The impact of implementing Egypt Pandemic preparedness plan for acute respiratory infections in combating the early stage of COVID-19 Pandemic, February-July 2020

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Abstract

Background: Egypt is a transcontinental country in the Middle East. Most of the country is situated in northeastern Africa with the Sinai Peninsula located in Western Asia. The country covers an area of 1 million km² and has a coastline at the Mediterranean Sea in north, and the Red Sea in east. Most of its population are concentrated along the banks of the Nile, and on the river's delta, with only about 3% of the territory is inhabited. Egypt population are more than 100 million inhabitants, GDP per capita in 2017 was $10,799. Life expectancy was 74.4 in females and 68.0 in males and under 5 mortality rate was 19.2. The main causes of death in Egypt are Ischemic heart diseases, stroke and cirrhosis, healthcare access and quality index are 58.0 and the governmental health spending per person was $39 in 2018. (IHME 2020)
The beginning of COVID-19 epidemic in Egypt

On December 1st, 2019 cluster of pneumonia cases of unknown cause was noticed in Wuhan, China. On the 31st of December 2019 China announced an epidemic of acute respiratory disease of unknown cause (She 2020). As soon as the epidemic was announced and before WHO announce a pandemic, Egypt Ministry of Health and Population (MoHP) started to adapt its ARI pandemic preparedness plan to apply to the anticipated pandemic.
Egypt is considered one of the oldest countries to monitor infectious diseases through a national surveillance system for reporting infectious diseases that was established in Egypt back in 1946. Egypt national surveillance was assessed, enhanced, and expanded to include all governmental healthcare facilities in 1999. The National Egyptian surveillance (NEDSS) targeting 40 communicable diseases including Acute Respiratory Infections (ARIs) has electronic reporting element (Madiha 2017). A comprehensive network of epidemiological and laboratory vertical system for reporting ARIs was developed in 2009 with an alert system for early detection of novel respiratory viruses. The network covers all the country and composes of surveillance systems targeting severe acute respiratory infections (SARI), influenza like illness (ILI), pneumonia, avian influenza and MERS-CoV. Event-based surveillance was introduced in Egypt in 2009 in response to the 2009 H1N1 pandemic to help timely detection and response to possible epidemics.

This viewpoint aims at review and discuss the preventive and control measures that have been implemented by MoHP Egypt in response to the COVID-19 pandemic to share Egypt experience with the public health practitioners and authorities for better response to such events in the future.
The specific objective of the preparedness plan for response to COVID-19 is to reduce morbidity and mortality in the event of a COVID-19 epidemic in Egypt.

Objective: To briefly describe Egypt acute respiratory infections (ARIs) epidemic preparedness and containment plan. In addition to find out the effect of plan implementation in combating the early stage of COVID-19 epidemic in Egypt.

Methods: Egypt preparedness 5 pillars ARI preparedness plan was briefly described. Pillars are: Crisis management, enhancing surveillance systems and contact tracing, case, and hospital management, raise community awareness, quarantine, and entry points. To identify the impact of plan implementation, all COVID-19 patients data February-July 2020 was obtained from Egypt national disease surveillance. Descriptive analysis was conducted to describe the epidemic situation in the early stage of the epidemic in Egypt.

Results: Overall, 102,789 COVID-19 cases were reported to NEDSS in the study period including 78,048 (43.2%) confirmed COVID-19 cases giving an attack rate of 77.0 case/1,000,000 population, and 3,457 (4.4%) deaths due to COVID-19. Of all cases 44,969 (57.6%) had mild symptoms, 71.5% were > 53 years. Growth rate and R0 declines 1.18 to 0.13 and 6.5 to 1.6, respectively, while doubling time increased from 1.8 to 15.6 days by the end of July 2020.

Conclusions: Egypt was successful in mitigating the early stage of COVID-19 epidemic. Commitment of all partners to implementation of the ARI epidemic preparedness plan helped in flattening the curve and containing the epidemic. Post-epidemic evaluation is needed to better assess Egypt national response against COVID-19 epidemic.

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Abstract:

This article briefly describes Egypt acute respiratory infections (ARIs) epidemic preparedness and containment plan and illustrates the impact of plan implementation in combating the early stage of COVID-19 epidemic in Egypt. Plan pillars include: crisis management, enhancing surveillance systems and contact tracing, case and hospital management, raise community awareness and quarantine and entry points. To identify the impact of plan implementation on epidemic mitigation, literature review was performed for the studies published from Egypt in the early stage of pandemic. In addition, data of COVID-19 patients February-July 2020 was obtained from the National Egyptian Surveillance system and studied to describe the epidemic situation in the early stage of the epidemic in Egypt. Lessons learned indicated that the single most important key to success in epidemic early-stage containment is the commitment of all partners to pre-developed and agreed upon preparedness plan. This information could be useful for other countries in region and worldwide in mitigating future anticipated ARIs epidemics and pandemics. Post-epidemic evaluation is needed to better assess Egypt national response against COVID019 epidemic.

Key words: Pandemic preparedness, Egypt, ARI, epidemic mitigation.

Introduction:

Country profile:

Egypt is a transcontinental country in the Middle East. Most of the country is situated in northeastern Africa with the Sinai Peninsula located in Western Asia. The country covers an area of 1 million km² and has a coastline at the Mediterranean Sea in north, and the Red Sea in east. Most of its population are concentrated along the banks of the Nile, and on the river's delta, with only about 3% of the territory is inhabited. Egypt population are more than 100 million inhabitants, GDP per capita in 2017 was $10,799. Life expectancy was 74.4 in females and 68.0 in males and under 5 mortality rate was 19.2. The main causes of death in Egypt are Ischemic heart diseases, stroke and cirrhosis, healthcare access and quality index are 58.0 and the governmental health spending per person was $39 in 2018 (1).

The beginning of COVID-19 epidemic in Egypt

On December 1st, 2019 cluster of pneumonia cases of unknown cause was noticed in Wuhan, China. On the 31st of December 2019 China announced an epidemic of acute respiratory disease of unknown cause (2). As soon as the epidemic was announced and before WHO announce a pandemic, Egypt Ministry of Health and Population (MoHP) started to adapt its ARI pandemic preparedness plan to apply to the anticipated pandemic.

Egypt is considered one of the oldest countries to monitor infectious diseases through a national surveillance system for reporting infectious diseases that was established in Egypt back in 1946. Egypt national surveillance was assessed, enhanced, and expanded to include all governmental healthcare facilities in 1999. The National Egyptian surveillance (NEDSS) targeting 40 communicable diseases including Acute Respiratory Infections (ARIs) has electronic reporting element (3). A comprehensive network of epidemiological and laboratory vertical system for reporting ARIs was developed in 2009 with an alert system for early detection of novel respiratory viruses. The network covers all the country and composes of surveillance systems targeting severe acute respiratory infections (SARI), influenza like illness (ILI), pneumonia, avian influenza and MERS-CoV. Event-based surveillance was introduced in Egypt in 2009 in response to the 2009 H1N1 pandemic to help timely detection and response to possible epidemics.

This viewpoint aims at review and discuss the preventive and control measures that have been implemented by MoHP Egypt in response to the COVID-19 pandemic to share Egypt experience

with the public health practitioners and authorities for better response to such events in the future.

The specific objective of the preparedness plan for response to COVID-19 is to reduce morbidity and mortality in the event of a COVID-19 epidemic in Egypt.

Methodology:

This report used two approaches to discuss the interventions implemented in the COVID-19 epidemic in Egypt as a part of the preparedness plan and to describe the epidemic situation in its early stage in an attempt to link it to the interventions performed.

To describe the ARI epidemic preparedness and containment plan in Egypt, all documents dealing with ARI epidemic preparedness and response plan and their updates were reviewed including: ARI case management plan, ARI and Influenza Pandemic Preparedness Plan, National Disease Surveillance guidelines. In addition, the key studies and publications describing the situation of COVID-19 epidemic early stage were reviewed to describe the epidemic situation.

Egypt national surveillance data on all COVID-19 patients February-July 2020 was obtained from the national disease surveillance database. Online data sources were consulted regularly to collect data published on the early stage of epidemic in Egypt. Descriptive data analysis was performed to assess the response to the epidemic in Egypt.

Egypt ARI pandemic preparedness and containment plan:

Egypt ARI preparedness plan was first developed in 2007 in collaboration with WHO Egypt. It was activated in 2009 during the H1N1 pandemic, and updated in 2019, then adapted to the COVID-19 pandemic (4).

The pandemic preparedness plan was activated early before the introduction of the SARS-CoV2 virus into the county when the first positive case was identified among contacts of a Chinese lady who was tested positive after returning back to China from a short business trip to Cairo.

The plan includes 5 pillars:

1. Crisis management
2. Enhancing surveillance systems and contact tracing
3. Case and hospital management
4. Raise community awareness

5. Quarantine and entry points

Crisis management:

A pre-established Supreme National Committee for crisis management was activated early in the pandemic. Members of the committee are Ministers of relevant Ministries including Ministry of Health, Ministry of agriculture, Ministry of Local Development, Ministry of Environment, Ministry of defenses, Ministry of foreign affairs, Ministry of General Information Authority, General Administration of Veterinary Affairs, Crisis Management Room at Council of Ministers, Ministry of Interior, Preventive and Endemic Affairs of Ministry of Health. This committee was and still responsible for deciding on the necessary preventive and control measures based on the rapid changes in the pandemic situation globally and in Egypt.

The crisis management committee of MoHP assembled before the introduction of the virus to Egypt. The committee included all sectors concerned within the ministry (preventive sector, curative sector, health care and nursing sector, general authority for health insurance, general authority for hospitals and educational institutes, central administration of medical medicine, central administration of preventive affairs, The General Secretariat of Specialized Medical Centers - Central Administration of Pharmacy - General Directorate of Hospitals - General Department of Chest Diseases - General Department of Infectious Diseases - General Administration of Veterinary Affairs Mechanism - Epidemiology and Surveillance - The official spokesman of the Ministry of Health - a representative of the Supreme Council of Universities). The committee is responsible for monitoring the epidemiologic situation on a 24-hour basis, implementing all preventive and curative measures to contain the disease, ensuring the preparedness and response of emergency teams 24 hours a day, follow-up treatment protocols, ensure the availability of medical supplies necessary for prevention and case management and intensive care units equipment and supplies.

Enhancing different ARI surveillance systems

NEDSS, ILI, SARI and pneumonia and mortality surveillance systems were activated through 2-days training for surveillance teams in all governmental healthcare facilities conducted at central and regional levels. Guidelines for COVID-19 epidemic response were developed and distributed to at all health system levels and teams were instructed to report ARIs on-a-daily basis. Case definitions were developed using the WHO COVID-19 case definition (6) and distributed to all governmental and private healthcare facilities for reporting any suspected cases. The case definition was updated 3

times to increase the sensitivity for case detection as the epidemic progressed.

The most updated COVID-19 case definitions as of June 2020 are:

Suspected case: Anyone suffers from acute respiratory symptoms (cough, shortness of breath) or fever ≥ 38 °C or both with no other reasons

With any of the following conditions within 14 days before symptoms:

1. History of travel to a country / region that proves wide community spread or limited local transmission of (COVID-19(.

2. Contact to a confirmed case with COVID-19.

3. Contact to a person with acute respiratory symptoms (cough, shortness of breath) or a fever ≥ 38 °C and is epidemiologically related to a place or region (locally or internationally) with epidemic outbreaks corona disease COVID-19 but not yet Laboratory confirmed.

4. Healthcare workers or healthcare in a health facility had reported confirmed cases of COVID-19

OR

A patient with severe acute respiratory illness (SARI) with fever ≥38 °C with one of the symptoms of acute respiratory disease (cough, shortness of breath) and the cause of the pathological condition could not be identified.

If suspicion of (a) or (b) is not verified; consider the following:

OR

Any person with at least two of the following clinical characteristics:

1. Fever, severe respiratory symptoms, or both.

2. C.T. scan for chest (if not available; normal x-rays are performed on the chest) with diagnostic properties of COVID-19.

3. Normal or low leukocyte count with lymphocytopenia.

Confirmed case

A person with laboratory confirmation of COVID-19 infection with Real Time-Polymerase chain reaction (RT-PCR).

The COVID-19 was added to NEDSS reportable diseases, a data collection was developed and added to the online data screens. Suspected and confirmed cases of COVID-19 are entered at all governmental hospitals for regular description of the epidemic situation in Egypt, contact tracing and future predictions. Daily reports are developed and shared with relevant stakeholders.

The International Health Regulations unit at MoHP is in direct contact with WHO Egypt and EMR for daily reporting, regular sharing of global and country level information, updated recommendations, and viral genetic mutations.

The event-based surveillance was expanded to include all the country and teams at all levels are reporting alert signals immediately to central level. Signal verification and case detection is done for all received alert signals.

Laboratory role in epidemic mitigation:

Specimens are collected from all suspected cases for testing at regional laboratories in governorates and central laboratories in Cairo. Testing results are monitored daily and distributed to affiliated governorates and hospitals. Genetic mutation is monitored regularly at the global and regional levels.

COVID-19 and influenza testing kits and reagents are secured at CPHL and the regional laboratories. Training was conducted to laboratory specialist and technicians at governorate level in specimen collection, archiving, and transfer. Specimens are shared s with WHO reference laboratories regularly.

Contact tracing:

An evidence from COVID-19 response in China has indicated that efficient contact tracing can early detection and isolation of cases and substantially reduce disease transmission (7). Because contact tracing is a crucial part of COVID-19 epidemic control in conjunction with case finding, Egypt was able to apply this strategy early when the number of cases were small. In Egypt contacts were classified to close and casual contacts according to ECDC definition and traced for providing contacts with information on self-quarantine, proper hand hygiene and respiratory etiquette measures, and advise them what to do if developed symptoms. Contacts with symptoms are timely lab tested by PCR for early case detection (8). Guiltiness for contact tracing and management were

developed and distributed at all levels of the health system.

Case and hospital management

Intensive care units (adults - pediatric) and hospitals with ventilator capacity (adults - pediatric) were identified for management of COVID-19 cases. Referral system between hospitals was defined and information distributed to all governorates and hospitals. Training for all hospital physicians on case detection using the case definitions, triage, and a protocol for management of acute respiratory infections. Continuous supervision and monitoring from central level on assigned hospitals for hospitals performance evaluation in dealing with cases of acute respiratory symptoms. Chest consultants were assigned for management of severe cases. A manual was developed for treatment of patients at different disease stages and severity. The manual is revised and updated regularly based on new information available.

Raising community awareness

Activation of hotline, WhatsApp were used days a week to answer questions, respond to requests and complaints and coordinate patient transfer and hospital admissions. In addition, Facebook, radio and TV broadcasting were used to raise community awareness on Egypt COVID-19 current status, disease prevention, and patients home management. Development and distribution of printed posters on at intermediate and peripheral health system and hospital levels. Printed material included 3,000 posters for case definition, 30,000 brochures of fact sheets, 2,000 case management booklet and 30,000 how to manage patients at home. In addition to more than 2 million posters on preventive measures at home, community, and healthcare facilities. The printed materials were delivered to all governmental and private health facilities and community.

Quarantine and points of entry

Brochures were distributed on all points of entry staff, including the definition of the suspected case and the confirmed case of the pandemic. Assessment of travelers arriving to Egypt and transfer suspected cases to isolation hospitals for preventive measures. During the period from January -July 2020, 91,787 travelers arrived via different points of entry. Of them 1,616 had elevated temperature or respiratory symptoms detected at the check points and were transferred to hospitals for evaluation and treatment. All asymptomatic arrivals (90,171) were tested by rapid test. Of them 2,329 (2.6%) were positive and sent for PCR confirmation testing. Of the positive persons by rapid test 966 (41.5%) proved positive by PCR and were quarantined to prevent spread of the disease and for

follow up. All remining travelers (87,842) were sent to home for home isolation and follow up on daily basis by phone for any appeared symptoms.

Source of data:

We used data of the National Electronic Disease Surveillance System (NEDSS), February- July 2020. Descriptive data analysis was performed by time, person and place using Epi info7. Attack rate was calculated as: total number of confirmed cases/100,000 population with the population data for 2020 obtained from Department of Information Center at MoHP.

Epidemic situation of the early phase of epidemic:

According to MoHP senior officials, Egypt has passed the first wave of epidemic peak, entered flattening phase of daily cases in mid-June with the highest number of cases (1,774) reported in one day on the 20th of June. Number of cases started a gradual drop during July, August, and possibly through September with the least number of cases reported (112) on August 5th. (Figures 1 and 2). Models suggested that Egypt had succeeded in delaying the peak of the COVID-19 curve after the seventh week with no exponential growth of transmission rate identified (9).

Overall number of cases by week started to rise early May and peaked mid-June, started decline but did not reach the base line (Figures 1a and b). The mean weekly growth rate February to May 2020 was 0.35 (SD±0.33), have declined over time from 1.18 in early March to 0.13 at the end of May. Similarly, R_0 and herd immunity threshold (HIT) declined from 6.5 to 1.6 and from 85% to 39%). Whereas doubling time has increased from 1.8 days to 15.6 days (Table 1) (10).

Incidence of COVID-19 in Egypt by week has peaked in week 14 after first case confirmed in Egypt (15.4/1,000,000 population) and declined to 6.29 in week 19 after first case. While the average number recovered per week is constantly increased to reach 625.0 by week 19 after first case reported (Figure 2). Case fatality rate is showing 2 peaks pattern in week1-4 and weeks 16-18, with an increase after decline in the week 9-12 ranging between 2.57 in week 9-10 to 9.22% in week1 (Figure 3).

Overall, 102,789 COVID-19 cases were reported to NEDSS in the study period including 78,048 (43.2%) confirmed COVID-19 cases giving an incidence of 77.0 case/1,000,000 population, and 3,457 (4.4%) deaths due to COVID-19 (Table 3). Of all cases 44,969 (57.6%) had mild symptoms and identified in the outpatient clinics. The middle age group (35-60 years) is the most affected, while disease is rare in the <15 years of age representing 2.6% of all cases, with male percent slightly higher (52%) than female. Of all confirmed cases 51.2% were admitted to hospitals for healthcare, while 48.8% were isolated at home or youth hostels for follow up (Table 2).

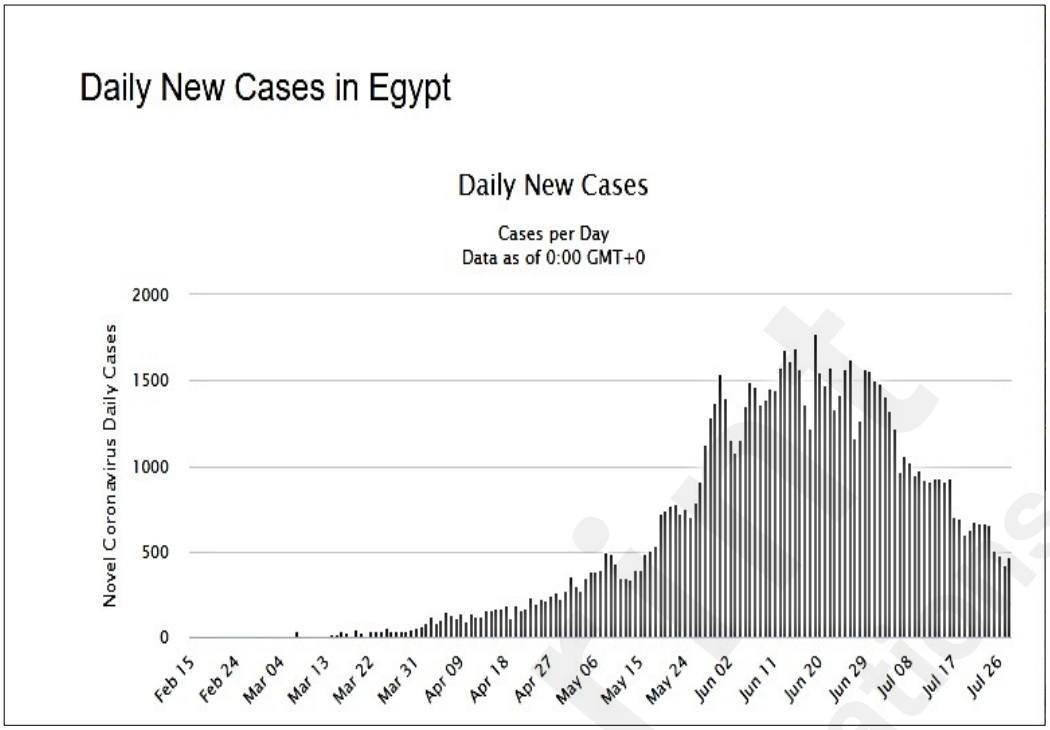
The most prominent symptom was fever (83.2%) followed by cough (72.8%), dyspnea (49.7%) and sore throat (48.5%). Of all confirmed cases 54.1% were having history of diabetes, 45.9% cardiovascular disease, while only 2.2% were obese and 2.2% were pregnant females (table 2).

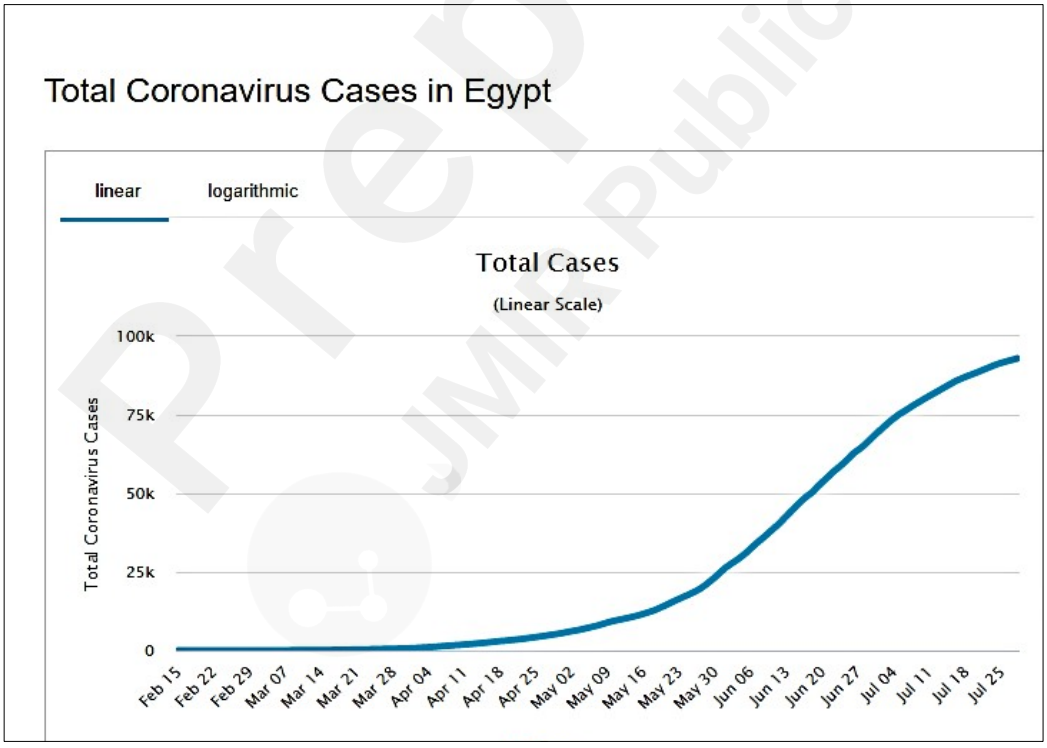
Incidence rate differed by region of residence ranging from 60.3 in Lower Egypt to 145.8/1,000,000 population in the urban governorates, while CFR ranged from 2.8 in the urban governorates to 5.4% in Lower Egypt governorates. Data analysis indicated that highest incidence rate and lowest CFR were identified in the urban governorates (Figure 4).

Conclusions:

Egypt succeeded in containing the early stage of COVID-19 epidemic. Containment measures taken in the early stage of the epidemic depended mainly on early case detection, trace and isolate those infected as well as raising community awareness to stop the disease from spreading. Strengthening mitigation efforts began when wide community transmission occurred in the form of proper case management and coordination of different interventions to slow disease spread and mitigate its effects on the healthcare system and community. The ARI pandemic preparedness plan proved effective in epidemic mitigation with high commitment from all partners. Post-epidemic performance evaluation is needed to better assess Egypt national response against COVID019 epidemic.

Figure 1 (a, b). Daily new and total number of COVID-19 cases, Egypt, February-July 2020.





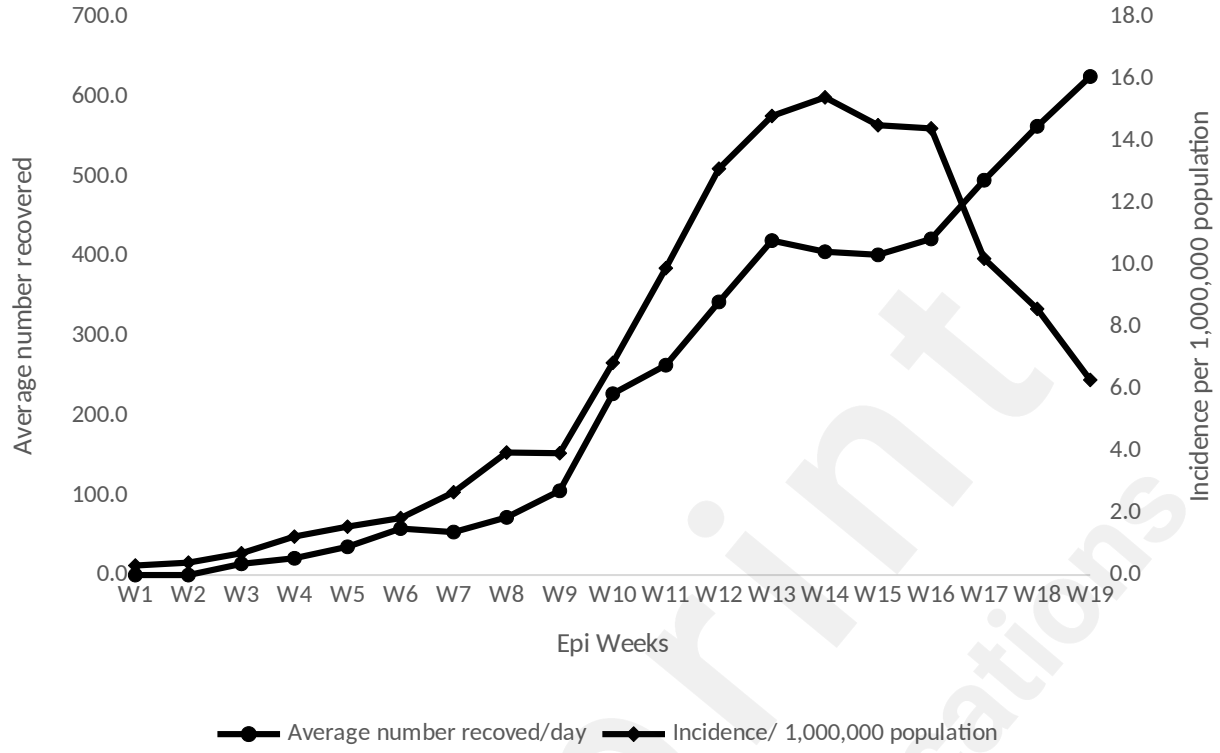
Source: worldmeter. https://www.worldometers.info/coronavirus/country/egypt/

Table1. Reproductive number (R_0) and corresponding Herd Immunity Threshold (HIT) of COVID-19 in Egypt, February-May 2020.

Date	Growth rate (weekly)	Doubling time (days)	Reproductive number (R_0)	Herd immunity threshold HIT (%)
28-Feb	0	0	1	0%
7-Mar	1.18	1.8	6.5	85%
14-Mar	0.79	2.7	4.7	79%
21-Mar	0.44	4.8	3.1	67%
28-Mar	0.29	7.4	2.3	57%
7-Apr	0.34	6.3	2.6	61%
14-Apr	0.31	6.8	2.5	59%
21-Apr	0.18	11.6	1.9	46%
28-Apr	0.16	13.4	1.7	42%
7-May	0.2	10.5	1.9	49%
14-May	0.14	15.2	1.6	39%
21-May	0.13	15.6	1.6	39%
Mean	0.35	8.73	2.6	52%
SD	0.33	4.85	1.55	22%

Source: G. N. Radwan. Epidemiology of SARS-CoV-2 in Egypt. EMHJ – Vol. 26 No. 7 – 2020

Figure 2. Egypt COVID-19 incidence rate and average number of recoveries, February-July 2020



Source: Ministry of Health and Population daily COVID-19 report

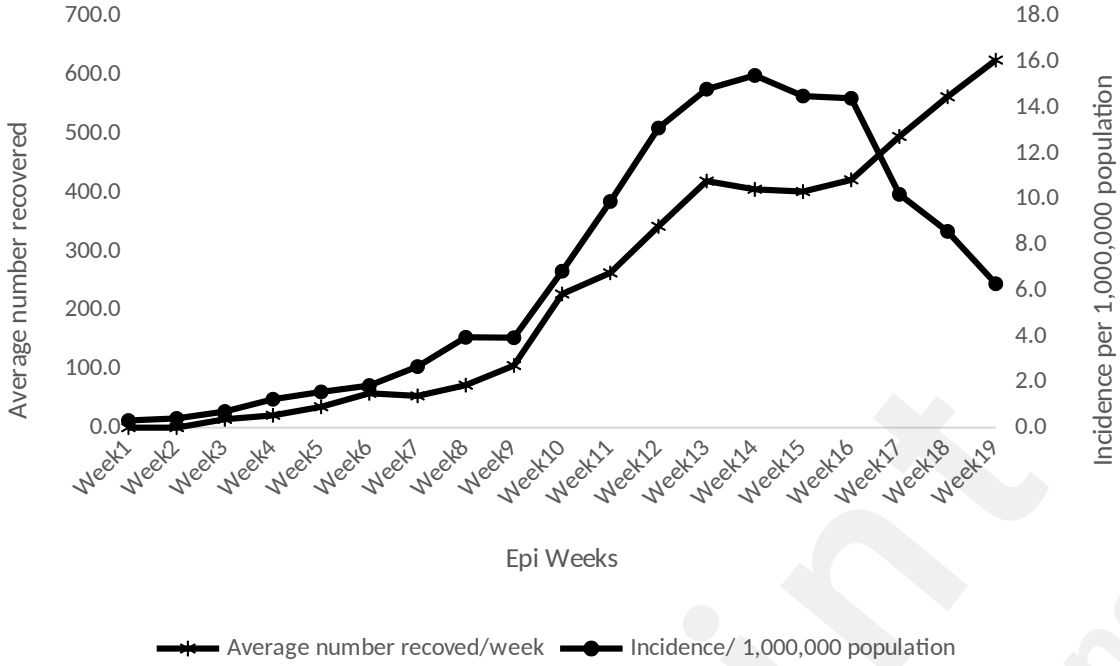
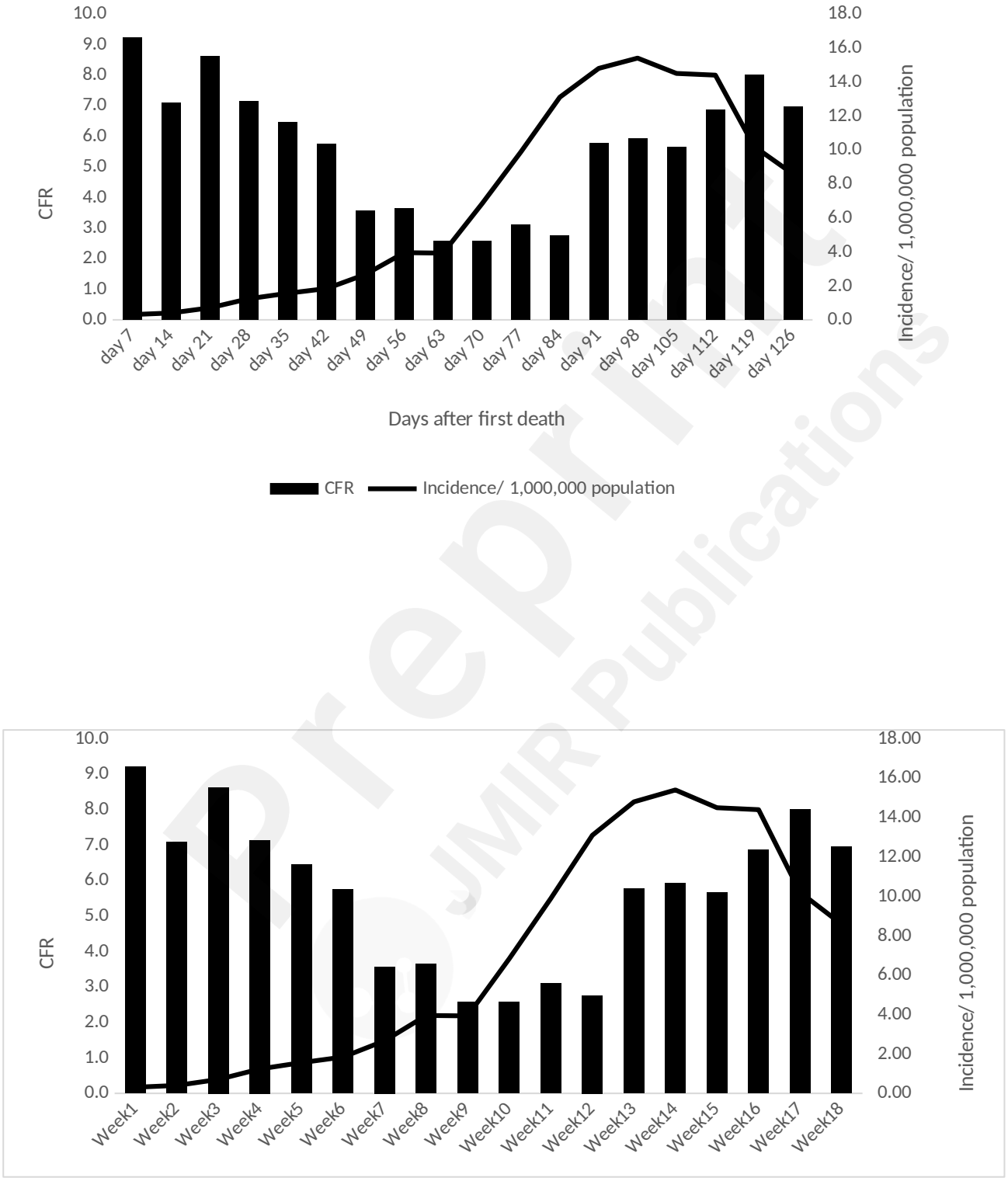


Figure 3. Egypt COVID-19 incidence rate and case fatality rate, February-July 2020



Source: Ministry of Health and Population daily report

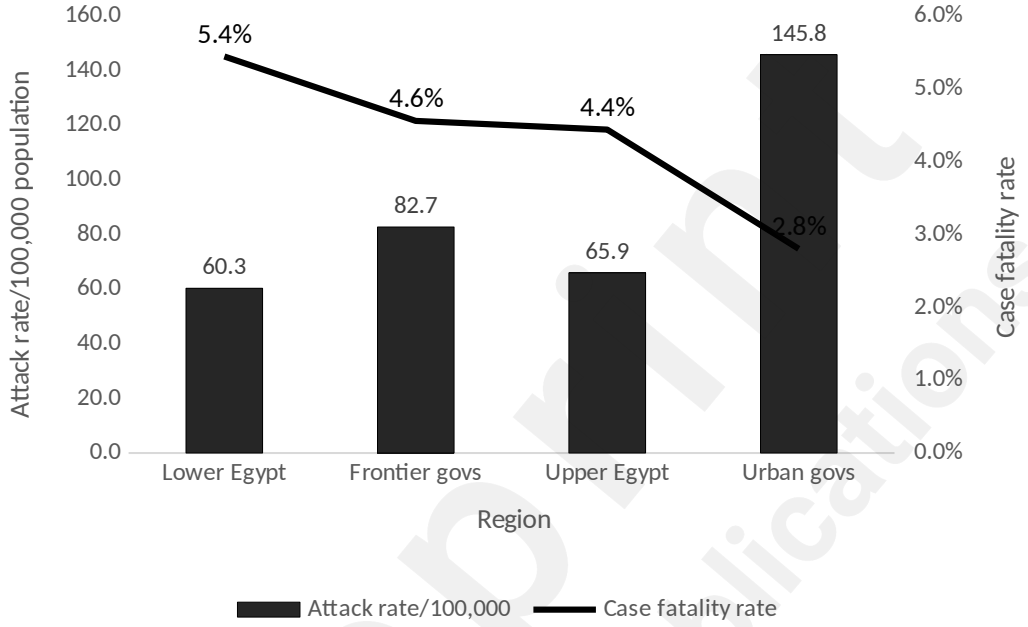
Table 2. Demographic, epidemiologic, and clinical characteristics of COVIID-19 confirmed cases, National Egyptian Disease Surveillance (NEDSS), February-July 2020.

Characteristics	Number of cases	percent
Suspected cases	102,789	
Confirmed cases	78,048	43.2%
Source		
Inpatient	44,969	57.6%
Outpatient	33,079	42.4%
Age groups (years)		
<1	223	0.3%
1-4	552	0.7%
5-14	1,268	1.6%
15-34	20,197	25.9%
35-64	44,948	57.6%
≥65	10,855	13.9%
Gender		
Males	40,621	52.0%
Females	37,422	48.0%
Clinical picture*		
Fever	45,188	83.2%
Cough	39,549	72.8%
Difficulty in breathing	27,009	49.7%
Sore throat	26,330	48.5%
Joint pain	18,287	33.7%
Diarrhea	6,260	11.5%
Vomiting	4,730	8.7%
Pneumonia	23,503	43.3%
Comorbidity**		
Diabetes	6,845	54.1%
Cardiovascular disease	5,816	45.9%
COPD	2,620	20.7%
Renal	630	5.0%
Liver	491	3.9%
Pregnant females	279	2.2%
Obese	274	2.2%
Immunocompromised	226	1.8%
Isolation		
Hospital isolation	39,964	51.2%
Youth hostel	8,380	10.7%
Home isolation	29,704	38.1%
Case fatality	3,333	4.3%

*Clinical data available for 54,300 cases

**Comorbidity data available for 12,661 cases

Figure 4. Distribution of COVID-19 attack rate and case fatality rate by region, National Egyptian Disease Surveillance (NEDSS), February-July 2020.



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