

# Worry and Perceived Risk of COVID-19 Among Government Employees in Ethiopia

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## Research

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# Abstract

## Background

Worry and perceived risk have been identified as important factors that affect people's attitude to adopt preventive behaviors against infectious diseases outbreaks and pandemics. However, very few recent studies investigated the worry and perceived risk aspects of the COVID-19 pandemic. This study aimed to assess the level of worry and perceived risk of COVID-19 among government employees working in 46 public institutions in Addis Ababa, Ethiopia.

## Methods

This cross-sectional study used a sample of 1,573 respondents selected by systematic random sampling technique. Data on socio-demographics, worry and perceived risks of COVID-19 were collected using a self-administered questionnaire between 8th and 19th June 2020. Summary statistics were used to summarize the data. Mixed-effects linear regression analyses were performed to identify predictors of COVID-19 worry and perceived risk.

## Results

The mean ( $\pm$  SD) age was 35 ( $\pm$  8.5) years, with 58.3% aged between 30 to 49 years. About 63% were male and 87% had bachelor's degree or above. Almost all (98%) respondents were worried about the economic crisis due to COVID-19, followed by worries related to limited access to food supplies (97%), and losing loved one's (95%). Majority (81%) reported they were being susceptible to coronavirus, and 79% indicated they had a chance of acquiring the virus. About 61% reported their personal health's increased risk of COVID-19 due to their work characteristics. Predictors of COVID-19 worry were increased year of service ( $\beta = 0.09$ ,  $p = 0.001$ ), being from Oromia ( $\beta = 3.93$ ,  $p < 0.001$ ), younger age ( $\beta = -0.07$ ,  $p < 0.001$ ), having bachelor's degree ( $\beta = -1.58$ ,  $p = 0.001$ ), and master's degree or above  $\beta = -1.84$ ,  $p < 0.001$ ). COVID-19 level of worry ( $\beta = 0.07$ ,  $p < 0.001$ ), being men ( $\beta = 0.34$ ,  $p = 0.010$ ) and self-reported chronic illness ( $\beta = 0.45$ ,  $p = 0.047$ ) were significant predictors of perceived risk.

## Conclusions

This study demonstrated higher level of COVID-19 related worry and perceived risk. COVID-19 worry correlated significantly with perceived risk. The findings highlight the importance of considering public reactions such as worry and risk perceptions towards COVID-19 to inform the ongoing public health interventions and health promotion programs.

## Background

The rapidly spreading coronavirus disease 2019 (COVID-19) has caused more than 190 million cases and over four million deaths across the world as of 10th July 2021 [1]. In Ethiopia, 276,871 confirmed COVID-19 cases and 4,342 deaths were reported as of 10th July 2021 [1]. The Government of Ethiopia adopted different first-line emergency responses to prevent the rapid spread of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and enforced policies targeting preventive behaviors such as travel restrictions, closure of international borders, flexible working arrangements, closing schools and universities, mandatory quarantine, partial lockdown, ban on mass gatherings, and state of emergency [2–5]. These policy measures were applied between March and June 2020 particularly in Addis Ababa city. During this period, the Government has adequately raised the awareness and knowledge of the people and informed the public about the health risks and socio-economic consequences of the pandemic and encouraged the public to adopt preventive behaviors such as social distancing, physical distancing and non-pharmaceutical public health interventions. These measures aim to prevent the rapid transmission of the virus in the general population. Despite all the measures, the numbers of confirmed COVID-19 cases and deaths in the country have continued to increase. Ethiopia received the first batch of 2.2 million doses of AstraZeneca vaccine during the first week of March 2021.

People have been impacted due to the COVID-19 pandemic and by the policy measures undertaken to mitigate the rapid spread of the pandemic. The prolonged measures and the continued uncertainty of the pandemic could result in massive disruptions which can lead to loss of jobs, economic recession, shuttered businesses, lockdowns, closure of schools and day-care facilities, inability to support children and dependents, overwhelmed healthcare facilities by COVID-19 cases, lack of employment, and finally, socio-economic crisis. As the pandemic continues threatening not only health of individuals but also the socio-economic condition of the nation, people's attitude, perceptions, worries and risk perceptions about the pandemic and the uptake of preventive behaviors might be affected [6, 7]. People are also highly worried about their personal, physical and mental health particularly due to fear of infection and psychological distress [8]. A recent multi-country study revealed a huge burden of economic crisis and mental health problems related to COVID-19 mitigation strategies and lockdown measures [9].

As part of the response to the pandemic, an overwhelming information related to COVID-19 has been spread to the public through multiple media platforms (e.g., television, radio, internet, and social media) to ensure the public understands how and why to adopt different preventive measures such as handwashing, facemask wearing, social and physical distancing measures, and travel restrictions. In addition, misinformation about COVID-19 has proliferated widely on social media with potential serious consequences [10]. In this context, the public might be in a difficult position to distinguish genuine evidence and facts from less reliable sources of information. The prolonged policy measures and broad media attention along with the future uncertainty of the pandemic might lead the public to an unnecessary fear and increased worries about the COVID-19 crisis [11]. Findings from previous infectious diseases outbreaks and pandemics reported the importance of effective risk communication approaches that bring correct information and knowledge, accurate risk perception and proper skills to promote and enable precautionary preventive practices of the people, particularly during the early phase of a new pandemic without treatment or vaccination [12].

While policy responses aimed at preventing the rapid spread of SARS-COV-2 are important, the behavioral change and adherence to public health interventions is also crucial in reducing transmission of virus [13, 14]. As a result, it is becoming increasingly important to understand emotional reaction and risk perception of the public [10]. Worry and perceived risk are important components of behavior to influence people's attitude to adopt appropriate preventive measures during infectious diseases outbreaks and pandemics [12, 15, 16]. Worry has been described as an emotional response to a threat, whereas perceived risk has been described as a cognitive behavior related to perceptions of susceptibility and severity [17]. Recent studies show that worry and perceived risks about the rapidly spreading COVID-19 pandemic have been identified as one of the factors that affect people's attitude to adopt appropriate protective measures [6, 7, 18]. Furthermore, several previous studies have demonstrated a strong positive relationship between perceived risk and preventive health behavior [17, 19]. Studies reported the influence of worry, perceived risk, and perceived susceptibility useful tools to promote and engage preventive behaviors during the COVID-19 pandemic [20–22].

Initial studies on the relationships between COVID-19 and protective health behaviors reported that people perceiving greater risks were more likely engaged in adopting protective behaviors [23]. Similarly, studies amidst the COVID-19 pandemic in Nigeria [24] and Zambia [25] reported the positive association between risk perceptions and behavioral responses to the pandemic. The emotional reactions such as worry that occur due to the threat of COVID-19 pandemic and the associated perceived risk can play important roles in influencing people to adopt protective behaviors [6, 7]. Studies have also shown that both worries and risk perception of COVID-19 are independently associated with increased preventive behaviors [18, 26]. However, there are very few recent studies that investigated the relationship between worry and perceived risk related to the COVID-19 pandemic, while earlier evidence show that worry and perceived risk are correlated with one another [17]. The link noted between worry towards the pandemic, perceived risk and compliance with COVID-19 preventive behavior provides further evidence of the importance of understanding people's behavior towards the pandemic. Nevertheless, there is limited evidence about the worry levels of the public about the currently rapidly spreading coronavirus transmission and their reactions towards the COVID-19 crisis in Ethiopia. There is also limited information on people's risk perceptions in response to the COVID-19 pandemic [27].

The purposes of this study were to investigate the levels of worry and perceived risk related to COVID-19, and potential predictors of each one among a comprehensive sample of government employees in Ethiopia. Furthermore, the study aimed to determine the association between worry and perceived risk due to COVID-19. We hypothesized that when people are more worried about the COVID-19 pandemic, they tend to develop higher perceived risk of the disease, which are often associated with adoption of protective behaviors. The results of this study are important to inform future responses to the COVID-19 pandemic focusing on the people's worry and perceived risk to comply with effective precautionary measures and the development of preventive strategies and health promotion programs.

## Methods

## **Study setting**

This study was conducted between 8th and 19th June 2020 in Addis Ababa city administration, approximately three months after the first confirmed COVID-19 case was reported in Ethiopia on 13th March 2020. The city is both the capital and commercial hub of Ethiopia, including private and public commercial businesses. It is also a seat for the African Union and other international agencies. Administratively, the city is divided into 10 sub-cities and 116 districts. The projected population of the city was about 3.7 million in 2020, which accounted for 3.7% of the population of the country [28]. COVID-19 has been the major problem in Addis Ababa, and about 71% of the confirmed cases in the country were identified from the city as of 21st June 2020 [29]. During the period of the current study, the spread of COVID-19 in the city cumulatively increased from 1,625 on 8th June to 2,988 on 19th June, with an average of 114 cases per day. Overall, Addis Ababa reported about 66% (171,947) of the confirmed COVID-19 cases in the country as of 9th May 2021 [2].

The Regional State of Oromia is one of the 10 states in Ethiopia, with a projected population of about 38 million in 2020 [28]. Oromia is the largest region in Ethiopia, and accounts for about 38% of the population. The landmass of Oromia stretches over the largest parts of eastern, southern, central and western parts of the country, and shares a boundary with almost every region except the Regional State of Tigray. The capital city of Oromia is the national capital, Addis Ababa (a.k.a. Finfinne). All national government offices including all ministry offices, the city and sub-city administration offices, the city's sector offices and the Regional State of Oromia and its sector offices are located in Addis Ababa. Many people including government employees and business persons reside in the Oromia Special Zone Surrounding Finfinne and commute daily to the city. The State of Oromia is one of the regions highly affected by COVID-19, next to Addis Ababa city. As of 9th May 2021, a total of 36,817 confirmed COVID-19 cases were reported from Oromia, accounting for 14% of the national cases [2].

## **Study design and sample size**

This study was an institution-based cross-sectional survey of government employees selected from 46 diverse public institutions located in Addis Ababa city administration. As it was not feasible to conduct a representative nationwide household or online survey during the study period, the researchers opted to use a self-administered survey. The expected prevalence of COVID-19 perceived risk was unknown at the time of the study and an estimate of 50% was used for the sample size calculation with a desired precision of 4%, 95% confidence level, a design effect of two and 30% non-response rate. Finally, the minimum total sample size required for this survey was 1,560 respondents. However, due to the growing concern of high non-response rate due to the fear of COVID-19 crisis, the sample size was increased to 1,730 after inflating it by about 10%.

## **Study population and sampling**

The target population for this study comprised all employees of 46 government institutions or organizations located in Addis Ababa city, and the study population constituted all employee's working in

the selected institution at the time of the survey and willing to participate in the study. These included professionals, experts, technicians and support staff working at different hierarchies and divisions/directorates in the selected institution including higher and midlevel officials. The study institutions were purposively selected from government institutions located in Addis Ababa city administration, particularly from three government levels: (1) the Federal or National Government Ministries, (2) Addis Ababa city administration bureaus and sub-cities, and (3) Oromia Regional State bureaus located in Addis Ababa. These included 16 national offices (14 Ministry offices, a National Bank of Ethiopia, and Addis Ababa branch Commercial Bank of Ethiopia), 12 sector bureaus and six sub-city administration offices in Addis Ababa city administration, and 12 sector bureaus from Oromia Regional State [Additional file 1].

A systematic random sampling technique was used to finally select the study participants in each institution. At the first stage, the data collectors contacted the Human Resource Directorate of each institution to explain the purpose of the survey. They obtained information on the total number of employees, number of directorates and departments in the institution with their respective number of personnel. The total sample size was then proportionally distributed to the 46 selected institutions based on the relative size of their employees. The allocated sample size to the institution was further distributed to the directorates or departments proportional to the relative size of the employees. At the second stage, the survey team selected participants from the list of employees in the selected directorate or department using systematic random sampling or consecutive sampling procedures. Participants had to be the employees of that institution in order to participate in this study.

### **Survey instrument and data collection**

The survey instruments were developed by the research team for the purpose of this survey. The questions were prepared in English after reviewing relevant literatures [30, 31], and the worry questions towards COVID-19 crisis were adapted from the World Health Organization (WHO) Cosmo protocol questionnaire [32]. The final survey instrument was organized into three sections: (i) socio-demographics characteristics; (ii) worries about the COVID-19 crisis, and (iii) perceived risk of COVID-19 [Additional file 2]. The English survey questionnaire was translated into *Amharic* and *Afan Oromo* languages and back-translated into English by two independent experienced personnel in order to ensure consistency. Few minor revisions of the instruments were made. Various scales measuring the worry and perceived risk of COVID-19 have been recently developed [33–36]. Unfortunately, none of these scales were used because they were not yet available at the time of our study.

Trained data collectors with previous experience in field data collection distributed the standardized paper-based self-administered questionnaires in two local languages (*Afan Oromo* in the offices of the Oromia Regional State and *Amharic* otherwise). The data collectors visited the selected institution, approached each potential participant who met the enrollment criteria and invited them to join the study. After obtaining consent, they handed over the questionnaires to the study participants with a cover letter (consent form), introducing the study and explaining the purpose of the survey, instructions on how to

complete the questionnaire, the confidentiality of individual responses and ethical safeguards, and researchers contact information for any questions the respondent might have. The respondents were free not to answer questions that they felt uncomfortable in answering. Participants completed the questionnaires themselves in the local languages. Individuals who declined to participate were excluded from the study.

## **Measures**

The socio-demographic variables included gender, age, education level, category of institution, years of service in the institution, location of residence, the COVID-19 worry scale and perceived risk scale.

### **COVID-19 worry**

The worry questions towards the COVID-19 crisis were measured using a 12-item worry scale, each rated on a three-point response options 1='don't worry at all', 2='worry somehow' and 3='worry a lot'. Respondents were asked to indicate how worried they were for each of the following 12 questions: (1) losing someone I love, (2) health system being overwhelmed, (3) own mental health, (4) own physical health, (5) own loved ones health, (6) restricted liberty of movement as a result of COVID-19, (7) small companies running out of business, (8) economic recession in the country, (9) restricted access to food supplies, (10) becoming unemployed because of COVID-19, (11) not being able to pay my bills, and (12) not being able to visit people who depend on me because of COVID-19. Responses to the questions were summed to obtain the total worry score of the 12-items, ranging from 12 to 36, with a higher score indicating a higher degree of worry regarding the COVID-19 crisis. The Cronbach's alpha coefficient of the reliability of scale used in this study had a higher internal consistency of 0.86 [37].

### **COVID-19 perceived risk**

Perceived risk toward COVID-19 was measured with three-items examining the extent to which the participant thinks about COVID-19: (1) "How likely is your chance of acquiring coronavirus?", (2) "How likely susceptible do you consider yourself to an infection with coronavirus?", and (3) "How likely do you feel that your own personal health is at risk of COVID-19 due to your work or occupational characteristics?". Responses for each question were rated on a 4-point Likert scale with higher scores indicating higher perceived risk: 1='very unlikely', 2='unlikely', 3='likely', and 4 = very likely. The total perceived risk score was the sum of the three items, ranging from 3 to 12. A higher total score indicates a greater perceived risk of COVID-19. The perceived risk index had the Cronbach's alpha coefficient of the internal consistency reliability of scale of 0.71. Cronbach's alpha values > 0.7 were considered acceptable [37].

## **Statistical analyses**

Data were entered into the Census and Survey Processing System (CSPRO) version 7.2 statistical software database (U.S. Census Bureau and ICF Macro). All descriptive analyses were performed using the Statistical Package for Social Sciences (SPSS) version 23.0 for Windows (IBM Corp., Armonk, NY, USA),

and two-level linear mixed-effects regression models were applied in STATA/SE version 14 for Windows (StataCorp., College Station, TX, USA). The main outcome variables were worries and perceived risk scores about COVID-19. The level-1 independent variables consisted of gender, age, years of service, educational status (diploma or lower, bachelor's degree, and master's degree or above), and reported chronic illness. The level-2 independent variables considered in the study included place of residence (Addis Ababa or other) and the group of institutions (national, Addis Ababa, and Oromia). The worry scores about the COVID-19 crisis were also used as the main independent variable for predicting the perceived risk score. The two continuous level-1 independent variables, age and service year of the respondents, were centered around their means in order to facilitate interpretation.

Descriptive statistics such as means, standard deviations, frequencies, percentages and cross-tabulations were used to summarize the data as appropriate. Exploratory analyses were conducted to evaluate the assumptions of normality, linearity, multicollinearity and interaction. Normality and linearity tests for the data of worry scores and perceived risk scores were checked through graphically. Both the data of the outcome variables were slightly skewed, but no transformation was undertaken since the requirement of the large sample size was met and modelling with and without transformation of the outcome variables produced results that did not differ substantially [38]. Therefore, untransformed scores of the outcome variables were used in the regression analyses. The variance inflation factor (VIF) test was performed for the predictor variables, and no evidence of multicollinearity was detected in the regression model (all VIF values < 1.6) [38]. In addition, interactions between level-1 independent variables (age, gender, service year, and education) were also evaluated, but no significant interactions were observed (all *p-values* > 0.05).

All variables were analyzed individually for an association with the outcome variables using bivariate analyses. In addition, bivariate correlations between COVID-19 worry and perceived risk scores were investigated using Pearson product-moment correlation coefficient. Finally, mixed-effects linear regression models were performed to estimate adjusted beta-coefficients ( $\beta$ ) and associated 95% confidence intervals (CIs) as measures of the associations between the outcome variables (worry scores and perceived risk scores) and the independent variables, adjusted for clustering and potential confounders. The intercept-only model (a null model) was modelled at the first step, followed by a model with all level-1 predictors. At the last step, the full model with all level-1 and level-2 predictors were modelled. The full model was better than the one with the level-1 variables, and the results presented in this study were obtained from the full model. Maximum likelihood was used to estimate the different parameters. The level of significance was set at  $p < 0.05$  for all tests.

## Results

### Characteristics of the study population

Of 1,730 eligible participants from 46 government institutions invited to participate in the study, 1,718 consented to join the study, 12 (0.7%) refused to take part, 1,589 completed the questionnaires, and 1,573

(91%) were used for the current analysis. Table 1 shows the characteristics of the study participants. The mean ( $\pm$  SD) age was 35 ( $\pm$  8.5) years, with 57.3% aged between 30 to 49 years (range: 19–66). Of the respondents, 62.5% were male, 86.6% had professional bachelor’s degree or higher, and 74.2% served less than 10 years in the current institution. About 82% of the respondents resided in Addis Ababa city, 39.6% were drawn from the national institutions, 38.8% from Addis Ababa city administration institutions, and 21.6% from Oromia Regional State institutions. About 93% of the respondents did not report health problems or did not know their current health status, and only 7% subjectively reported having any chronic illness.

**Table 1.** Characteristics of the study participants (n=1,573)

<b>Characteristics</b>	<b>Number (%)</b>
<b>Gender</b>	
Male	983 (62.5)
Female	549 (34.9)
Not answered	41 (2.6)
<b>Age groups (year)</b>	
19–29	395 (25.1)
30–39	656 (41.7)
40–49	261 (16.6)
≥50	122 (7.8)
Mean age (SD)*, range	35 (± 8.5), 19–66
Not answered	139 (8.8)
<b>Educational status</b>	
≤12th grade	47 (3.0)
Diploma**	132 (8.4)
Bachelor's degree	889 (56.5)
Master's degree or above	473 (30.1)
Not answered	32 (2.0)
<b>Years of service</b>	
<5	766 (48.7)
5–9	412 (26.2)
10–14	178 (11.3)
≥15	161 (10.2)
Mean years of service (SD), range	6.5 (± 6.3), 1–37
Not answered	56 (3.6)
<b>Residence</b>	
Addis Ababa city	1293 (82.2)
Out of Addis Ababa	209 (13.3)
Not answered	71 (4.5)
*SD: Standard Deviation; **12th grade complete and one or more years of training	

Characteristics	Number (%)
<b>Category of institutions</b>	
National	624 (39.6)
Oromia	339 (21.6)
Addis Ababa	610 (38.8)
<b>Self-reported chronic illness</b>	
Yes	112 (7.1)
No, don't know or no response	1461 (92.3)
*SD: Standard Deviation; **12th grade complete and one or more years of training	

## Worries about the COVID-19 crisis

The responses of the individual items of the 12-item scales were used to measure how worried the respondents were about the impacts of COVID-19 crisis. Of the total 1573 study participants, 1425 (90.6%) respondents had complete responses on all the 12-items. Table 2 presents the distribution of the worries about the COVID-19 crisis by category of institutions. Almost all (98.1%) of the respondents (97.9% at national, 98.1% at Addis Ababa, and 99.1% at Oromia) were worried about the current economic crisis in the country, followed by worries related to limited access to food supplies (96.7%), and becoming unemployed (87.2%) due to COVID-19 pandemic ( $p < 0.001$ ). About 95% of the respondents (94.9% at national, 94.4% at Addis Ababa, and 94.3% at Oromia) were worried about losing someone they loved due to COVID-19. Furthermore, 80% of the respondents at national and Addis Ababa were worried about restricted liberty of movement as compared with 92.3% of respondents in Oromia ( $p < 0.001$ ). In contrast, about one-third (33.2%) and over a quarter (27.7%) of the participants did not worry at all about their own mental and physical health, respectively.

**Table 2.** Government employee's worry level of COVID-19 crisis by category of institutions

Worry questions (12 items)	Total (n = 1425)	Category of institutions			P-value*
		National (n = 568)	Oromia (n = 297)	Addis Ababa (n = 560)	
Loosing loved one's (%)					
Don't worry at all	5.4	5.1	5.7	5.5	0.132
Worry somehow	35.2	39.3	33.0	32.1	
Worry a lot	59.4	55.6	61.3	62.3	
Health system being overwhelmed (%)					
Don't worry at all	11.2	14.6	1.7	12.9	< 0.001**
Worry somehow	44.7	50.7	24.9	49.1	
Worry a lot	44.1	34.7	73.4	38.0	
Own mental health (%)					
Don't worry at all	33.2	38.7	18.5	35.4	< 0.001
Worry somehow	43.4	45.2	36.4	45.4	
Worry a lot	23.4	16.0	45.1	19.3	
Own physical health (%)					
Don't worry at all	27.7	30.3	18.5	30.0	< 0.001
Worry somehow	45.3	51.4	33.3	45.4	
Worry a lot	27.0	18.3	48.1	24.6	
Loved ones' health (%)					
Don't worry at all	4.7	5.1	2.7	5.4	< 0.001
Worry somehow	36.6	41.7	26.9	36.6	
Worry a lot	58.7	53.2	70.4	58.0	
Restricted liberty of movement (%)					
Don't worry at all	17.9	21.0	7.7	20.2	< 0.001
Worry somehow	49.1	55.8	36.7	48.9	
Worry a lot	33.0	23.2	55.6	30.9	

\*Chi-square test; \*\*Statistically significant at  $P < 0.01$

Worry questions (12 items)	Total (n = 1425)	Category of institutions			P-value*
		National (n = 568)	Oromia (n = 297)	Addis Ababa (n = 560)	
Companies running out of business (%)					
Don't worry at all	8.5	8.5	2.7	11.6	
Worry somehow	41.9	48.6	24.2	44.5	< 0.001
Worry a lot	49.6	43.0	73.1	43.9	
Economic recession (%)					
Don't worry at all	1.9	2.1	1.3	2.0	
Worry somehow	21.1	25.5	11.4	21.8	< 0.001
Worry a lot	77.0	72.4	87.7	76.3	
Restricted access to food supplies (%)					
Don't worry at all	3.3	3.3	1.0	4.5	
Worry somehow	26.3	31.0	15.8	27.1	< 0.001
Worry a lot	70.4	65.7	83.2	68.4	
Becoming unemployed (%)					
Don't worry at all	12.8	16.4	3.0	14.3	
Worry somehow	26.3	33.5	12.8	26.3	< 0.001
Worry a lot	60.9	50.2	84.2	59.5	
Inability to pay own bills (%)					
Don't worry at all	10.4	11.8	5.4	11.6	
Worry somehow	40.4	48.8	26.6	39.1	< 0.001
Worry a lot	49.3	39.4	68.0	49.3	

\*Chi-square test; \*\*Statistically significant at  $P < 0.01$

Worry questions (12 items)	Total (n = 1425)	Category of institutions			P-value*
		National (n = 568)	Oromia (n = 297)	Addis Ababa (n = 560)	
Inability to visit relatives (%)					
Don't worry at all	8.0	8.5	6.1	8.6	
Worry somehow	39.6	45.4	29.6	39.1	< 0.001
Worry a lot	52.4	46.1	64.3	52.3	
*Chi-square test; **Statistically significant at $P < 0.01$					

The mean score of each worry item is presented in Fig. 1. Overall, the participants reported an average of moderate-to-high levels of COVID-19 worry (2.38). Among the 12-worry scales, economic recession was the highest worry score (mean = 2.8, SD = 0.5), followed by restricted access to food supplies (mean = 2.7, SD = 0.5), losing loved ones (mean = 2.5, SD = 0.6) and becoming unemployed (mean = 2.5, SD = 0.7). However, the worry scores on own mental health (mean = 1.9, SD = 0.8) and physical health (mean = 2.0, SD = 0.7) were the lowest.

## Predictors of worries related to COVID-19 crisis

The overall mean scores of worries about the COVID-19 crisis based on the 12-item scales was high, with a mean ( $\pm$  SD) of 28.6 ( $\pm$  4.9), ranging from 12 to 36. Study participants from Oromia had higher mean worry scores (mean = 31.4) than Addis Ababa (mean = 28.2) and national (mean = 27.5) respondents. Table 3 shows the adjusted beta-coefficients ( $\beta$ ), standard errors and  $p$ -values for the association between the mean scores of worries related to COVID-19 crisis as an outcome variable and the potential predictors using the fully adjusted two-level mixed-effects linear regression model. The level-1 and level-2 predictor variables accounted for approximately 12% of the variance in worry scores related to COVID-19 crisis,  $F(9, 1147) = 17.2, R^2 = 0.12, p < 0.001$ . We observed a significantly higher level of worries among participants from Oromia ( $\beta = 3.93, p < 0.001$ ). The results also showed a significant positive association between years of service and worry of COVID-19 ( $\beta = 0.09, p = 0.001$ ), with all the other predictors held constant. However, age ( $\beta = -0.07, p < 0.001$ ) and higher educational level (bachelor's degree  $\beta = -1.58, p = 0.001$  and master's degree or above  $\beta = -1.84, p < 0.001$ ) showed a negative significant association with reported worry scores. Gender, location of residence and reported chronic illness were not significantly associated with reported worries about COVID-19.

**Table 3.** Mixed-effects linear regression model's beta-coefficients ( $\beta$ ) for worry of COVID-19 crises (n = 1157)

Predictor	Adjusted beta-coefficient (95% CI) <sup>a</sup>	SE <sup>b</sup>	P-value
<b>Gender (male)</b>	-0.20 (-0.79, 0.40)	0.30	0.514
<b>Age in years</b>	-0.07 (-0.11, -0.03)	0.03	<0.001
<b>Years of service</b>	0.10 (0.04, 0.14)	0.03	0.001
<b>Educational status</b>			
Diploma or lower level	1 (Ref) <sup>c</sup>		
Bachelor's degree	-1.58 (-2.51, -0.66)	0.47	0.001
Master's degree or above	-1.84 (-2.84, -0.83)	0.51	<0.001
<b>Category of institutions</b>			
National	1 (Ref)		
Oromia	3.93 (3.01, 4.83)	0.47	<0.001
Addis Ababa	0.31 (-0.27, 0.90)	0.30	0.294
<b>Residence (Addis Ababa)</b>	-0.11 (-1.04, 0.83)	0.48	0.826
<b>Reported chronic illness (Yes)</b>	0.57 (-0.46, 1.61)	0.53	0.276
<b>R<sup>2</sup></b>	<b>0.12</b>		

<sup>a</sup>95% CI=95% Confidence Interval of  $\beta$  coefficient; <sup>b</sup>SE=Standard Error; <sup>c</sup>Ref=Reference

## Perceived risk of COVID-19

Majority (79.2%) of the respondents rated their chance of acquiring coronavirus as likely or very likely, and 80.8% thought it likely or very likely that they might be susceptible to infection with the virus (Table 4). Few respondents thought they were unlikely or very unlikely about their chance of getting coronavirus or susceptibility to infection. About 32% of respondents in Oromia reported that their chance of infection with coronavirus was unlikely or very unlikely, despite the corresponding lower figures for national (17.4%) and Addis Ababa (18.1%) respondents ( $p < 0.001$ ). About 61% of the respondents also rated their personal health as likely or very likely at risk of COVID-19 due to their work or occupational characteristics. Nevertheless, a significant proportion of respondents (34.5%) stated that their personal health was not at risk of COVID-19 pandemic due to their work or occupational characteristics.

**Table 4.** Government employee's perceived risk of COVID-19 by category of institutions

COVID-19 perceived risk questions	Total (n=1519)	Category of institutions			P-value*
		National (n=608)	Oromia (n=320)	Addis Ababa (n=591)	
<b>How likely is your chance of acquiring coronavirus (%)?</b>					
Very unlikely	13.1	12.0	13.1	14.2	<0.001**
Unlikely	7.6	5.4	18.8	3.9	
Likely	62.9	69.7	44.4	66.0	
Very likely	16.3	12.8	23.8	15.9	
<b>How likely susceptible do you consider yourself to an infection with coronavirus (%)?</b>					
Very unlikely	16.8	17.1	18.8	15.4	<0.001
Unlikely	2.4	2.3	3.4	2.0	
Likely	67.9	69.6	55.9	72.6	
Very likely	12.9	11.0	21.9	10.0	
<b>How likely do you feel that your own personal health is at risk during COVID-19 due to your work or occupational characteristics (%)?</b>					
Very unlikely	23.2	29.4	10.6	23.5	<0.001
Unlikely	11.3	12.0	16.3	8.0	
Likely	45.2	42.9	41.3	49.7	
Very likely	20.3	15.6	31.9	18.8	

\*Chi-square test; \*\*Statistically significant at  $P < 0.01$

Ranging from 1 to 4, the likelihood mean ( $\pm$  SD) score was 2.8 ( $\pm$  0.9) for the chance of contracting the virus, 2.8 ( $\pm$  0.9) for susceptibility to infection and 2.7 ( $\pm$  1.1) for the risk of personal health due occupational characteristics (Table 5). An overall mean ( $\pm$  SD) score of 8.2 ( $\pm$  2.1) was obtained for the overall perceived risk of the 3-items, ranging from 3 to 12. Pearson correlations indicated that worry of COVID-19 crisis was positively associated with the chance of acquiring infection ( $r = 0.13$ ,  $p < 0.001$ ), susceptibility to infection ( $r = 0.10$ ,  $p < 0.001$ ) and risk of personal health due to occupational characteristics ( $r = 0.15$ ,  $p < 0.001$ ). Worries related to COVID-19 crisis was further positively associated with the overall perceived risk to COVID-19 ( $r = 0.17$ ,  $p < 0.001$ ).

**Table 5.** Pearson correlations between perceived risks and worry related to COVID-19

	SD <sup>a</sup>	1	2	3	4	5
1. Perceived chance of acquiring the virus	0.9	1				
2. Perceived susceptibility to infection from the virus	0.9	0.48*	1			
3. Perceived risk of personal health due to work or occupational characteristics	1.1	0.25*	0.28*	1		
4. Overall perceived risk	2.1	0.74*	0.76*	0.73*	1	
5. COVID-19 worry	4.9	0.13*	0.10*	0.15*	0.17*	1

<sup>a</sup>Standard Deviation; \* $P < 0.001$

## Predictors of perceived risk related to COVID-19

This study assessed the association between worries related to the COVID-19 crisis as independent variable and the four outcome variables (chance of infection with coronavirus, susceptibility to coronavirus infection, risk of personal health during COVID-19 due to occupational characteristics, and overall perceived risk to COVID-19) using two-level mixed-effects linear regression analyses with a full model, after adjusting for gender, age, education, years of service, location of residence, self-reported chronic illness and category of institution. Table 6 presents the beta-coefficients ( $\beta$ ), standard errors and  $p$ -values of the model for each outcome variable. The level-1 and level-2 predictors explained about 5% of the variance in the chance of infection of coronavirus,  $F(10, 1132) = 5.6$ ,  $R^2 = 0.05$ ,  $p < 0.001$ . COVID-19 worry ( $\beta = 0.03$ ,  $p < 0.001$ ) and being male ( $\beta = 0.17$ ,  $p = 0.001$ ) were positive and significant individual predictors of perceived chance of acquiring the virus. Both worries of COVID-19 ( $\beta = 0.02$ ,  $p < 0.001$ ) and being male ( $\beta = 0.12$ ,  $p = 0.027$ ) were also positively and statistically significantly associated with perceived susceptibility to coronavirus infection. The predictors explained approximately 3% of the variance in perceived susceptibility to infection,  $F(10, 1146) = 3.11$ ,  $R^2 = 0.03$ ,  $p < 0.001$ .

**Table 6.** Mixed-effects linear regression model's beta-coefficients ( $\beta$ ) for perceived risk of COVID-19

Predictor	Perceived chance of acquiring coronavirus (n = 1,143)			Perceived susceptibility to infection from coronavirus (n = 1,157)			Perceived risk of personal health (n = 1,149)			Overall perceived risk (n = 1,136)		
	Beta (95% CI) <sup>a</sup>	SE <sup>b</sup>	P-value	Beta (95% CI)	SE	P-value	Beta (95% CI)	SE	P-value	Beta (95% CI)	SE	P-value
COVID-19 worry	0.03 (0.02, 0.04)	0.01	<0.001	0.02 (0.01, 0.03)	0.01	<0.001	0.02 (0.01, 0.04)	0.01	<0.001	0.07 (0.04, 0.09)	0.01	<0.001
Gender (male)	0.17 (0.07, 0.28)	0.05	0.001	0.12 (0.01, 0.23)	0.06	0.027	0.08 (-0.06, 0.21)	0.07	0.34	0.34 (0.08, 0.60)	0.13	0.010
Age in years	0.01 (-0.004, 0.01)	0.01	0.337	0.001 (-0.006, 0.01)	0.004	0.695	-0.004 (-0.01, 0.01)	0.004	0.393	0.004 (-0.01, 0.21)	0.01	0.648
Year of service	-0.001 (-0.01, 0.01)	0.01	0.847	-0.006 (-0.02, 0.004)	0.005	0.288	-0.003 (-0.01, 0.01)	0.01	0.623	-0.01 (-0.03, 0.01)	0.12	0.383
Educational level	1 (Ref) <sup>c</sup>											
Diploma or lower level	0.02 (-0.14, 0.19)	0.08	0.769	0.19 (0.02, 0.36)	0.09	0.030	-0.07 (-0.27, 0.13)	0.10	0.506	0.13 (-0.27, 0.54)	0.21	0.511
Bachelor's degree	0.16 (-0.02, 0.34)	0.09	0.073	0.25 (0.06, 0.44)	0.09	0.009	-0.14 (-0.36, 0.08)	0.11	0.222	0.26 (-0.18, 0.70)	0.22	0.242
Master's degree or above	1 (Ref)											
Category of institutions	1 (Ref)											
National	-0.15 (-0.33, 0.04)	0.09	0.117	-0.03 (-0.23, 0.18)	0.11	0.786	0.38 (0.17, 0.59)	0.11	<0.001	0.21 (-0.24, 0.65)	0.23	0.358
Oromia	0.01 (-0.11, 0.13)	0.06	0.858	0.02 (-0.13, 0.16)	0.07	0.822	0.14 (0.01, 0.27)	0.07	0.035	0.17 (-0.12, 0.46)	0.15	0.258
Addis Ababa	0.14 (-0.03, 0.30)	0.08	0.105	-0.07 (-0.25, 0.10)	0.09	0.423	-0.06 (-0.27, 0.14)	0.10	0.544	0.01 (-0.04, 0.41)	0.21	0.973
Residence (Addis Ababa)	0.004 (-0.18, 0.19)	0.09	0.966	0.08 (-0.11, 0.27)	0.10	0.408	0.34 (0.11, 0.57)	0.12	0.004	0.45 (0.01, 0.90)	0.23	0.047
Chronic illness (Yes)	1 (Ref)											
R <sup>2</sup>	0.05			0.03			0.05			0.04		

<sup>a</sup>95% CI=95% Confidence Interval of beta ( $\beta$ ) coefficient; <sup>b</sup>SE=Standard Error; <sup>c</sup>Ref=Reference

The perceived risk of personal health during COVID-19 due to occupational characteristics of the respondents was positively and significantly predicted by worry of COVID-19 ( $\beta = 0.02, p < 0.001$ ), respondents from Oromia ( $\beta = 0.38, p < 0.001$ ) and self-reported chronic illness ( $\beta = 0.34, p = 0.004$ ) (Table 6). The variables explained nearly 5% of the variance in the perceived risk of personal health due to occupational exposure,  $F(10, 1138) = 6.31, R^2 = 0.05, p < 0.001$ . The level-1 and level-2 predictors accounted for approximately 4% of the variance in the overall perceived risk related to COVID-19,  $F(10, 1125) = 5.0, R^2 = 0.04, p < 0.001$ . The effect of the worry related to COVID-19 crisis was statistically significant ( $\beta = 0.07, p < 0.001$ ), demonstrating a positive association with the overall perceived risk of COVID-19. The overall perceived risk of COVID-19 among men was significantly higher than those of women ( $\beta = 0.34, p = 0.010$ ), and participants who reported any chronic illness perceived their risk as higher than those who did not ( $\beta = 0.45, p = 0.047$ ). Of all the predictor variables, worry of COVID-19 was positively and significantly associated with the four perceived risks (perceived chance of acquiring the virus, perceived susceptibility to infection from the virus, perceived risk of personal health due to work or occupational characteristics, and overall perceived risk). No significant associations were found in the regression analyses with overall perceived risk of COVID-19 in gender, age, years of service, educational level, categories of institutions and location of residence.

## Discussion

This study investigated the current level of worry and perceived risk of COVID-19 and potential predictors of each one in a comprehensive sample of government employees selected from 46 public institutions in Addis Ababa. Our findings show that majority of the respondents were highly worried about COVID-19 and indicated a higher degree of perceived risk. Younger age, increased service year, lower educational level, having reported any chronic illness, and being from Oromia were significantly associated with increased level of worry. Significant predictors of perceived risk were increased level of worry, being men, and having any chronic illness.

The present findings showed high levels of worry, and the results are generally consistent with recent studies that investigated the extent of worry during the COVID-19 pandemic [26, 33]. Additionally, a recent study among young people from Poland showed a high level of worry about health and restricted freedom of movement [26]. The present study results are also consistent with recent studies that reported high level of COVID-19 related perceived risk [18, 22, 39]. The finding of the current study is encouraging and may highlight the effectiveness of risk communication interventions extensively implemented during the early stage of the pandemic.

In the current study, perceived risk of COVID-19 was measured using questions about the chance of acquiring virus, susceptibility to infection from the virus, and risk of personal health from COVID-19 due to work or occupational characteristics. More than three-fourth of the respondents perceived that they had a chance of infection with coronavirus or were likely susceptible to contract the virus, and two-third

cited that their personal health was at risk of COVID-19 due to their work or occupational characteristics. These figures are higher than the results shown in a study conducted in the UK, which reported that just under half of their study participants were likely to acquire COVID-19, while a little more than half felt that it moderately impacted their health [40]. In addition, a separate survey of Australian adults also found that about half of respondents felt COVID-19 would 'somewhat' affect their health if infected and only less than a quarter perceived their level of risk as high or very high [41].

The achievement of the relatively higher level of worry and perceived risk related to COVID-19 in the current study could be attributed to the early extensive government interventions, most likely followed by a widely adopted preventive behaviors of the public. Both Hong Kong and South Korea achieved a similar success of higher perceived risk of COVID-19 and precautionary behaviors of the public through the early government interventions, together with the experience in outbreak management of the 2003 SARS epidemic in Hong Kong [39] and the 2015 MERS outbreak in South Korea [31]. Other potential reasons for the apparent higher degree of worry and perceived risk of COVID-19 in the current study might be due to the widespread information about the COVID-19 pandemic provided to the public and its considerable consequences not only on health but also on the overall socio-economic crisis. The community receive overwhelming information from various sources including mass media, social media, healthcare professionals, government officials, and colleagues, which can create a lot of fear, concern, worry and perceived risk about COVID-19. In this regard, relevant and accurate information on COVID-19 should be delivered to the public to mitigate the pandemic as well as to relief the community from fear and panic.

Although age and years of service are correlated, both variables acted negatively and positively as predictors of worry in in the present study, respectively. In other words, being younger was likely associated with more worry about COVID-19, which is consistent with the recent findings from Hong Kong [42] and Turkey [22]. In a study of pregnant women in Iran during the current COVID-19 pandemic, younger women had a higher level of worry than older women [43]. The present findings show that increased years of service was significantly associated with increased worry of COVID-19. However, both age and years of service were not significant predictors of perceived risk, though other studies reported a higher perceived risk of COVID-19 among younger people [22].

The findings of the present study indicate that men reported higher perceived risk than women though there was no statistically significant difference between them regarding worries about COVID-19. Men and women generally seem to respond differently to the effects of COVID-19. In a recent study that investigated the role of gender among patients with COVID-19, men were more likely to develop severe illness and die from the disease than women, owing presumably to the biological and lifestyle factors [44, 45]. Studies indicate that men tend to drink alcohol and smoke more frequently than women, and are prone to a wide range of health risks, particularly to acute health problems and non-communicable diseases [46]. Studies have found that women are less likely susceptible to viral infections than men, possibly because of their stronger immune response [47]. However, as far as the current evidence is concerned, men and women generally experience similar odds of COVID-19 infection, but men are

disproportionately exposed to the severest of outcomes, including death [44, 48]. This suggests that men are more likely to develop worse outcomes of COVID-19 compared with the women.

Recent evidence indicates that older ages were more likely susceptible to infection and develop a severe type of COVID-19 [44, 49]. Current observations in Ethiopia also indicate that older people are the groups most susceptible to contract coronavirus infection and develop severe illness, which is consistent with understandings in other settings [48, 50]. Although younger people in good health are generally less likely to suffer severe consequences of the virus if infected, they contribute to the transmission and spread of the virus. This suggests that strengthening information about the risk of COVID-19 to the public, including younger people, to consistently increase health protection risk about the susceptibility and severity of the disease is essential to improve compliance with COVID-19 preventive behaviors, particularly among older people.

In the current study, respondents with lower educational level expressed higher degree of worry about COVID-19 crisis although there were no associations between educational level and location of residence with perceived risk. A recent study from Turkey reported that more educated persons were less worried about COVID-19 than those with less years of education [22]. The COVID-19 worry level of participants from Oromia was significantly higher than those respondents from national or Addis Ababa. One possible explanation could be that about half of the participants from Oromia resided out of Addis Ababa and travelled longer distances between home and place of work on a regular basis, which might have increased the risk of exposure to COVID-19 and related crisis. Our findings also indicate that respondents who reported chronic disease indicated higher degree of worry and perceived risk of COVID-19 when compared with those without chronic illness, which is consistent with the findings that having chronic disease is associated with susceptibility to infection and disease severity in COVID-19 [48, 50]. A recent study from Ethiopia showed that 73% of the respondents knew that elderly people who have chronic illnesses are at higher risk of developing a severe form of COVID-19 [52]. The results suggest that individual factors such as gender, level of education, health status and location of residence can be predictors of worry and perceived risk, which ultimately increase engagement in preventive behaviors during the current COVID-19 pandemic.

During the early phase of the COVID-19 pandemic, perceived risks and the practice of preventive measures varied from country to country depending on the local situation of the pandemic. In Iran, only 44% of the study participants considered themselves at high risk of COVID-19, and 50% considered the disease as a severe and lethal disease [52]. In contrast, almost all respondents in the study in Hong Kong indicated high levels of perceived susceptibility to coronavirus infection (89%) and severity of the symptoms of COVID-19 (97%), which were associated with higher levels of preventive practices [39]. A study from Turkey reported a significantly improved engagement of people in preventive behaviors due to increased vulnerability and perceived risk associated with the coronavirus pandemic [22]. In Israel, people who believed they were less likely to become infected with COVID-19 less frequently practiced preventive measures [6]. The finding of the current study is encouraging and may highlight the effectiveness of risk communication interventions extensively implemented during the early stage of the pandemic.

A recent study showed that higher intentions of preventive behaviors were predicted by higher degree of worry about COVID-19 [26]. Similarly, studies indicated that higher perceived risks related to COVID-19 pandemic [6, 7, 18] were highly associated with increased behavioral change [20, 21, 22]. It seems that during the early stages of the new pandemic such as COVID-19, people may be highly worried about the consequences of the pandemic and are more likely to develop higher perceived risk that is associated with more preventive behaviors to protect themselves from being infected with the disease [8, 22]. Therefore, increasing the knowledge and awareness of the public about the health threats and socio-economic crisis of COVID-19 might make people more worried about it, increase their perceived risks and encourage people to be more likely engaged in the implementation of the preventive and social distancing measures [31].

The findings of the present study indicate that higher degree of worry about COVID-19 was significantly associated with increased perceived risk of the pandemic. Only very few recent studies reported about the positive relationship between worry and perceived risk related to COVID-19 [35], while earlier studies found that worry and perceived risk are correlated with one another [17]. Our findings shed light on the role of worry in predicting risk perception, which might be linked to improved preventive behaviors. It is worth noting that the current study was conducted during the early stages of the pandemic in Ethiopia, when uncertainty and the level of worry was particularly higher. It is possible that the perceptions and worries during the different stages of COVID-19 may be different. We argue that the levels of worry and perceived risk after our study might be different from those during the initial stages of the pandemic, but it needs further research to understand about the situation at the latter stages. The 2003 SARS pandemic study in Hong Kong found the decreasing levels of worries and risk perceptions of the people after the peak of the outbreak, resulting in declined uptake of precautionary measures [53].

Overall, the current evidence indicates that people with higher level of worry and perceived risk about COVID-19 have increased protective behavior [23]. It seems that when people tend to feel fearful and worrisome, they perceive higher risk about a health problem, and therefore they tend to take precautionary measures. This means that people's concerns and perceived risk about COVID-19 play a central role in the prevention and control of the pandemic through influencing and shaping their specific protective behaviors such as preventive measures and social distancing behavior [18, 20]. This suggests that for a low-income country like Ethiopia, preventing the transmission of the SARS-CoV-2 can be the most cost-effective way to prevent COVID-19. Given the importance of preventive measures and the current encouraging results of vaccines to control the spread of coronavirus, additional research on COVID-19 related worries and perceived risks and other behavioral determinants is warranted due to the clear danger of COVID-19 at present and in the near future. The present study showed that almost all participants were highly worried and perceived higher risk of COVID-19. The findings have a great practical implication for the mental health practitioners due to the higher level of COVID-19 worry, as it was a negative predictor for mental well-being [33].

## Limitations

Despite generating highly valuable and timely findings, the present study has some limitations that should be recognized. First, the cross-sectional study design can only demonstrate associations between outcome variables and predictors, and it does not assume a cause-effect relationship attributed to the findings. Second, the study was limited to a sample of government employees which might be affected by selection bias, and so is not representative of the whole population. As a result, generalizations of the findings should thus be made with caution. Third, the data presented in this study are self-reported and the results may reflect social desirability bias. Finally, the study was conducted during the initial phase of the pandemic, where the level of worry and perceived risk might be higher. People might change their risk perception and behaviors from time to time depending on the severity of the situation, and there may be concerns about the generalizability of the findings to the latter stages of the pandemic. Therefore, results should be cautiously interpreted with these limitations in mind.

## Conclusions

In conclusion, we found that government employee's current level of worry and perceived risk regarding the COVID-19 pandemic and infection were very high. Years of service, being from Oromia, age, and educational level were significant predictors of worry of the COVID-19. Worry due to COVID-19 crisis correlated significantly with perceived risk. In addition, being men and self-reported chronic illness were the positive predictors of perceived risk. This study is one of the first studies conducted in the early stage of the COVID-19 pandemic in Ethiopia, and the findings will broaden our understanding of the worry and perceived risk of the people about the COVID-19 pandemic. The findings highlight the importance of considering public reactions such as worry and risk perceptions towards COVID-19 to inform the ongoing public health interventions and health promotion programs. Future research is needed to investigate the trends in the level of worry and perceived risks of COVID-19 in relation to protective behaviors.

## Abbreviations

AAU: Addis Ababa University; CI: Confidence interval; COVID-19: Coronavirus disease 2019; CSPro: Census and Survey Processing; EPHI: Ethiopian Public Health Institute; IRB: Institutional Review Board; MoH: Ministry of Health; SARS: Severe acute respiratory syndrome; SARS-CoV-2: Severe acute respiratory syndrome coronavirus 2; SD: Standard deviation; SPH: School of Public Health; SPSS: Statistical Package for the Social Sciences; VIF: Variance Inflation Factor; WHO: World Health Organization.

## Declarations

### Ethical approval and consent to participate

Ethical approval was obtained from the Institutional Review Board (IRB) of the College of Health Sciences (protocol no: 042/20/SPH) at AAU, Ethiopia. Permission to undertake this study was obtained from every relevant authority at all levels. Verbal and written informed consent were obtained from all study

participants. All methods were performed in accordance with the relevant guidelines and Helsinki declaration.

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## **Consent for publication**

Not applicable

## **Availability of data and materials**

The datasets used and analyzed during the current study will be available from the corresponding author on reasonable request.

## **Competing interests**

The authors declare that they have no competing interests.

## **Author Contributions**

WD, AW, WAA and WA conceived and designed the study. SG, WD and AW supervised the field data collection. WD prepared the final dataset for analysis. WD and AW analyzed and interpreted the data. WD drafted the manuscript. AW provided intellectual role in improving the manuscript. AW, SG, WAA and WA provided major roles in revising the manuscript. All authors read and approved the final version of the manuscript.

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## **References**

1. Worldometers. COVID-19 Virus Pandemic (Live). <https://www.worldometers.info/coronavirus/>. 2021. Last updated: July 10, 2021, 08:23 GMT.
2. Ethiopian Public Health Institute. National Public Health Emergency Operation Center. COVID-19 Pandemic Preparedness and Response. Bulletin No. 54, May 16, 2021. Addis Ababa, Ethiopia.
3. Ethiopian Public Health Institute. A Directive Issued for the Prevention and Control of COVID-19 Pandemic. Directive No. 30/2020. October 05, 2020. Addis Ababa, Ethiopia.

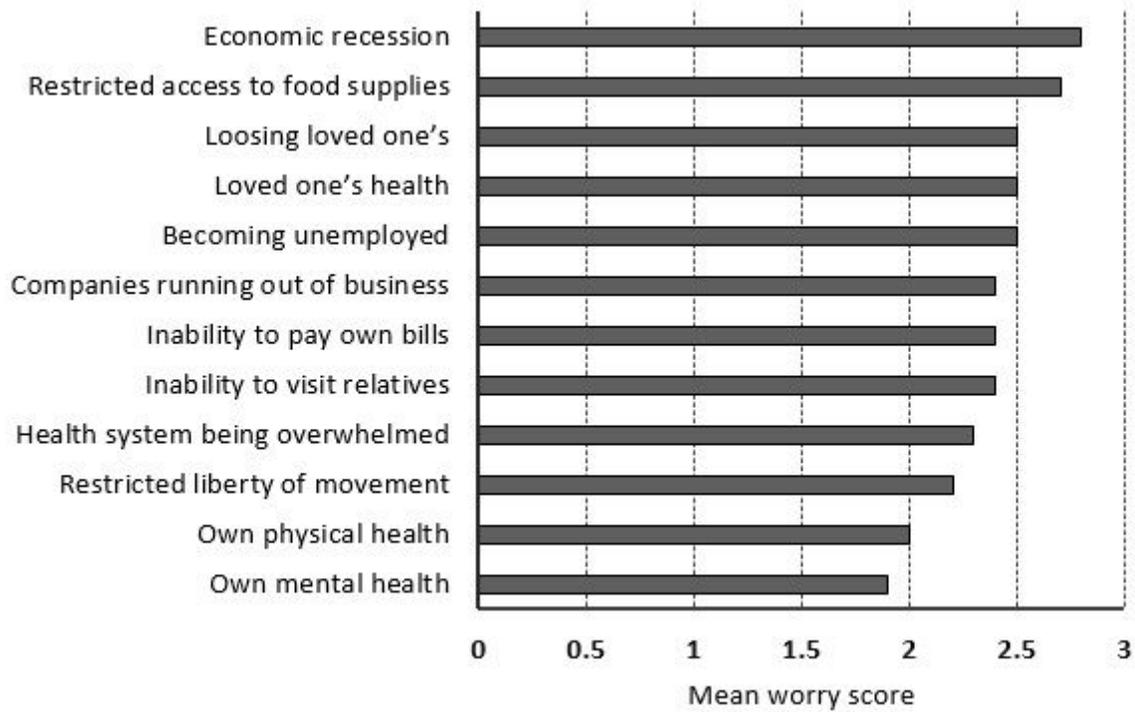
4. Mohammed H, Oljira L, Roba KT, Yimer G, Fekadu A, Manyazewal T. Containment of COVID-19 in Ethiopia and implications for tuberculosis care and research. *Infect Dis Poverty* 2020; 9:131. <https://doi.org/10.1186/s40249-020-00753-9>.
5. The Federal Democratic Republic of Ethiopia. A Regulation Issued to Implement the State of Emergency Proclamation No. 3/2020 Enacted to Counter and Control the Spread of COVID-19 and Mitigate its Impact. Council of Ministers Regulation No. 466/2020. 20<sup>th</sup> April 2020. Addis Ababa, Ethiopia.
6. Shinan-Altman S, Levkovich COVID-19 precautionary behavior: the Israeli case in the initial stage of the outbreak. *BMC Public Health* 2020; 20:1718. <https://doi.org/10.1186/s12889-020-09818-8>.
7. Tong KK, Chen JH, Yu EW, Wu AMS. Adherence to COVID-19 Precautionary Measures: Applying the Health Belief Model and Generalized Social Beliefs to a Probability Community Sample. *Appl Psychol Health Well Being*. 2020;12(4):1205-1223. doi: 10.1111/aphw.12230.
8. Khosravi M. Perceived Risk of COVID-19 Pandemic: The Role of Public Worry and Trust. *Electron J Gen Med*. 2020, 17(4), em203. e-ISSN: 2516-3507.
9. Codagnone C, Bogliacino F, Gómez C, Charris R, Montealegre F, Liva G, et al. Assessing concerns for the economic consequence of the COVID-19 response and mental health problems associated with economic vulnerability and negative economic shock in Italy, Spain, and the United Kingdom. *PLOS ONE* 2020; 15(10):e0240876. doi: 10.1371/journal.pone.0240876.
10. Bavel JJV, Baicker K, Boggio PS, Capraro V, Cichocka A, Cikara M, et al. Using social and behavioural science to support COVID-19 pandemic response. *Nat Hum Behav*. 2020; 4, 460–471. <https://doi.org/10.1038/s41562-020-0884-z>.
11. Wahl-Jorgensen K. Coronavirus: How media coverage of epidemics often stokes fear and panic. <https://theconversation.com/coronavirus-how-media-coverage-of-epidemics-often-stokes-fear-and-panic-131844> (Accessed: 08/05/2021).
12. Brug J, Aro AR, Richardus JH. Risk perceptions and behaviour: towards pandemic control of emerging infectious diseases: international research on risk perception in the control of emerging infectious diseases. *Int J Behav Med*. 2009; 16(1):3-6. doi: 10.1007/s12529-008-9000-x.
13. Kim S, Ko Y, Kim Y-J, Jung E. The impact of social distancing and public behavior changes on COVID-19 transmission dynamics in the Republic of Korea. *PLOS ONE* 2020; 15(9): e0238684. <https://doi.org/10.1371/journal.pone.0238684>.
14. McGrail DJ, Dai J, McAndrews KM, Kalluri R. Enacting national social distancing policies corresponds with dramatic reduction in COVID19 infection rates. *PLOS ONE* 2020; 15(7):e0236619. <https://doi.org/10.1371/journal.pone.0236619>.
15. van der Weerd W, Timmermans DR, Beaujean DJ, Oudhoff J, van Steenbergen JE. Monitoring the level of government trust, risk perception and intention of the general public to adopt protective measures during the influenza A (H1N1) pandemic in the Netherlands. *BMC Public Health* 2011; 11:575. <https://doi.org/10.1186/1471-2458-11-575>.

16. Ferrer R, Klein WM. Risk perceptions and health behavior. *Curr Opin Psychol*. 2015;5:85-89. doi: 10.1016/j.copsyc.2015.03.012.
17. Schmiede SJ, Bryan A, Klein WMP. Distinctions between worry and perceived risk in the context of the Theory of Planned Behavior. *J Appl Soc Psychol*. 2009; 39:95-119. <https://doi.org/10.1111/j.1559-1816.2008.00431.x>.
18. Dryhurst S, Schneider CR, Kerr J, Freeman ALJ, Recchia G, van der Bles AM, et al. Risk perceptions of COVID-19 around the world. *J Risk Res*. 2020; 23:7-8, 994-1006, DOI: [1080/13669877.2020.1758193](https://doi.org/10.1080/13669877.2020.1758193)
19. Rubin GJ, Amlôt R, Page L, Wessely S. Public perceptions, anxiety, and behaviour change in relation to the swine flu outbreak: cross sectional telephone survey. *BMJ*. 2009;339:b2651. doi: 10.1136/bmj.b2651.
20. Cori L, Bianchi F, Cadum E, Anthonj C. Risk Perception and COVID-19. *Int J Environ Res Public Health* 2020; 17, 3114; doi:10.3390/ijerph17093114.
21. Harper CA, Satchell LP, Fido D, Latzman RD. Functional Fear Predicts Public Health Compliance in the COVID-19 Pandemic. *Int J Ment Health Addict*. 2020 Apr 27:1-14. doi: 10.1007/s11469-020-00281-5. Epub ahead of print. PMID: 32346359; PMCID: PMC7185265.
22. Yildirim M, Gecer E, Akgul O. The impacts of vulnerability, perceived risk, and fear on preventive behaviors against COVID-19. *Psychology, Health & Medicine* 2021; 26(1):35-0043. DOI: 10.1080/13548506.2020.1776891.
23. Bruine de Bruin W, Bennett D. Relationships Between Initial COVID-19 Risk Perceptions and Protective Health Behaviors: A National Survey. *Am J Prev Med*. 2020;59(2):157-167. doi: 10.1016/j.amepre.2020.05.001.
24. Iorfa SK, Ottu IFA, Oguntayo R, Ayandele O, Kolawole SO, Gandi JC, et al. COVID-19 Knowledge, Risk Perception, and Precautionary Behavior Among Nigerians: A Moderated Mediation Approach. *Front Psychol*. 2020 Nov 20;11:566773. doi: 10.3389/fpsyg.2020.566773.
25. Kaulu B, Kabala E, Mapoma R, Munyonzwe C. Risk Perception, Behavioural Response to COVID-19, and the Mediating Role of Information Sources in Zambia. *Southern African Journal of Policy and Development* 2020; 5(1): Article 8. <https://scholarship.law.cornell.edu/sajpd/vol5/iss1/8>.
26. Sobkow A, Zaleskiewicz T, Petrova D, Garcia-Retamero R, Traczyk J. Worry, Risk Perception, and Controllability Predict Intentions Toward COVID-19 Preventive Behaviors. *Front Psychol*. 2020 19;11:582720. doi: 10.3389/fpsyg.2020.582720.
27. Asnakew Z, Asrese K, Andualem M. Community Risk Perception and Compliance with Preventive Measures for COVID-19 Pandemic in Ethiopia. *Risk Manag Health Policy* 2020 Dec 8;13:2887-2897. doi: 10.2147/RMHP.S279907.
28. CSA. Population Projections for Ethiopia 2007-2037. 2013, Addis Ababa.
29. Ethiopian Public Health Institute. National Public Health Emergency Operation Center. COVID-19 Pandemic Preparedness and Response. Bulletin No. 08, June 22, 2020. Addis Ababa, Ethiopia.
30. Liao Q, Cowling BJ, Lam WW, Ng DM, Fielding R. Anxiety, worry and cognitive risk estimate in relation to protective behaviors during the 2009 influenza A/H1N1 pandemic in Hong Kong: ten cross-

- sectional surveys. *BMC Infect Dis.* 2014;14:169. doi: 10.1186/1471-2334-14-169.
31. Lee M, You M. Psychological and Behavioral Responses in South Korea During the Early Stages of Coronavirus Disease 2019 (COVID-19). *Int J Environ Res Public Health* 2020;17(9):2977. doi: 10.3390/ijerph17092977.
  32. World Health Organization. Monitoring knowledge, risk perceptions, preventive behaviors and trust to inform pandemic outbreak response. Survey Tool and Guidance: Rapid, simple, flexible behavioral insights on COVID-19. 2020.
  33. Ahmed O, Ahmed MZ, Alim SMAHM, Khan MDAU, Jobe MC. COVID-19 outbreak in Bangladesh and associated psychological problems: An online survey. *Death Stud.* 2020 11:1-10. doi: 10.1080/07481187.2020.1818884. Epub ahead of print. PMID: 32915701.
  34. Faisal RA, Jobe MC, Ahmed O, Sharker T. Replication analysis of the COVID-19 Worry Scale. *Death Stud.* 2020 Aug 31:1-7. doi: 10.1080/07481187.2020.1815104. Epub ahead of print. PMID: 32866090.
  35. Jaspal R, Fino E, Breakwell GM. The COVID-19 Own Risk Appraisal Scale (CORAS): Development and validation in two samples from the United Kingdom. *J Health Psychol.* 2020:1359105320967429. doi: 10.1177/1359105320967429. Epub ahead of print. PMID: 33111594; PMCID: PMC7593702.
  36. Yıldırım M, Güler A. Factor analysis of the COVID-19 Perceived Risk Scale: A preliminary study. *Death Stud.* 2020 Jun 25:1-8. doi: 10.1080/07481187.2020.1784311. Epub ahead of print. PMID: 32584201.
  37. Taber KS. The Use of Cronbach's Alpha When Developing and Reporting Research Instruments in Science Education. *Res Sci Educ.* 2018; 48:1273–1296. DOI 10.1007/s11165-016-9602-2.
  38. Tabachnick BG, Fidell LS. Using Multivariate Statistics. 2013, 6<sup>th</sup> Edition, Boston: Pearson Education.
  39. Kwok KO, Li KK, Chan HHH, Yi YY, Tang A, Wei WI, et al. Community Responses during Early Phase of COVID-19 Epidemic, Hong Kong. *Emerg Infect Dis.* 2020;26(7):1575-1579. doi: 10.3201/eid2607.200500.
  40. Atchison CJ, Bowman L, Vrinten C, Redd R, Pristera P, Eaton JW, et al. Early perceptions and behavioural responses during the COVID-19 pandemic: a cross-sectional survey of UK adults. *BMJ Open* 2021;11:e043577. doi:10.1136/bmjopen-2020-043577.
  41. Seale H, Heywood AE, Leask J, Sheel M, Thomas S, Durrheim DN, et al. COVID-19 is rapidly changing: Examining public perceptions and behaviors in response to this evolving pandemic. *PLOS ONE* 2020, 15(6): e0235112. <https://doi.org/10.1371/journal.pone.0235112>.
  42. Chan EYY, Huang Z, Lo ESK, Hung KKC, Wong ELY, Wong SYS. Sociodemographic Predictors of Health Risk Perception, Attitude and Behavior Practices Associated with Health-Emergency Disaster Risk Management for Biological Hazards: The Case of COVID-19 Pandemic in Hong Kong, SAR China. *Int J Environ Res Public Health* 2020;17(11):3869. doi: 10.3390/ijerph17113869.
  43. Mortazavi F, Mehrabadi M, KiaeeTabar R. Pregnant women's well-being and worry during the COVID-19 pandemic: a cross-sectional study. *BMC Pregnancy Childbirth* 2021; 21(1):59. doi: 10.1186/s12884-021-03548-4.

44. Jin JM, Bai P, He W, Wu F, Liu XF, Han DM, et al. Gender Differences in Patients With COVID-19: Focus on Severity and Mortality. *Front Public Health* 2020; 8:152. doi: 10.3389/fpubh.2020.00152.
45. Wenham C, Smith J, Morgan R; Gender and COVID-19 Working Group. COVID-19: the gendered impacts of the outbreak. *Lancet* 2020;395(10227):846-848. doi: 10.1016/S0140-6736(20)30526-2.
46. Vlassoff C. Gender differences in determinants and consequences of health and illness. *J Health Popul Nutr.* 2007;25(1):47-61.
47. Gal-Oz ST, Maier B, Yoshida H, Seddu K, Elbaz N, Czysz C, et al. ImmGen report: sexual dimorphism in the immune system transcriptome. *Nat Commun.* 2019; 10, 4295. <https://doi.org/10.1038/s41467-019-12348-6>.
48. Zheng Z, Peng F, Xu B, Zhao J, Liu H, Peng J, et al. Risk factors of critical & mortal COVID-19 cases: a systematic literature review and meta-analysis. *J Infect.* 2020; 18, e16-e25. doi: 10.1016/j.jinf.2020.04.021.
49. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical Characteristics of 138 Hospitalized Patients With 2019 Novel Coronavirus-Infected Pneumonia in Wuhan, China. *JAMA.* 2020;323(11):1061-1069. doi: 10.1001/jama.2020.1585.
50. Shahid Z, Kalayanamitra R, McClafferty B, Kepko D, Ramgobin D, Patel R, et al. COVID-19 and Older Adults: What We Know. *J Am Geriatr Soc.* 2020;68(5):926-929. doi: 10.1111/jgs.16472.
51. Kebede Y, Yitayih Y, Birhanu Z, Mekonen S, Ambelu A. Knowledge, perceptions and preventive practices towards COVID-19 early in the outbreak among Jimma university medical center visitors, Southwest Ethiopia. *PLOS ONE* 2020; 15(5): e0233744. <https://doi.org/10.1371/journal.pone.0233744>.
52. Honarvar B, Lankarani KB, Kharmandar A, Shaygani F, Zahedroozgar M, Haghighi MRR, et al. Knowledge, attitudes, risk perceptions, and practices of adults toward COVID-19: a population and field-based study from Iran. *Int J Public Health* 2020, <https://doi.org/10.1007/s00038-020-01406-2>.
53. Leung GM, Ho LM, Chan SK, Ho SY, Bacon-Shone J, Choy RY, et al. Longitudinal assessment of community psychobehavioral responses during and after the 2003 outbreak of severe acute respiratory syndrome in Hong Kong. *Clin Infect Dis.* 2005;40(12):1713-20. doi: 10.1086/429923.

## Figures



**Figure 1**

Ranking of participants' worry scores of the COVID-19 crisis

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