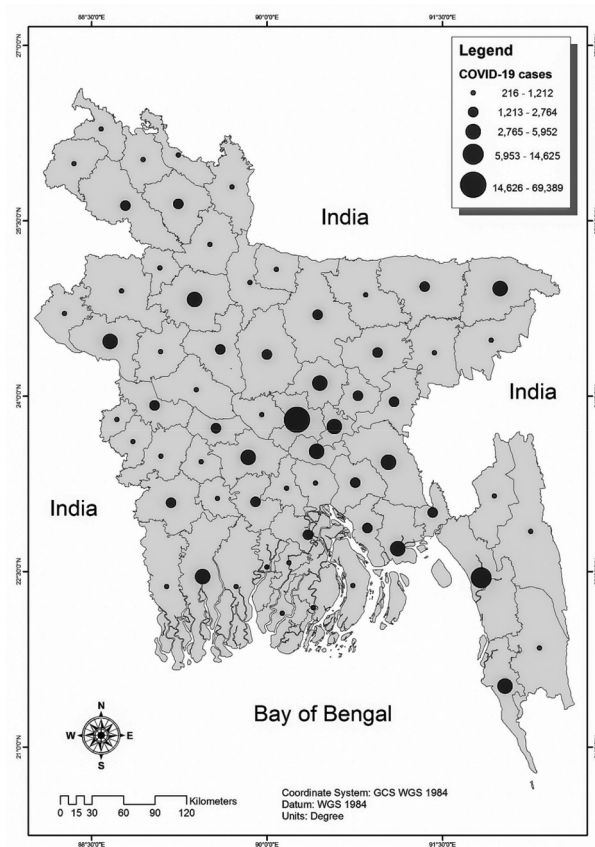


Figure 1. Area wise COVID-19 cases in Bangladesh. This map has been produced based on the COVID-19 cases adopted from Institute of Epidemiology, Disease Control and Research (IEDCR), Bangladesh.

Center, 2020). This pandemic has already been transmitted to all areas of the country (Figure 1). Bangladesh, already with several natural hazards and infectious diseases, is now facing unprecedented catastrophic situations (Ali, 1999; Anwar et al., 2020; Mutsuddy et al., 2019). The adverse impact of this pandemic has already plunged over all sectors across the county. It has faced several emerging challenges such as maintaining social distancing, inadequacy of COVID-19 testing facilities, limited mitigation measures against COVID-19, financial support. Bangladesh declared lockdown from March 26, 2020, to control this pandemic (Anwar et al., 2020). All offices, businesses, and educational institutions were closed. Despite the increased number of cases, Bangladesh lifted the country's lockdown on March 31, 2020, with limited movement and activities. On June 30, 2020, the country observed the highest number of COVID-19 induced mortality and COVID-19 cases (IEDCR, 2020). Several studies have ascertained the ongoing pandemic's impact on the country (Anwar et al., 2020; Mamun & Griffiths, 2020; Sakib et al., 2020). Along with other COVID-19 impacts, psychological impact of this pandemic has emerged as one of the most prominent one (Mamun et al., 2020; Mamun & Griffiths, 2020). A suicide case was associated with the fear of COVID-19 in the country (Mamun & Griffiths, 2020). Study

for psychometric validation of fear of COVID-19 scale identified the prevalence of insomnia, upset, and anger in Bangladeshi people during COVID-19 period (Sakib et al., 2020).

Currently, there is minimal information about the psychological condition during COVID-19 pandemic among Bangladeshi general people. However, this vital information is required to reduce the long-term impact of the pandemic. This study considered the psychological condition among general people of Bangladesh during rapid COVID-19 breakout period based on socio-demographic, socio-economic, physical health, and contact history of the respondents. The outcome of this study may assist the relevant social, non-government and governmental organizations to develop comprehensive response, plans, and strategies to reduce the current and future negative consequences of ongoing COVID-19 pandemic.

Materials and methods

Study design and ethical issues

This cross-sectional study followed self-reported rapid online-based survey method due to the ongoing COVID-19 pandemic in Bangladesh. Many relevant researches have already been applied to self-reported surveys successfully (Basolo et al., 2009; Bourque et al., 2012; Gillani et al., 2020; Nguyen et al., 2006; Rahman et al., 2020; Tan et al., 2017; Wang et al., 2020). This study considered the worst COVID-19 affected capital city Dhaka as the county's epicenter for the pandemic. Psychological condition among the general people of Bangladesh was measured through the association of survey-respondents' socio-demographic information, socio-economic condition, contact history, physical health condition, and prevalence of adverse mental health. This study was approved by the author's department compliance with the university research ethical committee maintaining all ethical issues. University's Institutional Review Board has also approved this study. The objective of the survey was clearly described on the cover page of questionnaire. Participants were also assured that their responses would remain anonymous and confidential, and it would be used only for the research purpose.

Survey instrument

Existing studies relevant to the psychological condition measuring method were reviewed (Alim et al., 2014; Goldmann & Galea, 2014; Lovibond & Lovibond, 1995; Math et al., 2015; Sadiq et al., 2019; Wang et al., 2020). Discussion with both psychological counselor and experts from disaster management field were also considered before pilot and final survey. The final online questionnaire had five main parts considering the ongoing COVID-19 pandemic in Bangladesh: socio-demographic information of the participants, such as age, gender, marital status, current location, living with family, occupation, and educational attainment; socio-economic condition of the participants such as confidence on current place, perception of social life, personal earning source, concerned about earning and concerned about mental health; respondents' physical health condition in the past 14 days; respondents' contact history in the past 14 days and the final part was for the measurement of mental health status following the widely used DASS 21 questions (Alim et al., 2014; Lovibond & Lovibond, 1995; Sadiq et al., 2019; Teh et al., 2015). The

questionnaires were both in original English and valid Bengali translated versions (Alim et al., 2014; Lovibond & Lovibond, 1995) considering both university students and general people of Bangladesh.

Data collection

The convenient and snowball sampling method was applied considering the country's ongoing rapid outbreak of COVID-19. A rapid online survey was conducted from June 6 to June 27, 2020 where many areas of Bangladesh were partially lockdown. The country had to pick COVID-19 cases during this period (IEDCR, 2020). Many offices with minimal activities and all universities campuses were closed. Author's university students were encouraged to disseminate the online survey link through online media platforms such as Facebook, WhatsApp, and E-Mail.

Data analysis

The 'R' software, version 3.6.3 (R Development Core Team, 2019) was applied for all statistical analyses. The linear regression analyses were employed to investigate the association between socio-demographic profile, socio-economic condition, physical health condition, contact history, and DASS subscales. Descriptive statistics (frequency and percentages) were also calculated where required. All statistical analyses considered 95% Confidence Interval (95% CI).

Results

Total 614 respondents participated in this rapid online survey where majority were 22–25 (34.40%) and 18–21 (27.98%) ages. Male (53.06%) and female (46.94%) was close by ratio, most of the participants were married (67.82%) among 289 participants for marital status, majority of the respondents were capital city residents (67.28%) where most of them were with their family (94.50%). Many respondents were university students (55.81%) and employees (30.43%) whereas majority of the respondents were educated.

Table 1 presents the association of participants' socio-demographic profile and DASS subscales. Respondents of 31–40 years age ($Beta = -4.82$, 95% CI: $-8.09; -1.54$) and more than 40 years age ($B = -7.88$, 95% CI: $10.53; -5.23$) were significantly associated with lower depression scores compared to the 18–21 years age respondents. More than 40 years of age respondents were significantly less likely to have anxiety ($B = -4.53$, 95% CI: $-6.58; -2.47$) and stress ($B = -6.38$, 95% CI: $-9.00; -3.75$).

Male respondents were significantly associated with lower depression ($B = -3.74$, 95% CI: $-5.52; -1.95$), anxiety ($B = -3.03$, 95% CI: $-4.38; -1.67$), and stress ($B = 4.81$, 95% CI: $-6.53; -3.09$) scores; unmarried respondents were significantly associated with higher depression ($B = 5.02$, 95% CI: $2.32; 7.72$) and higher anxiety score ($B = 2.62$, 95% CI: $0.46; 4.78$). Residents of outside Dhaka were significantly less likely to have anxiety ($B = -1.55$, 95% CI: $-3.01; -0.09$).

University students were significantly associated with higher depression ($B = 5.46$, 95% CI: $3.48; 7.43$), anxiety ($B = 2.45$, 95% CI: $0.92; 3.98$) and stress ($B = 3.94$, 95% CI: $1.99; 5.89$) scores compared to the employees.

Table 1. Association between the psychological condition of the respondents and their socio-demographic profile during COVID-19 pandemic.

Features	n (%)	Depression		Anxiety		Stress	
		R ²	B* (95% CI)	R ²	B (95% CI)	R ²	B (95% CI)
1. Age (Year)							
(a) 18–21	183 (27.98)		Reference		Reference		Reference
(a) 22–25	225 (34.40)		0.82 (–1.38; 3.02)		0.25 (–1.46; 1.96)		0.48 (–1.71; 2.66)
(a) 26–30	72 (11.01)	0.080	0.36 (–2.72; 3.45)	0.046	1.38 (–1.01; 3.77)	0.048	0.24 (–2.81; 3.30)
(a) 31–40	61 (9.33)		–4.82 (–8.09; –1.54)**		–2.28 (–4.82; 0.25)		–1.70 (–4.95; 1.54)
(a) >40	113 (17.28)		–7.88 (–10.53; –5.23)***		–4.53 (–6.58; –2.47)***		–6.38 (–9.00; –3.75)***
2. Gender							
(a) Male	347 (53.06)	0.025	–3.74 (–5.52; –1.95)***	0.029	–3.03 (–4.38; –1.67)***	0.044	–4.81 (–6.53; –3.09)***
(a) Female	307 (46.94)		Reference		Reference		Reference
3. Marital Status							
(a) Married	196 (67.82)	0.050	Reference	0.020	Reference	0.011	Reference
(a) Unmarried	89 (30.80)		5.02 (2.32; 7.72)***		2.62 (0.46; 4.78)*		2.30 (–0.50; 5.11)
(a) Separated, Divorced	4 (1.38)		8.62 (–2.07; 19.31)		0.76 (–7.76; 9.27)		4.82 (–6.26; 15.89)
4. Current Location							
(a) Dhaka	440 (67.28)	0.003	Reference	0.007	Reference	0.002	Reference
(a) Outside Dhaka	214 (32.72)		–1.49 (–3.41; 0.42)		–1.55 (–3.01; –0.09)*		–1.29 (–3.09; 0.64)
5. Living with family							
(a) Yes	618 (94.50)	0.000	Reference	0.000	Reference	0.000	Reference
(a) No	36 (5.50)		0.15 (–3.79; 4.10)		–0.88 (–3.88; 2.13)		–0.89 (–4.74; 2.96)
6. Occupational Status							
(a) Employee but not student (E)	199 (30.43)	0.056	Reference	0.024	Reference	0.032	Reference
(a) Furlough or laid-off from work due to COVID-19	48 (7.34)		–1.60 (–5.20; 2.00)		–1.46 (–4.25; 1.33)		–1.39 (–4.95; 2.17)
(a) Seeking for Job but not student	42 (6.42)		3.18 (–0.63; 6.98)		0.09 (–2.86; 3.04)		0.92 (1.99; 4.68)
(a) University Student	365 (55.81)		5.46 (3.48; 7.43)***		2.45 (0.92; 3.98)**		3.94 (1.99; 5.89)***
7. Educational Attainment							
(a) PhD	6 (0.92)	0.033	–12.58 (–21.93; –3.23)**	0.017	–6.62 (–13.80; 0.56)	0.018	–9.21 (–18.40; –0.02)*
(a) MPhil	6 (0.92)		–2.24 (–11.59; 7.11)		1.38 (–5.80; 8.56)		1.79 (–7.40; 10.98)
(a) Masters	221 (33.79)		–3.37 (–5.27; –1.47)***		–1.73 (–3.19; –0.27)*		–1.80 (–3.67; 0.06)
(a) Bachelor	406 (62.08)		Reference		Reference		Reference
(a) HSC	10 (1.53)		–4.71 (–11.99; 2.57)		–3.08 (–8.68; 2.50)		–5.74 (–12.89; 1.41)
(a) SSC	4 (0.61)		–9.91 (–21.34; 1.51)		–4.78 (–13.56; 3.99)		–6.04 (–17.27; 5.18)
(a) Under-SSC	1 (0.15)		–15.91 (–38.68; 6.85)		–10.28 (–27.77; 7.20)		–16.54 (–38.91; 5.83)

*Beta; *p < 0.05; **p < 0.01; ***p < 0.001.

In case of educational attainment, PhD respondents were significantly associated with lower depression ($B = -12.58$, 95% CI: $-21.93; -3.23$) and stress ($B = 9.21$, 95% CI: $-18.40; -0.02$) scores where Masters respondents were significantly associated with lower depression ($B = -3.37$, 95% CI: $-5.27; -1.47$) and anxiety ($B = -1.73$, 95% CI: $-3.19; -0.27$) scores.

Table 2 shows the association between respondents' socio-economic condition and DASS subscales. Respondents with the highest confidence on their current living place for COVID-19 demonstrated significant association with lower stress ($B = -6.05$, 95% CI: $-11.88; -0.22$) scores where respondents with the lowest confidence on the current living place showed significant association with higher depression ($B = 4.90$, 95% CI: $2.07; 7.28$), anxiety ($B = 3.88$, 95% CI: $1.72; 6.03$) and stress ($B = 5.92$, 95% CI: $3.18; 8.67$) scores.

In case of perception of social life during pandemic, very satisfied respondents were significantly less likely to have depression ($B = -7.72$, 95% CI: $-11.96; -3.48$) where satisfied respondents were also significantly less likely to have depression ($B = -5.39$, 95% CI: $-7.26; -3.51$), anxiety ($B = -3.59$, 95% CI: $-5.03; -2.15$) and stress ($B = -4.85$, 95% CI: $-6.70; -3.00$).

Part-time job holder respondents during the pandemic were significantly associated with higher depression ($B = 9.78$, 95% CI: $1.52; 18.04$) and stress ($B = 11.12$, 95% CI: $3.02; 19.22$) scores. Respondents who were medium concerned about their earning due to the pandemic were significantly associated with lower depression ($B = -4.02$, 95% CI: $-7.37; -0.66$), anxiety ($B = -3.07$, 95% CI: $5.59; -0.56$), and stress ($B = -3.77$, 95% CI: $-7.03; -0.52$) scores compared to the respondents who showed high concern about their earning. Low concerned respondents showed more significant association with lower depression ($B = -5.27$, 95% CI: $-8.20; -2.33$), anxiety ($B = -4.17$, 95% CI: $-6.37; -1.97$), and stress ($B = -4.58$, 95% CI: $-7.43; -1.74$) scores.

Respondents concerned about their mental health showed significant association between moderately concerned and lower depression ($B = -6.80$, 95% CI: $-8.61; -4.99$), anxiety ($B = -5.69$, 95% CI: $-7.06; -4.32$) and stress ($B = -6.33$, 95% CI: $-8.09; -4.56$) scores compared to the highly concerned respondents about their mental health. Lowly concerned about mental health respondents also showed significant association between with lower depression ($B = -11.40$, 95% CI: $-14.15; -8.64$), anxiety ($B = -8.69$, 95% CI: $-10.77; -6.60$) and stress ($B = -11.93$, 95% CI: $-14.61; -9.26$) scores.

Table 3 presents the association between respondents' physical health condition in the past 14 days and DASS subscales. Respondents experienced confirmed (Yes) and probable (May be) COVID-19 symptoms (fever, fatigue, and dry cough) in past 14 days were significantly associated with higher depression (Yes- $B = 5.51$, 95% CI: $2.80; 8.22$; May be- $B = 5.21$, 95% CI: $2.23; 8.19$), anxiety (Yes- $B = 6.18$, 95% CI: $4.15; 8.21$; May be- $B = 4.62$, 95% CI: $2.38; 6.85$) and stress (Yes- $B = 5.13$, 95% CI: $2.85; 7.77$; May be- $B = 4.85$, 95% CI: $1.94; 7.76$) scores. Infected respondents in past 14 days showed significantly more likely to have anxiety ($B = 6.34$, 95% CI: $0.76; 11.90$).

Table 4 shows the association between respondents' past 14 days contact history and DASS subscale's scores. Respondents who might have close and indirect contact with the confirmed infected person were significantly associated with higher depression (Close contact- $B = 3.58$, 95% CI: $1.31; 5.86$; Indirect contact- $B = 3.49$, 95% CI: $1.53; 5.45$), anxiety (Close contact- $B = 0.88$, 95% CI: $1.77; 5.22$; Indirect contact- $B = 3.13$, 95% CI: $1.65; 4.62$) and stress (Close contact- $B = 1.13$, 95% CI: $0.85; 5.29$; Indirect contact- $B = 3.79$, 95% CI: $1.88; 5.69$) scores. Respondents who had both confirmed and probable contact with

Table 2. Association between the psychological condition of the respondents and their socio-economic condition during COVID-19 pandemic.

Features	n (%)	Depression		Anxiety		Stress	
		R ²	B (95% CI)	R ²	B (95% CI)	R ²	B (95% CI)
1. Confidence on Current Place for COVID-19							
(a) <i>Very Safe</i>	15 (2.29)		-5.58 (-11.60; 0.43)		-3.52 (-8.11; 1.07)		-6.05 (-11.88; -0.22)*
(a) <i>Safe</i>	116 (17.74)		-2.53 (-5.08; 0.00)		-1.66 (-3.60; 0.28)		-2.26 (-4.73; 0.20)
(a) <i>Moderately Safe</i>	251 38.38	0.039	Reference	0.036	Reference	Reference	Reference
(a) <i>Unsafe</i>	186 (28.44)		1.51 (-0.68; 3.70)		1.06 (-0.61; 2.73)		1.72 (-0.40; 3.84)
(a) <i>Very Unsafe</i>	86 (13.15)		4.90 (2.07; 7.28)***		3.88 (1.72; 6.03)***		5.92 (3.18; 8.67)***
2. Perception of Current Social Life							
(a) <i>Very Satisfied</i>	30 (4.59)		-7.72 (-11.96; -3.48)***		-2.07 (-5.33; 1.19)		-3.58 (-7.75; 0.58)
(a) <i>Satisfied</i>	221 (33.79)	0.057	-5.39 (-7.26; -3.51)***	0.035	-3.59 (-5.03; -2.15)***	0.040	-4.85 (-6.70; -3.00)***
(a) <i>Least Satisfied</i>	403 (65.75)		Reference		Reference		Reference
3. Personal Earning Source							
(a) <i>Business</i>	8 (1.22)		Reference		Reference		Reference
(a) <i>Government Job</i>	78 (11.92)		1.81 (-6.57; 10.19)		-0.82 (-7.24; 5.59)		4.85 (-3.38; 13.07)
(a) <i>Private Job</i>	113 (17.28)	0.044	3.76 (-4.49; 12.02)	0.035	2.84 (-3.48; 9.16)	0.031	6.44 (-1.67; 14.55)
(a) <i>Part-time Job</i>	114 (17.43)		9.78 (1.52; 18.04)*		5.28 (-1.04; 11.60)		11.12 (3.02; 19.22)**
(a) <i>No Earning</i>	341 (52.14)		6.54 (-1.54; 14.61)		2.39 (-3.79; 8.57)		7.84 (-0.09; 15.76)
4. Concerned about Earning							
(a) <i>Large</i>	99 (28.95)	0.036	Reference	0.040	Reference	0.030	Reference
(a) <i>Medium</i>	87 (25.44)		-4.02 (-7.37; -0.66)*		-3.07 (5.59; -0.56)*		-3.77 (-7.03; -0.52)*
(a) <i>Low</i>	156 (45.61)		-5.27 (-8.20; -2.33)***		-4.17 (-6.37; -1.97)***		-4.58 (-7.43; -1.74)**
5. Concerned about Mental Health							
(a) <i>Highly</i>	334 (51.07)	0.126	Reference	0.138	Reference	0.133	Reference
(a) <i>Moderately</i>	245 (37.46)		-6.80 (-8.61; -4.99)***		-5.69 (-7.06; -4.32)***		-6.33 (-8.09; -4.56)***
(a) <i>Lowly</i>	75 (11.47)		-11.40 (-14.15; -8.64)***		-8.69 (-10.77; -6.60)***		-11.93 (-14.61; -9.26)***

*p < 0.05; **p < 0.01; ***p < 0.001.

Table 3. Association between respondents' DASS subscale's scores and physical health condition in the past 14 days during COVID-19 pandemic.

Features	n (%)	Depression		Anxiety		Stress	
		R ²	B (95% CI)	R ²	B (95% CI)	R ²	B (95% CI)
1. Symptoms (Fever, Fatigue and Dry cough) experienced							
(a) Yes	81 (12.39)		5.51 (2.80; 8.22)***		6.18 (4.15; 8.21)***		5.13 (2.85; 7.77)***
(a) <i>May be</i>	65 (9.94)	0.036	5.21 (2.23; 8.19)***	0.067	4.62 (2.38; 6.85)***	0.033	4.85 (1.94; 7.76)**
(a) No	508 (77.68)		Reference		Reference		Reference
2. Tested							
(a) Yes	20 (3.06)	<0.000	-0.39 (-5.62; 4.84)	0.000	1.18 (-2.81; 5.16)	<0.000	-0.64 (-5.74; 4.47)
(a) No	634 (96.94)		Reference		Reference		Reference
3. Infected							
(a) Yes	10 (1.53)	0.004	6.01 (-1.32;13.34)	0.007	6.34 (0.76;11.90)*	0.001	(-4.21; 10.08)
(a) No	644 (98.47)		Reference		Reference		Reference

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 4. Association between respondents' DASS subscale's scores and contact history in the past 14 days during COVID-19 pandemic.

Features	n (%)	Depression		Anxiety		Stress	
		R ²	B (95% CI)	R ²	B (95% CI)	R ²	B (95% CI)
1. Close contact with confirmed infected person							
(a) Yes	28 (4.28)		-0.073 (-4.52; 4.37)		1.72 (-3.47; 3.27)		2.21 (-5.36; 3.32)
(a) <i>May be</i>	127 (19.42)	0.015	3.58 (1.31; 5.86)**	0.024	0.88 (1.77; 5.22)***	0.012	1.13 (0.85; 5.29)**
(a) No	499 (76.30)		Reference		Reference		Reference
2. Indirect contact with confirmed infected person							
(a) Yes	54 (8.26)		2.75 (-0.57; 6.06)		1.81 (-0.71; 4.32)		1.50 (-1.72; 4.73)
(a) <i>May be</i>	208 (31.80)	0.020	3.49 (1.53; 5.45)***	0.026	3.13 (1.65; 4.62)***	0.023	3.79 (1.88; 5.69)***
(a) No	392 (59.94)		Reference		Reference		Reference
3. Contact with suspected COVID-19 or infected materials							
(a) Yes	60 (9.17)		4.14 (0.97; 7.32)*		2.95 (0.54; 5.35)*		4.23 (1.14; 7.32)**
(a) <i>May be</i>	210 (32.11)	0.016	2.52 (0.55; 4.48)*	0.027	3.03 (1.54; 4.51)***	0.019	2.79 (0.87; 4.70)**
(a) No	384 (58.72)		Reference		Reference		Reference

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

suspected COVID-19 or infected materials were significantly associated with higher depression (Yes- B = 4.14, 95% CI: 0.97; 7.32; *May be*- B = 2.52, 95% CI: 0.55; 4.48), anxiety (Yes- B = 2.95, 95% CI: 0.54; 5.35; *May be*- B = 3.03, 95% CI: 1.54; 4.51) and stress (Yes- B = 4.23, 95% CI: 1.14; 7.32; *May be*- B = 2.79, 95% CI: 0.87; 4.70) scores.

Discussion

This study identified the prevalence of normal, moderate, and extremely severe depression among the respondents were 38.68%, 21.41%, and 16.82% respectively during the rapid outbreak of COVID-19 in the country. In case of anxiety, prevalence of normal, moderate,

and extremely severe were 49.85%, 19.88%, and 17.12% respectively where 53.06%, 13.30%, and 12.08% of respondents showed the prevalence of normal, mild, and moderate stress. The calculation of severity labels was followed by DASS 21 subscales severity labels (Lovibond & Lovibond, 1995).

In case of pandemic, health workers perform as front-line workers, whereas effective policies, strategies, and robust implications are required to manage the pandemic. For early psychological interventions, health workers need to find out the vulnerable groups based on socio-demographic information (Wang et al., 2020). This study considered the association of the respondents' socio-demographic information with their psychological condition during COVID-19 pandemic. It had the highest number of young respondents due to the accessibility of internet which was the only medium of communication for this study. The results revealed that the young respondents, students, and female respondents had high risk of adverse mental health-related problems during pandemic. These results correspond to the previous studies associating students and female respondents with higher risk of depression, anxiety, and stress (Lim et al., 2018; Teh et al., 2015; Wang et al., 2020). Since March 2020 Bangladesh closed all educational institutions to control the COVID-19 outbreak. This necessary long time shut down could generate adverse effects on student's mental health. They might have experienced uncertainty and potential adverse impact on their study due to the ongoing COVID-19 outbreak. Many universities around the world are conducting online classes. University Grants Commission of Bangladesh (UGC) has also given the directions to all universities to set and start the academic activities online (UGC, 2020). However, along with the regular online classes other strategies such as incorporating online portals, web-based applications into lessons should be adopted to support this vulnerable group regarding adverse psychological effect due to the pandemic (Wang et al., 2020; Zhang et al., 2014). Since, maintaining social distancing is must to control the pandemic, health workers can adopt smartphone-based psychoeducation and psychological interventions to reach this young vulnerable group who usually are highly adept and receptive toward smartphone applications (Do et al., 2018; Wang et al., 2020). Government should have the policy and strategy to reach and support these susceptible young people who are more likely to work as leaders in any kind of country's complications. Universities can also initiate to identify the emerging complications among their students, and then support through different means such as online classes, online counseling, financial support for both internet package and for the deprived students (Rahman et al., 2020).

Regarding female respondents, studies pinpointed hormonal factors were one of the reasons why females were more likely to suffer from depression than their male counterparts (Albert, 2015; Ford & Erlinger, 2004). However, in developing countries like Bangladesh, socio-economic factors need to be considered to understand this association. In this society, females are normally dependent on males and sometimes they experience insecurity in case of any disaster or emergency. Compared to males, females have been identified with more struggles to secure their socio-economic status, which has increased manifold due to the unprecedented COVID-19 situation. Furthermore, this study revealed that depression and anxiety were prevalent among unmarried respondents which supports the previous study (Teh et al., 2015); One of the reasons could be unmarried individuals might not have supporting partner to share or suppress the adverse psychological impact due to the COVID-19. Residents of outside the country's worst COVID-19 affected capital Dhaka (IEDCR, 2020) showed less anxiety compared to the Dhaka city residents. Highly

educated respondents (PhD, masters) were identified with less negative mental health effect compared to the Undergraduate students. One of the probable explanations could be that the Undergraduate students normally have more regular classes which were hampered due to the pandemic, while PhD and Masters students require more research-oriented task than the regular class activities.

The present study postulated strong association between the respondents' socio-economic conditions and adverse mental health during COVID-19 rapid break out. The association between good socio-economic status and lower adverse mental health was also observed in other studies (Cohen & Hoberman, 1983; Cohen & Wills, 1985; Everson et al., 2002; Teh et al., 2015). Both confident and satisfied respondents on their current living place and social life were observed to be less sufferers of adverse mental health during the ongoing pandemic. Respondents concerned about their earning and mental health were observed prevalent of high depression, anxiety, and stress. Social, non-government, and governmental organizations should identify the unsafe areas based on the number of COVID-19 cases and then assist the health workers to reach those areas' susceptible people. Organizations should address effective social buffering and social events maintaining all the precautionary pandemic measures.

This study observed strong association between the respondents with COVID-19 basic symptoms (fever, fatigue, and dry cough) and high depression, anxiety, and stress. This result corresponds to the recent relevant study conducted in China (Wang et al., 2020). Government and pertinent organizations should have strategies for the special treatment of the people with the symptoms. Health workers should also intervene to support psychologically for those affected patients (Wang et al., 2020). The confirmed infected respondents were also observed with the prevalence of high anxiety. This study demonstrated strong relationship between the respondent's confirmed and probable contact history with the infected and suspected COVID-19 individual or materials, and prevalence of adverse mental health during COVID-19 pandemic. Relevant organizations and health workers should track the people who had close and indirect contact with the confirmed and suspected COVID-19 person and materials. This tracking strategy should not only to contain virus, but also to give them psychological aid.

This study had some limitations. Convenient and snowball sampling method was employed considering the ongoing pandemic and country's restriction of movement. Sample size might be small due to this limitation and lack of time and funding. However, the outcome of this exploratory study can assist organizations to plan and to reduce the psychological impact of COVID-19 on general people of Bangladesh. This study considered only Bangladeshi general people; however, other countries can use this study as a baseline and apply the information to effectively respond to ongoing COVID-19 and prepared for any future outbreak.

Conclusion

Bangladesh has become one of the hardest hit countries in COVID-19 pandemic. The "coronaphobia" has spilled over from the health care sector to the socio-economic sectors of this country. Reducing the impact of COVID-19 has become top priority for every sector. Along with the overwhelming impact of this pandemic, psychological condition might be

ignored like any other pandemic. Fast identification of the vulnerable people based on socio-demographic information is required to reduce the long-term psychological impact. Comprehensive approach can be effective where all sectors can work together. Government Organizations need to prepare the strategies and policies to assist health workers for the swift and feasible interventions. Health workers need to track the individuals with disease symptoms and confirmed infection. They also need to track the individuals with contact history to contain not only the virus, but also to have mental support. In addition, social and non-governmental organizations can assist this noble approach through social events maintaining the all government-imposed precautions and guidelines to prevent the breakout.

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References

- Albert, P. R. (2015). Why is depression more prevalent in women? *Journal of Psychiatry & Neuroscience: JPN*, 40(4), 219–221. <https://doi.org/10.1503/jpn.150205>
- Ali, A. (1999). Climate change impacts and adaptation assessment in Bangladesh. *Climate Research*, 12(2–3), 109–116. <https://doi.org/10.3354/cr012109>
- Alim, S. A. H. M., Kibria, S. M. E., Uddin, M. Z., Nessa, M., & Wahab, M. A. (2014). Translation of DASS 21 into Bangla and validation among medical students. *Bangladesh Journal of Psychiatry*, 28(2), 67–70. <https://doi.org/10.3329/bjpsy.v28i2.32740>
- Anwar, S., Nasrullah, M., & Hosen, M. J. (2020). COVID-19 and Bangladesh: Challenges and how to address them. *Frontiers in Public Health*, 8. <https://doi.org/10.3389/fpubh.2020.00154>
- Arshad Ali, S., Baloch, M., Ahmed, N., Arshad Ali, A., & Iqbal, A. (2020). The outbreak of Coronavirus Disease 2019 (COVID-19)—An emerging global health threat. *Journal of Infection and Public Health*, 13(4), 644–646. <https://doi.org/10.1016/j.jiph.2020.02.033>
- Basolo, V., Steinberg, L. J., Burby, R. J., Levine, J., Cruz, A. M., & Huang, C. (2009). The effects of confidence in government and information on perceived and actual preparedness for disasters. *Environment and Behavior*, 41(3), 338–364. <https://doi.org/10.1177/0013916508317222>
- Bourque, L. B., Mileti, D. S., Kano, M., & Wood, M. M. (2012). Who prepares for terrorism? *Environment and Behavior*, 44(3), 374–409. <https://doi.org/10.1177/0013916510390318>
- Cohen, S., & Hoberman, H. M. (1983). Positive events and social supports as buffers of life change stress1. *Journal of Applied Social Psychology*, 13(2), 99–125. <https://doi.org/10.1111/j.1559-1816.1983.tb02325.x>
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310. <https://doi.org/10.1037/0033-2909.98.2.310>
- Deng, C.-X. (2020). The global battle against SARS-CoV-2 and COVID-19. *International Journal of Biological Sciences*, 16(10), 1676–1677. <https://doi.org/10.7150/ijbs.45587>
- Do, T. T. T., Le, M. D., Van Nguyen, T., Tran, B. X., Le, H. T., Nguyen, H. D., Nguyen, L. H., Nguyen, C. T., Tran, T. D., Latkin, C. A., Ho, R. C. M., & Zhang, M. W. B. (2018). Receptiveness and preferences of health-related smartphone applications among Vietnamese youth and young adults. *BMC Public Health*, 18(1), 764. <https://doi.org/10.1186/s12889-018-5641-0>

- Dubey, S., Biswas, P., Ghosh, R., Chatterjee, S., Dubey, M. J., Chatterjee, S., Lahiri, D., & Lavie, C. J. (2020). Psychosocial impact of COVID-19. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(5), 779–788. <https://doi.org/10.1016/j.dsx.2020.05.035>
- Everson, S. A., Maty, S. C., Lynch, J. W., & Kaplan, G. A. (2002). Epidemiologic evidence for the relation between socioeconomic status and depression, obesity, and diabetes. *Journal of Psychosomatic Research*, 53(4), 891–895. [https://doi.org/10.1016/S0022-3999\(02\)00303-3](https://doi.org/10.1016/S0022-3999(02)00303-3)
- Ford, D. E., & Erlinger, T. P. (2004). Depression and C-reactive protein in US adults: Data from the third national health and nutrition examination survey. *Archives of Internal Medicine*, 164(9), 1010–1014. <https://doi.org/10.1001/archinte.164.9.1010>
- Gillani, A. H., Mohamed Ibrahim, M. I., Akbar, J., & Fang, Y. (2020). Evaluation of disaster medicine preparedness among healthcare profession students: A cross-sectional study in Pakistan. *International Journal of Environmental Research and Public Health*, 17(6), 2027. <https://doi.org/10.3390/ijerph17062027>
- Goldmann, E., & Galea, S. (2014). Mental Health Consequences of Disasters. *Annual Review of Public Health*, 35(1), 169–183. <https://doi.org/10.1146/annurev-publhealth-032013-182435>
- Hayat, K., Rosenthal, M., Xu, S., Arshed, M., Li, P., Zhai, P., Desalegn, G. K., & Fang, Y. (2020). View of Pakistani residents toward coronavirus disease (COVID-19) during a rapid outbreak: A rapid online survey. *International Journal of Environmental Research and Public Health*, 17(10), 3347. <https://doi.org/10.3390/ijerph17103347>
- Herrman, H. (2012). Promoting Mental Health and Resilience after a Disaster. *Journal of Experimental and Clinical Medicine*, 4(2), 82–87. <https://doi.org/10.1016/j.jecm.2012.01.003>
- Hua, J., & Shaw, R. (2020). Corona Virus (COVID-19) “Infodemic” and emerging issues through a data lens: The case of China. *International Journal of Environmental Research and Public Health*, 17(7), 2309. <https://doi.org/10.3390/ijerph17072309>
- IEDCR. (2020). IEDCR. <https://iedcr.gov.bd>
- Jalloh, M. F., Li, W., Bunnell, R. E., Ethier, K. A., O’Leary, A., Hageman, K. M., Sengeh, P., Jalloh, M. B., Morgan, O., Hersey, S., Marston, B. J., Dafaie, F., & Redd, J. T. (2018). Impact of Ebola experiences and risk perceptions on mental health in Sierra Leone, July 2015. *BMJ Global Health*, 3(2), e000471. <https://doi.org/10.1136/bmjgh-2017-000471>
- Johns Hopkins Coronavirus Resource Center. (2020). Johns Hopkins Coronavirus Resource Center. <https://coronavirus.jhu.edu/map.html>
- Lai, -C.-C., Wang, C.-Y., Wang, Y.-H., Hsueh, S.-C., Ko, W.-C., & Hsueh, P.-R. (2020). Global epidemiology of coronavirus disease 2019 (COVID-19): Disease incidence, daily cumulative index, mortality, and their association with country healthcare resources and economic status. *International Journal of Antimicrobial Agents*, 55(4), 105946. <https://doi.org/10.1016/j.ijantimicag.2020.105946>
- Lim, G. Y., Tam, W. W., Lu, Y., Ho, C. S., Zhang, M. W., & Ho, R. C. (2018). Prevalence of depression in the community from 30 countries between 1994 and 2014. *Scientific Reports*, 8(1), 2861. <https://doi.org/10.1038/s41598-018-21243-x>
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the beck depression and anxiety inventories. *Behaviour Research and Therapy*, 33(3), 335–343. [https://doi.org/10.1016/0005-7967\(94\)00075-U](https://doi.org/10.1016/0005-7967(94)00075-U)
- Mak, I. W. C., Chu, C. M., Pan, P. C., Yiu, M. G. C., & Chan, V. L. (2009). Long-term psychiatric morbidities among SARS survivors. *General Hospital Psychiatry*, 31(4), 318–326. <https://doi.org/10.1016/j.genhosppsych.2009.03.001>
- Mamun, M. A., Chandrima, R. M., & Griffiths, M. D. (2020). Mother and son suicide pact due to COVID-19-related online learning issues in Bangladesh: An unusual case report. *International Journal of Mental Health and Addiction*, 1–4. <https://doi.org/10.1007/s11469-020-00362-5>
- Mamun, M. A., & Griffiths, M. D. (2020). First COVID-19 suicide case in Bangladesh due to fear of COVID-19 and xenophobia: Possible suicide prevention strategies. *Asian Journal of Psychiatry*, 51, 102073. <https://doi.org/10.1016/j.ajp.2020.102073>
- Math, S. B., Nirmala, M. C., Moirangthem, S., & Kumar, N. C. (2015). Disaster management: Mental health perspective. *Indian Journal of Psychological Medicine*, 37(3), 261–271. <https://doi.org/10.4103/0253-7176.162915>

- Mutsuddy, P., Tahmina Jhora, S., Shamsuzzaman, A. K. M., Kaiser, S. M. G., & Khan, M. N. A. (2019). *Dengue situation in Bangladesh: An epidemiological shift in terms of morbidity and mortality* [Research Article]. *Canadian Journal of Infectious Diseases and Medical Microbiology; Hindawi*, 2019, 1–12. <https://doi.org/10.1155/2019/3516284>
- Nguyen, L. H., Shen, H., Ershoff, D., Afifi, A. A., & Bourque, L. B. (2006). Exploring the causal relationship between exposure to the 1994 Northridge earthquake and pre- and post-earthquake preparedness activities. *Earthquake Spectra*, 22(3), 569–587. <https://doi.org/10.1193/1.2219108>
- Norris, F. H., Friedman, M. J., Watson, P. J., Byrne, C. M., Diaz, E., & Kaniasty, K. (2002). 60,000 disaster victims speak: Part I. An empirical review of the empirical literature, 1981–2001. *Psychiatry: Interpersonal and Biological Processes*, 65(3), 207–239. <https://doi.org/10.1521/psyc.65.3.207.20173>
- R Development Core Team. (2019). *R: A language and environment for statistical computing, version 3.6.1*. R Foundation for Statistical Computing, Vienna, Austria. <https://www.r-project.org/>.
- Rahman, M., Khan, S., Sakib, M., Halim, M., Rahman, M., Asikunnaby, & Jhinuk, J. (2020). COVID-19 responses among university students of Bangladesh: Assessment of status and individual view toward COVID-19. *Journal of Human Behavior in the Social Environment*.
- Ramalingaswami, V. (2001). Psychosocial effects of the 1994 plague outbreak in Surat, India. *Military Medicine*, 166(suppl_2), 29–30. https://doi.org/10.1093/milmed/166.suppl_2.29
- Roo, A. D., Ado, B., Rose, B., Guimard, Y., Fonck, K., & Colebunders, R. (1998). Survey among survivors of the 1995 Ebola epidemic in Kikwit, Democratic Republic of Congo: Their feelings and experiences. *Tropical Medicine & International Health*, 3(11), 883–885. <https://doi.org/10.1046/j.1365-3156.1998.00322.x>
- Sadiq, M. S., Morshed, N. M., Rahman, W., Chowdhury, N. F., Arafat, S. Y., & Mullick, M. S. (2019). Depression, anxiety, stress among postgraduate medical residents: A cross sectional observation in Bangladesh. *Iranian Journal of Psychiatry*, 14(3), 192.
- Sakib, N., Bhuiyan, A. K. M. I., Hossain, S., Al Mamun, F., Hosen, I., Abdullah, A. H., Sarker, M. A., Mohiuddin, M. S., Rayhan, I., Hossain, M., Sikder, M. T., Gozal, D., Muhit, M., Islam, S. M. S., Griffiths, M. D., Pakpour, A. H., & Mamun, M. A. (2020). Psychometric validation of the Bangla fear of COVID-19 scale: Confirmatory factor analysis and rasch analysis. *International Journal of Mental Health and Addiction*. <https://doi.org/10.1007/s11469-020-00289-x>
- Sim, K., Huak Chan, Y., Chong, P. N., Chua, H. C., & Wen Soon, S. (2010). Psychosocial and coping responses within the community health care setting towards a national outbreak of an infectious disease. *Journal of Psychosomatic Research*, 68(2), 195–202. <https://doi.org/10.1016/j.jpsychores.2009.04.004>
- Tan, Y., Liao, X., Su, H., Li, C., Xiang, J., & Dong, Z. (2017). Disaster preparedness among university students in Guangzhou, China: Assessment of status and demand for disaster education. *Disaster Medicine and Public Health Preparedness*, 11(3), 310–317. <https://doi.org/10.1017/dmp.2016.124>
- Teh, C. K., Ngo, C. W., Binti Zulkifli, R. A., Vellasamy, R., & Suresh, K. (2015). Depression, anxiety and stress among undergraduate students: A cross sectional study. *Open Journal of Epidemiology*, 5(04), 260. <https://doi.org/10.4236/ojepi.2015.54030>
- Tsuruta, K., Fujii, Y., Maeda, H., Murakata, T., & Kato, T. (2005). [Mental health status and effects on daily life of patients of a large outbreak of Legionnaires Disease]. [*Nihon Kosshu Eisei Zasshi*] *Japanese Journal of Public Health*, 52(4), 308–318.
- UGC, 2020. www.ugc.gov.bd
- van Ommeren, M., Saxena, S., & Saraceno, B. (2005). Mental and social health during and after acute emergencies: Emerging consensus? *Bulletin of the World Health Organization*, 83, 71–75. <https://doi.org/10.1590/S0042-96862005000100017>
- Wang, C., Pan, R., Wan, X., Tan, Y., Xu, L., Ho, C. S., & Ho, R. C. (2020). Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) epidemic among the general population in China. *International Journal of Environmental Research and Public Health*, 17(5), 1729. <https://doi.org/10.3390/ijerph17051729>

- Xiang, Y.-T., Yang, Y., Li, W., Zhang, L., Zhang, Q., Cheung, T., & Ng, C. H. (2020). Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed. *The Lancet Psychiatry*, 7(3), 228–229. [https://doi.org/10.1016/S2215-0366\(20\)30046-8](https://doi.org/10.1016/S2215-0366(20)30046-8)
- Zhang, H., & Shaw, R. (2020). Identifying research trends and gaps in the context of COVID-19. *International Journal of Environmental Research and Public Health*, 17(10), 3370. <https://doi.org/10.3390/ijerph17103370>
- Zhang, M. W. B., Ho, C. S. H., & Ho, R. C. M. (2014). Methodology of development and students' perceptions of a psychiatry educational smartphone application. *Technology and Health Care*, 22(6), 847–855. <https://doi.org/10.3233/THC-140861>
- Zhong, B.-L., Luo, W., Li, H.-M., Zhang, -Q.-Q., Liu, X.-G., Li, W.-T., & Li, Y. (2020). Knowledge, attitudes, and practices towards COVID-19 among Chinese residents during the rapid rise period of the COVID-19 outbreak: A quick online cross-sectional survey. *International Journal of Biological Sciences*, 16(10), 1745–1752. <https://doi.org/10.7150/ijbs.45221>
- Zhou, F., Yu, T., Du, R., Fan, G., Liu, Y., Liu, Z., Xiang, J., Wang, Y., Song, B., Gu, X., Guan, L., Wei, Y., Li, H., Wu, X., Xu, J., Tu, S., Zhang, Y., Chen, H., & Cao, B. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: A retrospective cohort study. *The Lancet*, 395(10229), 1054–1062. [https://doi.org/10.1016/S0140-6736\(20\)30566-3](https://doi.org/10.1016/S0140-6736(20)30566-3)