

Validation of a Brochure to Guide Health Professionals in the Dressing and Undressing of Personal Protective Equipment During the SARS-CoV-2 Pandemic

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Abstract

Objective To develop and validate a brochure to guide health professionals in properly dressing and undressing the personal protective equipment (PPE) used in the SARS-CoV-2 pandemic.

Methods To develop the brochure, an integrative literature review was conducted after searching the following databases: SciELO, LILACS, and MEDLINE. The brochure was evaluated by 38 health professionals (nurses, physical therapists, and doctors) employing the Delphi technique. The results were analyzed using the Content Validity Index.

Results In the first evaluation cycle, the items in the brochure were considered by the panel of experts as ranging from “unsuitable” to “totally adequate”. After the appropriate corrections suggested by the experts, the brochure once again was sent to the second evaluation cycle, in which all items were rated as “adequate” or “totally adequate.” The result is a Content Validity Index of 1.0.

Conclusion The present study allowed the development of a brochure and its validation by consensus among the evaluation group. The developed and validated brochure presents the reliability of the technique of dressing and undressing the PPE used by health professionals during the pandemic of COVID-19. This information contributes to the management of assistance with quality and safety for the frontline workers and patients.

Keywords

- ▶ COVID-19
- ▶ personal protective equipment
- ▶ equipment and supplies
- ▶ medical device-related pressure injury

Introduction

The SARS-CoV-2 pandemic began in Wuhan city, in central China, with its transmission related to seafood and live animal markets. SARS-CoV-2 is highly contagious through respiratory droplets and close contact with infected people, mainly in closed places and inside hospital facilities.^{1,2} Therefore, it is necessary that health professionals on the frontline use personal protective equipment (PPE).

We are currently experiencing several reports by the media that health professionals are being infected with COVID-19, and many of them have acquired facial injuries (FI) due to the inappropriate and continued use of PPE.³ Some professionals describe that the healthcare institution where they work provides PPE; however, these institutions do not offer training and information material related to the correct technique to use PPE.

Personal protective equipment is all devices that healthcare workers should use when supporting patients with contagious

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infectious diseases. It must be designed for individual use and to protect the physical integrity of healthcare workers, and it includes gloves, eye or face protectors, masks, aprons, and caps.

In Brazil, according to the recommendation of the former Ministry of Labor and Employment, employers must provide the appropriate safety equipment in order to minimize the risks to which healthcare workers are exposed. Employers must also conduct on admission and periodic training on the correct use of PPE.⁴⁻⁶

Informative materials like brochures and booklets have been used to improve knowledge, satisfaction, and adherence to treatment, self-care, and preventive actions, in order to endorse the teaching-learning process through interactions between healthcare workers and patients.^{7,8}

Several authors consider brochures the most efficient, reliable, economical, and promptly present source of information for healthcare professionals.⁹⁻¹¹ The brochure acts as complementary information in the clinical practice, preventing injuries caused by excessive usage of PPE and guiding the correct technique use of PPE.

In this context, brochures are instruments or objects that can serve as resources, making it possible to learn something, stimulating and guiding the teaching-learning process. They can be understood as a fundamental mediation tool, given the instruments created by human culture and its relationship with the world. The use of this teaching material surpasses institutional, cultural, historical, political, and economic issues.^{7-10,12}

The use of brochures contributes to the health education of those on the frontlines of COVID-19 treatment, providing proper information on the use of PPE and preventive measures to avoid injuries caused by the use of PPE.

Consequently, by handling the brochure, the healthcare worker will properly provide damage-free relief, with safety and the least possible risk, avoiding contamination and preventing facial injuries, besides protecting other patients from acquiring the infection.

The aim of the present work is to develop and validate a brochure to guide health professionals in dressing and undressing PPE used in the SARS-CoV-2 pandemic.

Methods

This is a methodological study.

The brochure development process was conducted in four steps, which will be described below.

First step: Situational diagnosis

The idea of writing this brochure was born from observations made in clinical practice, working on the frontline in the COVID-19 pandemic. It was noticed that some healthcare workers have difficulties in the appropriate use of PPE. If these procedures are performed incorrectly, the professional will be at risk of being contaminated and acquiring FI caused by the usage of PPE.

The second step: Content search

To develop the brochure, an integrative literature review it was conducted with the Health Sciences databases, including

the Online Medical Literature Search and Analysis System, the Scientific Electronic Library Online, and the Latin American and Caribbean Health Sciences Literature published between 2015 and 2020.

The following Health Sciences descriptors were used: *COVID-19* and *personal protective equipment*, and the corresponding terms in Portuguese, English, and Spanish.

The search strategy for each language was determined by the combination of the selected descriptors and the Boolean operator "AND."

The following inclusion criteria were adopted to select publications to be included in the review: only primary studies that have a direct connection with the theme and which are available in full. No theses, dissertations, monographs, nor technical reports were included.

The categories from the Agency for Healthcare Research and Quality¹³ were used to classify the level of evidence of the selected studies, covering six levels: Level 1: evidence resulting from the meta-analysis of multiple controlled and randomized clinical trials; Level 2: evidence gathered in 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 experience or case reports; Level 6: evidence based on expert opinions.

From this search, the information brochure was developed in two phases.

The **first phase** describes the concept and types of PPE that should be used by healthcare workers and the NR-06 issued by the former Ministry of Labor.

The **second phase** describes the technique of dressing and undressing the PPE, and the necessary recommendations to act properly in the approach of patients with COVID-19 according to the former Ministry of Labor.

The third step: Production/design of the brochure

The illustrations and initial content were developed and submitted to copyediting and typesetting processes, following the criteria related to content, structure/organization, language, layout and design.

The images were authorized by the healthcare professionals. The first version of the brochure was created between June and August 2020 and was submitted for validation. The second version was developed between September and October 2020. The evaluation was carried out by nurses, physical therapists, and doctors, with a total of 32 participants.

The fourth step: Validation of the brochure

The raters were selected through snowball convenience sampling: when a subject who meets the established inclusion criteria was identified, they were asked to indicate other participants.

Professionals graduated in nursing, physical therapy, and medicine working in the COVID-19 frontline joined the study. Professionals who agreed to participate in the research but did not answer the questionnaire within the established period of 8 days were excluded.

An invitation letter was sent to 45 health professionals, which included the initial personal presentation and

explanations on the research topic, the opinion of the Research Ethics Committee (REC), explanations about the steps for the effective participation of professionals, and communicating the 8-day deadline to complete the questionnaire for each evaluation round and return of the answers. A total of 38 healthcare workers agreed to participate in the study and returned the questionnaire within the requested deadline.

A specific questionnaire divided into two parts was sent to the panel of experts: identification of the rater, with 4 questions, and evaluation of the brochure, with 10 questions. The experts evaluated the following main themes of the brochure: thematic content, graphic design, logical sequence, clarity and understanding, types of PPE, and technique of dressing and undressing of PPE.

The Likert scale was employed in the brochure evaluation questionnaire with the following answer options: “absolutely appropriate”, “appropriate”, “slightly inappropriate” and “inappropriate”. If the answers of the experts were “slightly inappropriate” and “inappropriate”, suggestions to improve the question were requested.

The Delphi technique was applied for the validation of the brochures. This method uses questionnaires to obtain opinions from a panel of experts in a certain area, in which the contents of the instruments are analyzed and judged by seeking consensus among the experts.¹⁴

The Content Validity Index (CVI) was used to define the degree of agreement among the experts related to the content of the brochure. The CVI value was calculated by the sum of the number of “appropriate” and “absolutely appropriate” responses, then divided by the total number of responses. The CVI value must be ≥ 0.80 of agreement among the experts.¹⁵

The present research was approved by the REC of the Dr. José Antônio Garcia Coutinho School of Medical Sciences of the Universidade de Vale do Sapucaí, under the protocol number 4,273,546.

Results

A total of 12,535 articles were identified, 4,523 of which were excluded because they were duplicated in the databases. A total of 8,012 papers were selected for looking at the title and 163 for reading the abstract, resulting in a sample of 112 articles for reading the full text. A total of 86 of the full-text articles were excluded, and only the remaining 26 articles were used to develop the brochure.

Two brochures were developed, comprising the techniques of dressing (→ Figs. 1 and 2) and undressing (→ Figs. 3 and 4).

→ Table 1 shows the rating of experts using the Delphi technique on the characteristics of the brochures. In the first

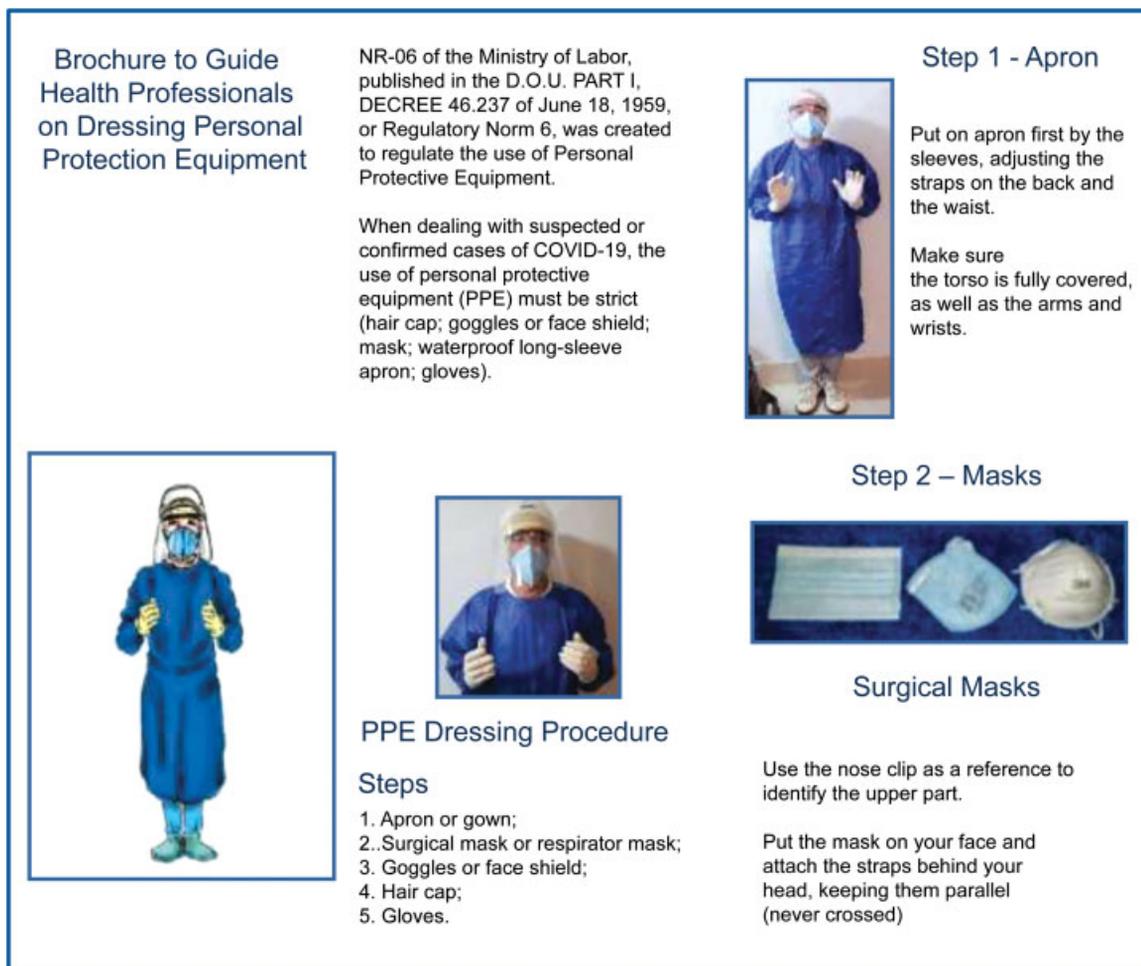


Fig. 1 Brochure to guide health professionals in dressing PPE (Page 1). Pouso Alegre, MG, Brasil, 2020.

<p>Squeeze the nose clip or the rigid edge of the mask in order to adapt it to the shape of your nose, and minimize spaces between the face and the mask.</p>	<p>The goggles must be of exclusive use for each professional responsible for caring.</p>	<h3>Step 5 – Gloves</h3>
<p>Pull the bottom of the mask so that it covers your mouth and chin.</p>	<p>The Face Shield must be used to care for and transport patients with suspected or confirmed respiratory symptoms for COVID-19.</p>	
<p>Masks N95, N99, N100, PFF2 or PFF3</p>	<p>The face shield must be used individually, and each professional must perform the hygiene of the equipment after each caring or transport.</p>	<p>Put on the gloves and extend until you cover the wrist of the isolation apron.</p>
<p>Hold the respirator with the nose clip near your fingertips, leaving the straps hanging.</p>	<p>Face shields must be worn over masks (respirator mask type N95, N99, N100, PFF2, or PFF3) and on top of goggles.</p>	<p>Change gloves whenever necessary or after contact with each patient.</p>
<p>Fit the respirator under the chin.</p>	<h3>Step 4 – Hair Cap</h3>	<p>Change gloves when moving from a contaminated body site to a clean one or if the glove is damaged.</p>
<p>Position one of the straps on the back of the neck and the other on the head.</p>		<p>Place the cap on the head, starting with the forehead towards the base of the neck.</p>
<p>Adjust the nose clip on the nose.</p>	<p>Fit the head comfortably, covering all hair and ears.</p>	<p>Do not wash or use the same pair of gloves again.</p>
<p>Check the seal by positive and negative pressure test.</p>	<p>Whenever the cap shows signs of humidity, they must be replaced by another one.</p>	<p>Gloves must not be reused. Proceed with hand hygiene immediately after removing the gloves.</p>
	<h3>Step 3 - Goggles or Face Shield</h3>	
	<p>Place over face in a comfortable way.</p>	

Fig. 2 Brochure to guide health professionals in dressing PPE (Page 2). Pouso Alegre, MG, Brasil, 2020.

assessment, the experts rated the brochures from “inappropriate” to “absolutely appropriate”; therefore, the CVI_g was 0.82. After making all the corrections based on the comments of the experts, the brochures returned to the panel of experts, who rated them as “appropriate” and “absolutely appropriate” and, therefore, the CVI_g was 1.0.

Discussion

As the new coronavirus spreads worldwide, the importance in public health of identifying the role of working environment for health professionals at the front line of COVID-19 also grows. Workplaces can play a crucial role in the spreading of the virus and, therefore, the analysis of how they are organized is crucial for preventing illness. Health professionals are exposed to infections from COVID-19 and FI caused by the usage of PPE.^{16,17} Several authors report in their research that, in addition to preventing the contagion of workers, it must be taken into consideration their physical safety, conditions of labor, and emotional and psychological stability, motivating management for these challenges within the context of the COVID-19 pandemic.^{5,18}

The need to develop brochures to guide health professionals in dressing and undressing PPE was reinforced by some studies that claim the brochure not only aims to inform or change attitudes, but also to enhance skills and encourage decision-making. The brochures were created based on an integrative literature review, after the identified articles were classified according to their level of evidence.

Brochures developed with a scientific basis support professionals in clinical practice, serving as guidelines in case of subsequent questions, and assist in decision-making in addition to increasing the autonomy of the professionals.^{18,19} They can change the reality of a population.^{19,20}

Brochures developed with a scientific basis support professionals in clinical practice, serving as guidelines in case of subsequent questions, and assist in decision-making in addition to increasing the autonomy of the professionals.^{18,19} They can change the reality of a population.^{19,20}

The panel of experts rated the contents of the brochure employing the Delphi technique. It had been classified within the first rating between “inappropriate” and “absolutely appropriate”. After the corrections suggested by the experts, it was reassessed between “appropriate” and “absolutely appropriate”.

Brochure to Guide Health Professionals on Undressing Personal Protection Equipment



PPE Undressing Procedure

Steps:

1. Gloves; 2. Apron; 3. Hair cap;
4. Goggles or face shield;
5. Surgical mask or respirator mask.

Step 1 – Gloves



During the removal of the gloves, the professional should avoid touching the outside, as it is contaminated.

With both gloved hands, hold the outside of a glove at the top of your wrist. Remove this first glove, moving away from the body and wrist to the fingertips, turning the glove from the inside out.

Hold the glove you just removed in your gloved hand.

Step 2 Apron



When removing the apron or gown, avoid touching the outside, as it is contaminated.

Open the straps and loosen them.

Push by the neck and shoulders, touching only the inside of the apron or gown.

Remove the apron/gown inside out.

Fold or roll it and dispose it in an appropriate container.

With the ungloved hand, remove the second glove by inserting your fingers into the glove at the top of the wrist.

Turn the second glove inside out while tilting it away from the body, leaving the first glove inside the second.

Discard the gloves in the trash. Do not reuse the gloves

Fig. 3 Brochure to guide health professionals in undressing PPE (Page 1). Pouso Alegre, MG, Brasil, 2020.

Step 3 – Hair Cap



The hair cap must be removed after the apron or gown.

To remove the hair cap, pull on the upper central part, without touching the hair.

Discard the cap in an appropriate container.

Step 5 - Surgical or Respirator Mask

Surgical Mask



Remove the mask, avoiding touching the front part, as it may be contaminated.

Hold the lower straps and then the upper straps or elastic and remove it.

Discard the mask in the trash.

Respirator Mask Type N95, N99, N100, PFF2 or PFF3

Hold the lower elastic band with both hands passing it over the head to remove it.

Hold the upper elastic band with both hands passing it over the head to remove it.

Remove the mask holding it by the elastic bands while carefully avoiding touching the inner surface.

Pack the mask in a paper bag or envelope with the elastics out to make it easy for removal later in case of reuse.

Step 4 - Goggles or Face Shield



Remove goggles or face shield from the side or lifting headband, since the front part is contaminated.

If the item is reusable, proceed with disinfection according to the Hospital Infection Control Committee protocol. Otherwise, discard in a waste container.

NOTES:

While wearing the mask, the professional should avoid touching it on the front.

The healthcare worker should change the mask if it is wet or whenever necessary



Wash your hands with soap and water or sanitize it with 70% alcohol solution.

Fig. 4 Brochure to guide health professionals in undressing PPE (Page 2). Pouso Alegre, MG, Brasil, 2020.

Table 1 Evaluation of the content of the brochures to guide health professionals in dressing and undressing the personal protective equipment, employing the Delphi technique and Content Validity Index. Pouso Alegre, MG, Brazil, 2020

	Delphi technique												CVI		
	Inappropriate			Slightly inappropriate			Appropriate			Absolutely appropriate				Total	
	n	%		n	%		n	%		n	%			n	%
Is the content suitable for the target audience?	00	00	03	07.90	16	42.10	19	50	38	100	0.81				
Is the text sequence logical and coherent?	00	00	03	07.90	14	36.80	21	55.30	38	100	0.81				
Does the content facilitate learning?	00	00	04	10.50	10	26.30	24	63.20	38	100	0.83				
Accessible vocabulary?	00	00	03	07.90	11	28.90	24	63.20	38	100	0.81				
Speech of easy assimilation?	00	00	03	07.90	10	26.30	25	65.80	38	100	0.81				
Does the content answer questions on the theme?	00	00	03	07.90	15	39.50	20	52.60	38	100	0.80				
Layout	00	00	05	13.20	08	21.00	25	65.80	38	100	0.83				
PPE recommended by the WHO for use in the COVID-19 pandemic	01	2.60	04	10.50	12	31.60	21	55.30	01	100	0.83				
PPE dressing techniques	01	2.60	04	10.50	12	31.60	21	55.30	01	100	0.82				
PPE undressing techniques	00	00	00	01	02.60	16	42.10	21	100	0.83					
General CVI												0.82			
	Delphi technique												CVI		
	Inappropriate			Slightly inappropriate			Appropriate			Absolutely appropriate				Total	
	n	%		n	%		n	%		n	%			n	%
Is the content suitable for the target audience?	00	00	00	00	13	34.20	25	65.80	38	100	1.0				
Is the text sequence logical and coherent?	00	00	00	00	08	21.10	30	78.90	38	100	1.0				
Does the content facilitate learning?	00	00	00	00	09	23.70	29	76.30	38	100	1.0				
Accessible vocabulary?	00	00	00	00	09	23.70	29	76.30	38	100	1.0				
Speech of easy assimilation?	00	00	00	00	08	21.10	30	78.90	38	100	1.0				
Does the content answer questions on the theme?	00	00	00	00	11	28.90	27	71.10	38	100	1.0				
Layout	00	00	00	00	05	13.20	33	86.80	38	100	1.0				
PPE recommended by the WHO for use in the COVID-19 pandemic	00	00	00	00	13	34.20	25	65.80	38	100	1.0				
PPE dressing techniques	00	00	00	00	13	34.20	25	65.80	38	100	1.0				
PPE undressing techniques	00	00	00	00	08	21.10	30	78.90	38	100	1.0				
GENERAL CVI												1.0			

Abbreviations: CVI, content validity index; WHO, world health organization.

Several studies that validated the tutorial technology content employing the Delphi technique concluded that the suggestions of the raters should be considered and corrected. This procedure contributes to a far better understanding, effectiveness, and implementation of the brochure within the healthcare institution, allowing the target audience to know the content of the brochure and have the motivation to use it.^{20,21}

Regarding the relevance of the content, speech, structure, layout, and therefore the general design of the brochure, the average CVI_g was > 0.78 in the first evaluation, and 1.0 in the second evaluation, marking that the brochure has presented excellent content.

Brochures should attract attention, be easy to read, so the vocabulary used must be consistent with the message and the target audience. Content validation should be performed by experts with specific knowledge in the field.²²⁻²⁵

The developed brochures offer a theoretical and practical foundation to health professionals and contribute to the standardization of the procedure of dressing and undressing PPE, leading to improvement of individualized, systematized, personalized assistance without damage, and with the minimum possible risk of infection for professionals and patients. The brochure will also contribute to the prevention of FI caused by the inappropriate use of PPE.

The present study allowed the development of a brochure and its validation by consensus among the panel of experts. The developed and validated brochure shows the reliability of the technique of dressing and undressing the PPE that ought to be employed by health professionals during the COVID-19 pandemic.

Conflict of Interests

The authors have no conflict of interests to declare.

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