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COVID-19 Clinical Manifestations & Concerns among the Kingdom of Saudi Arabia's 937 Health Hotline Callers in Jeddah

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The on-going COVID-19 pandemic has highlighted telehealth as a crucial tool in delivering high quality healthcare with increased efficiency. In the Kingdom of Saudi Arabia this has been evidently clear with the establishment of the robust Ministry of Health 937 COVID-19 hotline. The objectives of our study are to describe the clinical patterns of COVID-19, identify the most common concerns of the 937 hotline callers and to identify the associations between the clinical presentation of COVID-19 and risk factors of the patients. through an Analytic Cross-Sectional study design. **Results:** The average age was 36.8 ± 15.7 years, 61.1% were males and 38.9% were females. 69.3% were Saudi and 30.7% were non-Saudis. 82.5% employed, whilst 17.5% were unemployed. The most commonly reported symptoms were fever, followed by fatigue and cough respectively. With 41.8%, 28.2% and 23.2% of participants reporting those symptoms respectively. The most significant predictors of developing shortness of breath due to COVID-19 was chronic lung disease OR=5.7, p value >0.01, chronic kidney disease, OR = 4.8, p value >0.02 and immunocompromised state OR = 19, p value >0.01. 82% of all calls to the hotline were related to COVID-19 testing, and

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11% of all calls resulted in the caller receiving medical counselling and/or treatment without having to make a physical visit to a healthcare provider.
Conclusion: A well-designed telehealth program can mitigate the need for a physical visit to the emergency room or clinic and as such reduce the load on front-line healthcare workers, reducing transmission and improving outcomes during infectious disease epidemics. It can also provide valuable insights into the presentation and risk factors of a new disease to aid in the prevention, diagnosis, management and control of the disease.

Keywords: Respiratory failure; multiple organ dysfunction; psychological; telehealth; COVID-19 pandemic

LIST OF ABBREVIATIONS

COVID-19 : Coronavirus Disease
SARS-CoV-2 : Severe Acute Respiratory Syndrome Coronavirus
CDC : Center for Disease Control
937 Hotline : A hotline dedicated to coronavirus response by the ministry of health in the Kingdom of Saudi Arabia.
WHO : World Health Organization

1. INTRODUCTION

The COVID-19 pandemic is an ongoing global health crisis caused by the SARS-CoV-2 virus [1]. COVID-19 was first identified in Wuhan China in December of 2019 [2]. It has since been declared a Public Health Emergency of International Concern on the 30th of January, 2020 [3] and officially designated a pandemic on the 11th of March in 2020 [4]. Telehealth played and continues to play an instrumental role in the on-going fight against the COVID-19 pandemic globally, especially in the United States, the United Kingdom, France and China where the approach has been widely implemented to reduce the risk of transmission [5]. The pivotal role of the 937 hotline during this Covid-19 pandemic makes it an invaluable source of data to study the clinical manifestations of Covid-19 in Jeddah's population as well as better understand their needs and concerns to help address those needs and deliver high quality healthcare. In the Kingdom of Saudi Arabia, the ministry of health 937 hotline plays an instrumental role in our country's on-going fight against the Covid-19 Pandemic with more than 10 million calls received as of 2020 July 7 since the beginning of the Pandemic [6]. The hotline employs a comprehensive national health action plan to aid Covid-19 patients, contacts and healthy individuals in receiving medical treatment, testing, counseling, health education, as well as coordinating with different healthcare institutions to deliver timely and high quality patient care [7].

Despite the hotline's widespread renown and instrumental role in the backbone of the Kingdom of Saudi Arabia's healthcare services, especially during the COVID-19 pandemic, there are no published scientific studies in this area which represents a major gap in the current scientific literature. The first comprehensive large-scale study of the clinical and epidemiological picture of COVID-19 emerged in February from the Chinese CDC which analyzed 72,314 case records. 62% of these were confirmed cases and 1% of these cases were asymptomatic. The study illustrated that the clinical manifestations of the disease can be categorized by their severity to mild, severe and critical disease as such:

Mild disease: non-pneumonia and mild pneumonia; 81% of cases.

Severe disease: dyspnea, respiratory frequency ≥ 30/min, blood oxygen saturation (SpO2) ≤ 93%, and/or lung infiltrates > 50% within 24 to 48 hours; 14% of cases.

Critical disease: respiratory failure, septic shock, and/or multiple organ dysfunction (MOD) or failure (MOF); 5% of cases [8].

Subsequent reports indicate that asymptomatic to mild disease constitute 70% of cases [9]. Whilst one independent study found that completely asymptomatic cases were estimated to be 30% [10].

In China, at the height of the epidemic, a peak of 625 hotlines existed simultaneously, 420 of which operated 24/7, primarily to address the psychological needs of residents [11].

Australia has also highlighted the importance of the role of telehealth during the COVID-19 pandemic, primarily to address the associated psychological distress of the population [12].

Researchers from the University of Copenhagen's Faculty of Health and Medical

Sciences in Denmark conducted a review of the telehealth services provided around the globe, but particularly in Europe, and found 38 different providers offering services during the COVID-19 pandemic in Denmark, Finland, The United Kingdom, The Netherlands, Sweden, France, Norway, The United States, China, Singapore, and The United Arab Emirates ranging from patient communication, training, screening and triage to critical care and patient monitoring [13].

Regionally speaking, in Egypt telemedicine services were experimentally utilized to deliver dermatological consultations and neurosurgical post-operative care to reduce the risk of COVID-19 transmission with high degrees of success [14-15].

In the United Arab Emirates telehealth services were deployed during the surge of COVID-19 cases in April for surveillance as well as tele-consultations [16]. Additionally, telemedicine services were experimentally employed for renal transplant recipients to reduce the risk of COVID-19 transmission due to their high risk for complications and it resulted in fewer COVID-19 infections [17].

1.1 Aim

This study can play a role in helping decision makers to address the needs of 937 hotline callers and continue to deliver high quality healthcare.

1.2 Objectives

1. To describe the frequency of different COVID-19 clinical symptoms among COVID-19 positive callers of the Ministry of Health's 937 hotline Jeddah the Kingdom of Saudi Arabia in 2020.
2. To identify the most common concerns pertaining to COVID-19 among Ministry of Health 937 hotline callers in Jeddah the Kingdom of Saudi Arabia in 2020.
3. To identify associations between the clinical presentation of COVID-19 and risk factors.

2. METHODOLOGY

The study design is Analytical Cross-Sectional carried out in the city of Jeddah, which is one of the largest cities in The Kingdom of Saudi Arabia, it is located in the western province and is considered the main seaport for the kingdom and the main entry port for the two Holy Mosques. Additionally, it is considered as the economic and tourism capital of the country. According to the principality of Makkah Almukarama Province, the population is estimated around 4 million [18].

The setting is the Center of Control and Command in Jeddah's health directorate. The population is callers of the 937 Ministry of Health coronavirus hotline in Jeddah, the Kingdom of Saudi Arabia between March 1st and June 30th of 2020.

2.1 Eligibility Criteria

2.1.1 Inclusion criteria

All adult Ministry of Health hotline callers who are residents of Jeddah, Saudi Arabia whose purpose of the call was related to COVID-19 between March 1st and June 30th 2020 were eligible to be entered in this study. Additionally, only callers with laboratory-confirmed COVID-19 by nasopharyngeal swab using a Reverse Transcription-Polymerase Chain Reaction test for Severe Acute Respiratory Syndrome Coronavirus-2 (RT-PCR SARS-CoV-2) were included in our analysis of the clinical manifestations of COVID-19.

2.1.2 Sample size

This study targets a confidence level of 95%, Z value of 1.96 and a P Value of 0.05. The sample size was calculated using the Cochran formula and the latest CDC guidelines for Cross-Sectional studies [19]. We also assumed a prevalence of symptomatic to asymptomatic COVID-19 patients of 50%, which gave us the maximum variability and the largest sample size required for our study using the Cochran Formula.

Sample size calculation : $((Z)^2$ (Prevalence) (1-Prevalence)) / (Target P Value)^2 = Sample size $((1.96)^2$ (0.5) (0.5)) / $(0.05)^2$ = 385

However, following the completion of a pilot of our study we recognized a number of risk factors key to our research were not prevalent enough to yield statistically significant results at a 385 sample size and as such we increased the sample size to 3000. The risk factors in question are immunocompromised state, chronic kidney disease and chronic liver disease.

2.1.3 Sampling technique

A systematic random technique was used until we reached our sample size of 3000.Sampling occurred over a period of four months spread out evenly on the odd days of every month, to ensure a representative sample for the whole month. All callers to the hotline were entred into an excel sheet for every odd day of the month.

To reach our sample size over four months we calculated the number needed to sample for each day as 3000/60 = 50 per day. As such, before every daily sample collection, the total number of callers for the day was divided by 50. The resulting number was used as an interval at which a study participant was selected from the list. In cases where the sampled participant did not meet our inclusion criteria or did not wish to participate, we jumped to the following caller in the list whilst keeping the interval intact.

2.1.4 Example

Assuming we had 1000 callers on Day 1 and our determined sampling interval is 50, then callers numbered 50, 100, 150 and so on were selected. In case caller number 150 did not meet our inclusion criteria then caller number 151 would have been selected whilst the sampling interval would continue on from 150 at the same interval of 50.

2.2 Data Collection Tool

A constructed questionnaire validated by two Preventive Medicine Consultants was used, containing the primary reason for the call or the caller's primary concern, followed by a section for clinical symptoms identified by the WHO as COVID-19 symptoms [20] and key risk factors which have been linked to increased disease morbidity among COVID-19 patients [21].

2.2.1 Most common symptoms

Fever.
Cough.
Fatigue

2.2.2 Less common symptoms

Sore throat.
Diarrhea.
Headache.
loss Of taste or smell.

2.2.3 Serious symptoms

Shortness of breath

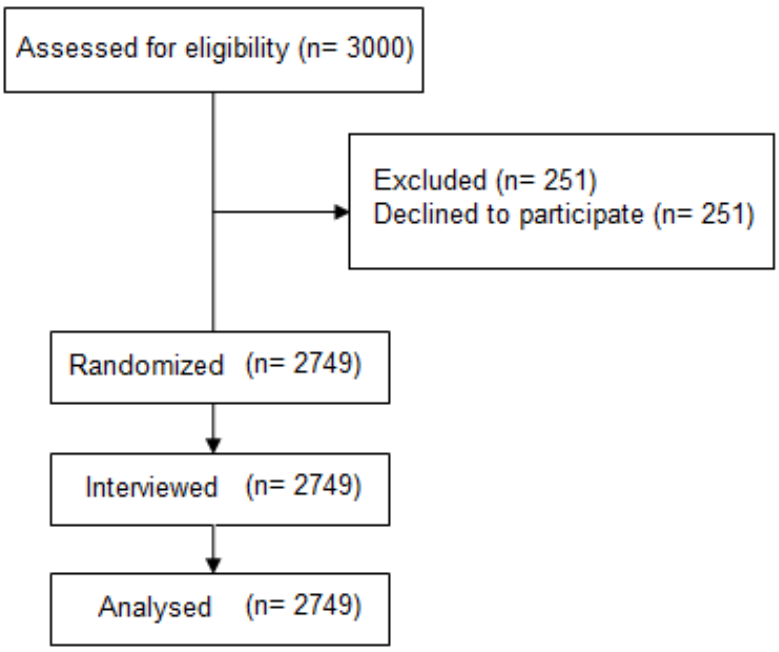

Fig. 1. Flowchart of sample analysis

2.2.4 Risk Factors

- Smoking
- Severe Obesity (BMI 35+)
- Hypertension
- Diabetes
- Cardiovascular Disease
- Chronic Lung Disease
- Chronic Kidney Disease
- Chronic Liver Disease
- Immunocompromised State

2.3 Data Collection Technique

The questionnaires were electronically filled via short phone interviews of each study participant, at Jeddah's Ministry of Health 937 hotline center.

The most commonly repeated concerns of the callers were aggregated into determined categories to be used in a quantitative approach. The categories are:

Testing appointment: Where the caller requests an appointment for a nasopharyngeal swab and a coronavirus test (RT-PCR SARS-CoV-2) test.

Testing result: Where the caller inquires about the result of a previous test. Health education: Where the caller seeks education regarding COIVD-19 precautions and information regarding mode of transmission and distancing guidelines.

Medical treatment: where the caller seeks direct medical treatment, either at a medical facility or at home for COVID-19.

Medical transfer: Where a COVID-19 positive caller seeks to transfer themselves or a COVID-19 positive relative to a different medical facility to continue receiveng care and maintain isolation.

Requesting admission: where the caller seeks hospital admission to receive treatment and/or isolation.

2.4 Data Entry and Analysis

The data was Inputted into Microsoft's Excel 2013 software then coded and analyzed using Statistical Package for Social Sciences (SPSS) Version 25.

To describe our data we used frequencies and percentages for categorical data and the means and standard deviation for age. To test for associations between risk factors and symptoms, we initially used chi-square and fisher's exact tests. Which were employed with the assumption of a normally distributed data-set. For non-parametric data we instead used Welch's t-test for two group means as an alternative. Furthermore, we constructed a Binary Logistic Regression Model (BLRM) with Backward Conditional Elimination, Enter Criteria=0.05 and Elimination=0.10, to identify any significant predictor for any given dependent variable in our study with a 95% confidence interval.. A p-value of <0.05 was the criteria to reject the null hypothesis in this study.

3. RESULTS

Our sample size n=2749is comprised only of confirmed COVID-19 cases with PCR at the command and control center in Jeddah, Saudi Arabia between March 1st and June 30th of 2020.. The average age of our sample is 36.8 ± 15.7 years, the youngest being 18 years of age and oldest being 106 years of age. Demographically, 61.1% of our sample are males and 38.9% are females. 69.3% of our participants were Saudi and 30.7% were non-Saudis. 82.5% of study participants were employed, whilst 17.5% were unemployed.

The most commonly reported symptoms by the study participants were fever, followed by fatigue and cough respectively. With 41.8%, 28.2% and 23.2% of participants reporting those symptoms respectively. Other commonly reported symptoms included sore throat and loss of taste or smell, both at 17.1% each. Whilst 14.6% reported having runny nose and 12.6% reported the loss of the sense of taste or smell. The least reported symptom was diarrhea with only 6.6% reporting having experienced it. The second least reported symptom was shortness of breath, at 9.1%. 33% of our study participants did not report any symptoms at all.

The most commonly reported risk factor was smoking, with 16.8% of participants identifying as being smokers. 5.8% reported diabetes as a pre-existing condition, 4.5% reported hypertension, 3.1% reported chronic lung disease and only 1.3% reported a BMI of more than 35. Cardiovascular disease, chronic lung disease, chronic kidney disease, chronic liver disease and immunocompromised status represented ≤ 1% each.

Table 1. Demographics

Demographics	N	Min	Max	Mean	SD	Frequency	Percent
Age in years	**2749**	**18**	**106**	**36.8**	**15.7**		
Gender							
Male						1681	61.1
Female						1068	38.9
Nationality							
Saudi						1905	69.3
Non-Saudi						844	30.7
Employment status							
Employed						2266	82.5
Unemployed						483	17.5
Total						**2749**	**100**

Table 2. Symptoms and risk factors

	Frequency	Percent
Symptoms		
Fever	1149	41.8
Fatigue	775	28.2
Sore Throat	471	17.1
Runny Nose	400	14.6
Headache	470	17.1
Loss of Taste and Smell	347	12.6
Cough	637	23.2
Shortness of Breath	249	9.1
Diarrhea	182	6.6
Asymptomatic	912	33
Total Sample	2749	100.0
Risk Factors		
Hypertension	124	4.5
Diabetes	159	5.8
Cardiovascular Disease	28	1
Chronic Lung Disease	86	3.1
Chronic Kidney Disease	11	0.4
Severe Obesity BMI 35+	35	1.3
Chronic Liver Disease	4	0.1
Smoking	461	16.8
Immunocompromised	5	0.2
Total Sample	2749	100.0

Table 3. Primary purpose of call

	Frequency	Percent
Testing appointment	1805	65.7
Testing result	429	15.6
Health education	78	2.8
Medical treatment	256	9.3
Medical transfer	48	1.7
Requesting admission	98	3.6
Physician counselling	223	8.1
Other	141	5.1
Total	2749	100.0

The most frequently reported reason for calling the hotline was to book a COVID-19 nasopharyngeal swab, with 65.7% of callers reporting this as being the primary reason for their call. The second and third most frequently reported reasons were to inquire about a COVID-19 test result and to receive medical treatment respectively at 15.6% and 9.3%. Telemedicine counseling by a physician was the fourth most commonly reported reason for calling the hotline. Admission requests, health education and medical transfer requests were the least reported reasons for calling the hotline.

Furthermore, logistic regression analysis was conducted to identify associations between risk factors and development of shortness of breath.

Smokers were 1.98 times as likely as non smokers to develop shortness of breath, p value <0.01. Patients with chronic lung disease were 5.7 times as likely to develop shortness of breath, p value <0.01. Those with chronic kidney disease were 4.88 times as likely to develop shortness of breath, p value <0.02. And finally, immunocompromised patients, defined as patients who are actively undertaking immunosupressive therapy, were 19 times as likely to develop shortness of breath as those with a competent immune system, p value <0.01.

Logistic regression analysis was also conducted to identify associations between risk factors and loss of taste or smell.

Smokers were 1.39 times as likely as non smokers to lose the sense of taste or smell, p value <0.02. Patients with severe obesity were 2.78 times as likely to lose the sense of taste or smell, p value <0.01.

Those with chronic liver disease were 7.97 times as likely to lose the sense of taste or smell, p value <0.04. And finally, immunocompromised patients were 9.78 times as likely to lose the sense of taste or smell as those with a competent immune system, p value <0.02.

4. DISCUSSION

The aim of this study was to identify the clinical patterns of COVID-19 among Jeddah's population, as well as to find associations between the clinical symptoms of the disease and a set of well-established risk factors. Additionally, we aimed to identify the most common needs and concerns of the 937 hotline callers. As such this multi-center, analytical, cross-sectional study was designed to reach those aims. 81.3% of all calls made to the 937 hotline were related to COVID-19 testing, either to book an appointment or to inquire about the result of a previously conducted test. The remaining 17.7% of calls were related to either COVID-19 prevention or management. Approximately 11% of calls resulted in the caller receiving medical counseling and/or treatment, remotely, at home or through coordinating

Table 4. Logistic Regression between COVID-19 symptoms and risk factors

Shortness of Breath			
	B	OR (CI 95%)	P-Value
Smoking	.681	1.976 (1.668 – 2.284)	.000
Severe Obesity	.451	1.570 (0.621 – 2.518)	.351
Hypertension	.411	1.509 (0.923 – 2.095)	.169
Cardiovascular Disease	-.038	.963 (0.295 – 2.221)	.953
Chronic Lung Disease	1.742	5.711 (5.298 – 6.183)	.000
Chronic Kidney Disease	1.585	4.879 (3.554 – 6.203)	.019
Chronic Liver Disease	-.048	.913 (0.215 – 1.611)	.989
Immunocompromised	2.946	19.029 (17.169 – 20.889)	.002
Loss of taste and Smell			
Smoking	.330	1.391 (1.109 - 1.673)	.022
Severe Obesity	1.023	2.783 (2.032 – 3.534)	.008
Hypertension	-.148	.862 (0.279 – 1.444)	.618
Cardiovascular Disease	.494	1.639 (0.619 – 2.658)	.342
Chronic Lung Disease	.270	1.309 (0.721 - 1.897)	.370
Chronic Kidney Disease	.335	1.399 (0.175 – 2.973)	.676
Chronic Liver Disease	2.075	7.964 (5.906 – 10.022)	.039
Immunocompromised	2.280	9.779 (7.941 - 11.614)	.015

a visit with a Ministry of Health healthcare provider. Notably, several life-saving medical transfers were also conducted by coordinating with the red crescent. This demonstrates that the 937 hotline played an instrumental role in the Kingdom's response to the COVID-19 epidemic. This was achieved by reducing patient loads at emergency departments through providing telehealth services and multi-sector coordination. Furthermore, with an average age of 36.8, a 3:2 male to female ratio and a 7:3 Saudi to non-Saudi ratio, the demographic characteristics of our sample is similar reflects that of the nation, which is highly skewed to a younger working population due to a large sub-population of migrant male workers [22]. Indicating that the health hotline was equally tapped by all demographic levels of the Kingdom of Saudi Arabia. However the demographic make up of the Kingdom of Saudi Arabia differs materially from that of the European Union and North America, who have much older populations with a more equal gender distribution, but is still substantially similar to its neighboring gulf countries [23-25].

When it comes to the clinical presentation of COVID-19 among Jeddah residents, our results indicate that a majority of our study sample was symptomatic rather than asymptomatic. This is likely because the hotline callers were alerted to their condition by experiencing symptoms first, or coming in contact with a symptomatic person which prompted them to contact the hotline. Smoking, severe obesity, chronic kidney, lung and or liver disease as well as the immunocomprised status – defined as individuals undergoing immunosuppressive therapies -- displayed strong and statistically significant associations with the development of two clinically important COVID-19 symptoms, shortness of breath and loss of taste or smell. Which is in accordance with the established literature around increased risk for mortality in patients with chronic kidney disease, chronic lung disease and patients with an immunocomrpomised state such as organ transplant recipients or those receiving immunosupressive cancer therapies [26-29]. The WHO and CDC and their respective guidelines for COVID-19 signs and symptoms group anosmia and ageusia under one common symptomatic presentation with either the loss of taste or smell and as such those guidelines were followed for this study. The former for the significant morbidity associated with it and the latter for its high specificity to COVID-19 [30].

When it come sto the clinical presentation of COVID-19, approximately one third of all study participants were completely asymptomatic. Which is in-line with the 40-45% estimated prevalence of asymptomatic COVID-19 world-wide [31]. Whilst two thirds experienced symptoms. Most commonly fever (41.8%), fatigue (28.2%) and cough (23.2%) this is notably different from a previous retrospective national study in the Kingdom of Saudi Arabia conducted in early 2020 on a sample size of 1519, which found only 9.3% were asymptomatic, whilst the most common symptoms were cough (89.4%), fever (85.6%), and sore throat (81.6%) and notably a hospitalization rate of 71.6% [32].

In contrast, because our study focused on hotline callers, which is expected to reflect more outpatient cases, undiscovered cases and fewer hospitalized cases – only 1.7% of all study participants were hospitalized -- the clinical presentation has also been reflective of fewer severe cases, more asymptomatic cases and fewer reported symptoms overall.

5. CONCLUSIONS AND RECOMMENDATIONS

Fever is the most commonly reported symptom of COVID-19 among the residents of Jeddah. Smoking, severe obesity, chronic lung disease, chronic kidney disease, chronic liver disease and immunocompromised state are the most significant risk factors for COVID-19 associated morbidity. Four fifths of all 937 COVID-19 related calls were related to COVID-19 testing and one fifth of all calls was related to COVID-19 prevention and treatment. One tenth of all calls resulted in the caller receiving medical counseling and/or treatment without having to make a physical visit to a healthcare provider. Therefore, developing and implementing a well-designed telehealth program can mitigate the need for a physical visit to the emergency room or clinic and as such reduce the load on front-line healthcare workers, reduce transmission and improve outcomes during infectious disease epidemics.

LIMITATIONS

There appears to be significant under-reporting of pre-existing medical conditions by COVID-19 patients. As the prevalence of several key risk factors, including Hypertension, diabetes and cardiovascular disease in the general population

is higher than what is reported by patients in our study [33]. This could be due to the fact that our sample size only included those who called the Kingdom of Saudi Arabia's health hotline which may under-represent hospitalized COVID-19 patients, whom are more likely to have pre-existing conditions and more risk factors. Because only 937 hotline callers were part of this study it may not be fully generalizable to all COVID-19 patients, including those that did not seek care or those that sought care directly without calling the hotline.

CONSENT AND ETHICAL APPROVAL

Ethical approval number 20-591E by the Research Ethics Committee of King Fahad Medical City was obtained.

1.1 Obtained research approval from Research Committee of The Joint Program for Preventive Medicine.
1.2 Obtained research approval from (Jeddah Research Committee Ethical and Scientific approval).
1.3 Approval of each participant to be enrolled in the study after explanation of the study objectives and health benefit, stressing on the anonymity of the collected data; their approval will be considered as consent.
1.4 The collected data was kept confidential by ensuring anonymity of the participants, the data was stored in personal computer secured by password. All data was not be disclosed except for the study purpose.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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