Health and safety of health workers in the context of COVID-19: A global survey

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Disclaimer

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Ethics

The study proposal was approved by the Behavioural Research Ethics Board of the University of British Columbia (Ref. H20-01825).

Abbreviations

AFRO	African Region
ANOVA	Analysis of variance
CI	Confidence interval
COVID-19	Coronavirus Infectious Disease
EMRO	Eastern Mediterranean Region
EURO	European Region
GDP	Global domestic product
HIV	Human immunodeficiency virus
ILO	International Labour Organization
IPC	Infection protection and control
ISCO-08	International Standard Classification of Occupations
ISIC	International Standard Industrial Classification
LMIC	Low and/or Middle Income Countries
OHS	Occupational health and safety
OR	Odds ratio
PAHO	Region of the Americas
PPE	Personal protective equipment
SEARO	South-East Asia Region
SARS	Severe acute respiratory syndrome
SES	Socio-economic status
UK	United Kingdom
US	United States
WHO	World Health Organization
WPRO	Western Pacific Region

Table of Contents

Executive summary

This report examines perceptions of occupational safety and health risks and mitigation measures faced by health workers in the context of the COVID-19 pandemic. It explores how these varied according to demographic, economic, and gender factors, as well as economic and occupation classification types. The results are based on a global survey devised by an Ad-Hoc Study Group of Experts on Health and Safety of Health Workers in COVID-19 convened by the World Health Organization (WHO) and the International Labour Organization (ILO). The study was undertaken in the early stages of the pandemic with the goal of identifying commonalities and differences between regions and groups. The survey was a convenience sample targeted to all health workers using a survey instrument disseminated by e-mail and by social media through several global networks of health workers and health professionals providing support services for protecting health and safety at work in healthcare facilities.

The largest proportion of the 4977 participants who responded to the survey were from the European region (35%), followed by the Americas region (31%). The South East Asian region (4%) and Eastern Mediterranean region (3%) made up the smallest proportion of participants. The majority of participants (65%) were female and participants were from 161 countries.

Participants in high income countries perceived there to be less unacceptable risks and a higher presence of mitigation measures for all 4 factors (1: work environment, 2: work organization, 3: IPC measures and 4: OHS measures), when compared to respondents in low and middle income countries (OR = 0.99, 0.96, 0.94, 0.97 for factors 1 though 4, p = <0.001, 0.001, <0.001 and <0.001 respectively). Participants from the European and African regions perceived there to be fewer infection protection and control (IPC) and occupational health and safety (OHS) mitigation measures in place than was observed in the rest of the world as a whole (Europe: OR = 1.02, and 1.04 4, p = 0.009, 0 respectively, Africa: OR = 1.08, 1.04, p = 0, 0 respectively). Females perceived there to be more unacceptable risks environment risks factors (OR = 1.01, p = 0.001), and males observed there to be fewer IPC measures in place (OR = 1.02, p = 0.001). Males also noted there to be less psychosocial support measures than “other/prefer not to answer” groups (p = 0.037). Health workers in patient care/health services perceived fewer measures for OHS measures factor

and IPC measures factor – but with limited difference (OR = 1.016 and 1.021, p = 0.015 and 0 respectively). Perhaps the most noteworthy finding concerns observation of risks and mitigation shortcoming as related to bullying, workplace violence and harassment. Participants perceived these psychosocial risks and corresponding mitigations consistently as the most unacceptable, regardless region demographic variables. *Bullying or psychological harassment at the workplace* and *physical violence and assaults* constituted the risk highlighted by the most participants as not acceptable at all (54% for each these). More than 50% of respondents scored the psychosocial work environment as currently not acceptable at all. These preventable risks have a long history in healthcare and were found across all regions surveyed. It is important to note that *exposure to infectious material* was also ranked consistently across demographic characteristics as one of the most unacceptable risks (52% overall as "risk is not acceptable at all).

Despite difference in responses to risk and mitigation across regions and economic groups, consistent messages came through in the results. Health workers in all regions need education and awareness to recognize and report workplace hazards. Workplace cultures need to be improved to minimize preventable behaviours such negative psychosocial behaviours that can be particularly destabilizing during events such as this COVID-19 pandemic. Risks to health workers remain at all levels and regions and contribute to health worker shortages globally. The speed at which the pandemic crossed international boundaries reminds us that we must ensure that even the lowest income countries have stable health workforces.

1. Introduction and objectives

The Coronavirus Infectious Disease (COVID-19) pandemic has rapidly become a global concern since the first cases were identified. Globally, health workers are at the front lines in the fight against the virus. Healthcare has been consistently demonstrated to be one of the most dangerous industries in the world, with particularly high risk noted during earlier pandemic outbreaks such as severe acute respiratory syndrome (SARS) and Ebola.[1–3] These dangers can include occupational infections, heat, stress, musculoskeletal disorders, exposure to harmful drugs, chemicals and radiation, as well physical violence and psychosocial harms.[4–6] Work-related diseases and injuries lead to illness, absence, disability and attrition, exacerbating already existing several shortages of health workers in many countries.[7] Low and Middle Income Countries (LMICs) experience the effects of these shortages disproportionately.

The objective of this research was to examine global perceptions of occupational health and safety (OHS) risks and mitigation measures for health workers in the context of the COVID-19 crisis. Our study also aimed to investigate how health workers' perceptions of these risks and mitigation measures differ by demographic and occupational factors, including geographic region, economic classification, gender and occupation type.

The results are intended to inform stakeholders at all levels about opportunities for improving the health and safety of health workers in the ongoing response to COVID-19.

2. Literature review and background

The healthcare sector is a significant contributor to gross domestic product (GDP)[8] that is estimated to employ 60 million people globally. Despite this, there is a shortage of health workers. The World Health Organization (WHO) has identified a global shortage, especially of doctors and nurses, and estimated that at least 57 LMICs face health human resource shortages and are unable to meet minimum healthcare needs.[10] To compound matters, the supply of health workers per capita varies inversely with healthcare need and socio-economics status.[11]

Healthcare is a dangerous industry. McDiarmid observed that healthcare poses a unique set of risks including biological and infectious disease agents, exposures to dangerous chemicals and violence, harassment and bullying.[12] Studies by Malotle and O'Hara found that health workers faced higher risks and rates of transmission for tuberculosis in South Africa.[13,14] Mossburg et al., in a systematic review of occupational hazards faced by health workers, found that while all workers face hazards, workers in Sub-Saharan Africa face higher rates of exposure to infectious disease than workers in high-income countries.[15] Duhart also reports that in the United States (US), nursing ranks second only to law enforcement in occupations that experience violence in the workplace.[16]

The COVID-19 pandemic has magnified many of these issues. Given the challenge posed by rapidly evolving circumstances, there is particular need for research into perceptions of health worker safety and risks as well as of the adequacy of the mitigation measures put in place to protect them throughout the pandemic. During the COVID-19 pandemic, health worker stressors have been accentuated and new risks and mitigation measures have been introduced. In a COVID-19 situation report, the WHO recommended that infection protection and control (IPC) measures be complemented by more comprehensive OHS measures.[17]

The WHO has called for a global plan of action to implement essential interventions and basic occupational health services for primary prevention of occupational and work-related diseases and injuries.[18] In addition, it recommended baseline measurements to monitor progress in achieving these measures.

Although health worker perception of risks and mitigation measures during the pandemic have begun to be examined in individual country and occupational settings, there is a paucity of literature that examines the differences across occupations and regions. Bhagavathula and colleagues conducted a cross-sectional survey of 529 health workers primarily targeting doctors and residents from Asia,[19] and reported significant gaps in knowledge about risks for and treatment of COVID-19. Another study of knowledge and perceptions of risks for COVID-19 for 407 healthcare workers in Egypt[1920] found that risk perception and overall knowledge was high, but with a more positive attitude detected in allied health professionals compared to physicians; the study therefore recommended continuous training for all health workers. Saqlain and colleagues, reporting on a cross-sectional survey of 414 health workers in Pakistan,[21] found good knowledge of COVID-19 transmission, a positive attitude and good knowledge of preventive measures. Most participants cited social media as their main source of information, and there were knowledge gaps about some aspects of COVID-19 despite readily available educational material from Pakistani and international agencies.

3. Methods

3.1. Survey instrument

The survey was initiated by global group of experts from the Ad Hoc Study Group on health and safety of health workers in COVID-19 convened by WHO and ILO. The purpose was to identify occupational risks and mitigation measures for health workers in the context of COVID-19. The study was initiated in the early stage of the COVID-19 pandemic, with the intention of noting specific gap areas and the degree to which there were similarities or differences among regions.

The survey collected data on the perception of risks and mitigation measures among health workers. This included people engaged in the promotion, protection or improvement of the health of the population. The survey instrument was pre-tested in four countries and was translated into Arabic, Chinese, English, French, German, Italian, Portuguese, Russian, Swahili and Spanish. It was then uploaded via the SurveyMonkey platform and was divided into three sections: demographic data, occupational risks and mitigation measures. The survey was made available via three channels – weblink, social media post and Facebook messenger. Survey links were disseminated through e-mail and social media through global organizations of health workers, trade unions, related professional networks, and through WHO offices. The survey was active between May 5th and June 25th, 2020.

Demographic information was collected on country, occupation, gender and employer type. The survey was then divided into two main groups: health and safety risks, and mitigation measures. In total there were 41 questions; 17 on health and safety risks and 24 on mitigation measures.

Questions regarding risks were further grouped into infectious risks, physical work environment risks, psychological work environment risks and work organization risks – with attention drawn to assessing work environment circumstances being experienced in a respondent's setting:

> *"Think about the working conditions of health workers in your country, jurisdiction or health facility - those that you are most familiar with."*

Available responses were the following:

a. Risk is not acceptable at all
b. Risk is acceptable for a short time
c. Risk is negligible
d. Don't know/unsure

Questions regarding mitigation measures were divided into the following 2 groups: IPC and OHS.

For each mitigation measure question, participants were asked the following:

> *"Think about the working conditions of health workers in your country, jurisdiction or health facility - those that you are most familiar with. How would you rate the level of application of these measures according to your knowledge of the real situation <u>now during the COVID-19 pandemic?</u>"*

Available responses were:

a. Measures do not exist at all
b. Measures exist and offer some protection
c. Measures exist and offer full protection
d. Don't know/unsure

The survey instrument is presented in the appendix.

3.2. Study population

The target population of the survey was all health workers, including health service providers, such as doctors, nurses, midwives, public health professionals, lab-, health- and medical and non-medical technicians, personal care workers, community health workers, healers and practitioners of traditional medicine. It also includes health management and support workers, such as cleaners, drivers, hospital administrators, district health managers, social workers, and other occupational groups in health-related activities as defined by the International Standard Classification of Occupations (ISCO-08).[22] The policy brief refers to the combined health and social work sectors as defined by the International Standard Industrial Classification of All Economic Activities (ISIC), revision 4, section Q: Human health and social work activities.[23]

The data collection technique used was a convenience sample, to enable a rapid low-cost assessment and draw attention to areas of potential concern. The survey was self-administered online, and the participants were self-selected. The sample was not random; therefore, the results were not necessarily generalizable to the study population of health workers.

The study sample consisted of all participants who answered the risk and mitigation questions. Participants who only answered the demographic questions were excluded from the study. Risk and mitigation questions were analysed separately, therefore participants who only answered one set of questions were still included. Demographics for the study population are provided (see appendix Table A 2 for comparison table each set of questions).

WHO region groupings were used to define geographic location. The 6 groupings are: African Region (AFRO), European Region (EURO), Eastern Mediterranean Region (EMRO), Region of the Americas (PAHO), South-East Asia Region (SEARO) and Western Pacific Region (WPRO).[24] World Bank income groups were used to define economic classification. The following country group classifications were used: low, lower-middle, upper-middle, and high.[24] These classifications are based on the World Bank list of analytical income classification of economies for the fiscal year, which is based on the annual Atlas gross national income per capita estimates.[24,25] Gender was classified as male, female or other/prefer not to answer. Occupation was chosen to be one of 13 categories, including an "other" category, as specified in Table A 1. These were then grouped into the following 4 categories: patient care/health services, specialized support, clerical support/administration and management, and other. Participants who responded with an occupation not listed were grouped into the most appropriate category.

3.3. Analysis

Counts for each independent variable were provided along with the percentage within the overall variable. Tables were provided for the survey questions and responses.

This study used factor analysis to group similar questions and reduce the dimensionality of the data. Principal component analysis with varimax rotation was used to create factors from each set of risk questions and mitigation measure questions. Because of the ordinal nature of the responses, participants who answered "don't know/unsure" were assigned blanks, as they these responses did not fit at either end of the spectrum. Missing values were excluded in a listwise fashion. The rotated component matrix was used to identify factors. To measure scale reliability, Cronbach's Alpha

was used for each individual factor. Scores over 0.7 are considered to be acceptable for internal consistency.[26]

Scores were assigned to each of the responses. A score of 3 was assigned to "risk is not acceptable at all" and "does not exist at all" for the risks and mitigation questions respectively (Table 1). A score of 2 was assigned to "risk is acceptable for a short time" and "exists and offers some protection" and a score of 1 was assigned to "risk is negligible" and "exists and offers full protection". As mentioned previously, a blank was assigned to "don't know/unsure" as this response did not fit into the otherwise ordinal nature of the responses.

Table 1: Scoring of responses

Question category	Responses	Score
Health and Safety Risks	Risk is not acceptable at all	3
	Risk is acceptable for a short time	2
	Risk is negligible	1
	Don't know/unsure	Blank
Preventive measures	Does not exist at all	3
	Exists and offers some protection	2
	Exists and offers full protection	1
	Don't know/unsure	Blank

Comparisons of survey score means was done using ANOVA to see if World Bank economic classification of country, WHO region, gender and occupation had an effect on response profiles. An alpha of 0.05 was used to test significance. Post-hoc pairwise comparisons were conducted using the Tukey HSD test, which adjusts the alpha level for multiple pairwise tests.

Regression analysis was conducted using the factors created. Binomial variables were created for each economic classification, region, gender and occupation variable. These binary variables were

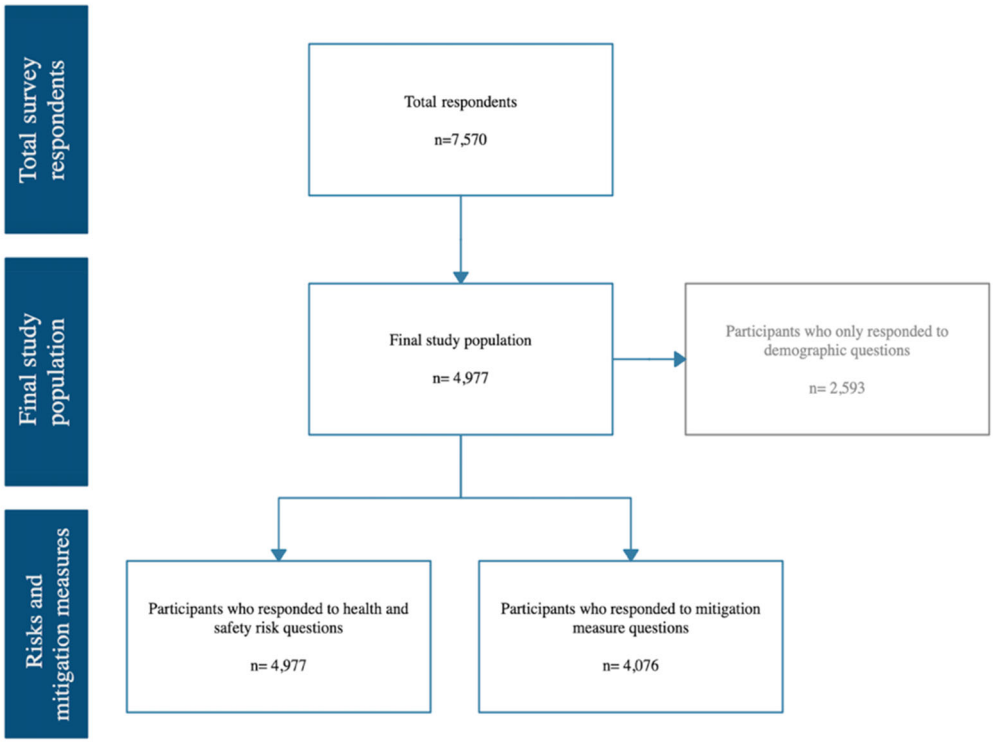
then used in logistic regression models to determine if the reference category significantly influenced the perception of health and safety risks, and the existence of mitigation measures. All statistical analysis was done using SPSS.

4. Results

4.1. Study population

The study population included 4,977 participants (Figure 1). Of these included participants, all responded to the health and safety risk questions, however, only 4,076 responded to the mitigation measure questions.

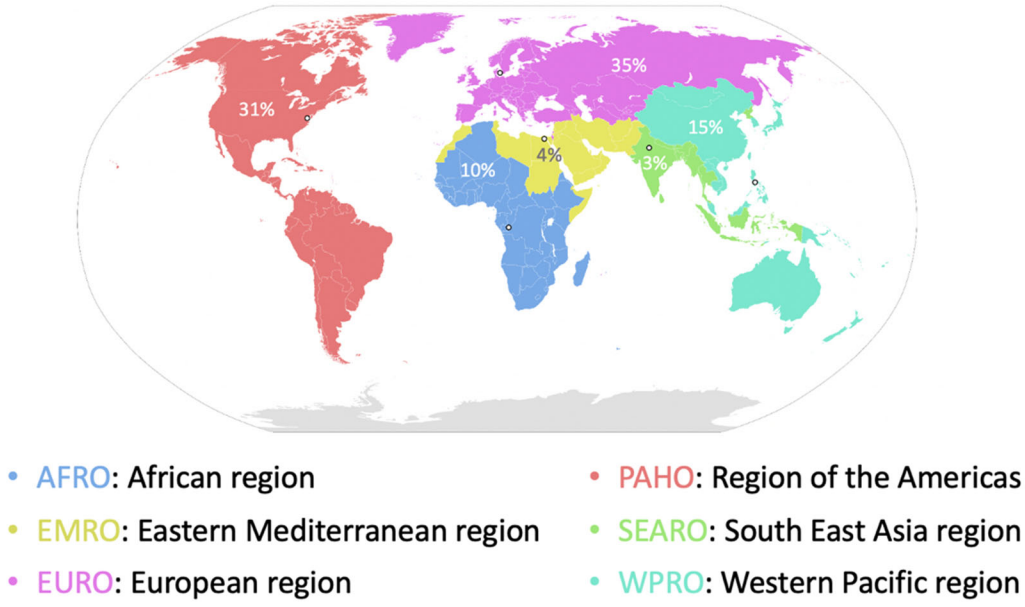
Figure 1: PRISMA diagram



The demographic characteristics were analysed for the 4,977 participants (Table 2). The largest proportion of participants were from the European region (35%), followed by Americas region (31%). The South East Asian region (4%) and Eastern Mediterranean region (3%) made up the smallest proportion of participants (

Figure 2).

Figure 2: Participants by geographic region



In total, there were 161 countries represented in the survey, with Portugal (n=549, 11%), US (n=451, 9%), Brazil (n=373, 7%), Canada (n=263, 5%), and China (n=233, 5%) with the most participants. Participants from countries of high-economic classification were the majority (59%), followed by upper-middle (27%), lower middle (10%) and low (4%). The majority of participants were female at 65%, followed by male (33%) and other/prefer not to answer (1%). The European, Western Pacific and Americas regions had proportion of females (~70%), whereas South East Asian , Eastern Mediterranean and African regions had the smallest (~40%). Finally, the majority of participants worked in patient care/health (56%) services. The table below presents all participants in the study, all of whom responded to both the risk and mitigation questions.

Table 2: Study population demographics

Variables		n	%
Total number of participants		4977	100%
Total who replied to the health and safety risks for health workers questions		4977	100%
Total who replied to the mitigation measures questions		4076	82%
Total number of countries		161	100%
Countries by region	African region	516	10%
	Americas region	1565	31%
	Eastern Mediterranean region	221	4%
	European region	1757	35%
	South East Asia region	158	3%
	Western Pacific region	760	15%
Economic Class	High	2960	59%
	Lower-middle	480	10%
	Upper-middle	1324	27%
	Low	213	4%
Sex	Male	1654	33%
	Female	3259	65%
	Other / prefer not to answer	64	1%
Occupation	Patient care/health services	2805	56%
	Specialized support	1426	29%
	Clerical support/administration and management	341	7%
	Other	405	10%

Of the 4,977 participants in the study, all responded to the risk questions, but only 4,072 (82%) responded to the mitigation questions. The survey instrument was arranged by asking questions regarding risks first, and mitigation questions were then answered after (see appendix). There were 905 participants who did not complete the survey and answer the remaining mitigation measure questions, with similar demographic distributions between those who answered risk questions and those who subsequently answered the mitigation measure questions.

4.2. Survey question results

For health and safety risks questions, 13 of 17 questions had "risk is not acceptable at all" as the most common response (42 %) followed by "risk is acceptable for a short time" (4 of 17 questions, see Table 3). Overall, participants responded with risk is not acceptable at all" 42 % of the time, followed by "risk is acceptable for a short time" (32%) , "risk is negligible" (21%) and "don't know/unsure" (6%).

Table 3: Reponses to health and safety risks questions

Question	Risk is not acceptable at all	Risk is acceptable for a short time	Risk is negligible	Don't know/unsure
Infectious risks				
Exposure to blood, body fluids, respiratory secretions, and other potentially infectious materials	**52%**	29%	15%	4%
Skin damage from PPE and/or frequent hand hygiene	33%	**46%**	16%	5%
Needle-sticks and sharps injuries	**46%**	21%	26%	7%
Inadequate sanitation facilities	**52%**	21%	23%	4%
Insufficient access to facilities for personal hygiene, such as, shower and menstrual hygiene	**49%**	22%	23%	6%
Physical work environment				
Thermal discomfort (cold, heat, humidity)	25%	**46%**	24%	5%
Crowded workplace	**42%**	36%	18%	4%
Slips, trips, and falls	**34%**	26%	33%	7%
Back injury from manual handling of patients and heavy objects	**41%**	34%	19%	6%
Hazardous chemicals, drugs, cleaning and disinfection agents	**36%**	**36%**	22%	6%
Psychosocial work environment				
Bullying or psychological harassment at the workplace	**54%**	18%	21%	7%
Sexual harassment	**50%**	10%	31%	9%
Physical violence and assaults	**54%**	16%	24%	6%
Work organization				
Time pressure, high workload	38%	**49%**	10%	3%
Shift work with night shifts	23%	**48%**	21%	8%
Regular long working hours (more than 48 hours a week)	**38%**	42%	15%	5%
Insufficient time-off duty to rest (less than 11 hours between shifts)	**40%**	36%	18%	6%

Bolded numbers represent the mode of the response variables.

Bullying or psychological harassment at the workplace and *physical violence and assaults* constituted the risk highlighted by the most participants as not acceptable at all (54% for each these). More than 50% of respondents scored the psychosocial work environment as currently not acceptable at all.

Exposure to blood, bodily fluids and other infectious materials, *inadequate sanitation facilities* and *sexual harassment* also scored high as at acceptably high risk, at 52%, 52%, and 50% respectively.

The questions prompting the least response of "risk is not acceptable at all" were *shift work with night shifts* (23%), *thermal discomfort* (25%), *skin damage from PPE* (33%).

There were differences in participant's responses when stratified by WHO region. All regions perceived very high levels of "risk is not acceptable at all" in their responses, however, the Western Pacific region tended to have the lowest proportion reporting this level of risk (15% – 55%). All regions consistently ranked *bullying and psychological harassment, physical violence and assaults* as well as *exposure to infectious materials* as experienced at levels that are not acceptable at all.

Responses of "risk is not acceptable at all" were quite consistent when stratified by economic classification. However, for psychosocial related questions, such as *bullying and psychosocial harassment*, *physical violence and assaults and sexual harassment*, participants working in countries of higher economic classification had a higher proportion of responses that there were "risk is not acceptable at all" (from 49% to 55%).

Responses across gender had relatively similar profiles, and only differed by a few percent in most cases. The largest differences were in psychosocial-related questions. Females perceived *bullying and psychosocial harassment, physical violence and assaults* and *sexual harassment* risks as not acceptable at all with rates of 6%, 5% and 7% more than men, respectively.

Participants in patient care/health services responded with "risk is not acceptable at all" equal to or more than clerical support/administration and management and all risk questions.

For 22 of the 24 mitigation questions, "exists and offers some protection" was the most common response (Table 4). The questions with the highest percentage of "exists and offers some protection" responses were *OHS policy and management system in the facility* with 60%, and *IPC policy in the health facility* with 58%.

All other questions had response rates for "exists and offers some protection" of over 40%. Mitigation measures perceived most commonly as "existing and offering full protection" were *policies in place for post-exposure prophylaxis (HIV, Hepatitis B)*, and *facilities for hand hygiene (hand washing and disinfection) are readily available* (42% and 54%, respectively).

Table 4: Responses to mitigation measure questions

Question	Does not exist at all	Exists and offers some protection	Exists and offers full protection	Don't know/ unsure
Infection prevention and control				
IPC policy in the health facility	8%	**60%**	28%	4%
Patient triage	9%	**54%**	28%	9%
Standard precautions	15%	**53%**	25%	7%
Regular environmental clean-up and disinfection	6%	**56%**	34%	4%
Immunization of health workers	19%	**46%**	26%	9%
Reporting of incidental exposures to blood, body fluids, or respiratory secretions	10%	**50%**	32%	8%
Policies in place for post-exposure prophylaxis, such as, for HIV, Hepatitis B	8%	41%	**42%**	9%
Facilities for hand hygiene (hand washing and disinfection) are readily available	3%	40%	**54%**	3%
PPE, such as masks, gloves, goggles, gowns are readily available	8%	**55%**	34%	3%
Training and education of workers about infection prevention and control	11%	**54%**	32%	3%
Occupational safety and health				
Occupational safety and health policy and management system in the facility	14%	**58%**	22%	6%
Regular assessment of workplace health and safety risks and controls	22%	**51%**	21%	6%
Engineering controls, such as ventilation, physical barriers, safer devices	19%	**54%**	19%	8%
Ergonomic workplace design and furniture	33%	**48%**	12%	7%
Devices for patient handling and lifting of loads	27%	**48%**	15%	10%
Prevention of workplace violence and security measures	21%	**52%**	21%	6%
Management of working time, rest and recuperation	20%	**55%**	19%	6%
Workplace policies against bullying, psychological and sexual harassment	27%	**43%**	21%	9%
Human resource management of safe staffing and workload	24%	**52%**	16%	8%
Psycho-social support and counselling	32%	**46%**	15%	7%
Regular medical check-ups of health workers	33%	**43%**	18%	6%
Medical first aid kits	15%	**48%**	30%	7%
Consultations between management and workers regarding health and safety at work	25%	**50%**	19%	6%
Training and education of workers about occupational safety and health	20%	**54%**	21%	5%

Bolded numbers represent the mode of the response variables.

Mitigation measure responses differed notably between regions. Participants from the African region perceived mitigation measures as "not existing" at a higher rate than other regions for most questions. This differed by as much as 34% for *regular medical check-ups for health workers* and 23% for *immunization of health workers*. African participants also responded "exists and offers full protection" at a lower rate than other regions for mitigation questions. More participants from the Western Pacific region markedly "exists and offers full protection" and fewer "does not exist at all" than other regions. In 14 of the 24 mitigation measure questions, fewer than 10% of participants from the Western Pacific region perceived that this measure did not exist at all.

A higher rate of participants from countries of lower economic classification responded with a "does not exist at all" and a lower rate of "exists and offers full protection" than respondents in countries of high economic classifications. Measures for *immunization of health workers* were perceived to be considerably less existent in countries of lower economic classifications. Response distributions were more uniform across economic classifications for *prevention of workplace violence and security measures*, and *workplace policies against bullying, psychological* and *sexual harassment*.

Like responses for questions regarding risks, responses for mitigation measures were relatively uniform across genders. However, females responded with "exists and offers full protection" at a rate of 4% less than men for both *prevention of workplace violence and security* measures, and *workplace policies against bullying, psychological and sexual harassment*. Participants who worked in patient care/health services responded with a "does not exist at all" and a lower rate of "exists and offers full protection" than respondents working in other occupations.

4.3. Factor analysis

Factor analysis produced 4 factors (**Error! Reference source not found.**), 2 for health and safety risks (work environment and work organization) and 2 for mitigation measures (IPC and OHS). All questions loaded with component scores greater than 0.5 except for *skin damage from PPE*. The Bartlett's test had p-values of zero for both risks and mitigation measures.

Table 5: Factor results

Risks and measures	Factor	Description of question
Health and Safety Risks	Work Environment (Factor 1)	Blood and bodily fluids exposure
		Skin damage from PPE and hand hygiene
		Needle-sticks and sharps injuries
		Sanitation facilities
		Personal hygiene
		Thermal discomfort
		Crowded workplace
		Slips trips & falls
		Back injury form heavy lifting
		Chemicals
		Bullying & harassment
		Sexual harassment
		Physical violence and assaults
	Work Organization (Factor 2)	Time pressure
		Shift work
		Long working hours
		Insufficient rest
Mitigation measures	Infection protection and control (Factor 3)	IPC policy
		Patient triage
		Standard precautions
		Cleanup & disinfection
		Immunization
		Reporting of blood exposure
		Policies for post-exposure prophylaxis
		Hand hygiene
		PPE
		IPC training
	Occupational health and safety (Factor 4)	OSH policy
		Occupational health and safety risk assessment
		OHS engineering controls
		Ergonomic workplace design and furniture
		Safe patient handling
		Violence prevention
		Management of working time & rest
		Policy harassment
		Safe staffing & workload
		Psychosocial support
		Medical checkups
		Medical first aid kits
		Labour management consultation on OSH
		Occupational health and safety training

The factors for risk, work environment and work organization had Cronbach's Alpha scores of 0.936 and 0.932. For mitigation measures, the scores were 0.892 and 0.911 for IPC measures and OHS measures, respectively. The removal of individual questions did not result in an increase in Cronbach's alpha for any of the factors. The mean response scores for the overall population as well as the scores stratified by region, economic classification, gender and occupation are presented in **Error! Reference source not found.**. The mean scores for work environment risks and work organization risks were 2.22 (SD = 0.58) and 2.19 (SD = 0.57) respectively, with mean scores for IPC and OHS measures 1.74 (SD = 0.45) and 2.04 (SD = 0.50).

Table 6: Mean response scores by factor

	Variables	Work Environment (Factor 1)		Work Organization (Factor 2)		IPC (Factor 3)		OHS (Factor 4)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Overall		2.22	0.58	2.19	0.57	1.74	0.45	2.04	0.50
Countries by region	African region	2.19	0.56	2.16	0.59	1.89	0.41	2.17	0.44
	Americas region	2.24	0.61	2.22	0.60	1.78	0.47	2.05	0.51
	Eastern Mediterranean	2.23	0.58	2.16	0.55	1.73	0.50	1.93	0.55
	European region	2.23	0.55	2.24	0.54	1.76	0.42	2.12	0.47
	South East Asia region	2.31	0.56	2.10	0.52	1.76	0.51	1.96	0.51
	Western Pacific region	2.19	0.58	2.08	0.54	1.52	0.44	1.80	0.47
Economic Class	High	2.19	0.60	2.17	0.57	1.69	0.44	1.99	0.49
	Lower-middle	2.30	0.55	2.26	0.57	1.79	0.48	2.09	0.52
	Upper-middle	2.24	0.54	2.15	0.54	1.86	0.45	2.11	0.47
	Low	2.13	0.57	2.15	0.60	1.99	0.41	2.27	0.46
Sex	Male	2.18	0.58	2.18	0.56	1.76	0.46	2.02	0.50
	Female	2.25	0.58	2.20	0.57	1.73	0.45	2.05	0.50
	Other / prefer not answer	2.17	0.65	2.21	0.63	1.71	0.52	1.95	0.59
Occupation	Patient care/health services	2.22	0.57	2.19	0.56	1.75	0.44	2.07	0.49
	Specialized support	2.24	0.59	2.22	0.57	1.74	0.47	2.02	0.51
	Clerical support/administration and management	2.17	0.64	2.12	0.60	1.70	0.49	1.90	0.51
	Other	2.29	0.57	2.19	0.59	1.78	0.47	1.99	0.49

Scoring system: 3 = "risk is not acceptable at all" or [mitigation action] "does not exist at all", 2 = "risks is acceptable for a short time" or [mitigation action] "exists and offers some protection", 1 = "risk is negligible" or [mitigation action] "exists and offers full protection", blank = "don't know/unsure"

4.4. Comparison across demographic variables

4.4.1. Country economic classification

Participants in high income countries perceived there to be less unacceptable risks and more presence of mitigation measures for all factors when compared to respondents in low and middle income countries (OR = 0.99, 0.96, 0.94, 0.97 for factors 1 though 4, p = <0.001, 0.001, <0.001 and <0.001 respectively). Investigation of individual survey questions found that upper-middle classification had less unacceptable *physical violence* risks than low and lower-middle (p = 0.04, 0.047 respectively). Low economic classification had more unacceptable *sanitation* risks than upper-middle and high (p = 0.049 and 0.031). Upper-middle classification also had less unacceptable *needle-stick injury* risks than low (p = 0.031). Finally, high economic classification had more existent *standard mitigation measures* than low (p = 0.048).

4.4.2. WHO region

Participants from the European and African regions perceived there to be less presence IPC and OHS mitigation measures than what was observed to be in place in the rest of the world as a whole (Europe: OR = 1.02, and 1.04, p = 0.009, <0.001 respectively, Africa: OR = 1.08, 1.04, p = <0.001 for both). Additionally, the European participants also perceived more unacceptable work environment and organization risks (OR = 1.01, 1.07, p = 0.013, <0.001 respectively), while African participants had perceived less unacceptable work environment risks (OR = 0.98, p = 0.001). The Western Pacific region had less unacceptable risks for work organization risks, and more existent measures for OHS measures and IPC measures factors (OR = 0.92, 0.90, 0.94 and, p = <0.001 for all).

When investigating individual questions, there were many differences by WHO region. For example, European region, respondents' perceptions of unacceptable risks for *crowded workplace* and *back injuries from heavy lifting* were higher than what the African region respondents expressed (p = 0.028, 0.047, respectively). *Harassment policy* mitigation measures were also perceived as less existent in Europe than in all other regions. The European region also perceived more existent *immunization measures* than the Americas (p = 0.022). Participants in the African region, however, observed more unacceptable *blood exposure* risks compared to Europe and the Americas (p = 0.006, 0.016 respectively), more *skin damage from PPE* risks compared to the European region (p = 0.009), *needle-stick risks* compared to the Western Pacific region (p = 0.007) and finally *sanitation risks* compared to European participants (p =0.021). Participants from the African region expressed less concern about unacceptable *physical violence risks* compared to Americas and the Western Pacific (p =0.048 and 0.007) *and sexual harassment* risks compared to the Western Pacific (p = 0.004), respectively. The Eastern Mediterranean region had less existent *ergonomic design* mitigation measures than the African, European and Americas regions (p = 0.020, 0.005, 0.041). Finally, participants from the Western Pacific region had less existent mitigation measures than most other regions for all IPC and OHS measures, except for policies in place for *post-exposure prophylaxis* and *immunization.*

4.4.3. Gender

Females perceived there to be more unacceptable risks environment risks factors (OR = 1.013, p = 0.001). Males, on the other hand, observed there to be less existent IPC measures in place (OR = 1.02, p = 0.001). Males also noted there to be less existent psychosocial support measures than "other/prefer not to answer" groups (p = 0.037). Despite there being no statistical significance,

women consistently ranked risks and mitigation measures for *violence*, *sexual assault* and *bullying* as more unacceptable and non-existent.

4.4.4. Occupation

Health workers in patient care/health services perceived less existent measures for OHS measures factor and IPC measures factor – but with limited difference (OR = 1.02 and 1.02, p = 0.015 and <0.001 respectively). Participants working in patient care/health showed increased concern for the need for preventive measures for OSH and IPC compared to other occupations. Analysis for occupation also had a significant overall effect on harassment policy and *ergonomic design* – highlighting these two areas of specific concern. In patient care/health services, *harassment policy* mitigation measures were rated less existent compared to "other" in *harassment policy* (p = 0.022). In patient care/health services, *ergonomic design* mitigation measures were less existent than to clerical/administration and management (p = 0.007).

5. Discussion and interpretation of results

The healthcare sector has long been identified as a dangerous setting in which to work. There are certain risks that are inherent in the workplace. Globally, these positions are disproportionately held by women and visible minorities which are groups that have been historically marginalized in the workforce.[27] A study by Stevens asserted that bullying has been a characteristic of the nursing profession for at least 75 years.[28] This occurs at a time when there is an international shortage of health workers, especially nurses. The international community has long called for healthcare human resources plan to address shortage and occupational health and safety plans to address workplace hazards.

It is against this backdrop that our international survey to measure risk and mitigation for health workers was created. The survey aimed to better understand the workers' perception of the risks they face, and adequacy of the measures in place to mitigate those risks. The survey was undertaken at an early stage in the midst of the ongoing COVID-19 pandemic and responses were no doubt influenced by it. The survey produced results that suggest further study and action is needed.

The regional diversity contributed to the results. Participants from the African region had perceived the least existent mitigation measures and the European region perceived the most unacceptable risks. The timing of this survey may have been a contributing factor to these regional findings. The COVID-19 pandemic originated in China, but rapidly spready across Europe. This may have exacerbated responses in Europe compared to other regions like Africa which were less affected at the time. However, in the face of many significant geographic differences, geographic regions were not the best variable to identify differences in responses, due to the regions' large and heterogenous nature. An example of this is the Americas region, composed of all countries in North and South America with very different economic classifications, wealth disparity, and expenditure. No baseline measurements were taken for pre-existing levels of OHS and IPC mitigation measures and work environments in each region. Therefore, existing disparities of resources, wealth, and availability of systematic safety protocols and regulations complicate our analysis. Furthermore, reporting of workplace harassment involve stigma and cultural and historical contexts which were unexplored in this survey. Because of this, economic classification

provides a better understanding of variation amongst participants, and stratified results within regions were made when appropriate.

The differences in responses between economic classifications presents a clear picture of how economic disparity affects health worker's perception of risks and mitigation measures. Participants in countries of high economic classification perceived less unacceptable risk and more existent mitigation measures when compared to other classifications. This finding is important in the context of the COVID-19 pandemic, which has proven to be a global crisis which requires global action. The pandemic responses confirm that resource-poor regions have less ability to implement and evaluate OHS programs to protect health workers. These regions are not able to follow the model of high-income countries such as South Korea and Singapore that slowed early spread of the virus, but were able to organize effective mitigation action in response. It is vital to strengthen health systems in all regions of the world to ensure a global response. The international community must strengthen measures in countries of need in order to help contain the virus at a global standpoint.

The results identified significantly less perceived needle-stick injury risk in upper-middle compared to lower-middle economic classification. This mirrors global prevalence rates of needle-stick injuries found, which showed health workers in higher economic countries experienced less needle-stick injuries than those in lower economic counter-parts.[29] Bouya et al. indicate that these lower incidence rates in countries of higher economic classification can be attributed to sufficient funding allocated to creating a safe work environment along with adequate prevention measures in place.[29] Not only does this apply to needle-stick injury risks, but for all risks and mitigation

measures. In countries of lower economic classification, there is less money being allocated to create sufficient mitigation measures.

Gender balance in the workplace also plays a key role. In most countries, women make up the majority of health workers. However in many countries, there is an unequal distribution of professions across female workers.[30] In Western countries, females make up a large proportion of the healthcare workforce but in more conservative societies, the female population is largely under-represented.[31,32] For the most part, females make up a much larger segment of frontline workers – but are often marginalized for economic and social reasons.[30] Front line workers such, care-aides are often entry level jobs with little or no barriers to entry and low pay. These jobs have the most risk for workplace accident or injury or infection. As a whole, women perceived increased risks for work environment risks. This included, physical work environment, infectious risks and psychosocial risks. Price and Clearihan found that psychological repression in female health workers lead to issues with confidence, lack and energy and self-silencing which ultimately may result in the underrepresentation in leadership roles.[33]

Those working in patient care/health services included front-line physicians and nursing staff. Their concern with shortcomings in OSH and IPC mitigation measures is reflected in the hazards faced in their work environment. These health workers arguably face increased transmission risks for COVID-19 on a daily basis compared to workers in support or clerical roles. This occupational grouping also comprised the majority of participants such that analysis of this subgroup mirrors that of the overall study. Further analyses of occupation revealed findings that may have been underlying concerns pre-dating the pandemic. Significant concerns regarding harassment policies

and ergonomic design in the workplace have also be exacerbated due to the ongoing pressures introduced by COVID-19. [34–37]

Perhaps the most noteworthy results were the universal very high levels of positive responses for psycho-social risks and the lack of successful mitigation of these risks. Although significant differences were found between key characteristics, these psychosocial risks were rated amongst the most unacceptable. These are entirely preventable social issues that were first identified over 75 years ago are still seemingly present today across all regions surveyed.[28] These issues have been linked to shortages of healthcare staff shortages, recruitment and retention issues across all regions surveyed. These finding are consistent with previous studies across all regions.[38–40] Even in wealthy countries such as Swedish, workplace threats and violence was in the top 3 of all reported causes of risk for all employment groups.[28] It seems incongruous that in a global pandemic healthcare workers are still targets of violence. McKay and colleagues document acts of violence toward health workers in place as diverse as Mexico, India, the US and Australia.[41]

There are limitations to this study that have to be considered. The survey used a convenience sample which presents methodological challenges with generalizations. The result of this is that the survey may not be fully representational. A more systematically robust method of collecting survey data would improve on this, although achieving a study population of this size in the short amount of time would be difficult. This study would also benefit from a comparison to pre-pandemic studies to see how health worker's perception of health and safety changed throughout the pandemic. Follow-up studies are currently underway to identify how these risks and mitigation measures may change throughout the course of the pandemic.

6. Conclusions

The survey results point to conclusions that seem to be equally applicable across different regions. Health workers in all countries need sufficient education and awareness to recognize and report workplace hazards. Workplace cultures must be improved to mandate appropriate reporting of hazards and to improve safety practices and especially to eliminate preventable bullying and harassment that can be intensified during an organizationally destabilizing pandemic experience. The global health worker job market is very mobile like COVID-19, so lessons learned in one country or region must be translated to others. Economic classification, region, occupation and sex all play key roles in health worker's perception of health and safety risk and mitigation measures in the workplace. Despite significant results across different demographic measures, the overall consensus of participants was clear. In spite of calls to action by the international community, risks to healthcare workers remain and mitigation measures are insufficient or in some cases non-existent. These issues will continue to haunt the healthcare sector and will continue to exacerbate staff shortages globally. In the face of COVID-19 and its impacts on workplaces, it is also another reminder to the global health community to help those countries in need.

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Appendices

Survey instrument

Health and safety of health workers in COVID-19
Welcome to the survey on health and safety of health workers in COVID-19
Dear colleague,

This survey aims to identify the most common occupational risks for the health and safety of health workers and the measures for their prevention in the context of the ongoing pandemic of Corona Virus Infectious Disease (COVID-19).

In this survey we are interested in the health and safety of all health workers - all people engaged in the promotion, protection or improvement of the health of the population. This includes health workers involved in direct patient care, both formal and informal, in public and private facilities, including traditional medicine, as well as other assisting and supporting staff, including administration, management, ambulance drivers, public health workers, community health workers, and others.

The survey is intended for health workers, managers, and practitioners providing services for protecting the health and safety of workers in health facilities. The results will be used to inform action at all levels for improving the protection of health and safety of health workers in the ongoing response to COVID-19.

The survey has been developed by an international group of experts convened by the World Health Organization and the International Labour Organization and should take approximately 7 minutes to complete.

Your answers are completely confidential, and the data will be processed and analyzed in a way that will not link your answers to your identity.

B. About yourself and your area of work

1. In what country do you usually work?
Standard list of all countries in the world
Other (please specify)

* 2. Your gender?
Male
Female
Other
Prefer not to answer

3. What is your primary area of work? (responses below were randomized)

Administration and clerical support
Allied health professional
Community health worker
Infection prevention and control
Management and human resources
Mental health and psychosocial support
Occupational and environmental health
Patient care (medicine, nursing, midwifery, dentistry)
Pharmacy
Public health
Support staff – cleaner, driver, food worker
Other

4. You work most of the time for: (responses below were randomized)

Academia, research
Business enterprise or farm·
Employers' association /hospital federation
Healthcare facility - hospital, primary health-care centre, isolation camp
Local community
National government agency
Other
Professional association
Social care facility (e.g. nursing home, home care)·
Sub-national (provincial, district) authority
Trade union

C. Risks for health and safety of health workers

Think about the working conditions of health workers in your country, jurisdiction or health facility - those that you are most familiar with. No workplace is without risk, but some risks are negligible, or acceptable for a short time, and some are not acceptable at all. Below are some common risks for the health and safety of health workers; we are asking you to rate the current level of these risks, now during the COVID-19 pandemic.

5. How would you rate the level of these risks for health workers, now? (randomized)

Questions	Risk is negligible	Risk is acceptable for a short time	Risk is not acceptable at all	Don't know/Unsure
Skin damage from personal protective equipment and/or frequent hand hygiene				
Needle-sticks and sharps injuries				
Inadequate sanitation facilities				
Insufficient access to facilities for personal hygiene, such as, shower and menstrual hygiene				
Exposure to blood, body fluids, respiratory secretions, and other potentially infectious materials				

6. How would you rate the level of these risks for health workers, now? (randomized)

Questions	Risk is negligible	Risk is acceptable for a short time	Risk is not acceptable at all	Don't know/Unsure
Back injury from manual handling of patients and heavy objects				
Hazardous chemicals, drugs, cleaning and disinfection agents				
Slips, trips, and falls				
Crowded workplace				
Thermal discomfort (cold, heat, humidity)				

7. How would you rate the level of these risks for health workers, now? (randomized)

Questions	Risk is negligible	Risk is acceptable for a short time	Risk is not acceptable at all	Don't know/Unsure
Physical violence and assaults				
Bullying or psychological harassment at the workplace				
Sexual harassment				

8. How would you rate the level of these risks for health workers, now? (randomized)

Questions	Risk is negligible	Risk is acceptable for a short time	Risk is not acceptable at all	Don't know/Unsure
Regular long working hours (more than 48 hours a week)				
Time pressure, high workload				
Shift work with night shifts				
Insufficient time-off duty to rest (less than 11 hours between shifts)				

9. How would you rate the level of these risks for health workers, now? (randomized)

Questions	Risk is negligible	Risk is acceptable for a short time	Risk is not acceptable at all	Don't know/Unsure
Skin damage from personal protective equipment and/or frequent hand hygiene				
Needle-sticks and sharps injuries				
Inadequate sanitation facilities				
Insufficient access to facilities for personal hygiene, such as, shower and menstrual hygiene				
Exposure to blood, body fluids, respiratory secretions, and other potentially infectious materials				

D. Preventive measures

There are measures for the prevention of most risks for health and safety at work, but these measures may not be fully implemented and not all workers may benefit from these measures. Think again about the working conditions of health workers in your country, jurisdiction or health facility - those that you are most familiar with. The following questions are about the preventive measures for their health and safety in the real situation, now, during the COVID-19 pandemic.

10. How would you rate the level of application of these measures in the health services according to your knowledge? (randomized)

Questions	Does not exist at all	Exists and offers some protection	Exists and offers full protection	Don't know/Unsure
Policy for infection prevention and control in the health facility				
Processes for triage of patient in place at the emergency room, including early detection and isolation of infectious patients				
Routine assessment of the risk of exposure to body substances or contaminated surfaces before any health care activity and use of appropriate measures for personal protection				
Regular environmental clean-up and disinfection				
Immunization of health workers				

11. How would you rate the level of application of these measures in the health services according to your knowledge? (randomized)

Questions	Does not exist at all	Exists and offers some protection	Exists and offers full protection	Don't know/Unsure
Reporting of incidental exposures to blood, body fluids, or respiratory secretions				
Policies in place for post-exposure prophylaxis, such as, for HIV, Hepatitis B				
Facilities for hand hygiene (hand washing and disinfection) are readily available				
Personal protective equipment, such as masks, gloves, goggles, gowns are readily available				
Training and education of workers about infection prevention and control				

12. How would you rate the level of application of these measures in health services according to your knowledge? (randomized)

Questions	Does not exist at all	Exists and offers some protection	Exists and offers full protection	Don't know/Unsure
Prevention of workplace violence and security measures				
Management of working time, rest and recuperation				
Workplace policies against bullying, psychological and sexual harassment				
Human resource management of safe staffing and workload				
Psycho-social support and counselling				

13. How would you rate the level of application of these measures in the health services according to your knowledge? (randomized)

Questions	Does not exist at all	Exists and offers some protection	Exists and offers full protection	Don't know/Unsure
Occupational safety and health policy and management system in the facility				
Regular assessment of workplace health and safety risks and controls				
Engineering controls, such as ventilation, physical barriers, safer devices				
Ergonomic workplace design and furniture				
Devices for patient handling and lifting of loads				

14. How would you rate the level of application of these measures in the health services according to your knowledge? (randomized)

Questions	Does not exist at all	Exists and offers some protection	Exists and offers full protection	Don't know/Unsure
Regular medical check-ups of health workers				
Medical first aid kits				
Consultations between management and workers regarding health and safety at work				
Training and education of workers about occupational safety and health				

Other (please specify)

Table A 1: Survey options for occupation

Group	Survey responses
Patient care/health services	Patient care (medicine, nursing, midwifery, dentistry)
	Allied health professional
	Mental health and psychosocial support
	Pharmacy
	Community health worker
Specialized support	Occupational and environmental health
	Public health
	Infection prevention and control
	Support staff – cleaner, driver, food worker
Clerical support/administration and management	Administration and clerical support
	Management and human resources

Table A 2: Comparison between participants who answered risk and mitigation questions

Variables		**Those who responded to risk questions (n=4977)**	**Those who responded to mitigation measure questions (n=4076)**
Countries by region	AFRO	10%	11%
	EMRO	4%	4%
	EURO	35%	36%
	PAHO	31%	31%
	SEARO	3%	3%
	WPRO	15%	16%
Economic Class	High	59%	60%
	Lower-middle	10%	10%
	Upper-middle	27%	26%
	Low	4%	4%
Sex	Male	33%	34%
	Female	65%	65%
	Other / prefer not to answer	1%	1%
Occupation	Patient care/health services	56%	58%
	Specialized support	29%	29%
	Clerical support/administration and management	7%	7%
	Other	8%	7%