Social Network Analysis and Mining (2021) 11:53
https://doi.org/10.1007/s13278-021-00750-2

ORIGINAL ARTICLE

# The nature, cause and consequence of COVID-19 panic among social media users in India

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Received: 8 November 2020 / Revised: 17 March 2021 / Accepted: 13 April 2021
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## Abstract
The recent pandemic of COVID-19 has not only shaken the healthcare but also economic structure around the world. In addition to these direct effects, it has also brought in some indirect difficulties owing to the information epidemic (hereafter termed as infodemic) on social media. We aimed to understand the nature of panic social media users in India are experiencing due to the flow of (mis)information. We further extend this investigation to other countries. We performed a cross-sectional study on 1075 social media users from India and 29 other countries. This revealed a significant increase in social media usage and the rise of panic (symbolizing a sense of alarm and/or fear) over time in India. Several of these behaviors are unique to social media users in India possibly because of later outbreak of COVID-19 and a prolonged uninterrupted lockdown. The amount of social media usage might not be causal but has a significant role in generating panic among the people in India. As multiple countries are entering into the second phase of lockdown, this study focused on India might provide a unique perspective of how various factors, including infodemic, affect the mental state of individuals around the globe.

**Keywords** COVID-19 · Panic · Anxiety · Mental health · Social media

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## 1 Introduction

The COVID-19 pandemic has caused direct losses like the collapse of public healthcare support and economic conditions around the world. In addition to this, mental health of people has been deeply affected by the prolonged change of social and economic activities of people. COVID-19 has globally affected the mental health of people in a significant way due to the incidents like economic slowdown, loss of jobs, losing the loved ones, and so on. However, there are other hidden factors causing the panic and anxiety (symbolizing a sense of alarm and/or fear) among people. Note that the word 'panic' is used throughout the paper in a linguistic sense and not with a medical or psychological perception. Containment methods (e.g., lockdown, travel restrictions, social distancing, etc.) appear to be the main anti-contagion policies to fight against COVID-19 pandemic throughout the world (Hsiang et al. 2020). This has caused a major impact on the mental health of people. Even with the administration of clinically suggested drugs, hidden threats of co-infections (Cox et al. 2020) and antimicrobial resistance (Afshinnekoo et al. 2021; Danko et al. 2021) are coming into notice. The focus on clinical health has been enormous (Butler et al.

Published online: 08 June 2021

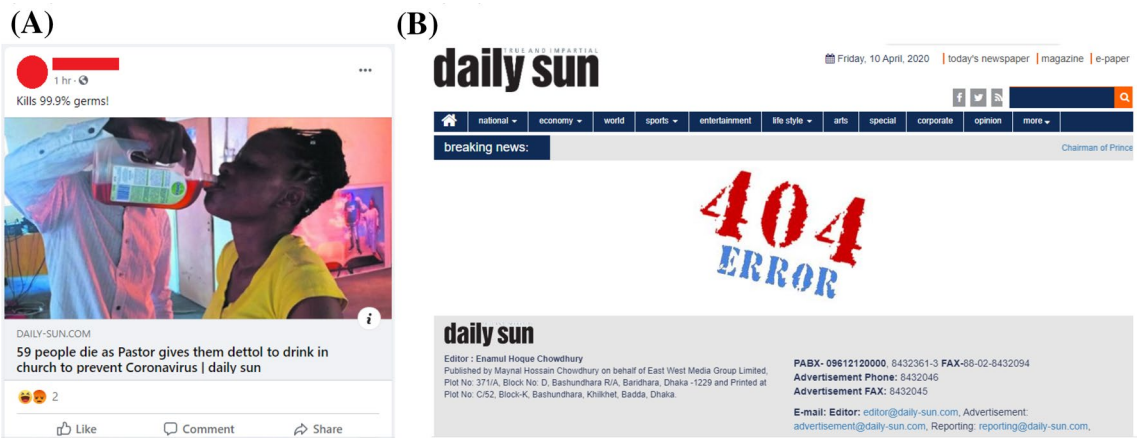


**Fig. 1** Spread of COVID-19 misinformation on social media. **a** Information related to COVID-19 with hyperlinks are getting spread on social media. **b** Many such information are fake in nature and lead to nowhere

2021), but the necessary psychological health protocols have not been established for an event like COVID-19 pandemic. Hence, there have been reports of people breaking the rules around the world. As a matter of fact, there is hardly any Psychological First Aid available for confronting COVID-19 in India.

As social media has emerged as a major source of knowledge and communication, there is a infodemic of misinformation related to of COVID-19 on various online social platforms (Garrett 2020; Ball and Maxmen 2020). It is therefore interesting to study whether we are experiencing the panic of COVID-19 pandemic or pandemic of COVID-19 panic on social media (Rosenberg et al. 2020). Recent studies highlight that the spread of fake information is creating considerable panic among the people in several countries (Kadam and Atre 2020). Figure 1 shows an example of fake information being spread in Facebook during the COVID-19 lockdown imposed in India. Misleading information and conspiracy theories have been an integral part of panic, and social media just adds the right medium for propagation and spread of panic. There has been a steep rise of moral panic (Cohen 2002) which was observed during multiple events earlier. Hence, it is highly likely that COVID-19 will also cause moral panic and catalyze the spread of fear through social media leading to a panic pandemic of its own.

Although social media plays a major role in spreading misinformation, all the topics are not discussed with equal priority in each region around the world. Figure 2 reflects that the popularity of the topic hydroxychloroquine, a controversial drug under trial for COVID-19 (Geleris et al. 2020; Kim et al. 2020; Mehra et al. 2020), on Twitter is restricted to limited number of countries. This is possibly because the expectations and resulting panic out of this drug is not the same everywhere. Hence, a region specific analysis is necessary for appropriately understanding the amount of COVID-19 panic among a group of social media users. As India experienced a prolonged and uninterrupted lockdown since March 25, 2020, performing a panic analysis on the Indian population could be compelling. With this motivation, the current study aims to realize the nature, causes and consequences of panic among the social media users in India.

## 2 Related work

Recent studies have highlighted that multiple types of psychological trauma follow COVID-19 pandemic, including fear of death, physical illness due to decreased immunity in patients, economic downfall curbed with loss of employment (Nicola et al. 2020), anxiety (Roy et al. 2020), depression, stress, insomnia, boredom and loneliness from prolonged quarantine phases (Yao et al. 2020).

Irrespective of social media being the source of self-gratitude by news-sharing (Lee and Ma 2012), multiple

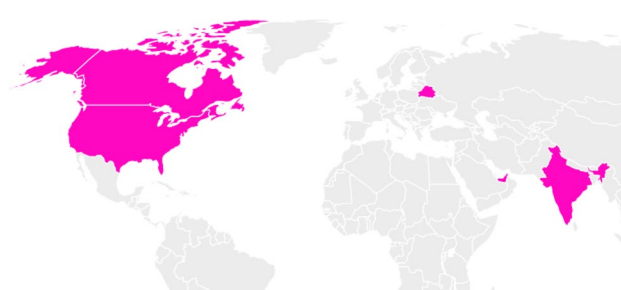

**Fig. 2** Countrywise popularity of the Twitter hashtag #hydroxychloroquine. Countries in which the hashtag #hydroxychloroquine appeared at least once in the top 50 list on Twitter during the COVID-19 pandemic. The data are collected until May 18, 2020

studies have shown that the same platform can be used in to spread misinformation (Ni et al. 2020; Shu et al. 2017), thus swaying the mindset of people and indirectly inducing psychological traumas as seen by past events (Bovet and Makse 2019; Waszak et al. 2018; Woo et al. 2015; Xiang et al. 2020). Multiple studies focusing on mitigating misinformation have shown that it might be a way of enhancing the quality of mental health during the pandemic (Da Silva 2020; Depoux et al. 2020; Flesia et al. 2020).

WHO has published guidelines to be followed for mental health and well-being during COVID-19 pandemic (Organization et al. 2020). Most countries have developed multiple forms of mental health mitigation to cope with neuropsychriatric linkage associated with phased of COVID-19 (Ornell et al. 2020; Shah et al. 2020). Some studies also mention the necessity for using Psychological First Aid (PFA) to combat with the rising fear during any pandemic (Haider et al. 2020; Maunder et al. 2008).

Even with Government in different countries and WHO trying to mitigate panic and fear, behavior associated with fear including panic buying of essential commodities (including food, masks, hand sanitizer) has been seen across the world (Leung et al. 2020; Sim et al. 2020). There has also been a global trend of increase in suicidal thoughts caused by both fear of unemployment (Kawohl and Nordt 2020) as well as fear of unknown caused by the virus (Dsouza et al. 2020; Roy et al. 2020). There is an immediate global need for assessment and understanding of associated behavior and distress signs including sleeping disorder and anxiety, to mitigate and reduce suicidal risks (Sher 2020; Zhang et al. 2020).

## 3 Data details

We received responses from 1075 social media users (median age group 21–30 years, 33.1% female) from 30 different countries between April 11, 2020, and May 15, 2020 (see Supplementary File 2). Most of the respondents were from Asia (about 91%). The other demography-related information of the respondents is summarized in Fig. 3 . Most of the responding people were young, belonging either to the age group of 21–30 years (58.7%) or below 21 years (14.2%) (see Fig. 3). A majority of the respondents (57.5%) had no direct association with COVID-19.

## 4 Methods

We performed a cross-sectional study on the users from multiple social media platforms through opportunistic sampling. Survey responses were collected using Google Forms with questionnaire (see Supplementary File 1). Study respondents were recruited via social media (Facebook, WhatsApp, Twitter and LinkedIn). The data are segregated into two parts—the first one comprising 935 responses received from India and the other one with rest of the 140 responses. We employed a grounded theory approach to perform quantitative and qualitative analyses separately on the Indian social media users and on the ones in other 29 countries. The values received in the form of numeric intervals are either studied as categorical values (e.g., age group) or averaged to derive a single value (e.g., social media usage). We grouped respondents into five distinct buckets of equal sizes for conducting temporal analysis of the panic level acquired over time. Note that a panic level of '0' (minimum) denotes the scenario when the respondent is not at all panicked and a panic level of '5' (maximum) denotes the scenario when the respondent is highly panicked.

The Twitter data are collected using the GetDayTrends website[1] on May 18, 2020. The COVID-19-related hashtags that appeared in the top 50 list at least once in India since the COVID-19 outbreak (in March, 2020) are chosen. The details of these hashtags like the appearance and rank are also taken.

Though most of the survey questions were self-explanatory with limited options, there were a few where the participants could express themselves. This resulted in generating valuable data which were unstructured. To retrieve the value and context from the unstructured data, we used sentiment analysis. The sentiment analysis results were obtained using the Magellan Text Mining tool[2] of OpenText. It uses a built-in multilingual natural language processing approach for extracting topics, sentiments and entities. By employing artificial intelligence and comparing a new dataset with its constantly updated library, OpenText Magellan performs text summarization and classification along with sentiment analysis. We collected the values of Topics (weight), Simple Context (Relevancy %, Frequency), Complex Context (Relevancy %, Frequency), Entities of Interest (Relevancy %, Frequency) only when frequency of occurrence is no less than 2, Sentiment Divisions (Positive %, Negative %, Neutral %), Comments Type (Opinion, Facts). Sentiment values were calculated using the Sentiment Analyzer tool.[3] The values lie in the range $[-100, 100]$. Sentiment Analyzer has been trained with more than 8000 corpora from American National Corpus. This general-purpose sentiment analysis toolkit was chosen to remove specific domain bias. Sentiment Analyzer provides the overall sentiment of the entire text set. Through the tool, we obtained a general tone of people and gave a quantitative score.

[1] https://getdaytrends.com.

[2] http://magellan-text-mining.opentext.com.

[3] https://www.danielsoper.com/sentimentanalysis/default.aspx.

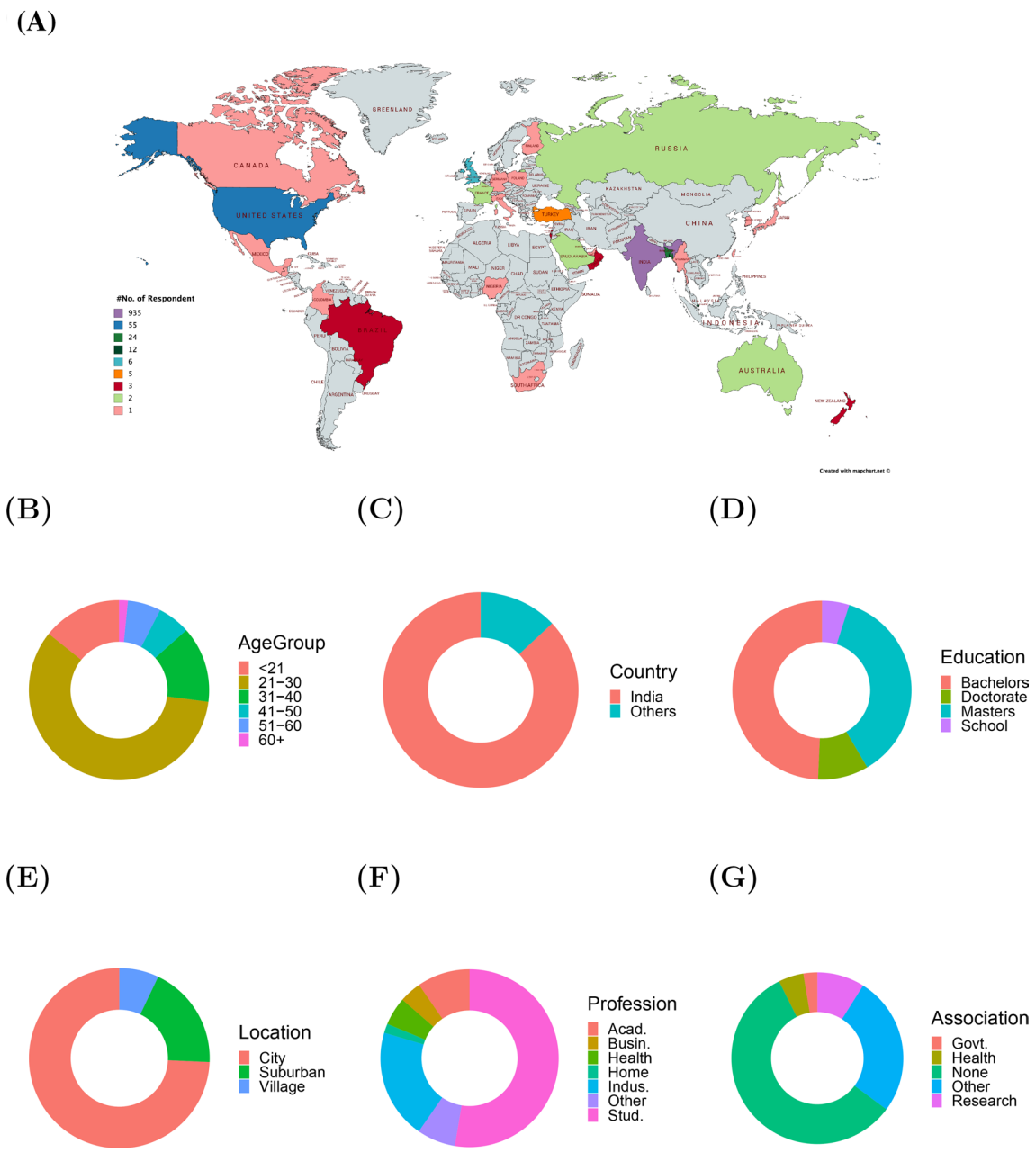


**Fig. 3** Demography and COVID-19 association of respondents. **a** Countries to which the 1075 people responding to the online survey during the COVID-19 pandemic belong across the world. (**b**–**f**) Demographic details of the respondents. (**g**) Nature of COVID-19 association of the respondents

## 5 Results

We found that the social media usage has significantly increased (McNemar Bowker, $p < 0.001$) across all the countries during the lockdown (see Supplementary Details, Table S3). This is true even within India and within other countries taken in separation. We observed that the mean usage (calculated from averaged interval) of social media has become 2.25 hrs per day in India during lockdown, while it happened to be 1.66 hrs per day earlier. The social media usage has significantly increased (Wilcoxon–Mann–Whitney, $p = 2.2e{-}16$) during lockdown (see Fig. 4a). The panic levels in India and other countries do not follow normal distributions (see Supplementary Details, Table S4). No significant difference of panic level (Wilcoxon–Mann–Whitney, $p = 0.5426$) is observed between India and other countries, although it exhibits a slightly higher value and variability of panic in India (see Fig. 4b). On grouping the respondents

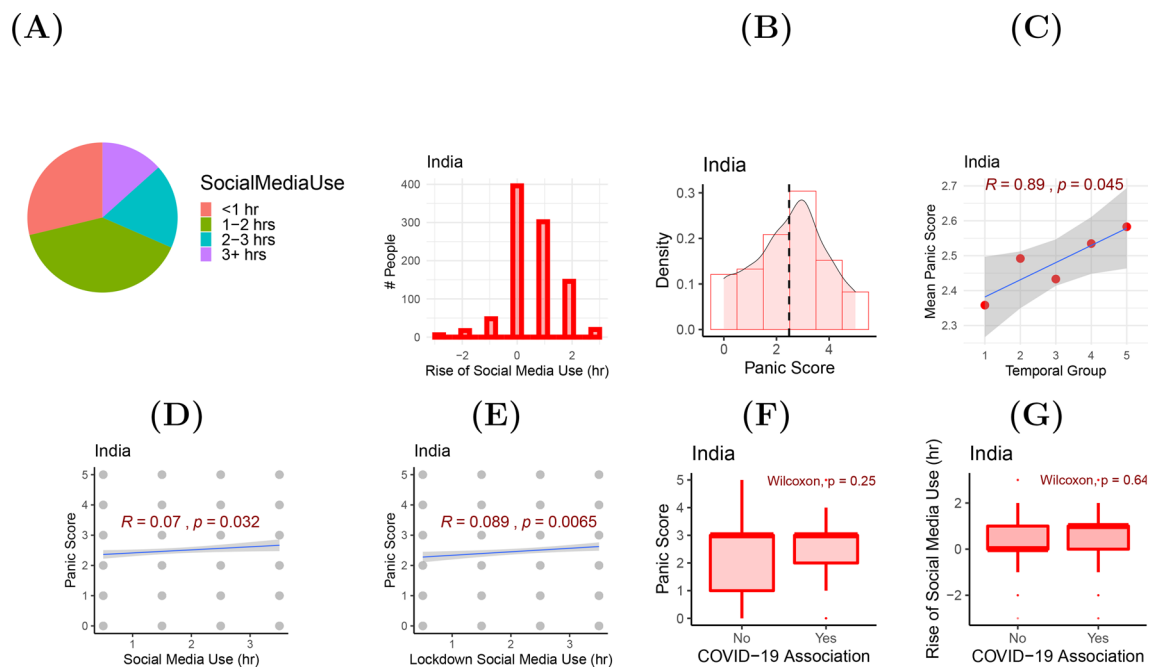


**Fig. 4** Effect of social media usage and COVID-19 association on the panic level in India. **a** The rise of social media usage during the lockdown. **b** Density of panic levels. **c** Mean panic level of people temporally grouped by the order of their participation in the survey. Correlations between the panic level and hourly usage of social media per day **d** before the lockdown and **e** during the lockdown. **f** Association with COVID-19 and its effect on the panic level. **g** Association with COVID-19 and its effect on the rise of social media usage during the lockdown

from India into equal-sized cohorts based on the temporal order of their participation in the survey, we observed a significant increase of panic over time (see Fig. 4c). However, a similar analysis highlights no such increase in other countries (see Supplementary Details, Fig. S3). A possible reason of this could be the fact that COVID-19 broke out relatively later in India in comparison with other countries and there was a prolonged and uninterrupted lockdown. The panic level in India is neither dependent on the usage of social media before lockdown nor during lockdown (see Fig. 4d, e). However, the panic level has no association with the rise of social media usage in India. We noticed that the level of panic is independent of the association of a person (as Government personnel, health professional or researcher) with COVID-19 in India (see Fig. 4f). Moreover, the panic level is also independent of the rise of social media usage in India (see Fig. 4g). A similar observation was also obtained for other countries (see Supplementary Details, Fig. S3).

We examined the level of panic against the demographic details of the respondents to understand the differentiating factors of panic in India. The violin plots in Fig. 5 highlight the sample distributions of panic score over different subgroups of demographic factors (among Indian respondents) along with a non-parametric test result to verify whether they originate from the same distribution. We noticed that mean panic level of the people belonging to the age group 31–40 is significantly higher (Kruskal–Wallis, $p = 0.0013$) than the others in India. Despite a higher fatality rate of COVID-19 reported amidst the older population (Dowd et al. 2020), panic is getting generated only among the middle-aged people. It is interesting to note that younger people are not less panicked than the others. We found that females express a significantly higher level of panic than males in India (Wilcoxon–Mann–Whitney, $p = 0.00063$). The same is also significantly higher in other countries (see Supplementary Details, Fig. S4). Finally, we found that the level of panic is independent of the nature of COVID-19 association, education, location type or profession of the respondents in India.

To realize how do people accept social media posts on COVID-19, we used Alluvial diagrams for highlighting associations between the different factors that people consider before sharing a post. The four categorical dimensions from left to right in Fig. 6 are the worldwide responses to the questions "Do you like the jokes/memes about COVID-19 and share?", "If your friend sends an apparently serious message on COVID-19 and asks you to forward, what will you do?", "When are you more likely to believe a statement on COVID-19 in a post?" and "How do you generally make a decision about sharing a COVID-19 post that contains a link?", respectively. Figure 6 highlights that most of the people in India consider

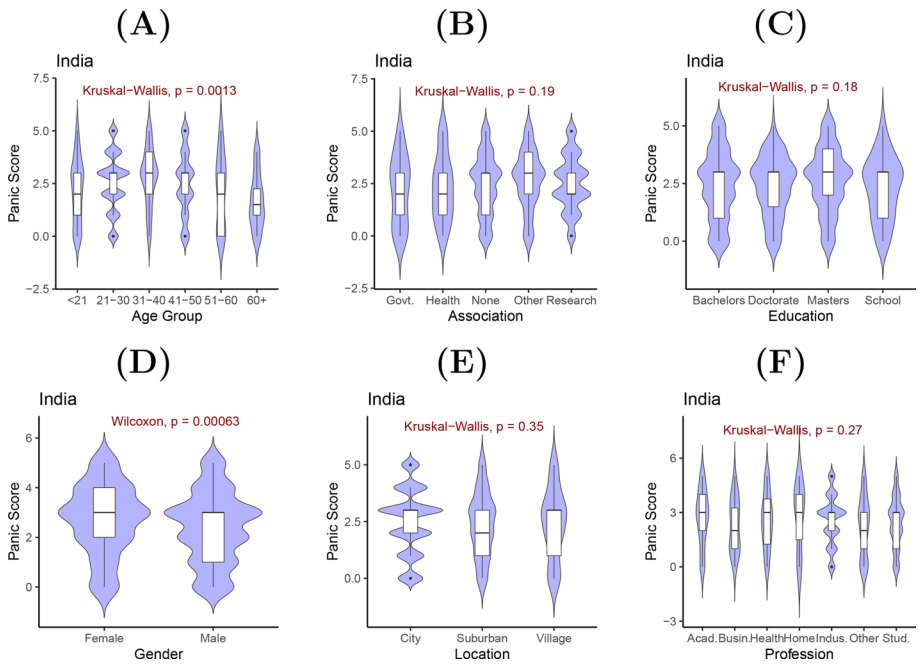


**Fig. 5** Panic level in India against different demographic factors. Violin plot showing the level of panic among different sets of people specific to their **a** age group has a significant difference, **b** association with COVID-19 has no significant difference, **c** level of education has no significant difference, **d** gender has a significant difference, **e** location type has no significant difference and **f** profession has no significant difference

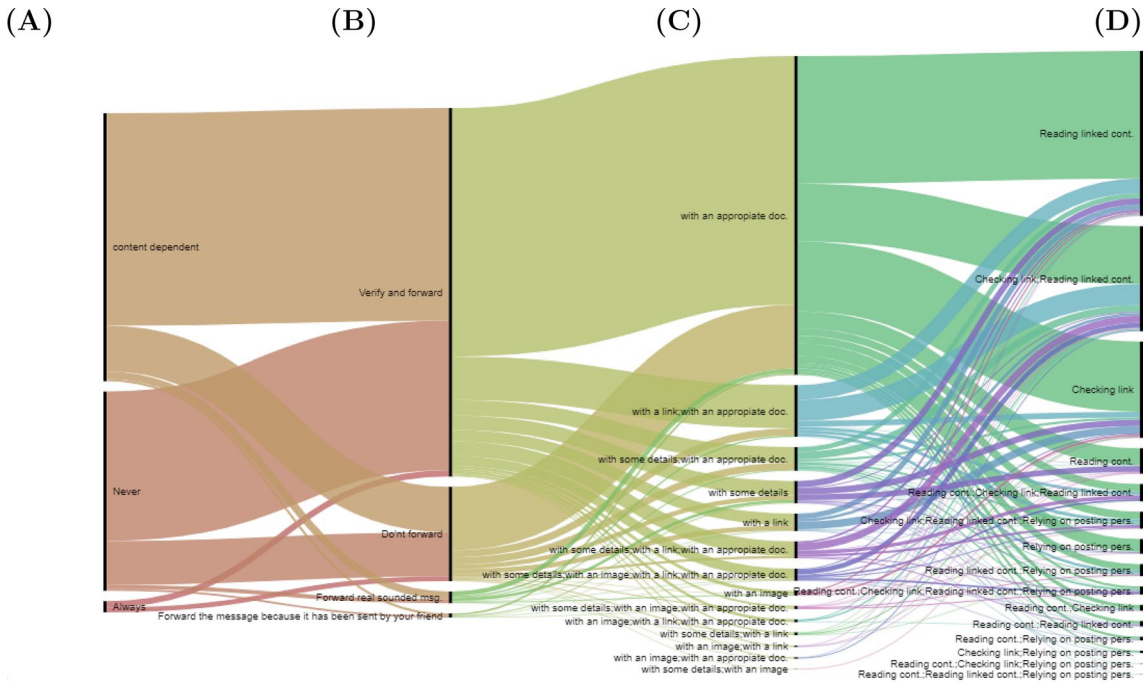


**Fig. 6** Sharing COVID-19 information on social media in India. Associations between the factors based on which people welcome and make decisions about sharing COVID-19-related information on social media. The vertical bars cover responses to the questions on **a** liking and sharing jokes/memes about COVID-19, **b** forwarding an apparently serious message on COVID-19 sent by a friend, **c** believing a statement on COVID-19 in a post and **d** making a decision about sharing a COVID-19 post that contains a link

COVID-19-related posts seriously and share them only after validation. However, the nature of validation (verifying post content, associated link and/or the linked document) differs among different sets of people.

Incomplete or lack of knowledge among social media users might be a reason of their anxiety. To better understand this, we studied how much people are aware about the disease COVID-19 and its different characteristics.

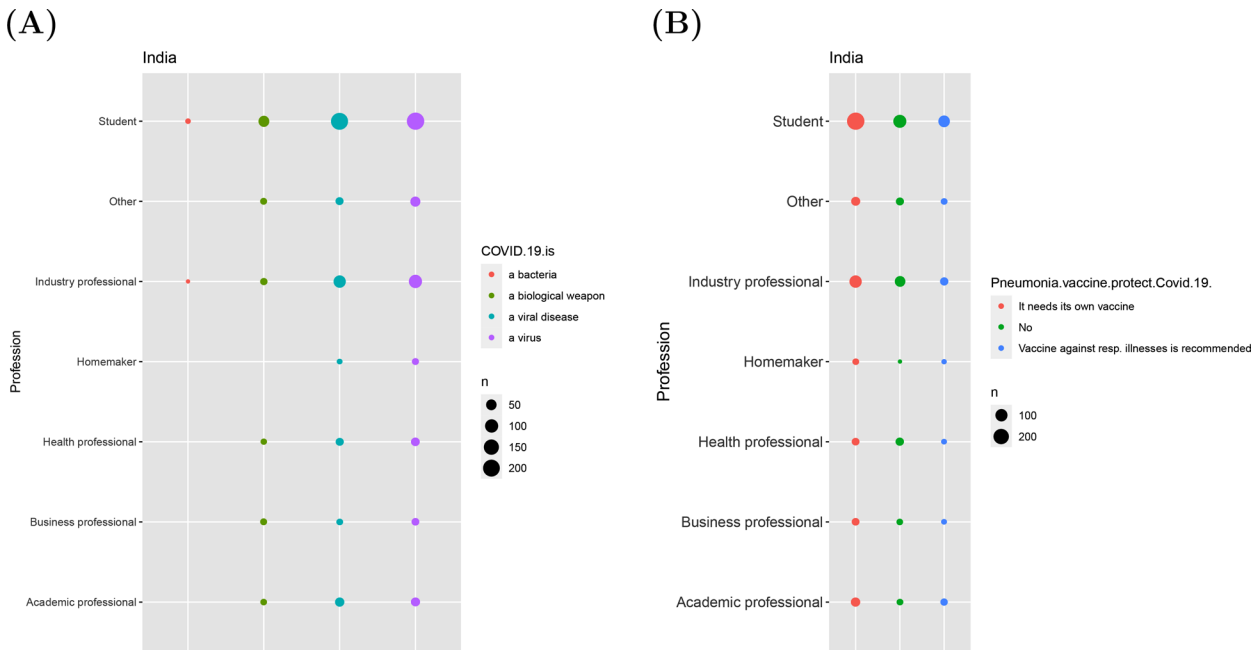


**Fig. 7** Association between the knowledge about COVID-19 and profession of the respondents in India. **a** Basic knowledge about COVID-19 is dependent on profession. **b** Basic knowledge about the treatment of COVID-19 is dependent on profession

We observed that a significant association exists between the understanding about COVID-19 and the profession of a person in India. In fact, the responses against the questions like what COVID-19 actually means (see Fig. 7a) or whether pneumonia vaccine can help prevent COVID-19 (see Fig. 7b) are significantly related to the profession (Chi-Square, $\chi^2 = 30.64, p = 0.03$ and Chi-Square, $\chi^2 = 31.13, p = 0.0019$, respectively). However, no such link is found for the people residing in the other countries (see Supplementary Details, Fig. S5). Further investigation highlights that the knowledge about COVID-19 is relatively poor among the common people in India in comparison with the other countries. To our surprise, a significantly higher number of respondents (test of proportions, $p = 0.00052$) in India is found to believe that COVID-19 is a biological weapon. Such responses are received from 11% of the total samples in India, while from only 2% in other countries.

We further studied the various preventive activities undertaken by the respondents in India and other countries during lockdown (or other types of containment). These activities include the actions to take after returning from grocery, when a neighbor is tested COVID-19 positive and when someone you know is tested COVID-19 positive. We observed a significant association between such activities and profession (Chi-Square, $\chi^2 = 113.46, p = 0.0178$, Chi-Square, $\chi^2 = 120.85, p = 0.0053$, and Chi-Square, $\chi^2 = 113.46, p = 0.0178$, respectively) of people in India but not in other countries (see Supplementary Details). A possible reason behind this could be the difference between government guidelines across the different countries. It is interesting to note that a reasonable number of people (7.2%) in India and rest of the countries (4.3%) were found to be ready to consume hydroxychloroquine and azithromycin at their own in case they came into contact with a COVID-19 patient.

We examined the change of mental health (stress and anxiety) people experienced due to the lockdown protocols in their respective countries and how did it affect their level of panic. We observed a highly significant association (Chi-Square, $\chi^2 = 80.19, p = 4.62\text{e}{-13}$) between the mental health and panic level in India (see Fig. 8a). We also noticed a highly significant association (Chi-Square, $\chi^2 = 42.40, p = 1.38\text{e}{-08}$) between the mental health and productivity in India (see Fig. 8b). Both these associations were significant in other countries (see Supplementary Details, Fig. S6). We found a highly significant connection (see Fig. 8c) between the mental health and level of tension felt after reading a post related to COVID-19 on social media in India (Chi-Square, $\chi^2 = 35.12, p = 4.10\text{e}{-06}$) but not in other countries. We also observed a significant dependence (see Fig. 8d) between the method perceived by people to reduce panic level with their COVID-19 association in India (Chi-Square, $\chi^2 = 37.53, p = 0.01$) but not in other countries. None of these associations were significant in other countries (see Supplementary Details, Fig. S6).

We verified whether the delay in getting a vaccine is responsible for the panic among people. We found that panic level is independent of the time expected (by the

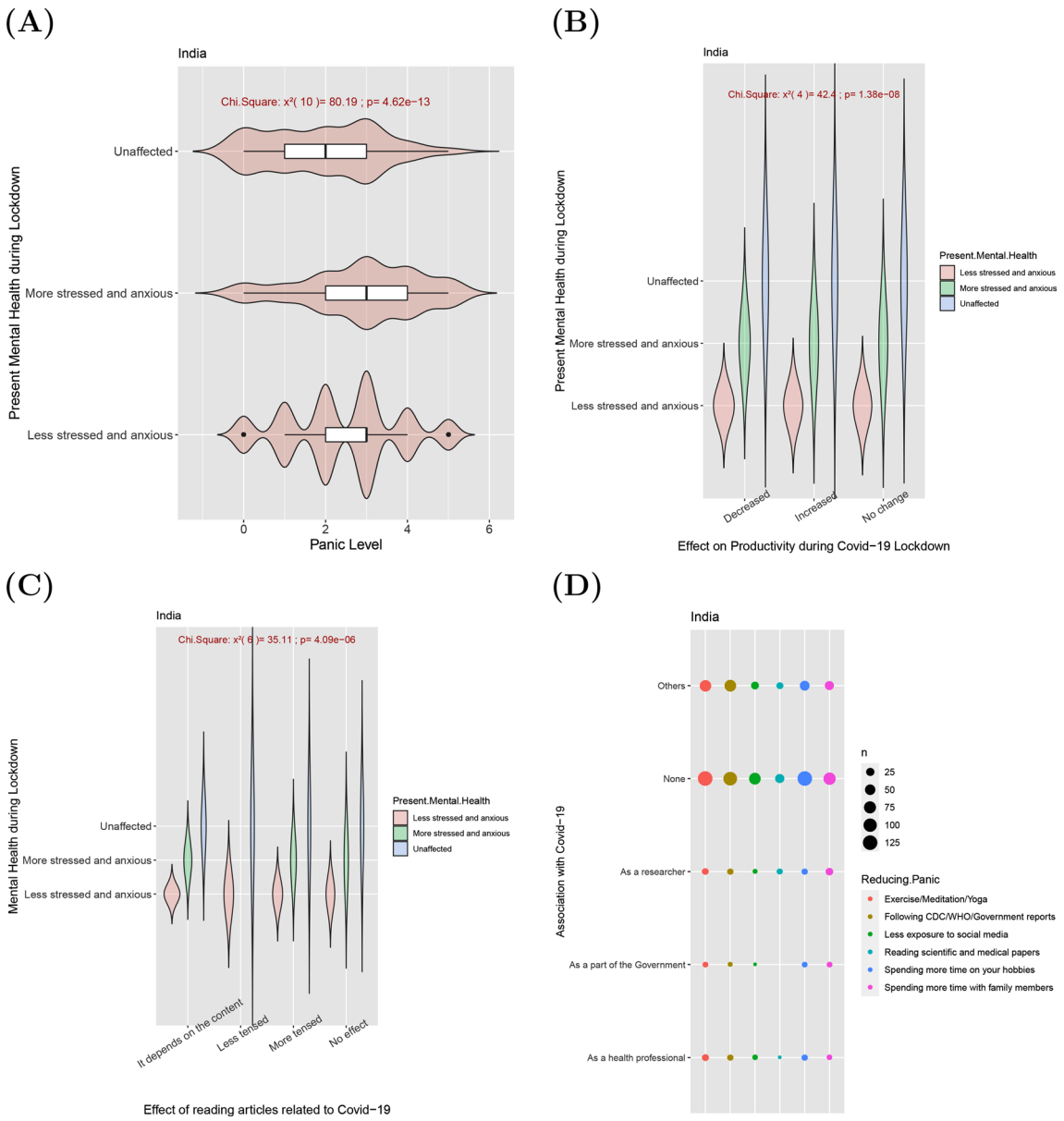


**Fig. 8** Association between mental health and other factors in India. **a** Violin plot depicting panic Level and its relation with mental health. **b** Violin plot depicting effect on productivity with respect to mental health, **c** violin plot representing how much the tension felt after reading articles on COVID-19 affect mental health and **d** ways to reduce panic as perceived by people associated to COVID-19 through various conditions

corresponding respondent) to get the vaccine in India (see Supplementary Details, Fig. S1). No significant dependence is also observed for other countries (see Supplementary Details, Fig. S7). We found no significant association between either the age group or profession of the respondents and their mental preparedness regarding the availability of COVID-19 vaccine either in India (see Supplementary Details, Fig. S2) or other countries (see Supplementary Details, Fig. S8). We noticed that the COVID-19 panic has a significant impact on the actions people take. We found a significant rise (Wilcoxon–Mann–Whitney, $p = 0.0012$) of panic among the people who prefers to send younger people out for shopping just because aged ones are more prone to COVID-19 infection (see Supplementary Details).

On further studying the precautions taken by people in India based on their perceptions about COVID-19 (see Fig. 9), we found most of them (59%) to be conditionally interested in a free test. This is also true for other countries (see Supplementary Details, Fig. S9). Moreover, we noticed that a significant fraction (42%) of people were not ready to take precautions like air-borne diseases, though recent evidences strongly suggest it (Bahl et al. 2020). This

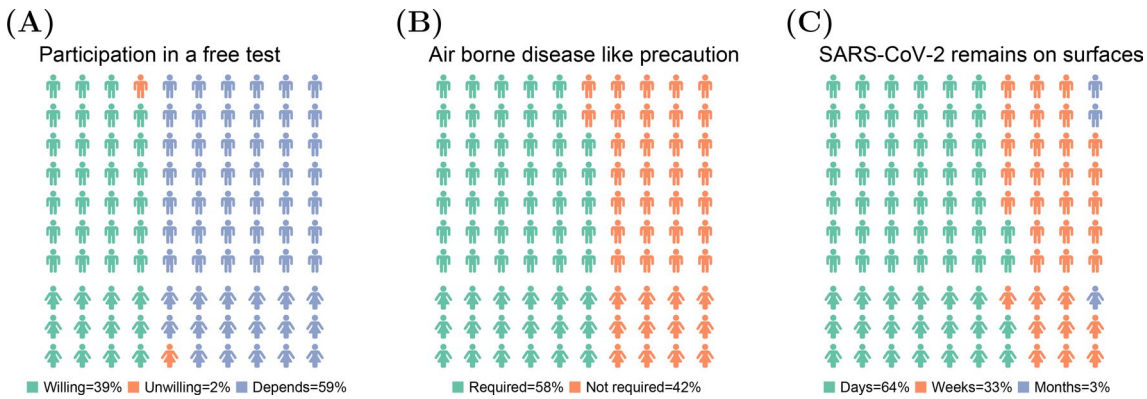


**Fig. 9** Gender-specific cautiousness about COVID-19 of the respondents in India. **a** Waffle plot depicting willingness to participate in free test offered by the Government for COVID-19. The conditional willingness depends on either having relevant symptoms or physical contact with someone infected. **b** Waffle plot depicting whether precautions are taken like air borne diseases. **c** Waffle plot depicting perception about survival of SARS-CoV-2, the virus responsible for COVID-19, on any arbitrary surfaces

fraction was quite low in other countries (see Supplementary Details, Fig. S9). We noted that people were overcautious about surface stability of SARS-CoV-2, the virus attributed to COVID-19. A significant fraction (36%) of people expected SARS-CoV-2 to survive on arbitrary surfaces for more than a week, which contradicts with reported results (Chin et al. 2020; Van Doremalen et al. 2020). A similar pattern was also observed for other countries (see Supplementary Details, Fig. S9). This might indicate a possible reason of panic among the people.

As hashtags depict the theme or specific content of a post on social media (Small 2011), analysis of popular hashtags might reveal new knowledge associated with an event. To study the popularity of contents related to COVID-19 on social media, we selected the top relevant hashtags appearing in India since the COVID-19 outbreak (see Supplementary Details, Table S5). We found that many hashtags are confined to limited locations although more than 200 countries got affected by COVID-19. On further examining the hashtags, we noticed many region-specific clusters of top hashtags. As for example, India and USA share a good number of top hashtags. This might be one of the reasons why many of the observations on Indian population differs from the other countries. We also noted that some of the drugs under trial for COVID-19 (azithromycin, hydroxychloroquine and remdesivir) were within the top hashtags. Such inclusions highlight an increasing discussion on them thereby generating different kind of panic in some countries. This is because these hashtags were popular within limited countries.

We performed sentiment analysis on the responses shared by people regarding the best and worst experiences they have faced during the lockdown in India (see Supplementary Details, Table S6–S11). “Reading” was identified across all the ages as an important entity of best experience. “Spending (quality) time” and “family time” appeared to be one of the most positive experiences. We found the main topics of “education” getting reflected in all categories of age up to 30 (including major school and college students). Gender-based assumed roles are not reflected much. Even though women in India reported “parents” as one of the leading best things while men mentioned “exercising”. “Family” was reported as both best and worst context, even though differently for Indian male and female. Amongst Indian women, we observed the terms “panic” and “fear” being mentioned more than male counterparts. Irrespective of the opinion that social distancing is the best thing to curb the spread, it emerged to be the worst thing for many people. Looking at the education level, for people with Bachelors and Masters, “lost jobs” appeared to be the top worst thing.

Qualitative analysis of the detailed experiences revealed that people have become more attached to the family and enjoyed the activities like cooking. Reading and learning, mostly for the younger people, had also been a relishing factor (see Supplementary Details, Fig. S10). On the other hand, long spare time, confinement, anxiety and loss of job had been the considerable worst experiences. Major suggestions that came from people to cope up with lockdown period were not related to personal activities rather restricted to the association with family. We can infer many novel things directly from the quantitative analyses on the survey responses. However, this gives a generic perspective of the reasons behind panic and its effects. To get an idea about the critical issues that might generate panic among the people, we conducted a qualitative analysis on the additional comments provided by the respondents (see Supplementary Details). It is interesting to note that diversity of causes of panic in India is much higher than the other countries. Moreover, males are observed to be more vocal in providing additional suggestions.

We adopted a citizen science approach to bring respondents in the analysis pipeline (Hand 2010). The entire survey responses received from 1075 people and initial experimental results were shared with the respondents. Full accessibility was given to the respondents toward the study resources. To make the study reproducible, we also released the source codes of the experimental analysis on GitHub. All the respondents were requested to participate as citizen scientists for extending the analysis wherever possible to enrich the paper. Interestingly, high school students also took part in this process and received authorship by making significant contribution. New observations and significant results were included in the paper. Revisions to statistical analyses were also performed based on the feedback from citizen scientists.

## 6 Conclusion

Though this paper is aimed toward realizing the effect of panic among social media users in India, we carried out some extended analyses on some users from other countries. Notably, the behavior conclusions made on these limited non-Indian users are all supported by further statistical significance analysis. Thus, the extended analysis is also worth reporting. The cross-sectional analysis we carried out not only reveals the panic but also highlights some positive thoughts of people. Many people welcomed this pandemic with a belief that this would make doctors and researchers well prepared for future attacks and shape politicians more responsible. Many interesting ideas to avoid boredom were also proposed. These opinions require more attention to understand the mental health of people. However, many people think that social media is helpful but it can also be disastrous because information-based decisions are becoming very much common nowadays, especially due to infodemic. We also received many important suggestions to improve the survey questionnaire. These include the information like the frequency of going outside for meeting the essential needs, personality traits and lifestyle choices and their responses during a crisis. It is highly promising to conduct epidemiological studies further on a separate population that has not experienced COVID-19 containment for obtaining additional insights.

**Supplementary Information** The online version supplementary material available at https://doi.org/10.1007/s13278-021-00750-2.

**Author Contributions** CB, DC, NA and MB designed the survey. CB and MB prepared the plan of experimentation. CB, DC and MB carried out the initial experiments and data analysis. SO, BB and SKM performed additional analyses as citizen scientists. CB, DC and MB drafted the manuscript. All the authors read and approved the final manuscript.

**Data availability** The complete questionnaire, dataset with anonymized survey responses and codes used (to create plots and perform statistical analyses) in this paper are freely accessible from the GitHub link: https://github.com/malaybhattacharyya/COVID-19_Panic_Survey.

## Declarations

**Conflict of interest** The authors declare that they have no conflict of interest.

**Consent to participate** All the participants were informed about the goal of the survey before they participated and the results were shared with them for their consent before publication.

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