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RESEARCH ARTICLE

REVISED **Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries: A cross-sectional study [version 2; peer review: 2 approved]**

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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.
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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This article is included in the Emerging Diseases and Outbreaks gateway.

This article is included in the Sociology of Health gateway.

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> **_REVISED_** **Amendments from Version 1**
>
> In the revised manuscript, we have provided more detail of information about the sampling technique and we provided explanation of the healthcare-related job under sub-heading Explanatory variables. We have revised some texts to avoid the confusion based on the suggestions of the reviewer. We also have deleted some texts to avoid the repetitive. We have added some other limitations of our study.
>
> **Any further responses from the reviewers can be found at the end of the article**

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 society[1–3] 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 study[23] 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. This study used nonprobability sampling technique, snowball sampling method, to recruit the respondents. The invited potential respondents were also requested to share the invitation to their friends or phone contacts. The survey[22] 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 study[11] 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 adequate (a score of more than 50%). Each question was analyzed separately.

Explanatory variables

Age, gender, residency, 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. Healthcare-related job included doctor, dentist, nurse, physical therapist, nutritionist, pharmacist, paramedic, and laboratory staff. 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 1[22] 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 37.5% were part of a family with a monthly household income of less than $500. 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 adequate perceived risk of being infected with COVID-19. The unadjusted and adjusted 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). Gender was only associated significantly with perceived risk in adjusted logistic regression.

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).

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

Variable	n (%)	High perceived risk n (%)	Unadjusted OR (95% CI)	p-value	Adjusted 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
Residency						
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 OR (95% CI)	p-value	Adjusted 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 OR (95% CI)	p-value	Adjusted 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.
[a]Have been tested or examined by a doctor but negative.
[b]Have 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 OR (95% CI)	p-value	Adjusted 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
Residency						
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 OR (95% CI)	p-value	Adjusted 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 OR (95% CI)	p-value	Adjusted 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.
[a] Have been tested or examined by a doctor but negative.
[b] Have been diagnosed by a doctor.

Perceived risk of dying from COVID-19 and associated determinants

Of the total respondents, only 22.4% (370/1,649) had a high (adequate) perceived risk of dying from COVID-19. In the adjusted logistic regression, country, age group, gender, religion, type of job, having 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).

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 SARC-CoV-2.[12,13]

According to our findings, the percentages of participants who had adequate perceived risk of COVID-19 infection and perceived risk of dying from COVID-19 were relatively low, only 36.4% and 22.4%, respectively. These are 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. In addition, since the survey was conducted in English, this could be source of bias because some of the individuals in those studied countries might unable to read and understand English.

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 (CC-BY 4.0).

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References

1. Giuntella O, Hyde K, Saccardo S, *et al.*: **Lifestyle and mental health disruptions during COVID-19.** *Proc. Natl. Acad. Sci. U. S. A.* 2021 Mar 2; **118**(9). pii: e2016632118. Epub 2021/02/12.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

2. Pak A, Adegboye OA, Adekunle AI, *et al.*: **Economic Consequences of the COVID-19 Outbreak: the Need for Epidemic Preparedness.** *Front. Public Health.* 2020; **8**: 241. Epub 2020/06/24.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

3. Fahriani M, Anwar S, Yufika A, *et al.*: **Disruption of childhood vaccination during the COVID-19 pandemic in Indonesia.** *Narra. J.* 2021; **1**(1): e7.
Publisher Full Text

4. Fajar JK, Ilmawan M, Mamada S, *et al.*: **Global prevalence of persistent neuromuscular symptoms and the possible pathomechanisms in COVID-19 recovered individuals: A systematic review and meta-analysis.** *Narra. J.* 2021; **1**(3): e48.
Publisher Full Text

5. Fahriani M, Ilmawan M, Fajar JK, *et al.*: **Persistence of long COVID symptoms in COVID-19 survivors worldwide and its potential pathogenesis-a systematic review and meta-analysis.** *Narra. J.* 2021; **1**(2): e36.
Publisher Full Text

6. Herbec A, Brown J, Jackson SE, *et al.*: **Perceived risk factors for severe Covid-19 symptoms and their association with health behaviours: Findings from the HEBECO study.** *Acta Psychol.* 2021; **222**: 103458.
Publisher Full Text

7. Curtis AF, Rodgers M, Miller MB, *et al.*: **Impact of Sex on COVID-19 Media Exposure, Anxiety, Perceived Risk, and Severity in Middle-Aged and Older Adults.** *J. Aging Health.* 2021; **34**: 51–59.
Publisher Full Text

8. Dolu I, Turhan Z, Yalniz DH: **COVID-19 Vaccine Acceptance is associated with Vaccine Hesitancy, Perceived Risk and Previous Vaccination Experiences.** *Disaster Med. Public Health Prep.* 2021 Dec 23: 1–9. Epub 2021/12/24
PubMed Abstract | **Publisher Full Text**

9. Boonsaeng T, Carpio CE, Guerrero P, *et al.*: **Perceived risks of infection, hospitalization, and death from COVID-19 at the Equator: Ecuador and Kenya.** *Disaster Med. Public Health Prep.* 2021; 1–6.
PubMed Abstract | **Publisher Full Text**

10. Siegrist M, Luchsinger L, Bearth A: **The Impact of trust and risk perception on the acceptance of measures to reduce COVID-19 cases.** *Risk Anal.* 2021; **41**(5): 787–800.
PubMed Abstract | **Publisher Full Text**

11. Zhang F, Shih SF, Harapan H, *et al.*: **Changes in COVID-19 risk perceptions: methods of an internet survey conducted in six countries.** *BMC. Res. Notes.* 2021 Nov 25; **14**(1): 428.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

12. Elharake JA, Shafiq M, McFadden SM, *et al.*: **The Association of COVID-19 Risk Perception, County Death Rates, and Voluntary Health Behaviors among U.S. Adult Population.** *J. Infect. Dis.* 2021 Mar 10. Epub 20210310. eng.
PubMed Abstract | **Free Full Text**

13. Ahuja M, Mamudu HM, Weierbach FM, *et al.*: **Correction: Perceptions of risk for COVID-19 among individuals with chronic diseases and stakeholders in Central Appalachia.** *Humanit. Soc. Sci. Commun.* 2021; **8**(1): 279. Epub 20211116. eng.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

14. Birhanu Z, Ambelu A, Fufa D, *et al.*: **Risk perceptions and attitudinal responses to COVID-19 pandemic: an online survey in Ethiopia.** *BMC Public Health.* 2021 May 25; **21**(1): 981. Epub 20210525. eng.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

15. Shahin MAH, Hussien RM: **Risk perception regarding the COVID-19 outbreak among the general population: a comparative Middle East survey.** *Middle East Current Psychiatry.*

2020 2020/12/22; **27**(1): 71.
Publisher Full Text

16. Mya KS, Aye SM, Hlaing WA, *et al.*: **Awareness, perceived risk and protective behaviours of Myanmar adults on COVID-19.** *International Journal of Community Medicine And Public Health.* 2020; **7**(5): 1627.
Publisher Full Text

17. Kwok KO, Li KK, Chan HHH, *et al.*: **Community Responses during Early Phase of COVID-19 Epidemic, Hong Kong.** *Emerg. Infect. Dis.* 2020 Jul; **26**(7): 1575–1579. Epub 20200621. eng.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

18. Lewis A, Duch R: **Gender differences in perceived risk of COVID-19.** *Soc. Sci. Q.* 2021 Sep; **102**(5): 2124–2133. Epub 20211029. eng.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

19. Deressa W, Worku A, Abebe W, *et al.*: **Risk perceptions and preventive practices of COVID-19 among healthcare professionals in public hospitals in Addis Ababa, Ethiopia.** *PLoS One.* 2021; **16**(6): e0242471. Epub 20210625. eng.
PubMed Abstract | **Free Full Text**

20. Bates BR, Tami A, Carvajal A, *et al.*: **Knowledge, attitudes, and practices towards COVID-19 among Venezuelans during the 2020 epidemic: An online cross-sectional survey.** *PLoS One.* 2021; **16**(4): e0249022. Epub 20210415. eng.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

21. Clark A, Jit M, Warren-Gash C, *et al.*: **Global, regional, and national estimates of the population at increased risk of severe COVID-19 due to underlying health conditions in 2020: a modelling study.** *Lancet Glob. Health.* 2020 Aug; **8**(8): e1003–e1017. Epub 20200615. eng.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

22. Harapan H: **Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries. figshare.** *Journal Contribution.* 2022.
Publisher Full Text

23. Harapan H: **STROBE checklist for Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries. figshare.** *Journal Contribution.* 2022.
Publisher Full Text

Open Peer Review

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Version 2

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The authors have adequately addressed my comments.

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Reviewer Expertise: Infectious Diseasis, Epidemiology, Public Health, Biostatistics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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Thanks for your response. Revised article is enough.

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Reviewer Expertise: Tropical and Infectious Disease, Internal Medicine, Problem Health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

- -

Version 1

Reviewer Report 09 August 2022

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✔ **Erwin Astha Triyono** 🆔

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A well-written article by collecting data taken from an online survey of several countries to analyze the perceived risk of infection and death due to Covid-19. Overall, this article is interesting and provides many references for its readers. What I learned from this article is that Covid-19 poses challenges to a country's health system. These challenges can be related to medical problems and non-medical problems (social problems). Non-medical problems (social problems) arise due to disinformation or hoax issues that make it difficult for medical/scientific information to be conveyed to the public in its entirety. This researcher is very helpful in describing the obstacles, especially in the non-medical aspect (social problems) in handling Covid-19 in a country.

However, there are some comments for improvement:
1. Need to explain the sampling method used, how to determine 10 countries?

2. The researcher explained that the limitations of the survey conducted could bias the results, especially because of the possibility that this survey might have excluded individuals belonging to lower socioeconomic classes, those with lower educational qualifications, and those who are illiterate. Can it be written in the conclusion to be a suggestion for further research?

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Tropical and Infectious Disease, Internal Medicine, Problem Health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Author Response 31 Aug 2022

Harapan Harapan, Universitas Syiah Kuala, Banda Aceh, Indonesia

Dear reviewer,

Thank you for reviewing our manuscript. The comments and suggestions have improved the quality of our current manuscript significantly.

1. Need to explain the sampling method used, how to determine 10 countries?

RESPONSE: Thank you for the question. Those countries were selected to cover of those in LMICs in three continents that had limited information of COVID-19. Also based on the availability of the collaborators.

Information about the sampling technique. In the revised manuscript: "This study used nonprobability sampling technique, snowball sampling method, to recruit the respondents. The invited potential respondents were also requested to share the invitation to their friends or phone contacts."

2. The researcher explained that the limitations of the survey conducted could bias the results, especially because of the possibility that this survey might have excluded individuals belonging to lower socioeconomic classes, those with lower educational qualifications, and those who are illiterate. Can it be written in the conclusion to be a suggestion for further research?

RESPONSE: Thank you for the suggestion. However, we feel this is not part of the conclusion of the study and we would like to provide the actual results of the study within the conclusion.

Thank you for the reviewing our manuscript.

Competing Interests: We do not have conflict of interest in this study.

Reviewer Report 24 May 2022

?   **Hesham M Al-Mekhlafi** iD

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Title: Perceived risk of infection and death from COVID-19 among community members of low- and middle-income countries: A cross-sectional study

This manuscript describes a cross-sectional online survey on the perceived risk of contracting and dying from COVID-19 among 1,646 respondents from 10 LMICs. The study found relatively low levels of perceived risk of infection and death, and identified some demographic, socio-economic and health factors that significantly associated with high perceived levels. Although, the topic is not novel as many studies on the same topic are available from different countries; however, data at the regional or multinational level are always interesting and appreciated.

Overall, the manuscript is interesting, well-written and straightforward. Some comments are provided below.

SPECIFIC COMMENTS
1. Study design and setting: What is the rationale of selecting the 10 countries included in the study? What was the selection strategy?

2. How was the selection for enrollment process? The questionnaire link was shared on Twitter, Facebook, and WhatsApp. More important information is needed about this process. How to ensure that the link has reached the targeted population? How WhatsApp numbers were selected, etc.?

3. Study design and setting: Other study design elements also need to be clearly described in the manuscript for a better understanding of the studied population and what they represent. For example, what is being considered a healthcare-related job in this study?

4. What is the rationale of choosing Pakistan as a reference group for country variable?

5. Page 5: "able to read and understand English in the 10 studied countries." Could this be source of bias, in respect to the aim of helping in the design of population-wide preventive measures?

6. Page 13, discussion, 3rd paragraph: working in non-healthcare sectors was the only variable explained while the rest were repeated as results. Why did females have higher perceived risk than males?

7. Page 13, discussion: Some significant variables were omitted in discussion and not explained, e.g. religion, type of occupation. What about country as a predictor? Any explanation?

8. Page 5: "which 203 respondents were excluded due to incomplete information." An advantage of online questionnaire is that it can be designed as a respondent cannot proceed with incomplete responses!

9. Page 6: "65% were part of a family with a monthly household income of less than $2,000". The tables show that 37.5% of the respondents had a monthly household income of less than $500. I think the later is better representative the studied population and it should be indicated.

10. Page 6, Results, Perceived risk of becoming infected with COVID-19 and the associated determinants, first paragraph: The variables found significant by the unadjusted model were also found significant in the adjusted model. The sentences can be rephrased without repeating the list of variables, especially with the variables and related statistics are mentioned in the next paragraph. Gender was found significant only in the adjusted model and this can be indicated.

11. Urbanicity or residency?

12. Page 6, results: "...... 22.4% (370/1,649) had a perceived risk of dying from COVID-19, which was classified as high". This can be rephrased to avoid confusion with a statement in page 3, conclusion "are relatively low".

13. Page 6, results: "..... knowing or not knowing someone ...", please rephrase.

14. Page 6, results, perceived risk of becoming infected...: again, the sentences can be rephrased without repeating the list of variables, especially with the variables and related statistics are mentioned in the next paragraph in page 13.

15. Page 13, discussion: "This is lower compared to the other studies". Before this comparison, it should be indicated that the overall reported rates were relatively low.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Infectious Diseasis, Epidemiology, Public Health, Biostatistics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 31 Aug 2022

Harapan Harapan, Universitas Syiah Kuala, Banda Aceh, Indonesia

Dear reviewer,

Thank you for reviewing our manuscript. The comments and suggestions have improved the quality of our current manuscript significantly.

1. Study design and setting: What is the rationale of selecting the 10 countries included in the study? What was the selection strategy?

RESPONSE: Thank you for the question. Those countries were selected to cover of those in LMICs in three continents that had limited information of COVID-19. Also based on the availability of the collaborators.

2. How was the selection for enrollment process? The questionnaire link was shared on Twitter, Facebook, and WhatsApp. More important information is needed about this process. How to ensure that the link has reached the targeted population? How WhatsApp numbers were selected, etc.?

RESPONSE: Thank you we have provided the information about the sampling technique. In the revised manuscript: "This study used nonprobability sampling technique, snowball sampling method, to recruit the respondents. The invited potential respondents were also requested to share the invitation to their friends or phone contacts."

Due to the this in the Discussion we discussed this as limitation of our study. "...this survey might have excluded individuals belonging to lower socioeconomic classes, those with lower educational qualifications, and those who are illiterate".

3.Study design and setting: Other study design elements also need to be clearly described in the manuscript for a better understanding of the studied population and what they represent. For example, what is being considered a healthcare-related job in this study?

RESPONSE: We have explained in some parts of the Study design and setting. The explanation of healthcare-related job has been provided under sub-heading "Explanatory variables". We stated that "Healthcare-related job included doctor, dentist, nurse, physical therapist, nutritionist, pharmacist, paramedic, and laboratory staff."

4. What is the rationale of choosing Pakistan as a reference group for country variable?

RESPONSE: Pakistan was chosen after the initial analyzing showing Pakistan had the lowest perceived risk rate.

5. Page 5: "able to read and understand English in the 10 studied countries." Could this be source of bias, in respect to the aim of helping in the design of population-wide preventive measures?

RESPONSE: We appreciate this. We acknowledged for this potential bias and we have included this as one of limitations of our study. "In addition, since the survey was conducted in English, this could be source of bias because some of the individuals in those studied countries might unable to read and understand English."

6. Page 13, discussion, 3rd paragraph: working in non-healthcare sectors was the only variable explained while the rest were repeated as results. Why did females have higher perceived risk than males?

RESPONSE: We have explained some explanatory variable. However, we focused to discuss the variables to determine the groups that could be targeted.

In our article, we provided the possible explanation why the females had higher perceived risk: "Men are less concerned about the potential health consequences associated with COVID-19 and, therefore, express a lower perceived risk of infection".

7. Page 13, discussion: Some significant variables were omitted in discussion and not explained, e.g. religion, type of occupation. What about country as a predictor? Any explanation?

RESPONSE: Thank you for you question. We aim to provide general overview in Discussion not too detailed and discussed the factors to determine the specific groups that are able to targeted to increase the perceived risk in the future. We have discussed the factors associated with perceived risk such as gender, type of occupation, having the comorbid and soon in the Discussion.

8. Page 5: "which 203 respondents were excluded due to incomplete information." An advantage of online questionnaire is that it can be designed as a respondent cannot proceed with incomplete responses!

RESPONSE: Thank you. The survey has been set that all question should be answer to be able to go to the next questions. However, some respondents stopped the survey in the middle of the survey, of which this was classified as incomplete responses.

9. Page 6: "65% were part of a family with a monthly household income of less than $2,000". The tables show that 37.5% of the respondents had a monthly household income of less than $500. I think the later is better representative the studied population and it should be indicated.

RESPONSE: I think both of the statements are correct. We would like not to repeat what in the table and text. However, the we have revised the text based on the recommendation. In the revised manuscript: "The majority (81%) of the respondents lived in urban areas, and 37.5% were part of a family with a monthly household income of less than $500."

10. Page 6, Results, Perceived risk of becoming infected with COVID-19 and the associated determinants, first paragraph: The variables found significant by the unadjusted model were also found significant in the adjusted model. The sentences can be rephrased without repeating the list of variables, especially with the variables and related statistics are mentioned in the next paragraph. Gender was found significant only in the adjusted model and this can be indicated.

RESPONSE: We have revised this section. We would like to thank you for the suggestion. The revised manuscript: "The unadjusted and adjusted 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). Gender was only associated significantly with perceived risk in adjusted logistic regression."

11. Urbanicity or residency?

RESPONSE: Thank you for your suggestion. Now it has been changed to residency.

12. Page 6, results: "...... 22.4% (370/1,649) had a perceived risk of dying from COVID-19, which was classified as high". This can be rephrased to avoid confusion with a statement in page 3, conclusion "are relatively low".

RESPONSE: We have revised the manuscript based on the suggestion. The revised manuscript: "Of the total respondents, only 22.4% (370/1,649) had an adequate (high) perceived risk of dying from COVID-19."

13. Page 6, results: "..... knowing or not knowing someone ...", please rephrase.

RESPONSE: This has been corrected: "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 someone in the*

immediate social environment who were or had been infected with COVID-19 to varying degrees (Table 2)."

14. Page 6, results, perceived risk of becoming infected...: again, the sentences can be rephrased without repeating the list of variables, especially with the variables and related statistics are mentioned in the next paragraph in page 13.

RESPONSE: We would like to thank you for this. We have corrected this section by providing the adjusted logistic regression only. In the revised manuscript: "In the adjusted logistic regression, country, age group, gender, religion, type of job, having 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)."

15. Page 13, discussion: "This is lower compared to the other studies". Before thiscomparison, it should be indicated that the overall reported rates were relatively low.

RESPONSE: Thank you. We have revised the text to provide the clear information. In the revised manuscript: "According to our findings, the percentages of participants who had adequate perceived risk of COVID-19 infection and perceived risk of dying from COVID-19 were relatively low, only 36.4% and 22.4%, respectively. These are lower compared to the other studies. [14 – 16]"

Thank you

Competing Interests: We do not have conflict of interest.

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