



## **Transmission of COVID-19 in Public and Private Schools in Benghazi, Libya: 13<sup>th</sup> -28<sup>th</sup> February 2021**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author NH designed the study and wrote the protocol. Author AFA performed the statistical analysis. Authors NH and AAM wrote the first draft of the manuscript. Author EA managed data collection of the study. Authors AM and HA managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

The aim of the present study was to provide a national estimate for transmission of COVID-19 Cases in public and private schools in Benghazi city in the Eastern region of Libya. A multistage procedure was followed to obtain a representative sample of students and teaching staffs at randomly selected schools across the Eastern region of Libya. The resultant sample consisted of 101 schools, 808 students, and 202 staff members. Data were collected on age, sex, class, and symptoms of COVID19. Rapid antigen test was performed as a diagnostic test for SARS-CoV-2 to detect the presence of a viral antigen. Specimen was taken from the upper nasopharyngeal swab.

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Out of 808 students tested, 5 specimens were positive. Every positive rapid antigen test was further confirmed by PCR test. All Specimens taken from staff members were negative. This survey highlights epidemiological concern on COVID-19 among students and staff members in school setting in Benghazi. Implementation and compliance with prevention measures are crucial.

**Keywords:** COVID-19; prevalence; school; student; Ag test; Libya.

## 1. INTRODUCTION

Since the World Health Organization (WHO) declared COVID-19 as a pandemic and a public health emergency around the world, all aspects of life (including education) have been negatively affected [1]. The schools in the eastern part of Libya closed from March 2020 until the end of the year. At the beginning of 2021, governmental efforts in the Eastern region of Libya have been made towards reopening of schools and resuming the education process under the preventive measures stated by the Medical Advisory Committee in the eastern region of Libya regarding combating the corona virus disease (COVID-19). These measures were based on the updated guidelines recommended by the WHO [2] and the CDC [3] regarding reopening of schools in the context of COVID-19.

Epidemiological reports released from the national centre of infectious diseases control show gradual increase in COVID -19 cases during January 2021 after school and other life facilities reopening [4]. Due to these concerns the medical advisory committee in the East of Libya has lunched school based screening in collaboration between the ministry of health, the ministry of education, and the Libyan centre of actuarial studies. It was reported that targeted screening yields higher positivity rates, more cost-effective than universal screening, and may helps stem outbreaks in vulnerable communities [5]. However, these benefits must be balanced against the potential for stigmatization, since different societies will weigh these considerations differently [6].

To the best of our knowledge, no published national study was undertaken to measure COVID-19 transmission among pupils and staffs in primary, preparatory, and secondary schools. This study therefore, aims to investigate the prevalence of current coronavirus (COVID-19) infection and presence of antigen to COVID-19 among pupils and staff in sampled primary, preparatory and secondary schools in Benghazi. The transmission was measured in the period of 13-28 February. Further objectives were to examine application of preventive measures at

schools, and undertake outbreak investigations in private and public schools of the three educational levels mentioned above.

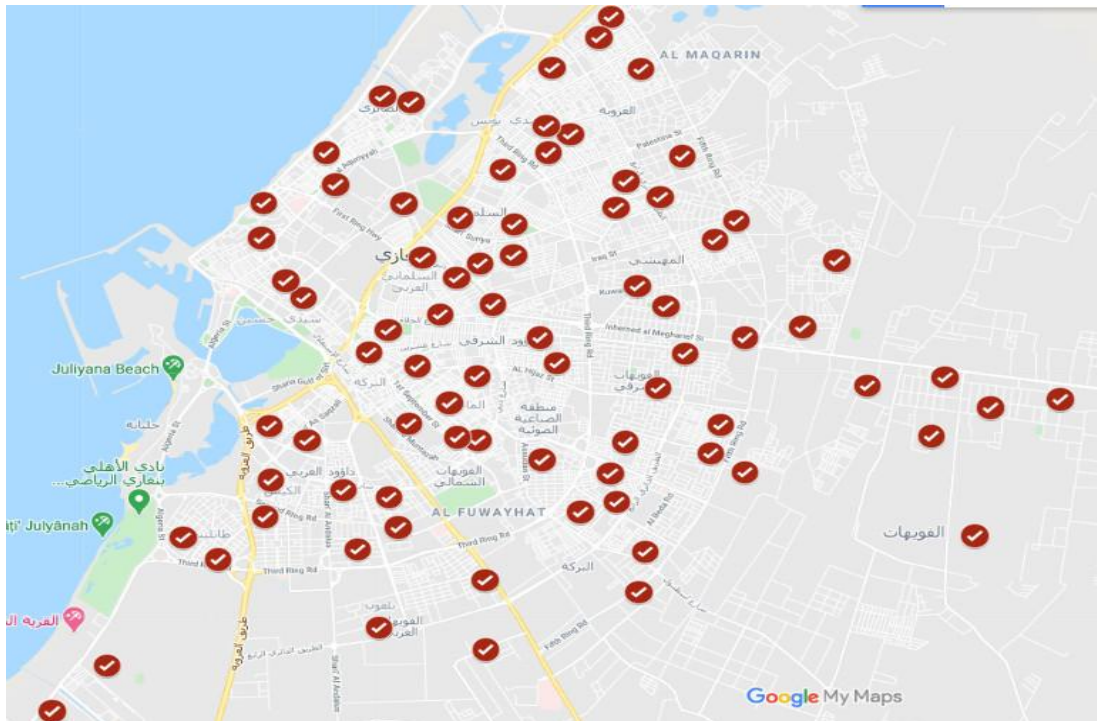
## 2. METHODOLOGY

### 2.1 Study Population

According to the ministry of Education records, there are 638 schools in Benghazi and its related villages, classified as primary, preparatory, and secondary. Total number of students and staffs member are 275,918. Schools are further classified as public and private. The focus of this study was to include the schools that located in the metropolitan area.

### 2.2 Study Design and Sampling Procedures

A cross sectional study was conducted according to time schedule of data collection arranged by teams of epidemiologic investigation in Benghazi. A multistage cluster sample of schools was drawn randomly from different geographical areas in the city. The study sample was selected with the assistance of the Libyan Centre for Actuarial Studies. The selection was based on the distribution of the total population in Benghazi. Testing in schools located in communities at moderate to highest risk may provide the maximum balance of testing efficiency [7]. Accordingly, we included schools from different regions in Benghazi. The metropolitan area was divided into four major parts (Fig. 1). Since the number of primary schools in Benghazi is twice as the number of preparatory and secondary schools, the study sample was divided for each part of the city as follows: 50% of primary schools, 25% of preparatory schools, and 25% of secondary schools. Each of the selected schools represented a cluster in the study sample. Therefore, the study included 101 clusters. 69 of them were public, and 34 were private. The number of students included in this study was 808, and 202 members of teaching staffs were included. 8 students and 2 staff members were included from each cluster.



**Fig. 1. Geographical distribution of the school sample**

**Table 1. Description of study sample**

Sample of schools =101 69 public schools & 34 private schools	
<b>Sample of students =808</b>	<b>Sample of staffs =202</b>
8 students from each school Chosen as :	2 staff members from each school selected randomly with inclusion of any staff with symptoms
3 students with symptoms of COVID-19 at the screening point in the entrance of school	1 administrative staff member
5 of asymptomatic students randomly from the class rooms by a systematic sampling method	1 teaching staff member

In each school included in the study, we consider the hierarchy for selection of persons for school-based testing suggested by the CDC [8] as the following:

1. Persons with symptoms of COVID-19
2. Random sample of asymptomatic students, and staffs to detect increasing incidence of COVID-19. Table 1 summarises Description of study sample

The prevention measures guidelines for schools have stipulated that any symptomatic student should be prevented from being in the classroom; therefore, the survey priority was given in this study to students who have shown symptoms at the screening point (school

entrance). Otherwise, students were systematically selected from each class of the school.

### 2.3 Data Collected

Age, gender, class for students, Job for staffs, Self-reported flu-like symptoms such as: Fever, cough, fatigue, headache, Sore throat, Muscle aches, Loss of taste or appetite.

- **Screening test:** Nasopharyngeal specimens were collected from all participants by Nasopharyngeal Panbio. To detect ongoing infection, Rapid Antigen test which is an in vitro diagnostic rapid test for qualitative detection of SARS-CoV-

2 antigen (Ag). Test results are available in 15 minutes .Positive cases (if any) were confirmed by PCR.

### 3. RESULTS

A school based targeted screening was performed for the students and staff in 69 public schools and 34 private schools randomly allocated for screening, selective inclusion of symptomatic subjects and random inclusion of asymptomatic were the baseline criteria. The total number of performed tests was 1010. All specimens were taken in the period from 13<sup>th</sup> - 28<sup>th</sup> February 2021; therefore, results only refer to the transmission during this period. Table 2 and 3 , show Characteristics of student and staff member's samples respectively.

**Table 2. Characteristics of student sample**

Characteristics	Frequency (%)
Gender	
Male	426 (52.7%)
Female	382 (47.3%)
Age Group	
6-7	66 (8.1%)
8-9	69(8.5%)
10-11	161(19.9%)
12-13	164(20.2%)
14-15	162(20%)
16-17	125(15.4%)
18-19	61(7.5%)
Level	
Primary	296 (36.6%)
Preparatory	325 (40.2 %)
Secondary	187 (23.2%)
Symptoms	
Fever	7 (0.8%)
Cough	18 (2.2%)
Shortness of Breath	7 (0.8%)
Muscle or body aches	9 (1.1%)
New loss of taste or smell	6 (0.7%)
Vomiting	1 (0.1%)
Diarrhoea	1 (0.1%)
Ag Test	
Negative	803(99.3%)
Positive	5(0.006%)
Total	808

All specimens taken from teaching and administrative staffs at both public and private schools were negative.

As shown in Table 2, only 50 Out of 808 students have reported one or more of suspected COVID.19 symptoms. Five specimens were

positive among students. Table 4 shows the cases with positive rapid test among sample of students confirmed by the PCR. The infected students as detected by the Ag rapid test were from different schools. Two of them were public schools located in AIKish area on the same date. Infected Students who reported fever were surveyed at the at the school entrance. Where as, the other 3 positive cases were detected by a systematic random selection in the classrooms. Two of them did not report any symptoms.

**Table 3. Characteristics of staff's sample**

Characteristics	Frequency (%)
Gender	
Male	55 (27.3 %)
Female	147 (72.7 )
Age Group	
20-24	5 (2.4%)
25-29	16 (7.9%)
30-34	17 (8.4%)
35-39	20 (9.9%)
40-44	40 (19.8%)
45-49	42 (20.8%)
50-54	36 (17.8%)
55-59	18 (8.9%)
60-64	6(2.9%)
Occupation	
Administrative staff	101 (50%)
Teaching staff	101(50%)
Symptoms	
Fever	0(0%)
Cough	2 (0.9%)
Shortness of Breath	2 (0.9%)
Muscle or body aches	1(0.5%)
New loss of taste or smell	0 (%)
Vomiting	0 (%)
Diarrhoea	0 (%)
Rapid Ag Test	
Negative	202 (100%)
Positive	0 (%)
Total	202

Bases on these findings, five students were detected as positive by rapid Ag tests from this sample of students and staff members from primary, preparatory and secondary schools in Benghazi. The estimated number of the infection among the sample of students and staffs is (0.005), which can be interpreted statistically as for each 100 students and staffs, there are 0.005 infected individual in the sample, 95 %CI =[ 0.006 ≤P≤0.009] . Accordingly, the estimated number of infections in the population of students and staffs in Benghazi during the period of survey is **1352**.

**Table 4. Result of random and targeted based schools screening in Benghazi**

Case	Date	Gender	Age	Symptoms	School Name	Public / Private	Location
1	15-2-2021	Male	13	Muscle or body aches	Abo Baker	Public Preparatory	Al Kish
2	15-2-2021	Female	16	Fever, Cough	Freedom	Public Secondary	Al Kish
3	16-2-2021	Female	14	Fever, Cough, Shortness of Breath	Al Hassan	Public Preparatory	Ras Obida
4	22-2-2021	Male	18	No symptom reported	Knowledge bridge	Private Secondary	Tabilino
5	25-2-2021	Female	10	No symptom reported	Rahman Lovers	Private Primary	Shibna

#### 4. DISCUSSION

This survey aimed to estimate the epidemiological picture in the school settings in Benghazi. The estimated number of infected students in Benghazi indicates to an increased transmission and represents a risk for spread of infection because of no symptoms appearing among some students with positive tests. These students are asymptomatic SARS-CoV-2 carriers, consequently, it is highly anticipated that they will spread the SARS-CoV-2 to their fellow students as well as the community. This is true especially, if they do not follow the recommended preventive measures within educational institutions, at home, and in community in general. Recent research indicates that symptom screening alone will not enable schools to contain Covid-19 outbreak [9]. Moreover, asymptomatic individuals identified as high-risk exposure (close) contacts of cases could also be considered for testing [10]. Therefore, this survey focused on these criteria for COVID-19 testing.

Data emerged from countries on COVID-19 transmission in school setting, where surveillance is mandatory [11,12,13]; these data are comparable with the current survey. Some reports documented that school reopening does not cause substantial increase in COVID.19 in the community [14,15]. Based on the available literature, transmission of virus from schools to community is depending on compliance of a society with preventive measures. Nevertheless, observations in Libya imply variety of risk factors contribute to the expected rise in cases and death, therefore, school reopening is not the only reason.

As mentioned earlier, to our knowledge, this is the first study to estimate the number of cases infected with COVID-19 in a representative sample of students and staff members in primary, preparatory, and secondary schools in

Benghazi. However, this descriptive study has some limitations .The school wide testing was a challenge due to the shortage of financial recourses. Furthermore, the estimated number of infected students and staffs only represents the burden of COVID-19 infection during the time of survey in the period from 13-28 February 2021 .Additionally, rapid Ag test used in this survey usually has a lower sensitivity. There is a substantial probability that some of the negative results from the rapid antigen test are false negatives, while the positive results are very likely to be true positives <sup>(10)</sup>. For confirmation of positives Ag tests, we used PCR test.

#### 5. CONCLUSION

This survey highlights epidemiological concern on COVID-19 among students and staffs in school setting in Benghazi. Therefore, effective social distancing and personal hygiene measures need to be followed to keep cases down and schools open. In addition, community screening testing, effective contact tracing, isolation of diagnosed individuals are recommended to break transmission chains and suppress the ongoing pandemic. Further epidemic investigations and surveillance are recommended in school setting.

#### ETHICAL APPROVAL AND CONSENT

Parents were informed through the media and administration of schools. Inclusion of any student to be tested is voluntary and based on verbal and written consent of parents. As such, contribution of staffs is voluntary. Specimens were collected by trained personnel considering the preventive procedures.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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