

## Review Article

# Ecological, Epidemiological, Demographic and Social Factors Facilitating the Spread of COVID-19 to Hitherto Unaffected African Nations

E. William Ebomoyi<sup>1\*</sup> and Josephine I. Ebomoyi<sup>2</sup><sup>1</sup>Department of Health Studies, Chicago State University, USA<sup>2</sup>Department of Biological Sciences, Saint Xavier University, USA

## Abstract

This study focused on the ecological, demographic and social factors facilitating the outbreak, and epidemiological spread of COVID-19 into hitherto unaffected African countries. The index cases of COVID-19 were in Wuhan, China. Infact, the emergence of SARS-CoV-2 in Wuhan, China by December 19, 2019 may have facilitated not only the onset of COVID-19 into the environment, but also created severe panic among people not only in the developed but also in developing nations. Many molecular biologists, virologists and epidemiologists have theorized that the initial outbreak and transmissibility to other continents and capital cities of other nations may have occurred as a result of exposure of trans-continental merchants traveling to Africa, Asia and other European nations to engage in international businesses. If these merchants and their collaborators were exposed to COVID-19, before returning to Africa, Asia, Europe and the Middle Eastern nations, the probability of transmission of COVID-19 to unsuspecting hosts, and other commercial contacts and family members can be very high. International commercial activities could have quickened the transmission of COVID-19 to hitherto uninfected continents such as Africa, Europe, Latin America, and other parts of the world experiencing conducive, climatic conditions. Besides, knowledge about effective contact tracing techniques to reduce the transmission of COVID-19 to unsuspecting potential patients, and at risk individuals, in developing nations was neither spontaneously disseminated, nor practically implemented in numerous epicenters in most African nations.

**Keywords:** COVID-19; SARS-CoV-2; Transmission

## Introduction

### Ecological characteristics of Wuhan, China and factors enabling the spread of COVID-19

Wuhan, China is one of the cities in Hubei Province, China. By December 19, 2019 there was the outbreak of pneumonia of unknown etiologic viral infection in Wuhan community [1]. However, the viral agent caused morbidity and mortality among at risk elderly patients with underlying diseases as diabetes and cardiovascular diseases among other chronic and degenerative diseases. Detection of the ecological factors accelerating the spread of this pandemic must have involved the urgent commitment of World Health Organization and many other international health organizations as “doctors without Borders” United Nations Children Emergency Fund UNICEF) and among others to effectively control the deadly impact of this pandemic [1]. From molecular biological sciences, mutation and adaptation could have led to the co-evolution of Coronaviruses (COVs), and

their primate hosts, including humans, mostly, those with underlying pathological conditions.

### RENE DUBOS’s ecological viewpoint

Rene Dubos [2] defined Ecology as “the study of the interaction between living and non-living things in human environment”. Strategically, Wuhan is the capital of Hubei Province in the People’s Republic of China. Demographically, it is the most populous city in central China with a population of over 11 million, and it is evidently the ninth-most populous Chinese city. In addition, Wuhan is considered the political, economic, financial, commercial, cultural and educational hub in central China [3-5].

In addition to becoming the industrial manufacturing hub for decades, Wuhan is also one of the cities which promote modern indoctrination in China. Wuhan not only consists of three national developmental epi-centers, but also four scientific and technological development parks and more than 350 research institutes. These technological resources have created an allure for both domestic and international visitors to this technological and economically prosperous city in China [1,2].

Detection of the ecological factors accelerating the spread of this pandemic must have involved the urgent commitment of World Health Organization and many other international health organizations as “doctors without Borders”, United Nations Children Emergency Fund UNICEF) and among others to effectively control the deadly impact of this pandemic. From molecular biological perspectives, mutation and adaptation could have led to the co-evolution of Coronaviruses (CoVs), and their primate hosts, including humans, mostly, those with underlying pathological conditions. Ecologically, a systematic spread

**Citation:** Ebomoyi EW, Ebomoyi JI. Ecological, Epidemiological, Demographic and Social Factors Facilitating the Spread of COVID-19 to Hitherto Unaffected African Nations. *Ann Clin Cases*. 2021; 2(2): 1032.

**Copyright:** © 2021 E. William Ebomoyi**Publisher Name:** Medtext Publications LLC**Manuscript compiled:** Mar 05<sup>th</sup>, 2021

**\*Corresponding author:** E. William Ebomoyi, Department of Health Studies, Professor of Epidemiological Science & International Health Consultant (APHA), College of Health Sciences, Chicago State University, Chicago Illinois 60628, USA, E-mail: eebomoyi@csu.edu

continued to be observed in United States and other South American nations, Europe, South East Asia and North Africa and other parts of South and East African nations. Business entrepreneurs from these nations not only visit Wuhan on commercial enterprises but also for diplomatic duties and site seeing activities [3].

Incidentally, a systematic spread continued to be observed in United States and other South American nations, Europe, South East Asia and North Africa and other parts of South and East African nations. From recent virological and clinical epidemiological investigations, coronaviruses as etiologic agents consist of a large group of enveloped, positive RNA viruses which have four specific genera: alpha, beta (infecting mammals); SAR-CoV-2 is known to infect human respiratory system. However, most virologists [4] are of the opinion, that it belongs to the orthocoronavirinae, subfamily and it is scientifically classified as a new beta coronavirus of group 2B (Rothan et al. 2020, and Wang Zhang, Wu, 2020).

After the initial onset in Wuhan, China, the virus subsequently, continued to spread to other parts of China with sadistic regularity, killing those elderly with underlying diseases as diabetes, Human Immunodeficiency Virus (HIV) and cardiovascular conditions. Higher mortality statistics were recorded particularly among elderly males, compared to their female counterparts. This pandemic has caused not only unexpected, global, economic disruption but also increased mortality and morbidity statistics in several nations worldwide [6]. Easily observed disruptions are the closure of advanced academic institutions to reduce personal contact and possibly eliminate trends in infecting unsuspecting students and their acquaintances. Painstaking interventions have led to closure of numerous churches, thereby reducing the intermingling of fellow congregation members in the churches with unavoidable mammoth crowd. Most academic institutions at all levels, in numerous nations, have developed alternatives of "remote and asynchronous academic instruction" for students to prevent intra-faculty and intra-students transmission of COVID-19 to unsuspecting classmates. As a result of the avoidable morbidity and mortality associated with COVID-19 this study was designed to:

Compare the mortality encountered from COVID-19 cross-classified by gender in Wuhan, -China.

Compare the mortality encountered from COVID-19 cross-classified by gender in United States.

Illustrate the age, sex and existing conditions and associated death from COVID-19.

Explore underlying factors which aggravate death associated with Covid-19 in Nigeria, Propose relevant strategies to eliminate COVID-19 from hitherto unaffected, African nations.

## Methods

This study reviewed epidemiologic data which continue to emerge from the Federal Centers for Disease Control and Prevention (USA, CDC) and other numerous sources since the outbreak of COVID-19 which is a pandemic. Cross-classification of data generated from The Chinese Centers for Diseases Control and Prevention were collected, the Department of Public Health in New York, the World Health Organization and the Nigerian Centers for Disease Control and other British public Health data sources. To accomplish data collection on mortality and morbidity rates, on COVID-19, we assessed data reported from the State offices of Public health in New

York, United States and compared with data derived from Federal Centers for Disease Control and Prevention, Offices of public health, at state level and morbidity and mortality reports from selected offices of Public Health States in United States. To facilitate data collection, we assembled reports from The Ministry of Health of several nations in Africa, their reported data were reviewed, and the morbidity and mortality statistics of many nations were also compiled for specific international comparison.

In addition to the authentic online sources, we also compiled and analyzed the collected data for accuracy and authenticity. We inspected comprehensive online websites such as <https://wwwbnoews.com> through such sources as <httpbnews.com>. We also retrieved comprehensive data from the World Health Organization (WHO) in Geneva, to confirm our analysis from national offices of Public Health and the National Institutes of Health, USA. Our priority in data collection focused basically, on the date of onset of COVID-19 disease, time and date of admission to the hospital, date of proficient diagnosis of COVID-19 infection; related demographic data such as gender, ethnicity, and age of patients were collected.

## Results

### COVID-19 Epi-Center

The mortality and morbidity rates associated with this pandemic have been overwhelming at the Epi-Center in Wuhan, China. By December 19, 2019, there was an outbreak of the first coronavirus disease-19 in Wuhan, Hubei, China. However, in the next three months trajectory, the Chinese Centers for Disease Control (CDC) reported 464,781 confirmed cases of covid-19 worldwide. The pandemic had occurred in China, Italy, the United States, Spain and Iran, with 50,000 patients who were previously diagnosed in Wuhan, China. Data collections from several nations worldwide continue to portray a higher frequency of mortality among males compared to their female counterparts. Therefore, based on genomics science, analytical assessment on male and female gene-chromosomes, retrospective epidemiological techniques were adopted to analyze the gene differentiation between male and female patients in United States, England and African nations to assess the relevance of the female XX gene chromosomes and the male XY alleles regarding human susceptibility to death associated with the lethal COVID-19 and associated underlying chronic and degenerative diseases.

A retrospective epidemiological approach has been used to collect mortality and morbidity data from the various public health centers such as the United States Centers for Disease Control and Prevention, and the offices of public health from Washington DC in United States, offices of Public health in London England, Department of Public Health in numerous African nations.

### Comparison of COVID-19- gender specific death rates in London

From epidemiological investigation, COVID-19 has been reported to create increased morbidity and mortality statistics among more males compared to their female counterparts. From the British, on-going research reported in the British White papers, a review of mortality and morbidity reports cross-classified by gender has revealed a preponderance of more cases of death encountered by males compared to their female counterparts. By July 10, 2020, Research and White papers have reported that even in New York, the State Department of Health [6] has published how about 60% of those in New York who died from COVID-19 were males compared to 40%

of their female counterparts.

Recently, the European Centre for Disease Prevention and Control (ECDC) also reported that the male-to-female ratio for COVID-19 mortality statistics observed across the European Union was 2.1. The U.K.'s Office for National Statistics (ONS) indicated that the rate of mortality due to COVID-19 for males has doubled the statistics of their female counterparts. For reasons that remain unclear, the novel coronavirus appears to present a significantly higher mortality risk to men than women. Although many journalists might wonder about the logical reasons for this gender disparity, however, genomic epidemiologists associate this gender disparities to the advantageous female XX gene chromosomes compared the male XY alleles [7].

### Comparison of COVID-19 gender specific death rates in Nigeria

The Data reported from the Nigerian Federal Ministry of Health have revealed not only higher mortality rate among 61-70-year-old, but also we have discovered their preexisting underlying diseases as diabetes, high blood pressure and other associated diseases of the elderly. However, The Nigeria Center for Disease Control (NCDC, 2020) has indicated that individuals within the age group of 31 to 40 years age are more susceptible to contracting the coronavirus in the country. Although a higher morbidity and mortality have been recorded among the elderly, sixty years and above, the News Agency of Nigeria on Thursday in Abuja, stated, from the Nigerian Centers for Disease Control (NCDC, 2020.) stated that data also revealed that men were two times more likely to get the virus as shown in its latest demographic data on COVID-19, confirmed cases. Besides, mortality statistics cross-classified by gender and age in the country continue to reveal the preponderance of male death. Besides, "more deaths have been recorded among older people of 60 years and above". The other observation made includes massive congestion in the state and federal penitentiary which increases the risk of transmissibility to fellow prisoners and unsuspecting criminal or inmates.

Reports from Nigerian CDC, have also revealed 797 males "Age 31-40: were infected with seven deaths; female - 324 with four deaths but lower mortality compared to older persons", it said. According to the report, older people die more owing to several factors from co-morbidity. The data showed more deaths among 61-70 years, though the lowest rates in confirmed cases were. "Ages 61-70: Male-188 infected with three deaths; female - 52 infected with four deaths". "Age 70 plus: Male - 74 infected with 12 deaths; female - 33 infected with five deaths. From the report from the Nigerian CDC, in 2020, the highest rate of mortality - continue to occur compared to other global data".

### Social factors facilitating the spread of COVID-19 (human congestions in prisons)

As a result of inadequate space in Nigerian Prison custody, the risk of infecting new prisoners as they get imprisoned for specific crimes cannot be over-stated. The probability of infecting new convicts with COVID-19 is very high. Besides, the risk of morbidity and mortality associated with COVID-19 differs between men and women across different age groups who are kept in some of the Nigerian highly congested prisons.

The fact that COVID-19 mortality rates differ by age and gender, in many countries studied, the male-to-female differences in COVID-19 mortality rates were observed to be greater and a higher variation than the differences in all-cause mortality rates. However, we have

discovered that COVID-19 mortality rates exponentially increase by age for both males and females. The male COVID-19 mortality rate is generally higher than the COVID-19 female mortality rate across all ages in the countries investigated. The age cohort is broadly similar by gender within the country, although there were some notable differences between other nations.

### Coronavirus: Recently Buhari, the president of Nigeria, asked the Nigeria's chief judge to free prisoners

Until relatively recent times, before the outbreak of COVID-19, the Nigerian prisons became highly congested, thereby creating opportunity for the heightened transmissibility for COVID-19 to unsuspecting prisoners. Besides, there more males in Nigerian prisons than their female counterparts.

The magnanimous and trustworthy, Nigerian president by April 22<sup>nd</sup>, 2020, has therefore, called for the release of inmates who are awaiting trial for six or more years amid coronavirus fears: President Buhari has asked Nigeria's chief judge to free prisoners. President Buhari said inmates with no confirmed criminal cases against them; elderly prisoners and those who are terminally ill could be discharged (Siphiwe Sibeko/Reuters, 2020). Nigerian President Muhammadu Buhari has asked the chief judge to free prison inmates who have been awaiting trial for six years or more to ease overcrowding as the novel coronavirus continues to spread, a spokesman said on Tuesday. A statement quoted President Buhari as saying 42 percent of Nigeria's 74,000 or so prisoners were awaiting trial. He urged Chief Judge Ibrahim Tanko Muhammad to reduce that number "since physical distancing and self-isolation in such conditions are practically impossible".

Two weeks ago, President Buhari of the Federal Republic of Nigeria pardoned 2,600 prisoners who were either 60 or older, terminally ill, or had less than six months left to serve in their sentences of three years or more.

Nigeria is Africa's most populous country, with some 200 million people. As of Wednesday morning, the West African country has 782 confirmed cases and reported 25 deaths, according to data from Johns Hopkins University. The country has introduced measures to stop the spread of the virus including closing its borders and locking down the capital Abuja, the commercial hub, Lagos, and the adjacent state, Ogun. Counting the Cost: Can Africa's healthcare system cope with coronavirus pandemic? (26:00) SOURCE: REUTERS NEWS AGENCY, 2020.

### Comparison of COVID-19- gender specific death rates in London

From epidemiological investigation, COVID-19 has been reported to create increased morbidity and mortality statistics among more males compared to their female counterparts in London. From the British, on-going research reported in the British White papers, a review of mortality and morbidity reports cross-classified by gender has revealed a preponderance of more cases of death encountered by males compared to their female counterparts. By July 10, 2020, Research and White papers have reported that even in New York, the State Department of Health has published that about 60% of those in New York who died from COVID-19 were males compared to 40% of their female counterparts.

Recently, The European Center for Disease Prevention and Control (ECDC) also reported that the male-to-female ratio for COVID-19

mortality statistics observed across the European Union was 2.1. The U.K.'s Office for National Statistics (ONS) indicated that rate of mortality due to COVID-19 for males have doubled the statistics of their female counterparts. For reasons that remain unclear, the novel coronavirus appears to present a significantly higher mortality risk to men than women. Although many journalists might wonder about the logical reasons for this gender disparity, however, genomic epidemiologists (Ebomoyi 2011) associate this gender disparities to the advantageous female XX gene chromosomes compared the male XY alleles.

### Comparison of COVID-19 gender specific death rates in Nigeria

The Data reported from the Nigerian Federal Ministry of Health have revealed not only higher mortality rate among 61-70-year-old, but also we have discovered their preexisting underlying diseases as diabetes, high blood pressure and other associated diseases of the elderly. However, The Nigeria Center for Disease Control (NCDC, 2020) has indicated that individuals within the age group of 31 to 40 years age are more susceptible to contracting the coronavirus in the country. Although higher morbidity and mortality have been recorded among the elderly, sixty years and above, the News Agency of Nigeria on Thursday in Abuja, stated from The Nigerian centers for disease control (NCDC, 2020) stated that "data also showed that men were two times more likely to get the virus as shown in its latest demographic data on COVID-19, confirmed cases, and deaths cross-classified by gender and age in the country. Besides, more deaths have been recorded among older people of 60 years and above". The other observation made, includes massive congestions in state and federal penitentiary which increase the risk of transmissibility to fellow prisoners and other unsuspecting criminal or inmates.

Reports from Nigerian CDC, also revealed that "Age 31-40: Male - 797 infected with seven deaths; female - 324 with four deaths but lower mortality compared to older persons", it said. According to the report, in spite of this, older people die more due to several factors from co-morbidity. The data showed more deaths among 61-70 years, though the lowest rate in confirmed cases "Ages 61-70: Male-188 infected with three deaths; female - 52 infected with four deaths". "Age 70 plus: Male - 74 infected with 12 deaths; female - 33 infected with five deaths. Highest rate of mortality - comparable to global data", it showed (NCDC, 2020).

### Social factors facilitating the spread of COVID-19 (human congestion in prisons)

As a result of inadequate space in Nigerian Prison custody, the risk of infecting new prisoners as they get imprisoned for specific crime cannot be over-stated. The probability of infecting new convicts with COVID-19 is very high. Besides, the risk of morbidity and mortality associated with COVID-19 differs between men and women across different age groups in some of the Nigeria highly congested prisons.

Since the COVID-19 pandemic began in Wuhan, China in December 2019, we have seen the virus spread to over 160 countries. Several countries have experienced large outbreaks, including China, South Korea, Italy, Iran, Spain and France, with the US and UK seeing rapidly increasing numbers. But most countries in the world have reported very few to no cases of COVID-19 (WHO, 2020).

While it is likely that the virus has not yet reached and started localized transmission in every country, many of these countries have incessant travel, migration or trade relationships with China. This

raises the question: are these low case numbers due to the virus not reaching or establishing infections, or adjoining communities, or is it due to effective border control, or does it reflect a lack of screening and reporting?

The spread of an infectious disease from its country of origin is a complicated process involving many factors, but at its core, it is related to the movement of people. There are several parameters that can be used to coarsely estimate movement: travel (inbound and outbound), migration, trade and proximity. Looking at the number of Coronavirus cases in the context of the ranked order of flow of people and goods between China other countries, we see the following, (as of March 15, 2020).

### 2019 Sources: UN, World Bank, Statistics, WTO and Worldometers.info. Jeremy Rossman

While this is a vastly simplified analysis of population movement, it is striking that there are only 63 cases reported in all of Russia. Given that Russia has very strong travel, emigration, immigration and trade relationships with China, it has very low case numbers which raise questions, especially as other countries with comparably close relationships (Japan, South Korea and the US) are experiencing significant local transmission.

Also, it is interesting to find that in the 15 countries that share land or sea borders with China have reported only 310 cases. Only India has reported more than 100 cases (108) and ten countries have reported between zero and five cases. Given that many of these countries have significant trade and travel relationships with China the low level of cases is surprising.

### Few coronavirus cases throughout Africa

Aside from Russia, there are other regions of the world that have not reported any (or many) cases of COVID-19. Of particular note, is that in Africa only Egypt has reported over 100 cases (126) with most countries reporting between zero to five cases. Nations reporting less than 100 cases include: Martinique, Guadeloupe, Liechtenstein, Macau, Monaco, French Guiana, Togo, Barbados, Zambia, Uganda, Maldives, Tanzania, Ethiopia, Equatorial Guinea, Dominica, Mongolia, Gambia, Guam, Seychelles, Nepal, Gibraltar, Bhutan, Vatican City, Saint Barthelemy, Puerto Rico, Namibia, Aruba, Central African Republic, Gabon, Saint Vincent and the Grenadines, French Polynesia, Antigua and Barbuda, Sudan, Saint Lucia, Swaziland, Suriname, Mauritania, Liberia, Greenland, Somalia, Benin, Botswana, Cape Verde, Eritrea East Timor, Zimbabwe, Papua New Guinea, Chad, Angola, Hati, Fiji, Nicaragua, Syria, Mozambique, Guinea-Bissau, Laos, Burundi, Sirre Leone, Malawi, Yemen, Myanmar (Burma), South Sudan

Although more than 44,000+ people have died from COVID-19, currently 543,000+ have recovered from COVID-19 and may now have developed immunity against COVID-19.

Sources: US CDC, ECDC, Johns HOPKINS UNIVERSITY, NHC China, RKI Australia DOH, MDS, Spain, SP france, gov.uk, Canada, ca, politi (DK), FOPH Swiss, and other reliable sources, 2020.

At the initial outbreak, of COVID-19, between December and March, in the 54 countries in Africa, there were only 253 cases out of the 167,519 cases worldwide. There are several possible reasons for the low number of cases in many of these countries. But at present, there is an increase in the prevalence of COVID-19 in numerous African nations. From molecular biological epidemiology, we cannot rule out the possibility of genetic shift and genetic drift in the increased

prevalence of COVID-19 in these African nations.

We are still in the early stages of the COVID-19 pandemic, so it is not surprising that some countries have not had any cases and are not yet experiencing local transmission of the virus. But understanding the reason why these sometimes well-connected countries have few reported cases is important for the global effort to contain the spread of the pandemic. There is a range of explanations for low case numbers, including weak travel connections, effective border screening and travel restrictions, local climate effects, a lack of screening or a lack of reporting.

When considering travel, many countries in question have very low levels of travel exchange with China. This is amplified by the travel restrictions implemented by China during the early stages of their outbreak that may have delayed the arrival of COVID-19 to many countries throughout Africa. In this scenario, case numbers will probably increase significantly over the coming two weeks due to the extensive ongoing transmission in many European countries with robust travel links to Africa.

Some countries with very good roads, migration and trade links with China still have comparable low case numbers (both Japan and Singapore have fewer than 1,000 cases). For these countries, there has been early and extensive border screening, control and surveillance, which have probably held the localized transmission in check. If these measures are sustained, these countries will probably see only slow increases in case numbers over the coming weeks.

It is interesting to see that most of the global cases are found north of the tropic of cancer. At present, there are only 2,025 cases south of the tropic of cancer. Case numbers in countries residing in the tropics or current southern hemisphere winter make up just 1.29% of the global cases. This could reflect global travel and trade relationships with China or could reflect impacts of climate on COVID-19 transmission.

It is also possible that the broad range of tropical infectious diseases may have masked the identification of COVID-19 cases that often present with mild, non-specific symptoms.

If travel connections with China have been the limiting factor, then cases are likely to rise over the next two weeks, as discussed above for Africa. If climate is affecting virus transmission then cases might remain low until cooler weather in the southern hemisphere, and if other diseases are masking COVID-19 cases, then the reported cases will probably remain low in these countries, though the actual cases would increase.

Finally, the low levels of reported cases in many countries may be due to a lack of testing or a lack of reporting. Many countries are actively pursuing policies in which only those with serious illness and a travel history to an area with strong local transmission will be tested, including the UK. This will lead to a dramatic under-reporting of case numbers and can jeopardize the ability to contain the pandemic, as the WHO has stated: "You can't fight a virus if you don't know where it is. Find, isolate, test and treat every case, to break the chains of transmission".

Other countries may simply not have the infrastructure and resources to afford large-scale testing, limiting their ability to control the disease within the country and potentially creating hot spots where the virus can continually spread from. It is also possible that some countries are not reporting any or many of their cases to

preserve their reputation or to prevent economic hardships that may be associated with containment measures, such as travel restrictions.

### Dangerous game

It is of particular concern that with the close relationships with China and extensive national resources, at the time of this investigation Russia had only reported 63 cases. While it is possible that this low number reflects their active border control and screening there is a concern that reflects either a lack of screening or a lack of reporting. This is a dynamically unfolding pandemic that will require the concerted efforts of countries around the world to control. As the WHO director-general Tedros Adhanom Ghebreyesus says: "we're all in this together".

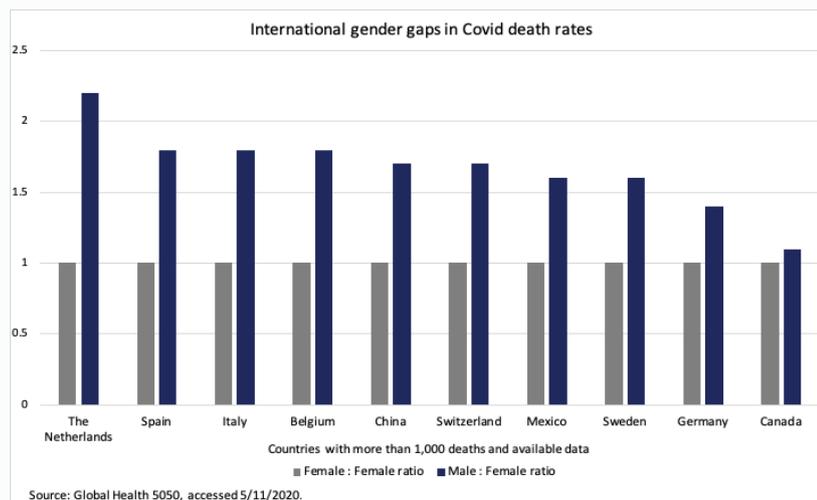
Jeremy Rossman, Honorary Senior Lecturer in Virology and President of Research-Aid Networks, University of Kent. There's never been a more important time to explain the facts, cherish evidence-based knowledge and to showcase the latest scientific, technological and engineering breakthroughs. Cosmos is published by The Royal Institution of Australia, a charity dedicated to connecting people with the world of science. Financial contributions, however big or small, help us provide access to trusted science information at a time when the world needs it most. Please support us by making a donation or purchasing a subscription today.

It is quite evident that COVID-19 mortality rates differ by age and gender, in many countries studied. The male-to-female differences in COVID-19 mortality rates were observed to be greater and a higher variation than the differences in all-cause mortality rates. However, we have discovered that COVID-19 mortality rates exponentially increased by age for both males and females. The male COVID-19 mortality rate is generally higher than the COVID-19 female mortality rate across all ages in the countries investigated. The age shape is broadly similar by sex within a country, although there were some notable differences between countries.

### Discussion

This epidemiological study focuses on the unpredictable, COVID-19 which is a pandemic viral disease. This disease is associated with high case fatality mortality and morbidity among infected patients worldwide. At the initial outbreak of this pandemic, very limited interventional strategies were known about the virulent nature and the associated case-fatality and morbidity rates associated with this disease. By the advent of 2020 winter season, COVID-19 had infected several developed and developing nations with overwhelming, morbidity and mortality rates worldwide. At the early phase of onset of COVID-19, virologists, clinical epidemiologists, and other healthcare personnel continued to investigate interventions to combat this lethal viral disease, and analyze gender disparities which could be associated with the mortality and morbidity of COVID-19 [7,8]. As summarized in Figure 1, patients infected by COVID-19 were few in the cohort of 0-17. Besides, there was a higher frequency of those in the age-group of 50 and above. From Table 1, the observed frequency data demonstrate those predominantly infected by COVID-19. These are patients in the age groups of forties and above [5].

As illustrated in Tables 2, the mortality statistics reported on COVID-19 revealed the preponderance of elderly males in their fifties and above. These patients were most at risk of getting infected by COVID-19; and they were more exposed to the numerous symptoms associated with the disease. Genome Epidemiologists and virologists have confirmed that coronaviruses are the largest, enveloped,



**Figure 1:** Illustrates the international gender gap in COVID-19 death rate in ten highly developed nations.

single-stranded positive-sense RNA viruses, including four genera: Alphacoronavirus, Betacoronavirus, Gammacoronavirus, and Deltacoronavirus, Alpha- and Betacoronavirus which mainly infect mammals, the rest of the other two mainly infect birds [5].

The United States Center For Disease Control and Prevention, (CDC) has recommended that at risks cohorts to be meticulous in protecting themselves against such classical signs and symptoms which could appear within two to four days which are indicators of the incipient stage of COVID-19. These symptoms include: fever, chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of a taste of smell, sore throat, congestion or running nose, nausea or vomiting and sporadic diarrhea [6] by far most critical, is the predominant case fatality rate among male patients which outnumbers the death and disabilities observed in their female counterpart.

**Table 1:** Race-ethnicity, percentage is calculated among those with known race-ethnicity as reported by the medical provider. Source: Chicago office of Public Health 2020.

Characteristic	Deaths	% Total deaths	% Deaths within group	Rate per 100,000 population
Chicago	2,798	100%	4.50%	103.4
Age Cohort				
0-17	2	0.10%	0.10%	0.4
18-29	20	0.70%	0.20%	3.6
30-39	68	2.40%	0.60%	14.9
40-49	151	5.40%	1.40%	44.9
50-59	311	11.10%	3.10%	99.4
60-69	613	21.90%	8.70%	233.1
70+	1,633	58.40%	24.00%	693.9
Gender				
Female	1,157	41.40%	3.70%	83.5
Male	1,641	58.60%	5.50%	124.3
Under investigation	0	0%	0.0%	-
Race-ethnicity2				
Latinx	912	32.70%	3.9%	117.4
Black, non-Latinx	1,198	43.00%	8.00%	152.8
White, non-Latinx	535	19.20%	6.80%	59.4
Asian, non-Latinx	120	4.30%	8.80%	66.7
Other, non-Latinx	21	0.80%	0.80%	16.7
Under investigation	12	0.40%	0.10%	-

**Table 2:** COVID-19 Case Characteristics for Chicago residents.

Characteristic	Number	% Total Cases1	Rate per 100,000
Chicago	62,797	100%	2,320.70
Age Cohorts			
0-17	3,602	5.70%	656.1
18-29	12,776	20.30%	2,310.60
30-39	11,413	18.20%	2,501.10
40-49	11,009	17.50%	3,272.00
50-59	10,106	16.20%	3,229.10
60-69	7,088	11.30%	2,695.10
70+	6,792	10.80%	2,886.20
Under investigation	11	0.00%	-
Gender			
Female	31,534	50.20%	2,275.00
Male	30,256	48.20%	2,292.30
Under investigation	1,007	1.60%	-
Race-ethnicity2			
Latinx	23,796	47.10%	3,063.90
Black, non-Latinx	14,993	29.60%	1,911.70
White, non-Latinx	7,892	15.60%	876.9
Asian, non-Latinx	1,372	2.70%	762.9
Other, non-Latinx	2,520	5.00%	2,109.30
Under investigation	12,224	19.50%	-

### Gender differences in longevity

From genomic epidemiological studies, the inherent biologic genes of females with their XX gene chromosomes confer better longevity and improved quality of life as a universal advantage. However, in many developing nations, their male counterparts develop and modify human cultural attributes just to compensate for their biological disadvantages [7,8]. Curley et al. [9] substantiate the present finding that more males are dying from COVID-19 than females. They also reported that males tend to engage in more risky behavior such as ignoring physical distancing, and they do not take the symptoms of COVID-19 seriously. Besides, some of the other underlying reasons why more males die from COVID-19 are basically, the higher frequency of underlying diseases as heart disease in men, high-blood pressure and other chronic and degenerative diseases which are common in most males. Finally, Reeves and Ford [8] have emphasized that although both male and female face the same predicament, yet males are more exposed to higher risk of death than their female counterpart across United States, Nigeria and

in fact, other parts of the world. As reported in England and Wales, to illustrate, male social (care) workers are dying from COVID-19 at a higher rate of 23.4 deaths per 100,000 compared to a rate of 9.6% for their female counterparts [8]. In fact, Marais et al. [9] have emphasized from their comprehensive analysis of the Calabrian (South Italy) population that there are twice as many women as men in their cohort of centenarians.

Besides, Ebomoyi [10] in his *Globalization Health and Human Rights*, Kendall Hunt Press, emphasized the genomic attributes of female complimentary XX alleles as the unique female advantage in enhancing the longevity of our female counterpart compared to the heterozygote XY male alleles which neither enhance male's longevity, nor fortify males' genomic composition to combat new emerging infectious disease such as COVID-19, Ebola viral disease, or even smallpox.

## Conclusion

With COVID-19 as a pandemic, very strict compliance with primary preventive strategies are required to combat this lethal disease. The relatively several offices of Disease Control and Prevention must adopt salient and innovative primary preventive strategies to combat COVID-19, Ebola, HIV, anthrax and related pandemic diseases. The various federal and state agencies charged with the responsibility of combating virulent diseases and are required to protect humankind from getting infected with these virulent infectious agents, which have relatively high case fatality rates. To ensure we protect ourselves and others from getting infected, we must constantly wash our hands thoroughly and apply alcohol hand sanitizer to ensure effective protection. Constant, thorough washing of hands and application of alcohol hand sanitizers should ensure the protection of at risk individuals. Sick employees are advised to stay at home to prevent the transmission of the disease to unsuspecting co-workers. As a result of the higher risk of mortality among males from COVID-19, very strict compliance is required for primary prevention of this lethal pandemic. Individuals with underlying chronic diseases are particularly at more risk of getting infected; therefore, compliance with primary preventive strategies against COVID-19 should not be trivialized.

## References

1. World Health Organization (WHO). The Epidemiological Characteristics of an outbreak of 2019 of Novel Coronavirus Disease (COVID-19). 2020.
2. National Human Genome, Institute of Medicine (IOM), Definition of Genomics USA 2020.
3. Dubos R Man Adapting, New Haven Yale University Press 1981; PP. 1-150.
4. Carlos DR, Malani P. Translating science on COVID to improve clinical care and support the public health response JAMA. 2020;323(24):2464-65.
5. Austad SN, Bartke A. Sex differences in longevity and in responses to anti-aging interventions: A mini-review. *Gerontology*. 2015;62(1):40-6.
6. Ebomoyi EW. Gender disparities in fetal abortion and sex selection in *Globalization Health and Human Rights* Kendal Hunt Publishing Co. 2011;248-9.
7. Chen Y, Liu Q, Guo D. Emerging coronavirus; genome structure, replication, and pathogenesis. *J Med Virol*. 2020;92(4):418-23.
8. Reeves RV, Ford T. Brookings COVID-19 much more fatal for men, especially taking age into account. 2020.
9. Austad SN, Bartke A. Sex differences in longevity and in response to anti-aging interventions Amini-review. *Gerontology*. 2015;62(1):40-6.
10. Meng Y, Wu P, Lu W, Liu K, Ma K, Huang L, et al. Sex-specific clinical characteristics and prognosis of Coronavirus disease-19 infection in Wuhan, china: A retrospective study of 168 severe patients. *PLoS Pathog*. 2020;16(4):e1008520.
11. Buhari M. President of Nigeria since the COVID-19 pandemic began in Wuhan, China in December 2019; we have seen the virus spread to over 160 countries. Several countries have experienced large outbreaks, including China, South Korea, Italy, Iran, Spain and France, with the US and UK seeing rapidly increasing numbers. But most countries in the world have reported very few to no cases of COVID-19.