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Trends in incidence of COVID 19 based on performed Rapid Antigen Test

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Abstract

The COVID 19 outbreak represents a historically unprecedented pandemic, particularly dangerous and potentially lethal for elderly population. The biological differences in the immune systems between men and women exist which may impact our ability to fight an infection including SARS-2-CoV-2. Men tended to develop more symptomatic and serious disease than women, according to the clinical classification of severity. Age-related changes in the immune system are also different between sexes and there is a marked association between morbidity/mortality and advanced age in COVID-19. This is a single-center, retrospective, data oriented study performed at the private hospital, in Central Province, Sri Lanka. The data of the patients who performed the Rapid Antigen Test (RAT) to know whether they have infected by SARS-CoV-2 or not, were taken for analysis. Test performed date, age, sex, number of positive and negative cases, number of male and female patients were extracted. Finally the data were analyzed in simple statistical method according to the objective of the study. Totally 642 patients performed RAT within the period of one month from 11.08.2021 to 11.09.2021. Among them 426 (66.35%) are male and 216 (33.64%) are female. 20.4% (n=131) of male obtained positive result among the total male population (n=426). Likewise 11.4% (n=73) of female obtained positive result among the total female population (n=216). Large number of positive cases was observed (34.89%) between the age group of 31-40 years in both sexes. The age group of 21-30 and 41-50 years also were shared the almost same percentage (17.13% & 17.75%). The large number of positive male patients observed among the age group of 41-50 years. Almost same number of patients was observed in the age group of 21-30 and 31-40. The least number of positive cases (0.7% and 0.9%) observed almost in 0-10 and 81-90 years. When considering the females, large number of positive female patients observed among the age group of 31-40 years.

Introduction

A rapid antigen test (RAT) or rapid antigen detection test (RADT), is a rapid diagnostic test suitable for point-of-care testing that directly detects the presence of an antigen. It is used to detect SARS-CoV-2 that cause COVID-19. This test is one of the type of lateral flow tests that detect protein, differentiate it from other medical tests such as antibody tests or nucleic acid tests, of either laboratory or point-of-care types. Generally 5 to 30 minutes only will take to get result and, require minimal training or infrastructure, and cost effective (1).

Sri Lanka was extremely vulnerable to the spread of COVID-19 because of its thriving tourism industry and large expatriate population. Sri Lanka almost managed two waves of Covid-19 pandemic well, but has been facing difficulties to control the third wave. The Sri Lankan government has executed stern actions to control the disease including island-wide travel restrictions. The government has been working with its development partners to take necessary action to mobilize resources to respond to the health and economic challenges posed by

the pandemic (2) (3).

The COVID 19 outbreak is dangerous and fatal for elderly population. Since the beginning of the actual SARS-CoV-2 outbreak there were an evident that older people were at higher risk to get the infection and develop a more severe with bad prognosis. The mean age of patients that died was 80 years. The majority of those who are infected, that have a self-limiting infection and do recover are younger. On the other hand, those who suffer with more severe disease require intensive care unit admission and finally pass away are older (4).

Sandoval. M., et al mentioned that the number of patients who are affected by SARS-CoV-2 with more than 80 years of age is similar to that with 65–79 years. The mortality rate in very elderly was 37.5% and this percentage was significantly higher compared to that observed in elderly. Further their findings were suggested that the age is a fundamental risk factor for mortality (5).

Since February 2020, more than 27.7 million people in US have been diagnosed with Covid-19 (6). Rates of COVID-19 deaths have increased across the Southern US, among the Hispanic population, and among adults aged 25–44 years (7). Young adults are at increased risk of SARS-CoV-2 because of exposure in work, academic, and social settings. According to the several database of different health organizations young adult, aged 18-29, were confirmed Covid-19 (9).

The latest immunological study on the receptors for SARS-CoV-2 suggest that ACE2 receptors are responsible for SARS-CoV-2. According to the study by Lu and colleagues there are positive correlation of ACE2 expression and the infection of SARS-CoV (10). Based on the positive correlation between ACE 2 and coronavirus, different studies quantified the expression of ACE 2 proteins in human cells based on gender ethnicity and a study on the expression level and pattern of human ACE 2 using a single-cell RNA-sequencing analysis indicated that Asian males had higher expression of ACE 2 than female (11). Conversely, in establishing the expression of ACE 2 in the primary affected organ, a study conducted in Chinese population found that expression of ACE 2 in human lungs was extremely expressed in Asian male than female (12).

A study by Karnam and colleagues reveled that CD200-CD200R and sex are host factors that together determine the outcome of viral infection. Further a review on association between sex differences in immune responses stated that sex-based immunological differences contribute to variations in the susceptibility to infectious diseases and responses to vaccines in males and females (13). The concept of sex-based immunological differences

driven by sex hormone and X chromosome has been well demonstrated via the animal study by Elgendy et al (14) (35). They were concluded the study that estrogen played big role in blocking some viral infection.

The biological differences in the immune systems between men and women may cause impact on fight for infection. Females are more resistant to infections than men and which mediated by certain factors including sex hormones. Further, women have more responsible attitude toward the Covid-19 pandemic than men such as frequent hand washing, wearing of face mask, and stay at home (15).

Most of the studies with Covid-19 patients indicate that males are mostly (more than 50%) affected than females (16) (17) (18). Although the deceased patients were significantly older than the patients who survived COVID-19, ages were comparable between males and females in both the deceased and the patients who survived (18).

A report in The Lancet and Global Health 5050 summary showed that sex-disaggregated data are essential to understanding the distribution of risk, infection and disease in the population, and the extent to which sex and gender affect clinical outcomes (19). The degree of outbreaks which affect men and women in different ways is an important to design the effective equitable policies and interventions (20). A systematic review and meta-analysis conducted to assess the sex difference in acquiring COVID-19 with 57 studies that revealed that the pooled prevalence of COVID-19 confirmed cases among men and women was 55% and 45% respectively (21). A study in Ontario, Canada showed that men were more likely to test positive (22) (23). In Pakistan 72% of COVID-19 cases were male (24). Moreover, the Global Health 5050 data showed that the number of COVID-19 confirmed cases and the death rate due to the disease are high among men in different countries. This might be because behavioral factors and roles which increase the risk of acquiring COVID-19 for men than women. (25) (26) (27).

Men mostly involved in several activities such as alcohol consumption, being involved in key activities during burial rites, and working in basic sectors and occupations that require them to continue being active, to work outside their homes and to interact with other people even during the containment phase. Therefore, men have increased level of exposure and high risk of getting COVID-19 (28) (29) (30).

Men tended to develop more symptomatic and serious disease than women, according to the clinical classification of severity (31). The same incidence also noticed during the previous coronavirus epidemics. Biological sex variation is said to be one of the reasons for the sex discrepancy in COVID-19 cases, severity and mortality (32) (33). Women

are in general able to stand a strong immune response to infections and vaccinations (34).

The X chromosome is known to contain the largest number of immune-related genes in the whole genome. With their XX chromosome, women have a double copy of key immune genes compared with a single copy in XY in men. This showed that the reaction against infection would be contain both innate and adaptive immune response. Therefore the immune systems of females are generally more responsive than females and it indirectly reflects that women are able to challenge the coronavirus more effectively but this has not been proven (32).

Sex differences in the prevalence and outcomes of infectious diseases occur at all ages, with an overall higher burden of bacterial, viral, fungal and parasitic infections in human males (36) (37) (38) (39). The Hong Kong SARS-CoV-1 epidemic showed an age-adjusted relative mortality risk ratio of 1.62 (95% CI = 1.21, 2.16) for males (40). During the same outbreak in Singapore, male sex was associated with an odds ratio of 3.10 (95% CI = 1.64, 5.87; $p \leq 0.001$) for ITU admission or death (41). The Saudi Arabian MERS outbreak in 2013 - 2014 exhibited a case fatality rate of 52% in men and 23% in women (42). Sex differences in both the innate and adaptive immune system have been previously reported and may account for the female advantage in COVID-19. Within the adaptive immune system, females have higher numbers of CD4+ T (43) (44) (45) (46) (47) (48) cells, more robust CD8+ T cell cytotoxic activity (49), and increased B cell production of immunoglobulin compared to males (43) (50). Female B cells also produce more antigen-specific IgG in response to TIV (51).

Age-related changes in the immune system are also different between sexes and there is a marked association between morbidity/mortality and advanced age in COVID-19 (52). For example, males show an age-related decline in B cells and a trend towards accelerated immune ageing. This may further contribute to the sex bias seen in COVID-19 (53).

Hence, this single center, retrospective, data oriented study performed to identify the gender age influences the RAT results and the rate of positive cases before and after the lockdown.

Methodology

This is a single-center, retrospective, data oriented study performed at the private hospital, Central Province, Sri Lanka. The data of the patients who performed the Rapid Antigen Test (RAT) from 11.08.2021 to 11.0.2021 to know whether they have infected by SARS-CoV-2 or not, were taken for analysis. The authors developed a data

extraction form on an Excel sheet and the following data from main data sheet. Test performed date, age, sex, number of positive and negative cases, number of female patients and number of male patients were extracted. Mistyping of data was resolved by crosschecking. Finally the data were analyzed in simple statistical method according to the objective of the study.

Results and discussion

Totally 642 patients performed RAT within the period of one month from 11.08.2021 to 11.09.2021. Among them 426 (66.35%) are male and 216 (33.64%) are female. Men mostly involved in several activities such as alcohol consumption, being involved in key activities during burial rites, and working in basic sectors and occupations that require them to continue being active, to work outside their homes and to interact with other people even during the containment phase. Therefore, men have increased level of exposure and high risk of getting COVID-19 (28) (29) (30). The present data descriptive study also were supported certain previous research findings.

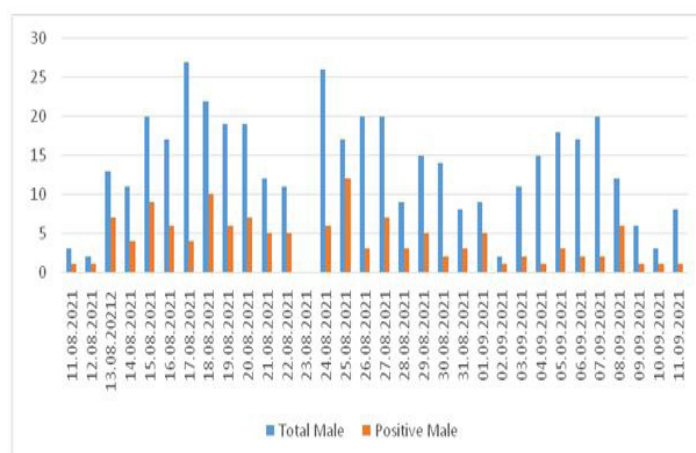


Figure 1: RAT positive male cases among the total male patients performed RAT with days

Figure 1 shows that the number of male patients got positive result in RAT among the total male patients who performed RAT on every day. According to that, 20.4% ($n=131$) of male obtained positive result among the total male population ($n=426$). Philip Goulder, professor of immunology at the University of Oxford stated that women's immune response to the virus is stronger since they have two X chromosomes which is important when talk about the immune response against SARS-Cov-2. Because the protein by which viruses such as coronavirus are detected is fixed on the X chromosome. This is exactly looks like females have double protection compare to male. The present study also showed that large number of RAT positive cases were observed in males compare to females. Gender based lifestyle would have been another possibility for large number of males got positive in RATs. There

are important behavioral differences between the sexes according to certain previous research findings (54).

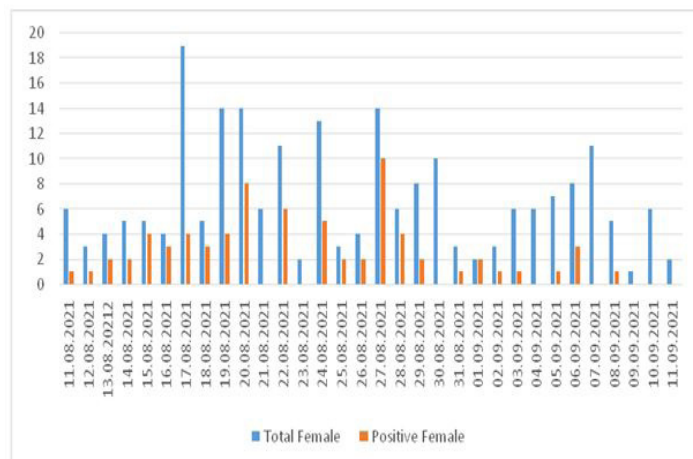


Figure 2: RAT positive female cases among the total female patients performed RAT

Figure 2 shows that the number of female patients got positive result in RAT among the total female patients who performed RAT on every day. According to that, 11.4% (n=73) of female obtained positive result among the total male population (n=216).

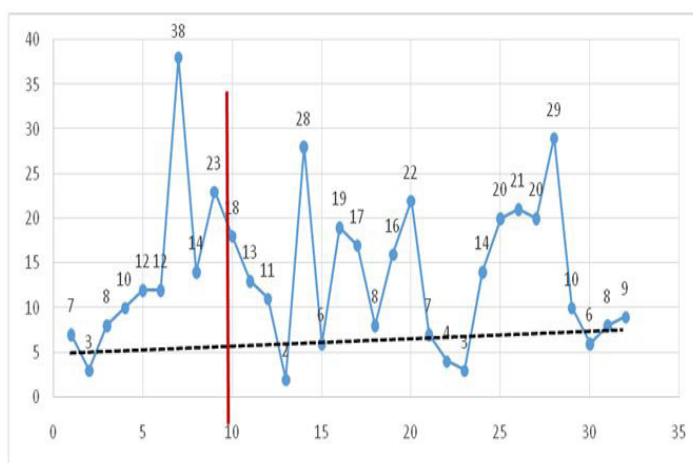


Figure 3: The pattern of total RAT positive cases before and after lockdown

Figure 3 showed that the relations between the number of positive cases before and after the lockdown. The lockdown declared by the tenth day from the initial day when the data was taken for analysis. The red vertical line differentiates the period as two such as before and after the lockdown. Though there was no decline observed as soon as immediately considerable decline was observed after the 21 days of onset of lockdown. Staying at home, avoiding physical contacts, and avoiding exposure in crowded areas are the best way to prevent the spread of Covid – 19 (54). However the significant decline would be able to see after three weeks only from the date of lockdown since the incubation period of SARS-CoV-2 is 14-21 days. The continuous study should be conducted in order to prove it. However the molecular

mechanism of COVID-19 transmission pathway from human to human is still not resolved, the common transmission of respiratory diseases is droplet sprinkling. In this type of spreading, a sick person is exposed to this microbe to people around him by coughing or sneezing. Only the way to prevent these kind of respiratory diseases might be prevent the people to make close contact (54) (55). Approximately 214 countries reported the number of confirmed COVID-19 cases (56). Countries including Sri Lanka have taken very serious constraints such as announced vacation for schools, allowed the employers to work from home and etc. to slow down the COVID 19 outbreak. The lockdown days differ by countries. Countries have set the days when the lockdown started and ended according to the COVID-19 effect on their public. Some countries have extended the lockdown by many days due to COVID-19 continues its influence intensely on the public (57) (58).

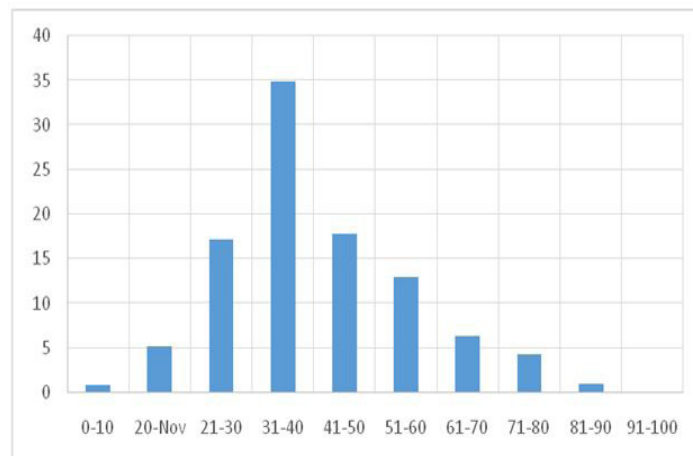


Figure 4: Incidence of COVID-19 by age group

Figure 4 showed that the incidence of Covid-19 and age group. Accordingly large number was observed (34.89%) between the age group of 31-40 years in both sexes. The age group of 21-30 and 41-50 years also were shared the almost same percentage (17.13% & 17.75). A study provides evidence that the growing COVID-19 epidemics in the US in 2020 have been driven by adults aged 20 to 49 and, in particular, adults aged 35 to 49, before and after school reopening (59). However many researches pointed out that adults over the age of 60 years are more susceptible to infection since their immune system gradually loses its resiliency.

Figure 5 & 6 showed that the relations between the positive number of male & female patients and the age group of total patients. According to that the large number of positive male patients observed among the age group of 41-50 years. Almost same number of patients was observed in the age group of 21-30 and 31-40. The least number of positive cases (0.7% and 0.9%) observed almost in 0-10 and 81-90 years. When considering the females, large number

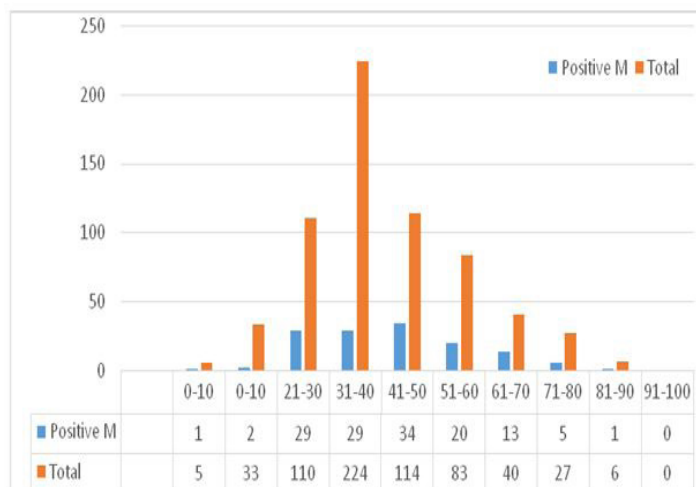


Figure 5: The age group and RAT positive male cases among the total positive cases

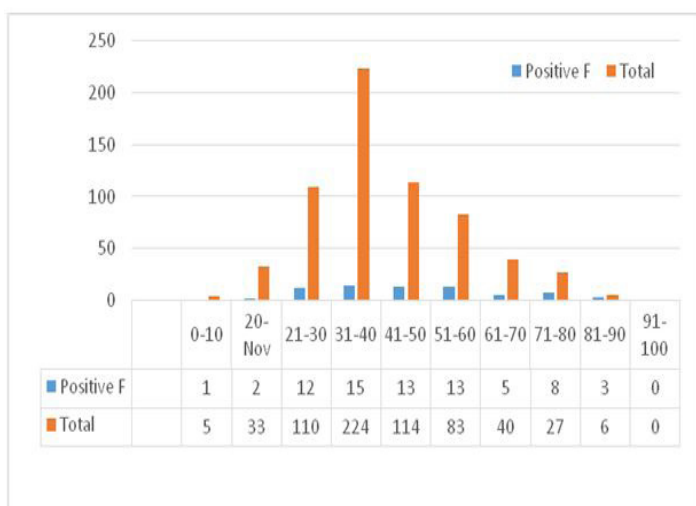


Figure 6: Age group and RAT positive female cases

of positive female patients observed among the age group of 31-40 years. In USA Ministry of Health has reported 444 921 COVID-19 cases and 15 756 deaths as of August 31. For men, most reported cases were persons aged 30–39 years (22.7%), followed by 20–29 year-olds (20.1%) and 40–49 year-olds (17.1%). Most reported deaths were seniors, especially 70–79 year-olds (29.5%), followed by those aged 80 years and older (29.2%), and 60–69 year-olds (22.8%). Also found a similar pattern for women, except that most deaths were reported among women aged 80 years and older (44.4%) (60).

Conclusion

The present study showed that the male are mostly got positive in RAT test than female. Further comparing the old age young age group in both sexes were noticed as positive in RAT. Moreover there were no relationship observed before and after the lockdown and trend of Covid-19

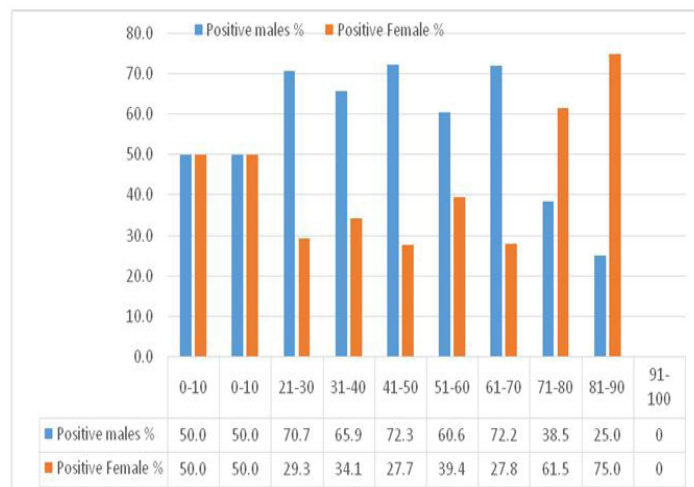


Figure 7: Age group and the positive cases

Table 1: Relations between the age group, sex, and RAT results

Age Category	Positive M	Positive F	Negative M	Negative F	Total M & F	%
0-10	1	1	1	2	5	0.7
11-20	2	2	19	10	33	5.1
21-30	29	12	12	57	110	17.1
31-40	29	15	122	58	224	34.8
41-50	34	13	38	29	114	17.7
51-60	20	13	31	19	83	12.9
61-70	13	5	11	11	40	6.2
71-80	5	8	9	5	27	4.2
81-90	1	3	1	1	6	0.9
Total	206		436		642	
	20.4%	11.4%	46%	22.2		
	31.8%		68.2%			

The limitations of the study

This study has several limitations.

- Only 1 hospital was studied.
- More than the absence of specific data on mobility patterns or transportation, detail of recovery, detail of mortality etc.
- The COVID-19 pandemic is still ongoing so statistical analysis should continue. There are conflicting statements regarding lockdown by countries on COVID-19.
- The effect of the lockdown caused by the COVID-19 pandemic on human health may be the subject of future work

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