Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Short Communication

Evaluation of SARS-CoV-2 RT-PCR test results from a pandemic hospital according to demographic data

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ABSTRACT

Objectives: The emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) leading to coronavirus disease 2019 (COVID-19) in China at the end of 2019 has resulted in a global pandemic. On 11 March 2020, the first case of COVID-19 was reported in Turkey. The aim of this study was to evaluate SARS-CoV-2 Real-Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test results from the Medical Microbiology Laboratory of a pandemic hospital according to demographic data.
Study design: Retrospective cohort study.
Methods: SARS-CoV-2 RT-PCR test results of 413,013 samples from 194,062 patients were retrospectively analysed. Tests were carried out between 27 March and 31 December 2020 using two commercial kits. The patient's age and gender were recorded, in addition to the percentage of positive test results per month (i.e. monthly positivity). Pearson's Chi-squared test was used to analyse statistical significance.
Results: Overall SARS-CoV-2 positivity in the pandemic hospital was 19.9%. Female gender and younger age (0–18 years) had a statistically significant higher positivity ($P < 0.05$). There was a statistically significant higher positivity in August and September.
Conclusions: Higher positivity among the younger population and females may be the leading cause of low COVID-19 mortality rates in Turkey as these population groups are less likely to die from the disease. Governments should disaggregate COVID-19 data by age and gender, and vaccine studies focussing on younger populations should be accelerated because this population group represents an important source of infection.

Introduction

Since December 2019, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) leading to coronavirus disease 2019 (COVID-19) has spread all around the world, with 101,561,219 confirmed cases and 2,196,944 deaths reported by the World Health Organisation (WHO) as of 30 January 2021.[1] In Turkey, the first case of COVID-19 was identified on 11 March 2020, and as of 30 January 2021, 2,470,901 cases and 25,865 deaths have been reported.[2]

There are studies reporting different prevalence rates of COVID-19 among males and females, which may be due to different lifestyles and social behaviours of females and males in various societies.

The majority of COVID-19 patients are adults, especially those aged >50 years; however, this may be due to the fact that there is less information available about the paediatric population.[3]

Demographic data have become more important in order to identify priority groups for vaccination programmes.

Initially, COVID-19 was full of unknowns. The Ministry of Health in Turkey quickly created algorithms for the diagnosis and treatment of COVID-19 and tried to control the epidemic. COVID-19 demographic studies are essential as they can indicate the population groups that are most susceptible and how the disease may progress. In this study, we evaluated demographic data of patients

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who had Real-Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) tests from ten hospitals in Turkey, including Ankara City Hospital in the capital city of Ankara. Ankara is the second largest city of Turkey, located in the middle of the country, with a population of 5,663,322. We hope with a large number of cases, findings from this study will be useful to inform vaccination policies.

Materials and methods

Patients were tested for COVID-19 infection by RT-PCR in the Medical Microbiology Molecular Laboratory of Ankara City Hospital. The Microbiology Laboratory of Ankara City Hospital started to perform RT-PCR testing for COVID-19 on 27 March 2020. Ankara City Hospital is the biggest hospital in Europe, with 3811 beds. At the beginning of the outbreak, Ankara City Hospital was designated a pandemic hospital and the majority of COVID-19 patients in Ankara and surrounding provinces were referred to Ankara City hospital. This laboratory performed RT-PCR tests for Ankara City Hospital in addition to nine hospitals/centres serving patients with lower socio-economic and sociocultural levels in and around Ankara up to June 2020.

Testing criteria included at least one of the signs/symptoms of SARS-CoV-2 infection (i.e. fever, cough, shortness of breath, sore throat, myalgia, loss of taste and smell, or diarrhoea), where the clinical signs could not be explained by another disease, and/or close contact with a COVID-19 patient. Nasopharyngeal and/or oropharyngeal samples from patients were placed in vNAT (Viral Nucleic Acid buffer; various manufacturers) transfer tubes. The nucleic acid isolation process occurs during the transfer of these tubes. The PCR process started after vortexing the samples for 15 s. Detection of SARS-CoV-2 in nasopharyngeal samples was performed by the RT-PCR method with two commercial kits according to manufacturers' instructions (BioSpeedy COVID-19 RT-qPCR Detection Kit [Bioeksen, Istanbul, Turkey] targeting RdRp [RNA dependent RNA polymerase] gene; and Coronex COVID19 (Ver.2.0) Multiplex RT-qPCR Diagnosis Kit [DS Bio and Nano Technology, Ankara, Turkey] targeting Orf1ab and N genes). Both kits also target the human RNaseP (Ribonuclease P) gene, which was used as an internal control to evaluate sample-based inhibition control and kit reagent control. Thermal cycling was performed in the Rotor-Gene Q device (Qiagen, Hilden, Germany) according to RT-PCR kit instructions.

Statistical analyses were performed by using the Statistical Package for the Social Sciences (SPSS.26, IBM SPSS Statistics for Windows, Version 26.0, IBM Corp., Armonk, NY, USA). Pearson's Chi-squared test was used to evaluate the statistically significant difference between groups. Statistical significance was defined as $P < 0.05$.

Results

From 27 March to 31 December 2020, 413,013 samples from 194,062 patients were tested. The first test result of each patient was included in the study. Repetitive tests of a patient and preoperative tests were excluded.

Of the 194,062 patients, 106,117 (54.7%) and 87,945 (45.3%) were male and female, respectively. Overall, 25,314 (13%), 150,291 (77.4%) and 18,457 (9.6%) of the patients were aged 0–18, 19–64 and $\geq$ 65 years old, respectively.

During the period between 27 March and 1 June 2020, when samples from nine additional hospitals/centres were being processed by the Ankara City Hospital Molecular Laboratory, there was a statistically significant positivity ($P < 0.05$) in samples from patients from Sincan Hospital. All hospitals/centres in Turkey used the same testing criteria declared by the Ministry of Health.

During the entire study period (27 March to 31 December 2020), of the 194,062 patients, 38,694 (19.9%) were positive and 155,368 (80.1%) were negative for SARS-CoV-2. Regarding the total number of positive cases, 18,684 (48.3%) and 20,010 (51.7%) were female and male, respectively, and 5714 (14.8%), 29,279 (75.6%) and 3701 (9.6%) were aged 0–18, 19–64 and $\geq$ 65 years, respectively.

Considering the entire study period, female gender (18,684/87,945 [21.2%]) and patients aged 0–18 years old (5714/25,314 [22.6%]) had statistically significant higher positivity ($P < 0.05$).

The data of 194,063 patients were also evaluated according to the month between 27 March and 31 December 2020, and the highest positivity rate was seen in September (28.3%) (see Fig. 1).

Discussion

We studied 413,013 samples from 194,062 patients, which is the largest series of cases from the capital city of Turkey. Since Ankara City Hospital was designated as a pandemic hospital, the majority of COVID-19 patients in Ankara and surrounding provinces were referred to Ankara City hospital, which may be the leading cause of the high (19.9%) positivity rate.

At the beginning of the outbreak, including samples of other hospitals, we found a positivity rate of 10.3%. During the same period, RT-PCR for COVID-19 was positive in 70 of 200 (35%) cases in Iran, which has a border with Turkey.[4] Sincan Hospital, which serves patients with lower sociocultural levels and lower incomes, had the highest positivity among all hospitals during the initial outbreak (13.3%). During this time, people from this area predominantly returned from Umrah and had intense social contact according to Islamic traditions. At this stage, people from this area were not aware of COVID-19 transmission and preventative measures, which supports the findings of Xia et al.[5] who highlighted the risk of family aggregation.

Gender seems to be an important variable that should be considered in the prevention and treatment of COVID-19. Globally, the COVID-19 ratios for females to males (F:M) are as follows: cases (10:10), hospitalisations (10:12), Intensive Care Unit admissions (10:20) and deaths (10:13).[6] Although mortality seems higher among males, there are controversial results about gender regarding case ratios. This may be due to different social habits in different societies. We found a statistically significant higher positivity in the female population (21.2%). As Ankara is the capital city of Turkey, females are more active in patient care, as well as home care and childcare, thus have more direct contact with other people, which may explain the statistically significant higher positivity among the female population.

Although COVID-19 was more prevalent among adults at the beginning of the outbreak, with the emergence of new studies, it appears that the disease is also common in the paediatric age group.[7] In a series of cases in patients aged <16 years, 171/1391 (12%) were SARS-CoV-2 RT-PCR positive.[8] The results from the current study in Ankara show that the highest positivity rate was found in the age group 0–18 years (22.6%), which may be explained by the difficulty for children to remain socially distant. Further studies are needed to investigate the prevalence of COVİD-19 in the paediatric population since they have a potential role in the transmission dynamics of the outbreak and may be significant spreaders of the disease.

Results from this study show that the majority of positive cases were among patients aged 19–64 years (75.6%) and that the elderly group comprised 9.6% of all positive cases. The age group 19–64 years consisted of people who remained actively involved in life during the outbreak when there was a strict lockdown for the younger and older age groups. A study from South Korea[9] reported that 6%, 68% and 24% of the positive cases were in the 0–19, 20–59

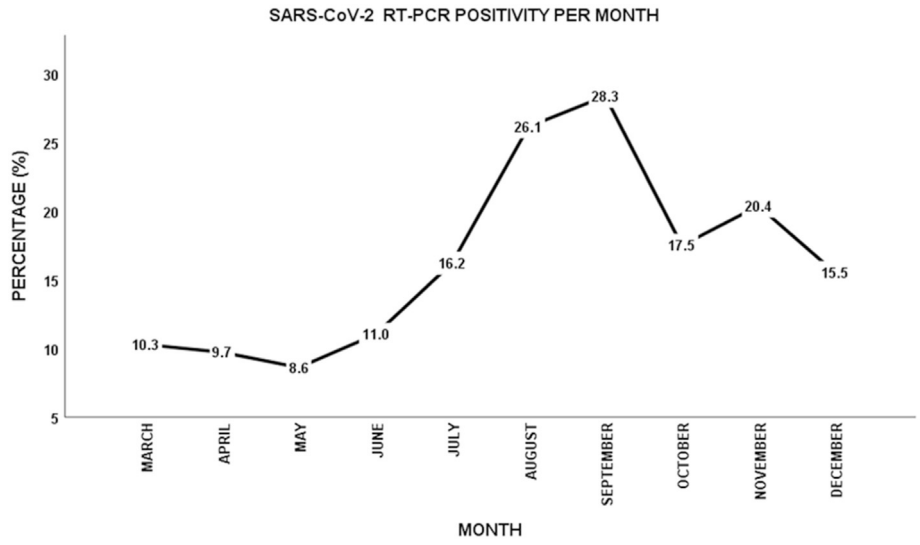

Fig. 1. Monthly distribution of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) Real-Time Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) positive cases between 27 March and 31 December 2020.

and ≥ 60 years old age groups, respectively, which is similar to the results of the current study. It is likely that the 9.6% positivity rate seen among the older age group in the current study is due to family aggregation since most elderly people have close relationships with other family members in Turkey.

In this study, the percentage of positive cases (i.e. monthly positivity) was also examined. During March, April and May 2020, the positivity rate was relatively low (10.3%, 9.7% and 8.6%, respectively) due to strict lockdown measures and population compliance. Transmission of many respiratory pathogens is linked to seasonal changes and human behaviours, and close physical contact is the main route of transmission. Since COVID-19 is a new pathogen, it is not clear whether seasonal changes or human behaviours play a major role in transmission. In Turkey, at the end of May 2020, which is the beginning of the tourism season, public health measures were not strictly adhered to by the population. The number of cases gradually increased due to the relaxation of the rules in June 2020 and peaked in August and September. From these results, we believe that seasonal changes play a minor role in viral spread, but public health measures, such as masks and social distancing, play primary roles in mitigating the spreading of the virus. Many countries, including Germany,[10] experienced an increase in new cases and deaths during this period. Further studies in both the Northern and Southern hemispheres are needed to determine the seasonal distribution of COVID-19.

In conclusion, this study examined age and gender and monthly changes in SARS-CoV-2 RT-PCR positivity from a large number of cases. Statistically significant positivity among females and the younger age group may explain the low COVID-19 mortality rates in Turkey as these population groups are less likely to die from the disease.

A limitation of this study was the lack of the entire patient health record, including hospitalisation length of stay and mortality or recovery outcomes. However, with the large number of cases, the results of this study are important because they emphasise the importance of vaccination studies for the paediatric population.

Author statements

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Ethical approval

The study protocol was approved by both the Turkish Ministry of Health (2020-05-20T15_06_59) and the Ethics Committee of Ankara City Hospital (11/06/2020-E1-20-770).

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Competing interests

The authors have no competing interests to declare.

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