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RESEARCH ARTICLE
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Compare the Effectiveness of Positive Results Between N95 Respirators and Medical Masks in the COVID-19 Pandemic: A Meta-analysis and Systematic Review

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ABSTRACT

Objective: According to recent studies and systematic review and meta-analysis, there is not enough evidence to determine which has a positive effect on COVID-19 epidemics, and the number of articles is very low. Therefore, the present study aims to compare the efficiency of positive results between N95 respirators and medical masks.

Methods: Among the electronic databases, we selected Cochrane Library, PubMed, ISI, and Embas for systematically review the publications from 2010 to 2020. We then applied a software program called Endnote X8 to investigate the electronic topics and used mesh terms and concepts for searching. Log risk-ratio between both groups (N95 respirators & medical masks) with 95% confidence interval (CI), Mantel-Haenszel method as well as fixed effect model were computed. Moreover, we employed a commercial software program called Comprehensive Meta-Analysis Stata 16 for evaluating forest plots and meta-analysis.

Results: Totally, we observed 27 abstracts and topics with the potential relevance in the course of the manual and electronic searches so that three papers matched our inclusion criteria for performing a systematic review. Risk ratio equaled (RR, 0.01 95% CI 0.00, 0.02. P= 0.07), showing that using N95 respirators and medical masks did not significantly differ in preventing respiratory viral infections. Moreover, Using N95 respirators and medical masks did not significantly differ in preventing bacterial colonization (p=0.02).

Conclusion: This research revealed a positive impact of both N95 respirators and medical masks for COVID-19.

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INTRODUCTION

In December 2019, some evidence reported 2019 novel coronavirus (2019-nCoV) infection in Wuhan, China,[1] and spread quickly in China and several other countries.[2] The World Health Organization (WHO), at February 11, 2020, reported a modern term for the epidemic disease due to 2019-nCoV: Corona Virus Disease (COVID-19). Earlier investigations confirmed its transmission from animals to human beings; however, other investigations also referred to the human-to-human transmission of COVID-19 via direct contacts or droplets.[3, 4] Therefore, the International Committee on Taxonomy of Infections also named the acute respiratory syndrome coronavirus-2, SARS-CoV-2.[5] According to the latest statistics (May 30, 2020), more than 5,931,963 cases have been reported so far.[6] Increased risk of morbidity and mortality in Pneumonia can directly relate to Chronic Obstructive Pulmonary Disease (COPD).[7] Immune system disorders, microbial imbalances, changes in local inflammation, persistent mucus production, and the use of inhaled corticosteroids can all contribute to Pneumonia.[8] The SARS-CoV-2 mortality rate is reported to be about 10%.[1] vaccination or specific anti-infective treatments has not been available since the advent of SARS-CoV-2, and this doubles the vital importance of diminishing the infection risks; SARS-CoV-2 also affects the respiratory system.[7] N95 respirators would be employed for

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preventing inhalation of fine airborne particles. The medical mask is also designed to protect against the transmission of microorganisms, both of which should fit the consumer's face.[8] However, medical masks cannot prevent inhalation; they just play a protective role.[9] WHO recommends using a medical mask when the risk is low, and N95 respirators are recommended in high-risk situations. It is noteworthy that the use of both is recommended in the Centers for Disease Control and Prevention (CDC).[10] However, medical masks may be used more due to limited resources.[10] According to recent studies and systematic review and meta-analysis, there is not enough evidence to determine which has a positive effect on COVID-19 epidemics, and the number of articles is very low. Therefore, the present study aims to compare the efficiency of positive results between medical masks and N95 respirators.

METHOD

Search strategy

Among the electronic databases, we selected Cochrane Library, PubMed, ISI, and Embas for systematically review the publications from 2010 to 2020. We then applied a software program called Endnote X8 to investigate the electronic topics and used mesh terms and concepts for searching. We used the following mesh concepts and terms for searching: ((((("COVID-19 vaccine" [Supplementary Concept]) AND "Ventilators, Mechanical"[Mesh]) AND "Masks"[Mesh]) OR "Respiratory Protective Devices"[Mesh]) AND "Influenza, Human"[Mesh]) AND "Severe Acute Respiratory Syndrome"[Mesh]. The present systematic review is based on the major concern of the Statement-Preferred Reporting Items for the Systematic Review and Meta-analysis (PRISMA),[11] as well as PECO or PICO approach (see Table 1).

Criteria for selecting the studies

Criteria for including the publications

1. Controlled clinical trials, retrospective and prospective cohort studies, and randomized controlled trial studies.
2. Complete outcome of interventions
3. Compere N95 respirators vs. medical masks in English

Exclusion criteria

1. *In-vitro* studies, case reports, reviews, and case studies.
2. Animal studies

Data Extraction and analysis method

We extracted the required data from the obtained publications about the studies, year of publication, research design, Number of Patients, and Range and or mean of the participant's age, Undertake hand washing after touching a patient, Undertook high-risk procedure. Then, we used Cochrane Collaboration's tool for assessing the research quality.[12] Results have shown the scale score for lower risk was one and for higher unclear risks equaled 0. The scale score ranged between 0 and 6 so that the greater score implies the greater quality of the studies. In order to extract the data, we selected two reviewers who blindly and individually dealt with the data extraction from the respective abstracts and full texts of publications.

Table 1: PECO or PICO approach

PECO or PICO approach	*Descriptions*
P	Participants: Patients with influenza/ respiratory viral infections
E	Exposure/ Intervention: Used medical masks & N95 respirators.
C	Comparison: effectiveness of results between medical masks & N95 respirators.
O	Outcome: laboratory-approved infection

We computed log risk-ratio between both groups (N95 respirators & medical masks) with 95% CI, Mantel-Haenszel method, and fixed-effect model. In the next step, we applied random effects for addressing the possible heterogeneity so that I2 implied heterogeneity. As mentioned earlier, a commercial software program called the Comprehensive Meta-Analysis Stata 16 was applied for evaluating the forest plots and meta-analysis.

RESULTS

As mentioned above, we found 27 important abstracts and topics. Initially, 18 research were chosen with regard to the abstracts and titles. Then, we fully evaluated the detailed full-text studies of the remaining six publications to exclude 3 of them due to the absence of the specified criteria to be included in the study. In the next step, three papers matched the above criteria (Figure 1). Table 2 gives each study in our meta-analysis.

Sample size

We selected three papers (the randomized controlled trials) for the present review, whose participants were 7802 with the mean of age of 36.33 years.

N95 respirators

We selected three papers (the randomized controlled trials) for the present review. There were 574 and 3491 male and female participants, respectively, 4070 with a mean of age 33.33 years and 1056 Undertake hand washing after touching a patient. Also, 3434 Undertook high-risk procedure.

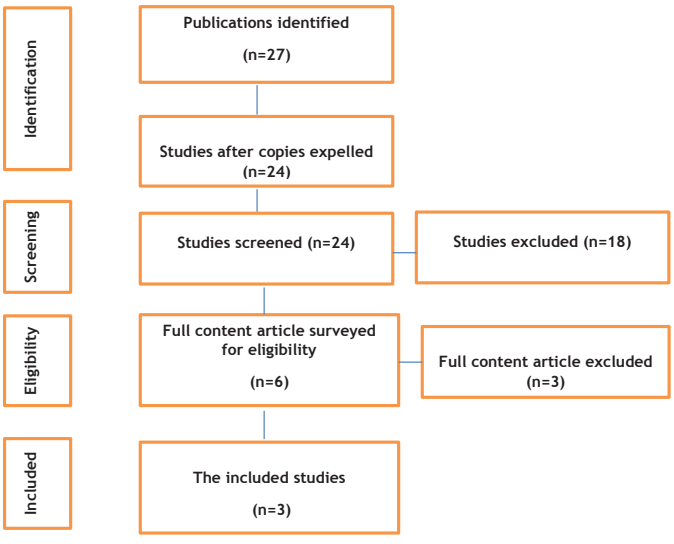

Fig. 1: Study Attrition

Medical masks

We selected three papers (the randomized controlled trials) for the present review. There were 569 and 3163 male and female participants, respectively, 3732 with a mean of age 35.66 years and 1324 Undertake hand washing after touching a patient. Also, 3276 Undertook high-risk procedure.

Bias assessment

Using the Cochrane Collaboration tool, one study received a total score equal to 5.6; two studies had a total score equal to 3/6, which confirm the moderate bias risk in each study (Table 3).

Laboratory-confirmed influenza

Risk ratio equaled (RR, 0.11 95% CI 0.10, 0.13. P = 0.00) from 3 investigations and heterogeneity equaled (I2 = 99.85%; P =0.00) (figure 2). Therefore, no significant differences were observed between using N95 respirators and medical masks of preventing influenza (p=0.00).

Laboratory-confirmed respiratory viral infections

Risk ratio equaled (RR, 0.01 95% CI 0.00, 0.02. P= 0.07) from two papers (figure 3). This result did not show any statistically significant differences between using the medical masks and N95 respirators to prevent respiratory viral infections (p=0.07).

Laboratory-confirmed bacterial colonization

Risk ratio equaled (RR, 0.04 95% CI 0.01, 0.08. P= 0.02) in one paper (figure 4). This result showed the statistically significant differences between using the medical masks and N95 respirators of prevention of bacterial colonization (p=0.02).

Laboratory-confirmed respiratory infection

Risk ratio equaled (RR, -0.01 95% CI -0.03, 0.01. P = 0.53) in one study (figure 5). This result did not show any statistically significant differences between using the medical masks and N95 respirators to prevent bacterial colonization (p=0.53).

DISCUSSION

Results obtained from our meta-analysis and present systematic review show in lab-approved influenza and lab-approved bacterial colonization outcomes, statistically significant differences were observed between using the medical masks and N95 respirators. Also, we did not observe any statistically significant differences between using the medical masks and N95 respirators in the lab-approved respiratory viral infections and the lab-approved respiratory infection outcomes. As shown in a meta-analysis and systematic review conducted by Long et al.,[16] they did not find any significant difference in preventing lab-approved influenza, lab-approved respiratory

Table 2: Details of selected studies

		Number of Patients				*Mean/ Range of age*		*Undertake hand washing after touching a patient*		*Undertook high-risk procedure*	
		N95.G		*MedM.G*							
Study. Year	*Design*	*M*	*F*	*M*	*F*	*N95.G*	*MedM.G*	*N95.G*	*MedM.G*	*N95.G*	*MedM.G*
Radonovich et al. 2019[13]	RCT	5180				43	43	183	204	2511	2667
		2512		2668							
		378	2134	420	2248						
MacIntyre et al. 2013 [14]	RCT	1669				34.20	31.34	759	417	815	408
		1097		572							
		151	941	92	480						
MacIntyre et al. 2011 [15]	RCT	953				32	33	382	435	108	201
		461		492							
		45	416	57	435						

Table 3: Risks of bias assessment.

Studies	*Random sequence generation*	*Allocation concealment*	*Blinding of the patients and employees*	*Blinding of outcomes' evaluation*	*Uncompleted outcome data*	*Selective reporting*	*Total score*
Radonovich et al. 2019 [13]	+	?	+	+	+	+	5
MacIntyre et al. 2013 [14]	+	?	?	?	+	+	3
MacIntyre et al. 2011 [15]	+	?	-	?	+	+	3

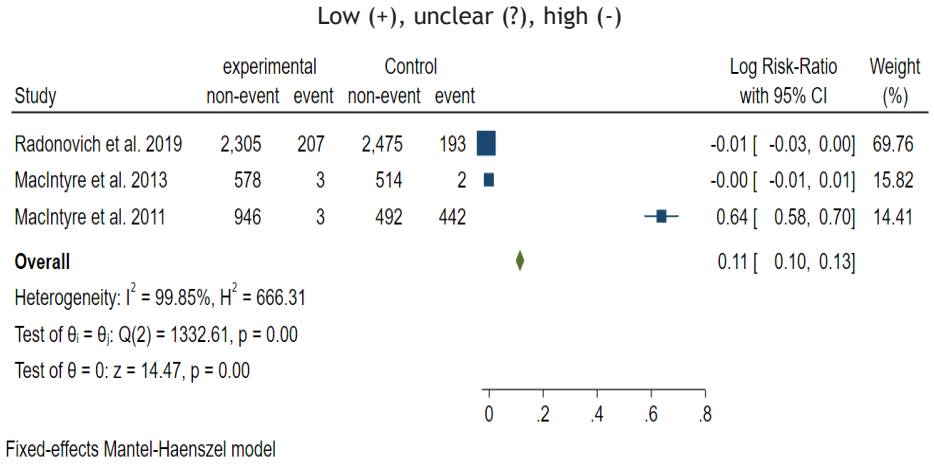

Fig. 2: Forest plots showed laboratory-confirmed influenza outcomes.

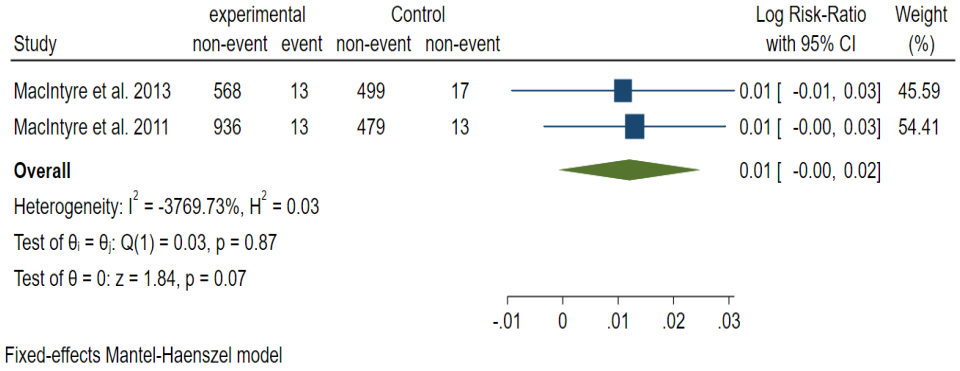

Fig. 3: Forest plots showed laboratory-confirmed respiratory viral infections outcomes.

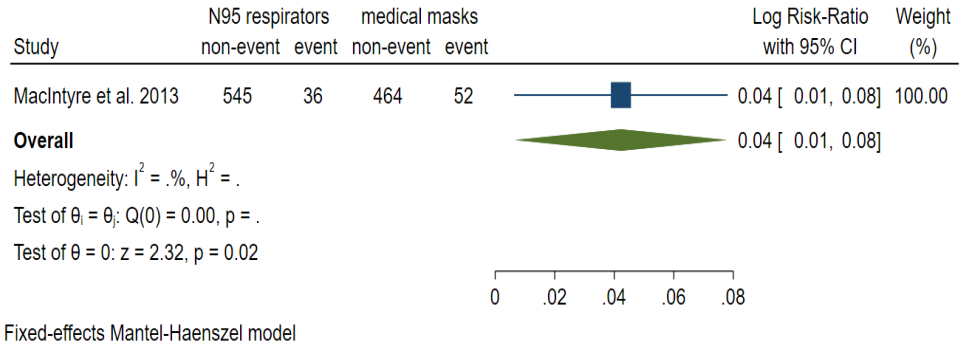

Fig. 4: Forest plots showed laboratory-confirmed bacterial colonization outcomes.

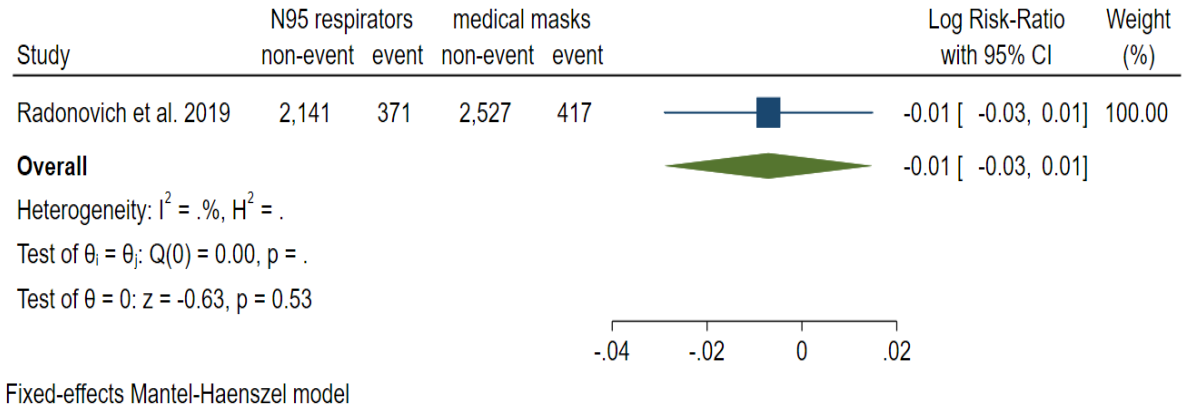

Fig. 5: Forest plots showed laboratory-confirmed respiratory infection outcomes.

viral infections, lab-approved respiratory infection as well as influenza in the use of the medical masks and N95 respirators. Which in some findings may match our review. The other meta-analysis and systematic review showed by Bartoszko et al.[17] referred to the same level of protection of the N95 respirators and medical masks against viral respiratory infections. These similar positive impacts of medical masks and N95 respirators in preventing viral infections can also be attributed to COVID-19.[18] However, In interventional studies, N95 respirators may be superior.[19] Evidence suggests that using the N95 respirators is much lower than a medical mask because it is not easy to use, and the person does not feel comfortable.

Nonetheless, experts in the field have initially presented the medical mask for protection, but the N95 respirators, in addition to their protective role, also prevent the passage of small particles.[20] In the present study, the number of articles used was very small, which is one of the limitations of the present study. Further studies are needed in this field, especially now that COVID-19 is widespread and has become a global problem. Another limitation of studies is the low focus on society, which should be addressed in future research. For this purpose, data analysis is unreliable and maybe one of the reasons for differences in the results of meta-analysis studies. In the present study, RCTs were slightly included in the study because there were no RCTs in the intended time frame. In general, it seems that these results can also be used for COVID-19 epidemics.

CONCLUSION

This review determined the positive impacts of both N95 respirators and medical masks for the COVID-19 pandemic. However, applying the N95 respirator is not suitable for the general public, and it is recommended that hospital staff who are at risk of coagulation use N95 respirators; the use of a medical mask has similar effects.

REFERENCES

1. Aponte Mendez, M., Rivera Marval, E. K., Talebzade Toranji, M., Amini, F., & Casaroto, A. R. (2020). Dental care for patients during the Covid-19 outbreak: a literature review. International Journal of Scientific Research in Dental and Medical Sciences, 2(2), 42-45. doi:10.30485/IJSRDMS.2020.232096.1058.
2. Thompson, R. (2020). Pandemic potential of 2019-nCoV. The Lancet Infectious Diseases, 20(3), 280. DOI:https://doi.org/10.1016/S1473-3099(20)30068-2.
3. Casaroto, A. R., Jamali, J., Amini, F., Talebzade Toranji, M., & Kayasöken, G. (2020). Evaluating Epidemiology, Symptoms, and Routes of COVID-19 for Dental Care: A Literature Review. International Journal of Scientific Research in Dental and Medical Sciences, 2(2), 37-41. doi: 10.30485/IJSRDMS.2020.231680.1056.
4. Baghizadeh Fini, M., Seraj, B., & Ghadimi, S. (2020). COVID-19 in Pediatric Patients: A Literature Review. International Journal of Scientific Research in Dental and Medical Sciences, 2(4), 126-130. doi: 10.30485/ijsrdms.2020.246164.1083.
5. Wei, F. F., Moradkhani, A., Hemmati Hezaveh, H., Miraboutalebi, S. A., & Salehi, L. (2020). Evaluating the treatment with favipiravir in patients infected by COVID-19: a systematic review and meta-analysis. International Journal of Scientific Research in Dental and Medical Sciences, 2(3), 87-91. doi: 10.30485/IJSRDMS.2020.241494.1079.
6. COVID, C. (19). global cases by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU).
7. Chen, X., Chughtai, A. A., & MacIntyre, C. R. (2017). Herd protection effect of N95 respirators in healthcare workers. Journal of International Medical Research, 45(6), 1760-1767. https://doi.org/10.1177/0300060516665491.
8. Zhiqing, L., Yongyun, C., Wenxiang, C., Mengning, Y., Yuanqing, M., Zhenan, Z., ... & Zanjing, Z. (2018). Surgical masks as source of bacterial contamination during operative procedures. Journal of orthopaedic translation, 14, 57-62. https://doi.org/10.1016/j.jot.2018.06.002.
9. Sandaradura, I., Goeman, E., Pontivivo, G., Fine, E., Gray, H., Kerr, S., ... & Andresen, D. (2020). A close shave? Performance of P2/N95 respirators in healthcare workers with facial hair: results of the BEARDS (BEnchmarking Adequate Respiratory DefenceS) study. Journal of Hospital Infection, 104(4), 529-533. https://doi.org/10.1016/j.jhin.2020.01.006.
10. Chughtai, A. A., Seale, H., Islam, M. S., Owais, M., & Macintyre, C. R. (2020). Policies on the use of respiratory protection for hospital health workers to protect from coronavirus disease (COVID-19). International journal of nursing studies, 105, 103567. doi: 10.1016/j.ijnurstu.2020.103567.
11. Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., Altman, D., Antes, G., ... & Tugwell, P. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement (Chinese edition). Journal of Chinese Integrative Medicine, 7(9), 889-896. https://doi.org/10.1371/journal.pmed.1000097.
12. Higgins, J. P., Altman, D. G., Gøtzsche, P. C., Jüni, P., Moher, D., Oxman, A. D., ... & Sterne, J. A. (2011). The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. Bmj, 343. doi: https://doi.org/10.1136/bmj.d5928.
13. Radonovich, L. J., Simberkoff, M. S., Bessesen, M. T., Brown, A. C., Cummings, D. A., Gaydos, C. A., ... & Perl, T. M. (2019). N95 respirators vs medical masks for preventing influenza among health care personnel: a randomized clinical trial. Jama, 322(9), 824-833. doi:10.1001/jama.2019.11645.
14. MacIntyre, C. R., Wang, Q., Seale, H., Yang, P., Shi, W., Gao, Z., ... & Dwyer, D. E. (2013). A randomized clinical trial of three options for N95 respirators and medical masks in health workers. American journal of respiratory and critical care medicine, 187(9), 960-966. https://doi.org/10.1164/rccm.201207-1164OC.
15. MacIntyre, C. R., Wang, Q., Cauchemez, S., Seale, H., Dwyer, D. E., Yang, P., ... & Ferguson, N. (2011). A cluster randomized clinical trial comparing fit-tested and non-fit-tested N95 respirators to medical masks to prevent respiratory virus infection in health care workers. Influenza and other respiratory viruses, 5(3), 170-179. https://doi.org/10.1111/j.1750-2659.2011.00198.x.
16. Long, Y., Hu, T., Liu, L., Chen, R., Guo, Q., Yang, L., ... & Du, L. (2020). Effectiveness of N95 respirators versus surgical masks against influenza: A systematic review and meta-analysis. Journal of Evidence-Based Medicine, 13(2), 93-101. https://doi.org/10.1111/jebm.12381.
17. Bartoszko, J. J., Farooqi, M. A. M., Alhazzani, W., & Loeb, M. (2020). Medical masks vs N95 respirators for preventing COVID-19 in healthcare workers: A systematic review and meta-analysis of randomized trials. Influenza and other respiratory viruses, 14(4), 365-373. https://doi.org/10.1111/irv.12745.
18. COWLING, B. J., Zhou, Y. D. K. M., Ip, D. K. M., Leung, G. M., & Aiello, A. E. (2010). Face masks to prevent transmission of influenza virus: a systematic review. Epidemiology & infection, 138(4), 449-456. DOI: https://doi.org/10.1017/S0950268809991658.
19. Baldock, T. E., Bolam, S. M., Gao, R., Zhu, M. F., Rosenfeldt, M. P., Young, S. W., ... & Monk, A. P. (2020). Infection prevention measures for orthopaedic departments during the COVID-2019 pandemic: a review of current evidence. Bone & Joint Open, 1(4), 74-79. https://doi.org/10.1302/2633-1462.14.BJO-2020-0018.R1.
20. Baghizadeh Fini, M. (2020). Transmission routes of SARS-CoV-2 in dentistry: a literature review. International Journal of Scientific Research in Dental and Medical Sciences, 2(4), 135-137. doi: 10.30485/ijsrdms.2020.252402.1088.