AIJR Preprints
Section: Coronavirus
Article Id: 183, Version: 1, 2020
URL: https://preprints.aijr.org/index.php/ap/preprint/view/183
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NOT PEER-REVIEWED

Version 1: Received: 30 July 2020 / Approved: 30 July 2020 / Online: 30 July 2020

Role of the Epidemiologist in the Containment of COVID-19 Pandemic

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Article Type: Review.

ABSTRACT

The COVID-19 virus is a novel virus that is zoonotic and has infected more than two million people with over Three hundred people who died from the pandemic. The virus has been declared a pandemic by the W.H.O overwhelming the health system and capacity of many countries with known cases of death of health workers and non-health workers alike. The virus can be prevented through adequate personal and respiratory hygiene and maintaining social distancing at this point in time. Although doctors and nurses might be the frontline and visible image of health workers in the ongoing battle against the virus, there are other health workers behind the scene like epidemiologists working round the clock to control this current pandemic Epidemiologist deals with data and data is the focal point in the prevention and control of diseases. Epidemiologists are involved in the Surveillance, Identification and Monitoring of Outbreaks, conducting researches and evaluating policies geared at Outbreaks. Problems associated with Data are the major constraints of an Epidemiologist. Efforts are currently ongoing by various health personnel to control the virus and provide vaccines for the treatment of the disease.

Keywords: COVID-19, Epidemiologist, Outbreak.

7. Introduction

Infectious diseases consist of illnesses showing medical signs and symptoms arising from pathogenic biological agents or infections present and growing in an individual/host/organism and also known as transmissible diseases or communicable diseases (1). The ability of an organism to enter (invade), survive and multiply in the host is called Infectivity while the level with which the disease is transmitted to other hosts is called infectiousness of the disease (1). Over the years, we have witnessed distinct emerging and re-emerging infectious diseases spread to several countries of the world, causing millions of deaths and also led to severe economic crises (2). These infectious diseases

How to Cite:
Chidera Gabriel Obi *et al.* "Role of the Epidemiologist in the Containment of COVID-19 Pandemic". *AIJR Preprints*, 183, version 1, 2020.

include but are not limited to Ebola, Malaria, Measles, and the Coronavirus family, and many of the infectious diseases have emerged or re-emerged in Africa in the 21st century(3).

Coronaviruses are important pathogens to humans and vertebrates (4). COVID-19 is caused by infection with severe acute respiratory Coronavirus 2 (SARS-CoV-2) (5). Three coronavirus species have triggered serious respiratory disease outbreaks in humans over the years, including severe acute respiratory syndrome-related coronavirus (SARS-CoV) (6), which triggered severe acute respiratory syndrome (SARS) disease between 2002 and 2003 (7), coronavirus-related respiratory syndrome in the Middle East (MERS-CoV) , which caused Middle East respiratory syndrome (MERS) in the year 2012 (8), and the current severe acute respiratory disorder related coronavirus (SARS-CoV-2), which has caused a pandemic of COVID-19 (9). A total of **16,249,165 cases** of COVID-19 have been reported, including **649,208 deaths,** as of 27th July 2020. (10). COVID-19 is transmitted through droplets of different sizes (11), which occurs when a person in close contact with someone who has the symptoms (12) and is at risk of potentially exposing the eyes, mouth, and nose (13). From disease surveillance to field evaluation, and Policy development (14), Epidemiologist's play a critical role in the control of outbreaks (15). These are done in collaboration with other health workers (16). Epidemiologists work with data which is an important feature of the modern response to epidemics (17).

1. History of COVID-19

The Chinese authorities informed the W.H.O of several cases of pneumonia with unfamiliar etiology towards the end of 2019 (18). This outbreak was reported in December at a seafood wholesale market in Wuhan, China where 66% of the staff showed symptoms (19). The market sells live animals such as bats, frogs, snakes, birds, marmots, and rabbits (5). In January, China's National Health Commission released more information (5), after sequence-based analysis of patient isolates, China's National Health Commission identified the virus as a novel coronavirus, and the genetic sequence was provided for its diagnosis (18). The novel coronavirus was declared a Public Health emergency on 30th January and named COVID-19 on 11th February 2020 (20). COVID-19 was first reported in the Northern part of Africa (21). The first case of COVID-19 in Nigeria was on the 28TH of January, 2020 (22), and was the first in Sub-Sahara Africa (1). As at 27th of July, 2020, Nigeria had a total of **41,180 cases** with **860 deaths** and **18,203 discharged** (23)

2. Symptoms of COVID-19

Symptoms of COVID-19 range from mild to severe symptoms (24). The symptoms include fever, cough, difficulty in breathing, Chills, muscle pain, headaches, sore throat, sudden loss of taste, or smell with an incubation period of 5.2 days after which infection appears (25). This depends on both the strength of the immune system and the age of the patient (26), with studies showing a shorter incubation period in patients >70 years compared to patients <70 years (27). People who are older or suffer from chronic medical conditions are at higher risk of serious illness that can lead to death (28). Symptoms of the disease can progress towards pneumonia, respiratory failure, and death by the end of the first week (26), this development is associated with a severe increase in inflammatory cytokines including IL2, IL7, IL10, GCSF, IP10, MCP1, MIP1A, and TNFα (29). Symptoms in neonates, infants, and children are milder than in an adult counterpart (29). COVID-19 and earlier beta-coronaviruses have similarity in symptoms that include symptoms such as fever, dry cough, dyspnea, and bilateral ground-glass opacity on chest CT scans (30), but COVID-19 has shown some special clinical features that include targeting lower airways as evident from symptoms of the upper respiratory tract such as sneezing and sore throat (31).

3. Etiology of COVID-19

Coronavirus is an enveloped single stranded virus (32), belonging to Orthcoronavirus, belonging to Subfamily *Orthcoronavirus*, and characterized by crown spike on the surface (33), which is a reason for the names Corona(42). 2019-nCoV belongs to subgenus *Sarbecovirus* and of the family *coronaviridae* (32) of the genus beta-coronavirus as well as SARS-COV (19) .Coronaviruses are known to cause diseases of the hepatic, respiratory, gastrointestinal systems, and nervous system in humans (4). The COVID-19 virus is 400-500mm in size and encodes a structural protein (4). The envelope contains four major structural proteins encoded by the coronaviral genome, one of which is the spike(s) protein, which binds to the angiotensin-converting enzyme 2 (ACE2) receptor and mediates subsequent fusion between the envelope and the host cell membranes to enable viral entry into the host cell (34). Full viral genome analysis indicates that the virus shares 88% genome identity with two bat-derived severe coronavirus-like acute respiratory syndromes (SARS), although more distant from severe coronavirus acute respiratory syndrome (SARS-CoV) (35). It has been established that seven coronaviruses affect humans (36). COVID-19 was classified as a severe acute respiratory coronavirus syndrome 2 (SARS-CoV-2) based on phylogeny, taxonomy, and proven expertise (37) and was later referred to as Coronavirus Disease 2019 (COVID-19) by the WHO (38). SARS-CoV-2 has a full genomic length of 29,891 to 29,903 nucleotides (39). These viruses can be inactivated with the use of ethanol (60%), ether (75%), and chlorine-containing disinfectants (39). The virus is sensitive to ultraviolet light and heat (40).

4. Role of Epidemiologist in Disease Outbreak

Outbreaks are a sudden occurrence of a disease in a population (41), they do not give notice before it happens nor do they respect the boundaries of nations (42). Epidemiology is the study of the distribution and determinants of disease in populations and the application of this study in the prevention and control of health problems (43). In times of outbreaks, epidemiologists are actively engaged, they collect and analyze data to relay the effects on public health (44). Epidemiologists are currently playing roles in various health concerns such as Natural Disasters, Infectious Diseases, Cancer, and Obesity (45). Once an understanding has been reached that an assessment should be carried out before or generally at the same time as emergency operations, the role of the epidemiologist is to prepare and organize the collection of relevant and useful data (46). These roles help to gain more knowledge of the various diseases and the creation of policies to control them. There is currently two distinct views on the roles of Epidemiologists which is whether its role stops in science part or if it involves policy making (47).

5.1 Establish a system of Disease Surveillance

Disease monitoring is the continuous scrutiny of occurrences of health events that allow for timely response in its control (48) and serves as an effective way to control disease (49). Disease surveillance also means looking out for new and emerging diseases and an example is “Mad Cow disease” in the 1980s” (49). Surveillance of diseases has been recognized as an effective strategy for disease prevention and control, particularly epidemic-prone diseases (50). Disease Surveillance is the first link in response to emerging infections (51) like COVID-19. Disease surveillance involves the Epidemiologist, Public Health Laboratory, and Healthcare delivery system (51) which involves 4 basic components namely, Collection, Analysis, Dissemination, and response (52). The epidemiologist ensures that the data is collected properly as which is one of the steps in Disease Surveillance. Other steps include Reporting, Data accumulation, Data analysis, Judgment, and

action (53). Samples collected are sent to the Public Health laboratories for analysis and in the case of Nigeria to designate Laboratories across the country were the samples are tested and efforts are taken to isolate the patient if positive.

5.2 Field Investigation

Surveillance provides information for action (54). After surveillance, an investigation is carried out by the Epidemiologist. Field investigations are means by which data is transferred into action, a core function of epidemiologists who investigate in other to identify causes and risk factors of diseases (54). This can be identifying the travel history of a patient, previous treatment plan so far, and identifying contacts with the patient (55). It is invaluable to understand community values and the vocabulary they use to identify health and illness (55). Field experience in previous outbreaks helps the epidemiologist to recognize the data that are most critical in helping to identify threats and to plan and evaluate strategies in a particular situation (56). Field Investigation helps to understand the incidence of diseases especially novel diseases (55) and is often done in response to acute public health problems (57). Field investigations help prevent the further spread of diseases as can be seen in Nigeria during the Ebola Outbreak (56).

5.3 Evaluation

Evaluation in terms of epidemiology deals with determining the effectiveness, relevance, efficiency, and impact of activities concerning the desired goal (58). Evaluation in health promotion and disease prevention programs can be used to document a program's effectiveness (59). The evaluation showed the impact of the African Programme for Onchocerciasis Control (APOC) in the reduction of microfilaria prevalence and showed that ivermectin treatment can be used to prevent *Onchorcercial* blindness (60). Epidemiologists access the effectiveness of policies through evaluation (61) for instance, an epidemiologist can perform experimental study design to access the effectiveness of social distancing.

5.4 Conducting Research

Epidemiological research deals with the mapping of health and disease in populations and studying factors affecting initiation and prognosis (62). The approach used in Epidemiological Research is the same in Outbreaks and Other health practices and there is already a well-established ethics review protocol that will extend to almost all epidemiological research performed in a disease outbreak (63). Epidemiologists use all sorts of data, such as observational data, interviews, surveys, and blood or other tissue samples (49). Data for Epidemiological Research can come from the researcher's work (49) or external sources (64). Conducting Research in Outbreaks can pose ethical challenges (65)

5.5 Communicating public health information

Epidemiologists and other Public Health professionals play an active role in communicating Public Health Information provided by surveillance and health information to the Public health care providers and Policymakers (66). This is important since effective communication is a means by which Epidemiologists influence policy (67) and there is an increased demand for epidemiologists to affect the public when designing, interpreting, and reporting their work (68). Communication about an increase in exposure prompts an outbreak investigation (69).

5.6 Contact-Tracing

Contact tracing is the process of identifying, assessing, and managing people who have been exposed to a disease to prevent onward transmission (70). Contact tracing is one of the beneficial surveillance strategies for controlling the spread of COVID-19 (71) and also critical in the SARS outbreak in 2003 (72), Ebola Outbreak in 2014 (73), and eradication of smallpox (85). Contact Training is Important in

COVID-19 like other Outbreaks to ensure early detection and Isolation of cases (71). Mathematical models on how contact tracing and follow-up may control Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) transmissions have been developed for evaluating different infection control interventions (74).

6. Challenges of Epidemiologist During Outbreaks

6.1 Maintaining complete and accurate data

Maintaining complete and accurate data has always been a big challenge during Novel Outbreaks (75). Epidemiologists in low- and middle- income countries encounter constraints in maintain data due to limited resources and lack of medical infrastructures (76). Local Communities are usually in panic mood and full of anxiety due to the outbreaks especially novel outbreaks (77). These anxieties and psychological meltdowns can lead to the provision of false data or even refuse government policies to curb the outbreak. Also, in the developing world, the quality of existing health-related data is low and is usually gathered by different governmental organizations (76).

6.2 Accessibility of Epidemiological data

Accessible epidemiological data are of great value for emergency preparation and response and Epidemiologists encounter three main problems in accessing data which include Interface, data formatting, and Reporting (78). The interface is the presentation of Data to an individual for consumption, this can be gotten from a variety of sources and can be expensive at certain times (78). Accessing and using data is difficult in practice and most times the primary way of accessing the data is through the Internet where the data is published in various formats (78). This affects the epidemiological researches because some of the data are also of substandard quality. Data that is related to some specific and sensitive health-related issues are difficult or even impossible to access such data for epidemiological investigations (79).

6.3 Late Detection of Diseases

Irrespective of the fact that early detection can reduce the ultimate size of the outbreak, there is very little evidence concerning factors that influence earlier detection (80). Surveillance capability for detection can be expensive, and many countries lack the resources for recognize outbreaks at their earliest stages (81) where some countries are usually unwilling to disclose data (82). Epidemiologists are limited in tracing of contacts of COVID-19 due to the virus being contagious, being politicked and the novel nature of the virus (83). Researches have shown that delay in detection of diseases can be lead to delay in Outbreak responses (84).

6.4 Communicating public health information

*The c*hallenge for the practicing Epidemiologist are posed with the challenge is to use these strategies to communicate important health information effectively, to improve the public's health. Lack of communication from Epidemiologist or other health personnel can lead to Ignorance and lack of proper information.

8. Conclusion

The fight against outbreaks like the Novel coronavirus involves teamwork between the various healthcare workers and other sectors. Epidemiologists are essential in outbreaks especially novel outbreaks. This is because they are in the frontline identifying probable cases and contacts of those cases, using available data to determine the best policies and also identifying the effect of those policies. These are done with the use of data which is the basic element in fighting outbreaks. Through these data, Epidemiologists act as the foundation of health workers in the event of an outbreak while working in collaboration with other sectors.

9. Declarations

9.1 Author's Contributions

All authors contributed to the writing of the manuscript

9.2 Competing Interests

Authors declare no conflict of interest.

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