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Original Article

COVID-19: fatores associados ao uso adequado de equipamentos de proteção individual por trabalhadores da atenção primária

COVID-19: factors associated with the use of personal protective equipment by primary care workers

COVID-19: factores asociados al uso adecuado de equipos de protección individual por parte de trabajadores de atención primaria

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RESUMO

O estudo tem como objetivo analisar os fatores associados ao uso adequado dos Equipamentos de Proteção Individual (EPI) pelos trabalhadores da Atenção Primária à Saúde (APS). Estudo transversal, realizado no Brasil, em ambiente virtual entre os meses de agosto/2020 e março/2021. Para a coleta de dados utilizou-se o instrumento validado "E.P.I. - APS COVID-19". Foram utilizados testes qui-quadrado ou exato de Fisher, razão de prevalência, Intervalo de Confiança de 95% e regressão de Poisson com significância p≤0,005. Pesquisa aprovada pelo Comitê de Ética em Pesquisa com Seres Humanos. Participaram da pesquisa 455 trabalhadores. Os trabalhadores com 37 anos ou mais apresentaram prevalência de 1,59 vezes maior para uso adequado de óculos/protetor facial, 1,39 vezes maior para máscara N95 e 1,23 vezes maior para a higienização correta das mãos. O uso de luvas apresentou uma prevalência 35% maior para os trabalhadores com carga horária ≤ 40 horas. A faixa etária 37 anos ou mais foi associada ao uso de máscara N95 (RP=1,107) e a higiene das mãos (RP=1,075). A carga horária ≤ 40 horas foi associada ao uso de luvas (RP=0,846). Conclui-se que são fatores associados ao uso adequado de EPI a faixa etária 37 anos ou mais e a carga horária ≤ 40 horas.

PALAVRAS-CHAVE: COVID-19. Equipamentos de Proteção Individual. Biossegurança. Atenção Primária à Saúde. Profissionais da Saúde.

ABSTRACT

This study aims to analyze the factors associated with the proper use of Personal Protective Equipment (PPE) by Primary Health Care (PHC) workers. Cross-sectional study, carried out in Brazil, in a virtual environment between August/2020 and March/2021. For data collection, the validated instrument "P.P.E. - PHC COVID-19" was used. Chi-square or Fisher's exact tests, prevalence ratio, 95% confidence interval, and Poisson regression with p≤0.005 significance were used. The research was approved by the Ethics Committee for Research with Human Beings and 455 workers participated in the survey. Workers aged 37 years or older had a prevalence of 1.59 times higher for proper use of glasses/face shields, 1.39 times higher for N95 masks, and 1.23 times higher for correct hand hygiene. The use of gloves showed a 35% higher prevalence for workers with working hours of ≤ 40 hours. The age group 37 years or older was associated with the use of N95 masks (PR=1.107) and hand hygiene (PR=1.075). Working hours of ≤ 40 hours were associated with the use of gloves (PR=0.846). It is concluded that the factors associated with the proper use of PPE are age group 37 years or older and working hours of ≤ 40 hours.

KEYWORDS: COVID-19. Personal Protective Equipment. Biosafety. Primary Health Care. Health professionals.

RESUMEN

El estudio tiene como objetivo analizar los factores asociados al uso adecuado de los Equipos de Protección Individual (EPI) por parte de trabajadores de Atención Primaria de la Salud (APS). Estudio transversal, realizado en Brasil, en ambiente virtual entre los meses de agosto/2020 y marzo/2021. Para la recolección de datos se utilizó el instrumento validado "E.P.I. -APS COVID-19". Se utilizaron pruebas de Chi-cuadrado o exacta de Fisher, razón de prevalencia, intervalo de confianza del 95% y regresión de Poisson con significancia p≤0,005. Investigación aprobada por el Comité de Ética en Investigación en Humanos. En la encuesta participaron 455 trabajadores. Los trabajadores de 37 años o más tuvieron una prevalencia 1,59 veces mayor para el uso adecuado de gafas/protectores faciales, 1,39 veces mayor para las mascarillas N95 y 1,23 veces mayor para la correcta higiene de manos. El uso de guantes mostró una prevalencia 35% mayor para trabajadores con carga de trabajo ≤ 40 horas. El grupo etario de 37 años o más se asoció con el uso de mascarilla N95 (RP=1,107) y la higiene de manos (RP=1,075). La jornada laboral ≤ 40 horas se asoció con el uso de guantes (RP=0,846). Se concluye que factores asociados al uso adecuado de EPI son el grupo etario de 37 años o más y la jornada laboral ≤ 40 horas.

PALABRAS CLAVE: COVID-19. Equipos de Protección Individual. Bioseguridad. Atención Primaria de Salud. Profesionales de la Salud.

INTRODUCTION

The COVID-19 pandemic has highlighted the urgency and relevance of adherence to the proper use of Personal Protective Equipment (PPE) by all healthcare workers,1-3 as a measure to prevent Healthcare-Related Infections (HAIs),[4-5] since the work activities carried out by these workers have increased the risk of contamination[6-7].

The proper use of PPE is related to the appropriate selection of PPE for a given activity in the health sector[8]. Adherence, on the other hand, is characterized by the professional's behavior and commitment to using them appropriately, to provide quality and effective care based on good health practices, thus ensuring an improvement in the protection of patients and workers who are exposed to care-related risks daily[2-3].

Standard precautions are already routine and known by all health professionals4, but non-adherence and inadequate use of PPE was a reality in health services during the COVID-19[9-15] pandemic.

This situation may be linked to a number of factors, such as professionals' lack of awareness of the risk of becoming ill[13]; professionals' insecurity about dressing and undressing in PPE[11]; training activities,[2,16-17] as well as work overload9; a shortfall in the supply of PPE[18]; reuse for longer than recommended[10,19], denial of the disease,[10] as well as factors such as age, length of experience and area of concentration of work activities[20].

Given the above, we ask: what factors are associated with the proper use of PPE by Primary Health Care (PHC) workers in coping with the COVID-19 pandemic? This study aims to analyze the factors associated with the proper use of PPE by PHC workers.

METHODS

Study design, period, and location

This is a cross-sectional, descriptive, and analytical study carried out in Brazil between August 2020 and March 2021. This study is linked to the research: “Use of Personal Protective Equipment by health professionals in the fight against COVID-19 - E.P.I. COVID-19 Brazil”. It was guided by the guidelines Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and Checklist for Reporting Results of Internet E-Surveys (CHERRIES).

Population

Potential participants in the study were all PHC workers who carried out their work activities in the face of COVID-19 and are listed in the National Council of Health Establishments (*Conselho Nacional de Estabelecimentos em Saúde* - CNES) (nurse, doctor, physiotherapist, speech therapist, dental surgeon, nutritionist, pharmacist, psychologist, social worker, nursing technician, community agent, oral health agent, oral health technician, administrative technical assistant, and receptionist).

This is a convenience sample made up of workers who voluntarily agreed to take part in the research.

Study protocol and instrument

The survey was carried out in a virtual environment using the free KoboToolbox platform. Various means of dissemination were used, including e-mail, telephone contact, social media, and recruiting participants to help with dissemination[21]. The questionnaire was accessed after accepting the Free and Informed Consent Term (FICT) made available online.

For data collection, the validated instrument "P.P.E. - PHC COVID-19" was used, consisting of 86 items involving personal, professional, and professional training data, as well as data on the use of PPE. The questions relating to the use of PPE were organized into eight domains after psychometric validation and exploratory factor analysis: 1- Disposable cap or hat; 2- Gloves; 3- Safety behavior; 4- N95 mask; 5- Hand hygiene; 6- Disposable apron or cloak; 7- Disposable surgical mask; and 8- Goggles or individual protection mask[22].

Analysis of results and statistics

The data collected on the KoboToolbox platform was exported to Microsoft Office Excel to assess consistency and organize the database. After organizing the database, the data was exported to the Statistical Package for the Social Sciences (SPSS) version 29.0 for statistical analysis. The Kolmogorov-Smirnov normality test was used.

The dependent variables were the eight domains relating to the appropriate use of PPE. To measure appropriate use, the total number of points assessed in each domain was taken into account[22]. It is worth noting that the items referring to the lack of PPE were not used in this analysis.

The independent variables were: age (19 to 36 years; 37 years or more), position in PHC (nursing staff; other positions), time working in PHC (zero to eight years; nine years or more), and

weekly workl hours (≤ 40 hours; 41 hours or more).

Descriptive statistics were used to show the frequencies and percentages of the variables. The association between the variables was checked using Pearson's chi-square or Fisher's exact tests, the prevalence ratio, and the 95% Confidence Interval (CI), with significance p≤0.005.

The variables with a p-value ≤0.20 were included in Poisson regression models with a robust estimate, namely: a) model 1: the dependent variables were considered individually; b) model 2: the dependent variables were included together; c) model 3: the dependent variables were considered together with the inclusion of the control variables; gender, higher education, and region. A significance value of p≤0.005 was adopted.

Ethical aspects

The research was approved by the Human Research Ethics Committee of the Federal University of Juiz de Fora – UFJF (opinion n.º 5.429.839; CAAE n.º 30933220.7.0000.5147).

RESULTS

A total of 455 PHC workers took part in the survey, of whom 343 (75.4%) had higher education qualifications, with a predominance of nurses (184; 40.9%), females (365; 80.2%), marital status with a partner (258; 56.7%) and from the Southeast (313; 68.8%). The average age was 37.38 years (SD±8.9). Concerning professional data, 252 (55.3%) reported having a specialization in the health area and worked in the Family Health Team (FHT) (272; 59.8%). The average weekly workload was 37.7 hours (SD±7.7) and the average time working in PHC was 9.5 years (SD±7.7). Among the participants, 105 (23.1%) were part of the risk group for COVID-19 and 69 (15.2%) had been diagnosed with the disease.

When assessing the proper use of PPE among PHC workers, it was observed that 59.0% had inadequate use of gloves and 50.8% sanitized their hands incorrectly. Appropriate use of PPE was observed in 54.1% of cases for the N95 mask and in 63.8% for the use of goggles/face shields (Table 1).

Table 1 - Appropriate use of PPE, hand hygiene, and safety behavior among PHC workers. Brazil, 2021 (n=455).

Appropriate use	Yes n (%)	No n (%)
Hat	39 (13.0)	261 (87.0)
Gloves	123 (41.0)	177 (59.0)
Apron/Cloak	103 (42.2)	141 (57.8)
Goggles/Face shield	166 (63,8)	94 (36.2)
Surgical mask	100 (26.0)	285 (74.0)
N95 mask	119 (54.1)	101 (45.9)
Safety behavior	55 (12.1)	400 (87.9)
Hand hygiene	224 (49.2)	231 (50.8)

Source: Prepared by the authors

In the analysis of the association between proper use and age, it was found that workers aged 37 or over had a prevalence 1.59 times higher for the use of goggles/face shield, 1.39 times higher for the use of an N95 mask, and 1.23 times higher for correct hand hygiene when compared to workers aged 19 to 26 (Table 2).

Table 2 – Association between the appropriate use of PPE and the variable age of PHC workers. Brazil, 2021 (n=455)

Age (in years)	Appropriate use															
	Hat		Gloves		Apron / Cloak		Goggles / Face shield		Surgical mask		N95 mask		Safety behavior		Hand hygiene	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
19 to 36	16 (10,8)	132 (89,2)	63 (42,6)	85 (57,4)	47 (40,5)	69 (59,5)	69 (55,2)	56 (44,8)	49 (25,4)	144 (74,6)	50 (46,3)	58 (53,7)	26 (11,0)	210 (89,0)	104 (44,1)	132 (55,9)
37 years or older	23 (15,1)	129 (84,9)	60 (39,5)	92 (60,5)	56 (43,8)	72 (56,2)	97 (71,9)	38 (28,1)	51 (26,6)	141 (73,4)	69 (61,6)	43 (38,4)	29 (13,2)	190 (86,8)	120 (54,8)	99 (45,2)
p-value	0,26		0,58		0,61		<0,001		0,79		0,02		0,46		0,02	
PR	1,05		0,94		1,05		1,59		1,01		1,39		1,02		1,23	
(95% CI)	(0,963-1,147)		(0,785-1,146)		(0,854-1,310)		(1,141-2,219)		(0,903-1,144)		(1,044-1,875)		(0,958-1,098)		(1,029-1,488)	

Source: Prepared by the authors

There was no association between appropriate use and the position held in PHC (Table 3), or with the length of time workers had worked

in PHC (Table 4).

Table 3 – Association between the adequate use of PPE and the variable position in PHC. Brazil, 2021 (n=455)

Position in PHC	Appropriate use															
	Hat		Gloves		Apron / Cloak		Goggles / Face shield		Surgical mask		N95 mask		Safety behavior		Hand hygiene	
	Yes	No	Yes	No	Yes	No	Yes	No	Sim	No	Yes	No	Yes	No	Yes	No
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Nursing team	23 (14,5)	136 (85,5)	62 (39,0)	97 (61.0)	54 (43,5)	70 (56,5)	79 (65,8)	41 (34,2)	40 (24,8)	121 (75,2)	56 (58,9)	39 (41,1)	23 (12,4)	162 (87,6)	83 (44,9)	102 (55,1)
Other positions	16 (11,3)	125 (88,7)	61 (43,3)	80 (56,7)	49 (40,8)	71 (59,2)	87 (62,1)	53 (37,9)	60 (26,8)	164 (73,2)	63 (50,4)	62 (49,6)	32 (11,9)	238 (88,1)	141 (52,2)	129 947,8)
p-value	0,42		0,45		0,66		0,53		0,66		0,2		0,85		0,12	
PR	0,96		1,07		0,95		0,9		1,02		0,82		0,99		1,15	
(95% CI)	(0,884-1,053)		(0,889-1,301)		(0,770-1,182)		(0,651-1,251)		(0,911-1,156)		(0,614-1,116)		(0,927-1,065)		(0,964-1,382)	

Source: Prepared by the authors

Table 4 - Association between the adequate use of PPE and the variable time working in PHC. Brazil, 2021 (n=455)

Time working in PHC (in years)	Appropriate use															
	Hat		Gloves		Apron / Cloak		Goggles / Face shield		Surgical mask		N95 mask		Safety behavior		Hand hygiene	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
0 to 8	13 (9,9)	118 (90,1)	48 (36,6)	83 (63,4)	44 (40,4)	65 (59,6)	67 (59,8)	45 (40,2)	45 (25,1)	134 (74,9)	55 (57,3)	41 (42,7)	27 (12,6)	188 (87,4)	106 (49,3)	109 (50,7)
9 or more	20 (15,9)	106 (84,1)	53 (42,1)	73 (57,9)	40 (39,6)	61 (60,4)	79 (68,7)	36 (31,3)	41 (26,3)	115 (73,7)	54 (56,8)	41 (43,2)	22 (12,3)	157 (87,7)	93 (52,0)	86 (48,0)
p-value	0,15		0,37		0,91		0,16		0,81		0,95		0,93		0,6	
PR	1,07		1,09		0,98		1,28		1,01		0,99		0,99		1,05	
(95% CI)	(0,974-1,177)		(0,897-1,333)		(0,792-1,231)		(0,902-1,826)		(0,895-1,152)		(0,714-1,372)		(0,925-1,074)		(0,863-1,291)	

Source: Prepared by the authors

In the analysis of the association between adequate use and weekly working hours, the prevalence of adequate use of PPE among PHC workers with weekly working hours ≤40 hours was 35% higher for the use of gloves when compared to workers with weekly working hours of 41 hours or more (Table 5).

Table 5 – Association between the adequate use of PPE and the weekly workload variable. Brazil, 2021 (n=455)

Weekly working hours	Appropriate use															
	Hat		Gloves		Apron / Cloak		Goggles / Face shield		Surgical mask		N95 mask		Safety behavior		Hand hygiene	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)	Yes n (%)	No n (%)
≤ 40	38 (13,4)	246 (86,6)	121 (42,6)	163 (57,4)	102 (43,2)	134 (56,8)	159 (64,4)	88 (35,6)	97 (26,4)	270 (73,6)	113 (54,3)	95 (45,7)	54 (12,5)	377 (87,5)	216 (50,1)	215 (49,9)
≥ 41	1 (13,0)	15 (87,0)	2 (12,5)	14 (87,5)	1 (12,5)	7 (87,5)	7 (53,8)	6 (46,2)	3 (16,7)	15 (83,3)	6 (50,0)	6 (50,0)	1 (4,2)	23 (95,8)	8 (33,3)	16 (66,7)
p-value	0,7		0,01		0,14		0,44		0,42		0,77		0,33		0,1	
PR	0,92		0,65		0,64		0,77		0,88		0,91		0,91		0,74	
(95% CI)	(0,808-1,057)		(0,531-0,810)		(0,488-0,863)		(0,419-1,4220		(0,712-1,095)		(0,509-1,639)		(0,834-0,999)		(0,555-1,008)	

Source: Prepared by the authors

Poisson regression models showed that age (37 years or older) was associated with the use of N95 masks (PR=1.107; CI:1.012-1.210) and hand hygiene (PR =1.075; CI:1.010-1.143), even when control variables were included in the model, indicating the relevance of this variable to the outcome of interest. Similarly, working hours (≤ 40 hours) were associated with the use of gloves (PR = 0.846; CI:0.765-0.935) among PHC workers (Table 6).

Table 6 - Relationship between adequate use of goggles/face shield, N95 mask, gloves and hand hygiene with demographic and work variables among PHC workers. Brazil, 2021 (n = 455)

Variables	Model 1			Model 2			Model 3		
	β	95% CI	p-value	β	95% CI	p-value	β	95% CI	p-value
Goggles/face shield									
Age	1,13	1,038-1,229	<0,001	1,101	0,994-1,220	0,06	1,108	1,000-1,227	0,05
Length of service	1,068	0,974-1,170	0,16	1,018	0,920-1,127	0,72	0,963	0,817-1,135	0,65
N95 Masks									
Age	1,111	1,016-1,214	0,02	1,104	1,010-1,208	0,03	1,107	1,012-1,210	0,02
Position in the APS	0,943	0,861-1,033	0,2	0,954	0,871-1,046	0,31	0,956	0,870-1,051	0,34
Gloves									
Working hours	0,839	0,764-0,922	<0,001	0,839	0,764-0,922	<0,001	0,846	0,765-0,935	<0,001
Hand hygiene									
Position in the APS	1,05	0,987-1,116	0,12	1,054	0,992-1,120	0,09	1,057	0,993-1,126	0,08
Age	1,074	1,010-1,141	0,02	1,072	1,009-1,140	0,02	1,075	1,010-1,143	0,02
Working hours	0,899	0,800-1,011	0,07	0,92	0,818-1,035	0,16	0,921	0,818-1,037	0,17

Source: Prepared by the authors

DISCUSSION

This study analyzed the factors associated with the proper use of PPE among PHC workers. The findings showed that age is associated with the use of goggles/face shields, N95 masks, and hand hygiene, and that workload is associated with the use of gloves. In addition, only goggles/face shields and N95 masks were properly used by PHC workers.

The use of PPE is the main safety measure for health workers to carry out their work activities safely, to avoid adverse events related to infections subsequently acquired after carrying out care procedures[7,23]. In this context, this research showed a compromise in the proper use of this equipment, with proper use only observed for PPE goggles/face shields and N95 masks.

Goggles or face shields are recommended for healthcare workers during procedures in which they are exposed to blood, excretions, and secretions[24]. A study carried out in Qatar with 757 PHC workers showed that 55.4% of them reported using goggles/face shields appropriately during care for suspected or confirmed COVID-19 cases[20].

The N95 mask is designed to prevent microorganisms from coming into contact with the oral and nasal cavities[26]. It is therefore an important protection factor for workers who carry out aerosol-generating procedures[20;26]. Both PPEs have become part of the work routine of PHC health professionals when carrying out aerosol-generating procedures[27].

The age variable (37 years or older) was associated with the proper use of PPE - goggles/face shield, N95 mask, and correct hand hygiene. This corroborates a study carried out in Qatar, which showed that workers aged 50 or over were more likely to use PPE properly when compared to workers aged between 18 and 29[20]. On the other hand, a study carried out in Ghana showed that the age variable was not associated with the use of PPE[2]. This variable has also been shown to be associated with hand hygiene. However, a study carried out in the pre-pandemic period in Brazil showed that the perception of risks for infections in PHC is low, when compared to the hospital environment, thus hindering the adoption of standard precautionary measures[28].

A weekly working hours of ≤ 40 hours among PHC workers is associated with the use of PPE gloves when compared to workers with a lower workload.

Some studies carried out in Qatar, Brazil, and Saudi Arabia have shown that this PPE was among the most used by health workers during the pandemic[20,29-30].

This study has some limitations inherent to a cross-sectional study and related to being carried out in a virtual environment[31]. However, it makes important contributions, such as identifying gaps in the proper use of PPE, given that PHC workers are the preferred gateway for users of the UHS[32] and, because they are in direct contact with the virus, are part of the risk group

for COVID-19[33-34]. This allows for the development and strengthening of biosafety measures based on scientific evidence aimed at the public.

CONCLUSION

We concluded that the factors associated with the proper use of PPE by PHC workers are age 37 years or older and weekly workload ≤ 40 hours. And that age is associated with the use of goggles/face shields, N95 masks, and hand hygiene, and working hours are associated with the use of gloves.

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