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# Preadmission testing for COVID-19 as a screening strategy: a retrospective chart review from a tertiary hospital in Kenya

David Echesa Odada<sup>a</sup>, James Ndai<sup>a</sup>, Jemimah Kimeu<sup>a</sup>, Jasmit Shah<sup>b</sup>,  
Reena Shah<sup>b,\*</sup>

<sup>a</sup> Department of Nursing, Aga Khan University Hospital, Nairobi, Kenya

<sup>b</sup> Department of Medicine, Aga Khan University Hospital, Nairobi, Kenya

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## ABSTRACT

**Background:** Since COVID-19 was declared a pandemic in March 2020, hospitals and patient care facilities have faced challenges in protecting healthcare workers and patients from being exposed to the infection. The main challenge has been how exposure to COVID-19 can be controlled when asymptomatic patients can transmit the infection. This study aims to evaluate pre-admission testing of COVID-19 in patients at the Aga Khan University Hospital, Nairobi as a screening strategy for understanding, preventing and controlling exposure to COVID-19.

**Methods:** This was a descriptive retrospective chart review study that analysed the incidence of COVID-19, incidental detection of laboratory-confirmed COVID-19 and effects on plan of care in patients prior to admission at the Aga Khan University Hospital from April to December 31, 2020. Demographic data, clinical characteristics, COVID-19 test report and plan of care were retrieved from patients medical records review.

**Results:** A total of 8837 pre-admission tests were done between April 2020 and December 2020, with a COVID-19 prevalence rate of 10.9% (961/8837). Among the positive pre-admission tests, 14.3% were incidental positive results (138/961). Among the 138 incidental positive tests 21% (30) had their plan of care affected, 14.5% [20] had their care interventions delayed, 4.3% [6] had their hospital stay shortened, 1.4% [2] their hospital stay prolonged and 0.7% [1] had their care diagnostics delayed.

**Conclusion:** While community spread of COVID-19 fluctuated during this period; depending on the level of compliance to infection control measures, pre-admission prevalence rates were increasing as the year progressed. Mandatory testing of COVID-19 in hospital facilities remains an important admission requirement in controlling asymptomatic transmission of the virus. COVID-19 health burden justifies resource allocation for universal screening of all patients before hospital admission.

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\* Corresponding author. 3<sup>rd</sup> Parklands Avenue, Nairobi, Kenya.

E-mail address: [reena.shah@aku.edu](mailto:reena.shah@aku.edu) (R. Shah).

## Introduction

COVID-19 was declared a pandemic in March 2020, after it was first identified in December 2019 in Wuhan, China. Since then, hospitals and patient care facilities have faced challenges in promptly identifying infected patients being admitted in hospitals [1]. The reproduction rate of COVID-19 infection has been estimated to be 2.24 to 3.58, however the numbers may vary with mobility, containment measures, individual susceptibility and population at risk [2]. Identification of cases became more challenging after World Health Organization (WHO) revised its guidelines on how SARS COV-2 is transmitted by airborne spread and asymptomatic transmission [3]. Transmission of COVID-19 by asymptomatic individuals has been approximated to account for 40%–45% of infections, which justifies the inclusion of individuals without symptoms in

testing programs for SARS-COV-2 [4]. Asymptomatic transmission of COVID-19 has been demonstrated in a study at a London teaching hospital, where 15% of COVID-19 infections admitted between March and April were reported to have been infected while in the hospital [5].

With the emergence of COVID-19, communicable disease screening using symptoms may not be enough in identifying potentially infected cases because there is a significant chance of cases being asymptomatic [6]. Misdiagnosis is highly likely for patients without symptoms of COVID-19 and one would require additional vigilance to accurately suspect a case [7–9]. It is also noted that the risk of infection is increased where people are overcrowded in enclosed spaces [10]. A study in Wuhan showed how crowded emergency rooms promoted transmission of COVID-19 to people who were wearing masks that were inferior to N95 [11].

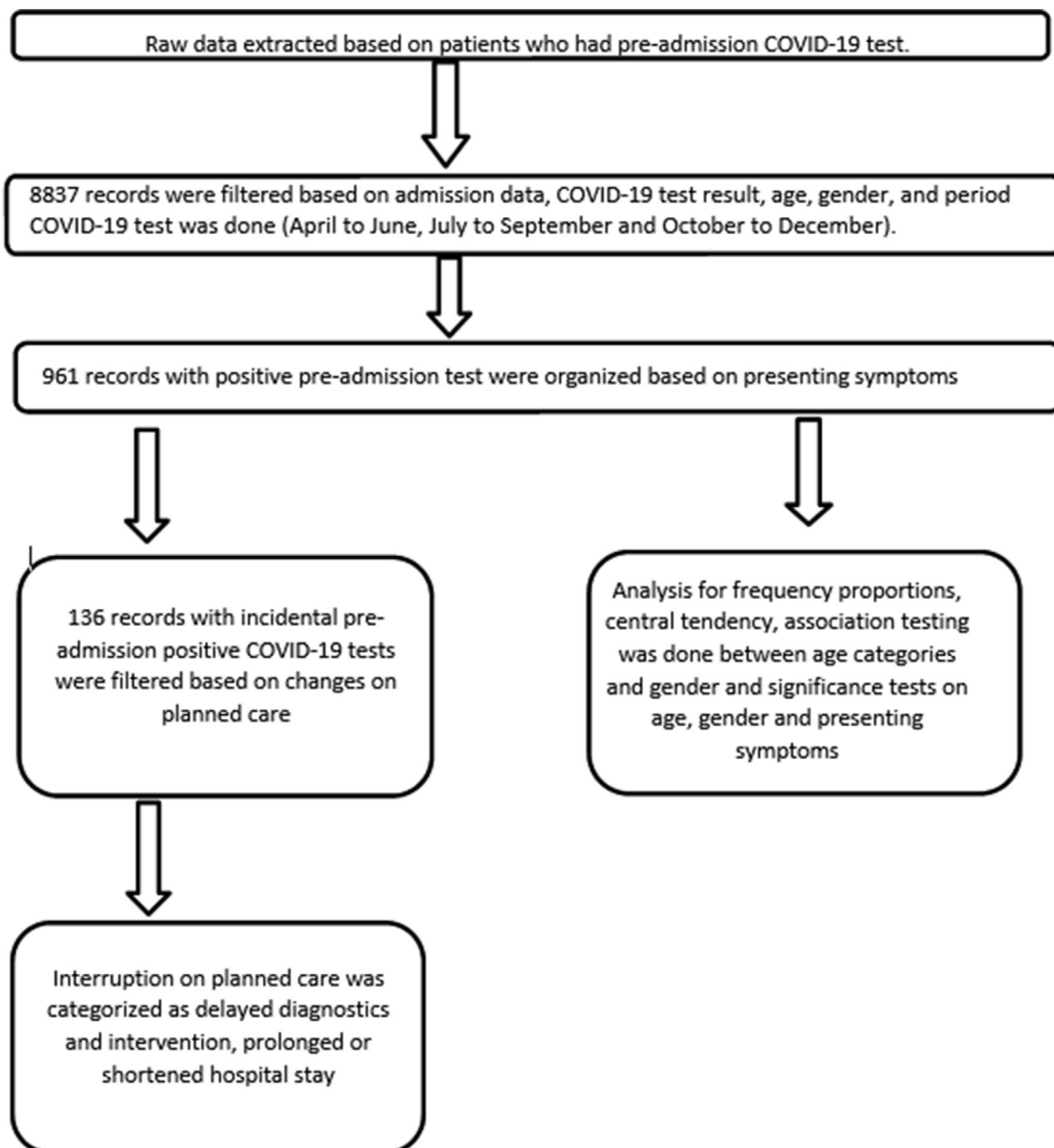


Figure 1. Flowchart of study methodology.

Despite having several testing strategies for COVID-19, the gold standard for testing COVID-19 clinical cases remains nucleic acid detection techniques, like RT-PCR [12]. Asymptomatic transmission of COVID-19 has further challenged efforts to control nosocomial infections, necessitating universal testing for SARS-CoV-2 in all patients being admitted [13]. In the United Kingdom, universal screening using COVID-19 PCR is now advised for every patient admitted to hospital due to high prevalence of COVID-19 in the community [14]. The pre-admission testing strategy has significantly improved workforce depletion due to unnecessary quarantine and controlled potential transmission of COVID-19 infection by asymptomatic patients [15].

In Africa, the first case of COVID-19 was first confirmed in Egypt on February 14, 2020. The continent's level of preparedness strongly depended on the application and execution of testing measures for COVID-19 [16]. The first case reported in Kenya was on March 13, 2020, and the number of confirmed cases has continually increased. By June 2020, the population-weighted test-performance-adjusted national seroprevalence was 4.3%, which was lower than the actual exposure of 5.6% by a study conducted on SARS-CoV-2 Immunoglobulin G among blood donors [17]. At some point, Kenya's Ministry of Health (MoH) embarked on mass testing but faced challenges of test kit shortages because of high global demand, human resources, and logistical challenges which negatively affected the response towards controlling COVID-19 [18].

The Aga Khan University Hospital, Nairobi (AKUHN), adopted mandatory PCR testing of the nasopharyngeal swab for all patients admitted at the beginning of April 2020 as an additional strategy to diagnosing COVID-19. The AKUHN admitted its first confirmed COVID-19 patient on March 22, 2020.

COVID-19 diagnosis has also resulted in delays in patient care, early discharge from hospital, or a change in care management [19]. This study aims to evaluate pre-admission testing of COVID-19 in patients at the Aga Khan University Hospital, Nairobi as a screening strategy for understanding, preventing and controlling exposure to COVID-19. And controlling exposure to COVID-19.

## Methods

This was a descriptive retrospective chart review study for COVID-19 patients who were tested during hospital admission at AKUHN. Extracted data contained pre-admission COVID-19 test results, presenting complaint, incidental COVID-19 (a positive COVID-19 test that was unexpected based on clinical features) and its effect on care. This study was approved by the Institutional Ethics Review Committee at AKUHN and National Commission for Science, Technology and Innovation (NACOSTI). The data extracted was limited to information that was specific to the aims. Patient identifiers in the data were removed and extracted data was stored in an excel sheet and password protected to ensure confidentiality and integrity.

Summary statistics was presented as frequencies and percentages or means and standard deviations. Univariate analysis was performed using Chi-squared tests or Kruskal Wallis test. Logistic regression was also used and odds ratios were presented with 95% confidence intervals. The statistical significance was considered at the  $P$ -value of  $<0.05$ , and all the statistical tests were performed using IBM SPSS Version 23.0.

## Results

A total of 8,837 pre-admission tests were done between April 2020 and December 2020, with a COVID-19 prevalence rate of 10.9% (961/8837) (Fig. 1). Of the 961 positive tests, 639 (66.5%, 639/961) were males and majority of the cases (621, 64.6%, 621/961) were between 31- 60 years old. Incidental COVID-19 test results accounted for 14.2% (136/961) of the total positive tests and 1.5% (136/8837) of the total pre-admission COVID-19 tests. The plan of care was affected in 22% (30/136) of patients whose COVID-19 positive tests were incidental while care diagnostics and interventions were delayed in 0.7% (1/136) and 14.7% (20/136) respectively in patients that had asymptomatic COVID-19. As for hospital stay, 4.4% (6/136) of the patients' hospital stay was shortened and 1.5% (2/136) prolonged. The prevalence rate of positive COVID-19 tests at admission for males and females was 7.2% (639/

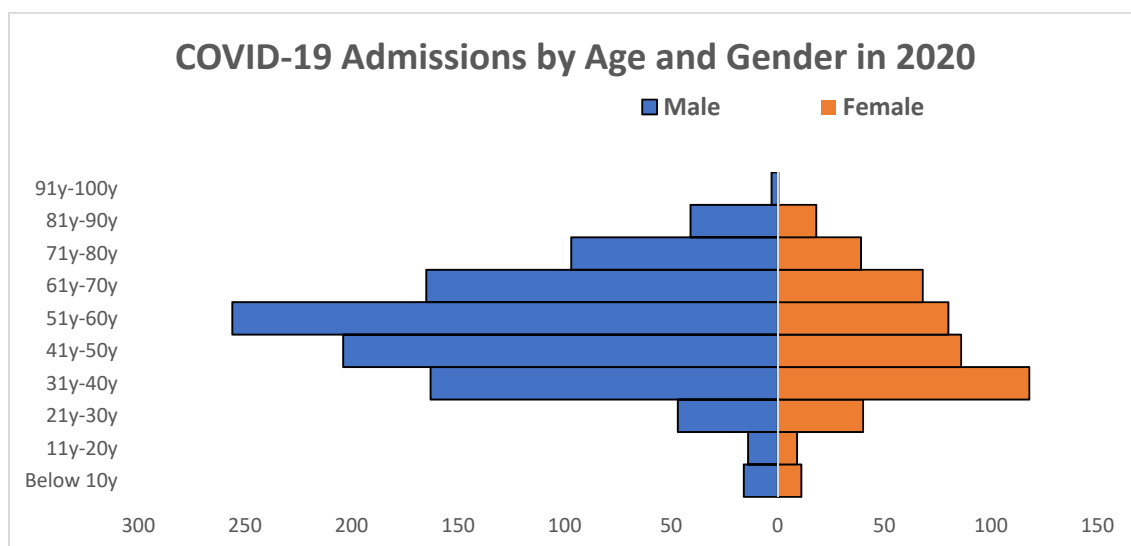


Figure 2. COVID-19 Admissions distribution by age and gender.

8837) and 3.6% (322/8837) respectively. There was an increase in the overall prevalence rate over time, 8.6% (123/1430) in April to June, 10.4% (380/3650) in July to September and 12.2% (458/3757) in October to December. The mean age of positive tests was 50.1 years (SD=13.5), males (mean 51.5 years; SD=15.7) and females (mean 47.2 years; SD=17.1). The distribution of age and gender is presented in Figure 2. Gender was associated with COVID-19 symptoms, where only 9% (55/639) of the males were incidental positive, compared to 25% (81/322) of females ( $P < 0.001$ ). Age distribution was also associated with COVID-19 symptoms. The association of gender and age with COVID-19 symptoms is shown in Table 1.

The mean age of females with COVID-19 was lower as compared to the males and was statistically significant; (Females: 46.99 years (SD=17.1) vs Males: 51.52 years (SD=15.71);  $P < 0.001$ ).

The mean age of incidental COVID-19 was lower as compared to non-incidental COVID-19 and was statistically significant (Incidental: 39.88 years (SD=17.9) vs Non-Incidental: 51.67 years (SD=15.43);  $P < 0.001$ ) (Table 2).

Based on logistic regression, the odds of having incidental COVID-19 infection was significantly higher in both 0–30 years and 31–60 years as compared to >60 years (reference). Regarding gender, females were more likely to have incidental COVID-19 compared to males. Table 3 presents the results of the logistic regression.

## Discussion

In this study, the prevalence rate of 10.9% (961/8837) is higher than the earlier reported rates in two surveys that showed a national seroprevalence rate of 4.3% by population-weighted, test-performance-adjusted and 5.6% from actual exposure on Immunoglobulin G among blood donors [17]. The difference of these rates can be explained by the duration and point of time the surveys were done. The prevalence rate from this study was over several months during which two waves of infections occurred. Overall COVID-19 numbers were higher in males, however the numbers were similar for those who were between 31 and 60 years. This was different to other findings which indicated that females below age 35 years had higher chances of getting infected than males in the same age category [20]. Over the review period, the prevalence rates for positive COVID-19 tests at admission for males and females were 7.2% (639/8837) and 3.6% (322/8837) respectively. For tests that were positive, 14% (136/961) were incidental positive results. To understand the pandemic, use of percentages

**Table 1**  
Association with COVID-19 symptom status.

Characteristics	Symptomatic positive PCR	Incidental positive PCR	P Value
Gender	<b>N (825)</b>	<b>N (136)</b>	<0.001
Male	584 (91%)	55 (9%)	
Female	241 (75%)	81 (25%)	
Age (years)			<0.001
1–30 years	59 (65.6%)	31 (34.4%)	
31–60 years	534 (86.0%)	87 (14.0%)	
>60 years	232 (92.8%)	18 (7.2%)	

**Table 2**  
Association of age by gender and incidental COVID-19.

Characteristics	Mean age	Std	P Value
Gender			
Male	51.52	15.714	<0.001
Female	46.99	17.098	
Incidental COVID-19			
Yes	39.88	17.899	<0.001
No	51.67	15.434	

in estimating the rates of infection is more relevant using actual numbers [21]. Asymptomatic patients who tested positive for COVID-19 accounted for 1% (136/8837) of the total patients who had a preadmission test for COVID-19 between March 2020 and December 2020.

More females than males had incidental COVID-19, 59% (81/136) and accounted for 25% (81/322) of the total positive tests for females likely explained by a higher number of females being admitted are of childbearing age, incidental positive tests seen mostly in women who came in during labour. The chances of getting infected with COVID-19 may vary among gender and different age categories. This study explores age categories and found that persons aged between 30 to 60 years 65.5% (621/961) were seven times likely to be admitted with COVID-19 as compared to ages between 0 to 30 years 9.5% (90/961). This finding is consistent with a previous study that indicated COVID-19 infection rates were low in persons with lower age category [22]. Other findings also indicate that all age groups are equally susceptible to SARS-CoV-2 infection but that the symptomatic rate is different across age groups (23). Variations in infection rates and symptomatic COVID-19 disease across age and gender may further be explained by biological variations. Currently, less testing is being done in developing countries. With regard to age, earlier evidence indicated that the older population were at higher risk of infection. However, since around mid-May and early-June 2020, younger people are increasingly being infected with the virus leading to a high rate of hospitalisation and isolation worldwide [22]. There was also significant effect on planned care following diagnosis of incidental COVID-19; with 22% (30/136) of incidental results cases having interruption of care.

Results from this study justify mandatory pre-testing of patients before admission as a significant measure of prevention and control of SARS CoV-2 infection transmission in hospital settings. The findings can also be used to estimate the prevalence rates of COVID-19 in the community. This is a single centre study, another limitation is that the nature of the data

**Table 3**  
Binary logistic regression model for age categories and gender as the predictor for incidental COVID-19.

Factors	P-value	O.R	95% CI. for O.R.	
			Lower	Upper
0–30 years	<0.001	6.77	3.54	12.94
31–60 years	0.006	2.10	1.23	3.56
Female	0.000	3.57	2.45	5.19



keeps changing. The trends of this study may have since changed because of vaccination developments, and so the interpretation of this study should apply to March 22 to December 31, 2020 period. Also new testing for COVID-19 with a shorter turnaround time are being adapted for preadmission screening although PCR test for SARS-CoV-2 still remains the gold standard.

## Conclusion

Mandatory pre-admission testing for COVID-19 can be used to estimate the prevalence rate of COVID-19 for both symptomatic and asymptomatic cases from the community in addition to other population based surveys. Mandatory pre-admission testing of COVID-19 is a strategy that should be used to control infection transmission of COVID-19 to both staff and patients. These findings can be used to inform new COVID-19 containment policies on universal testing, not just in hospital facilities but also for other boarding institutions that receive clients from the general public. Females, especially those being admitted for maternity care, are most likely to have an incidental COVID-19 positive result, it is recommended that appropriate personal protective be used while providing delivery services where COVID-19 results are not available. Patients should be psychologically prepared on the likelihood of care interruptions in case of an incidental COVID-19.

## CRDiT author statement

**David Odada**, Conceptualization, Methodology / Study design, Software, Formal analysis, Investigation, Resources, Data curation, writing original draft, Project administration.

**Reena Shah**, Conceptualization, Methodology / Study design, Validation, Resources, writing review and editing, Supervision, Project administration, Funding acquisition.

**James Ndai**, Methodology / Study design, Software, writing review and editing,

**Jasmit Shah**, Software, Validation, Formal analysis, Data curation, Visualization.

**Jemimah Kimeu**, Validation, Funding acquisition.

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## Ethics statement

Ethical approval was obtained from the Aga Khan University, Nairobi Institutional Ethics Review Committee. No additional patient consent was required, as it was hospital policy to screen all patients for COVID-19 infection.

## Conflict of interest

The authors declare there are no conflicts of interest.

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The authors confirm that no funding was received for this study.

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