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Investigation of the Determining Questions in the Selection of Respiratory Masks in the Prevention of COVID Using the DEMATEL Method

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***Keywords*— Prevention of COVID-19, Respiratory protective equipment, Masks, Multicriteria methods, DEMATEL.**

***Abstract*—** *The World Health Organization recommends the use of respiratory protective equipment, in this context masks, as a way to alleviate the severe acute respiratory infection disease pandemic COVID19 (SARS-CoV-2). This recommendation was made to the general population, not just health professionals or people who are in direct contact with the sick. Generally speaking, there was a lot of publicity for the use of masks, but there was no disclosure of what would be the most important requirements to be considered for the choice. In this context, the objective of this work was to verify the understanding of the community in general about what are the important requirements in choosing a protective mask against pathogens. For this, an analysis was carried out in 200 scientific articles where it was possible to obtain five keywords related to the most important requirements when choosing a mask, namely: comfort, safety, cost, reuse and facial adjustment. An opinion poll was carried out in 4 groups, in which a weighting was requested for each keyword. The first group is composed of five health professionals and five teachers, the second of five students and people randomly chosen from the community. The objective is to study the influential criteria for the choice of respiratory protection equipment using the mathematical method Decision Making Trial and Evaluation Laboratory (DEMATEL) to demonstrate the influence relationship between the criteria. As a result, it was found that the group of professionals considers criteria related to safety and the group of non-professionals considers factors related to cost and reuse, and this demonstrates a higher risk of infection.*

I. INTRODUCTION

As the COVID-19 (SARS-CoV-2) disease pandemic progresses, a debate concerns the use of respiratory protective equipment (RPE), face masks, by healthcare professionals and individuals in the community enters the picture (Cheng et al., 2020). The use of face masks as part of a comprehensive strategy of measures to mitigate transmission (WHO, 2020; Brazil, 2005). That surgical masks are one of the administrative control measures, which aim to mitigate exposure to pathogens that cause numerous respiratory syndromes, including covid-19 (Brazil, 2005). This premise is confirmed by the National Institute for Occupational Safety and Health when it states that among the protection methods, the use

of personal protective equipment is one of the least effective means of prevention when compared to the use of collective protection equipment, imperative measures or actions that eliminate the danger (NIOSH, 2020), as shown in Figure 1.

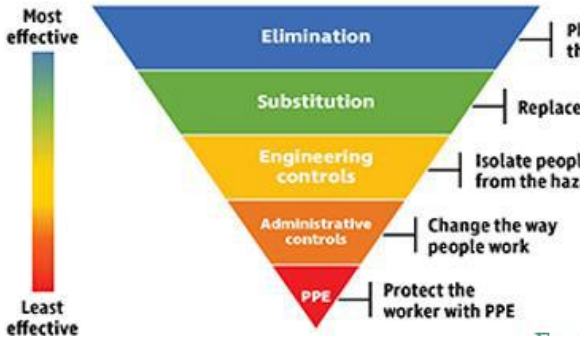

Fig.1 – Hierarchy of controls (NIOSH, 2020)

Cheng et al. (2020) corroborate this statement when they explain that there are concerns that the use of masks may generate a false sense of security in relation to other infection control methods, such as social distancing and hand washing.

For these reasons, it is important to highlight that the EPR does not eliminate the risk but contributes significantly to its mitigation (WHO, 2020; NIOSH, 2020). According to the National Health Surveillance Agency – ANVISA, there are several types of masks for different purposes. Some of them are used for respiratory protection for professionals and other masks have the main function of protecting the community in general, and each activity requires an appropriate type of mask (ANVISA, 2020).

Several types of EPR are being used at this time of pandemic in Brazil. It can be divided into three categories: a) Protective masks for non-professional use; b) Surgical masks and; c) Personal protective equipment (PPE) or respirators (ANVISA, 2020).

In relation to surgical masks, Anvisa Resolution RDC No. 356 (Brazil, 2020) provides, in an extraordinary and temporary way, on the requirements for the manufacture, import and acquisition of medical devices identified as priority for use in health services, due to the international public health emergency related to SARS-CoV-2. And in this resolution, the minimum and necessary conditions for the manufacture of surgical masks are presented.

According to Torloni and Vieira (2019), personal protective equipment or respirators are EPR that must have a Certificate of Approval, registration with ANVISA according to RDC 185/2001 (ANVISA, 2001) and be produced and tested by light of the standards ABNT NBR 13698 (ABNT, 2011).

Regarding non-professional use protection masks, which are a homemade option for protection, there are no standards or legislation available for their production. As a way to guide some good manufacturing, use and conservation practices, ANVISA made available a manual with basic guidelines (ANVISA, 2020). As this type of mask does not comply with a standard for the choice of raw material, design and standardized test criteria, its efficiency are questioned. It is a fact that this type of EPR, easily manufactured at home and reused after washing, raises concerns among authorities about the correct techniques of use, removal and disposal of facial masks, but these techniques can be learned through public education (Cheng et al., 2020).

From what has been said so far, the considerations presented refer to safety in choosing the mask. In another line of thought, studies are carried out considering the comfort of these EPRs. Fikenzer et al. (2020) carried out studies on the effect of RPR during exercise practice and its influence on cardiopulmonary capacity. In their studies Lee et al. (2020) examine the influencing factors that affect the comfort of reusable face masks. Liu et al. (2020) state that wearing masks for a long time alters subjective sensations if physiological reactions such as increased mean skin temperature, change in heart rate and reduced blood oxygen saturation decreases, which ultimately leads to a decline in health and comfort levels.

Regarding aspects of mask reuse, Rubio-Romero et al. (2020) carried out a scientific literature review to identify the main disinfection strategies and determine the effectiveness of masks. In similar studies Seresirikachorn et al. (2021) who outlined their research on N95 type masks, presented existing decontamination methods, and provided evidence-based recommendations for selecting an appropriate decontamination method. Pereira-Avila et al. (2020) draw attention to a risky practice for the reuse of this RPE, which increases the chance of transmission due to ineffective respiratory protection. New scientific evidence regarding the use and reuse of masks, which can be used to support the establishment of guidelines, public policies and educational strategies, promote the adoption of correct practices.

As noted by Pereira-Ávila et al. (2020) the proper use presents itself as a significant premise for the reduction of risk. In a case study of 373 Vietnamese subjects (15-47 years) Huynh (2020) noted that only 22.25% of respondents demonstrate proper EPR use based on WHO recommendations and suggest public communication policies and guidance on the proper use of a medical mask to contain the COVID-19 outbreak. In the same line of research, but for a group of health professionals, Bakhit et

al. (2021) identified, evaluated and synthesized studies evaluating the use of face masks.

The layout of the EPR, that is, the mask that fits perfectly to the face, is fully related to the risk of infection. According to Young et al. (2020) ill-fitting face masks pose risks when exposed to pathological agents. Adjustments to full face masks can help prevent fogging or slippage of the mask and increase test reliability.

A relevant aspect in choosing a type of EPR from the user's point of view is the cost, especially when it comes to non-professional use protection masks, as the cost of these are supported by users, unlike professionals supported by employers.

Based on what has been said so far, five items are considered when choosing an EPR, such as safety, comfort, cost, reuse and facial adjustment. In a survey conducted on abstracts of 200 scientific articles, between 2020 and 2021, it was observed that the items most cited by researchers are: 84% safety, 44% reuse, 34% comfort and 0% cost.

It is a fact that the perception of the significance of the judgment of which item is the most relevant for the choice of EPR varies according to the respondent. To solve this gap, multi-criteria analysis methods assist in this analysis and help decision makers to prioritize the processes of this action (Kijewska et al., 2018).

The Decision Making Trial and Evaluation Laboratory (DEMATEL) mathematical method is intended for the development and evaluation of a hierarchical structure based on expert opinion in order to obtain the level of relationship between complex variables (Li; Mathiyazhagan, 2018; Kijewska et al., 2018). Such methodology helps in the quantification and subjective judgments of respondents (Sara et al., 2015; Kijewska et al., 2018).

There are countless researches that use the DEMATEL methodology in the health areas. Suzan and Yavuzer (2020) studied the cause-and-effect relationships between diseases often seen in medicine. Chen and Li (2020) used patient influence factors to choose medical institutions based on three aspects: patients, medical institutions and government. Both studies aimed at causal classification and classification of the importance of relevant factors that influence these choices of items analyzed for decision making.

In addition to these researchers, many others have used the DEMATEL tool to investigate accidents, but it is clear that these applications are divided into sectors.

In the context presented so far, this study aims to propose an analysis of the decisive factors for choosing EPR, in two distinct groups (professionals and non-professionals) using the DEMATEL methodology that will contribute to mitigating the weight of bias in judgments (Altuntas; Dereli, 2015) of users in choosing the mask.

II. METHODOLOGY

The methodology of this proposal is presented in Figure 2, described as:

a) Initially, a bibliographic research is carried out in summaries of 200 articles, in a period between 2020 and 2021.

b) From this research, the keywords (K) are extracted.

c) Two groups are formed to answer the questions proposed in this study (Appendix 1). A group formed by professionals (5 health professionals, 5 teachers, defined as P1.1 to P1.10) and a group formed by non-professionals (5 people randomly chosen from society and 5 students, defined as P2.1 to P2.10). a) The DEMATEL methodology is applied, following the steps (Altuntas; Dereli, 2015; Li; Mathiyazhagan; 2018):

i. All K obtained are grouped in pairs for further analysis.

ii. Respondents are asked to assign a grade to each K obtained, using Table 1 as a reference, obtaining the direct degree of influence of the investigated causes. The notation aij indicates the degree is the presentation of the level of influence of the Kn compared in pairs in the analyst's view.

Table 1 – Raing Influence

Variable	Influence Score
No influence	0
Very low influence	1
Low influence	2
High influence	3
Very high influence	4

$$I = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{nn} \end{bmatrix}$$

iii. Construction of the Initial Matrix (Matrix I), according to Eq. (1). Eq. (1)

iii. Determination of the Initial Influence Matrix (Matrix Y), obtained by Equation 2.

$Y = k.I$ Eq. (2)

Where:

$$k = \frac{1}{\max_{1 \le i \le n} (max \sum_{i=1}^{n} (a_{ij}), max \sum_{j=1}^{n} (a_{ij}))}, \quad (i,j = 1,2..., n)$$

iii. Obtaining the Total Influence Matrix (T Matrix) by Equation 3.

$T = Y (I - Y)^{-1}$ Eq. (3)

Where I is the Identity Matrix

iv. Obtaining the thershold value (α) that will be compared to all elements of Matrix T, in order to analyze whether the elements are a cause or an effect. For the calculation of Linear Value, equations 4 to 6 were used.

$R_i = \sum_{j=1}^{n} (t_{ij}) = [t_i]_{nx1}$, (i,j = 1,2..., n) Eq. (4) $C_j = \sum_{i=1}^{n} (t_{ij}) = [t_j]_{nx1}$, (i,j = 1,2..., n) Eq. (5)

$$\alpha = \frac{\sum_{j=1}^{n} (t_{ij}) \sum_{i=1}^{n} (t_{ij}) [t_{ij}]}{N}$$ Eq. (6)

iv. Obtaining the prominence vector (Ri + Cj) and the relative vector (Ri - Cj).

v. Based on the value obtained from α, each element of the Matrix T is analyzed, and in this the classification “Cause” is obtained when the element presents a numerical value greater than or equal to the value of α, otherwise it is classified as “Effect”. This identity (Cause or effect) is obtained when (Ri - Cj) > 0 will be "Cause", otherwise, "Effect"

vi. Hierarchization of the "Causes" raised for further treatment of these "causes" or development of an action plan, practices that are present in an accident investigation. And this is defined by the prominence vector (Ri + Cj), in descending order.

vii. The Impact Diagram is prepared, based on the Matrix T, which represents a visible structural modeling (Fu et al., 2012) of the causes of accidents (criteria) that contribute directly or indirectly to the occurrence of the final event.

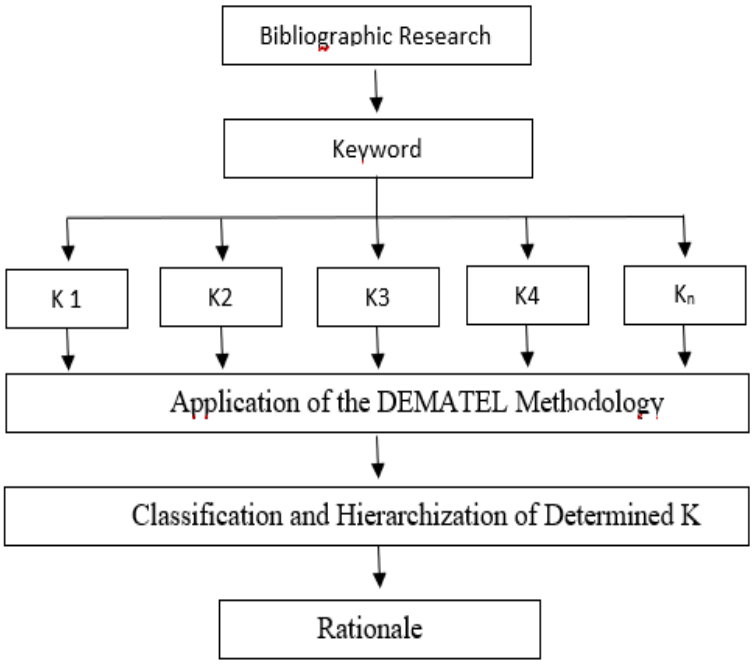

Fig.2: Research flowchart

III. RESULTS AND DISCUSSIONS

A survey was carried out, subdivided into two groups, professionals (5 health professionals, 5 teachers) and a group consisting of non-professionals (5 people randomly chosen from society and 5 students). The result of this research can be seen in Appendix 2 and 3, as well as the arithmetic means for each K in pairs.

With these K averages, the DEMATEL methodology was applied in order to classify and weight the observed events (Altuntas; Dereli, 2015; Li; Mathiyazhagan; 2018).

1.1 Group of Professionals

Construction of the Initial Matrix, presented in Table 2, using the information obtained in Appendices 2 and 3, and in pairs with the degree of influence between each K, demonstrates the effect that one criterion has on all the others.

Table 2 - Matrix I for the group of professionals

Criteria	K1.1	K1.2	K1.3	K1.4	K1.5
Safety (K1.1)	0	3,50	3,50	3,60	3,40
Comfort (K1.2)	2,80	0	3,30	3,50	3,00
Possibility of Reuse (K1.3)	2,30	2,60	0	2,50	2,60
Face Adjustment (K1.4)	3,80	3,10	2,60	0	3,40
Cost (K1.5)	3,00	1,90	2,50	2,20	0

Table 3 shows the Initial Influence Matrix (Matrix I).

Table 3 - Matrix Y for the group of professionals

Criteria	K1.1	K1.2	K1.3	K1.4	K1.5
K1.1	0,00	0,25	0,25	0,26	0,24
K1.2	0,20	0,00	0,24	0,25	0,21
K1.3	0,16	0,19	0,00	0,18	0,19
K1.4	0,27	0,22	0,19	0,00	0,24
K1.5	0,21	0,14	0,18	0,16	0,00

In Table 4, the matrix of total influence (Matrix T) is presented, as well as the value of α.

Table 4 - Matrix T for the group of professionals

Criteria	K1.1	K1.2	K1.3	K1.4	K1.5
K1.1	1,08	1,22	1,28	1,27	1,31
K1.2	1,16	0,93	1,18	1,18	1,20
K1.3	0,96	0,92	0,81	0,96	1,00
K1.4	1,23	1,14	1,17	1,01	1,25
K1.5	0,97	0,87	0,94	0,92	0,82
α = 1,07					

Table 5 shows the values of Ri, Cj, the prominence vector (Ri + Cj) and the relative vector (Ri - Cj) and the identities of each criterion are defined (Altuntas; Dereli, 2015; Li; Mathiyazhagan; 2018) . For the criteria classified as causes, positive values (Ri - Cj) mean that the degree of influential impact (Ri) is greater than the degree of influenced impact (Cj) (Li; Mathiyazhagan; 2018). It was then observed that events K1.1, K1.2 and K1.4 were classified as causes and K1.3

and K1.5 were classified as effect factors. The safety criterion (K1.1) is the most influential and this fact is justified by the main reason for using an EPR, which is prevention. Regarding comfort (K1.2), classified as cause, it is directly related to the need to use the EPR for long periods of time, a characteristic related to the analyzed group being professionals. This fact was observed by Liu et al. (2020) when they state that wearing masks for a long time alters subjective sensations. In his studies, Huynh (2020) observed that the correct fit on the face is a risk factor for infection, and this fact is observed when analyzing the degrees of influence of the fit on the face criterion (K1.4), that is, for the group of professionals this criterion is associated with security. When comparing the reuse (K1.3) and cost (K1.1) criteria, it is observed that both are classified as effects, that is, (Ri - Cj) negative, and this fact is justified due to the fact that the analyzed group does not bear with the cost of the EPR.

Table 5 - Identification of criteria identities for the group of professionals

Criteria	Ri	Cj	Ri + Cj	Ri - Cj	Identity
K1.1	6,17	5,40	11,56	0,77	**Cause**
K1.2	5,65	5,08	10,73	0,57	**Cause**
K1.3	4,65	5,39	10,04	-0,73	**Effect**
K1.4	5,81	5,34	11,15	0,47	**Cause**
K1.5	4,52	5,58	10,10	-1,07	**Effect**

Figure 3 presents the classification categorized into two groups, as a cause group and an effect group (Fu et al., 2012). In the same Figure, it is possible to verify the hierarchy of the group of professionals. And in this it is possible to observe that the criterion that proved to be more relevant was K1.1 (security) followed by K1.2 (comfort) and K1.4 (fit on the face).

Fig.3: Impact diagram and hierarchy of criteria for the group of professionals

1.2 Non-Professional Group

In an application similar to section 3.1, the methodology was applied to the Group of Non-Professionals. Tables 6 to 9 show the results of the DEMATEL methodology.

Table 6 - Initial matrix for the group of non-professionals

Criteria	K2.1	K2.2	K2.3	K2.4	K2.5
Safety (K2.1)	0	3,80	3,60	3,90	3,60
Comfort (K2.2)	3,00	0	4,00	3,60	2,00
Possibility of Reuse (K2.3)	3,10	3,70	0	3,60	3,30
Face Adjustment (K2.4)	4,00	2,60	1,90	0	2,60
Cost (K2.5)	3,30	3,00	3,70	2,70	0

Table 7 - Matrix I for the group of non-professionals

Criteria	K2.1	K2.2	K2.3	K2.4	K2.5
K2.1	0,00	0,26	0,24	0,26	0,24
K2.2	0,20	0,00	0,27	0,24	0,13
K2.3	0,21	0,25	0,00	0,24	0,22
K2.4	0,27	0,17	0,13	0,00	0,17
K2.5	0,22	0,20	0,25	0,18	0,00

Table 8 – Matriz T for the group of non-professionals

Criteria	K2.1	K2.2	K2.3	K2.4	K2.5
K2.1	1,40	1,58	1,57	1,65	1,43
K2.2	1,39	1,20	1,41	1,45	1,20
K2.3	1,48	1,48	1,28	1,54	1,33
K2.4	1,32	1,24	1,20	1,14	1,13
K2.5	1,42	1,38	1,42	1,43	1,09
α = 1,37					

Table 12 presents the values of the prominence and relative vectors and defines the identities of each criterion. It was then observed that the K2.1 and K2.3 criteria were classified as causes and the others as effects. Similar to the group of professionals, the safety criterion (K1.1) is the most influential and this fact is justified by the main reason for using an EPR, which is prevention. The comfort criterion (K2.2), for this group, was not considered an influencing factor for choosing a type of RPE, a fact that can be explained by the shorter time of use compared to the other group. Regarding the face fit criterion (K1.4), after applying the methodology, it was classified as an effect, and this fact can be explained by the lack of knowledge of this group regarding the correct sealing of the RPE on the face, which contributes to greater safety. This fact was also observed by Huynh (2020) who observed that the correct fit on the face is a risk factor for infection, which leads to an intensification of public communication policies and guidance on the proper use of EPR. When analyzing the reuse (K2.3) and cost (K2.1) criteria, it is observed that both are classified as causes, unlike the group of professionals, a fact explained by the fact that this group bears the costs of the EPR. This fact suggests a public communication program aiming to guide the filtration efficiencies of each type of EPR, since it is known that homemade masks do not offer the same degree of protection.

Table 9 - Identification of criteria identities for the group of non-professionals

Criteria	Ri	Cj	Ri + Cj	Ri - Cj	Identity
K2.1	7,62	7,01	14,63	0,60	**Cause**
K2.2	6,65	6,87	13,52	-0,23	**Effect**
K2.3	7,10	6,88	13,98	0,23	**Cause**
K2.4	6,03	7,20	13,23	-1,17	**Effect**
K2.5	6,73	6,17	12,90	0,57	**Cause**

Figure 4 shows the impact diagram that demonstrates the classification and hierarchy of criteria. It is noted that the K2.1 (security) criterion was more relevant, followed by the K.2.3 (reuse) and K2.5 (cost) criteria.

Fig.4: Diagram of impact and hierarchy of criteria for the group of non-professionals

IV. CONCLUSION

When comparing the findings of this study for the two groups, it is clear that there was a difference in influencing factors. The group of non-professionals tends to find greater security seen in the values obtained for K1.1, K1.2 and K1.4 and the other group considered the criteria related to the cost of the EPR, with the criteria K2.3 and K2 .5 obtained higher values. It is evident the lack of association of these criteria, in the group of non-professionals, the perfect fit to the face is a safety factor, as it provides a better seal and, consequently, better protection. As for the fact that this group elects the cost and reuse criteria as the most relevant, it can be pointed out as a greater risk of infection when considering that homemade masks have lower filtration efficiency and do not have efficiency assessment certifications. These two factors suggest a greater communication policy to the general population about the criteria for choosing an EPR based on its prevention effectiveness.

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REFERENCES

[1] Cheng, K. K., Lam, T. H., & Leung, C. C. (2020). Wearing face masks in the community during the COVID-19 pandemic: altruism and solidarity. *The Lancet*.National Association of Labor Attorneys.

[2] Brazil - Ministry of Labor and Employment (BR). Ordinance no. 485, of November 11, (2005). Approves Regulatory Norm No. 32 (Safety and Health at Work in Health Establishments). [accessed on Apr. 12, 2020] Available at: https://enit.trabalho.gov.br/portal/images/Arquivos_SST/SST_NR/NR-32.pdf.WHO. Advice on the use of mascks in the context of COVID-19 [Internet].

[3] WHO - World Health Organization; (2020). Available at: https://apps.who.int/iris/rest/bitstreams/1279750/retrieve. [accessed in April 2021]

[4] BRAZIL, National Health Surveillance Agency. GENERAL GUIDELINES – Facial masks for non-professional use. (2020). Available at: < https://agenciabrasilia.df.gov.br/wp-conteudo/uploads/2020/04/NT-M%C3%A1scaras-Tecido-Anvisa. pdf-2.pdf>. Accessed on Oct. 2020.

[5] NIOSH - National Institute for Occupational Safety and Health. (2020) Hierarchy of controls. Available at: <https://www.cdc.gov/niosh/topics/hierarchy/>. [Accessed in July 28 2020].

[6] ANVISA. National Health Surveillance Agency. (2020). Technical Note GVIMS/GGTES/ANVISA No. 04/2020. Guidelines for health services: prevention and control measures that should be adopted when assisting in suspected or confirmed cases of infection by the new coronavirus (SARS-CoV-2) [Internet]. Brasília: National Health Surveillance Agency; 2020 [updated 2020 Mar 31]. Available from: http://portal.anvisa.gov.br/documents/33852/271858/Note+T%C3%A9cnica+n+04-2020+GVIMS-GGTES-ANVISA/ab598660-3de4-4f14-8e6f-b9341c196b28.

[7] Fikenzer, S., Uhe, T., Lavall, D., Rudolph, U., Falz, R., Busse, M., ... & Laufs, U. (2020). Effects of surgical and FFP2/N95 face masks on cardiopulmonary exercise capacity. *Clinical Research in Cardiology*, *109*(12), 1522-1530. https://doi.org/10.1007/s00392-020-01704-y.

[8] Lee, K. P., Yip, J., Kan, C. W., Chiou, J. C., & Yung, K. F. (2020). Reusable face masks as alternative for disposable medical masks: factors that affect their wear-comfort. *International Journal of Environmental Research and Public Health*, *17*(18), 6623. https://doi.org/10.3390/ijerph17186623.

[9] Rubio-Romero, J. C., del Carmen Pardo-Ferreira, M., Torrecilla-García, J. A., & Calero-Castro, S. (2020). Disposable masks: Disinfection and sterilization for reuse, and non-certified manufacturing, in the face of shortages during the COVID-19 pandemic. *Safety science*, *129*, 104830. https://doi.org/10.1016/j.ssci.2020.104830.

[10] Seresirikachorn, K., Phoophiboon, V., Chobarporn, T., Tiankanon, K., Aeumjaturapat, S., Chusakul, S., & Snidvongs, K. (2021). Decontamination and reuse of surgical masks and N95 filtering facepiece respirators during the COVID-19 pandemic: A systematic review. *Infection Control & Hospital Epidemiology*, *42*(1), 25-30. https://doi.org/10.1017/ice.2020.379.

[11] Pereira-Ávila, F. M. V., Lam, S. C., Góes, F. G. B., Gir, E., Pereira-Caldeira, N. M. V., Teles, S. A., ... & Bazilio, T. R. (2020). Factors associated with the use and reuse of face masks among Brazilian individuals during the COVID-19 pandemic. *Revista latino-americana de enfermagem*, *28*. https://doi.org/10.1590/1518-8345.4604.3360**.**

[12] Huynh, T. L. D. (2020). "If You Wear a Mask, Then You Must Know How to Use It and Dispose of It Properly!": A Survey Study in Vietnam. *Review of Behavioral Economics*, *7*(2), 145-158. http://dx.doi.org/10.1561/105.00000121.

[13] Bakhit, M., Krzyzaniak, N., Scott, A. M., Clark, J., Glasziou, P., & Del Mar, C. (2021). Downsides of face masks and possible mitigation strategies: a systematic review and meta-analysis. *BMJ open*, *11*(2), e044364. http://dx.doi.org/10.1136/bmjopen-2020-044364

[14] Kijewska, K., Torbacki, W., & Iwan, S., 2018. Application of AHP and DEMATEL Methods in Choosing and Analyzing the Measures for the Distribution of Goods in Szczecin Region. Sustainability, 10 (7), 2365. https://doi.org/10.3390/su10072365.

[15] Li, Y., & Mathiyazhagan, K.,2018. Application of DEMATEL approach to identify the influential indicators towards sustainable supply chain adoption in the auto components manufacturing sector. Journal of cleaner production, 172, 2931-2941. https://doi.org/10.1016/j.jclepro.2017.11.120

[16] Sara, J.; Stikkelman, R.M .; Herder, P.M., 2015. Assessing relative importance and mutual influence of barriers for CCS deployment of the ROAD project using AHP and DEMATEL methods. Int. J. Greenh. Gas Control, 41, 336–357. https://doi.org/10.1016/j.ijggc.2015.07.008.

[17] Suzan, V., & Yavuzer, H. (2020). A Fuzzy Dematel Method To Evaluate The Most Common Diseases In Internal Medicine. *International Journal of Fuzzy Systems*, *22*(7), 2385-2395. https://doi.org/10.1007/s40815-020-00921-x

[18] Chen, P., & Li, Y. (2020). Study on the management of patients' choice of medical institutions based on DEMATEL method. In *2019 International Conference on Management Science and Industrial Economy (MSIE 2019)*. Atlantis Press. https://doi.org/10.2991/msie-19.2020.45.

[19] Torloni , M. Vieira, A.V. Manual of respiratory protection. (2019).São Paulo: ABHO, 518p.

[20] Altuntas, S., & Dereli, T., 2015. A novel approach based on DEMATEL method and patent citation analysis for prioritizing a portfolio of investment projects. Expert Systems with Applications, 42 (3), 1003-1012. https://doi.org/10.1016/j.eswa.2014.09.018.

[21] Young, S. L., Smith, M. L., & Tatham, A. J. (2020). Visual field artifacts from face mask use. *Journal of Glaucoma*, *29*(10), 989-991. https://doi.org/10.1097/IJG.0000000000001605.

[22] Fu, X., Zhu, Q., & Sarkis, J. (2012). Evaluating green supplier development programs at a telecommunications systems provider. International Journal of Production Economics, 140(1), 357-367.

[23] ANVISA. National Health Surveillance Agency.. (2001). Resolution RDC No. 185, of October 22, 2001. Approves the Technical Regulation contained in the annex to this Resolution, which deals with the registration, alteration, revalidation and cancellation of the registration of medical products with the National Health Surveillance Agency - ANVISA. Official Gazette [of] the Federative Republic of Brazil, Executive Branch, Brasília, DF, Executive Branch, 22 oct. 2001.

[24] Liu, C., Li, G., He, Y., Zhang, Z., & Ding, Y. (2020, July). Effects of wearing masks on human health and comfort during the COVID-19 pandemic. In *IOP Conference Series: Earth and Environmental Science* (Vol. 531, No. 1, p. 012034). IOP Publishing.

[25] ABNT/NBR. 13698: 2011. Brazilian Association of Technical Standards (ABNT). Respiratory protection

equipment-Filtering half face piece for particles. ICS ISBN, p. 978-85.

Appendix 1

Name of respondent:

Does the respondent authorize the disclosure of their name in the article and TCC? Yes No ( )

1- In your opinion, what are the most important items when choosing an EPR to protect COVID-19?

2- Using Table 1 as a reference, answer:

Table 1 – Raing Influence

Variable	Influence Score
No influence	0
Very low influence	1
Low influence	2
High influence	3
Very high influence	4

Influence Relationship	**Score**
Safety & Comfort	
Safety & Possibility of Reuse	
Safety & Face Adjustment	
Safety & Cost	
Comfort & Safety	
Comfort & Possibility of Reuse	
Comfort & Face Adjustment	
Comfort & Cost	
Possibility of Reuse & Safety	
Possibility of Reuse & Comfort	
Possibility of Reuse & Face Adjustment	
Possibility of Reuse & Cost	
Face Adjustment & Safety	
Face Adjustment & Comfort	
Face Adjustment & Possibility of Reuse	
Face Adjustment & Cost	
Cost & Safety	
Cost & Comfort	
Cost & Possibility of Reuse	
Cost & Face Adjustment e Cost	

Appendix 2 – Grouping of Research Results – Professional Group

Influence Relationship	**P1.1**	**P1.2**	**P1.3**	**P1.4**	**P1.5**	**P1.6**	**P1.7**	**P1.8**	**P1.9**	**P1.10**	**Average**
Safety & Comfort	3	4	4	3	4	3	3	3	4	4	3,50
Safety & Reuse	4	3	3	3	3	4	4	4	3	4	3,50
Safety & Adjustment	4	3	4	3	4	3	4	3	4	4	3,60
Safety & Cost	3	2	3	3	3	4	4	4	4	4	3,40
Comfort & Safety	3	2	3	3	3	2	4	3	2	3	2,80
Comfort & Reuse	2	4	4	3	2	4	4	2	4	4	3,30
Comfort & Adjustment	3	4	4	3	2	4	4	3	4	4	3,50
Comfort & Cost	3	4	2	3	2	4	2	2	4	4	3,00

Reuse & Safety	1	3	1	2	3	2	2	3	3	3	2,30
Reuse & Comfort	2	3	3	1	3	4	2	3	2	3	2,60
Reuse & Adjustment	1	3	3	1	2	4	2	3	3	3	2,50
Reuse & Cost	2	2	3	1	3	3	2	3	4	3	2,60
Adjustment & Safety	4	4	4	4	4	4	4	2	4	4	3,80
Adjustment & Comfort	4	4	2	3	3	3	4	3	2	3	3,10
Adjustment & Reuse	4	3	2	3	2	2	3	2	3	2	2,60
Adjustment & Cost	4	3	4	4	2	3	4	3	4	3	3,40
Cost & Safety	1	3	3	2	3	4	3	4	3	4	3,00
Cost & Comfort	2	2	2	0	2	3	2	1	3	2	1,90
Cost & Reuse	2	4	3	1	2	2	2	4	3	2	2,50
Cost & Adjustment	1	3	2	1	2	3	2	3	3	2	2,20

Appendix 3 – Grouping of Research Results – Non-Professional Group

Influence Relationship	**P1.1**	**P1.2**	**P1.3**	**P1.4**	**P1.5**	**P1.6**	**P1.7**	**P1.8**	**P1.9**	**P1.10**	**Average**
Safety & Comfort	4	3	4	4	4	4	3	4	4	4	3,80
Safety & Reuse	4	3	3	4	3	4	4	4	3	4	3,60
Safety & Adjustment	4	3	4	4	4	4	4	4	4	4	3,90
Safety & Cost	4	3	3	4	3	4	4	4	3	4	3,60
Comfort & Safety	3	3	3	4	3	2	4	3	2	3	3,00
Comfort & Reuse	4	4	4	4	4	4	4	4	4	4	4,00
Comfort & Adjustment	4	3	4	3	3	4	4	3	4	4	3,60
Comfort & Cost	1	3	2	3	2	1	2	2	2	2	2,00
Reuse & Safety	3	3	4	3	3	2	4	3	3	3	3,10
Reuse & Comfort	4	4	3	3	3	4	4	4	4	4	3,70
Reuse & Adjustment	3	4	3	4	4	4	3	4	3	4	3,60
Reuse & Cost	4	3	3	3	3	3	4	3	4	3	3,30
Adjustment & Safety	4	4	4	4	4	4	4	4	4	4	4,00
Adjustment & Comfort	2	3	2	3	3	3	2	3	2	3	2,60
Adjustment & Reuse	2	2	2	2	2	2	1	2	2	2	1,90
Adjustment & Cost	2	3	3	3	2	3	2	3	2	3	2,60
Cost & Safety	3	4	3	4	3	4	3	4	3	2	3,30
Cost & Comfort	4	3	2	3	4	3	2	3	4	2	3,00
Cost & Reuse	4	4	3	4	4	4	2	4	4	4	3,70
Cost & Adjustment	2	4	3	2	2	4	2	4	2	2	2,70