

Assessment of fear among the general public of Kerala, India, following a surge of COVID-19 cases

BEENA THAZHACKAVAYAL BABY^{1*}, ASHA ANICHUVATTIL VILSON^{2*},
JESIL MATHEW ARANJANI¹, SAFEEDA EESPINTAKATH³, ARSHA PERUVANTHARA SUDHEER³,
SAM THOMARAYIL MATHEW⁴, VIPIN NAIR⁵ and SINDHU PUTHENPURAKKAL JOSEPH⁶

¹Department of Pharmaceutical Biotechnology, Manipal College of Pharmaceutical Science, Manipal Academy of Higher Education, Udipi, Karnataka 576104; ²St. Theresa's College of Nursing, St. Theresa's Hospital, Bangalore, Karnataka 560010; ³Centre for Professional and Advanced Studies, Mahathma Gandhi University, Kottayam, Kerala 686008; ⁴Independent Medical Communications Expert, Bangalore, Karnataka 560076; ⁵Department of Data Sciences, Manipal Academy of Higher Education, Udupi, Karnataka 576104; ⁶Department of Statistics, Mount Seena College of Arts and Science, Palakkad, Kerala 679302, India

Received November 12, 2021; Accepted March 11, 2022

DOI: 10.3892/mi.2022.34

Abstract. During the initial stages of the coronavirus disease 2019 (COVID-19) pandemic, the community spread of the virus had efficiently been prevented in Kerala, India. The present study aimed to assess fear and its predictors among the general public following the unforeseen surge of COVID-19 cases in July, 2020 using a reliable and validated tool, the 'Fear of COVID-19 Scale', administered through social media. Of 1,100 responses, 1,046 responses were included in the analysis. The majority of the respondents expressed mild fear 44.6%; moderate fear was found in 39.4% of the respondents, severe fear in 13.6% and very severe fear in 2.4% of the respondents. The mean fear score was found to be 15.93±5.81. Statistically significant ($P \leq 0.05$) associations were found between fear and sociodemographic variables, such as age, sex, education and occupation, along with predictors, such as the district of residence, healthcare stakeholders in the family, and the presence of an infected individual in the family. Women and students were found to be the most affected. On the whole, the present study provides sufficient insight into the fear associated with COVID-19. The findings presented herein may enable authorities to take adequate measures to prevent the aftermath.

Introduction

An outbreak of the novel severe acute respiratory syndrome coronavirus 2 (SARS-Cov-2) has been the cause for the coronavirus disease 2019 (COVID-19) pandemic, jeopardizing the global demography by its ferocity, causing acute respiratory disease and rapid human-human transmission (1). Kerala, a southern state of India, has been described as a 'unique' case among developing countries for various reasons. During the initial stages of the pandemic, the state effectively managed to control the spread of COVID-19 infection (Fig. 1); this was greatly appreciated by the World Health Organization (WHO). However, this scenario changed between July and August, 2020 (Fig. 2). Despite the intense measures imposed by the government and support from healthcare professionals, the total number of infections surged considerably. Even though the development of COVID-19 vaccines was successful worldwide, the continuous mutations and new variants are creating an alarming situation across the globe (2-4).

The economy of Kerala is the 9th largest in India, with 110 billion USD in gross state domestic product (GSDP) and a per capita GSDP of 2,900 USD. Kerala has the lowest positive population growth rate in India (3.44%); the highest human development index (HDI; 0.784 in 2018; 0.712 in 2015); the highest literacy rate (96.2%; according to the 2018 literacy survey conducted by the National Statistical Office, India); the highest life expectancy (77 years); and the highest sex ratio (1,084 females per 1,000 males) (5). Kerala is the second least impoverished state in India, according to the Annual Report of Reserve Bank of India published in 2013 (6). The state ranked first in the country to achieve the Sustainable Development Goals according to the annual report of NITI Aayog (The National institution for transforming India) published in 2019 (5). Kerala is considered a model to be emulated, not only by the rest of the country, but also by other developing countries for maintaining high health standards with low levels of per capita income (7; https://en.wikipedia.org/wiki/Economy_of_Kerala).

Correspondence to: Dr Jesil Mathew Aranjani, Department of Pharmaceutical Biotechnology, Manipal College of Pharmaceutical Science, Manipal Academy of Higher Education, Udupi, Karnataka 576104, India
E-mail: jesil.m@manipal.edu; jesilmathew@gmail.com

*Contributed equally

Key words: coronavirus disease 2019, pandemic, fear, community spread, general public, mental health

The rapid outbreak of COVID-19 infection worldwide, which was declared a pandemic, has intensified fear in both infected and uninfected populations globally (8). The National Health Commission of China summoned a call for emergency psychological crisis intervention which was followed by various mental health associations and organizations. Even though the governments claimed ample facilities, reports from China reveal that the rapid transmission of COVID-19 has emerged to pose a serious challenge to the mental health service in China (9).

Research data regarding the response of individuals to the pandemic are necessary to build evidence-driven strategies to reduce adverse psychological impacts and psychiatric symptoms during this period. A study from China reported the anxiety level of individuals; it was found that more than half of the respondents exhibited a moderate to severe psychological impact and more than a quarter had moderate-severe anxiety symptoms; the remainder of the respondents suffered from depression and increased stress levels. The study also reports that women and students are affected by greater psychological impact (10). A similar study conducted among the general population of Saudi Arabia regarding the psychological impact of COVID-19 also demonstrated a similar pattern; 23.6% of cases reported a moderate or severe psychological impact of the outbreak, while 28.3, 24 and 22.3% reported moderate to severe depressive, anxiety and stress symptoms, respectively (11).

The psychological burden on the general public of all countries may be the same, involving anxiety, fear, depression and insomnia. All these factors may have a negative impact on disease control. Patients with symptoms may conceal the disease and abstain from testing, leading to an enhanced transmission, a worsening of the condition and an increased mortality rate (12). Psychological implications, such as the fear and anxiety associated with a pandemic are evident in such situations (13). These emotions appear to exacerbate when the infection is highly contagious and there are no effective treatment options (14). Fear is a natural, adaptive response to a potential threat that enables individuals to overcome danger. However, the extent of the threat, either excessive or moderate, is crucial for determining the positive impact of fear on individuals and society (16). The fear of a pandemic has psychosocial consequences that lead to irrational actions, while reacting to pandemic-related situations (16). Potential negative psychosocial consequences of fear may provide a clear understanding of the social factors and individual thought and behaviour during this COVID-19 pandemic. Throughout the early stage of the COVID-19 outbreak in Saudi Arabia, the results revealed that almost one-fourth of the sampled general population experienced a moderate to severe psychological impact (11). Considering that the sudden surge in COVID-19 cases in Kerala, India had an impact on the prevailing psychosocial situation, the present study investigated the fear of infection among the population in this state in India.

Subjects and methods

Study participants. The present study was a questionnaire-based study using the 'Fear of COVID-19 Scale', a reliable and validated tool used to assess the fear of COVID-19 infection

among the general population (17). The questions were entered into Google forms both in English and Malayalam (the local language of Kerala). A convenient snowball sampling was used to identify and recruit the participants. The potential participants were recruited through personal contacts, religious communities, schools and colleges. The online survey questionnaire was administered through social media platforms, predominantly WhatsApp, between August 13 and 23, 2020. A link to access the Google form was provided through these social media platforms. A period of 3 to 5 days was given for the participants to respond. In the case that the feedback was not received as per the given timelines, the authors contacted such participants via telephone and collected the feedback directly into the Google form. Once the feedback was completed, the authors reconfirmed the same with the authors and shared the Google form with the participants. Verbal and written informed consents were collected from all participants. The confidentiality was maintained throughout data collection coding and analysis. Data were preserved in a password protected system. The present study was an online survey. It was non-experimental and does not involve any sort of intervention, hence no ethical approval was required. It was purely a voluntary survey, and an informed consent was mandatory to participate in the survey. The collected data were analysed anonymously. Parental consent was collected for the underaged participants and the parents conducted the survey for the underaged participants. All ethical concerns of the Helsinki Declaration were followed.

Questionnaire and target population. The 'Fear of COVID-19 Scale' was recently developed and validated in a Turkish population by Ahorsu *et al* (17). The questionnaire used in the present study was based on this scale, and a sample questionnaire is provided as supplementary material (Data S1).

Individuals from all 14 districts of Kerala participated in the survey. All these districts were affected by multiple triple lockdowns, curfew measures and strict invigilation from authorities: The target population was the general public of Kerala, including students. The present study surveyed 1,100 individuals across the state and included only 1,046 who fulfilled the study criteria. The inclusion criteria of the target population were as follows: i) Being a resident of Kerala for the past 6 months and Malayalam was the native language; ii) an age of ≥ 10 years; and iii) the ability to communicate (written or verbal) in English or Malayalam.

The 'Fear of COVID-19 Scale' and statistical analysis. This unidimensional scale consists of seven items. The level of agreement is specified using the five-point Likert scale, with the no. 1 indicating strong disagreement and the no. 5 indicating strong agreement. The factor loadings from the included items range from 0.66 to 0.74, and the correlations of total items range from 0.47 to 0.56, with a Cronbach's alpha internal consistency coefficient of 0.82. The scale has a positive, significant correlation between the total score and depression ($r=0.43$), anxiety ($r=0.51$), perceived infectability ($r=0.48$) and germ aversion ($r=0.46$). The possible maximum and minimum scores are 35 and 7, respectively. The fear score is calculated by totalling individual scores (17). Descriptive statistics were compiled first to describe participant demographics,

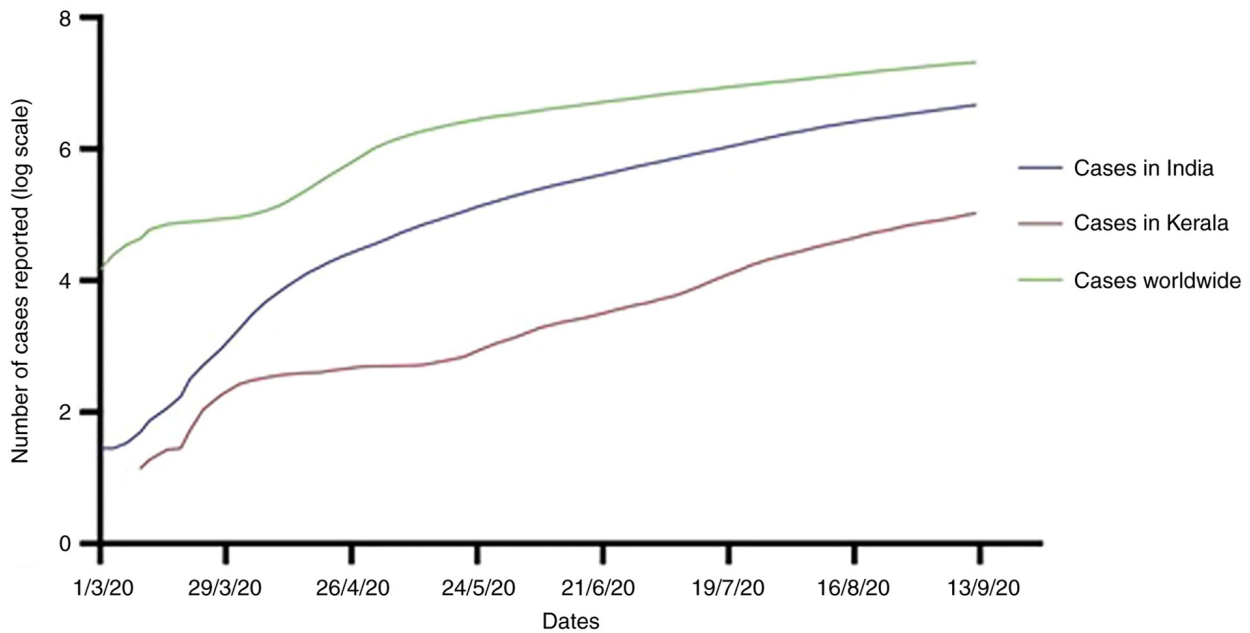


Figure 1. COVID-19 cases worldwide vs. COVID-19 cases in Kerala, India. The graph depicts the trend of cases reported in Kerala in comparison with cases reported in India and worldwide. The graph depicts how Kerala was successful in preventing the pandemic in its initial days. Being the state where the infection was reported for the first time in the country, the efficient health machinery of the state was instrumental to prevent the surge of infection for a considerable time. The data presented in the figure were adapted from: https://www.worldometers.info/coronavirus/?utm_campaign=homeAdvegas1?%20.

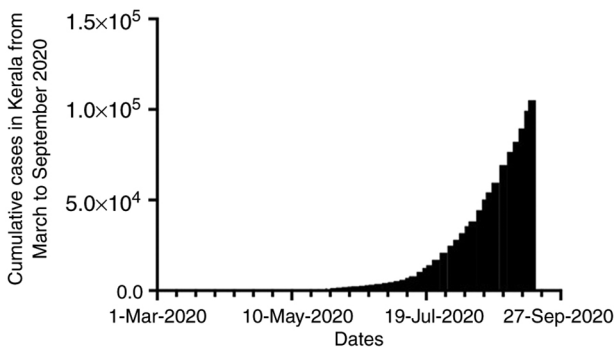


Figure 2. The surge in the number of COVID-19 cases in Kerala (March to September, 2020). The graph shows that the effective control of cases in the initial stages and the surge of cases from July, 2020. Source: The data presented in the figure were adapted from: https://en.wikipedia.org/wiki/Timelineof_the_COVID-19_pandemic_in_India_and_Kerala.

followed by the predictors of fear. The overall level of fear among the participants during the COVID-19 pandemic was estimated using the mean (SD) fear score. A score of 7-14 indicated mild fear, 15-21 moderate fear, 22-28 severe fear, and 29-35 very severe fear. A total of 1,100 individuals were surveyed and from these, 1,046 were selected who met the inclusion criteria. The association between sociodemographic variables, such as age, education, sex, occupation, the type of family and predictors of fear were also analysed. The association between the fear of COVID-19 and the predictors of fear, such as district, the frequency of watching COVID-19 updates on media, COVID-19 infection in the respondent or relatives or family members, family members serving at a hospital or COVID-19 care centre, and whether the living location of the respondent was a containment or red zone were also analysed. The Chi-squared test was used to determine the association

between the factors and the fear of COVID-19. Fisher's exact test was used for the predictors of fear, such as occupation, relatives or friends affected with COVID-19 and the type of residence (districts). All tests were two-tailed, and a value of $P < 0.05$ was considered to indicate a statistically significant difference. Data were analysed using SPSS software (version 17.0; IBM Corp.).

Results

The questionnaire was distributed to 1,100 participants. Of these participants, 54 were excluded as they were not residing in Kerala at the time of the survey. The responses obtained from 1,046 participants were analysed. The respondent characteristics were as follows: Males, 30.9%; and females, 69.1%; mean age, 28.5 ± 12.07 years (SD; range, 10-77 years) (Table I). Of the participants, 45% were graduates and 42.4% were students; 78.1% of the participants belonged to the nuclear family and frequently observed COVID-19 updates; 14.9% had a family member or relative with COVID-19 infection; 2.9% had COVID-19 infection; 22.6% had a relative serving at a COVID-19 prevention and treatment center, and 33.5% were residing in a containment zone (Tables I and II).

Fear of COVID-19. Overall, of the respondents ($n=1,046$), 44.6% had mild fear, 39.4% moderate fear, 13.6% severe fear and 2.4% had very severe fear (Fig. 3).

Residential area. A few districts in Kerala were affected the most, with the residents facing extended stay-at-home orders and multiple lockdowns. A notable predictor of fear of COVID-19 was the area of residence. The categorization was central, south and north Kerala. Fisher's exact test was used to determine the association with the total score of fear. The

Table I. Sociodemographic variables of the respondents in the present study (n=1,046).

Variable	Category	n (%)
Education (based on the Indian education system)	Degree (graduates)	471 (45.0)
	Post-graduation and above	256 (24.5)
	Primary (1-10)	120 (11.5)
	Secondary (11-12)	199 (19.0)
Sex	Female	723 (69.1)
	Male	323 (30.9)
Occupation	Daily wages worker	28 (2.7)
	Healthcare personnel related to COVID-19	36 (3.4)
	Homemaker	53 (5.1)
	Other	79 (7.6)
	Professional	312 (29.8)
	Student	443 (42.4)
	Technician	22 (2.1)
Type of family	Unemployed	73 (7.0)
	Joint	229 (21.9)
Age (years)	Nuclear	817 (78.1)
	10-20	311 (29.7)
	21-40	582 (55.6)
	>40	153 (14.6)

Table II. Predictors of fear of COVID-19 infection (n=1,046).

Questions asked to respondents	Category	n (%)
Do you watch COVID-19 updates on media?	Not at all	40 (3.8)
	Frequently	807 (77.2)
	Rarely	170 (16.3)
	Very rarely	29 (2.8)
Are your family members/relatives affected with COVID-19?	May be	26 (2.5)
	No	864 (82.6)
	Yes	156 (14.9)
Have you tested positive for COVID-19 infection?	No	1,016 (97.1)
	Yes	30 (2.9)
Is any of your family members working in a hospital or COVID care centre?	No	809 (77.3)
	Yes	236 (22.6)
Is/was your residential area a containment or red zone?	No	696 (66.5)
	Yes	350 (33.5)

majority of the participants expressed mild and moderate fear ($P=0.001$). The prevalence of fear in all the groups is provided in Table III. To assess whether fear was associated with the residing area, the respondents were questioned whether they were residing in a containment zone. However, a few residents residing in a non-containment zone also exhibited severe fear compared to those living in a containment zone.

Exposure to COVID-19. The survey also sought responses to whether the respondent or a family member or relative



Figure 3. Fear response of the general public of Kerala regarding fear of COVID-19 infection.

Table III. Association between fear of COVID-19 infection and predictors of fear (n=1,046).

Variable	Type of fear, n (%)				P-value
	Mild	Moderate	Severe	Very severe	
District of residence					
Central Kerala (n=152)	50 (32.9)	75 (49.3)	25 (16.4)	2 (1.3)	0.001 ^a
South Kerala (n=678)	309 (49.2)	285 (37.4)	72 (11.5)	12 (1.9)	
North Kerala (n=266)	108 (40.6)	102 (38.3)	45 (16.9)	11 (4.1)	
Any family members working in a hospital or COVID-19 care centre					
Yes (n=236)	113 (47.9)	99 (41.9)	23 (9.7)	1 (0.1)	0.024 ^a
No (n=810)	354 (43.7)	313 (38.6)	119 (14.7)	24 (3.0)	
Relatives/friends infected with COVID-19					
Perhaps (n=26)	11 (42.3)	12 (46.2)	3 (11.5)	0 (0.0)	0.027 ^a
Yes (n=156)	64 (41)	78 (50)	14 (9.0)	0 (0.0)	
No (n=864)	392 (45.4)	322 (37.3)	125 (14.5)	25 (2.9)	
Watching social media					
Frequently (n=807)	348 (43.1)	323 (40.0)	119 (14.7)	17 (2.1)	0.160
Not at all (n=40)	20 (50)	12 (30)	6 (15)	2 (5)	
Rarely (n=170)	82 (48.2)	68 (40)	16 (9.4)	4 (2.4)	
Very rarely (n=29)	17 (58.6)	9 (31)	1 (3.4)	2 (6.9)	

^aStatistically significant differences (P<0.05).

was exposed to the viral infection. The Chi-squared test was performed to determine the association. Exposure to COVID-19 and fear exhibited a significant association. A lesser percentage of respondents stated that they were exposed to infection (Table III).

Healthcare stakeholder in the family. Overall, 22.6% (236) of the respondents (n=1,046) had a family member or relative serving in a COVID-19 care centre. However, only a small percentage of this group reported having severe fear. More respondents with no healthcare stakeholders in the family had severe fear and very severe fear compared to those with a healthcare stakeholder in the family (P=0.024) (Table IV).

Media exposure. Among the respondents (n=1,046), 96.2% (1,006) had some type of media exposure. Even though the differences were not statistically significant, considering the two categories of respondents with media exposure (respondents who watched media and who did not watch media) regarding COVID-19, interesting results were observed. Among the participants who never observed COVID updates, 15% expressed severe fear, and in the category of frequently watching COVID updates, only 14.7% expressed severe fear (Table III).

Association between fear of COVID-19 and sociodemographic variables. The Chi-squared test was performed to identify the associations between the variables. The age of the participants was significantly (P=0.014) associated with the fear of COVID-19 infection. The majority of the older adults reported

having a mild to moderate fear (82.4%), and a similar pattern was found in respondents aged between 10 to 20 and 21 to 40 years. An almost equal proportion of participants in the age groups of 10 to 20 years and >40 years noted severe fear, and extreme fear was comparatively lesser in the older adult group. Other sociodemographic variables, such as sex, education and occupation also exhibited a significant (P=0.01) association with the fear of COVID-19 infection (Table IV).

As regards the parameter of sex, moderate and severe fear was found in a greater proportion among females, whereas very severe fear was increased in males. The proportion of participants with very severe fear was relatively less, with participants having a higher level of education (1.1% for graduates and 1.2% for post-graduation and above). None of the participants who were unemployed, health professionals related to COVID-19 care, and technicians reported very severe fear (Table IV).

Association between fear of COVID-19 and its predictors. The predictors of COVID-19, area of residence, healthcare stakeholder and the family members or friends affected with the infection were significantly (P=0.001, 0.024 and 0.027, respectively) (Table III) associated with COVID-19.

Discussion

The COVID-19 pandemic has brought about a feeling of fear worldwide, particularly in the marginal and vulnerable segments of society. This fear has created a significant threat to the majority of areas of human life, ranging from the global

Table IV. Association between fear of COVID-19 infection and demographic variables (n=1,046).

Variable	Type of fear, n (%)				P-value
	Mild	Moderate	Severe	Very severe	
Age (years)					
10-20 (n=311)	132 (42.4)	120 (38.6)	51 (16.4)	8 (2.6)	0.014 ^a
21-40 (n=582)	258 (44.3)	243 (41.8)	66 (11.3)	15 (2.6)	
>40 (n=153)	77 (50.3)	49 (32.1)	25 (16.3)	2 (1.3)	
Sex					
Male (n=323)	154 (47.7)	115 (35.6)	40 (12.4)	14 (4.3)	<0.01 ^a
Female (n=723)	313 (43.3)	297 (41.1)	102 (14.1)	11 (1.5)	
Education					
Primary (classes 1-10) (n=120)	40 (33.3)	47 (39.2)	29 (24.2)	4 (3.3)	<0.01 ^a
Secondary (classes 11-12) (n=199)	101 (50.8)	51 (25.6)	34 (17.1)	13 (6.5)	
Graduation (n=471)	202 (42.9)	202 (42.9)	62 (13.2)	5 (1.1)	
Post-graduation and above (n=256)	124 (48.4)	112 (43.8)	17 (6.6)	3 (1.2)	
Occupation					
Professional (n=312)	137 (43.9)	143 (45.8)	31 (9.9)	1 (0.3)	<0.001 ^a
Technician (n=22)	11 (50.0)	4 (18.2)	7 (31.8)	0 (0.0)	
Student (n=443)	195 (44.0)	174 (39.3)	60 (13.5)	14 (3.2)	
Daily wages worker (n=28)	5 (17.9)	7 (25.0)	11 (39.3)	5 (17.9)	
Homemaker (n=53)	23 (43.4)	17 (32.1)	11 (20.8)	2 (3.8)	
Health personnel-related to COVID-19 care (n=36)	20 (55.6)	15 (41.7)	1 (2.8)	0 (0.0)	
Unemployed (n=73)	35 (47.9)	24 (32.9)	14 (19.2)	0 (0.0)	
Other (n=79)	41 (51.9%)	28 (35.4%)	7 (8.9%)	3 (3.8%)	

^aStatistically significant differences (P<0.05).

economy to the daily life of the general public (18). Fear has both positive and negative dimensions. Adaptive fear can bring about changes in the behaviour of individuals, such as complying with instructions given by the authorities to avoid infection. Fearlessness can be a contributing factor to the rapid spread of infection.

The sociodemographic profile of the present study was similar to that of a Turkish study on the fear of COVID-19 infection and its association with career anxiety, in which the study population comprised predominantly of women, and the age of the participants ranged from 18 to 64 years (19). However, the sociodemographic profile of the present study was in contrast to that of a study from Bangladesh on the fear of COVID-19 infection, and its relation to career anxiety, in which the study population comprised 54.7% males and 45.3% females (18). Overall, in the present study, the majority of the respondents (84%) had only mild or moderate fear; 13.6% of respondents reported severe fear, and 2.4% had very severe fear (18).

Nguyen *et al* (20) used the same fear of COVID-19 scale to associate the health literacy and fear of COVID-19 of the medical students in China. Their study reported a lower fear of COVID-19 scores [coefficient B, -0.06; 95% confidence interval (95% CI), -0.08, -0.04; P<0.001], indicating that a higher health literacy was associated with lower fear of COVID-19 (20). Therefore, the major proportion of participants experiencing

mild to moderate fear of COVID-19 in the present study may be attributed to higher literacy rate in Kerala and to the efforts of the government and the media to educate the public about the pandemic during the global crisis.

In the present study, moderate and severe fear were significantly higher in females (41.1 and 14.1%, respectively) than in males (35.6 and 12.4%, respectively), whereas very severe fear was higher in males (4.3%) than in females. This sex difference is in line with a previous Spanish study on the fear of COVID-19 infection among common individuals (21). The findings of the present study suggested that the COVID-19 pandemic caused more psychological effects in women, which is in line with the study by Monteiro *et al* (22). Sex can be one of the factors that affect the health and disease status of individuals. Women seem to adapt better to environmental stress factors and thus typically have long-life expectancy, although they are vulnerable to various physical stressors and become ill more often (23). The frequent illness in women compared to men may be responsible for the higher levels of the fear of COVID-19 infection among females (24). The increased mortality from COVID-19 infection among males appears to be a contributing factor for the higher rate of severe fear in the male population.

Elderly individuals are perceived to have lesser control over their environment than others, which may adversely affect the coping mechanisms (22). However, the findings of the present

study are contradictory to this previous scientific report. In the present study, younger adults and students had an increased fear compared to older adults during the pandemic. This may be due to the increase in mental strength among individuals as they grow older, and the significantly decreasing ability to face difficult situations in younger individuals.

In the present study, significant associations were found between the fear of COVID-19 infection and age, sex, education, occupation and the place of residence. Fear appeared to increase with a decrease in the education level; in the severe fear group, individuals with a primary level education had an increased prevalence of fear compared to those with post-graduate level. However, there was no pattern in the mild or moderate fear group, which consisted of the majority of respondents.

The present study demonstrated that none of the 3.4% healthcare stakeholders had a severe fear of COVID-19 infection, in contrast to a previous study among Chinese healthcare providers, who were reported being under anxiety while managing the pandemic situation (25).

In addition, another study from the Hubei Province of China reported that the majority of the healthcare professionals experienced symptoms of depression, anxiety and insomnia during the pandemic (25,26).

This pattern was consistent with responses regarding family members working in the frontline of COVID-19 prevention and treatment. The findings shed light on the dedicated and selfless of healthcare providers. Literacy is a foundational feature of the culture of Kerala. The study by Marrone *et al* (7) reported that on the basis of UNESCO, the state has achieved total literacy, with >85% adult population being educated.

Literacy, particularly female literacy, has been an essential facilitator of Kerala's achievements in health and demographic changes, particularly during the COVID-19 pandemic. The high literacy rate and excellent healthcare system helped reduce panic among citizens during the pandemic, thus helping manage fear to a certain extent (7).

In the present study, the findings suggested a strong association between the fear of COVID-19 infection and the area of residence (district). The residents of the majority of affected districts had a higher percentage of fear in the moderate and severe fear categories. It was found that individuals residing in highly affected areas exhibited increased fear compared to those residing in less affected areas. This finding indicates a possible shift in severity of fear from mild to moderate to severe with the worsening situation. The current situation of fear among people of the state is concerning, implying a need for more attention to the psychological needs of the state's population.

Currently, the media is associated with an information 'explosion', and the majority of information lacks authenticity. In the present study, the majority of individuals reporting having severe fear never or rarely frequently observed media updates on COVID-19. This finding suggests a positive impact of media exposure in reducing the fear of COVID-19 in Kerala, which is in line with the findings of a Chinese study. In their study on university students, Lin *et al* (27) investigated the impact of the media and found that the media was a useful tool which may be used to put forth health-related messages, which contributes to improved

psycho-behavioural responses to COVID-19 situations (27). Another study from Pakistan demonstrated however, that the media was not effective in educating individuals during the pandemic, and the authors suggested that the electronic media in Pakistan and did not comprise medical experts (28).

The digital media play an increasingly significant role in communicating information and news to the population (29). It plays a prominent role in creating or reducing fear among the public during the pandemic. However, at a certain point in time, the media became coronavirus info-demic. Social media may also undermine situations by under-reporting and diverting current concerns toward other topics, possibly leading to social disobedience. Unauthentic news and stories may cause panic among viewers and reduce the ability to bravely face a concerning situation (30). The failure of state authorities to manage fear among citizens may lead to significant public harm. In this situation, fear as a positive dimension may aid in the understanding of and in the effective management of the disease risk. On the contrary, fear as a negative dimension can cause panic and anxiety when the perceived risk has characteristics that are feared. Authorities may face challenges managing such a complex situation. Stress in the general population may worsen the ability to comprehend simple messages. Vulnerable individuals may be the most affected, with scientific information possibly increasing fear among the population (29). In the present study, the majority of individuals reported mild to moderate fear, with only a small percentage of the responders reporting severe fear. These findings may suggest the success of efforts undertaken by authorities and media in communicating pertinent information and instructions regarding the pandemic. However, the lack of fear of pandemic among the residents of Kerala and negligence in preventing the community spread may have contributed to the surge in cases of COVID-19, from July, 2020. Appropriate psychological interventions need to be provided to vulnerable groups of women and students affected by the fear of COVID-19 infection.

To the best of our knowledge, this is the first effort to document the psychological impact of the COVID-19 pandemic on a representative sample of the general public from Kerala in India. However, there are several limitations to the present study. Although the sample size was adequate to prove the hypothesis, samples from categories, such as those affected by the infection were insufficient. It was highly challenging to obtain a heterogeneous population comprising all the categories of the society. The present study analysed social variables related to the pandemic, but did not investigate the familial information, such as income and religion, of participants. Additionally, responses toward the use of masks and sanitizers, as well as following social distancing, could not be included in the study. The study findings may be used to compare the fear of COVID-19 infection among other states of India. Investigating the reason for fearlessness using scientific and statistical tools may be beneficial.

In conclusion, the COVID-19 pandemic has affected the entire globe and has shown the need for the integration of three major aspects of the mental health of the public, namely interventions to improve mental health, mental health readiness to face a pandemic, and an emergency crisis management plan.

The rapid spread of the COVID-19 pandemic in Kerala after July, 2020 has warranted an introspection of strategies to prevent infection. The lack of fear among the general public has both positive and negative dimensions during this global tragedy. On the one hand, fear may be a contributory factor for the surge of cases. On the other hand, the long-lasting pandemic situation and onerous measures, such as lockdown and stay-at-home orders have not significantly affected the mental health of the general public. The findings of the present study may be helpful for the local government authorities to prevent further spread of infections or to face similar future challenges.

The present study underlines the importance of studying the mental health implications of the pandemic to help reduce its impact on society. Published reports from China describe the implementation of the psychological interventions to alleviate the negative impacts, including the fear of COVID-19 (31,32). It may be advantageous to follow these recommendations by other countries; however, in some instances, this demands studies that are specifically conducted in that geographical region.

From a global perspective, the current literature lacks sufficient data on the fear among the general public from developed countries, particularly from Europe. Performing adequate research and developing data on the current mental health situation of the public may be helpful in successfully fighting the current pandemic and future pandemics worldwide. Owing to the lack of data from developed countries and considering the sociodemographic and financial similarity of Kerala with developed countries, the findings of the present study may be considered an initial lead for further assessing the psychological impact of the general public in developed countries.

Acknowledgements

Not applicable.

Funding

No funding was received.

Availability of data and materials

The datasets generated during and or analysed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

BTB, AAV, SE and APS were involved in the conception of the study. JMA, STM, VN, SPJ, AAV and BTB were involved in the study design and analysis. BTB and AAV wrote and drafted the manuscript. STM and JMA revised and edited the manuscript. BTB, AAV, SE and APS were involved in data collection and management. BTB and AAV confirm the authenticity of all the raw data. All authors have read and approved the final manuscript.

Ethics approval and consent to participate

Verbal and written informed consents were obtained from the participants. The confidentiality was maintained throughout the

data collection coding and analysis. Data were preserved in a password protected system. None of the identifying details of the participants are published in the manuscript. For the under-aged participants the consent was obtained from the parents.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

1. Sidiropoulou P, Docea AO, Nikolaou V, Katsarou M, Spandidos DA, Tsatsakis A, Calina D and Drakoulis N: Unraveling the roles of vitamin D status and melanin during COVID-19 (Review). *Int J Mol Med* 19: 92-100, 2021.
2. Calina D, Hartung T, Docea AO, Spandidos DA, Egorov AM, Shtilman MI, Carvalho F and Tsatsakis A: COVID-19 vaccines: Ethical framework concerning human challenge studies. *Daru* 28: 807-812, 2020.
3. Calina D, Hernández AF, Hartung T, Egorov AM, Izotov BN, Nikolouzakis TK, Tsatsakis A, Vlachoyiannopoulos PG and Docea AO: Challenges and Scientific Prospects of the Newest Generation of mRNA-Based Vaccines against SARS-CoV-2. *Life (Basel)* 11: 907, 2021.
4. Kostoff RN, Kanduc D, Porter AL, Shoenfeld Y, Calina D, Briggs MB, Spandidos DA and Tsatsakis A: Vaccine- and natural infection-induced mechanisms that could modulate vaccine safety. *Toxicol Rep* 7: 1448-1458, 2020.
5. NITI Aayog: Sustainable Development Goal (SDG) India. Index and Dashborad. NITI Aayog, New Delhi, 2019. <https://www.niti.gov.in/sites/default/files/2020-07/SDG-India-Index-2.0.pdf>. Accessed March 20, 2021).
6. Reserve Bank of India: Reserve Bank of India Annual Report 2013-2014. Reserve Bank of India, Kolkata, 2013. www.rbi.org.in.
7. Marrone P: *Chambers, RT. Etica e Politica* 15: 583-605, 2013.
8. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, Liu L, Shan H, Lei CL, Hui DSC, *et al.*: Clinical characteristics of coronavirus disease 2019 in China. *N Engl J Med* 382: 1708-1720, 2020.
9. Li W, Yang Y, Liu ZH, Zhao YJ, Zhang Q, Zhang L, Cheung T and Xiang YT: Progression of mental health services during the COVID-19 outbreak in China. *Int J Biol Sci* 16: 1732-1738, 2020.
10. Wang C, Pan R, Wan X, Tan Y, Xu L, Ho CS and Ho RC: Immediate psychological responses and associated factors during the initial stage of the 2019 coronavirus disease (COVID-19) Epidemic among the general population in China. *MDPI. Int J Environ Res Public Health* 17: 1729, 2020.
11. Alkhamees AA, Alrashed SA, Alzunaydi AA, Almohimeed AS and Aljohani MS: The psychological impact of COVID-19 pandemic on the general population of Saudi Arabia. *Compr Psychiatry* 102: 152192, 2020.
12. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, Zhang L, Fan G, Xu J, Gu X, *et al.*: Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 395: 497-506, 2020.
13. Thankam FG and Agrawal DK: Molecular chronicles of cytokine burst in patients with coronavirus disease 2019 (COVID-19) with cardiovascular diseases. *J Thorac Cardiovasc Surg* 161: e217-e226, 2021.
14. Serafini G, Parmigiani B, Amerio A, Aguglia A, Sher L and Amore M: The psychological impact of COVID-19 on the mental health in the general population. *QJM* 113: 531-537, 2020.
15. Jackson C: Fear in and about education. In: *Contemporary Debates in the Sociology of Education*. Brooks R, McCormack M and Bhopal K (eds). Palgrave Macmillan, London, pp6-25, 2013.
16. Pappas G, Kiriakos IJ, Giannakis P and Falagas ME: Psychosocial consequences of infectious diseases. *Clin Microbiol Infect* 15: 743-747, 2009.
17. Ahorsu DK, Lin CY, Imani V, Saffari M, Griffiths MD and Pakpour AH: The Fear of COVID-19 Scale: Development and initial validation. *Int J Ment Health Addict*: Mar 27, 2020 (Epub ahead of print).

18. Mahmud MS, Talukder MU and Rahman SM: Does 'Fear of COVID-19' trigger future career anxiety? An empirical investigation considering depression from COVID-19 as a mediator. *Int J Soc Psychiatry* 67: 35-45, 2021.
19. Özdin S and Bayrak Özdin Ş: Levels and predictors of anxiety, depression and health anxiety during COVID-19 pandemic in Turkish society: The importance of gender. *Int J Soc Psychiatry* 66: 504-511, 2020.
20. Nguyen HT, Do BN, Pham KM, Kim GB, Dam HTB, Nguyen TT, Nguyen TTP, Nguyen YH, Sørensen K, Pleasant A and Duong TV: Fear of COVID-19 scale-associations of its scores with health literacy and health-related behaviors among medical students. *Int J Environ Res Public Health* 17: 4164, 2020.
21. Gómez-Salgado J, Allande-Cussó R, Domínguez-Salas S, García-Iglesias JJ, Coronado-Vázquez V and Ruiz-Frutos C: Design of fear and anxiety of covid-19 assessment tool in spanish adult population. *Brain Sci* 11: 328, 2021.
22. Monteiro NM, Balogun SK and Oratile KN: Managing stress: The influence of gender, age and emotion regulation on coping among university students in Botswana. *Int J Adolesc Youth* 19: 153-173, 2014.
23. Overfield T: *Biologic Variation in Health and Illness*. 1st edition. CRC Press, Boca Raton, FL, 2017.
24. Bakioglu F, Korkmaz O and Ercan H: Fear of COVID-19 and positivity: Mediating role of intolerance of uncertainty, depression, anxiety, and stress. *Int J Ment Health Addict* 19: 2369-2382, 2021.
25. Liang Y, Wu K, Zhou Y, Huang X, Zhou Y and Liu Z: Mental health in frontline medical workers during the 2019 novel coronavirus disease epidemic in China : A comparison with the general population. *Int J Environ Res Public Health* 17: 6550, 2020.
26. Wang W, Song W, Xia Z, He Y, Tang L, Hou J and Lei S: Sleep disturbance and psychological profiles of medical staff and non-medical staff during the early outbreak of covid-19 in hubei province, China. *Front Psychiatry* 11: 733, 2020.
27. Lin Y, Hu Z, Alias H and Wong LP: Influence of mass and social media on psychobehavioral responses among medical students during the downward trend of COVID-19 in Fujian, China: Cross-sectional study. *J Med Internet Res* 22: e19982, 2020.
28. Bilal, Latif F, Bashir MF, Komal B and Tan D: Role of electronic media in mitigating the psychological impacts of novel coronavirus (COVID-19). *Psychiatry Res* 289: 113041, 2020.
29. Ng KH and Kemp R: Understanding and reducing the fear of COVID-19. *J Zhejiang Univ Sci B* 21: 752-754, 2020.
30. Dubey S, Biswas P, Ghosh R, Chatterjee S, Dubey MJ, Chatterjee S, Lahiri D and Lavie CJ: Psychosocial impact of COVID-19. *Diabetes Metab Syndr* 14: 779-788, 2020.
31. AlTakarli NS: China's response to the COVID-19 outbreak: A model for epidemic preparedness and management. *Dubai Med J* 3: 44-49, 2020.
32. Yu X, Li N and Dong Y: Observation on China's strategies to prevent the resurgence of the Covid-19 epidemic. *Risk Manag Healthc Policy* 14: 2011-2119, 2021.



This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International (CC BY-NC-ND 4.0) License.