Experience Report

# Experience of a public university in the production of technologies for the protection of workers in the COVID-19 Pandemic

# Experiência de uma universidade pública na produção de tecnologias para a proteção de trabalhadores na pandemia da COVID-19

**Thiago da Silva Santana**[1]
**Pollyana Pereira Portela**[2]
**Ariane Cedraz Morais**[3]
**Karine Emanuelle Peixoto de Souza**[4]
**Jeidson Antonio Morais Marques**[5]
**Silvone Santa Bárbara da Silva**[6]
**Evanilda Souza de Santana Carvalho**[7]
**Silvia da Silva Santos Passos**[8]

[1]Corresponding author. Universidade Estadual de Feira de Santana (Feira de Santana). Bahia, Brasil. tssantana@uefs.br
[2-8]Universidade Estadual de Feira de Santana (Feira de Santana). Bahia, Brasil. ppportela@uefs.br, acmorais1@uefs.br, kepsouza@uefs.br, jeidson@uefs.br, silvone.santabarbara@gmail.com, evasscarvalho@uefs.br, sspassos@uefs.br

**ABSTRACT | OBJECTIVE:** To describe the experience of production and distribution of personal protective equipment of the face shield type within the scope of the UEFS-PROVIDES project. **METHODS AND MATERIALS:** Experience report, with the participation of professors and volunteers linked to State University of Feira de Santana, Bahia, Brazil between March and May 2020 in three stages: planning, proposal construction, and fundraising; execution, with the operationalization of the proposal; distribution of face shields. **RESULTS:** The experience in producing technologies to protect workers in the COVID-19 pandemic occurred in stages. Its execution enabled the production of 6,227 (six thousand, two hundred and twenty-seven) face shields, benefiting more than 6,000 (six thousand) workers who worked on the front lines of the COVID-19 pandemic in 90 health institutions. **CONCLUSION:** It was possible to describe the experience of production and distribution of personal protective equipment of the face shield type. The project reached health workers in the second-largest city in Bahia and its micro-region, strengthening the inseparable articulation of scientific knowledge produced at the university, meeting the demands of society in times of a pandemic to reduce the vulnerability of workers.

**DESCRIPTORS:** Technological Equipment. Individual protection equipment. Health Professionals. Health Projects. Prevention.

**RESUMO | OBJETIVO:** Descrever a experiência de produção e distribuição de equipamento de proteção individual do tipo face shield no âmbito do projeto UEFS-PROVIDAS. **MÉTODOS E MATERIAIS:** Relato de experiência, com participação de docentes e voluntários vinculados à Universidade Estadual de Feira de Santana, Bahia, Brasil, entre março e maio de 2020 em três etapas: planejamento, construção da proposta e levantamento de recursos; execução, com operacionalização da proposta; distribuição dos protetores faciais. **RESULTADOS:** A experiência na produção de tecnologias para a proteção de trabalhadores na pandemia da COVID-19 ocorreu em etapas. Sua execução possibilitou a produção de 6227 (seis mil e duzentos e vinte e sete) protetores faciais, beneficiando mais de 6000 (seis mil) trabalhadores que atuaram na linha de frente da pandemia da COVID-19 em 90 instituições de saúde. **CONCLUSÃO:** Foi possível descrever a experiência de produção e distribuição de equipamentos de proteção individual do tipo face shield. O projeto alcançou trabalhadores da saúde na segunda maior cidade da Bahia e sua microrregião fortalecendo a indissociável articulação dos saberes científicos produzidos na universidade atendendo às demandas da sociedade em tempos de pandemia para a redução da vulnerabilidade dos trabalhadores.

**DESCRITORES:** Equipamentos Tecnológicos. Equipamento de Proteção Individual. Profissionais de Saúde. Projetos em Saúde. Prevenção.

Submitted 10/17/2021, Accepted 02/01/2022, Published 03/14/22
J Contemp Nurs., Salvador, 2022;11:e4178
http://dx.doi.org/10.17267/2317-3378rec.2022.e4178
ISSN: 2317-3378

*How to cite this article:* Santana TS, Portela PP, Morais AC, Souza KEP, Marques JAM, Silva SSB, et al. Experience of a public university in the production of technologies for the protection of workers in the COVID-19 pandemic. J Contemp Nurs. 2022;11:e4178. http://dx.doi.org/10.17267/2317-3378rec.2022.e4178

## Introduction

The COVID-19 pandemic translates into the most serious public health threat caused by a respiratory virus in the 21st century. Moreover, since the identification of the SARS-CoV-2 virus in late December 2019 in Wuhan, China, the number of cases imported from other countries has been on the rise, generating profound impacts on a global scale.[1]

The new Coronavirus, called SARS-CoV-2, is the virus that causes the disease COVID-19[1], characterized by high transmissibility and high demand for health services. According to the World Health Organization, 14% of identified cases develop severe disease requiring hospital admission and oxygen therapy, and 5% will require admission to Intensive Care Units; its lethality varies according to country, age group, and associated clinical conditions.[2] Efforts to contain the spread of this disease are being made on all continents.[3]

Transmission of SARS-Cov-2 occurs through droplets and/or aerosols containing the virus, which are expelled by speaking, coughing, or sneezing from an infected person. These particles can be transmitted from one person to another about 1 to 2 meters away. The disease can also be transmitted through physical contact, by touching objects and surfaces contaminated by droplets containing the virus, followed by hand contact with the eyes, nose, or mouth.[4] The proper use of Personal Protective Equipment (PPE) can prevent contamination and control transmissibility.

However, the complaints about the lack of PPE and the sickness of professionals working on the front line of the pandemic highlighted their vulnerability and the need to correct the working conditions to avoid the collapse of the health system. In the world, numerous professionals affected by the new Coronavirus were removed from their activities, and many others died from COVID-19. In March 2020, Italy was considered the world epicenter of the disease, i.e., it became the country with the highest number of cases, 8.3% of which were among healthcare professionals.[5]

The lack of PPE, the growing volume of suspected and confirmed cases, evidenced by health organizations, and the alertness of scientific studies pointed out the urgency of PPE production for the adequate protection of workers. Thus, in order to fight the pandemic and overcome these challenges, several segments of society have invested in the creation of specific units for clinical evaluation of people of medium severity, enabling the concentration of investments in equipment and the release of flows in units of greater complexity, necessary for the most severe cases.[6]

In Brazil, Public Universities have expanded their investment in research and the production and distribution of technologies to strengthen the care for health professionals who are on the frontline of the fight against the pandemic, thus assuming their space for intellectual production social insertion.

Among the technologies needed to create a respiratory barrier to prevent COVID-19, face shields have become popular. They have been introduced to compose the paramentation of health professionals, together with the other PPE, such as goggles, the respiratory protective mask (particulate respirator) N95 or similar, cap, glove, shoe, and waterproof apron. Face shields are now being advocated as part of strategies to reduce SARS-CoV-2 transmission among health care workers and the community.[4,7]

The use of face shields is indicated when there is a risk of exposure to splashes of blood, body secretions, and excretions, also serving as a barrier in aerosol-generating procedures such as intubation or tracheal suction, non-invasive ventilation, manual ventilation before intubation, sputum induction, nasotracheal sampling, and bronchoscopy. They must be for individual use, and hygiene is required after use.[4]

Given the high rate of morbidity and mortality of health professionals by COVID-19 and the severity of the pandemic, as well as the difficulty faced by these professionals due to the lack of PPE, specifically Face Shield and the scientific, ethical, and social commitment that the Public University has before the professional training and strengthening of teaching practices, this project, entitled UEFS-PROVIDAS, was developed and executed involving the Dean of Research and Graduate Studies (PPPG) of the Universidade Estadual de Feira de Santana (UEFS), in Bahia, in partnership with professors from the Departments of Health (DSAU) and Physics (DFIS) and some students and employees of the institution.

This project was designed with the purpose of producing additional care technologies for the protection of workers in the Municipal and State Health Network of Bahia due to the pandemic of COVID-19. Therefore, the objective is to describe the experience of production and distribution of face shield personal protective equipment under the UEFS-PROVIDAS project.

## Methodology

This is a descriptive study of the experience report type, which involved the participation of teachers and volunteers linked to the Universidade Estadual de Feira de Santana, Bahia, Brazil, in the planning, construction, and execution of the UEFS-PROVIDAS project, from March to May 2020.

Feira de Santana was the first municipality in Bahia to register a positive case of COVID-19. This case imported from Italy was a woman who traveled for tourism in March 2020, and it unfolded in three other cases in people who had direct contact with the index case. The Epidemiological Surveillance professionals of the municipality acted quickly, and the disclosure of the arrival of the new coronavirus led to the mobilization of state and municipal governmental instances.[8]

Eleven days after the first case was registered in Feira de Santana-Ba, the pandemic was already showing growth data in other regions of the country and the world. On March 16th, by decree of the Governor, all educational institutions were closed to adopt isolation and social distancing measures, aiming to promote the flattening of the pandemic growth curve, thus avoiding the collapse of the health system.

Meanwhile, on TV and social media, narratives and images of front-line care workers have begun to be aired, with grievances, requests, and complaints about the precarious working conditions, especially regarding the lack of PPE.[8]

Even before identifying the first suspected case in Feira de Santana, UEFS, a university referenced in social commitment, organized a committee to monitor the situation of COVID-19. It was from this group that strategies to face the disease were designed, and in this aspect, the starting point to produce the face shields was given. Additionally, teachers from DSAU and DFIS have strengthened the project, making the produced equipment available to health professionals on the front line of care for suspected and confirmed cases of COVID-19.

Then, a project management group was formed, of which the participants of this report are part. Subsequently, volunteers were recruited through the formation of new workgroups. The adhesion was immediate, composing new production and distribution fronts, totaling 30 volunteers, including professors from the Nursing, Dentistry, Pharmacy, and Physics courses, undergraduate and graduate students, and administrative personnel.

The teaching and extension activities with educational actions occurred through training developed by the project coordinators to guide the handling of 3D printing machines, preparation of the materials that make up the face shield (shaft/crown, visor, and fixing elastics), assembly and packaging of the material for delivery (with the fixing of identification labels, provision of guidelines for use and cleaning of the equipment) and protocol of delivery of the material with completion of the delivery list and signing of the terms of donation.

Since this is an experience report, there was no need for approval by the Research Ethics Committee; however, we obtained the university's consent to create the project and the participants' consent for the publication of this experience.

## Results e discussion

Faced with the health crisis generated by the COVID-19 pandemic, evidenced by the real difficulties in the availability of PPE and the high demand for respiratory protectors for health professionals, meeting the resolution 356 of ANVISA (03/23/2020) that disposed of extraordinary on the requirements

for the manufacture, importation, and acquisition of medical devices identified as priorities, that this group engaged in the production of technologies consistent with the current requirements arising from the specificity of the work.

The experience of health professionals in the planning, construction, and execution of this project is described in three stages, namely: the initiation stage, characterized by the description of the planning, construction of the proposal, and gathering of resources; the execution stage where the operationalization of the proposal is reported; and finally, the stage of the distribution of the face shields.

**Initiation stage: planning, building the proposal, and gathering resources.**

Aiming to develop and distribute technologies to protect health workers from the COVID-19 pandemic, the Dean of Research and Graduate Studies (PPPG) of UEFS organized a group composed of professors from the DSAU and DFIS the institution to initially develop the project's management plan.

In the first moment, it was identified the real need of the project for the university based on teaching, research, and extension, its viability, costs, and execution timelines to attend the front-line workers quickly and equitably in the fight against the new coronavirus, in the fastest time possible given the urgent need evidenced by the cataclysm caused by the pandemic.

Thinking about these issues, added to a chaotic pandemic scenario, these professionals fight the virus and face the shortage of basic equipment for their individual protection and struggle for better working conditions.[9] Thus, given these issues, the project management group defined the production and adaptation of a Face Shield PPE, given its utmost importance for protecting the professionals' health, constituting a physical barrier to prevent infection by the new coronavirus.

Given the high cost imposed by private companies as a result of increased demand and the lack of Face Shield in the market, and the need to quickly produce this technology on a large scale for the protection of professionals, working groups (WG) were created from the management group, in which each WG was responsible for some activities, as follows: WG - 01 - raising material resources by partners represented by private enterprise or non-governmental organizations; WG - 02 - recruitment of people to work in the line of printing in 3D printers, production and distribution of personal protection technologies; and the WG - 03 - organization of crowdfunding and marketing to publicize the project in the academic community, social networks and companies located in Feira de Santana-BA and metropolitan region that could jointly contribute financially to make the project viable and finally, the WG - 04 - responsible for the survey of public institutions to be benefited.

The material resources and equipment estimated by the management group for the production of the Face Shield were PLA and ABS filaments, transparent acetate sheets, elastic bands, plastics, office supplies, and a 3D printer. The initial manufacturing of the face shields occurred through the purchase of resources raised through a voluntary donation by people sensitized through the dissemination of the project through social networks such as Facebook, Instagram, and WhatsApp and by partner companies from the private sector, corporate associations and, in a second moment, through a collective contribution made possible through the Internet and acquisition of consumables by UEFS.

This initial movement enabled the project to create sustainability and appropriation of additive manufacturing; however, the group still needed to acquire 3D printers, equipment that uses the technique called FFF (fused filament fabrication), high cost for printing the adjustable support crown to assemble the Face Shield kits.[10]

PPPG made the movement to acquire the 3D printers through contact with Higher Education Institutions of the State of Bahia through the Secretariat of Science and Technology and Innovation of the State of Bahia. PPPG obtained the authorization and loan of four 3D printers allocated in several campuses of State Universities of Bahia.

The printers were allocated in a space organized by the university, initially creating a laboratory to develop a production and distribution model of Face Shield with low cost, high quality, and simple assembly, using material resources available in the local market and virtual stores.

Four 3D printers were received. One of type GTMAX3D CORE H4® and three of type SETHI3D BB®, installed and assembled with the support of DFIS and collaboration of makers (Specialists in areas such as science, technology, architecture, engineering, and design) installed in Feira de Santana. ABS and PLA filaments of 1,75mm were acquired, and the potential for printing supports per day is up to 40 units since the support model was remodeled, making the equipment simpler, more economical, and faster to produce.

For Blazquez Tobias et al.[10], the 3D printer is defined as a machine capable of replicating three-dimensional objects from a 3D design. 3D printing, rapid prototyping, is a high-resolution method that starts from an image to be reconstructed, processed, and printed as a digital file.[11]

The adaptation of the production model and the Face Shield prototype was left to the discretion of two Ph.D. professors from DSAU and DFIS. The mask prototyping was composed of three parts: crown/rod (PLA/ABS filament), visor (transparent acetate sheet), an elastic band. The production model was saved on the 3D printer, with an average time for the crown/rod mask printing of 1 hour, initially printing 40 parts per day. The following figure illustrates the printer used and the prototype Face Shield initially printed.

**Figure 1.** 3D printer used for printing the Face Shield

Source: created by the authors, Feira de Santana, Bahia, Brazil, 2020.

The Face Shield works as an additional barrier for facial protection, which avoids mask contamination and increases its useful life, besides protecting the eyes and face4. The most widespread type in Brazil and the world is built with 3D Printing, composed of various materials such as ABS, PLA, PETg. The first two were the types chosen by the Project.

It is noteworthy that the PLA (polylactic acid) used is made from renewable sources and is not harmful to your health or the environment when the parts are discarded. On the other hand, ABS is a material widely used in industry. Its temperature resistance and shock absorption make it suitable for 3D printers. Because it has a low surface hardness, it becomes abrasive and easy to sand and has acetone as a solvent. If the part printed in ABS has an opaquer aspect, the acetone finish gives it more shine and can correct some imperfections that may be generated.[10,11]

**Execution stage: operationalization of the proposal**

The WG - 02 was responsible for attracting people to work voluntarily in the 3D printer printing line, production, and distribution of the personal protection technologies structured a multidisciplinary group composed of nurses, doctors, dentists, and pharmacists, mostly professors from the DSAU, and also students and administrative servers from the university, which were sized on a daily work schedule to supervise the printing of the rods/crowns, perform the face shield assembly, and participate in the distribution to public institutions.

The distribution was at the discretion of WG - 04, which surveyed the number of professionals per institution to benefit the city of Feira de Santana and the metropolitan region. A corporate email was also prepared to request extra demands so that no public institution would not receive the produced material. The goal was to expand the area of coverage in order to protect more professionals since face shields can significantly reduce the amount of exposure by inhalation of the virus.[4]

The physical space was divided into two areas, one for production line and assembly, the other for storage and distribution. The distribution was scheduled by the WG - 04, which took place in a space reserved for delivery, respecting the distance and the prevention measures established by the Ministry of Health. A form was produced with information for assembling the Face Shield, recommendations for disinfection of the material and disposal of protective devices in health services, and acquisition of spare parts, as illustrated below:

**Figure 2.** Instructions for use and maintenance of the Face Shield


Source: Created by the authors, Feira de Santana, Bahia, Brazil, 2020.

In the first fortnight referring to the stage of execution and operationalization of the proposal, between April 04 and 20, 2020, 206 Face Shield masks were produced. The slow production at the pace of 3D printers, faced with intense demand from work institutions, was an object of concern and discussion among the group, which aroused the interest of a civil society organization of philanthropic and humanitarian character along with a plastics industry to adopt the same production model of the project, however, using industrial machinery to produce in large scale the rods/crowns for the assembly and distribution of the face shields.

The partner company donated about 500 rods/crown and passed on the others at a low cost. The WG 3 was responsible for organizing the crowdfunding, as well as for enabling the participation of the company.

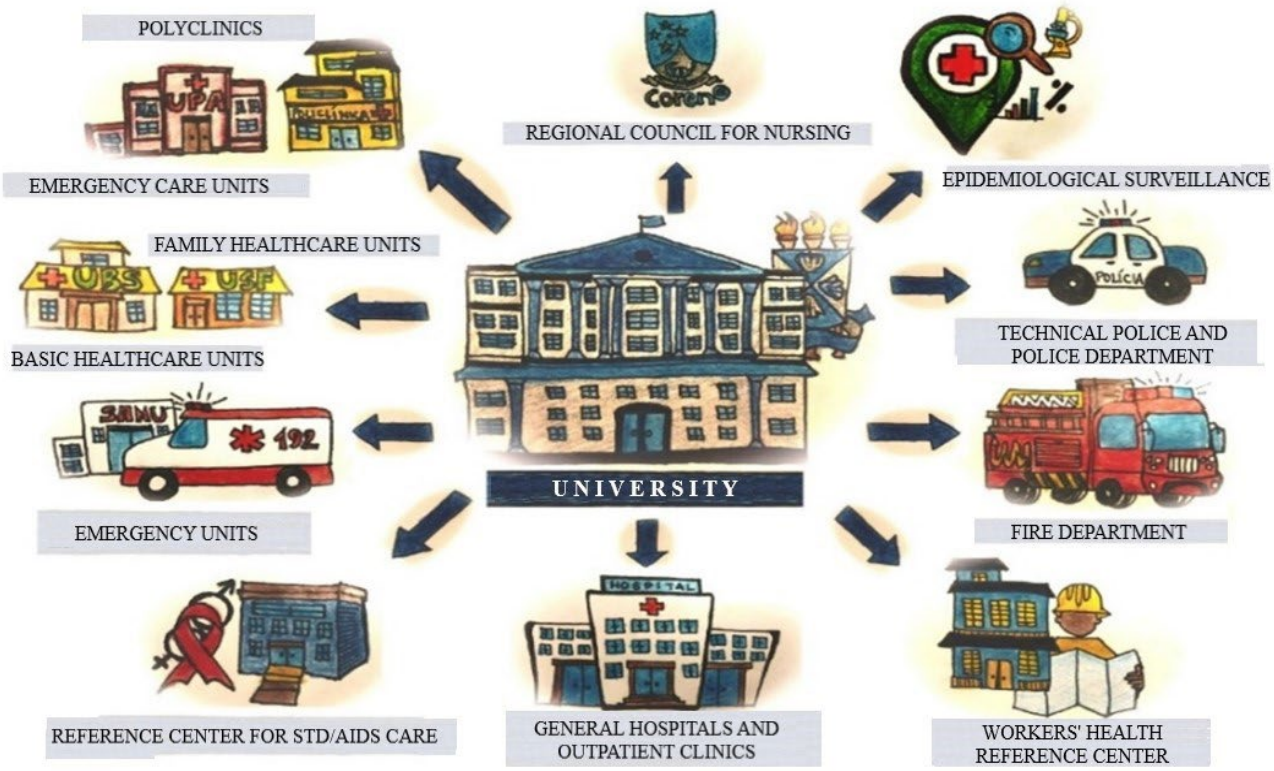
The partnership with the industry has enabled a significant increase in the production of face shields, allowing us to supply a large part of the municipality of Feira de Santana and the metropolitan region. From the project's start date (March 28) to May 31, 2020, 6227 (six thousand, two hundred and twenty-seven) face shields were produced, benefiting more than 90 work institutions and more than six thousand people who are performing actions that place them in situations of greater vulnerability for COVID-19.

**Stage of the distribution of the face Shields**

Among the public institutions that benefited are Family Health Units, Basic Health Units, Outpatient Clinics, Emergency Care Units, Polyclinics, Mobile Emergency Care Service (SAMU), Reference Center for STD/AIDS Care, hospital care such as General Hospitals, and also support services such as Epidemiological Surveillance, Technical Police Department, Police Officers, Fire Department, Workers' Health Reference Center (CEREST) and Regional Council for Nursing (COREN).

The input and output control was performed by the WG - 04, and all deliveries were logged to forecast and provide all available material used in the production of the face shields. In this phase, we had the support of the Municipal Health Secretary to inform the map of all services and the number of workers so that all could be contemplated with the face protector. It was up to the group to develop a distribution strategy to meet the health and support services both in Feira de Santana and in the metropolitan region. Figure 03 reinforces the social role of the public university in the pandemic scenario.

**Figure 3.** The university's social role with the community




Source: Fabricia Cristiane Santos Leite, 2020, Feira de Santana, Bahia, Brazil.

The project has enabled the participation of a multidisciplinary team composed of teachers from various areas of knowledge, students, technical-administrative staff, and volunteers in the making of technologies such as face shields, consolidating the involvement of the academic community in the university tripod in the actions of teaching, research, and extension.

In this way, it is understood that, through the use of the face shield, it was possible to contribute so that the front-line professionals fighting COVID-19 would follow the precepts of the biosafety standards recommended by NR 32, as well as the guidelines of the Ministry of Health, since the use of the face shield is included in a set of actions aimed at precaution and minimizing risks.[12]

Face shields can substantially reduce short-term exposure of healthcare workers to large infectious aerosol particles, but smaller particles may remain in the air longer and flow around the face shield more easily to be inhaled[4]. Therefore, we reiterate the recommendation for the adequate use of face shields as a complement for the workers' respiratory protection, already mentioned before.

Thus, one can observe the importance of using adequate PPE to avoid contamination. Synchronous to the provision of PPE, as described in this report, health services should adopt control actions to prevent the spread of the virus, such as the development of algorithms to guide health professionals in the correct use of PPE13, as well as structural adjustments in operational and clinical flows, promoting the monitoring of professionals and conducting continuous training, in addition to the constant encouragement of rigorous hand washing and maintenance of appropriate workplaces.[14-1]

## Final considerations

The university initiative was the driving force of the project, in which the research activities were initiated to produce new knowledge and improvement of existing technologies. This way it was possible to direct the actions for the production of the face shields, and the prototype of the rod/crown produced by the three-dimensional (3D) printer, and subsequent industrial production, which is customized and reusable, thus benefiting numerous health professionals.

It is understood that all the planned steps were successfully accomplished, and the goal was reached, strengthening the inseparable character between research, teaching, and extension of the university, responding to the demand for protection of workers against the pandemic, collaborating to reduce the spread of the virus among those who worked in the front line of the pandemic.

Thus, considering the shortage of facial shields that occurred during the pandemic of COVID 19, the manufacture of this equipment to overcome the deficit faced in Brazil and in Feira de Santana-Ba, without compromising the safety of health professionals who are on the front line was relevant and motivating, including to arouse the interest of other universities and people to develop solidary and scientifically valid actions for the benefit of the entire population, in this and/or future events, which require harmony, solidarity, and cooperation among all.

### Contributions of the authors

Santana TS, Carvalho ESS, Portela PP and Silva SSB participated in the conception and design of the article, discussion of the results, writing and critical review of its content and approval of the final version. Morais AC, Souza KEP and Marques JAM, Passos SSS participated in the conception and design of the article and in the discussion of the results.

### Conflict of interest

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

## References


1. Lana RM, Coelho FC, Gomes MFC, Cruz OG, Bastos LS, Villela DAM, et al. The novel coronavirus (SARS-CoV-2) emergency and the role of timely and effective national health surveillance. Cad. Saúde Pública. 2020;36(3):e00019620. https://doi.org/10.1590/0102-311X00019620

2. World Health Organization. Prioritizing diseases for research and development in emergency contexts [Internet]. Geneva: WHO; 2020. Available from: https://www.who.int/activities/prioritizing-diseases-for-research-anddevelopment-in-emergency-contexts

3. Ruiyun LI, Sen P, Bin C, Yimeng S, Tao Z, Wan Y, et al. Substantial undocumented infection facilitates the rapid dissemination of novel coronavirus (SARS-CoV2). Science. 2020;368(6490):489-93. https://doi.org/10.1126/science.abb3221

4. Perencevich EN, Diekema DJ, Edmond MB. Moving Personal Protective Equipment Into the Community: Face Shields and Containment of COVID-19. JAMA. 2020;323(22):2252–3. https://doi.org/10.1001/jama.2020.7477

5. Wu Z, McGoogan JM. Characteristics of and Important Lessons From the Coronavirus Disease 2019 (COVID-19) Outbreak in China: Summary of a Report of 72 314 Cases From the Chinese Center for Disease Control and Prevention. JAMA. 2020;323(13):1239–42. https://doi.org/10.1001/jama.2020.2648

6. Freitas ARR, Napimoga M, Donalisio MR. Assessing the severity of COVID-19. Epidemiol. Serv. Saúde. 2020;29(2):e2020119. https://doi.org/10.5123/s1679-49742020000200008

7. COVID-19: protecting health-care workers. Lancet. 2020; 395(10228):922. https://doi.org/10.1016/S0140-6736(20)30644-9

8. Prefeitura de Feira de Santana (Brasil), Secretaria Municipal de Saúde. Situação Epidemiológica dos casos da Doença pelo Coronavírus (COVID-19) em Feira de Santana [Internet]. Feira de Santana: Vigilância Epidemiológica; 2020. Available from: http://www.feiradesantana.ba.gov.br/coronavirus/Boletins/boletim-16-03.pdf

9. Vedovato TG, Andrade CB, Santos DL, Bitencourt SM, Almeida LP, Sampaio JF. Health workers and COVID-19: flailing working conditions? Rev. bras. saúde ocup. 2021;46:e1. https://doi.org/10.1590/2317-6369000028520

10. Tobías PJB, Palma LO, Salvador JM, Benito DS. Methodological proposal for the improvement of students learning process through the use of 3D printers as an educational resource in project-based learning. Psicol. Conoc. 2018;8(1)139-66. http://dx.doi.org/10.26864/pcs.v8.n1.8

11. Boll LFC, Rodrigues GO, Rodrigues CA, Bertollo FL, Irigoyen, MC, Goldmeier S. Using a 3D printer in cardiac valve surgery: a systematic review. Rev. Assoc. Med. Bras. 2019;65(6):818-24. https://doi.org/10.1590/1806-9282.65.6.818

12. Teixeira CFS, Soares CM, Souza EA, Lisboa ES, Pinto ICM, Andrade LR, et al. The health of healthcare professionals coping with the Covid-19 pandemic. Ciênc. saúde coletiva. 2020; 25(9):3465-34. https://doi.org/10.1590/1413-81232020259.19562020

13. Salomé GM. Algorithm for paramentation, deparamentation and prevention of facial injuries: covid-19. Rev Enferm Contemp. 2021;10(2):333-46. https://doi.org/10.17267/2317-3378rec.v10i2.3317

14. Silva OM, Cabral DB, Marin SM, Bitencourt JVOV, Vargas MAO, Meschial WC. Biosafety measures to prevent COVID-19 in healthcare professionals: an integrative review. Rev Bras Enferm. 2022;75(1):e20201191. https://doi.org/10.1590/0034-7167-2020-1191

15. Ministério da Saúde (Brasil), Secretaria de Vigilância em Saúde. Recomendações gerais para organização dos serviços de saúde e preparo das equipes de enfermagem [Internet]. Cofen; 2020. Available from: http://www.cofen.gov.br/wp-content/uploads/2020/04/cofen_covid-19_cartilha_v3-4.pdf