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A Cross-Sectional Study of Dental Students and Practitioners on the Laboratory Diagnosis and Testing of COVID-19

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Abstract:-

➢ ***Aim*:**
The purpose of this study /survey was to determine the knowledge about laboratory diagnosis and testing among dental students and practitioners.

➢ ***Background*:**
Corona Virus Disease 2019 (COVID-19), caused by SARS COV-2, is currently rattling the world. The fact that humans are highly mobile and migrating and the virulence and easy transmission of this virus has helped lock its place in history as a Pandemic. This cross-sectional helped demonstrate the knowledge of dental students and practitioners on the laboratory diagnosis and testing of COVID-19.

➢ ***Methods:***
A link of a questionnaire comprising 17 questions were sent among 111 students. Students who participated in survey were asked about cause, symptoms, protection, sample and testing of COVID. Data was collected through Google Forms.

➢ ***Results*:**
Among this final sample, 79.3% (n=88) were females while the rest were male. 82.9% (n= 92) of the sample were dental students and the rest (17.1%[n=19]) were practitioners.58.6% of people knew the etiology of COVID-19. 75.7% selected the symptoms correctly. 90.1% knew about the protection worn during sample collection. Only 27.9% knew that PCR is the diagnostic test and a fourth of the respondents knew that serological testing is the 'rapid test kit'.

➢ ***Conclusion*:**
This study ascertains that there is adequate knowledge about the basic information about COVID-19 and its specimen collection in the sample. Whereas, there is not enough passable knowledge about the laboratory diagnosis and testing of COVID-19 which can help ensure the dental students and professions prevent the transmission of this disease and aid in minimizing panic and maximizing awareness among general public.

Keywords:- *COVID-19, Pandemic, RNA-Seq, PCR, Serology.*

I. INTRODUCTION

According to the World Health Organization (WHO), viral infections continue to emerge and represent a serious issue to public health. In the last twenty years, several epidemics such as SARS, H1N1 influenza, and MERS have been recorded. An epidemic of cases with unexplained low respiratory infections detected in Wuhan, China, on December 31,2019, were reported. In February 2020, the World Health Organization (WHO) termed the disease "COVID 19" which stands for "Corona Virus Disease in 2020". This virus is very contagious and has quickly spread all around the world, due to tourism and migration. From 266 reported cases at the end of December 2019 to a colossal number of 28 million confirmed cases reported worldwide. [(1)]

Coronaviruses are enveloped viruses with a positive sense single-stranded RNA genome. SARS-CoV most likely originated in bats and adapted to non-bat ACE2 variants as it crossed species to infect humans. Virus genome sequencing of the patients in Wuhan revealed the presence of a previously unknown β-CoV strain. The binding of the virus with host cell receptors is a significant determinant for the pathogenesis of infection. [(2)]

The clinical features of COVID-19 are varied, ranging from asymptomatic state to acute respiratory distress syndrome and multi organ dysfunction. The common clinical features include fever, cough, sore throat, headache, fatigue, headache, myalgia and breathlessness. [(3)]Thus, they are indistinguishable from other respiratory infections. This poses a threat to the people to prevent the transmission of COVID19. In consequence, this urges the need for proper diagnostic test for COVID19.

As for all viral infections, the diagnosis of SARS-CoV-2 infection is based on either the direct - viral RNA (antigen) identification {by (reverse polymerase chain reaction [RT-PCR])} or the indirect- antibody identification (serological studies). In the case of an active infection, the direct viral RNA identification is considered the Gold standard, however for the identification of a previous infection and contact tracing for epidemiological reasons, antibodies specific to COVID-19 is the leading diagnostic test.[(4)]Since knowledge about the virus and its diagnostic methods are rapidly evolving, readers are advised to keep themselves informed regularly.

II. MATERIALS AND METHODS:

This cross-sectional, descriptive study demonstrates the knowledge of dental students and practitioners on the laboratory diagnosis and testing of COVID-19. The questionnaire was prepared in English, focusing on both the demography of the subjects and to assess the knowledge on the laboratory diagnosis of COVID-19. The target population were both students of Dental College and Dental practitioners in India. This questionnaire was converted to the online platform called Google Forms and was distributed to college students via Social Media platforms like WhatsApp, Instagram, etc.

The demographic questions are to determine the Age, Sex, and whether the respondent is a student or a practitioner. The leading questions articulates 17 close-ended questions with Multiple Choices but one right answer. The questions cover a wide range of data like ‘cause of COVID’, ‘specimen collection’, ‘various diagnostic tests’, etc. The questions were intended to assess the knowledge of the laboratory diagnosis of COVID-19, with respect to various ranges of questioning and with different groupings as to how it influences the outcome.

A total of 111 respondents completed the survey with willingness (100% completion rate), which was conducted from 19/05/2020-to-24/05/2020 (6-d period) and the purpose of this questionnaire was clarified prior. No identifying information was included in this.

III. RESULTS

This cross-sectional, descriptive study aims to ascertain the Knowledge of Dental Professionals on the Diagnosis of COVID-19. A total of 111 participants completed the online survey questionnaire. The data include four major groups of variables: (A) Individual demographics, including gender, age and whether a student or a practitioner. (B) 3 items measured their knowledge on COVID-19 related questions including etiology, symptoms and the criteria for testing. (C) 3 items measured their knowledge on practices during sample collection including protection, specimen to be collected and transport of the sample. (D) 11 items measured their knowledge on the laboratory processes and diagnosis of COVID-19. Each question of the knowledge sections was rated in a way that a score of one was given to correct responses and a score of zero was used for incorrect.

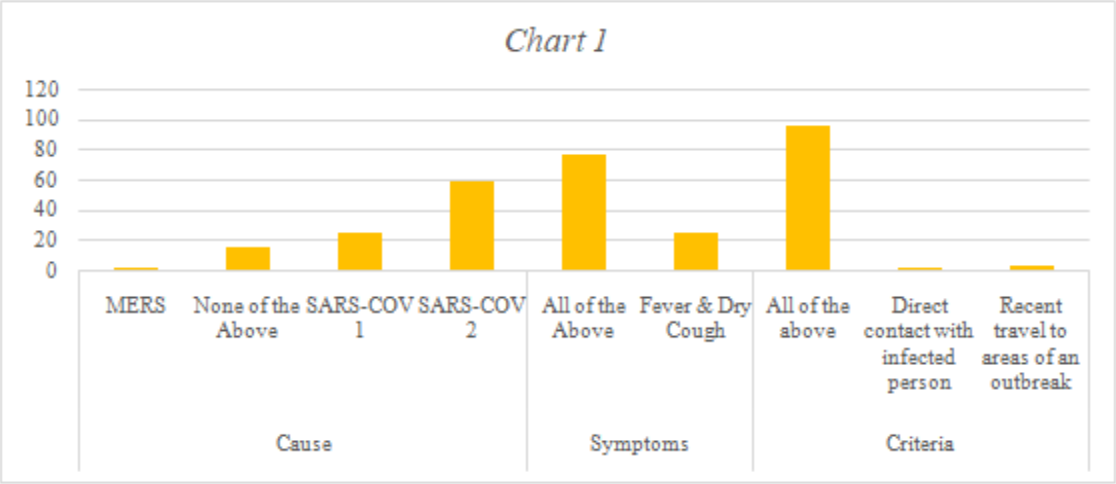
Frequency and percentage of all the demographic characteristics are represented in *Table 1*. Among this final sample, 79.3% (n=88) were females while the rest were male (20.7%[n=23]) and the average age was 21.98 years (standard deviation [SD]: 3.68, range: 25) and the majority of them (n=89) were 17-23 years old while only 19.8% (n=22) were ≥23 years old. Furthermore, 82.9% (n= 92) of the sample were dental students and the rest (17.1%[n=19]) were practitioners.

Variables	Frequency (N)	Percentage (%)
Gender		
Female	88	79.3
Male	23	20.7
Age-Category(years)		
17-23	89	80.2
>23	22	19.8
Description		
Student	19	17.1
Practitioner	92	82.9

Table 1:

Participants were asked to answer wide range of questions regarding their knowledge on COVID-19. The results of the knowledge survey are presented in *Chart 1*. When asked about the etiology of COVID-19, 58.6% (n=65) have chosen as SARS-COV 2 correctly, whereas 41.4% (n=46) of participants had chosen the incorrect answers. Among those who chose the correct answer, 46.8% (n=52) were females and only 11.7% (n=13) were males [p=0.049].

The majority (75.7%) (n=84) of the participants knew the symptoms of COVID-19 include fever, dry cough, fatigue and chest tightness. The majority (95.5%) (n=106) of the participants had correct knowledge about the criteria for the testing for COVID-19 and only 4.5% (n=5) answered incorrectly.



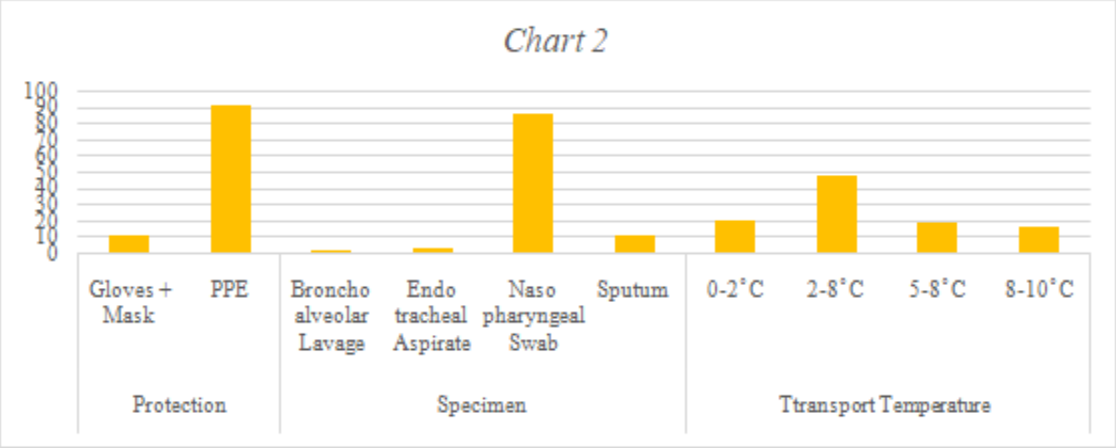


Chart 2 represents knowledge on practices during sample collection. It shows the highest percentage of participants, 90.1% (n=100) knew about the personal protective equipment worn during sample collection and only 9.9% (n=11) of the participants chose only mask and gloves, which cannot prevent transmission of the infection. Correct and accurate sample collection ensures accurate test results and the majority of 85.6% (n=95) had answered correctly when asked what sample was collected in the given picture. Consciousness about the WHO transport protocol for the collected specimen were only seen in almost half (46.8%) (n=52) of the participants.

In the final group of questions, participants were inquired about their familiarity and comprehension on the laboratory diagnosis of COVID-19 and the results are displayed in *Table 2*. When asked about the Quantitative Reverse Transcriptase PCR (q-RT PCR), only 37.8% (n=42) of participants knew that it detects the presence of Viral RNA, and almost a third of the participants (27.9%) (n=31) knew that PCR is the Confirmatory Diagnostic test for COVID-19. To the contrast, a majority of 60.4% (n=67) knew the disadvantages of PCR are differing temperature, specialised machines and time and money consuming. Also, reasons why RT-LAMP had been preferred over RT-PCR has been answered correctly by 59.5% (n=66) of the participants.

The questions regarding Serological tests yielded the following results. Almost a fourth of the participants only knew that serological test is the Rapid test for COVID-19 and only 26.1% of the participants knew the antibody which is formed after one week of incubation is Ig M. A majority of 42.3% (n=47) knew that the rapid tests is recommended to contain the spread, to identify asymptomatic cases, and to identify cases quickly as PCR tests are technique sensitive and time consuming.

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Question	Option	Frequency (n)	Percentage (%)
What does Quantitative Reverse Transcriptase PCR detect?	Presence of Viral Antibody IgG	32	28.8
	Presence of Viral Antibody IgM	10	9
	Presence of Viral Antigen	27	24.3
	Presence of Viral RNA	42	37.8
Which of the following provides Confirmatory Diagnosis?	All of the above	64	57.7
	Chest CT	7	6.3
	PCR	31	27.9
	Serological test	9	8.1
What is the disadvantage of PCR?	All of the above	67	60.4
	Differing temperature	8	7.2
	Specialised and Expensive Machines	15	13.5
	Time-consuming	21	18.9
Reasons why Reverse Transcription Loop-Mediated Isothermal Amplification (RT-LAMP) preferred over RT-PCR?	All of the above	66	59.5
	Cost – Effective	23	20.7
	Isothermal (single temperature)	10	9
	Rapid	12	10.8
Which is the test considered as rapid test kit?	Chest CT	6	5.4
	PCR	67	60.4
	Serological test	27	24.3
	Viral genome mapping	11	9.9
What is the antibody which tests positive within a week of incubation of the virus?	Ig A	9	8.1
	Ig E	20	18
	Ig G	53	47.7
	Ig M	29	26.1
The rapid screening test is recommended, for all the following reasons EXCEPT:	Higher accuracy than PCR	47	42.3
	To contain the spread in a hotspot area	20	18
	To identify asymptomatic cases	19	17.1
	To identify suspect cases quickly	25	22.5
What are the reasons for False Negative results on the tests?	Improper test kit	5	4.2
	Poor sample collection	6	5.1
	Poor viral material in the sample	5	4.2
	Sample not handled properly	3	2.5
	All of the above	99	83.9
How to minimise False Negative test results?	Acquire paired samples	62	55.9
	Cannot be eliminated, opt for other tests	10	9
	More amount of sample	14	12.6
	None of the above	25	22.5
Role of Smartphones in Diagnostics in the following Except:	Extensive surveillance	16	14.4
	Patient monitoring	25	22.5
	Sharing of epidemiological data	27	24.3
	Sharing of false information	43	38.7
Which of the following on a Chest Xray/CT is diagnostic EXCEPT?	Atelectasis	22	19.8
	Consolidation with or without vascular enlargement	40	36
	Ground-glass opacities (GGOs)	26	23.4
	Interlobular septal thickening	23	20.7

Table 2:

83.9% (n=99) of the participants knew the reason for false-negative results and 55.9% (n=62) knew how to eliminate false-negative results. Furthermore, 38.7% (n=43) of the participants knew the role of smartphones are for surveillance, patient monitoring and epidemiological data collection. The findings, further show that, only 19.8% (n=22) of the participants knew that Consolidation, GGOs and interlobular thickening, seen in the chest X-ray can be diagnostic, of which, it was answered right completely by females and all the males answered incorrectly (p=0.01).

IV. DISCUSSION

In December 2019, the outbreak of the novel COVID-19, in China, spread internationally, becoming an emergency of major worldwide concern. It has now spread to 216 countries, affecting 29 million people worldwide [(1)]. It is caused by a strain of coronaviruses called "SARS-CoV-2", which was known to 56.8% of the participants in this study.[(2)]The mechanism of action described by Marco Cascella et al. [(3)], is as follows: the spike RBD (receptor-binding domain) allows the binding to the ACE2 receptor in the lungs and other tissues which allows the functional processing by a protease enzyme. This process allows a necessary passage for the virus to enter the cell. The pathogenic mechanism that produces pneumonia seems to be particularly complex. Its cause has been studied to be cytokine storm [(5)], MicroCLOTS, etc. [(6)]

Studies by Chen et al. [(7)] and Song et al. [(8)] shows that the symptoms of the disease include fever, dry cough, fatigue and chest tightness, which was correctly identified by 75.4% of the participants. The verdict to test should be based on clinical and epidemiological factors and linked to an assessment of the likelihood of infection. Majority of the participants (95.5%) had correct knowledge regarding the major health organisation guidelines (e.g. CDC) [(9)] for the criteria for the testing of the disease.

Personal Protective equipment (PPE) protects against the transmission of the disease to the health-care workers [(10)(11)] ; which known to 90.1% of the participants. According to CDC and WHO guidelines, the specimen collected for the purpose of testing for COVID-19 are Nasopharyngeal swab, Deep Nasal Swab, Bronchial Lavage, Pleural fluid, Lung Biopsy, Sputum, etc. [(12)(13)] The specimen collected in the picture was correctly identified by 85.6% of the participants as Nasopharyngeal swab. Specimens for virus detection should reach the laboratory as soon as possible after collection to ensure accurate results. WHO and CDC protocol dictates storing the specimen at 2-8°C for up to 72 hours after collection and If a delay in testing or shipping is expected, store specimens at -70°C or below.[(12)(13)]

There are various tests that can be applied for the laboratory diagnosis of COVID-19. One, Reverse-transcription polymerase chain reaction (rRT-PCR) is a nucleic acid amplification test which detects the presence of viral RNA antigen in the sample and it is the Confirmatory test for COVID detection.[(12)] However, the knowledge of this information was low among the participants, 37.8% and 27.9% respectively. Owing to certain difficulties of RT-PCR like the need for specialised and expensive machinery and technique and being time and money-consuming, Reverse Transcription Loop-Mediated Isothermal Amplification (RT-LAMP) is preferred to conquer these challenges.[(14)] The knowledge of this evidence had yielded results, 60.4% and 59.5% respectively, to the contrary.While RT-PCR-based viral RNA detection has been extensively used in diagnosis of COVID-19, it cannot be used to monitor the progress of the disease stages and cannot be applied to wide identification of past infection and immunity.

The second mainstream test is the Serological or Antibody test. This test plays an imperative role in epidemiology and vaccine development, providing an evaluation of both short-term (days to weeks) and long-term (years or permanence) trajectories of antibody response. The primary antibody formed within a week of incubation is Ig M [(15)], which the findings show correctly identified by 26.1%. Only 24.3% of the participants knew the rapid test kits are actually serological test for antibodies, owing to the advantages including a low cost, rapid, and accurate point-of-care test [(16)]. Where there is little or no access to molecular testing, rapid serology tests provide a means to quickly triage suspected cases of COVID-19, provided the test is highly specific for the disease and to identify asymptomatic cases, correctly answered by 42.3% [(17)].

However, studies by Tang YW et al., 2020 showed that the prime concerns are the false-negative rate due to either a low or variable viral load, and the variability in sampling, the latter having the potential to further compound the problem in cases with low viral titres, thereby increasing the false-negative rate [(18)], correctly answered by 83.9%. As per WHO laboratory testing for COVID-19 (Interim Guidance), paired serum samples (in the acute and convalescent phase) could help minimise False Negative Results [(12)], however, only 55.9% had knowledge of this.

Yan Li and Liming Xia found that chest CT had a low rate of missed diagnosis of COVID-19 (3.9%, 2/51) and may be useful as a standard method for the rapid diagnosis of COVID-19 to optimize the management of patients [(19)]. Tao Ai and Zhenlu Yang has concluded that Chest CT has a high sensitivity for diagnosis of COVID-19and that it may be considered as a primary tool for the current COVID-19 detection in epidemic areas [(20)]. According to the WHO, the foremost priority for COVID-19 diagnostics research is the development of nucleic acid tests and protein tests and detection at the point-of-care [(21)]. Due to these limitations, a combined approach of laboratory testing methods (clinical, laboratory and imaging studies) is essential for the betterment of accurate diagnoses.Managing epidemics requires extensive

surveillance, sharing of epidemiological data, and patient monitoring. Smartphones can be utilized for this purpose as they possess the connectivity, computational power, and hardware to facilitate electronic reporting, epidemiological databasing, and point-of-care testing [(21)]. A study conducted by Collado-Borrell et al. showed that Governments have adopted these apps during the pandemic, and more than half of it were developed by government agencies. This initiative was taken for various purposes including News, Contact Tracing, Awareness, Monitoring of health, Helplines, Warning of nearby cases and to access control [(22)].

V. CONCLUSION

This study reported detailed data on the assessment of the knowledge of dental professionals on the laboratory diagnosis of COVID-19. Being in the medical field, there is an expectant amount of knowledge being known to the students and practitioners. The findings of this study state that there is sufficient knowledge among people regarding the common inquiry on COVID-19, but drastic insufficiency of knowledge on the laboratory testing of the same. This may be due to the fact that misinformation and myths about the disease are being spread faster than the disease itself, resulting in mass-panic. Smartphones, social media and 24/7 news channels may be the causative factor to the above fact. This can be overcome by governments and health bodies like the WHO, utilizing proper influencing channels to deliver detailed, accurate and truthful information to expand the knowledge of the people, to best understand this situation and respond in a proper manner, to ensure quicker and better reclamation.

REFERENCES

[1]. World health Organisation (WHO) Corona Virus Pandemic – Dashboard https://www.who.int/emergencies/diseases/novel-coronavirus-2019
[2]. Li. X, Geng. M, Peng. Y, Meng. L, Lu. S. Molecular immune pathogenesis and diagnosis of COVID-19. Shaanxi, China. Volume 10, Journal of Pharmaceutical Analysis; 2020.https://doi.org/10.1016/j.jpha.2020.03.001
[3]. Tanu Singhal. A Review of Coronavirus Disease-2019 (COVID-19). The Indian Journal of Pediatrics. 2020. https://doi.org/10.1007/s12098-020-03263-6
[4]. Russo. A, Minichini. C, Starace. M, Astorri. R, Calò. F, Coppola. N. Current Status of Laboratory Diagnosis for COVID-19: A Narrative Review. Infect Drug resist; 2020.https://doi.org/10.2147/IDR.S264020
[5]. Cascella. M, Rajnik. M, Cuomo. A, Dulebohn. S.C, Di Napoli. R. Features, Evaluation, and Treatment of Coronavirus (COVID-19). Treasure Island (FL): Stat Pearls Publishing; 2020.https://www.ncbi.nlm.nih.gov/books/NBK554776/
[6]. Ciceri. F, Beretta. L, Scandroglio. A.M, Colombo. S, Landoni. G, Ruggeri. A, et al. Microvascular COVID-19 lung vessels obstructive thromboinflammatory syndrome (MicroCLOTS): an atypical acute respiratory distress syndrome working hypothesis. Crit Care Resusc. 2020;22(2):95-97.
[7]. Chen. N, Zhou. M, Dong. X, Qu. J, Gong. F, Han. F, et al. Epidemiological and clinical characteristics of 99 cases of 2019 novel coronavirus pneumonia in Wuhan, China: a descriptive study. The Lancet. China; 2020. https://doi.org/10.1016/S0140-6736(20)30211-7
[8]. Song. F, Shi. N, Shan. F, Zhang. Z, Shen. Z, Lu. H, et al.Emerging 2019 Novel Coronavirus (2019-nCoV) Pneumonia. Radiology, RSNA. China; 2020. https://doi.org/10.1148/radiol.2020200274
[9]. [9] Centre for Disease Control (CDC). COVID-19 Testing Overview. https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/testing.html
[10]. Liu. M, Cheng. S, Xu. K, Yang. Y, Zhu. Q, Zhang. H, et al. Use of personal protective equipment against coronavirus disease 2019 by healthcare professionals in Wuhan, China: cross sectional study. The British Medical Journal. China; 2020. https://doi.org/10.1136/bmj.m2195
[11]. T. M. Cook. Personal protective equipment during the coronavirus disease (COVID) 2019 pandemic – a narrative review. Volume 75; Anesthesia. 2020. https://doi.org/10.1111/anae.15071
[12]. World health Organisation (WHO). Laboratory testing for 2019 novel coronavirus (2019-nCoV) in suspected human cases; Interim guidance. 2020. https://www.who.int/publications/i/item/10665-331501
[13]. Centre for Disease Control (CDC). Interim Guidelines for Collecting, Handling, and Testing Clinical Specimens for COVID-19. https://www.cdc.gov/coronavirus/2019-nCoV/lab/guidelines-clinical-specimens.html
[14]. Lai. D, Zhang. Y, Huang. Q, Yin. G, Pennerman. K, Liu. Z, et al. Reverse transcription loop-mediated isothermal amplification to rapidly detect Rice ragged stunt virus. Volume 25; Saudi Journal of Biological Sciences. China; 2016. https://doi.org/10.1016/j.sjbs.2016.02.024
[15]. Carter.L.J, Garner. L.V, Smoot. J.W, Li. Y, Zhou. Q, Saveson. C.J., et al. Assay Techniques and Test Development for COVID-19 Diagnosis. ACS Cent Sci.; 2020. https://dx.doi.org/10.1021%2Facscentsci.0c00501
[16]. Bastos. M.L, Tavaziva. G, Abidi. S.K, Campbell. J.R, Haraoui. L, Johnston. J, et al. Diagnostic accuracy of serological tests for covid-19: systematic review and meta-analysis. Volume 370; The British Medical Journal. Canada; 2020. https://doi.org/10.1136/bmj.m2516

[17]. Peeling. R.W, Wedderburn. C.J, Garcia. P, Boeras. D, Fongwen. N, Nkengasong. J, et al. Serology testing in the COVID-19 pandemic response. Volume 2; The Lancet- Infectious Diseases. China; 2020. https://doi.org/10.1016/S1473-3099(20)30517-X
[18]. Tang. Y, Schmitz. J, Persing. D, Stratton. C, et al. Laboratory Diagnosis of COVID-19: Current Issues and Challenges. Journal of Clinical Microbiology. USA; 2020. 10.1128/JCM.00512-20
[19]. Li. Y and Xia. L. Coronavirus Disease 2019 (COVID-19): Role of Chest CT in Diagnosis and Management. Volume 214; American Journal of Roentgenology. 2020. 10.2214/AJR.20.22954
[20]. Ai. T, Yang. Z, Hou. H, Zhan. C, Chen. C, Lv. W, et al. Correlation of Chest CT and RT-PCR Testing for Coronavirus Disease 2019 (COVID-19) in China: A Report of 1014 Cases. Radiology, RSNA. China; 2020. https://doi.org/10.1148/radiol.2020200642
[21]. BuddhishaUdugama. B, Kadhiresan. P, Kozlowski. H, Malekjahani. A, Osborne. M, Li. V, et al. Diagnosing COVID-19: The Disease and Tools for Detection. ACS Nano. Canada; 2020. https://doi.org/10.1021/acsnano.0c02624
[22]. Collado-Borrell. R, Escudero-Vilaplana. V, Villanueva-Bueno. C, Herranz-Alonso. A, Sanjurjo-Saez. M. Features and Functionalities of Smartphone Apps Related to COVID-19: Systematic Search in App Stores and Content Analysis. Volume 22; JMIR. Spain; 2020. 10.2196/20334