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COVID-19 Triage System in Tajoura, Tripoli, Libya

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ABSTRACT

Introduction: *COVID-19 pandemic is a serious worldwide health threat. For this reason critical health-care measures have been applied. This study is to describe the organizational procedure in setting up a coronavirus disease 2019 triage unit in Tajoura Triage Centre (TTC).*

Methods: *TTC is a local triage in Tripoli/Libya which set-up in an independent building and consists of three areas: 1. Pre-triage, 2. Triage, and 3. Triage plus. The Pre-triage is to classify COVID-19 infected patients and transfer them to the Triage area which patients undergo to assessment and diagnosis. If the patient symptomatic or suspected, nasopharyngeal swabs are collected. Some cases need further investigation which are transfer to Triage plus. At this point, patients are discharged home after additional investigations or admitted to the isolation centre for administration.*

Results: *A total of 6432 cases were screened between 20 June 2020 and 31 august 2020 at TTC. Of these, 726 (15.6%) tested positive for COVID-19. Of all positively-tested patients 294 (40.5%) were female and 432 (59.5%) were male. However, the negative cases were 3913 (84.4%). The mean age for positive cases was (35) and the mean age for negative cases was (45). The mortality was reported 5 (0.68%) which were 3 females and 2 males.*

Discussion: *TTC unit was creation successfully and also has been able to effectively screen and organize the spread of COVID-19 within the area even the COVID-19 is still unclear. This study helps other health care to develop similar triage centre.*

Keywords: *COVID-19, Triage, Tajoura Triage Centre (TTC).*

1. Introduction

Globally, emerging and reemerging Infectious agents are Great challenges for public health [(1)]. The enveloped RNA viruses such as coronaviruses are distributed widely among mammals, humans, and some birds which are responsible for causing variety of illnesses including respiratory, enteric, hepatic, and neurologic diseases [(2, 3)]. It has been known that there were six species of coronavirus can cause diseases in humans [(4)].

In late December 2019, low respiratory infections like pneumonia of unknown cause were conducted in clusters of patients at Wuhan (Hubei Province, China) several local health settings [(5)]. Rapid response team has been dispatched on December 31, 2019 by Chinese Center for Disease Control and Prevention (China CDC) to conduct an etiologic and epidemiologic investigation. It has been reported that on Jan 26, 2020, over 2000 patients have been confirmed with human-to-human transmission 2019-nCoV infection, majority of which included people visiting or living in Wuhan [(6)], this novel virus known as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).

The first case confirmed with COVID-19 in Libya was reported on March 24, 2020[(7)]. On March 4, 2020, it has been reported that by the National Center for Disease Control in Libya, an old man who come back to the country from abroad, and had developed symptoms almost 2 weeks later was confirmed as case zero. Since then, during the period from April to May 2020the number of cases has increased steadily, bringing the total number of confirmed cases to 156. Of which five cases have died, an 85-year-old woman was the first official recorded death on 3 April 2020 [(8)]. Nonetheless, Approximately 34 to 52 of patients were recovered, and by the end of May nearly 99 active cases [(9)].Thankfully, this number is considered a relatively small, compared

with neighbor countries and globally. On the other hand, the number of confirmed COVID-19 Cases had doubled in the first two weeks in June [10]. On 26 June, the number of confirmed cases had increased to 713 [11]. Moreover, on July the number of confirmed cases has raised dramatically in to about 2,797, bringing the total number of confirmed cases to 3621patients [12]. Whereas, there were sudden elevation in the number of confirmed cases to reach 10,035 new cases in August, which raise the total number of confirmed cases to 13,656, and about 232cases died [13].

2. Rationale

Control of COVID-19 depends on its early detection, appropriate risk assessment, isolation of possible cases and prevention spreading of the virus. A critical plan in minimizing the risk of virus spreading start with a successful triage system. Strategically, Tajoura triage center (TTC) was an independent building to minimize COVID-19 spreading through early screening and assessment, before potentially affected individuals even enter the triage.

Highly suspicious cases who are recognized as meeting COVID-19 criteria or who have tested positive for the disease are categorized as suspected or confirmed cases and are immediately re-directed into specialized isolation area. There are many benefits of screening in specialized centers for epidemics, aimed to differentiate between patients with mild to moderate symptoms and who do not have risk factors, and required home isolation only. On the other hand, individuals who have severe symptoms and/ or other risk factors might need further investigation or isolation centers. The concept consists of three areas: Pre-triage, Triage and, Triage plus (Figure 1 & 2).

3. Methods

During infectious disease outbreaks, triage is particularly important to separate patients likely to be infected with microorganisms [14]. Tajoura Triage Center (TTC) is developed in the perspective of the COVID-19 pandemic and does not replace any routine clinical triage already in place in healthcare facilities to categorize patients into different urgency categories. This center is designed to categorize suspected cases with COVID-19 which are included symptomatic cases, cases who are contact with COVID-19 patients, people who need the swab for travelling and old ages.

3.1. Pre-triage

The aim of pre-triaging is to allow a select group of individuals, including patients who do not fulfill COVID-19 criteria and all hospital staff, to enter the center. All staff who enters the premise for work have to present a hospital identification in order to gain access to the hospital facilities [14]. TTC is public, and received all symptomatic and/ or asymptomatic persons from different cities, surgical masks were provided for all visitors. Symptomatic stable cases admitted immediately into the pre-triaging process. Whereas, symptomatic cases who present unstable illness are directed to triage area. In these cases, relatives and visitors are generally not permitted to enter to the triage, except in special circumstances. The pre-triage area or check-point is located in front of each of the two main entrances of the center (Figure 2). This check-point

operated by the center security, as well as the Civil Protection Unit, which are responsible for protection of customers and their critical resources in the event of major emergencies and armed conflict. Surgical masks or N95, hand sanitizer (70% Ethanol) are provided as Personal Protective Equipment (PPE) at this level. The minimal distance is about 2meters (≈3.28 feet) which maintained at all times (Figure 1/A, B).

3.2. Triage

3.2.1 Structure

The main Triage area consists of one building measuring about 400 square meters (≈4305.56 square feet). In general, the building has a good ventilation and wider space capacity. Inside the center, two bathroom facilities were sealed off to minimize contamination. The remaining eight rooms were modified as follows: the first one is a patient reception room for collection of personal information, second as room for patient waiting, third is an assessment area and the forth one is to nasopharyngeal sampling collection, fifth room is sterilization room which is a storage unit for PPE and hand sanitizers, sixth room is as a dressing room to remove PPE, seventh room is for staff meetings.

In addition to isolation room for further assessment and observation (Figure 2). All rooms have large windows to further increase ventilation the floors are clearly marked with arrows to show the patients' route. In fact, triage is opened 24 h, with staff rotating between 2 shifts (Figure 1).

3.2.2. Staff & equipment

Routinely, there are 4 medical staff who should be present at the center (2 physicians and 2 nurses) in addition to 2 receptionists. Furthermore, there are 4 staff belong to Marseille company. The PPE for all staff, which are included surgical masks, gowns, goggles and face shield, with hand sanitizer (70% Ethanol) and gloves also available. Patients are provided a chair to sit. This chair is then cleaned and disinfected after every use by Marseille staff. Physicians who must come closer than 2 m (≈3.28 feet) to patients in order to perform the nasopharyngeal swabs, are equipped with filtering face pieces with protection 2 (FFP2) respirators, long sleeve fluid repellent gowns, polycarbonate safety glasses and disposable gloves.

Carefully, physicians, who are responsible for directly screening suspected COVID-19 patients and performing the swabs and do not make any direct contact with the patients themselves or with other staff members. If direct physical contact with patients has been inadvertently made, then the contaminated gowns and gloves are disposed of in clearly labeled bins and fresh protective device is then re-applied (Figure 1).

3.2.3. Infection control

Marcella Company for cleaning and environmental protection provides an integrated system for the management of medical waste in all its classifications and using the newest technologies to make sure the main environmental quality principles which are considered one of the most negative phenomena in our society as it is the biggest cause of epidemic diseases, the environment and cancer. Marseille is responsible for disinfecting floors and surfaces, as well as sterilizing equipment and machines such as chairs, tables, and the

imaging room. It is also responsible for transporting the wastes to the specific designed places [15] (Figure 1/G).

3.3. Procedure

3.3.1. Patient Registration

Patient is directed from a Pre-triage checkpoint to the triage unit, primarily, patient is registered at reception area, the administration staff are located inside the reception room while the patients stand outside, and a face shield is sited in between to avoid direct contact. Here, patient's data, including their name, age, address, mobile phone number as well as a cause of swab taken, are confirmed and recorded(Figure 1/B&2).

3.3.2. Waiting Area and assessment

After registration patients are waiting maximum for 10 min in the waiting room. At this stage physician confirmed their personal information, temperature measurement, History Taking and Assessment. The next step is collecting the patients from the waiting area into the assessment area for clinical assessment by a physician. All patients is must to wear a surgical mask. For those individuals, especially small children, and elderly patients where the application of a face mask is not well tolerated, the assessment is performed outside (Figure 2). Prolonged stay (>15 min) inside the main building is avoided. Again no physical contact is allowed and a minimum distance of 2 meters (≈3.28 feet) is maintained (Figure 1/D, E).

Inside the assessment room, the patient is asked a series of specific questions to identify if they display symptoms indicative of COVID-19, fulfill the criteria for a nasopharyngeal swab , or require additional investigations in Triage plus. A flow diagram is designed to help facilitate the screening process for all people. After assessment patients are either advised to stay at home without diagnostic testing, or undergo testing by a nasopharyngeal swab. In the latter group, individuals with no additional risk factors are then discharged home for self-isolation until the test results are achieved, or they are referred to Triage plus for further investigation (Figure 2). All patients who are discharged home are provided with information leaflets with appropriate advice and contact details according to their clinical scenario. The center provides to all customers a book included all information aboutCOVID-19(Figure 1/D, E).

3.3.3. Sampling Collection

The following step is the nasopharyngeal sample collection itself, which is performed in a separate room with good ventilation (Figure 2). Patients are provided with information leaflets which include details of the isolation protocol until further notification of their test results, which is usually within 48 h. If the patient is then discharged home, they leave the main Triage area using a separate exit. If, however, isolation center is required, then the patient is transferred by ambulance. Patients are received of their results via text messaging service if the test is negative or via a phone call if the test is positive to provide detailed instructions for subsequent home quarantine. This service is coordinated directly by the Department of Infectious Disease and provides the opportunity for "telemedicine" or a remote clinical assessment via telephone if necessary (Figure 1/F).

3.4. Triage plus

The Triage plus area is situated in the main center building, and is directly closest to the main Triage pavilion. At this point, patients are further assessed by a separate team of physicians and technician who perform further clinical examinations including oxygen saturation measurement, computerizing tomography (CT scan) and investigations, including CBC, capillary blood C-reactive protein (CRP). If patients appear more severely affected which are with chronic diseases like diabetes, hypertensive further medical investigations are indicated including (Lactate dehydrogenase) LDH, D-Dimer and Serum Ferritin (Figure 2). Patients then leave Triage plus using the same exit as the other Triage patients unless they are transmitted to an isolation center for further management (Figure 1/C, H).

Fig.1. (A–H): Triage Unit set-up. A: Triage entrance. B: Patient reception, C: CT scan room area, D: Waiting room, E: Clinical assessment room, F: Testing area for nasopharyngeal specimen collection, G: Marsekia infection control area, H: Laboratory room

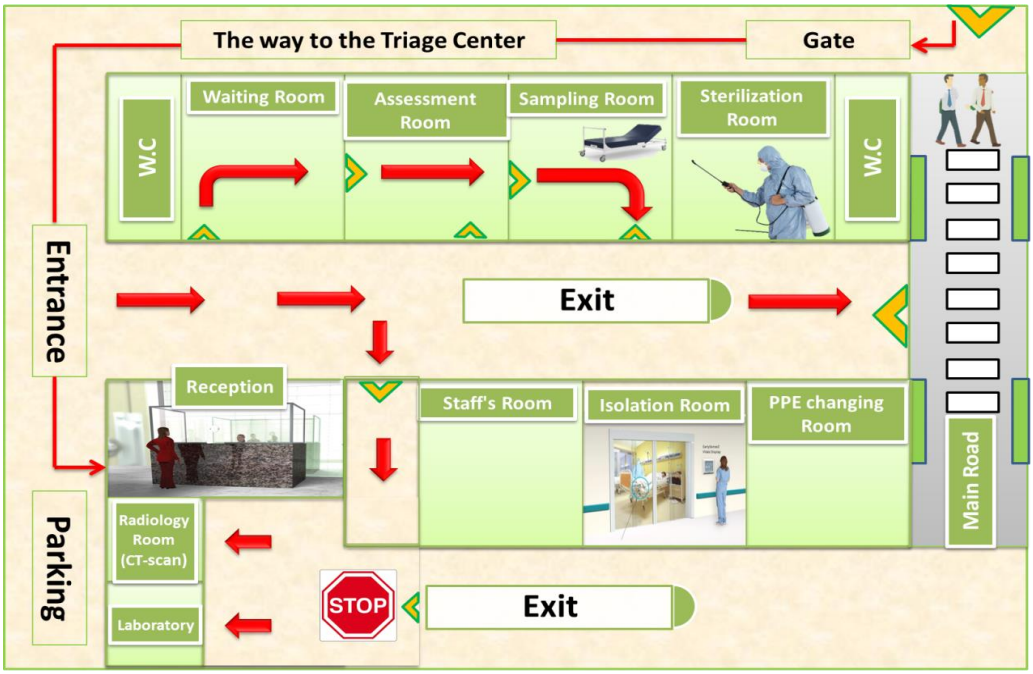

Fig.2. The flow diagram shows building structure of Tajoura Triage Centre (TTC)

4. Results

A total of 4639 cases were screened between 20 June and 31 august 2020 at TTC. The triage is received and screening about 65 to 70 cases daily. Of these, 726 (15.6%) tested positive for COVID-19. Of positively-tested patients 294 (40.5%) were female and 432 (59.5%) were male. However, the negative cases were 3913 (84.4%). The mean age for positive cases was (35) and the mean age for negative cases was (45). The mortality was reported 5 cases (0.68%) which were 3 females and 2 males (Table 1) (Figure 3& 4). Due to a large number of cases the PCR test require about 48-h to 72-h. Current studies reported that PCR sensitivity for nasopharyngeal specimen collection is about 67%.

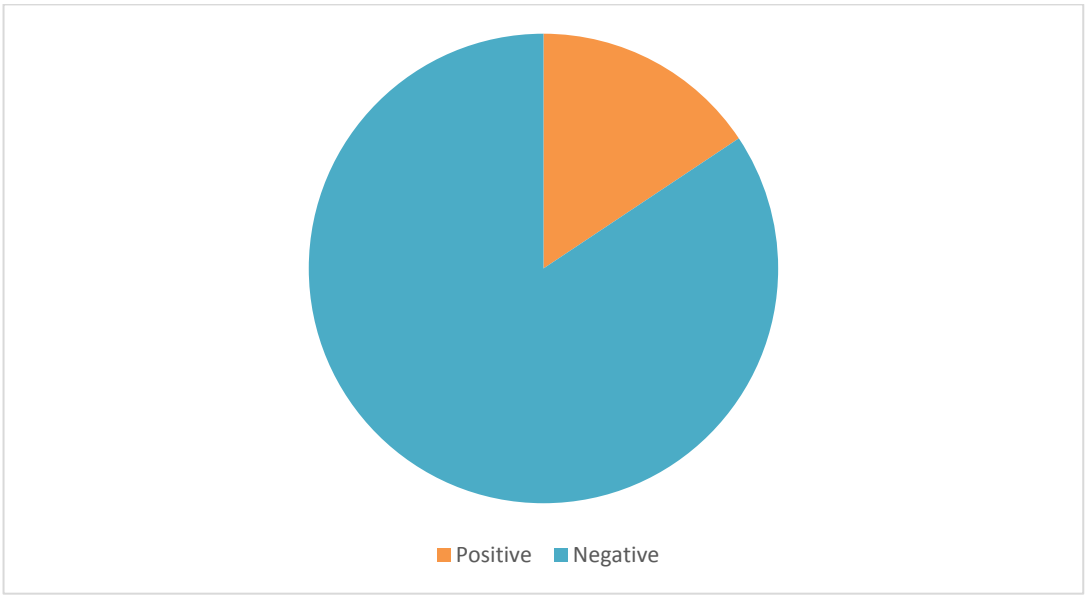

Fig.3. This graph illustrates the total cases (positive-15.6% and negative-84.4%) which are repeated in TTC

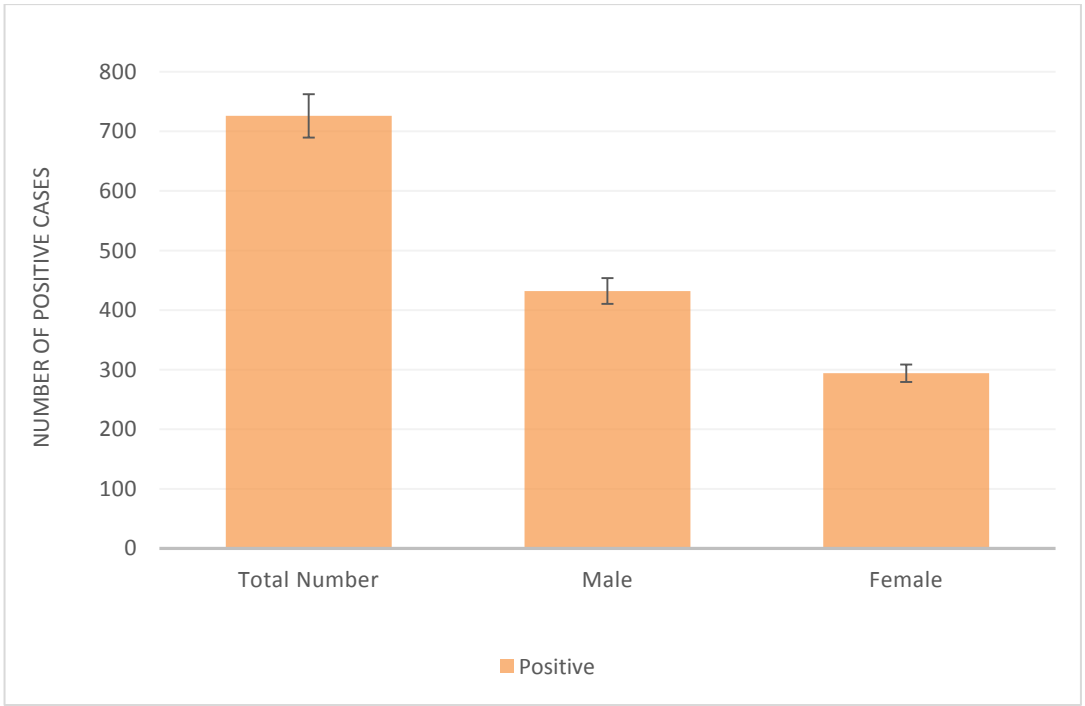

Fig.4. This chart shows the total positive cases of COVID-19, including males and females

Table 1. It shows statistics for suspected COVID-19 patients who undergo testing in TTC

Number of cases	Total	Positive	Negative	Mortality rate
	4639	726 (15.6%)	3913 (84.4%)	5 cases (0.68%)
Gender	**Male**	432 (59.5%)	2120 (54.2%)	2
	Female	294 (40.5%)	1793 (45.8%)	3
Mean age		35	45	

5. Discussion

Generally, COVID-19 is a major global health concern worldwide, it can cause death in a severity way due to the respiratory failure. Recently, the overthrow of new cases is increasing daily in Middle East countries [(2)].

Total patients were tested 4600 cases through the time from 20 of June to 31 of August at our triage center (TTC). Patients came for the screening during the days of the week more than patients who screened during the weekend. Furthermore, around 50 patients were tested per day, of these 720 cases tested positive for COVID-19, 391 patients were positively male and 329 patients were female. The age of all patients were screened about 45-55 years old, which was similar age tested in the previous study [(16)]. However, the number of patients were infected with COVID-19 and screened in our triage more than in patients were infected in SWISS which was around 112 patients tested positive for COVID-19 [(16)]. The key consequences of this study designate safety, feasibility, and the outstanding medical outcomes in a low-threshold Triage for COVID-19. Safety was clearly revealed by a low death rate during follow-up as well as a low re-presentation rate. Outcomes were excellent, as documented by low hospitalization and emergency department transfer rates. Implementation of informal triage by providing a high throughput swab-team including from both medical staff and medical students was the reason of having a good feasibility [(16)].

It has been demonstrated that previously, nonspecific symptom for instance weakness are related with disapproving prognosis [(17)], symptoms such like that do not commonly upsurge the likelihood of infection in elderly persons in the emergency unit [(18, 19)]. Adding to that, these symptoms seem to be incapable to distinguish COVID-19 from other infectious diseases. Consequently, molecular diagnostic testing cannot be substituted by clinical estimation based on symptoms and comorbidities, and repeated testing may be indicated in patients with symptoms, but initially negative PCR test results. The advantage of this methodology, waiving vital sign assessment, formal triage, and physician examination in most patients is the reduction in resources used, whereas safety and feasibility are assumed. Based on this triage, there will contemplate that, when successfully fulfilled, a low-threshold approach like the one used in this triage might donate to pacifying the COVID-19 contagion. This, nevertheless, will only be succeeded by following a wide

range of interventions, include public distancing, contact tracing, and self-isolation of persons verified COVID-19 positive. To sum up, the criteria used in this triage has been able to effectively screen and organize the spread of COVID-19 within the area. As well as, provides hospitals and health centers a chance to work in their specialized fields and reduction of corona virus transmission. It is our hope that this article can provide some guidance.

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Declarations

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Competing Interests Statement

The authors declare no competing financial, professional and personal interests.

Consent for publication

We declare that we consented for the publication of this research work.

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