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Covid-19 pandemic and rational use of personal protective equipment

Pandemia de Covid-19 e o uso racional de equipamentos de proteção individual

Pandemia de Covid-19 y uso racional de equipos de protección personal

Samira Silva Santos Soares[I]; Norma Valéria Dantas de Oliveira Souza[II]; Karla Gualberto Silva[III]; Márcia Peixoto César[IV]; Jaqueline da Silva Soares Souto[V]; Jandra Cibele Rodrigues de Abrantes Pereira Leite[VI]

ABSTRACT

Objective: to describe the recommendations on the rational, safe use of personal protective equipment (PPE) throughout the chain of care for people with suspected or confirmed contamination by the new coronavirus. **Content:** the new coronavirus is responsible for the disease Covid-19, and among those at high risk of infection are health workers in very close contact with patients. It is thus a priority recommendation for these workers to use PPE. However, international and national shortages of this equipment make rational use essential in order to prevent even greater impact from these shortages. **Conclusion:** it is essential that health workers use PPE during the Covid-19 pandemic, but it is also essential to coordinate the supply chain for these inputs, implement strategies that minimize the need for PPE and ensure proper use.

Descriptors: Pandemics; Coronavirus; Personal Protective Equipment; Occupational Health.

RESUMO

Objetivo: descrever as recomendações sobre o uso racional e seguro dos equipamentos de proteção individual (EPI) no transcorrer da cadeia assistencial de pessoas com suspeita ou confirmação de contaminação pelo novo coronavírus. **Conteúdo:** o novo coronavírus é responsável pela doença Covid-19, e dentre as pessoas com maior risco de desenvolver a infecção estão os trabalhadores de saúde, devido ao contato muito próximo a pacientes. Desse modo, a utilização de EPI é recomendação prioritária a estes trabalhadores. Todavia, em função do desabastecimento internacional e nacional relacionado a estes equipamentos, o uso racional é fundamental a fim de evitar que o impacto do desabastecimento seja ainda maior. **Conclusão:** o uso de EPI é indispensável aos trabalhadores de saúde durante a pandemia de Covid-19, contudo, é imprescindível coordenar a cadeia de fornecimento destes insumos, implementar estratégias que minimizem a necessidade de EPI e garantir o uso de maneira adequada.

Descritores: Pandemias; Coronavírus; Equipamento de Proteção Individual; Saúde do Trabalhador.

RESUMEN

Objetivo: **Objetivo**: describir las recomendaciones sobre el uso racional y seguro del equipo de protección personal (EPP) en toda la cadena de atención para las personas con sospecha o confirmación de contaminación por el nuevo coronavirus. Contenido: el nuevo coronavirus es responsable de la enfermedad de Covid-19, y entre aquellos con alto riesgo de infección se encuentran los trabajadores de la salud en contacto muy cercano con los pacientes. Por lo tanto, es una recomendación prioritaria para estos trabajadores usar EPP. Sin embargo, la escasez internacional y nacional de este equipo hace que el uso racional sea esencial para evitar un impacto aún mayor de esta escasez. Conclusión: es esencial que los trabajadores de la salud usen EPP durante la pandemia de Covid-19, pero también es esencial coordinar la cadena de suministro para estos insumos, implementar estrategias que minimicen la necesidad de EPP y garantizar un uso adecuado.

Descriptores: Pandemias; Coronavirus; Equipo de Protección Personal; Salud Laboral.

INTRODUCTION

In March 2020, COVID-19 was characterized by the World Health Organization (WHO) as a pandemic[1]. The main form of transmission of the infectious disease caused by the new coronavirus (SARS-CoV-2) is respiratory droplets[1]. Due to the rapid and easy spread of the virus, the need for intensive care, and the use of intensive care technologies for a portion of infected people, changes in workflows, health care protocols, and expenses with consumables, especially with Personal Protective Equipment (PPE), have been observed.

[I]Nurse. MS. Substitute Teacher. Anna Nery Nursing School. Federal University of Rio de Janeiro. Brazil. E-mail: samira_opg@hotmail.com. ORCID: http://orcid.org/0000-0001-9133-7044

[II]Nurse. PhD. Full Professor. Nursing School of the University of the State of Rio de Janeiro. Brazil. E-mail: norval_souza@yahoo.com.br. ORCID: http://orcid.org/0000-0002-2936-3468

[III]Nurse. Master's Degree course student Anna Nery Nursing School. Federal University of Rio de Janeiro. Brazil. E-mail: karlagualberto@hotmail.com. ORCID: http://orcid.org/0000-0002-7870-0600

[IV]Nurse. PhD course student. Anna Nery Nursing School. Federal University of Rio de Janeiro. Brazil. E-mail: marciapcesar@yahoo.com.br. ORCID: http://orcid.org/0000-0002-3667-7764

[V]Nurse. PhD course student. Substitute Teacher. Anna Nery Nursing School. Federal University of Rio de Janeiro. Brazil. E-mail: jaquelinesouto91@gmail.com. ORCID: http://orcid.org/0000-0003-2069-5260

[VI]Nurse. PhD course student. Anna Nery Nursing School. Federal University of Rio de Janeiro. Brazil. E-mail: jandra13cibele@gmail.com. ORCID: http://orcid.org/0000-0002-8676-3898

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In this context, several countries, including Brazil, have shown failures in the protection of the health workers due to the scarcity of this equipment or to mistakes in the process of putting the PPE on or of taking it off[2-4]. Another factor highlighted is the unpreparedness of the professionals in dealing with this equipment, which, although already recommended in the routines of the different care levels, is sometimes handled incorrectly, leaving professionals with a false sense of protection.

Thus, considering the global emergence of the topic, the need to protect the health workers, and the problems related to the international and national shortage of PPE, this article aims to describe the recommendations on the rational and safe use of Personal Protective Equipment (PPE) in the care procedures for people with suspected or confirmed contamination by the new coronavirus.

The PPE crisis during the pandemic

Since the cases of coronavirus have spread in Brazil and worldwide, some PPE has become increasingly rare and the crisis related to this equipment can affect the recommendations on these items, thus requiring a brief contextualization of this topic.

China is the main producer and exporter of this type of material but, as it is the first epicenter of SARS-CoV-2, its production and sales were affected. When resumed their activities, Chinese industries had a high number of orders from all over the world; thus, they had to recover their full manufacturing capacity and, above all, increase it. Given the difficulty of access, high prices, and the questionable quality of some PPE, buyers need to evaluate the device they plan to buy, the manufacturer, third-party intermediaries (if applicable), and the terms of the contract, before deciding to purchase. It is necessary to consider a logistics plan to ensure the delivery of these materials in a timely manner, since the demand is urgent[5,6].

For the Pan American Health Organization (PAHO) and the WHO, in addition to the cases of COVID-19, which require the use of PPE by patients, caregivers, and health professionals, misinformation and panic led to the uncontrolled purchase and storage of products by the population, contributing to an even greater shortage of these supplies[7]. They also emphasize that it is likely that the supply of surgical gowns and protection goggles will be insufficient soon, since the capacity to expand the production of PPE is limited in view of the current demand, mainly due to the widespread and inappropriate use of this material[7]. It is necessary to clarify to people that, in the face of the PPE crisis, surgical masks and the N95/PFF2 masks should be mainly destined to health professionals, as the care units are the places with the greatest potential for virus concentration; thus, the population in general should use homemade (fabric) masks[8-10].

In addition to the aforementioned problems, bureaucracies, and market disputes, there is also concern about the discrepancy of information among the scientific community and political authorities and, even among specialist organizations. A study conducted in a health institution revealed that the professionals who wore cotton fabric masks had a higher risk of infection compared to those who wore surgical masks, which is why cloth face masks should not be used by the health professionals[11].

However, the Centers for Disease Control and Prevention (CDC) considered that, in case of shortage of PPE, homemade masks could be considered a last resort when treating patients with COVID-19[12]. Moreover, the CDC recommends that, when the supply of N95 masks is running low, people can use them beyond the expiration date designated by the manufacturer but, under these conditions, there is no guarantee of effectiveness[5]**.**

It is necessary to carefully analyze the recommendations for the production and use of this equipment in the context of a crisis. Cloth face masks are not recognized as PPE, and the workers' health cannot be put at risk under the pretext of scarcity of resources; it would be like accepting the use of plastic bags as substitutes for (improvised) aprons. The guidelines should follow scientific knowledge; otherwise, the health professionals may lose confidence in the specialist bodies, which can even impact the adoption or not of the recommendations and future guidelines[13].

In Brazil, the PPE is regulated by certifying bodies and by the Brazilian Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária*, ANVISA), which, motivated by the current international public health emergency situation related to COVID-19, through Resolution of the Collegiate Board (*Resolução da Diretoria Colegiada*, RDC) No. 356/2000, simplified the requirements for manufacturing, importing, and purchasing priority medical devices, and surgical masks, N95, PFF2, or equivalent particulate respirators used in health care services[14]. However, the manufacturer or importer is responsible for guaranteeing the quality, safety, and effectiveness of the products manufactured in accordance with the specificities established in the aforementioned resolution.

It is also noteworthy that the PPE is addressed by the Regulatory Rules (*Normas Regulamentadoras*, NRs) of the Ministry of Labor and Employment, which, among other aspects, indicate that it is the responsibility of public or private

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employers who have employees governed by the Consolidated Labor Laws (*Consolidação das Leis do Trabalho*, CLT) or statutory to guarantee their access to the PPE, making it available in sufficient numbers and providing immediate supply or replacement in case of contamination or damage, given its importance in protecting the workers and in minimizing exposure to occupational diseases[15-17].

Therefore, in the face of this scenario of PPE crisis, in addition to the statement of government officials and employers related to an effort to supply these materials, the workers should be aware of the importance and the need to use this PPE in a rational and safe way. They should also be aware of their rights to have access to this equipment in sufficient quantity and quality to meet the care demands, safeguarding their own health and their patients' safety.

The workers can and should report the lack of PPE and reject any request for concealment related to the scarcity of PPE since, unfortunately, there are reports from health professionals who were expressly informed by the management not to speak publicly about the inadequate conditions to which they are subjected. Thus, for fear of retaliation by the employer, many workers remain silent regarding this negligence. This serious situation may indicate that the information available on PPE deficiency in the health services is likely to underestimate the problem[18].

Recommendations for the rational and safe use of PPE

The recommendations for the rational use of PPE in the context of COVID-19 aim to guide the individuals involved in the distribution and management of this equipment, as well as to assist public health authorities and individuals working in the community and in health care settings, offering guidance on situations in which the use of PPE is more appropriate. Administrative, environmental, and engineering controls are needed for joint and effective actions and strategies against the pandemic[7].

Administrative controls include ensuring the availability of resources for infection prevention and control measures. These controls require actions by both the employer/contracting party and the workers, changes and development of policies, and new work routines in order to reduce or minimize exposure to a risk, its duration, frequency, or intensity[19]. The effectiveness of these measures depends on the commitment of the employer, on the acceptance/commitment of the staff, and on the consistent use of the strategies[19,20].

The environmental and engineering controls aim to reduce the spread of pathogens and to reduce the contamination of surfaces and inanimate objects. These controls include ensuring adequate space so that a minimum distance of one meter is maintained between patients, and between patients and health care workers, as well as availability of well-ventilated isolation rooms for patients who are suspected or confirmed cases of COVID-19[7].

The use of PPE should consider the care level and the type of activity to be performed: screening, sample for laboratory diagnosis, suspected or confirmed cases of 2019-nCov that require hospitalization in the health unit but do not require an Aerosol Generating Procedure (AGP) and, finally, confirmed or suspected cases of COVID-2019 requiring admission to the health unit and AGP[19,21]. Standard precautions, as well as precautions against contact and contamination by droplet are recommended for all the suspected or confirmed cases of COVID-19 and, in specific situations, it is also recommended to adopt aerosol precautions[22].

Therefore, the health care professionals involved in the direct care for the patients should wear the following: surgical gowns, gloves, surgical mask, and eye protection (goggles or face mask)[23-25].

If surgical gowns are not resistant to fluids, aprons should also be used, and only in cases of AGP (tracheal intubation, non-invasive ventilation, tracheostomy, and cardiopulmonary resuscitation, among others), respirators (N95, PFF2, or equivalent standards) should also be used and combined with the other PPE[26-29]. Two (overlapping) gloves should not be used, and the protection goggles/face shield must be exclusive to each professional and undergo cleaning and disinfection immediately after use[23].

For each patient/day, the health institutions should have a mean of 25 units of surgical scrubs and masks, a respirator, and a face shield, in addition to 50 units of procedure gloves[21]. Management of PPE should be coordinated through basic supply chain management mechanisms at the national and international levels, which include, but are not limited to, the following items: PPE usage forecasts based on rational quantification models to guarantee rational use; monitoring and control of the requests for equipment by countries or by major outbreak response centers; encouraging the use of a centralized order management to avoid inventory duplication and to ensure strict compliance with basic inventory management rules to limit losses, excessive inventory, or stockout; monitoring the

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distribution of PPE from end to end; in addition to monitoring and controlling the distribution of this equipment sold in medical stores[7].

Primary-level health institutions are responsible for the high complexity specialties, for training of the professionals (especially on techniques for putting the PPE on and for taking it off), for the supervision on the use of PPE, and for the maintenance and replacement of the PPE as indicated by the manufacturer[19,30]. In addition, the PPE should be available in sizes suitable for the users and, if the equipment is disposable, it should be discarded in an appropriate place and never be reused[30-32].

The surgical masks should have high resistance to fluids, good breathability, at least an inner and outer layer, and a mandatory filter element. They should be made in such a way as to adequately cover the user's nose and mouth area, and they must have nasal clips made of malleable material that allow for the proper adjustment to the contour of the nose and cheeks[14,30]. Such masks shall not be used together with an N95 mask or equivalent since, in addition to not guaranteeing protection from filtration or contamination, it contributes to the waste of another PPE item[19,23].

In the case of N95/PFF2 masks or equivalent items, it is recommended to change them when they are saturated, dirty or moist, crushed, or creased[19]. If the professionals need to reuse them, they must follow the criteria to change them and meet the conditions for packaging and storing this type of mask, which must be defined by the service/sector, considering adequate protection.

Exceptionally, that is, in situations of supply shortages and to meet the demand of the COVID-19 epidemic, this PPE can be used for a longer period or for a number of times greater than that indicated by the manufacturer, as long as it is used by the same professional and obeying the routines established by the Hospital Infection Control Commissions of the health service. The health services should define a protocol to guide the professionals on the prolonged use of respirators and their reuse[19,20].

To reuse the N95/PFF2 mask or equivalent items, it is necessary to protect it from exposure to the patient's droplets and this can be accomplished using the face shield; the professionals must always visually inspect the mask before using it to assess its integrity and perform the seal test. If it is not possible to successfully verify the mask seal on the worker's face, the mask must be immediately discarded. It should be noted that, even though reuse is a limited practice, there are restrictions that signal the number of reuse instances[20,32].

The health units must provide adequate places to store the masks used during the shift, with identification of the professional's name on the packaging, always as close as possible to the room of the suspected/probable/confirmed case[19,32].

In view of the global shortage, it is recommended (in order to reduce the need for PPE and, at the same time, to protect the workers and other individuals from exposure to the new coronavirus in health care facilities) to use telemedicine to assess suspected cases; to use physical barriers to reduce exposure to the virus, such as glass or plastic panels; and to restrict the entry of health workers to the rooms of patients infected with COVID-19 if they are not directly involved in their care. The combination of activities to minimize the number of times the workers enter a room is also worth considering, based on an appropriate planning of the activities carried out at the bedside[7].

Whenever possible, a team of health service workers should be assigned to deal exclusively with suspected or confirmed cases of COVID-19, and they should not circulate in other areas or provide assistance to other patients. It is recommended to limit the number of workers and family members in contact with suspected or confirmed cases of COVID-19. During the transportation of these patients, unnecessary handling should be avoided to minimize the possibility of contamination of the team and of the material[19,20].

CONCLUSION

Considering the need to protect the health workers who are at the forefront of combating the COVID-19 pandemic and the problems related to the international and national shortage of PPE, the rational use of this equipment is essential to minimize the impacts of this crisis, especially with regard to the workers' health.

An integrated action between health sectors and the scientific community is necessary to provide the professionals with scientific evidence that can guarantee their safety. Epidemiological surveys, systematic assessments of work environments, and inspections by workers unions can evidence the vulnerability of the health professionals and inadequate working conditions.

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Ensuring workers access to the PPE is an indispensable condition and, to achieve this goal, it is essential, among other actions, to coordinate the supply chain of these inputs, optimize their availability, implement strategies that can minimize the need for PPE, and ensure the proper use of these products. Finally, it should be noted that, as it is a recently discovered disease, new recommendations will emerge throughout the crisis as studies are conducted in Brazil and worldwide.

REFERENCES

1. Folhetim OMS - Folha informativa – COVID-19: doença causada pelo novo coronavírus. [Internet]. 2020 [cited 2020 Apr 14]. Available from: https://www.paho.org/bra/index.php?option=com_content&view=article&id=6101:covid19&Itemid=875
2. Agenzia Nazionale Stampa Associata – Sociedade Cooperativa: Mais de dois mil médicos e enfermeiras contraíram vírus na Itália. Agência Italiana de Notícias [Internet]. 2020 [cited 2020 Apr 04]. Available from: http://ansabrasil.com.br/brasil/noticias/italia/noticias/2020/03/16/mais-de-2-mil-medicos-e-enfermeiras-contrairam-virus-na-italia_010f1866-3b04-402f-8e07-6461e179a2b9.html
3. Conselho Federal de Enfermagem (BR). Fiscalização identifica 4.602 profissionais afastados por suspeita de COVID-19. [Internet]. 2020 [cited 2020 Mai 04]. Available from: http://www.cofen.gov.br/fiscalizacao-identifica-4-602-profissionais-afastados-por-suspeita-de-covid-19_79347.html
4. Wang J, Zhou M, Liu F. Exploring the reasons for healthcare workers infected with novel coronavirus disease 2019 (COVID-19) in China. J Hosp Infect [Internet]. 2020 [cited 2020 Mar 22]; DOI: https://doi.org/10.1016/j.jhin.2020.03.002
5. Centers for Disease Control and Prevention. Factors to Consider When Planning to Purchase Respirators from Another Country. 2020 [cited 2020 May 11]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/international-respirator-purchase.html
6. Estadão Conteúdo. Mandetta diz que governo tem 'plano de logística' para buscar equipamentos na China. [Internet]. 2020 [cited 2020 May 09]. Available from: https://odia.ig.com.br/brasil/2020/04/5893698-mandetta-diz-que-governo-tem--plano-de-logistica--para-buscar-equipamentos-na-china.html
7. World Health Organization (WHO). Rational use of personal protective equipment (PPE) for coronavirus disease (COVID-19). [Internet]. 2020 [cited 2020 Apr 08]. Available from: https://apps.who.int/iris/bitstream/handle/10665/331498/WHO-2019-nCoV-IPCPPE_use-2020.2-eng.pdf
8. Ministério da Saúde (BR). Nota informativa Ministério da saúde recomendando máscaras caseiras – NOTA INFORMATIVA Nº 3/2020-CGGAP/DESF/SAPS/MS. [Internet]. 2020 [cited 2020 Apr 03]. Available from: https://www.saude.gov.br/images/pdf/2020/April/04/1586014047102-Nota-Informativa.pdf
9. Universidade Federal do Rio de Janeiro (UFRJ). GT de Produção de Material para Enfrentamento do COVID-19 da Escola de Enfermagem Anna Nery. USO DE MÁSCARA PELA POPULAÇÃO DURANTE A PANDEMIA DE COVID-19. [Internet]. 2020 [cited 2020 Apr 15]. Available from: https://ufrj.br/sites/default/files/documentos/2020/04/uso_de_mascara_pela_populacao_a_covid_19_final_rev.pdf
10. Governo do Estado do Rio Grande do Sul. Comitê científico de apoio ao enfrentamento à pandemia covid-19. Carta a sociedade gaúcha – 09 de abril de 2020: orientações sobre o uso de máscaras. [Internet]. 2020 [cited 2020 Apr 12]. Available from: https://medicina.furg.br/images/Noticias/mascarasCOMITE-09abr2020_v5.pdf
11. MacIntyre CR, Seale H, Dung TC, Hien NT, Aga PH, Chugtai AA, et al. A cluster randomised trial of cloth masks compared with medical masks in healthcare workers. BMJ Open 2015; 5:e006577. DOI: https://doi.org/10.1136/bmjopen-2014-006577
12. Centers for Disease Control and Prevention. Strategies for Optimizing the Supply of Facemasks. 2020 [cited 2020 May 09]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/face-masks.html
13. O'Sullivan, Eoin D. PPE guidance for covid-19: be honest about resource shortages. BMJ [Internet]. 2020 [cited 2020 May 09]; 369: m1507. DOI: https://doi.org/10.1136/bmj.m1507
14. Ministério da Saúde (BR). Resolução - RDC nº 356, de 23 de março de 2020. [Internet]. 2020 [cited 2020 Apr 14]. Available from: http://www.in.gov.br/en/web/dou/-/resolucao-rdc-n-356-de-23-de-marco-de-2020-249317437
15. Ministério do Trabalho e Emprego (BR). Norma Regulamentadora 6 - NR 6 - Equipamento de Proteção Individual – EPI. [Internet]. 2020 [cited 2020 Apr 14]. Available from: https://enit.trabalho.gov.br/portal/images/Arquivos_SST/SST_NR/NR-06.pdf
16. Ministério do Trabalho e Emprego (BR). Portaria nº 485, de 11 de novembro de 2005. Aprova a norma regulamentadora nº 32 (Segurança e saúde no trabalho em estabelecimentos de saúde) [Internet]. Diário Oficial da República Federativa do Brasil, Brasília (DF); 2005 [cited 2020 Apr 10]. Available from: http://sbbq.iq.usp.br/arquivos/seguranca/portaria485.pdf
17. Balthazar MAP, Andrade M, Souza DF de et al. Occupational Risk Management in Hospital Services: A Reflective Analysis. Rev. enferm. UFPE. [Internet]. 2017 [cited 2020 Apr 10]; 11(9):3482-349. Available from: https://periodicos.ufpe.br/revistas/revistaenfermagem/article/viewFile/110248/22190
18. Mandola J. CoViD-19 e dispositivi di protezione individuale: qualcuno di noi morirà per la loro carenza. Recenti Prog Med [Internet]. 2020 [cited 2020 May 08]; 111:183. Available from: https://www.recentiprogressi.it/r.php?v=3347&a=33175&l=340294&f=allegati/03347_2020_04/fulltext/04_Editoriale%20-%20Mandrola.pdf
19. Ministério da Saúde (BR). Recomendações de proteção aos trabalhadores dos serviços de saúde no atendimento de COVID-19 e outras síndromes gripais. [Internet]. 2020 [cited 2020 May 07]. Available from: https://portalarquivos.saude.gov.br/images/pdf/2020/April/16/01-recomendacoes-de-protecao.pdf

Update Article
Artigo de Atualidades
Artículo de Actualidades

DOI: http://dx.doi.org/10.12957/reuerj.2020.50360

20. Centers for Disease Control and Prevention. Strategies for Optimizing the Supply of N95 Respirators. 2020 [cited 2020 May 09]. Available from: https://www.cdc.gov/coronavirus/2019-ncov/hcp/respirators-strategy/index.html
21. World Health Organization (WHO). Requirements and technical specifications of personal protective equipment (PPE) for the novel coronavirus (2019-ncov) in healthcare settings. [Internet]. 2020 [cited 2020 May 08]. Available from: https://iris.paho.org/bitstream/handle/10665.2/51906/requirements-%20PPE-coronavirus-eng.pdf?sequence=1&isAllowed=y
22. World Health Organization (WHO). Cuidados para profissionais da saúde expostos ao novo coronavírus (COVID-19) em estabelecimentos de saúde. [Internet]. 2020 [cited 2020 May 11]. Available from: https://iris.paho.org/bitstream/handle/10665.2/52050/OPASBRACOVID1920046_por.pdf?sequence=1&isAllowed=y
23. Agência Nacional de Vigilância Sanitária. Nota Técnica 04/2020 Anvisa. [Internet]. 2020 [cited 2020 Apr 14]. Available from: http://portal.anvisa.gov.br/servicos/notas-tecnicas
24. Ministério da Saúde (BR). Procedimento Operacional Padronizado. Equipamento de Proteção Individual e Segurança no Trabalho para profissionais de Saúde no atendimento às pessoas com suspeita ou infecção pelo novo coronavírus (covid-19). [Internet]. 2020 [cited 2020 Apr 14]. Available from: http://189.28.128.100/dab/docs/portaldab/documentos/POP_EPI_APS_20200319_ver001.pdf
25. World Health Organization. Infection prevention and control of epidemic-and pandemic-prone acute respiratory infections in health care. [Internet]. 2014 [cited 2020 Apr 14]. Available from: https://apps.who.int/iris/bitstream/handle/10665/112656/9789241507134_eng.pdf?sequence=1
26. Janssen L, Zhuang Z, Shaffer R. Criteria for the collection of useful respirator performance data in the workplace. J Occup Environ Hyg. [Internet]. 2014 [cited 2020 Apr 14]; 11(4):218-226. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4739800/pdf/nihms753016.pdf
27. Janssen LL, Nelson TJ, Cuta KT. Workplace protection factors for an N95 filtering facepiece respirator. J Occup Environ Hyg. 2007 [cited 2020 Apr 03]; 4(9):698-707. DOI: https://doi.org/10.1080/15459620701517764
28. Radonovich LJ, Cheng J, Shenal BV, Hodgson M, Bender BS. Respirator tolerance in health care workers. JAMA. [Internet]. 2009 [cited 2020 Apr 10]; 301(1):36-38. DOI: https://doi.org/10.1001/jama.2008.894
29. World Health Organization (WHO). Advice on the use of masks in the community, during home care and in healthcare settings in the context of the novel coronavirus (2019-nCoV) outbreak: interim guidance. Geneva: World Health Organization; [Internet]. 2020 [cited 2020 Apr 14]. Available from: https://www.who.int/publications-detail/advice-on-the-use-of-masks-in-the-community-during-home-care-and-in-healthcare-settings-in-the-context-of-the-novel-coronavirus-(2019-ncov)-outbreak
30. World Health Organization (WHO). Requerimientos para uso de equipos de protección personal (EPP) para el nuevo coronavirus (2019-nCoV) en establecimientos de salud. [Internet]. 2020 [cited 2020 May 10]. Available from: https://iris.paho.org/bitstream/handle/10665.2/51976/OPSPHEIHMCovid1920003_spa.pdf?sequence=1&isAllowed=y
31. Centers for Disease Control and Prevention. Recommended Guidance for Extended Use and Limited Reuse of N95 Filtering Facepiece Respirators in Healthcare Settings. 2020 [cited 2020 May 11]. Available from: https://www.cdc.gov/niosh/topics/hcwcontrols/recommendedguidanceextuse.html
32. Ferioli M, Cisternino C, Leo V, Pisani L, Palange P, Nava S. Protecting healthcare workers from SARS-CoV-2 infection: practical indications. European Respiratory Review [Internet]. 2020 [cited 2020 Apr 06]; 29(155): 200068. DOI: https://doi.org/10.1183/16000617.0068-2020