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Original Article

CONSTRUÇÃO E VALIDAÇÃO DO *CHECKLIST* PARA PARAMENTAÇÃO E DESPARAMENTAÇÃO DOS EQUIPAMENTOS DE PROTEÇÃO INDIVIDUAL

ELABORATION AND VALIDATION OF A CHECKLIST FOR DONNING AND DOFFING PERSONAL PROTECTIVE EQUIPMENT

CONSTRUCCIÓN Y VALIDACIÓN DE UN *CHEKLIST* PARA COLOCACIÓN Y REMOCIÓN DE EQUIPOS DE PROTECCIÓN PERSONAL

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RESUMO

Objetivo: Descrever a construção e validação de um checklist, para paramentação e desparamentação dos equipamentos de proteção individual (EPI), pelos profissionais de saúde para a prevenção da autocontaminação por agentes infectocontagiosos como o SARS-CoV-2. **Métodos:** Pesquisa metodológica em três etapas: 1) elaboração de um *checklist* dos EPI para paramentação e desparamentação; 2) validação por comitê de especialistas; 3) validação em grupo focal. Realizou-se análise descritiva dos dados. Foram considerados válidos os itens do *checklist* com concordância superior a 80% pelos especialistas e 100% pelo grupo focal. **Resultados:** O *checklist* foi organizado, em três momentos: antes da paramentação, durante a paramentação e durante a desparamentação. Contém itens sobre higienização das mãos, avaliação da integridade dos EPI, colocação e remoção dos EPI e descarte seguro dos mesmos. A versão 1 do *checklist* dos EPI foi validada por 20 especialistas e obteve concordância superior a 80%. Quatro enfermeiras e dois médicos infectologistas analisaram a versão 1, em um grupo focal e concordaram com a inclusão das sugestões dos especialistas, na versão final do instrumento. **Conclusão:** O estudo possibilitou a construção e validação de um *checklist* de itens para orientar a paramentação e desparamentação dos EPI e a inclusão de melhorias no instrumento.
Descritores: Enfermagem; Equipamentos de Proteção Individual; Saúde do Trabalhador; Riscos Ocupacionais; Infecções por Coronavirus.

ABSTRACT

Objective: to describe the elaboration and validation of a checklist for donning and doffing of personal protective equipment (PPE) by health professionals to prevent self-contamination by infectious agents, such as SARS-CoV-2. **Methods:** This is a three-stage methodological research: 1) preparation of a checklist for PPE donning and doffing procedures; 2) validation by an expert committee; 3) focus-group validation. A descriptive analysis of the data was performed. The checklist items were considered valid by more than 80% of specialists and 100% by the focus group. **Results:** The PPE checklist was subdivided into three moments: before and during putting on the PPE, and during its removal. It contains items on hand hygiene, evaluation of PPE integrity, PPE donning and doffing and its safe disposal. Version 1 was validated by 20 specialists and was agreed upon by over 80%. Four nurses and two doctors of infectiology analyzed the first version in a focus group and agreed on the inclusion of the specialists' suggestions to the final version of the instrument. **Conclusion:** The study enabled the elaboration and validation of a checklist for donning and doffing PPE and the inclusion of improvements to the instrument.
Descriptors: Nursing; Personal Protective Equipment; Occupational Health; Occupational Risks; Coronavirus Infections.

RESUMEN

Objetivo: describir la construcción y validación de una lista de verificación de equipos de protección personal (EPP) que se deben poner y quitar los profesionales de la salud para prevenir la autocontaminación por agentes infecciosos, como el SARS-CoV-2. **Métodos:** investigación metodológica: 1) elaboración de una lista de verificación de EPP para ponerse y quitarse el equipo; 2) aprobación por un comité de expertos; 3) aprobación de grupos focales. Se realizó un análisis descriptivo. Se consideraron válidos los ítems con más del 80% de acuerdo por parte de los especialistas y 100% por el grupo focal. **Resultados:** la lista se subdividió en: antes, durante la colocación del EPP y durante su extracción. Contiene elementos sobre higiene de manos, evaluación de la integridad del EPP, colocación y retirada segura del EPP. La versión 1 de la lista fue aprobada por 20 especialistas y obtuvo una concordancia superior al 80%. Cuatro enfermeras y dos médicos analizaron la versión 1 en un grupo focal y acordaron incluir las sugerencias de los expertos en la versión final del instrumento. **Conclusión:** el estudio permitió la construcción y aprobación de un checklist de ítems para orientar la colocación y remoción del EPP y la inclusión de mejoras en el instrumento.
Descriptores: Enfermería; Equipo de Protección Personal; Salud Laboral; Riesgos Laborales; Infecciones por Coronavirus.

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INTRODUCTION

At the end of 2019, a new coronavirus was identified, the Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), causing the disease called Coronavirus 2019 (COVID-19), which spread rapidly around the world, affecting millions of people due to the high transmissibility by contact and air[1-2].

The pandemic scenario brought to light the discussion of the safety of professionals who assist patients with suspected or confirmed SARS-CoV-2 infection, because many health professionals, at the beginning of the pandemic, were not properly trained on biosecurity measures, including the techniques of donning and doffing of personal protective equipment (PPE). Many professionals were called to provide care to a high number of patients who arrived in health institutions at the beginning of the pandemic, including those without clinical experience. Moreover, at that time, the quantity of PPE was insufficient, because the health care institutions were not prepared to attend the expressive increase of patients in contact precautions, droplets or aerosols. This fact led health professionals to reuse masks and aprons, putting at risk their protection to care for those who needed assistance. The high rate of virus transmission, the constant occupational exposure of health professionals to patients with COVID-19, and the scarcity or lack of PPE are aspects that cause worldwide concern, in view of the commitment of this workforce, due to the illness and even death that has already affected thousands of professionals around the world[3-9].

In Brazil, according to the Ministry of Health, by December 1, 2020, more than six million confirmed cases of COVID-19 were notified and the lethality rate was approximately 2.7%. Among health professionals, 406.803 had already been diagnosed with the disease. The largest number of cases are in nursing professionals (198.423), followed by doctors (44.257), community agents (21.146) and health unit receptionists (16.593)[9].

To reduce the contamination and incidence of COVID-19 cases among health professionals, it is essential that they have knowledge about the transmission routes of SARS-CoV-2 and know how to correctly choose, wear and remove PPE according to the type of precaution[10-11]. Thus, the recommendation is for hand sanitizing, the use of cap, apron, gloves and goggles or face shield for contact precautions, adding a surgical mask when there is risk of transmission by droplets expelled through the respiratory tract and an N95/PFF2 (Semi-Facial Filter Part) mask in environments with risk of aerosolization and in procedures with access to the oral cavity and area pathways (intubation, tracheal aspiration, noninvasive ventilation, cardiopulmonary resuscitation, manual ventilation before intubation, sputum induction, oral/nasogastric catheter insertion, oral or nasopharyngeal and tracheal material collection, and bronchoscopy [1,6,10-15].

The inadequate placement or removal of PPE exposes health professionals to the risk of contamination and illness by SARS-CoV-2, so several activities must be implemented to ensure safe donning and doffing of PPE, such as face-to-face training of professionals regarding the types of exposure risk and PPE to be used, in addition to the technique and correct sequence of placement and removal of PPE through theoretical and practical activities; implementation of donning and doffing with oral instructions and supervised by another professional, and with the completion of a checklist containing the actions for donning and doffing of each of the PPE. Such activities can contribute to the direction and fulfillment of all steps and reduce the risk of self-infection, besides improving the automation of the efficient placement and removal of PPE among health professionals[5,13-15].

The checklist is a simple tool and has been applied in a variety of situations with varying degrees of complexity. Its purpose is to check the compliance of the professionals, in view of the fallibility, lack of discipline, overwork, or short time to perform the activities, besides contributing to the prevention of errors that may put the professional's safety at risk[16].

In the Americas, almost 570.000 health professionals were infected by SARS-CoV-2 and almost 2.500 died as a result of COVID-19. In the United States, as well as in Ireland, Italy and Brazil, nursing professionals have the highest infection rates[3,8-9,17-18]. By December 1, 2020 the Brazilian Ministry of Health had notified 137.312 cases of COVID-19 in nursing technicians, 61.111 in nurses, with a lethality rate of about 1.88%. The data reveal a progressing curve, both of cases and deaths between April and December/2020[9,17]. That is, after nine months of confirmation of the first death by COVID-19, in Brazil, of the increase of PPE availability, of the training carried out by the institutions, as well as of the production and dissemination of videos guiding on preventive measures and technique of donning and doffing

PPE and a greater clinical experience in the use of PPE, there is no significant decrease of cases among health professionals, except in intensive care unit professionals. Probably the more consistent use of PPE or the lower infectivity of the virus in the more advanced stages of the disease, even among critically ill patients, seems to contribute to a lower incidence of COVID-19 in the professionals of these units, when compared to the professionals who take care of patients in the initial stages of unsuspected infections (asymptomatic patients), when the viral loads are high and the professionals are not properly equipped with all PPE, such as in units for the care of patients for other causes, for example in primary and secondary care, medical or surgical clinic inpatient units, or diagnostic sectors, among others[19].

The growing illness of health professionals with COVID-19, especially nursing professionals, and the lack of identification, until now, of a validated protocol to guide these professionals, orally, and with direct supervision in the accomplishment of the donning techniques and doffing of PPE justified the design of the present study. The objective was to describe the construction and validation of a checklist for donning and doffing of PPE, by health professionals, for the prevention of self-contamination by infectious agents such as SARS-CoV-2.

METHODS

This is a methodological research of construction and validation by specialist consensus of a checklist to guide health professionals in the donning and doffing PPE with verbal guidelines and direct supervision.

The study was conducted in three stages. In the first stage, a checklist was constructed for donning and doffing of PPE. This stage considered: a) narrative literature review on the techniques of donning and doffing of PPE by health professionals, description of the stages and actions of these techniques that met the specific national and international regulations[10,20], aiming at the safety of the professional in the exercise of professional activities; b) elaboration of a script and recording of a video on the techniques of donning and doffing of PPE. In order to improve the recording script, it was sent by e-mail to three nurses/teachers of the nursing course of a Federal University of the State of Minas Gerais with knowledge on the subject and the suggestions forwarded were included; and c) in-service training on the techniques of donning and doffing PPE with approximately 500 health professionals from four institutions (primary, secondary and tertiary care) in a city of Minas Gerais, from March to May/2020 and implementation of these techniques in services by the authors of this study.

The activities of the 1st stage, the knowledge and clinical experience of researchers in biosafety and, in clinical practice, attending patients with suspicion or confirmation of COVID-19, the reports of insecurity of health professionals in the execution of the techniques of donning and doffing of PPE, during in-service training motivated and subsidized the preparation by the authors of the checklist of PPE (version 0). It was described in Microsoft Office Word® and subdivided in three times: before donning, during donning and during doffing. It contains guidelines on hand hygiene, evaluation of PPE integrity, actions for placement and removal of each type of PPE, until their removal and safe disposal. It has space for registration of the name and professional category of the person performing and the person responsible for supervising the techniques, date and time of completion. Later, the checklist was reviewed, independently, as to appearance and content by the same professionals who analyzed the recording script in view of their knowledge on the subject. The suggestions were analyzed and included, generating version 1.

In the 2nd stage, the consensus validation of version 1 took place with the participation of specialists. The initial sample was of the intentional type, inviting three clinical nurses, three nursing professors, three odontologists and three doctors who attended at least two of the following inclusion criteria: to be a health professional with at least one year of experience; to be a nurse or doctor of a hospital infection control service; to have published studies on biosafety; to assist patients with suspicion/confirmation of COVID-19, at the moment of data collection and to perform the donning and doffing of PPE, in clinical practice. For the final composition of the sample, the snowball technique was also used, requesting that the initial participants indicate three other professionals, who meet the inclusion criteria. Thus, the final sample was composed by 20 specialists.

The Google Docs application was used to organize the data collection tool composed of

specialists' profiles regarding age, gender, professional training, training time and workplace, and 68 items about the stages of PPE donning and doffing techniques. The experts evaluated each item of the instrument regarding the checklist's comprehensiveness, clarity, content and applicability to practice by marking the level of agreement, using a Likert scale: (-2) I totally disagree, (-1) I disagree, (0) I don't care, (+1) I agree and (+2) I totally agree. After each item of the PPE checklist there was a space to record comments or suggestions from the experts.

The link to the data collection instrument and the informed consent form, as well as the printed format were sent by e-mail to the experts in May/2020. A period of up to fifteen days was given to answer the survey.

For data analysis, descriptive statistics were used, with calculation of absolute and relative frequency, mean and standard deviation, according to the nature of the variable. In the validation of the checklist the items with more than 80% agreement were considered valid in the experts' evaluation, for the levels I agree and I totally agree on the Likert scale.

The suggestions for modifications (version 2) were analyzed and agreed upon in the 3rd stage, in an on-line focus group, due to the need to maintain social distance, during the COVID-19 pandemic. The sample was of the intentional type with the participation of four nurses and two doctors, who met the following inclusion criteria: minimum of five years of clinical experience; being a nurse or infectologist doctor; developing research on biosafety and/or COVID-19. The meeting with the specialists took place in June 2020, through the google meet platform, by videoconference, with voice and video resources and lasted approximately three hours.

The experts' suggestions for version 2 of the PPE checklist were presented to the focus group participants on a board and discussed, individually, as to the scientific relevance, and relevance of the changes to the health professional's safety. A 100% agreement was adopted to include or not the suggestions in the final version.

The study complied with the recommendations of the National Health Council Resolutions 466/2012 and 510/2016 and was approved by the Research Ethics Committee (CAAE: 32324720.0.0000.5153; Opinion Number: 4.054.981) duly recognized by the National Research Ethics Committee.

RESULTS AND DISCUSSION

20 health professionals participated in the validation stage, by consensus of experts. The majority were women (n= 14; 70%), mean age was 36.7 years (SD ± 7.174; 23 to 48 years), concluded graduation more than 10 years ago (n= 14; 70%), in nursing (n= 15; 75%), medicine (n= 2; 10%) and odontology (n= 3; 15%). As for academic education, they had a doctorate (n= 10; 50%), master's degree (n= 2; 10%), specialization (n= 5; 25%) and undergraduate (n= 3; 15%). Participants worked in health institutions, in Minas Gerais (n= 8; 40%), in Rio de Janeiro (n= 4; 20%) and in Paraná (n= 1; 5%) or were professors in public or private universities in Minas Gerais (n= 7; 35%).

Version 1 of the PPE checklist obtained agreement of more than 80% (I agree and totally agree) on all items evaluated by the committee of experts. Although the suggestions were not uniform and most were described by a single expert, they were analyzed in the online focus group in synchronous format, in view of their relevance. All focus group participants (n= 6; 100%) agreed with the expert suggestions, which were included in the final version of the instrument. Figure 1 describes the experts' suggestions.

Figure 1 - Suggestions of the committee of experts to the PPE checklist for donning and doffing by health professionals.

Version 1	**Suggestions from the experts**
Personal Protective Equipment (PPE*) Donning and Doffing Checklist.	"Checklist for donning and doffing personal protective equipment".

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1) Before Donning the Health Professional:	
Sanitizes the hands.	Sanitizes your hands "with soap and water. "

Separates the PPE: apron, surgical mask or N95/PFF2† mask, cap, goggles or face shield (preferably), disposable shoe covers (optional) and gloves.	It separates "and evaluates the integrity of PPE": apron, "mask (surgical or N95/PFF2)", cap, glasses or face shield, disposable shoe covers (optional) and gloves.
Check the N95/PFF2 mask for the presence of: ❑ Marks, grooves, cracks and creases. ❑ Secretion and/or dirt. ❑ Humidity. ❑ It does not apply.	Check the mask N95/PFF2 as to the presence of: ❑ Marks, grooves, cracks and creases. ❑ Secretion and/or dirt. ❑ Humidity. ❑ "Validity" ❑ "PPE not used."
Name of the professional dressed: Category of the professional dressed:	Name of the professional dressed: Category of the professional dressed: "Name of the professional you supervised:"
2) During doffing the Health Professional:	
Surgical mask: Position the elastics behind the ears or tie the straps in the supra-auricular region and posterior cervical region	Surgical mask: Position the elastics behind the ears or tie the tapes to the "back region of the head. ”
Mask N95/PFF2	Mask N95/PFF2 "disposable
OBS‡: REUSE OF MASK N95	"Mask N95/PFF2 reusable:" Add the item: "Pack the plastic bag in the paper bag".
- It positions the external elastic in the posterior cervical region. - It positions the internal elastic in the supra-auricular region.	"Position the elastic behind the ears or the lower and/or upper elastics on the back of the head".
Hygiene your hands with 70% alcohol gel.	Sanitize your hands with "water and soap. ”
Position the glasses or *face shield*. The glasses cover the eyes, or the face shield covers the face.	"Position the glasses.” "The glasses cover the eyes.” "PPE not used." "Position the *face shield*." "The face shield covers the face". "PPE not used."
Put on your disposable shoe covers (optional): Sanitizes the hands.	Put on your disposable shoe covers (optional): Sanitizes hands "with soap and water.” "PPE not used."
Put on gloves overlapping the sleeves of the apron.	Put on the gloves "covering the sleeves of" the apron.
It does not apply.	"PPE not used."
3) During doffing the Healthcare Professional	
Sanitizes hands with 70% alcohol gel.	Sanitizes hands with "70% alcoholic preparation.”
Removal of the N95/PFF2 mask in case of reuse:	"Mask N95/PFF2 reusable:"
Pull the upper elastic towards the bottom of the package while keeping your eyes closed.	Pull "the elastics behind your ears or hold the elastics on the top and bottom of your head" towards the bottom of the package while keeping your eyes closed.
Date: Time: Name of the donned professional: Category of the doffed professional:	Date: Time: Name of the donned professional: Category of the doffed professional: "Name of the professional who supervised:"

Note: *EPI = Individual Protection Equipment; †N95/PFF2 = Semi-facial Filter Part; ‡OBS: Note.
Source: the authors, 2020.

Figure 2 presents the final version of the PPE checklist for donning and doffing, validated by consensus in expert committee and focus group.

Figure 2 - Checklist for donning and doffing personal protective equipment (PPE).

***Checklist* dos Equipamentos de Proteção Individual (EPI*) para Paramentação e Desparamentação**	
1) Antes da Paramentação o Profissional de Saúde:	
❑ Higieniza as mãos com água e sabão.	
❑ **Separa e avalia a integridade dos EPI:** avental, máscara (cirúrgica ou N95/PFF2†), gorro, óculos ou protetor facial (f*ace shield*), propés (opcional) e luvas.	❑ **Verifica a máscara N95/PFF2 quanto a presença de:** ❑ Marcas, sulcos, fissuras e vincos. ❑ Secreção e/ou sujidade. ❑ Umidade. ❑ Validade. ❑ EPI não utilizado.

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2) Durante a Paramentação o Profissional de Saúde:

1º - Veste o avental: ❑ Prende os laços do pescoço e da cintura.	
2º - Máscara cirúrgica: ❑ Posiciona o clipe nasal sobre o dorso do nariz. ❑ Posiciona os elásticos atrás das orelhas ou amarra as fitas na região posterior da cabeça. ❑ Assegura que a máscara cobre o nariz, a boca e o queixo. ❑ EPI não utilizado. **Máscara N95/PFF2 descartável:** ❑ Posiciona a máscara na face, cobrindo o nariz e a boca, sem tocar em seu interior. ❑ Posiciona a máscara sob o queixo, minimizando os espaços entre a face e a máscara. ❑ Posiciona o elástico atrás das orelhas ou os elásticos inferior e/ou superior na região posterior da cabeça. ❑ Ajusta o clipe nasal com as pontas dos dedos, evitando tocar na pele. ❑ Realiza o teste de vedação e observa eventuais vazamentos de ar nas laterais da máscara. ❑ EPI Não utilizado	**Máscara N95/PFF2 reutilizável:** ❑ Posiciona a embalagem transparente contendo a N95/PFF2 sobre o nariz e a boca, sem tocar no interior da máscara. ❑ Posiciona os elásticos atrás das orelhas ou os elásticos inferior e/ou superior na região posterior da cabeça. ❑ Ajusta o clipe nasal no nariz com as pontas dos dedos, sem tocar na pele. ❑ Realiza o teste de vedação e observa eventuais vazamentos de ar nas laterais da máscara. ❑ Em caso de vedação inadequada reposiciona os elásticos, a máscara, o clipe nasal e repete o teste de vedação. Se persistir, desprezar a máscara no lixo. ❑ Acondiciona a embalagem plástica no saco de papel. ❑ Higieniza as mãos com preparação alcoólica a 70%. ❑ EPI não utilizado.
3º - Posiciona os óculos ❑ Os óculos cobrem os olhos. ❑ EPI não utilizado.	**4º - Coloca o gorro:** ❑ Coloca o gorro cobrindo os cabelos e as orelhas.
5º - Posiciona o protetor facial (*face shield*). ❑ O protetor facial cobre a face. ❑ EPI não utilizado.	**6º - Calça os propés (opcional):** ❑ O propé cobre a sola do sapato e o dorso do pé. ❑ Higieniza as mãos com água e sabão. ❑ EPI não utilizado.
7º - Calça as luvas: ❑ Calça as luvas cobrindo os punhos das mangas do avental**.**	**Data: Hora:** **Nome do profissional paramentado:** **Categoria do profissional paramentado:** **Nome do profissional que supervisionou:**
3) Durante a Desparamentação o Profissional de Saúde:	
1º - Remove as luvas: ❑ Segura no punho da luva da mão não dominante e retira a primeira luva. ❑ Posiciona o dedo indicador sob o punho da luva e retira a segunda luva. ❑ Descarta as luvas no lixo infectante. ❑ Higieniza as mãos com preparação alcoólica a 70%.	**2º - Remove o avental:** ❑ Remove primeiro o laço do pescoço e depois da cintura. ❑ Posiciona o dedo indicador na parte interna do punho e puxa o avental cobrindo a mão não dominante. ❑ Com a mão protegida pela manga do avental, segura a outra manga (próximo ao punho) enquanto desliza e retira o braço e mão dominante do avental. ❑ Segura na parte interna do avental (próximo ao ombro) e retira a manga do braço não dominante. ❑ Continua virando o avental de dentro para fora, dobrando-o e formando um pacote. ❑ Descarta o avental no lixo infectante. ❑ Higieniza as mãos com preparação alcoólica a 70%.
3º - Remove os óculos ou protetor facial (*face shield*): ❑ **Óculos:** segura nas hastes laterais, enquanto fecha os olhos e puxa-os para a frente. OU ❑ **Protetor facial:** segura na fixação posterior na região superior da cabeça, enquanto fecha os olhos e puxa-o para frente, sem tocar em sua superfície externa. ❑ Coloca os óculos ou protetor facial num recipiente para posterior higienização. ❑ Higieniza as mãos com preparação alcoólica a 70%.	**4º - Remove o gorro:** ❑ Posiciona os dedos indicadores dentro do gorro ao lado das orelhas e desliza o gorro para cima, para trás e para o lado. ❑ Descarta o gorro no lixo infectante. ❑ Higieniza as mãos com preparação alcoólica a 70%.
5º - Remove a máscara: **Máscara cirúrgica:** ❑ Segura nos elásticos atrás das orelhas, ou desfaz os laços das fitas na região posterior da cabeça. ❑ Puxa a máscara para frente, segurando nos elásticos ou nas fitas, sem tocar em sua superfície externa. ❑ Descarta a máscara no lixo infectante. ❑ Higieniza as mãos com preparação alcoólica a 70%.	**Máscara N95/PFF2 reutilizável:** ❑ Na frente do espelho (preferencialmente), posiciona o pote de plástico transparente sobre a face externa da máscara. ❑ Puxa os elásticos atrás das orelhas ou segura nos elásticos na região superior e inferior da cabeça em direção ao fundo do pote, enquanto mantém os olhos fechados. ❑ Sem tocar no interior da máscara, acondiciona o pote

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3) Durante a Desparamentação o Profissional de Saúde:

❑ EPI não utilizado. **Máscara N95/PFF2 descartável:** ❑ Puxa os elásticos das orelhas ou segura e eleva os elásticos em cima da cabeça e puxa os elásticos e a máscara para frente, lentamente, sem tocar na superfície interna e externa. ❑ Descarta a máscara N95/PFF2 no lixo infectante. ❑ Higieniza as mãos com preparação alcoólica a 70%. ❑ EPI não utilizado.	aberto (sem a tampa) com a máscara dentro de um saco de papel, identificado com o nome do profissional e número de vezes de reutilização da N95/PFF2. ❑ Higieniza as mãos com preparação alcoólica a 70%. ❑ EPI não utilizado.
6º - Remove os propés: ❑ Desliza os dedos indicadores dentro do propé na região maleolar e empurra para baixo enquanto eleva o pé. ❑ Descarta os propés no lixo infectante. ❑ Higieniza as mãos com água e sabão. ❑ EPI não utilizado.	**Data: Hora:** **Nome do profissional desparamentado:** **Categoria do profissional desparamentado:** **Nome do profissional que supervisionou:**

Nota: *EPI = Equipamento de Proteção Individual; †N95/PFF2 = Peça Semifacial Filtrante.
Fonte: os autores, 2020.

The process of placing and removing PPE involves different materials and several steps that can compromise the safety of the professional. Therefore, to reduce the risk of contamination of health professionals and increase safety, especially in removing PPE, frequent training and supervision by another professional in all stages of donning and doffing is suggested [14-15].

A study on error and contamination, during the placement and removal of PPE, showed less non-compliance with the steps or errors and contaminated sites when the professional was verbally instructed by another colleague/auxiliary[15]. However, the colleague/auxiliary themselves may expose those who are donning or doffing to critical errors. Therefore, following a checklist with the detailing of each item is suggested, and all professionals should participate in the training, using both theoretical and practical components by means of clinical simulation and debriefing technique, as this enables self-evaluation and reflection on actions[13,21].

It was a consensus in the present study that gloves should be the first PPE to be removed, i.e., before the apron, although a study identified greater contamination when choosing this order[22]. However, the design of aprons in a health context in Brazil, in general, makes it impossible to remove the apron with the gloves from the anterior region of the thorax, as the aprons have straps to be tied in the posterior region of the neck, risking that the gloves contaminate the skin of that region. Moreover, the option of using two pairs of gloves increases usage of this PPE and may cause a false sense of safety to the professional. According to a study[15], the using two pairs of gloves is associated to less viral and bacterial contamination when compared to the use of a single pair, but it does not reduce the contamination when removing this PPE[15]. It is necessary to ensure that PPE is used properly and not unnecessarily or at a different or higher level than necessary, because the increase in cases of COVID-19 and, consequently, the higher consumption of PPE to assist patients in contact precautions, by droplets or aerosols, during the pandemic, the dependence on imports of PPE from other countries, such as China and the limited stocks may compromise the safety of health professionals and patients[23]. Therefore, due to the risk of contamination of the skin or mucous membranes of the professional during the PPE removal, especially by the hands, the appropriate decontamination of the hands with alcohol preparation at 70% after the removal of each of the PPE was the consensus of the committee of experts in this study and is the recommended course of action [24].

Some studies have discussed the possibility of transmission of SARS-CoV-2 not only in aerosol generating procedures (endotracheal intubation, noninvasive ventilation, manual ventilation, airway aspiration, collection of oral or nasopharynx swab and bronchoscopy), but also, during breathing, speech, singing, coughing or sneezing. The virus has already been detected more than four meters away from the patient's bed, in sanitary facilities and in PPE doffing areas, and the contamination of people in non-aerosol generating contexts such as in public areas with crowding of people and during the practice of singing (choire)[25-28] has been documented. This evidence has implications on organizational policy for the provision and selection of the type of precaution and PPE to be used by health professionals, especially in relation to the use of the N95/PFF2 mask[23-24].

Despite the evidence of the risk of aerosol transmission, not only in aerosol generating procedures, the World Health Organization[29] maintains the recommendation of using a N95/PFF2 mask only in these circumstances, while the Centers for Disease Control (CDC) recommends airborne precaution, with the use of a N95/PFF2 mask or equivalent, in any situation involving the care of patients with COVID-19 and the use of surgical masks only in the absence of the N95, PFF2 or PFF3[10] masks.

In Brazil, due to the public health emergency caused by COVID-19, the N95/PFF2 respiratory protection mask or equivalent has been, exceptionally, reused by health professionals for a period longer than that recommended by the manufacturer[20]. Therefore, the evaluation of the integrity of this PPE, with emphasis on the evaluation of the presence of marks, grooves, cracks, creases, secretions, moisture and due date, according to the recommendation of the infection control service associated to the health care of each institution, is a relevant action and present in the first item of the proposed checklist, in this study, its inclusion being a consensus by the committee of specialists.

Considering the risk of contamination of the health professional, during the reuse of the N95/PFF2 mask or equivalent, it is recommended to pack it in plastic packaging and then in paper packaging[20], avoiding the contamination of the internal part of the mask by the rubber bands and of these with the external part, since the rubber band is kept attached to the bottom of the plastic packaging after the removal of the mask. In order to reduce a possible contamination of the hands of the healthcare professional, during the placement of the mask N95/PFF2 or equivalent, the committee of experts agreed on the use of alcohol preparation at 70% before and after handling this PPE, in order to perform the decontamination of the hands, in view that the SARS-CoV-2 is inactivated in the presence of this antiseptic.

Facing the risk of contamination of the external side of the N95/PFF2 mask or equivalent by excretions or secretions and therefore reduce the lifespan of this PPE in a situation of scarcity, besides the need to extend the protection of the frontal and lateral region of the professional's face, because the glasses protect only the eyes, the checklist proposed by this study corroborates the CDC recommendation that professionals use the face shield in all patient care with suspicion or confirmation of COVID-19, optimizing the protection of an area so sensitive and exposed to SARS-CoV-2[10].

Currently, disposable shoe covers is not an PPE recommended by health agencies in the control of infection associated with health services[10]. However, a study found SARS-CoV-2 in half of the samples of the soles of health professionals working in units with patients infected by this virus, and in 100% of the samples of the floor of a pharmacy service, where there were no patients[27]. The possibility of the professionals' feet carrying the virus to other areas justified the optional inclusion of the disposable shoe covers, in the present PPE checklist, and obtained the agreement of all participants of the expert committee.

Checklist systems or practical guidelines and an observer/guide are tools used and indicated to reduce incidents and improve the safety of patients and professionals in the health services, especially in the realization of donning and doffing of PPE, in the current COVID-19 pandemic scenario. The checklist will allow the conference of items that can assist in the full execution of the practice, regardless of the failing of the team's memory, reinforcing constant verification and encouraging discipline with high performance. In addition, it is essential for the professional to participate in training and practice the use of PPE donning and doffing techniques for the acquisition of skills and safety[5,23,30].

CONCLUSION

The study allowed the construction and validation by a committee of experts of a checklist with items for use, during the donning and doffing of PPE, and allowed the inclusion of improvements in the instrument, considering its applicability in the clinical contexts of the COVID-19 pandemic. It is believed that the proposed checklist can be evaluated and adapted to different national and international realities in different situations of assistance to people with infectious diseases, highlighting its importance. Thus, this study contributes the availability of a validated instrument to support the donning and doffing activities of health professionals with emphasis on safety and occupational risk reduction.

This study is a contribution to the area of nursing and more broadly of health, particularly in the field of biosafety, because the use of the checklist of PPE validated in clinical practice may assist in PPE donning and doffing, with greater

safety, thus contributing to the prevention of self-contamination by SARS-CoV-2, by nursing professionals who assist patients with suspected or confirmed COVID-19, as well as in other contexts in assisting people with infectious diseases. The use of this checklist may contribute to the reduction of organizational costs by favoring the correct use of PPE and minimizing the risk of contamination among professionals, which results in a team available for assistance and lower rates of work absences. Furthermore, the validated instrument can help professionals in the identification of weaknesses in each of the stages, in the process of donning and doffing of PPE in the contexts of primary, secondary and tertiary health care and provide evaluation indicators, pointing to the need for review, adequacy or training to improve safety.

As limitations of the study, we highlight the reduced number of responses from the data collection instrument through google docs and the impossibility of holding a face-to-face focus group, despite the great interaction of the participants in the online videoconference. In addition, there is the need for evaluating the feasibility and adherence of health professionals, because although the presence of a colleague/auxiliary is important for verbal guidance and monitoring of donning and doffing, the difficulties in adequate health team sizing are highlighted, as well as the situations of temporary withdrawal imposed during the pandemic, due to the illness of several professionals which may limit the number of personnel available for assistance activities and team demands. Therefore, it is recommended the validation in the several clinical contexts to patients with suspicion or diagnosis of COVID-19 and, when necessary, the adaptation of the PPE checklist to attend to the institutional context, the national and international guidelines, and the updating of the scientific knowledge on the ways of transmission of SARS-CoV-2 and PPE for prevention. Another limitation of this research is the proposed method that considers validation by a committee of experts, and therefore does not rely on objective data in the foundation of the results, but on the expertise of the judges in the given subject.

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