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Assessment of Adequacy of Nasopharyngeal and Oropharyngeal Swab-Based Collection for Diagnosis of Novel 2019 Coronavirus Infection

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Letter to Editor

Since December 2019, SARS-CoV-2, the causative agent of COVID-19, has presented an exceptional challenge to the international medical community. As of May 20 2020, more than 12,945,828 confirmed cases of SARS-CoV-2 have been registered in at least 210 countries, with a fatality rate of approximately 4.40% (569,878/12,945,828) [1,2]. However, these numbers might be underestimated because of limited diagnostic tests and qualified professionals to perform clinical or laboratory evaluations, the presence of asymptomatic individuals who do not seek medical assistance, as well as reporting delay, misclassification and misdiagnosis of the disease [3,4]. In addition, preanalytical and analytical drawbacks, such as lack of identification or inadequate procedure for specimen collection and use of non-adequately validated assays, respectively, emerge as a significant predictor of true positive and false results.[5] However, no quantitative and in-field research was performed to our knowledge [5]. Therefore, considering the possible ineffectiveness of specimen collection by healthcare providers, in this study we aimed to assess the adequacy of nasopharyngeal and oropharyngeal swab collection in patients with suspected coronavirus infection in four major hospitals in Brazil. Furthermore, we aimed to evaluate the effect of update training in the performance of specimen collection by healthcare providers in a countryside city in Minas Gerais.

We performed a single-day assessment observational study in Sete Lagoas, in the State of Minas Gerais, in Southeastern Brazil. Eligible subjects were medical personnel qualified to perform swab collection from patients with suspected novel coronavirus infection. We excluded participants who work in hospital settings and do not necessarily approach suspected patients for swab collection, such as cleaners, receptionists, pharmacists, speech therapists and psychologists. Medical personnel answered an illustrated paper-based multiple-choice questionnaire on swab collection techniques. Each question had four possible answers, the correct answer being the technique recommended by the Centers for Disease Control and Prevention (Guidelines for Collecting, Handling and Testing Clinical Specimens from Persons for Coronavirus Disease 2019). There was a separate paper sheet for each swab collection type (naso- and oropharyngeal). After personnel had completed the questionnaire, one research team member provided a 40-minute training session, explaining how an appropriate collection should be performed, safety management, sample handling and storage, and basic characteristics of the disease (clinical,

laboratory and radiological features). The training included an *in-situ* real demonstration of the correct procedures (minitip swab insertion through the nostril or mouth and target areas, as well as biosafety procedures). At the end of the training, professionals were asked to provide feedback about the intervention and the knowledge shared during the training. Chi-square tests were used to analyze proportions of correct and incorrect answers from the study. *P<0.05* was considered significant. Statistics were carried out using the IBM Statistical Package for the Social Sciences (SPSS, Windows version). This investigation was approved by the local Research Ethics Committee, through protocol number 31483720.5.0000.8164, and consent was obtained from all participants in accordance with the Helsinki Declaration.

In total, 102 health professionals were surveyed. There was an unequal distribution of professionals in terms of specialty: 64 nurses, 16 nursing technicians, 10 physiotherapists, eight medical laboratory technicians and four physicians. Analysis of survey answers on performing both nasopharyngeal and oropharyngeal swab-based collection showed that 35 (34%) participants performed these procedures inappropriately before the training. Physicians (n = 4) and physiotherapists (n = 10) were the only medical professionals who performed both techniques correctly. Considering individual professional classes, nursing technicians (n = 16) were the group most likely to perform any technique inadequately (63%), while 19 (30%) nurses and 4 (50%) medical laboratory technicians performed any technique inadequately. Professionals with secondary level education (medical laboratory technicians and nursing technicians) were significantly more likely to perform any technique inadequately compared with those with higher level education (physicians, physiotherapists and nurses) (p<0.001).

During the current SARS-CoV-2 pandemic, the diagnosis of the disease is challenging because of the wide spectrum of symptoms, diverse radiological features and limited training of technical and medical staff. Our finding of high levels of inadequate swab collection technique particularly among nursing technicians and medical laboratory technicians is important because in Brazil these healthcare workers are most likely to perform swab collection. This rate of incorrect swab collection may contribute to underestimation of confirmed cases. Our results suggest that it is of upmost importance that medical institutions train their professionals in accordance with international guidelines. In addition to formal education at college or universities, lifelong learning should also be created and fostered by the implementation of a cooperative and multidisciplinary learning environment [6].

We observed positive recognition from individual feedback from the trained professionals. Statements such as *"...I personally believe that I am much better prepared now..."* or "*...I wish you could have come before...*" highlight the importance of creating a collaborative work environment. In an attempt to halt the chain of pre-analytical errors, several medical platforms have recently summarized the entire nasopharyngeal technique execution, from the preparation and equipment required until the removal of personal protective equipment used in the procedure [7]. However, the majority of high-quality instructive materials are in English, which is a potential barrier in many countries. Proper training (using video and text-based methodology) should be implemented internationally to minimize pre-analytical errors associated with swab collection. In addition, the creation of an open and team-based environment, where knowledge is shared by those with higher education or those who are technically more prepared, can enhance the better understanding of the deployment of medical techniques, and thus provide a more realistic incidence of novel coronavirus worldwide.

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