



RESEARCH ARTICLE

Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries: A cross-sectional study [version 1; peer review: awaiting peer review]

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Abstract

Background: Risk perceptions of coronavirus disease 2019 (COVID-19) are considered important as they impact community health behaviors. The aim of this study was to determine the perceived risk of infection and death due to COVID-19 and to assess the factors associated with such risk perceptions among community members in low- and middle-income countries (LMICs) in Africa, Asia, and South America.

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Any reports and responses or comments on the article can be found at the end of the article.

Methods: An online cross-sectional study was conducted in 10 LMICs in Africa, Asia, and South America from February to May 2021. A questionnaire was utilized to assess the perceived risk of infection and death from COVID-19 and its plausible determinants. A logistic regression model was used to identify the factors associated with such risk perceptions.

Results: A total of 1,646 responses were included in the analysis of the perceived risk of becoming infected and dying from COVID-19. Our data suggested that 36.4% of participants had a high perceived risk of COVID-19 infection, while only 22.4% had a perceived risk of dying from COVID-19. Being a woman, working in healthcare-related sectors, contracting pulmonary disease, knowing people in the immediate social environment who are or have been infected with COVID-19, as well as seeing or reading about individuals infected with COVID-19 on social media or TV were all associated with a higher perceived risk of becoming infected with COVID-19. In addition, being a woman, elderly, having heart disease and pulmonary disease, knowing people in the immediate social environment who are or have been infected with COVID-19, and seeing or reading about individuals infected with COVID-19 on social media or TV had a higher perceived risk of dying from COVID-19.

Conclusions: The perceived risk of infection and death due to COVID-19 are relatively low among respondents; this suggests the need to conduct health campaigns to disseminate knowledge and information on the ongoing pandemic.

Keywords

COVID-19, perceived risk, online cross-sectional study, preventive measure, determinants



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Introduction

The coronavirus disease 2019 (COVID-19), caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has had catastrophic effects on the economy, health, and society¹⁻³ and is associated with long-term health problem.^{4,5} The risk perceptions of COVID-19 are considered important as they influence health behaviors in the community.⁶ According to one study, accessing the media to obtain information on COVID-19 is linked to an increase in COVID-19 perceived risk and severity.⁷ In addition, a study found that the willingness to receive COVID-19 vaccination was related to the perceived risk of becoming infected with SARS-CoV-2.⁸ Therefore, providing reliable information on the risks of infection and possible adverse health outcomes (including death) could directly influence an individual's risk perceptions. This, in turn, may affect their decisions to select suitable preventive measures.⁹

Several studies have analyzed risk perceptions during the ongoing pandemic to learn more about their correlates and predictors.^{6,7,9,10} In general, the findings from these studies suggest that risk perceptions of SARS-CoV-2 infection are predictive of the adoption of different protective behaviors.^{6,9} Furthermore, strategic interventions aimed at increasing the risk perceptions of individuals can help promote desired protective behaviors.⁶ In addition, perceived risks are also considered as important drivers for the adoption of COVID-19 control measures implemented by the government and other responsible agencies.¹⁰

Studies that assess risk perceptions and the associated determining factors will provide policymakers with critical information that will help to design population-wide health measures to combat the ongoing pandemic. In addition, long-term COVID-19 risk perception studies, especially in low- and middle-income countries (LMICs), will help to develop efficient preventive strategies within the population.⁹ The present study was designed to determine the perceived risk of becoming infected and dying as a result of COVID-19, as well as to assess the factors associated with such risk perceptions in the community members of LMICs in Africa, Asia, and South America.

Methods

Study design and setting

We conducted an online cross-sectional study²³ in 10 LMICs in Africa, Asia, and South America between February and May 2021. The survey link, hosted by [SurveyMonkey](#), was shared on Twitter, Facebook, and WhatsApp. The survey²² consisted of three sections: an introduction page with study information and an informed consent page where respondents had to provide consent to participate, and the main survey, which asked respondents about their demographic background, previous health conditions, perceived risk of infection and death due to COVID-19, and several possible determinants. The survey included an informed consent page that included the benefits of the study, risks and discomforts and information that this study was completely voluntary. All respondents provided consent to participate by clicking "Agree" before the next page could be opened. It took approximately 15 minutes to complete all the questions. Before being utilized in the study, the questions in the questionnaire were evaluated and their validity was confirmed. Most of the questions were adopted from a previous study¹¹ and during the validity assessment, each question was assessed by experts in the fields of virology and public health. Changes were made to the questionnaire based on the validity assessment. No further reliability or validity tests in the field were made. The inclusion criteria to be eligible in this survey were those who were aged over 18 years old and able to read and understand English in the 10 studied countries. We sought a 95% confidence level and a 5% margin of error to recruit the minimal sample size with a conservative assumption that 50% of respondents having good perceived risk of COVID-19. We employed a convenience sampling approach, a non-probability sampling method, to recruit the samples. We received 1,849 responses during the study of which 203 respondents were excluded due to incomplete information.

The Institutional Review Board of Universitas Syiah Kuala & Zainoel Abidin Hospital (129/EA/FK-RSUDZA/2021) approved the study protocol and it was registered with the Indonesian National Health Research and Development Ethics Commission (1171012P).

Study variables

Response variable

The response variable in this study was the perceived risk of COVID-19. To assess the perceived risk, the respondents were asked two questions: (1) "What do you think are the chances that you will get COVID-19 in the next month?" and (2) "What do you think is your risk of dying from COVID-19 if infected?" A slide bar was provided to the respondents, with which they could move the percentage between 0% and 100%. The perceived risk score was then classified into low (a score equal to or less than 50%) and high (a score of more than 50%). Each question was analyzed separately.

Explanatory variables

Age, gender, urbanicity, monthly household income in USD, religion, occupation sector (healthcare- and non-healthcare-related), type of occupation, and the presence of COVID-19 comorbidities based on self-reports, such as hypertension, diabetes, heart disease, and pulmonary disease were all included as explanatory variables. In addition, the respondents were asked whether they knew anyone in their immediate social environment who were or had been infected with COVID-19. Respondents were also questioned about their exposure to information (have seen or read) of individuals infected with COVID-19 on TV or social media.

Statistical analysis

Logistic regression analysis was used to assess the factors associated with the perceived risk of contracting COVID-19 and the factors associated with the perceived risk of dying from COVID-19 if infected. The unadjusted logistic regressions, crude odds ratio (OR), and 95% confidence interval (CI) of each plausible factor were calculated separately in the first step. Factors with p-values of less than 0.25 in the univariate analysis were included in the adjusted analysis, where the adjusted OR (aOR) was calculated. The analyses were conducted using **SPSS software** version 24 (SPSS Inc., Chicago, IL, USA) (SPSS, RRID:SCR_019096).

Results

Demographic characteristics

Table 1²² presents the characteristics of the 1,646 responses that were analyzed. India and Pakistan had the highest number of respondents. More than half of the participants were between the ages of 21 and 30, and 58% of the total respondents were female. The majority (81%) of the respondents lived in urban areas, and 65% were part of a family with a monthly household income of less than \$2,000. Respondents with hypertension, diabetes, heart disease, and pulmonary disease made up 5.9%, 3.5%, 3.3%, and 5.5% of the study participants, respectively. Almost 70% of the respondents knew someone who had been infected with COVID-19 in their immediate social environment, and more than 92.7% had seen or read about individuals infected with COVID-19 on social media or TV.

Perceived risk of becoming infected with COVID-19 and the associated determinants

Of the 1,646 respondents, 36.4% (600/1,646) had a high perceived risk of being infected with COVID-19. The unadjusted logistic regression suggested that the country, age group, religion, type of job, having pulmonary disease, knowing people in the immediate social environment who were or had been infected with COVID-19, seeing or reading about individuals infected with COVID-19 on social media or TV, and type of occupation were associated with a perceived risk of contracting COVID-19 (**Table 1**). In the adjusted logistic regression, only country, age group, gender, religion, type of job, those with pulmonary disease, knowing people in the immediate social environment who were or had been infected with COVID-19, seeing or reading about individuals infected with COVID-19 on social media or TV, and type of occupation were associated with a perceived risk of contracting COVID-19.

Females had a greater perceived risk of contracting COVID-19 compared to males (aOR: 1.40; 95% CI: 1.10–1.78, $p=0.006$) (**Table 1**). Those working in healthcare-related sectors had almost 1.48 times higher odds of a higher perceived risk of contracting COVID-19 compared to those working in non-healthcare sectors (aOR: 1.48; 95% CI: 1.16–1.89, $p=0.002$). Our study also found that people with COVID-19 comorbidities, in particular pulmonary disease, had a higher perceived risk compared to those with no pulmonary disease (aOR: 2.44; 95% CI: 1.48–4.05). Participants who knew someone from their immediate social environment who were or had been infected with COVID-19, as well as those who had seen or read about COVID-19 cases on social media or TV, had 2.05 (95% CI: 1.55–2.70) and 1.72 (95% CI: 1.06–2.77) times higher odds of perceived risk of becoming infected with COVID-19 compared to those who did not know and had never seen or read about COVID-19 cases, respectively. Compared to self-employed participants, those who were employed for wages, students, and those who were retired (unable to work) had higher odds of contracting COVID-19 (aOR: 2.22, 2.05, and 11.36, respectively) (**Table 1**).

Perceived risk of dying from COVID-19 and associated determinants

Of the total respondents, 22.4% (370/1,649) had a perceived risk of dying from COVID-19, which was classified as high. In the unadjusted analysis, the level of perceived risk was associated with country, age group, gender, monthly household income, religion, having hypertension, heart disease, and pulmonary disease, and knowing or not knowing someone in the immediate social environment who were or had been infected with COVID-19 to varying degrees (**Table 2**). In the adjusted logistic regression, country, age group, gender, religion, type of job, pulmonary disease, knowing people in the immediate social environment who were or had been infected with COVID-19, had seen or read about individuals infected with COVID-19 on social media or TV, and type of occupation were associated with a perceived risk of dying from COVID-19 (**Table 2**).

Table 1. Logistic regression showing factors associated with perceived risk of COVID-19 infection (n=1,649).

| Variable | n (%) | High perceived risk n (%) | Unadjusted | | Adjusted | |
|--------------------------------|-------------|------------------------------|--------------------|---------|--------------------|---------|
| | | | OR (95% CI) | p-value | OR (95% CI) | p-value |
| Country | | | | | | |
| Pakistan (R) | 263 (15.9) | 52 (19.8) | 1 | | 1 | |
| Brazil | 107 (6.5) | 40 (37.4) | 2.42 (1.48 – 3.98) | <0.001 | 2.32 (1.13 – 4.77) | 0.022 |
| Chile | 106 (6.4) | 23 (21.7) | 1.12 (0.65 – 1.95) | 0.677 | 1.40 (0.66 – 2.97) | 0.379 |
| Egypt | 98 (6.0) | 50 (51.0) | 4.23 (2.57 – 6.96) | <0.001 | 2.35 (1.36 – 4.07) | 0.002 |
| India | 339 (20.6) | 149 (44.0) | 3.18 (2.19 – 4.61) | <0.001 | 4.28 (2.33 – 7.86) | <0.001 |
| Iran | 141 (8.6) | 53 (37.6) | 2.44 (1.55 – 3.86) | <0.001 | 1.30 (0.75 – 2.24) | 0.353 |
| Nigeria | 161 (9.8) | 28 (17.4) | 0.85 (0.51 – 1.42) | 0.543 | 1.00 (0.50 – 2.00) | 0.995 |
| Bangladesh | 131 (7.9) | 54 (41.2) | 2.85 (1.79 – 4.52) | <0.001 | 2.86 (1.68 – 4.87) | <0.001 |
| Sudan | 174 (10.6) | 76 (43.7) | 3.15 (2.05 – 4.82) | <0.001 | 1.61 (0.97 – 2.67) | 0.066 |
| Tunisia | 129 (7.8) | 75 (58.1) | 5.64 (3.55 – 8.96) | <0.001 | 3.66 (2.12 – 6.32) | <0.001 |
| Age group (year) | | | | | | |
| <20 (R) | 280 (17.0) | 63 (22.5) | 1 | | 1 | |
| 21-30 | 926 (56.2) | 373 (40.3) | 2.32 (1.70 – 3.17) | <0.001 | 1.50 (1.03 – 2.18) | 0.035 |
| 31-40 | 270 (16.4) | 115 (42.6) | 2.56 (1.77 – 3.70) | <0.001 | 1.69 (1.02 – 2.82) | 0.043 |
| 41-50 | 119 (7.2) | 33 (27.7) | 1.32 (0.81 – 2.16) | 0.264 | 0.90 (0.48 – 1.69) | 0.745 |
| >51 | 54 (3.3) | 16 (29.6) | 1.45 (0.76 – 2.77) | 0.261 | 0.71 (0.31 – 1.63) | 0.423 |
| Sex | | | | | | |
| Male (R) | 692 (42.0) | 234 (33.8) | 1 | | 1 | |
| Female | 957 (58.0) | 366 (38.2) | 1.21 (0.99 – 1.49) | 0.065 | 1.40 (1.10 – 1.78) | 0.006 |
| Urbanicity | | | | | | |
| Rural (R) | 314 (19.0) | 116 (36.9) | 1 | | | |
| Urban | 1335 (81.0) | 484 (36.3) | 0.97 (0.75 – 1.25) | 0.820 | | |
| Monthly household income (USD) | | | | | | |
| <500 (R) | 618 (37.5) | 228 (36.9) | 1 | | 1 | |
| 500-999 | 289 (17.5) | 110 (38.1) | 1.05 (0.79 – 1.40) | 0.734 | 1.02 (0.74 – 1.40) | 0.921 |

Table 1. *Continued*

| Variable | n (%) | High perceived risk n (%) | Unadjusted | | Adjusted | |
|---|-------------|------------------------------|--------------------|---------|--------------------|---------|
| | | | OR (95% CI) | p-value | OR (95% CI) | p-value |
| 1,000-1,999 | 192 (11.6) | 72 (37.5) | 1.03 (0.73 – 1.43) | 0.879 | 0.92 (0.63 – 1.35) | 0.665 |
| 2,000-2,999 | 148 (9.0) | 63 (42.6) | 1.27 (0.88 – 1.83) | 0.202 | 1.29 (0.85 – 1.98) | 0.236 |
| 3,000-4,999 | 128 (7.8) | 39 (30.5) | 0.75 (0.50 – 1.13) | 0.169 | 0.79 (0.50 – 1.26) | 0.319 |
| 5,000-7,999 | 100 (6.1) | 36 (36.0) | 0.96 (0.62 – 1.49) | 0.864 | 1.00 (0.60 – 1.64) | 0.984 |
| ≥8,000 | 174 (10.6) | 52 (29.9) | 0.73 (0.51 – 1.05) | 0.088 | 0.67 (0.43 – 1.05) | 0.080 |
| Religion | | | | | | |
| Islam (R) | 915 (55.5) | 354 (38.7) | 1 | | 1 | |
| Christian/Protestant/Methodist/Lutheran/Baptist | 179 (10.9) | 46 (25.7) | 0.55 (0.38 – 0.79) | 0.001 | 0.65 (0.38 – 1.11) | 0.117 |
| Catholic | 127 (7.7) | 41 (32.3) | 0.76 (0.51 – 1.12) | 0.164 | 0.68 (0.37 – 1.25) | 0.213 |
| Hindu | 239 (14.5) | 92 (38.5) | 0.99 (0.74 – 1.33) | 0.956 | 0.44 (0.26 – 0.74) | 0.002 |
| Atheist or agnostic | 87 (5.3) | 25 (28.7) | 0.64 (0.39 – 1.04) | 0.069 | 0.50 (0.27 – 0.93) | 0.028 |
| Others | 102 (6.2) | 42 (41.2) | 1.11 (0.73 – 1.68) | 0.625 | 0.84 (0.49 – 1.43) | 0.510 |
| Healthcare-related job | | | | | | |
| No (R) | 908 (55.1) | 261 (28.7) | 1 | | 1 | |
| Yes | 741 (44.9) | 339 (45.7) | 2.09 (1.71 – 2.56) | <0.001 | 1.48 (1.16 – 1.89) | 0.002 |
| Have hypertension | | | | | | |
| No ^a (R) | 1102 (66.8) | 404 (36.7) | 1 | | | |
| Yes ^b | 97 (5.9) | 34 (35.1) | 0.93 (0.60 – 1.44) | 0.752 | | |
| Do not know | 450 (27.3) | 162 (36.0) | 0.97 (0.77 – 1.22) | 0.806 | | |
| Have diabetes | | | | | | |
| No ^a (R) | 1190 (72.2) | 447 (37.6) | 1 | | 1 | |
| Yes ^b | 58 (3.5) | 19 (32.8) | 0.81 (0.46 – 1.42) | 0.461 | 0.79 (0.40 – 1.55) | 0.487 |
| Do not know | 401 (24.3) | 134 (33.4) | 0.83 (0.66 – 1.06) | 0.136 | 0.79 (0.56 – 1.13) | 0.200 |
| Have heart disease | | | | | | |
| No ^a (R) | 1093 (66.3) | 395 (36.1) | 1 | | 1 | |
| Yes ^b | 55 (3.3) | 26 (47.3) | 1.58 (0.92 – 2.73) | 0.097 | 1.59 (0.82 – 3.07) | 0.166 |
| Do not know | 501 (30.4) | 179 (35.7) | 0.98 (0.79 – 1.23) | 0.874 | 1.07 (0.71 – 1.59) | 0.755 |

Table 1. Continued

| Variable | n (%) | High perceived risk n (%) | Unadjusted | | Adjusted | |
|---|-------------|------------------------------|---------------------|---------|----------------------|---------|
| | | | OR (95% CI) | p-value | OR (95% CI) | p-value |
| Have pulmonary disease | | | | | | |
| No ^a (R) | 1044 (63.3) | 371 (35.5) | 1 | | 1 | |
| Yes ^b | 90 (5.5) | 51 (56.7) | 2.37 (1.53 – 3.67) | <0.001 | 2.44 (1.48 – 4.05) | 0.001 |
| Do not know | 515 (31.2) | 178 (34.6) | 0.96 (0.77 – 1.20) | 0.705 | 1.22 (0.82 – 1.82) | 0.335 |
| Know people in immediate social environment who are or have been infected with COVID-19 | | | | | | |
| No (R) | 508 (30.8) | 105 (20.7) | 1 | | 1 | |
| Yes | 1141 (69.2) | 495 (43.4) | 2.94 (2.30 – 3.76) | <0.001 | 2.05 (1.55 – 2.70) | <0.001 |
| Have you seen or read about individuals infected with the COVID-19 on social media or TV? | | | | | | |
| No (R) | 121 (7.3) | 27 (22.3) | 1 | | 1 | |
| Yes | 1528 (92.7) | 573 (37.5) | 2.09 (1.34 – 3.24) | <0.001 | 1.72 (1.06 – 2.77) | 0.027 |
| Occupation | | | | | | |
| Self-employed (R) | 155 (9.4) | 42 (27.1) | 1 | | 1 | |
| Employed for wages | 417 (25.3) | 177 (42.4) | 1.98 (1.33 – 2.97) | <0.001 | 2.22 (1.43 – 3.45) | <0.001 |
| Out of work for less 1 year AND more than 1 year | 73 (4.4) | 23 (31.5) | 1.24 (0.67 – 2.27) | 0.492 | 1.49 (0.77 – 2.89) | 0.241 |
| Homemaker | 34 (2.1) | 12 (35.3) | 1.47 (0.67 – 3.23) | 0.340 | 1.65 (0.68 – 4.00) | 0.272 |
| Student | 948 (57.5) | 330 (34.8) | 1.44 (0.98 – 2.10) | 0.061 | 2.05 (1.31 – 3.22) | 0.002 |
| Retired or unable to work | 22 (1.3) | 16 (72.7) | 7.18 (2.63 – 19.56) | <0.001 | 11.36 (3.81 – 33.87) | <0.001 |
| Has how much your work changed as a result of the COVID-19 pandemic? | | | | | | |
| No change and not applicable (not working) (R) | 1009 (61.2) | 349 (34.6) | 1 | | 1 | |
| I work more hours | 300 (18.2) | 126 (42.0) | 1.37 (1.05 – 1.78) | 0.019 | 1.17 (0.85 – 1.59) | 0.336 |
| I work fewer hours | 286 (17.3) | 107 (37.4) | 1.13 (0.86 – 1.48) | 0.378 | 1.02 (0.75 – 1.39) | 0.900 |
| I was let go from my job | 54 (3.3) | 18 (33.3) | 0.95 (0.53 – 1.69) | 0.850 | 0.90 (0.46 – 1.74) | 0.753 |

COVID-19, coronavirus disease 2019; OR, odds ratio; CI, confidence interval; R, reference group.

^aHave been tested or examined by a doctor but negative.

^bHave been diagnosed by a doctor.

Table 2. Logistic regression showing factors associated with perceived risk of dying from COVID-19 if infected (n=1,649).

| Variable | n (%) | High perceived risk n (%) | Unadjusted | | Adjusted | |
|--------------------------------|-------------|------------------------------|--------------------|---------|--------------------|---------|
| | | | OR (95% CI) | p-value | OR (95% CI) | p-value |
| Country | | | | | | |
| Pakistan (R) | 263 (15.9) | 65 (24.7) | 1 | | 1 | |
| Brazil | 107 (6.5) | 25 (23.4) | 0.93 (0.55 – 1.58) | 0.784 | 0.88 (0.40 – 1.92) | 0.745 |
| Chile | 106 (6.4) | 16 (15.1) | 0.54 (0.30 – 0.99) | 0.045 | 0.70 (0.30 – 1.60) | 0.392 |
| Egypt | 98 (6.0) | 26 (26.5) | 1.10 (0.65 – 1.87) | 0.724 | 1.00 (0.56 – 1.80) | 0.990 |
| India | 339 (20.6) | 56 (16.5) | 0.60 (0.40 – 0.90) | 0.013 | 0.93 (0.49 – 1.78) | 0.823 |
| Iran | 141 (8.6) | 32 (22.7) | 0.89 (0.55 – 1.45) | 0.651 | 0.63 (0.35 – 1.13) | 0.117 |
| Nigeria | 161 (9.8) | 25 (15.5) | 0.56 (0.34 – 0.93) | 0.026 | 0.83 (0.40 – 1.73) | 0.622 |
| Bangladesh | 131 (7.9) | 47 (35.9) | 1.70 (1.08 – 2.68) | 0.021 | 2.10 (1.23 – 3.58) | 0.006 |
| Sudan | 174 (10.6) | 44 (25.3) | 1.03 (0.66 – 1.60) | 0.892 | 0.74 (0.44 – 1.25) | 0.260 |
| Tunisia | 129 (7.8) | 34 (26.4) | 1.09 (0.67 – 1.77) | 0.725 | 0.80 (0.45 – 1.44) | 0.462 |
| Age group (year) | | | | | | |
| <20 (R) | 280 (17.0) | 54 (19.3) | 1 | | 1 | |
| 21-30 | 926 (56.2) | 207 (22.4) | 1.21 (0.86 – 1.68) | 0.275 | 1.23 (0.83 – 1.85) | 0.305 |
| 31-40 | 270 (16.4) | 68 (25.2) | 1.41 (0.94 – 2.11) | 0.097 | 1.57 (0.90 – 2.75) | 0.116 |
| 41-50 | 119 (7.2) | 22 (18.5) | 0.95 (0.55 – 1.65) | 0.853 | 1.20 (0.60 – 2.40) | 0.613 |
| >51 | 54 (3.3) | 19 (35.2) | 2.27 (1.21 – 4.28) | 0.011 | 2.70 (1.21 – 5.99) | 0.015 |
| Gender | | | | | | |
| Male (R) | 692 (42.0) | 137 (19.8) | 1 | | 1 | |
| Female | 957 (58.0) | 233 (24.3) | 1.30 (1.03 – 1.65) | 0.029 | 1.58 (1.20 – 2.08) | 0.001 |
| Urbanicity | | | | | | |
| Rural (R) | 314 (19.0) | 70 (22.3) | 1 | | | |
| Urban | 1335 (81.0) | 300 (22.5) | 1.01 (0.75 – 1.36) | 0.945 | | |
| Monthly household income (USD) | | | | | | |
| <500 (R) | 618 (37.5) | 167 (27.0) | 1 | | 1 | |
| 500-999 | 289 (17.5) | 66 (22.8) | 0.80 (0.58 – 1.11) | 0.179 | 0.80 (0.56 – 1.14) | 0.212 |

Table 2. Continued

| Variable | n (%) | High perceived risk n (%) | Unadjusted | | Adjusted | |
|---|-------------|------------------------------|--------------------|---------|--------------------|---------|
| | | | OR (95% CI) | p-value | OR (95% CI) | p-value |
| 1,000-1,999 | 192 (11.6) | 36 (18.8) | 0.62 (0.42 - 0.93) | 0.022 | 0.58 (0.38 - 0.90) | 0.015 |
| 2,000-2,999 | 148 (9.0) | 36 (24.3) | 0.87 (0.57 - 1.32) | 0.504 | 0.94 (0.59 - 1.49) | 0.777 |
| 3,000-4,999 | 128 (7.8) | 23 (18.0) | 0.59 (0.36 - 0.96) | 0.034 | 0.62 (0.36 - 1.05) | 0.076 |
| 5,000-7,999 | 100 (6.1) | 21 (21.0) | 0.72 (0.43 - 1.20) | 0.205 | 0.73 (0.42 - 1.28) | 0.267 |
| ≥8,000 | 174 (10.6) | 21 (12.1) | 0.37 (0.23 - 0.61) | <0.001 | 0.34 (0.19 - 0.60) | <0.001 |
| Religion | | | | | | |
| Islam (R) | 915 (55.5) | 242 (26.4) | 1 | | 1 | |
| Christian/Protestant/Methodist/Lutheran/Baptist | 179 (10.9) | 24 (13.4) | 0.43 (0.27 - 0.68) | <0.001 | 0.54 (0.29 - 1.00) | 0.051 |
| Catholic | 127 (7.7) | 28 (22.0) | 0.79 (0.50 - 1.23) | 0.290 | 0.96 (0.50 - 1.85) | 0.902 |
| Hindu | 239 (14.5) | 32 (13.4) | 0.43 (0.29 - 0.64) | <0.001 | 0.44 (0.24 - 0.81) | 0.008 |
| Atheist or agnostic | 87 (5.3) | 18 (20.7) | 0.73 (0.42 - 1.24) | 0.243 | 0.93 (0.47 - 1.84) | 0.840 |
| Others | 102 (6.2) | 26 (25.5) | 0.95 (0.60 - 1.52) | 0.835 | 1.05 (0.58 - 1.90) | 0.862 |
| Healthcare-related job | | | | | | |
| No (R) | 908 (55.1) | 198 (21.8) | 1 | | | |
| Yes | 741 (44.9) | 172 (23.2) | 1.08 (0.86 - 1.37) | 0.496 | | |
| Have hypertension | | | | | | |
| No ^a (R) | 1102 (66.8) | 227 (20.6) | 1 | | 1 | |
| Yes ^b | 97 (5.9) | 32 (33.0) | 1.90 (1.21 - 2.97) | 0.005 | 1.29 (0.75 - 2.22) | 0.365 |
| Do not know | 450 (27.3) | 111 (24.7) | 1.26 (0.97 - 1.64) | 0.078 | 1.38 (0.96 - 1.99) | 0.087 |
| Have diabetes | | | | | | |
| No ^a (R) | 1190 (72.2) | 266 (22.4) | 1 | | | |
| Yes ^b | 58 (3.5) | 16 (27.6) | 1.32 (0.73 - 2.39) | 0.353 | | |
| Do not know | 401 (24.3) | 88 (21.9) | 0.98 (0.74 - 1.28) | 0.865 | | |
| Have heart disease | | | | | | |
| No ^a (R) | 1093 (66.3) | 233 (21.3) | 1 | | 1 | |
| Yes ^b | 55 (3.3) | 24 (43.6) | 2.86 (1.65 - 4.96) | <0.001 | 2.35 (1.20 - 4.60) | 0.013 |
| Do not know | 501 (30.4) | 113 (22.6) | 1.08 (0.83 - 1.39) | 0.578 | 1.03 (0.67 - 1.58) | 0.901 |

Table 2. Continued

| Variable | n (%) | High perceived risk n (%) | Unadjusted | | Adjusted | |
|---|-------------|------------------------------|--------------------|---------|--------------------|---------|
| | | | OR (95% CI) | p-value | OR (95% CI) | p-value |
| Have pulmonary disease | | | | | | |
| No ^a (R) | 1044 (63.3) | 215 (20.6) | 1 | | 1 | |
| Yes ^b | 90 (5.5) | 42 (46.7) | 3.37 (2.17 – 5.24) | <0.001 | 2.88 (1.73 – 4.78) | <0.001 |
| Do not know | 515 (31.2) | 113 (21.9) | 1.08 (0.84 – 1.40) | 0.539 | 0.88 (0.57 – 1.37) | 0.578 |
| Know people in immediate social environment who are or have been infected with COVID-19 | | | | | | |
| No (R) | 508 (30.8) | 93 (18.3) | 1 | | 1 | |
| Yes | 1141 (69.2) | 277 (24.3) | 1.43 (1.10 – 1.86) | 0.007 | 1.51 (1.11 – 2.05) | 0.008 |
| Have you seen or read about individuals infected with the COVID-19 on social media or TV? | | | | | | |
| No (R) | 121 (7.3) | 33 (27.3) | 1 | | 1 | |
| Yes | 1528 (92.7) | 337 (22.1) | 0.76 (0.50 – 1.15) | 0.187 | 0.70 (0.44 – 1.10) | 0.122 |
| Occupation | | | | | | |
| Self-employed (R) | 155 (9.4) | 35 (22.6) | 1 | | 1 | |
| Employed for wages | 417 (25.3) | 103 (24.7) | 1.13 (0.73 – 1.74) | 0.599 | 1.12 (0.69 – 1.81) | 0.643 |
| Out of work for less 1 year AND more than 1 year | 73 (4.4) | 23 (31.5) | 1.58 (0.85 – 2.94) | 0.150 | 1.64 (0.83 – 3.25) | 0.153 |
| Homemaker | 34 (2.1) | 12 (35.3) | 1.87 (0.84 – 4.15) | 0.124 | 1.52 (0.63 – 3.68) | 0.351 |
| Student | 948 (57.5) | 192 (20.3) | 0.87 (0.58 – 1.31) | 0.507 | 0.92 (0.56 – 1.49) | 0.720 |
| Retired or unable to work | 22 (1.3) | 5 (22.7) | 1.01 (0.35 – 2.93) | 0.988 | 0.70 (0.21 – 2.31) | 0.558 |
| Has how much your work changed as a result of the COVID-19 pandemic? | | | | | | |
| No change or not applicable (not working) (R) | 1009 (61.2) | 203 (20.1) | 1 | | 1 | |
| I work more hours | 300 (18.2) | 80 (26.7) | 1.44 (1.07 – 1.95) | 0.016 | 1.39 (0.99 – 1.96) | 0.056 |
| I work fewer hours | 286 (17.3) | 71 (24.8) | 1.31 (0.96 – 1.79) | 0.086 | 1.25 (0.89 – 1.75) | 0.192 |
| I was let go from my job | 54 (3.3) | 16 (29.6) | 1.67 (0.91 – 3.06) | 0.095 | 1.26 (0.65 – 2.46) | 0.497 |

COVID-19, coronavirus disease 2019; OR, odds ratio; CI, confidence interval; R, reference group.

^aHave been tested or examined by a doctor but negative.

^bHave been diagnosed by a doctor.

Our data suggested that the elderly group (those over the age of 51) had a higher perceived risk of dying from COVID-19, if infected, by 2.7 times (95% CI: 1.21–5.99) compared to the youngest age group (those under the age of 20) (Table 2). Compared to male participants, female participants had 1.5 times higher odds of perceived risk of dying from COVID-19 (aOR: 1.58; 95% CI: 1.20–2.08, $p=0.001$). Participants who had heart disease and pulmonary disease had a 2.3- and 2.8-fold chance of having a perceived risk of dying from COVID-19 compared to those who did not have such comorbidities (aOR: 2.35; 95% CI: 1.20–4.60 and aOR: 2.88; 95% CI: 1.73–4.78, respectively). Our study also found that participants who knew someone from their immediate social environment who were or had been infected with COVID-19 had higher odds of perceiving the risk of dying from COVID-19 with an aOR: 1.51; 95% CI: 1.11–2.05.

Discussion

An individual's perception of COVID-19-associated risks plays a major role in the ongoing pandemic.¹² At the community level, perceived risk contributes to increased public participation in preventive measures devised by governments and other health organizations. In addition, it encourages voluntary health behaviors that are beneficial in controlling the spread of SARS-CoV-2.^{12,13}

According to our findings, 36.4% of participants had a high perceived risk of COVID-19 infection, while only 22.4% had a high perceived risk of dying from COVID-19. This is lower compared to the other studies.^{14–16} In a cross-sectional study conducted in Myanmar, the COVID-19-associated risk perception level was reported to be moderate to high.¹⁶ However, a study conducted in Hong Kong reported high levels of perceived risk among participants.¹⁷ In another study, higher risk perception was found to be associated with spending more time at home. Furthermore, higher risk perception was also observed in individuals living in counties with higher mortality rates.¹² Therefore, governments and other health agencies should focus on increasing the COVID-19 risk perception of the public to enhance voluntary health behaviors. Our study found that female participants had a higher perceived risk of being infected and dying from COVID-19 compared to their male counterparts. Several studies have reported similar findings. Men are less concerned about the potential health consequences associated with COVID-19 and, therefore, express a lower perceived risk of infection.¹⁸

In an online survey conducted in Ethiopia, perceived risk was found to be dependent on age, occupation, educational status, and place of residence.¹⁴ Our study found that participants working in healthcare-related sectors had a higher perceived risk of contracting COVID-19 compared to those working in non-healthcare sectors. Previous studies have reported that the perceived risk of becoming infected is higher among healthcare professionals.¹⁹ The high perceived risk among individuals working in healthcare-related sectors can be attributed to their better knowledge of COVID-19 than the general population.²⁰ In addition, being a woman, having pulmonary disease, knowing people in the immediate social environment who were or have been infected with COVID-19, and seeing or reading about individuals infected with COVID-19 on social media or TV were also associated with a higher perceived risk of being infected with COVID-19.

It has been already established that individuals with chronic diseases (such as heart diseases, chronic obstructive pulmonary disease, hypertension, diabetes, and cancer) are at an increased risk for adverse outcomes with COVID-19.^{13,21} In our study, individuals with pulmonary disease had a higher perceived risk of COVID-19 infection than healthy individuals. Furthermore, knowing people in the immediate social environment who were or have been infected with COVID-19, as well as seeing or reading about individuals infected with COVID-19 on social media or TV, were associated with a higher perceived risk. Similarly, being an elderly individual with heart disease and pulmonary disease, knowing people in the immediate social environment who were or had been infected with COVID-19, as well as seeing or reading about individuals infected with COVID-19 on social media or TV, also had a higher perceived risk of death due to COVID-19.

Being an online survey, there are a few limitations that can lead to bias in this study. For example, this survey might have excluded individuals belonging to lower socioeconomic classes, those with lower educational qualifications, and those who are illiterate. In addition, variation in Internet access might have contributed to selection bias across the countries evaluated in this study. Furthermore, the participants may also respond in a manner that may cause a social desirability bias.

Conclusions

Our data suggests that there is a low perceived risk of becoming infected and dying due to COVID-19 among community members in certain LMICs. Factors such as age group, sex, religion, type of job, health status, etc., modify the perceived risk. These determinants can be used to alter and influence community health behaviors. Governments and other health agencies can use the data from this study to target susceptible groups within the community by conducting health campaigns to disseminate knowledge and information on the ongoing pandemic.

Data availability

Underlying data

Figshare: Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries. <https://doi.org/10.6084/m9.figshare.19128134>.²²

The project contains the following underlying data:

- Perceived Risk Master Data.xlsx
- Questionnaire of Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries.pdf

Reporting guidelines

Figshare: STROBE checklist for 'Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries'. <https://doi.org/10.6084/m9.figshare.19128332>.²³

Data are available under the terms of the [Creative Commons Attribution 4.0 International license](https://creativecommons.org/licenses/by/4.0/) (CC-BY 4.0).

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