

Algorithm for paramentation, deparamentation and prevention of facial injuries: covid-19

Algoritmo para paramentação, esparamentação e prevenção de lesões faciais: covid-19

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ABSTRACT | OBJECTIVE: To develop algorithms to guide health professionals in the correct use of Personal Protective Equipment and to offer preventive measures related to facial skin injuries caused by the inappropriate use of personal protective equipment during the SARS-CoV-2 pandemic. **METHOD:** Integrative literature review with the databases of Health Sciences, MEDLINE, SciELO and LILACS, in the period from 2015 to 2020, using the descriptors: COVID-19, Pressure injury related to medical device and Equipment and provisions. **RESULTS:** Three algorithms have been developed that describe the techniques of dressing, de-dressing of personal protective equipment and preventive measures to avoid facial injuries caused by the inappropriate use of personal protective equipment. **CONCLUSION:** The algorithms built offer the health professional the description of techniques for the use of personal protective equipment and preventive measures for facial injury caused by the use of personal protective equipment, as well as allowing the professional a better visualization, practicality and understanding of the procedure. to be accomplished.

DESCRIPTORS: COVID-19. Personal protective equipment. Equipment and supplies.

RESUMO | OBJETIVO: Elaborar algoritmos para orientar os profissionais da saúde na correta utilização dos Equipamentos de Proteção Individual e oferecer medidas preventivas relacionadas às lesões de pele facial causadas pelo uso inadequado dos equipamentos de proteção individual durante a pandemia da SARS-CoV-2. **MÉTODO:** Revisão integrativa da literatura junto às bases de dados das Ciências da Saúde, MEDLINE, SciELO e LILACS, no período de 2015 a 2020, sendo utilizados para a busca os descritores: COVID-19, Lesão por pressão relacionada a dispositivo médico e Equipamentos e provisões. **RESULTADOS:** Foram desenvolvidos três algoritmos que descrevem as técnicas de paramentação, de desparamentação dos equipamentos de proteção individual e as medidas preventivas para evitar as lesões faciais causadas pelo uso inadequado dos equipamentos de proteção individual. **CONCLUSÃO:** Os algoritmos construídos oferecem ao profissional de saúde a descrição de técnicas do uso dos equipamentos de proteção individual e medidas preventivas para lesão facial causada pelo uso dos equipamentos de proteção individual, assim como possibilitam ao profissional uma melhor visualização, praticidade e entendimento do procedimento a ser realizado.

DESCRITORES: COVID-19. Equipamento de proteção individual. Equipamentos e provisões.

Introduction

Late in 2019, a new disease caused by the coronavirus strain (SARS-CoV-2) was announced globally, referred to by the World Health Organization (WHO) as COVID-19.¹ In March 2020, the World Health Organization classified the spread of the virus as a pandemic, potentially infecting humans, becoming a public health emergency of international concern.¹⁻³

SARS-CoV-2 is highly transmissible by droplets and contact, especially in indoor and hospital settings. One person infected with the new coronavirus will transmit it to two or three other people, depending on environmental conditions. Enclosed places with poor ventilation and low light facilitate the transmission of the virus. This transmission rate is called the reproductive number, which in COVID-19 ranges from 2.0 to 3.5.⁴⁻⁵

Several healthcare workers who are on the front lines of COVID-19 are suffering facial injuries from the use of personal protective equipment (PPE) and are being infected by COVID-19, and it is important that healthcare institutions provide these workers with PPE and that they receive training in the technique of using it. Such devices are indispensable to contemplate the measures of standard precautions, contact, and droplet precautions recommended in the face of this pandemic.⁶⁻⁷

PPE are all the devices for individual use, designed to protect the physical integrity of the worker and include gloves, eye or face shields, respiratory protectors, aprons and protection for the lower limbs, and hand hygiene cannot be ignored as one of the essential standard precautions to avoid contamination and dissemination of the virus.

The prolonged or incorrect use of face masks, respirators, and goggles/visors is responsible for the constant friction and pressure forces on the tissues in the facial skin region, leading the professionals to suffer from facial skin injuries (FSI) and dermatitis.⁸⁻⁹ In this sense, it is important to build educational technology, including algorithms, which provides health professionals with appropriate information about the techniques of PPE use and preventive

actions and therapeutic conduct of FSI caused by the devices. Thus, the professional prevents injuries by using this technology correctly, and there is less exposure to infectious agents.

The algorithms were chosen because they are graphic maps that help the professional visualize and develop, step by step, using PPEs and preventive measures for FSI. Algorithms consist of a finite sequence of well-defined instructions carried out systematically. They are commonly used in healthcare; they are simple, straightforward, and easily accessible instruments that provide a complete view of the clinical process. They are also an indispensable tool in the standardization of techniques and quality management, constituting an important means of organizing processes that guide decision-making.¹⁰⁻¹¹

This study aimed to develop algorithms to guide healthcare workers in the correct use of PPE and to provide preventive measures related to FSI caused by the inappropriate use of PPE during the SARS-CoV-2 pandemic.

Method

An integrative literature review applied to technology production of the methodological development research type. The following steps were outlined for the development of the research: identification of the theme and selection of the research question; establishment of criteria for inclusion and exclusion of studies; definition of the information to be extracted from the selected studies and categorization of the studies; evaluation of the studies included in the integrative review; interpretation of results, presentation of the review; and synthesis of knowledge.¹²

Facial pressure injury caused by the inappropriate use of PPE during the COVID-19 pandemic was defined as the topic, with the following guiding questions: What are the correct PPEs and techniques for use? What preventive measures are available in the literature to prevent FSI caused by improper use of PPEs during the COVID-19 pandemic?"

The PICO strategy was used¹³ – with "P" corresponding to the population (health professional); "I" corresponding to the intervention (garment technique and PPE stripping, preventive measures for LPF); "C" corresponding to the comparison (not applicable, since this is not a comparative study) and "O" corresponding to the outcome (protocol in the form of an algorithm) to construct the appropriate question for the resolution of the clinical research question.

An integrative literature review was carried out using the Health Sciences databases: (MEDLINE), Scientific Electronic Library Online (SciELO), and Latin American and Caribbean Literature on Health Sciences (LILACS), with the controlled descriptors in Health Sciences: COVID-19, Medical device-related pressure injury and Equipment and supplies. The search strategy was based on their different combinations, using the Boolean operator AND in Portuguese, Spanish, and English, depending on the base search.

The following inclusion criteria were adopted for the selection of publications: primary studies with a direct link to the theme; being available in full, original articles and published between 2015 and 2020. Exclusion criteria were: theses, dissertations, monographs, technical reports.

The reading of titles and abstracts was done independently by the author and another researcher to ensure that the texts contemplated the guiding question of the review and met the established inclusion criteria. In case of doubt about the selection, it was decided to include the publication initially and decide on its selection only after reading its full content.

To classify the level of evidence of the selected studies, the Agency for Healthcare Research and Quality categories were used¹⁴, that cover six levels: Level 1: evidence resulting from a meta-analysis of multiple randomized controlled trials; Level 2: evidence from individual studies with experimental design; Level 3: evidence from quasi-experimental studies; Level 4:

evidence from descriptive (non-experimental) studies or qualitative approach; Level 5: evidence from the case or experience reports; Level 6: evidence based on expert opinion.

From this survey, the algorithms were built, comprising a sequence of procedures described in two steps:

First step: Description of the technique of paramentation and deparamentation of PPE used by healthcare workers during the SARS-Cv-2 pandemic - Well-defined instructions have been identified on the techniques of PPE paramentation and deparamentation during the clinical practice of health care workers, which must be carried out systematically in order to prevent health care workers from contracting the SARS-Cov-2 infection and not being affected by FSI due to the inappropriate use of PPE.

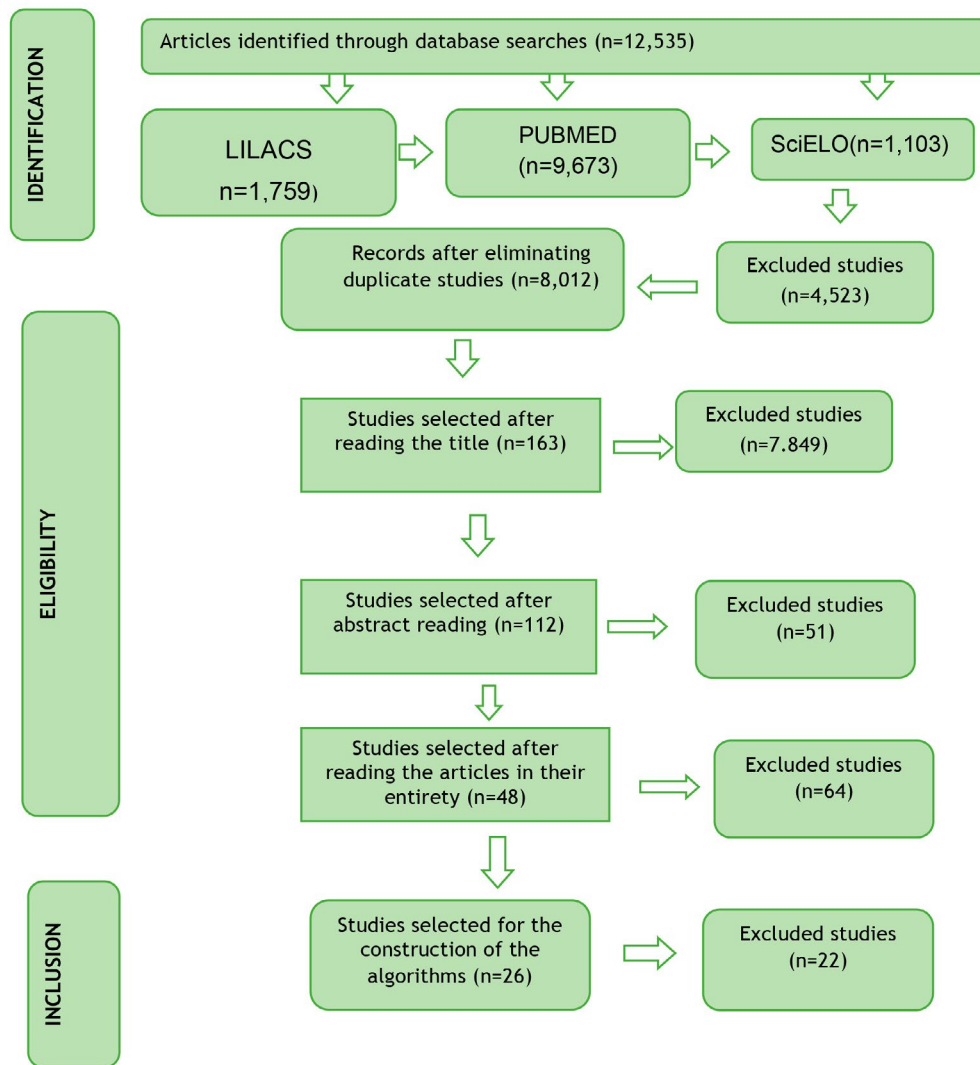
Second Step: Device Injuries Caused by Improper PPE Use - The preventive measures (types and technique of using facial devices, technique of using creams, barrier shields) that should be used to prevent and treat FSI before, during, and after using facial devices have been described.

Since this is an integrative literature review and algorithm construction, this study did not require approval from the Research Ethics Committee. However, ethical aspects were considered, such as citing the authors of the selected articles.

Results

Initially, 12,535 articles were identified; of these, 4,523 were excluded from duplicating in the databases. Thus, 8,012 articles were selected for reading the title and 163 for reading the abstract, which resulted in a sample of 112 articles for reading the full text. Of this total, 51 were excluded for not answering the guiding question, which led to a total of 26 articles selected to build the algorithms, as shown in Figure 1.

Figure 1. Flowchart of the process of identification, selection, and inclusion of studies, prepared based on the PRISMA recommendation. São Paulo, SP. Brazil, 2020



Source: Own author.

Chart 1 shows the articles selected during the integrative literature review to develop the algorithms classified according to the level of evidence.

Chart 1. Characteristics of the articles selected using the integrative literature review to construct the algorithms. São Paulo, SP, Brazil, 2020 (to be continued)

	Author	Title	Journal/year/volume/issue	Results	Level of Evidence
1	Black J ¹⁵	COVID-19 and wound care in the US	Wounds International [Internet]. 2020;11(2):6-7. https://www.woundsinternational.com/resources/details/covid-19-and-wound-care-us	Importance of mask use in preventing facial skin injuries.	6
2	Taminato M, Mizusaki-Imoto A, Saconato H, Franco ES ¹⁶	N95 respirator associated pressure ulcer amongst COVID-19 health care workers	Int Wound J. 2020;10.1111/iwj.13398. https://doi.org/10.1111/iwj.13398	The effectiveness of mask use in preventing skin injuries and infection during the pandemic of COVID-19.	4
3	Taminato M, Mizusaki-Imoto A, Saconato H, Franco ES, Puga ME, Duarte ML, et al. ¹⁷	Tissue masks in the containment of respiratory droplets - systematic review	Acta Paul Enferm. 2020;33:eAPE20200103. http://dx.doi.org/10.37689/actape/2020AR0103	The mask is an additional resource in prevention and should always be associated with breathing etiquette, hand hygiene, social distancing and isolation of cases.	1
4	Gefen A, Ousey K. ¹⁸	Prevention of skin damage caused by the protective equipment used to mitigate COVID-19	J Wound Care. 2020;29(6):311. https://doi.org/10.12968/jowc.2020.29.6.311	Provides preventive measures for facial skin injury caused by PPE use.	6
5	Smart H, Opinion FB, Darwich I, Elnawsany MA, Kodange C. ¹⁹	Preventing facial pressure injury for health care providers adhering to COVID-19 personal protective equipment requirements	Adv Skin Wound Care 33(8):418-427. DOI: 10.1097/01.ASW.0000669920.94084.c1	Use of silicone dressing to prevent facial skin injuries caused by PPE use.	4
6	APTferidas ²⁰	PREPI/COVID19 recommendation: Prevention of skin injuries caused by Personal Protective Equipment	https://www.aptferidas.com/Ficheiros/COVID19/APTFeridas%20-%20Recomendação%20Prepi-COVID19.pdf.2020	Technical guidance on PPE paramentation, technique for cleaning the skin before and after PPE use, also indicates types of devices and covers to prevent skin injuries caused by PPE.	4
7	Jiang Q, Liu Y, Wei W, Zhu D, Chen A, Liu H, et al. ²¹	The prevalence, characteristics, and related factors of pressure injury in medical staff wearing personal protective equipment against COVID-19 in China: A multicentre cross-sectional survey	Int Wound J. 2020;17(5):1300-9. https://doi.org/10.1111/iwj.13391	Prevalence of facial skin injuries caused by PPE and the risk factors for the professional to develop facial skin injury.	3
8	Gefen a, Ousey K. ²²	<u>Update to device-related pressure ulcers: SECURE prevention. COVID-19, face masks and skin damage</u>	Journal Wound Care. 2020;29(5):245-59. ps://doi.org/10.12968/jowc.2020.29.5.245	How to prevent facial skin injuries caused by the use of PPE.	4
9	Del Castillo PVJL, Reina AS, Cebrian CJL, Burgueño GM. ²³	The preventive effect of hydrocolloid dressing to prevent facial pressure and facial marks during use of medical protective equipment in COVID-19 pandemic	Br J Oral Maxillofac Surg. 2020;58(6):723-5. https://doi.org/10.1016/j.bjoms.2020.04.047	Describes the techniques and types of dressings that should be used to prevent facial injuries caused by the use of PPE.	3

Chart 1. Characteristics of the articles selected using the integrative literature review to construct the algorithms. São Paulo, SP, Brazil, 2020 (continuation)

Author		Title	Journal/year/volume/issue	Results	Level of Evidence
10	Ramalho AO, Freitas PSS, Nogueira PC. ²⁴	Medical Device-Related Pressure Injury in Healthcare Workers at a Time of Pandemic	ESTIMA, Braz. J. Enterostomal Ther. 2020;18:e0120. https://doi.org/10.30886/estima.v18.867_PT	Definition, risk factors, types of dressings to prevent facial skin injuries caused by the use of PPE. Cleaning of facial skin before and after the use of PPE to prevent injuries caused by the use of PPE.	6
11	Moore Z, Pattio D, Avsar P, McEvoy NL, Gurley G, Budri A, et al. ²⁵	Prevention of pressure ulcers among individuals cared for in the prone position: lessons for the COVID-19 emergence	J Wound Care. 2020;29(6):312-20. https://doi.org/10.12968/jowc.2020.29.6.312	Provides emergency room personnel with preventive measures for facial skin injuries caused by the use of PPE.	4
12	Cruz EDA. ²⁶	Coping with the coronavirus - the triad of reverse protection: by protecting myself, I protect the other, by protecting the other, I protect myself	Cogitare enferm. 2020;25:e73708. http://dx.doi.org/10.5380/c.e.v25i0.73708	Facing the coronavirus - the triad of reverse protection: by protecting myself, I protect the other, by protecting the other, I protect myself.	4
13	Oliveira AC, Lucas TC, Iquiapaza RA. ²⁷	What the Covid-19 pandemic has taught us about taking precautionary measures?	Texto Contexto Enferm.2020; 29:e20200106. Available from: https://doi.org/10.1590/1980-265X-TCE-2020-0106	The precautions that healthcare professionals and patients should take during the pandemic of COVID-19 to prevent facial injuries and to avoid contamination are: hand hygiene, use of PPE, use of alcohol gel, respiratory etiquette, cleaning of surfaces, avoidance of crowding, and social distancing.	4
14	Fumarola S, Allaway R, Callaghan R, Collier M, Downie F, Geraghty J, Kiernan S, Spratt F. ²⁸	Overlooked and underestimated: medical adhesive-related skin injuries. Best practice consensus document on prevention	J Wound Care. 2020;29(Suppl 3c):S1-S24. https://doi.org/10.12968/jowc.2020.29.Sup3c.S1	After reviewing the literature, the authors developed an instrument on medical adhesive-related skin injuries and discussed best practices for their assessment and prevention.	4
15	Padula CA, Paradis H, Goodwin R, Lynch J, Hegerich-Bartula D. ²⁹	Prevention of injuries related to medical devices associated with the use of respiratory equipment in a critical care unit: a quality improvement project	J Wound Ostomy Continence Nurs. 2017;44(2):138-41. https://doi.org/10.1097/won.0000000000000311 .	Provides professionals with preventive measures for facial skin injuries caused by PPE use during PPE use	4
16	Oliveira HC, Souza LC, Leite TC, Campos JF ³⁰	Personal Protective Equipment in the coronavirus pandemic: training with Rapid Cycle Deliberate Practice.	Rev Bras Enferm. 2020;73(Suppl 2):e20200303. doi: http://dx.doi.org/10.1590/0034-7167-2020-0303	Confronting the covid-19 pandemic requires proper use of Personal Protective Equipment, and it is important that institutions provide training for personnel on paramentation and deparamentation.	4
17	Sousa Neto AR, Freitas DRJ. ³¹	Use of face masks: indications for use and handling during the covid-19 Pandemic	Cogitare enferm. 2020;25:e72867. http://dx.doi.org/10.5380/c.e.v25i0.72867	Masks should be worn during the COVID-19 pandemic to prevent infection and facial skin injuries, but users should observe the following criteria: masks should always be clean and dry. Use paper towels to absorb moisture, use moisturizing cream before and after mask use.	4

Chart 1. Characteristics of the articles selected using the integrative literature review to construct the algorithms. São Paulo, SP. Brazil, 2020 (conclusion)

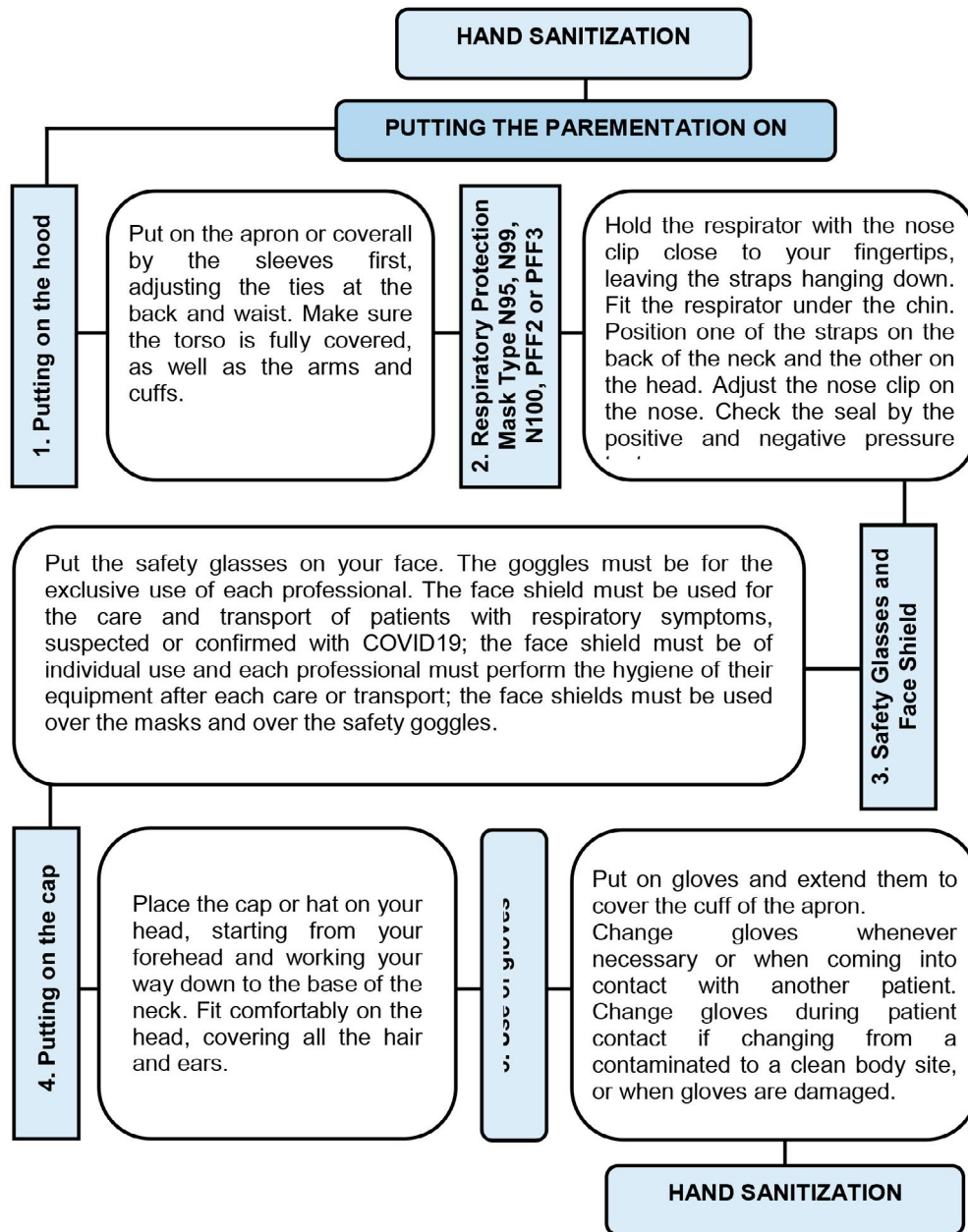
	Author	Title	Journal/year/volume/issue	Results	Level of Evidence
18	Ramalho AO, Freitas PSS, Moraes JT, Nogueira PC ³²	Reflections on recommendations for the prevention of pressure injuries during the Covid-19 pandemic	ESTIMA, Braz. J. Enterostomal Ther. 2020;18:e2520. https://doi.org/10.30886/estima.v18.940_PT	Describes the types of dressings and devices to prevent facial skin injuries caused by PPE use.	4
19	Gefen A, Alves P, Ciprandi G, Coyer F, Milne CT, Ousey K et al. ³³	Device related pressure ulcers: SECURE prevention.	J Wound Care 2020; 29(Sup2a): S1-S52 https://doi.org/10.12968/jowc.2020.29.Sup2a.S1	Reaffirms the importance of healthcare workers using PPE during the COVID-19 pandemic in preventing infections and facial skin injuries.	4
20	Coelho MMF, Cavalcante VMV, Moraes JT, Menezes LCG, Figueirêdo SV, Branco MFCC, et al ³⁴	Pressure injury related to the use of personal protective equipment in COVID-19 pandemic	Rev Bras Enferm. 2020;73(Suppl 2):e20200670. http://dx.doi.org/10.1590/0034-7167-2020-0670	Describes the prevalence and preventive measures for facial skin injury caused by the use of PPE.	2
21	Cook TM. ³⁵	Personal protective equipment during pandemic coronavirus disease (COVID) 2019 - a narrative review	Anaesthesia. 2020;75(7):920-7. https://doi.org/10.1111/anae.15071	Stresses the importance of PPE use during the COVID-19 pandemic.	4
22	Ong SWX, Tan YK, Sutjipto S, Chia PY, Young BE, Gum M, et al. ³⁶	Absence of contamination from personal protective equipment (PPE) by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).	Infect Control Hosp Epidemiol. 2020;41(5):614-6. https://doi.org/10.1017/ice.2020.91	Addresses the importance of healthcare workers using PPE during the COVID-19 pandemic in preventing infections and facial skin injuries.	3
23	Schank JE ^{37]}	The NPUAP Meeting - This was No Consensus Conference	J Am Coll Clin Wound Spec. 2016;7(1-3):19-24. https://doi.org/10.1016/j.jcwc.2016.07.001	Definition of medical device pressure ulcers.	3
24	Kelechi TJ, Brunette G, Lee LW ³⁸	Personal Protective Equipment-Related Equipment Dermatitis: A View From Here	J Wound Ostomy Continence Nurs. 2020;47(4):324-5. https://doi.org/10.1097/won.0000000000000673	Discusses the importance of PPE use during the COVID-19 pandemic in preventing dermatitis.	5
25	Gondi S, Beckman AL, Deveau N, Raja AS, Ranney ML, Popkin R. ³⁹	Personal protective equipment needs in the USA during the COVID-19 pandemic	Lancet. 2020;395(10237):e90-e91. https://doi.org/10.1016/s0140-6736(20)31038-2	It reports that the shortage of PPE puts both patients and healthcare workers at risk during the COVID-19 pandemic. It is necessary for institutions to provide PPE to the staff. When the staff uses them improperly, they can contract the infection and the skin injuries caused by improper use of PPE.	4
26	Atzrodt CL, Maknoja I, McCarthy RDP, Oldfield TM, Po J, Ta KTL, Stepp HE, Clements TP. ⁴⁰	A guide to COVID-19: a global pandemic caused by the de novo hair coronavirus SARS-CoV-2.	FEBS J. 2020 Set; 287(17): 3633-3650. doi: 10.1111/febs.15375.	Healthcare workers are at high risk for infection risk of infection, especially when they use PPE inappropriately. It is important that institutions provide health care workers with training related to paramentation and deparamentation.	4

Source: Own author.

Algorithms

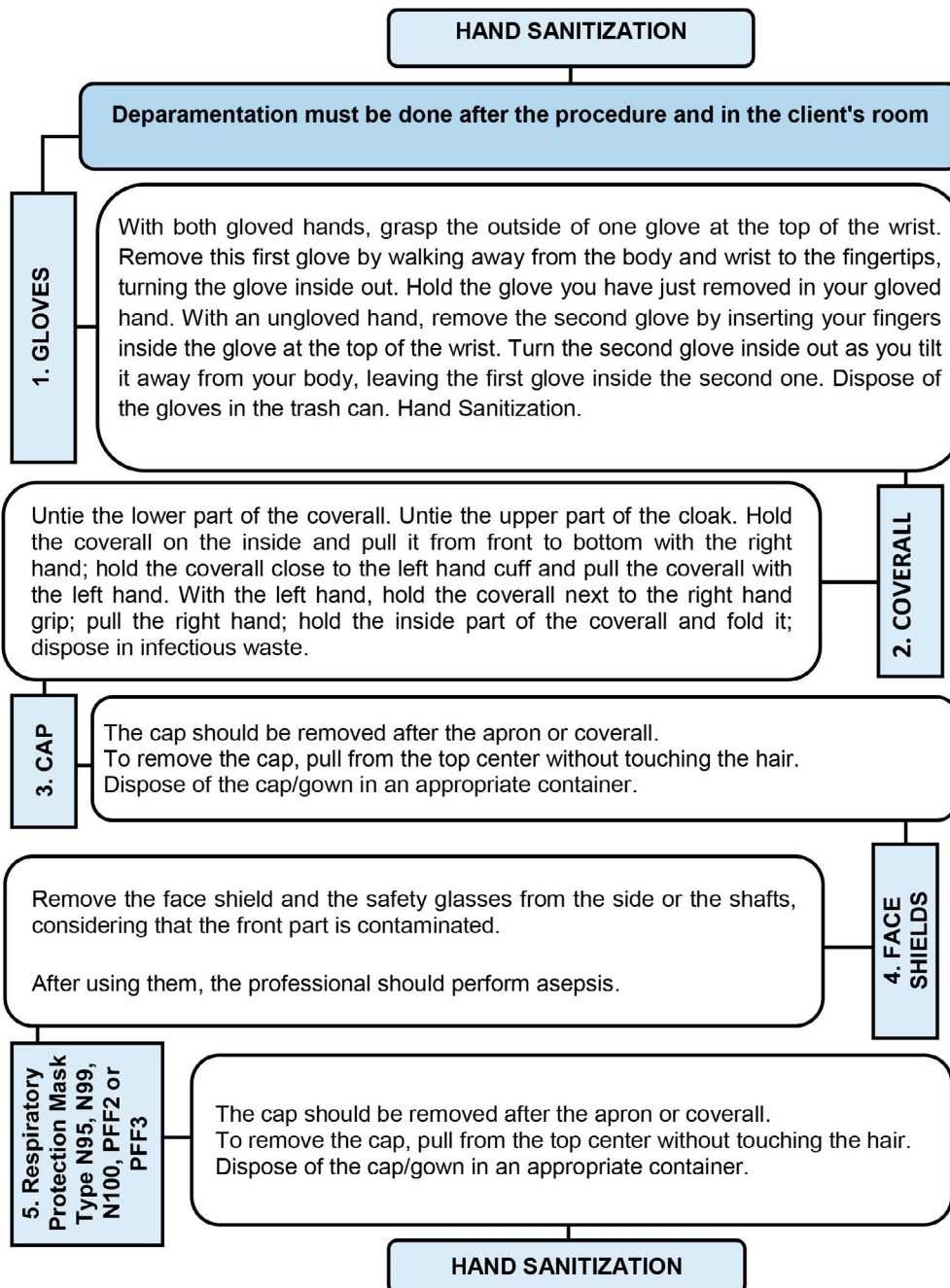
After the integrative literature review, three algorithms were developed. These algorithms describe the paramentation techniques, the PPE deparamentation techniques that healthcare workers should use during the SARS-Cov-2 pandemic, and the measures for healthcare workers to protect themselves from FSI caused by the inappropriate use of PPE in the SARS-CoV-2 pandemic, as presented in Figures 2 to 4.

Figure 2. Algorithm to guide health professionals in the use of the technique of personal protective equipment paramentation during the pandemic of COVID-19. São Paulo, SP. Brazil, 2020



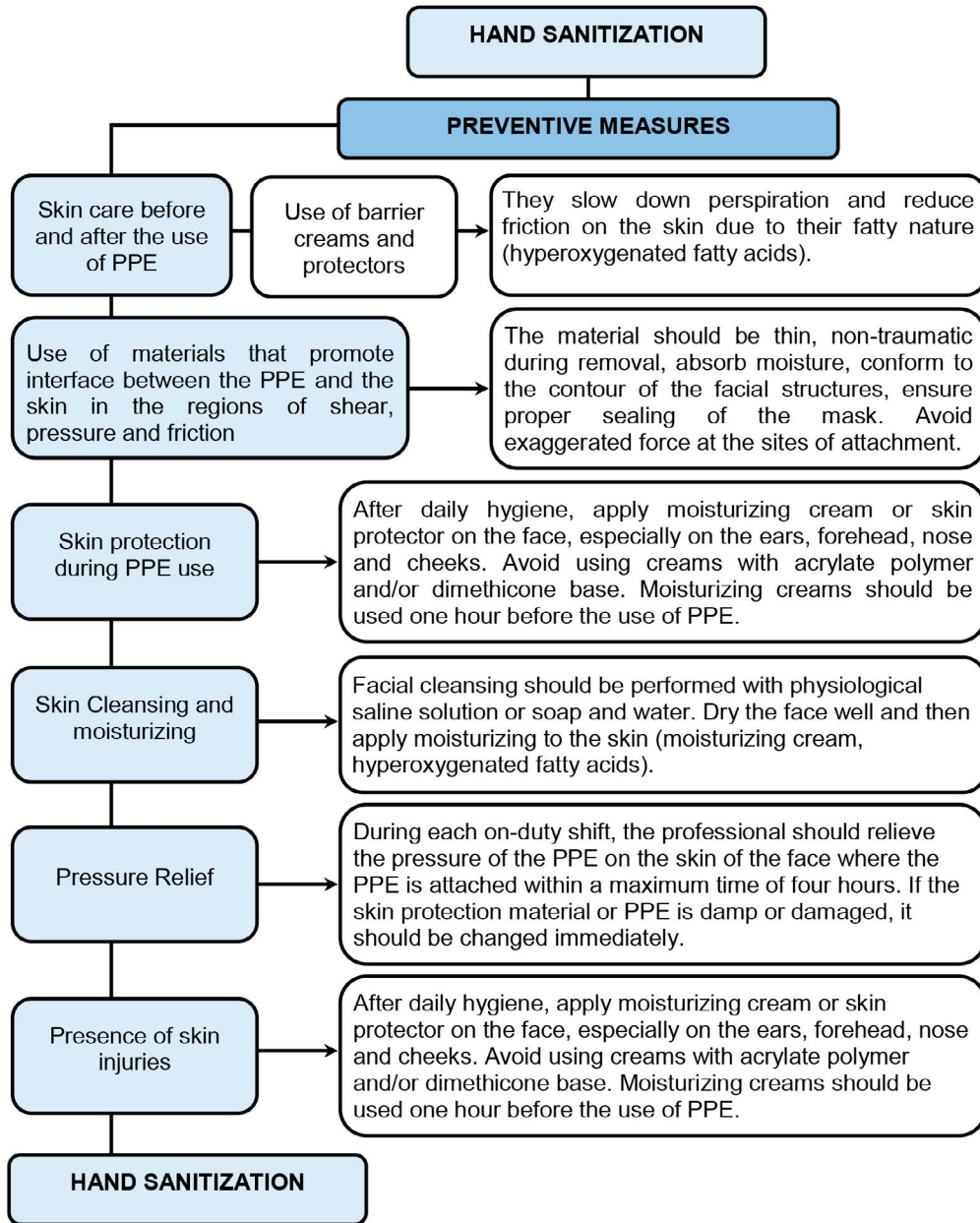
Source: Own authorship.

Figure 3. Algorithm for the deparamentation of personal protective equipment during the pandemic of COVID-19. São Paulo, SP. Brazil, 2020



Source: Own authorship.

Figure 4. Algorithm to prevent injury from the use of personal protective equipment in the pandemic of COVID-19. São Paulo, SP. Brazil, 2020



Source: Own author.

Discussion

During the pandemic of COVID-19, the safety of frontline healthcare workers is being highlighted in the national and global media. Many health care workers are contracting the infection and FSI because of inadequate use of PPE; thus, some workers are afraid, stressed, have low self-esteem, and feel powerless in the face of the disease. Healthcare organizations must provide PPE and devices to prevent injuries and develop protocols and training to promote care free of harm and adverse events for the professional.

Healthcare workers on the front lines fighting COVID-19 show physical and mental exhaustion, difficulties in decision making, and anxiety over the pain of losing patients and colleagues, in addition to the risk of infection and FSIs and the possibility of transmitting it to family members. Thus, ensuring health care for health care workers, PPE, and psychological support are fundamental^{5,40}. As well as developing protocols, providing training related to PPE use technique and preventive measures for FSI.^{8,21}

Standardization of protocols and training during the pandemic of COVID-19 enables the professional to remember how to perform the technique, which has as consequence assistance without damage and mainly the reduction of risk in acquiring infection and FSI caused by inadequate use of PPE.

In this study, three algorithms were developed to offer paramentation techniques, PPE deparamentation, and preventive measures to prevent injuries caused by the inappropriate use of PPE. The development of an algorithm should be based on scientific evidence, including articles with clinical evidence, to assist in technical, clinical, administrative, and financial procedures to prevent infection, improve care, and reduce the cost of treatment.¹⁰⁻¹¹

The adoption, standardization, and orientation of professionals on the technique of PPE use, especially during the pandemic of COVID-19, is fundamental in the protection and prevention of adverse effects.

The healthcare professional who is on the front line in the pandemic of COVID-19 is at increased

risk of infection exposure; this risk is increased by the frequent need to perform invasive procedures and the wide range of disorders that the patient presents, being necessary to observe the standard precautions of the World Health Organization. It is also recommended that hospital organizations provide PPE and training in the use of paramentation and deparamentation of PPE, aiming to minimize the risk.^{3,18,41-46}

It is understood as PPE caps, aprons, gloves, goggles, face shields, masks, and their use should be routine and incorporated into the professional's daily routine. These protection devices are basic material during the pandemic of COVID-19, necessary and indispensable to avoid the spread of infection in the hospital environment, as well as to maintain and protect their physical integrity and prevent the FSI, since, in this environment, there is a greater possibility and ease of contracting pathologies, by the peculiarity of the place and function/activity performed.^{18-19,43,47}

The Algorithm to prevent personal protective equipment (PPE) injury in the pandemic of COVID-19 provides health care workers with preventive actions to prevent FSI that should be incorporated into the routines of health care workers regarding skin hygiene and the use of moisturizing cream before and after the use of PPE and recommends the use of dressings to prevent FSI.

A skin injury related to the use of devices (mask, goggles, face shield) is considered that which causes irritation, wound, and erythema that remains for more than 30 minutes after its removal. When the devices remain moist, they can cause maceration on the skin, which contributes to injuries. This type of injury happens when the device's force is greater than that of the skin and ends up separating the epidermis from the dermis, which can cause pain and offer a risk of infection, impairing the quality of life of the professional.^{22,25,48-49}

Regarding the prevention and treatment measures for FSI, there are general ones that include the hygiene of the skin with soap, preferably with pH compatible with the skin (slightly acidified), the hydration of the skin with moisturizing cream without the presence of lipids,

which must be performed before and after removing the devices. The professional must also apply a prophylactic covering as an interface between the skin and the area where the devices are fixed, which can be polyurethane foam covers, silicone, transparent film, or extra-thin hydrocolloid plate.^{24,37-39,50}

Conclusion

The constructed algorithms offer the healthcare professional the description of techniques for using PPE, preventive measures for FSI caused by the use of PPE, and allowing the professional a better visualization, practicality, and understanding of the procedure to be performed.

Conflicts of interest

No financial, legal, or political conflicts involving third parties (government, private companies, and foundations, etc.) have been declared for any aspect of the submitted work (including but not limited to grants and funding, advisory board participation, study design, manuscript preparation, statistical analysis, etc.).

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