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Brief Report

Adherence to non-pharmacological preventive measures among healthcare workers in a middle-income country during the first year of the COVID-19 pandemic: Hospital and community setting



Silvia Figueiredo Costa MD, PhD^{a,*}, Sebastian Vernal MD, PhD^a, Pedro Giavina-Bianchi MD, PhD^b, Carlos Henrique Mesquita Peres^c, Lanuse G.D. dos Santos RN^d, Roseli E.B. Santos RN^d, Rita C.C. Santos RN^d, Maria Cristina P.B. Francisco RN^c, Fatima M. Satie RN^c, Ligia M. dal Secco RN^c, Aline Pivetta Cora MD^d, Carolina Lazari dos santos MD^d, Alberto Jose da Silva Duarte MD, PhD^d, Eloisa Silva Dutra de Oliveira Bonfá MD, PhD^e, Antonio Jose Perreira BEng^e, Ester Cedeira Sabino MD, PhD^f, Aluisio Cotrin Segurado MD, PhD^g, Anna Sara Levin MD, PhD^g

^a LIM-49, Instituto de Medicina Tropical, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

^b Clinical Immunology and Allergy Division, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

^c Hospital das Clínicas, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

^d Divisão de Laboratório Central, Hospital das Clínicas, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

^e Covid-19 Emergency Committee, Hospital das Clínicas, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

^f LIM-46, Instituto de Medicina Tropical, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

^g Divisão de Moléstias Infeciosas, Hospital das Clínicas, and Department of Infectious Diseases, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil

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This study assessed, using a self-reported questionnaire, the adherence to PPE (mask, gowns, and gloves) at the workplace, as well as to non-pharmacological preventive measures (NPPM) (physical distance defined as hardly ever and/or never approaches other people within 1.5 meters, social isolation as leaving home less than once a week, hand hygiene was defined as performing hand hygiene ≥ 6 times per period, and adherence to the use of a mask outside of the workplace was defined as on all outings and hardly ever and/or never removes the mask) outside of the workplace among 1,296 health care workers (HCWs), including if NPPM adherence was associated with COVID-19 in HCWs. High adherence to PPE was independently associated with younger age, professional category, work in an area of direct patient assistance; use of public transportation, or adherence to NPPM outside of the workplace.

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Non-pharmacological preventive measures (NPPMs) (eg, avoiding travel, limiting physical contact with people outside of one's household,

* Address correspondence to Silvia Figueiredo Costa, MD, PhD, LIM-49, Instituto de Medicina Tropical, Faculdade de Medicina da Universidade de São Paulo, São Paulo, Brazil - Avenida Dr. Enéas Carvalho de Aguiar, 470 - CEP 05403-000, SP/São Paulo, Brazil.

E-mail address: silviacosta@usp.br (S. Costa).

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and maintaining a 1–2 meter distance between oneself and others when in public) are the primary strategies used to prevent transmission of SARS-CoV-2 recommended by the World Health Organization (WHO).¹ Healthcare workers (HCWs) are the first line of care for COVID-19 patients.^{2,3} Although work in the healthcare system may be considered a risk factor, HCWs can acquire COVID-19 in the community, especially categories such as housekeeping and security.^{2,3} However, data regarding the compliance to NPPM, such as physical distance, social distance, hand hygiene, and adherence to the use of a mask outside of the workplace among HCWs is scarce.

The goals of this study were to evaluate the adherence to NPPM by HCWs to prevent COVID-19, as well as to investigate whether adherence to these measures was associated with having had an infection by SARS-CoV-2.

METHODS

Setting

The Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo (HC-FMUSP) is a public teaching hospital with 2,200-beds spread across seven buildings. The Central Institute was the designated location for receiving COVID-19 cases and comprised an emergency department, 300 ICUs, 300 ward beds, with 6,000 HCWs.

Serology chemiluminescence test for IgG (DiaSorin, Italy)⁴ was offered to all HCWs, including contractors in cleaning and security. These HCWs were requested to answer an online questionnaire using the SurveyMonkey platform. The questionnaire included questions on the use of PPE (mask, gowns, and gloves) at work and NPPM (physical distance, social isolation, hand hygiene, and adherence to the use of a mask) outside of the workplace and were based on a questionnaire used in another study in Brazil⁵ which was validated as a pilot study and has been applied several times during the pandemic.

A HCW was considered to have had oligo/asymptomatic COVID-19 if they presented positive serology⁶ without previously having been tested with RT-PCR.⁶

PPE were made available to all HCWs. HCWs providing direct patient care wore N95 masks and scrubs during their entire shifts. When examining or touching patients they added disposable gloves and a gown.

Data analysis

Two analyses were performed. HCWs who had had a documented infection by SARS-CoV-2 (positive serology or positive RT-PCR) were compared with those who had not; and HCWs who reported high adherence to PPE within the hospital were compared with those who did not. Some variables were evaluated as follows:

1. Adherence to PPE use within the hospital. One point was attributed to each PPE item used by the HCW during work: mask, gloves, face-shield, goggles, gown, and cap. The scores were then categorized as follows: (1) Low adherence to PPE: 0-2 points; (2) moderate adherence: 3-4 points; and (3) high adherence: 5-6 points.
2. Intensity of previous symptoms. One point was considered for each symptom: fever, nasal discharge, sore throat, cough, wheezing, chest pain, anosmia, ageusia, and diarrhea. The scores were then categorized as follows: (1) Asymptomatic: 0 points; (2) Mild symptoms: 1-3 points; (3) Moderate and/or intense symptoms: >3 points.
3. Professional category. HCWs considered to provide direct patient assistance were: Physicians and/or Residents and/or Medical students, nurses, nursing technicians, physiotherapists. The following categories were considered to not have direct physical contact with patients: pharmacists, nutritionists, psychologists, Laboratory and/or Radiology and/or Pathology technicians, administrative workers, and others.
4. Hospital workplace was divided into 2 categories: direct patient assistance areas (ICU, Emergency room, and medical and/or surgical units); and areas without direct assistance.
5. NPPM. Questionnaire included categorical multi-choice answers, but they were grouped for bi- and multivariate analyses such as dichotomy variables. Physical distance was defined as hardly ever/never approaches other people within 1.5 meters; social isolation as leaving home less than once a week; hand hygiene was defined as performing hand hygiene ≥ 6 times per period; and adherence to the use of a mask outside of the workplace was defined as on all outings and hardly ever and/or never removes the mask.⁵

Multivariate logistic regression was performed including the variables with *P-value* $\leq .2$ in the bivariate analysis using the software SPSS version 22.00 (SPSS v22, IBM, USA). The inclusion of age and sex was decided *a priori*. Significance was set at $\alpha = 5\%$.

RESULTS

A total of 1,296 HCWs participated in the study. HCWs who had had a documented infection by SARS-CoV-2 (159; 12.2%) were compared with the group that did not. The bivariate analysis of factors associated with having had an infection by SARS-CoV-2 can be seen in Table 1-supplementary material. The multivariate analysis revealed 2 factors associated with infection by SARS-CoV-2: reporting moderate/intense symptoms; and working in an area with direct patient assistance (Table 2-supplementary material).

HCWs reported using a mask on all occasions when outside the home and never and/or hardly ever removing it (841; 74%), and adherence to hand washing ≥ 6 times and/or period (eg, morning, afternoon) when outside the workplace (708; 63%). Table 3 shows the bivariate analysis of factors associated with high adherence to PPE at the workplace. The multivariate analysis showed that high adherence to PPE at the workplace was independently associated with a younger age; professional category that performed direct patient assistance; working in an area of direct patient assistance; use of public transportation at least once a week; and adherence to NPPM outside of the workplace (physical distancing and social isolation) (Table 4).

DISCUSSION

Among the hospital's HCWs, the only factors associated with having had a SARS-CoV-2 infection were working in an area with direct patient assistance and having reported symptoms. HCWs who adhered strongly to PPE at work also adhered more to NPPM outside of work. They were aged < 60 years and belonged to professional categories involved in direct patient assistance. The adherence to NPPM was significantly less frequent in the physicians and/or residents and/or students group when compared to other HCWs (*P-value* < .001).

Although the WHO clearly recommended the use of cloth masks in the community, in Brazil, the federal government did not recommend the use of a mask nor NPPM in the first year of the pandemic. The amount of fake news on social media made the recommendations more confusing,^{7,8} with different recommendations at the state and municipal level. Data on population mobility based on mobile phones indicate that immobility in Brazil ranged from 30%-62.2%.⁹ This lack of clear recommendation might have had an impact on the adherence to NPPM among HCWs who participated in our study.

Interestingly, we observed that high adherence to PPE at the workplace was independently associated with younger age, professional category that performed direct patient assistance, work in an area of direct patient assistance, use of public transportation at least once a week, and adherence to NPPM outside of the workplace. As we used a self-reported questionnaire, it is possible that this finding was related to a positive self-perception of the HCW in both the workplace and outside.

Adherence to NPPM during the pandemic varies depending on behavioral and cultural conditions.¹⁰ A study that evaluated 2,013 adults in North America and Europe pointed out that the strongest barriers included having friends or family who needed help with running errands and socializing in order to avoid loneliness.¹⁰ A systematic review that included 16 studies¹¹ on compliance with social and protective behaviors among HCWs during outbreaks observed that staff working in emergency or intensive care settings or in contact with confirmed cases appeared more likely to comply with recommendations as reported in our questionnaire. The review pointed out

Table 1
 Characteristics of 1,296 healthcare workers evaluated as to previous infection by SARS-CoV-2, and their self-reported adherence to non-pharmacologic measures to prevent COVID-19 (Hospital das Clínicas, University of Sao Paulo, Brazil)

Variables		Total N (%)	Previous infection by SARS-CoV-2 N (%)		OR (95% CI)	P-value
			Yes (N = 159)	No (N = 1,137)		
Age	≥60 years	123 (10)	7 (4)	116 (10)	2.46 (1.12 – 5.39)	0.02
	<60 years	1173 (90)	152 (96)	1021 (90)		
Sex	Female	983 (76)	115 (72)	868 (76)	1.23 (0.85 – 1.79)	0.26
	Male	313 (24)	44 (28)	269 (24)		
Professional category	Administrative (does not carry out direct patient assistance)	144 (11)	15 (9)	129 (11)	1.84 (1.27 – 2.68)	0.01
	Pharmacist/Nutritionist/Psychologist	83 (6)	3 (2)	80 (7)		
	Housekeeping/Security	4 (<1)	1 (1)	3 (<1)		
	Laboratory/Radiology/Pathology technician	69 (5)	5 (3)	64 (6)		
	Others professions (no patient assistance)	184 (14)	17 (11)	167 (15)		
	Physicians/Residents/Medical students	426 (33)	56 (35)	370 (33)		
	Nurse	155 (12)	21 (13)	134 (12)		
	Nursing technician	154 (12)	31 (20)	123 (11)		
	Physiotherapist	73 (6)	10 (6)	63 (5)		
	<i>Data not available</i>	4 (<1)				
Workplace at the hospital	Administrative office (areas in which there is no direct patient assistance)	130 (10)	12 (8)	118 (10)	2.19 (1.56 – 3.09)	<0.01
	Laboratory	184 (14)	12 (8)	172 (15)		
	Other local (no medical care)	395 (31)	36 (23)	359 (32)		
	Intensive care unit	186 (14)	32 (20)	154 (13)		
	Medical and surgical units	279 (22)	51 (32)	228 (20)		
	Emergency room	115 (9)	15 (10)	100 (9)		
	<i>Data not available</i>	7 (<1)				
Unit dedicated to COVID-19	No	721 (56)	90 (57)	631 (56)	0.95 (0.68 – 1.33)	0.79
	Yes	575 (44)	69 (43)	506 (44)		
Adherence to PPE at work	Low	635 (49)	64 (40)	571 (50)	1.70 (1.19 – 2.44)	0.01
	Moderate	357 (28)	43 (27)	314 (28)		
	High	304 (24)	52 (33)	252 (22)		
Intensity of previous symptoms	Asymptomatic	723 (56)	85 (54)	638 (56)	Reference	0.54
	Mild	480 (37)	51 (32)	429 (38)		
	Moderate/intense	81 (6)	22 (14)	66 (6)		
	<i>Data not available</i>	5 (<1)				
Use of public transportation	Does not use	307 (24)	30 (19)	277 (25)	1.19 (0.85 – 1.67)	0.30
	Almost never uses (less than once a week)	276 (21)	36 (23)	240 (21)		
	1-3 times per week	137 (11)	20 (13)	117 (10)		
	4-5 times per week	341 (26)	43 (27)	298 (26)		
	≥ 6 times per week	211 (16)	28 (18)	183 (16)		
	Don't know / Did not want to answer	14 (1)	2 (1)	12 (1)		
	<i>Data not available</i>	10 (<1)				
Adherence to use of mask outside of the hospital workplace	Does not use	7 (<1)	1 (1)	6 (<1)	0.62 (0.44 – 0.89)	0.01
	Uses on all outings and frequently removes from face	52 (4)	7 (4)	45 (4)		
	Uses on all outings and removes mask now and again	287 (22)	48 (30)	239 (21)		
	Uses on all outings and hardly ever/never removes the mask	943 (73)	102 (65)	841 (74)		
	<i>Data not available</i>	7 (<1)				
Adherence to hand hygiene (HH) when away from home and from work	Occasionally or never when away from home	15 (1)	2 (1)	13 (1)	0.70 (0.50 – 0.98)	0.04
	HH 1-2 times per period (eg, morning, afternoon)	86 (7)	15 (10)	71 (6)		
	HH 3-5 times per period	390 (30)	54 (34)	336 (30)		
	HH ≥6 times per period	792 (61)	84 (54)	708 (63)		
	Not applicable (never leaves home)	3 (<1)	2 (1)	1 (<1)		
Adherence to physical distancing	<i>Data not available</i>	10 (<1)			0.98 (0.64 – 1.50)	0.94
	Frequently approaches other people within 1.5 meters	106 (8)	14 (9)	92 (8)		
	Sometimes approaches other people within 1.5 meters	404 (31)	61 (39)	343 (30)		
	Rarely approaches other people within 1.5 meters	530 (41)	53 (34)	477 (42)		
	Hardly ever/never approaches other people within 1.5 meters	247 (19)	30 (19)	217 (19)		
Adherence to social isolation (except for work)	<i>Data not available</i>	9 (<1)			0.85 (0.52 – 1.39)	0.53
	Leaves home ≥6 times per week	112 (9)	17 (11)	95 (8)		
	Leaves home 4-5 times per week	365 (28)	51 (33)	314 (28)		
	Leaves home 1-3 times per week	613 (47)	68 (43)	545 (48)		
	Leaves homes less than once a week	193 (15)	21 (13)	172 (15)		
<i>Data not available</i>	13 (1)					

OR, odds ratio; CI, confidence interval.

Table 2
Multivariate analysis of the factors associated with having had a previous infection by SARS-CoV-2 among healthcare workers (Hospital das Clínicas, University of Sao Paulo, Brazil)

Variable	Indicator	adjusted OR (95% CI)
Age	<60 years	1.87 (0.83 – 4.17)
Sex	Male	1.18 (0.79 – 1.76)
Professional category	Involved in direct patient assistance	1.29 (0.83 – 2.02)
Hospital workspace	Area with direct patient assistance	1.65 (1.10 – 2.47)
Adherence to PPE at work	Moderate (3–4 points)	1.00 (0.64 – 1.54)
	High (5–6 points)	1.41 (0.91 – 2.19)
Intensity of symptoms	Mild (1–3 points)	0.92 (0.63 – 1.35)
	Moderate/Intense symptoms (>3 points)	2.15 (1.21 – 3.81)
Adherence to the use of a mask outside of the workplace	On all outings and hardly ever/never removes the mask	0.71 (0.48 – 1.07)
Adherence to hand hygiene (HH) when away from home and from work	HH ≥6 times per period	0.83 (0.57 – 1.22)

OR, odds ratio; CI, confidence interval.

Table 3
Bivariate analysis of potential factors associated with healthcare workers reporting high adherence to PPE against COVID-19 at the workplace (Hospital das Clínicas, University of Sao Paulo, Brazil)

Variables	Adherence to the use of PPE at the workplace		OR (95% CI)	P-value	
	High (N = 304)	Low/Moderate (N = 992)			
Age	≥60 years	12 (4)	Reference	<0.01	
	<60 years	292 (96)	3.06 (1.66 – 5.64)		
Sex	Female	238 (25)	Reference	0.25	
	Male	66 (21)	0.83 (0.61 – 1.13)		
Professional category	Administrative	1 (<1)	Reference	<0.01	
	Pharmacist/Nutritionist/Psychologist	5 (2)	(no direct patient assistance)		
	Cleaning/Security	0 (0)	4 (<1)		
	Laboratory/Radiology/Pathology technician	6 (2)	63 (6)		
	Others professions (no patient assistance)	20 (7)	164 (17)		
	Physicians/Residents/Medical students	82 (27)	344 (35)		
	Nurse	64 (21)	91 (9)		
	Nursing technician	85 (28)	69 (7)		
	Physiotherapist	41 (14)	32 (3)	7.16 (4.86 – 10.55)	
Hospital Workplace	Administrative office	1 (<1)	Reference		<0.01
	Laboratory	13 (4)	(areas without direct patients assistance)		
	Other	86 (28)	309 (31)		
	Intensive care unit	108 (36)	78 (8)		
	Medical and surgical units	66 (22)	213 (22)		
	Emergency department	30 (10)	85 (9)		
covid-19 educated unit	No	177 (58)	Reference	0.29	
	Yes	127 (42)	0.87 (0.67 – 1.13)		
Intensity of previous symptoms	Asymptomatic (0 points)	173 (57)	Reference	0.45	
	Mild (1–3 points)	106 (35)	0.90 (0.68 – 1.18)		
	Moderate/intense (>3 points)	24 (8)	1.19 (0.72 – 1.96)		
Use of public transportation	Does not use	66 (21)	Reference	0.07	
	Rarely (less than once a week)	57 (19)	219 (22)		
	1–3 times per week	35 (12)	102 (10)		
	4–5 times per week	92 (31)	249 (25)		
	≥ 6 times per week	48 (16)	163 (17)		
Adherence to the use of a mask outside of the workplace	Does not use mask	1 (<1)	Reference	0.01	
	Uses on all outings and frequently removes it	4 (1)	48 (5)		
	Uses on all outings and removes mask now and again	59 (20)	228 (23)		
	Uses on all outings and hardly ever/never removes the mask	239 (79)	704 (71)		
Adherence to hand hygiene (HH) when away from home and from work	Occasionally or never when away from home	3 (1)	Reference	0.02	
	HH 1–2 times per period (eg, morning, afternoon)	9 (3)	77 (8)		
	HH 3–5 times per period	87 (29)	303 (31)		
	HH ≥6 times per period	202 (67)	590 (60)		
Adherence to physical distancing	Frequently approaches other people within 1.5 meters	17 (6)	Reference	<0.01	
	Sometimes approaches other people within 1.5 meters	85 (28)	319 (32)		
	Rarely approaches other people within 1.5 meters	119 (40)	411 (42)		
	Hardly ever/never approaches other people within 1.5 meters	80 (27)	167 (17)		
Adherence to social isolation (except for work)	Leaves home ≥6 times per week	16 (5)	Reference	<0.01	
	Leaves home 4–5 times per week	77 (26)	288 (29)		
	Leaves home 1–3 times per week	141 (47)	472 (48)		
	Leaves homes less than once a week	65 (22)	128 (13)		

OR, odds ratio; CI, confidence interval.

Table 4
Multivariate analysis of factors associated with healthcare workers reporting high adherence to personal protective equipment (PPE) against COVID-19 at the workplace (Hospital das Clínicas, University of Sao Paulo, Brazil)

Variables	Indicator	adjusted OR (95%CI)
Age	<60 years-old	2.87 (1.46 – 5.63)
Sex	Male	0.83 (0.59 – 1.17)
Professional category	Involved in direct patient assistance	6.66 (4.32 – 10.27)
Hospital workplace	Area with direct patient assistance	1.80 (1.31 – 2.47)
Use of public transportation	At least once a week	1.80 (1.34 – 2.43)
Adherence to the use of a mask outside of the workplace	On all outings and hardly ever/never removes the mask	1.39 (0.96 – 2.01)
Adherence to hand hygiene (HH) when away from home and from work	HH \geq 6 times per period	1.07 (0.77 – 1.49)
Adherence to physical distancing	Hardly ever/never approaches other people within 1.5 meters	1.70 (1.16 – 2.47)
Adherence to social isolation (except for work)	Leaves homes less than once a week	1.71 (1.15 – 2.54)

OR, odds ratio; CI, confidence interval.

as well that anxiety and concern about the risk of infection were contributors to compliance, and that monitoring from superiors could improve compliance.¹¹ Unfortunately, we did not evaluate anxiety neither monitoring from superiors in our study.

Our study has limitations as the data were self-reported, single centered, and voluntary, and we did not evaluate anxiety on risk of infection nor monitoring from superiors.

In summary, the factors associated with having had a SARS-CoV-2 infection among HCWs were working in an area with direct patient assistance and having reported symptoms. High adherence to PPE at the workplace was independently associated with a younger age; working in an area of direct patient assistance; use of public transportation at least once a week; and adherence to NPPM outside of the workplace that can be related to a positive self-perception of HCW.

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