

Predictive Models on COVID 19: What Africans Should Do?

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Research

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Abstract

Background

COVID 19 is becoming a global health problem, where strong intervention is needed. Thus, this paper addresses predictive models on COVID 19 in Africa, from which the government and others put a strong intervention in optimizing resources and necessary healthcare demand.

Methods

Predictive models (Cubic polynomial and quadratic regression models) are considered based on the daily report of WHO, 2020 rampant data. The data were analyzed using R and STATA packages.

Results

The result of the study has shown that the spatial and temporal pattern of this novel virus is varying, spreading and covering the entire world within a brief time. The result has shown that the fitting effect of cubic model is best outperforming compared to the other six families of exponentials ($R^2=0.996$, $F=538.334$, $D_{\{F\}_1}=3$, $D_{\{F\}_1}=7$, $b_1=13691.949$, $b_2=-824.701$, $b_1=12.956$). The cubic algorithm is more robust in predicting the deaths and confirmed cases of COVID 19. There are also evidences that the source of the outbreak of the epidemic is related to Huanan Seafood from the whole market, fever (78%), cough (59%), fatigue (75%), headache (76%), and others are identified as the major symptoms of COVID 19. Moreover, the result of our study has shown the corona virus infection epidemic is increasing, which seeks a long-term plan to take an action in disease prevention and intervention programs.

Conclusion

The trend of COVID 19 is increasing with an alarm rate, thus strong intervention is needed to mitigate the spread of this novel virus. This also can be done through reducing the spread of COVID 19 as persistent and strict self-isolation. The results acquired from this study also recommend that COVID-19 mortality and more cases might be engulfing in Africa due to lack of preparedness and giving strong awareness for the public.

This pandemic will sustain to grow up, and peak to the highest for which a strong care and public health interventions practically implemented. Africans must go beyond theory preparations, strong awareness for the public and practical implementation is highly recommended. Highly recommended more sophisticated equipment to tackle the spread of the virus and safe the loss of the infected from deaths.

1. Introduction

1.1. Background of the Study

Rendering to *Nature*, a spatial spreading of COVID-19 is attractive overwhelming and has already extended the necessary the standard health benchmarks for the virus to be acknowledged a pandemic, with high infection more than 1.5 million people in 170 countries [16]. On January 7th, 2020, a potential coronavirus was quarantine and considered as severe acute; respiratory syndrome COVID 19, where this virus is considered as COVID 19 by the WHO on February 11th, 2020. The suspicions of this novel and potential virus have been regarded and related to the to ABO blood group. For example, Norwalk virus and Hepatitis B have clear blood group susceptibility [1, 2].

The spatial distribution of COVID 19 has ready taken on pandemic rate; impacting almost over 170 regions in a matter of several weeks a global reaction to prepare health systems to meet this unprecedented challenge. Thereby, a synchronized global reaction is greatly needed to prepare coordinated health systems so as to attain this unparalleled major areas challenge. There are still growing up of expansion countries that have been unsuccessful adequate to have been vulnerable to these diseases already have, illogically, very appreciated lessons to pass this critical time. Though the suppression measures implemented in China have at least for the current moment reduction to the coming new cases by more than 90%, this reducing is not the case in other Europeans and other African countries [17]. Therefore, cogently known the spatial and temporal modeling, prediction rate of its distribution along with its mitigation mechanisms are very important to give some information in the future to mitigate this serious problem. COVID 19 is becoming the world problem for health, depletion of economy and terrorizing the world, unexpected death and hundred thousands of illness. This work is aimed to determine the spatial and temporal distribution, prediction of death rate and mitigation mechanisms of COVID 19: The Case of Africa.

In the present paper, we present adopted mathematical models for COVID-19 that incorporates both potential parameters, including both the environment-to-human and human-to-human routes. Temporarily, the diffusion rates in our model depend on the epidemiological status and the confirmed cases and deaths with time. In particular, when the infection level is high, people would be motivated to take necessary action to reduce the contact with the infected individuals and contaminated environment so as to protect themselves and their families, leading to a reduction of the average transmission rates. We adopted two algorithms both are quadratic and curved exponential process to examine the prediction of confirmed and death rates of COVID 19.

Therefore, the foremost contribution novel ideas of the up-to-date are:

- An efficient and effective prediction models to predict the confirmed number of cases and deaths of the COVID 19.
- Improved quadratic and curved models are proposed as compared with the other exponential families (logarithmic, logistic, compound, growth and exponential).

2. Methods

In this work, the updated information and data related for this study is based on the daily release of world health organizations (World Health Organizations, 2020). The prominent information for the study is based on the confirmed number of cases, number of deaths, and the transmission type, which are conveyed on daily registered by the world health organization. The appropriate data for this study is depending on the world health organization.

2.1. COVID 19

COVID 19 are encircled, pleomorphic or spherical particle, with having the size 150 to 160 nm, linked with positive single stranded RNA, unsegment, nucleoprotein, capsid, matrix, and S-protein (Fig. 1). Important viral proteins are nucleocapsid protein (N), membrane glycoprotein (M), and spike glycoprotein (S) [37, 38]. COVID-19 differs from other coronaviruses by encoding an additional glycoprotein that has acetyl esterase and hem agglutination (HE) properties [36, 38].

2.1.1. Performance Evaluation of the Measures

The effectiveness of the adopted methods are evaluated based on the using a performance statistical index. This is determined using the result of coefficient of determination is considered to examine the performance of the adopted algorithms as compared to the state of the art of the works. This can be obtained through, the coefficient of determination (R^2)

$$R^2 = 1 - \frac{\sum_{i=1}^n (X_i - X_{P_i})^2}{\sum_{i=1}^n (X_i - \bar{X}_i)^2} \dots \dots \dots [1]$$

Where n , is the total is number of observations, X_p and X are represents forecasted and the observed values, respectively. The ultimate goal of this work is to assess the ability of the quadratic and cubic distribution to predict the COVID 19 through comparison of the other approaches, namely the logarithmic, logistic, curved, compound and exponential models.

3. Results And Discussions

3.1. Descriptive Summary

In this section several results are addressed. The results are both the descriptive and inferential statistics. The data for this study has been taken from the latest release of [WHO, 2020] patients of COVID 19, across the world and particularly focusing in the Africa, in the year first January, 2020 to Beginning of 2020. Within this data two potential variables (confirmed cases and deaths) are taken into consideration for this study.

3.2. Spatial Pattern of COVID 19

This study reveals about 1048, 156 confirmed cases and 55,143 deaths are taken into account worldwide, from the global assessment this is considered as very high risk. From the descriptive results, we noted that the spatial pattern of confirmed number cases of COVID-19 and deaths are both varying with high spread. This entails the distribution of this novel virus across worldwide both in death rate and confirmed cases is varying almost all countries in the world. We rely on the daily reported aggregated data across the globe on two main predictors: the confirmed number cases and deaths. We emphasize the significance of the confirmed cases that is not included in public and private media as broadly as the confirmed cases or the deaths. Therefore, completely two data distributions display an increment in America, the patterns of the deaths were also increased in European (Fig. 2).

3.3. Spatial Distribution of CoVID-19 in Africa

A spatial distribution of COVID 19 across the world is varying and growing up alarmingly. As noted in the following figure, the spatial distribution of COVID 19 is varying where the confirmed cases are almost growing up in South Africa, Burkina Faso and Ghana (See Figure). As the number of entering into Africa is very recent, the confirmed cases are high in Africa and spatially varying (Fig. 3).

3.4. Source, Characteristics and Fatality Rate of COVID 19 Patients

There is no a clear indication of the source of the COVID 19, but some recently published works such as [4, 5, 6, 7, 8, 9] indicates as the source of the outbreak belongs to the Huanan Seafood whole market. The main cause of source and handover to human being is unknown; but an alarm spread is from human to human got deeply taken into consideration by the world. The zoonotic source of the virus is not yet established, but, a sequential grounded scrutiny recommended bats as the main and very important basin. The novel and very potential COVID 19 originated from the Hunan seafood market at Wuhan, China where bats, snakes, raccoon dogs, palm civets, and other animals are sold, and rapidly spread up to 109 countries. This indicates majority of the patients infected due to COVID 19 were highly exposed of Huanan Seafood seller at the wholesale market. The novel coronavirus originated from the Hunan seafood market at Hubie, where China where bats, snakes, raccoon dogs, palm civets, and other animals are sold, and rapidly spread up to 170 different places [4, 5, 7, 34] (Table 1).

Table 1
Source, Symptoms, Patients Characteristics of COVID-19

Authors	Huang et al[4]	Chen et al[5]	Li et al[6]	Song et al[7]	Chen et al[8]	Wang et al[9]
History of the patients cases and the source of the outbreak	66%	49%	55%	98%	7%	8.7%
The source of the outbreak of the COVID 19 is due the patients are exposed to the Huanan Seafood from wholesale market.						
Authors	Huang et al[4]	Chen et al[5]	Li et al[6]	Song et al[7]	Chen et al[8]	Wang et al[9]
Signs and symptoms	Fever, 98% Cough, 76% Myalgia or fatigue, 44% Sputum production, 28% Headache, 8% Hemoptysis, 5% Diarrhea, 3% Dyspnea, 55%	Fever, 83% Cough, 82% Shortness of breath, 31% Muscle ache, 11% Confusion, 9% Headache, 8% Sore throat, 5% Rhinorrhea, 44% Chest pain, 2% Diarrhea, 2% Nausea and vomiting, 1%	Fever, with or without recorded temperature	Fever, 96% Cough, 47% Phlegm, 20% Myalgia or fatigue, 31% Headache and dizziness, 16% Dyspnea or chest pain, 14% Loss of appetite, 18% Diarrhea, 10% Stuffy and runny nose, 4% Sore throat, 6% Nausea and vomiting, 6%	Fever, 97% Cough or expectoration, 72% Dyspnea, 59% Myalgia or fatigue, 41% Headache, 7% Diarrhea, 14%	Fever, 98.6% Fatigue, 69.6% Dry cough, 59.4% Anorexia, 39.9% Myalgia, 34.8% Dyspnea, 31.2% Expectoration, 26.8% Pharyngalgia, 17.4% Diarrhea, 10.1% Nausea, 10.1% Dizziness, 9.4% Headache, 6.5% Vomiting, 3.6% Abdominal pain, 2.2%
Authors	Mingli Yuan[25]	<i>Fei Zhou[26]</i>	<i>Robert Verity[27]</i>	The symptoms, characteristics and source of the outbreak of the novel virus cogently addressed. Therefore, strong prevention and mitigation approaches have to take into		

Authors	Huang et al[4]	Chen et al[5]	Li et al[6]	Song et al[7]	Chen et al[8]	Wang et al[9]
Signs, symptoms And others patients characteristics	Fever 78%, Cough 59%, Myalgia 11%, Dyspnea 41%	hypertension 30% ,diabetes 19%, coronary heart disease 8%.	The mean duration from onset of symptoms to death to be 17. 8 days	account. Patients with elders and other health problem need to be a give attention.		

3.5. Predictive Models

To predict confirmed number of infections of COVID 19, additionally we considered several prediction approaches. We create predicts using some prediction models with an exponential family [48, 49]. This finding has entailed showing good prediction precision over different prediction mechanisms [50–51]. Exponential related approaches can take into consideration a variability of pattern and prediction so as to accurately predict the confirmed cases and deaths, then we can give a due a attention for Africa to mitigate its spatial and temporal distributions. Remarkably, unless we give a strong care in combating its mitigation, and develop an effective method, the pattern of this virus will remain danger for human beings even in the future. The proposed method also resembles to the other modeling methods to COVID 19 through an S-Curve algorithms (logistics curve, logarithmic, exponential, compound and the growth curves) that assumes convergence. Thus, all these approaches can be assessed using two different datasets related to COVID 19 on confirmed cases and death rates.

3.5.1. Prediction estimates of Confirmed Infections of COVID 19

Based on the January 27, 2020, 2798 infected individuals had tested positive for coronavirus disease and 80 deaths. Additionally, as of March 18, 2020, 206,250 patients and 8593 deaths outreached across the world, which cogently reveals the temporal distribution of COVID 19 is going very fact and covering the entire world alarmingly. The recent breakthrough in the temporal distribution of this novel virus pointed out by April 3, 2020 more than one million confirmed cases with more than a half of a million deaths widespread almost in part of the world. But, the estimated death rates are relying on the number infected patients to the total number of peoples died of the potential virus, which does not represent the real fact of the death rate. Notably, the full denominator remains unknown because asymptomatic cases or patients with very mild symptoms might not be tested and will not be identified. Such cases therefore cannot be included in the estimation of actual mortality rates; since actual estimates pertain to clinically apparent COVID-19 cases (Fig. 2). The spatial distribution of COVID 19 In the study area is more and more. This figure cogently illustrates as the temporal distribution of COVID 19 is going very fast and alarmingly (See Fig. 2). This period also based on the recent works [12, 13, 14, 15], indicated the supreme nurture time is expected to be up to 14 days, while the middle time from the onset of the patients characteristics and signs to severe care unit (ICU) charge is around 10 days. Yi-Cheng Chen et a, [35] proposed a time based vulnerable infected- recovered (SIR) algorithm and the result has shown that the one day forecast mistakes for the numbers of confirmed cases are almost fewer than 3% excepting for the day when the meaning of confirmed cases is altered. In addition to this, WHO report have shown that the time that the symptoms from the onsets and deaths that are ranged within 2 weeks to 8 weeks.

Seven different approaches cubic, exponential, quadratic, compound, logarithmic, logistic, Growth and Exponential distributions are considered to accurately estimate the prediction of number of confirmed cases and death rates. From Figure below, we can see that the values along the x-axis indicate duration time indicating days from January 27, 2020. The values along y axis are the confirmed cases of COVID 19. Different literature reviews focused on the under-estimation of coronavirus number of cases; while major surveys by Zhao and collaborators [20] and by Read et al. [21]. Specifically, Zhao and coworkers [20] more pointed out on the assessments under-reporting rate of coronavirus number of cases, through building the epidemic growing curves such as an exponential growing Poisson process. We repeated the process as aforementioned but this can be attained through fitting modeling the data on confirmed number cases between January 27th and 3rd April 2020 (Fig. 4) and the dot points are the observed of confirmed cases where the cubic and quadratic curve are both better fit in estimating the confirming cases of COVID 19 as compared to logarithmic, compound, growth, logistic and exponential using the exponential curve growing Poisson process. Adam J Kucharski et al, [39] proposed a combined a stochastic transmission model, showing that COVID 19 spreading approaches are probably reduced in Wuhan since the late January, 2020, but our findings have revealed the number of confirmed cases is highly increased as the duration of time is (Fig. 4.)

3.5.2. Performance of Predictive Approaches based on Confirmed Cases

There are several adopted predictive approaches to examine prediction of confirmed cases due to the impending influence of COVID 19. In this section, the performance of the Cubic, curved, quadratic, Logarithmic, Compound, Exponential and logistic are adopted to predict the confirmed cases and deaths. This entails as the shown in Table 2 that the presentation of cubic and quadratic are outperformed as compared methods in based on coefficient of determination. This finding has shown that the proposed algorithm can enhance the variables of the cubic approach efficiently and producing a convenient result through the result attained from the performance measures (Table 2).

Table 2
Performance of Confirmed Cases of COVID 19 using various approaches

Models Summary along with the Parameter Estimates								
Dependent Variable: Confirmed Cases of COVID 19								
Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	b1	b2	b3
Logarithmic	.582	12.521	1	9	.006	121358.857		
Compound	.821	41.153	1	9	.000	1.288		
Growth	.821	41.153	1	9	.000	.253		
Exponential	.821	41.153	1	9	.000	.253		
Logistic	.821	41.153	1	9	.000	.776		
Quadratic	.958	91.230	2	8	.000	-7397.505	330.544	
Cubic	0.996	538.334	3	7	.000	13691.949	-824.701	12.956
The independent variable is Days from January 27, 2020.								

3.6. Prediction Estimates of Death Rates COVID 19

The descriptive result has pointed out as there is still temporal variation of death of COVID 19 with an alarm growing. The temporal distribution of death rate is exponentially increasing across the globe, from which a serious attention is required to mitigate its expansion in Africa in the future. It is an amazing growth especially temporally from month to month with an alarm growth (Fig. 5).

But several adopted approaches are also implemented its prediction of the death rate, from which we can note that cubic and quadratic approaches are both better fit the death related data as compared to the other exponential families. The adopted models has shown that the COVID-19 disease infection rate increases more than an exponentially. Our findings is more resembled to the latest work which has shown that the model converges to a maximum number as time increases, indicating a limited impact of COVID-19 Yi Li et al [39]. But, the results attained from our work indicates, the deaths is increasing in cubic and quadratic form as shown in Fig. 6. Brandon Michael et al [41] based on Meta findings or analysis, with more than 1389 COVID-19 patients, of which 273 (19.7%) are considered as severe disease [41–45]. Moreover, Bin Zhao, et al., [46] has suggested as the results of the sensitivity analysis show that the time it takes for a suspected population to be diagnosed as a confirmed population can have a significant impact on the peak size and duration of the cumulative number of diagnoses. Xinmiao Rong et al [47] proposed a new algorithm, from which a sensitivity findings and the simulations results reveals that, enhancing the ratios of timely judgment and shortening the waiting time for diagnosis cannot eradicate COVID 19. This notes, the death and spatial confirmed cases of COVID 19 across the globe is growing in alarm way, the African must give a care and work on its mitigations.

3.6.1. Performance of Predictive Approaches to Predict Death Rates

The performance evaluation of the prediction models relying through comparing the findings obtained between adopted methods and other models to predict the deaths as shown in Table 3. It can be concluded that the cubic and quadratic approaches are both outperforms to the other exponential families. Furthermore, the cubic method has the largest coefficient of determination indicating the observed values and the fitted curve are almost overlapping as compared to all the other comparison algorithms (quadratic, logistic, logarithmic, compound, growth and exponential), and pointing with high quality in predicting the death rates. Meanwhile, the quadratic models suggested and ranked as the 2nd, which indicates superior results as compared to the other algorithms. Additionally, the results obtained from the coefficient of determination has again shown that good relationship between the predicted attained by the adopted methods and the observed confirmed cases of COVID 19, which is almost 0.994. Thereby, it also entails as the result is more consistent to the results attained from Fig. 7, which illustrates the data through the proposed algorithms based on the historical data of the COVID-19 death rate. Therefore, for an abnormal growth of cases like the COVID 19, it can be suggested that the cubic mathematical approach has a high potential and more robust to predict the COVID 19 relied dataset.

Table 3
Performance of death rates of COVID 19 using various approaches

Model Summary and Parameter Estimates								
Dependent Variable: Deaths since January 27,2020								
Equation	Model Summary					Parameter Estimates		
	R Square	F	df1	df2	Sig.	b1	b2	b3
Logarithmic	.543	10.677	1	9	.010	6029.308		
Compound	.877	64.467	1	9	.000	1.210		
Growth	.877	64.467	1	9	.000	.190		
Exponential	.877	64.467	1	9	.000	.190		
Logistic	.877	64.467	1	9	.000	.827		
Quadratic	.994	79.212	2	8	.000	-486.454	18.642	
Cubic	.994	414.215	3	7	.000	665.230	-44.446	.707
The independent variable is Days from January 27, 2020.								

3.7. Discussions

In this work, numerous concerns are addressed expressly, in the facet of the source of the outbreak, characteristics and symptoms of the patients, and also the pattern along with the spatial and temporal distribution indicates a strong remark for the developing countries. The result from the descriptive below has indicated as the COVID 19 patient above 40 years old needs a strong care especially in Africa as the infection fatality ratio in increasing exponentially (Fig. 7). This is also strongly supported as the age of 42.2% infected patients are 80–89 years, while nearly about 32.4% are 70–79 years, 8.4% are 60–69 years, and 2.8% are 50–59 years. The ratio of males to females is 80–20% as the median ages for women (85 years for women *versus* 80 years for men). The trend in mitigation of COVID 19 in Italians is good in theory, as they are than better than other countries to fight the novel virus however, the strongly recommended as an hostile approach requirements to be taken with infected patients who are disapprovingly ill with COVID 19, often including ventilator support [22, 23, 24].

In this discussion section, following these descriptive results, the prediction rates of some potential predictive factors are also addressed as given in the following table (Table 4). The result shown in [3] has shown that a significantly high risk is observed with blood group A for COVID-19 with 1.279 odd ratio (95% CI 1.136 ~ 1.440), while a low risks of blood type O for COVID 19 with 0.680 odd ratios along with the confidence interval of (95% CI 0.599 ~ 0.771). However, [10] noted as yet in the initial days of the outbreak of COVID 19 and there are a number of uncertainties in both the measure of the current outbreak, as well as the main epidemiological data concerning transmission. But, the speed and the rapidity of the progress of cases since the acknowledgement of the outbreak are much superior to that observed in outbreaks of the other virus. This is reliable with our larger prediction of the generative number for this outbreak compared to these other emergent coronaviruses, suggesting that containment or control of this virus may be significantly more problematic. To tackle the spread of this novel virus, [11] revealed as the 2019-nCoV infection was of clustering onset, are more likely to affect older males with comorbidities, and can result in severe and even fatal respiratory diseases such as acute respiratory suffering syndrome. In addition to this, the middle ages of those who expired in Italy was 81 years while about greater than more than two thirds of these infected patients had heart pressure, diabetes, HIV infected patients, cardiovascular diseases, or cancer, or were former smokers [18]. This table shown above cogently indicates as both old age and comorbidity proved the common risk factors for predicting death in 49 COVID 19 Patients. In support, COVID-19 related death was associated with old age (≥ 60 years, RR = 9.45; 95% CI, 8.09–11.04), male (RR = 1.67, 95% CI, 1.47–1.89) and any comorbidity(5.86; 95% CI, 4.77–7.19), most notably CVD (6.75; 95% CI, 5.40–8.43) followed by hypertension (4.48; 95% CI, 3.69–5.45) and diabetes (4.43; 95% CI, 3.49–5.61). In addition, medical staff had a lower fatality rate than non-clinical staff for COVID-19 (RR = 0.12; 95% CI, 0.05–0.30) [22, 23, 24] (Table 4).

Table 4
Comparison of risk factors for death due to COVID 19

Predictive factors		N	CFR, n (%)	RR (95%)
Age	Above 60 years	13909	829(6)	9.45 (8.09–11.04)
	Below 60 years	30763	194(0.6)	
Sex	Male	22981	653 (2.8)	1.67 (1.47–1.89)
	Female	21691	370 (1.7)	
Any comorbidity				5.86 (4.77–7.19)
	Present	5446	273 (5.0)	
	Absent	15536	133 (0.9)	
Health care worker	Yes	1716	5 (0.3)	0.12 (0.05–0.30)
	No	42956	1018 (2.4)	
Hypertension	Yes	2683	161 (6.0)	4.48 (3.69–5.45)
	No	18299	245 (1.3)	
Diabetes	Yes	1102	80 (7.3)	4.43 (3.49–5.61)
	No	19880	326 (1.6)	
CVD	Yes	873	92 (10.5)	6.75 (5.40–8.43)
	No	20109	314 (1.6)	
Cancer	Yes	107	6 (5.6)	2.93 (1.34–6.41)
	No	20875	400 (1.9)	
Other factors	Respiratory disease			3.43 (2.42–4.86)
	Cerebrovascular disease			5.34 (2.34–12.16)
	Respiratory disease			3.1 (2.6–4.2)

4. The Way Forward and Forthcoming Directions to Mitigate the Spatial COVID 19 in Africa

The spatial and temporal distribution of COVID 19 is dispersing on across the world globally alarmingly, where the growth in death and number of confirmed cases are still continuing in Africa. Pervasive and well known actions are taken to decrease human to diffusion of COVID 19 are required to mitigate the current outburst in Africa. Several European countries such as Italians, the Spanish and UK are good in theory; but, they lack in responding in an aggressive approach to casting out the virus [18, 27]. As we have lack of health facility and human resource, the Africans must seek distinct courtesy and efforts to mitigate or decrease transmission must be implemented in vulnerable populations including youngsters, children, women's, health care providers, and elders. Additionally, the African guideline must prepare strong guideline on its medical staff, healthcare providers, and public health

individuals and researchers, which is more resembled as in [28]. The growth prediction rate of confirmed cases and death rate of COVID 19 is seems more cubic and quadratic, as such as the distribution of this growing up alarmingly the joint team is needed for Africans to give a strong awareness for African community. Strong attention is highly recommended especially for an early death cases of COVID-19 outbreak occurred primarily in elderly people, possibly due to a weak immune system that permits faster progression of viral infection [28, 29]. Thus, Africans must give a due attention in these areas where highly spreading is occurred to mitigate the expansion of this potential virus, and giving an aggressive response to this virus is the most fundamental issue. Physical contact with wet and contaminated objects should be considered in dealing with the virus as an alternative route of transmission [31, 32]. As it is observed in Wuhan, China and we also observed in another countries counting the US have implemented major preventing and important controlling actions including travel screenings to control additional distribution of the virus [33], as such all African countries must come together jointly to strongly work on mobility and tackle the spreading of the novel virus through a strong prevention and controlling mechanisms. Epidemiological changes in COVID-19 infection should be monitored taking into account potential routes of transmission and subclinical infections. To diminish fright and monetary harm, and to cogently accomplish and save the infection, much continue to be done in mitigating the spatial and temporal distribution of COVID 19. The Africans must work in cooperation to reduce its distribution so to disruption the transmission shackle of COVID 19. This will also entails to bring an efficient and an effective program to trace, diagnose, and cure an infected patients needs a due attention with regard to patient's previous health history, travelling experience, different blood types. It is of great authoritative that we call for global action to deal with this major public health emergency.

5. Conclusion

The recommendations of Italians to respond aggressively on the outbreak of COVID 19, is a lesson for Africans to alleviate the spatial and temporal distribution of the novel virus. This study proposed cubic and quadratic models to estimate and predict the epidemic curve of COVID 19 based on an epidemiological data [WHO,2020]. Additionally, the sources, major symptoms, patient's characteristics and mitigation mechanisms of COVID 19 are well addressed. The result has shown that the spatial and temporal distribution of COVID 19 is varying across the world, where the confirmed cases and deaths getting started to high in Africa. The results also pointed out, the fitting effects of cubic and quadratic models are the best among all the aforementioned methods, while the fitting effect of cubic model outperform to all family of an exponentials. The result has shown that the cubic algorithm is better predicts the confirmed cases and the deaths of COVID 19 as compared to the other baselines algorithms ($R^2 = 0.996, F = 538.334, D_{F_1} = 3, D_{F_1} = 7, b_1 = 13691.949, b_2 = -824.701, b_1 = 12.956$). The source of the outbreak is not well known but it is highly related with the Huanan Seafood from the whole market, fever, cough, fatigue, headache, and others are identified as the major symptoms of COVID 19. As the spatial and temporal distribution of COVID 19 is growing up, the best measures are persistent and strict self-isolation the most essential to reduce the spread. A more robust and effective preventing techniques are needed to take a strong actions so that the spread of the virus is alleviated through expanding more health facilities e.g., increasing accessible number of hospital beds, a strong unity and collaboration of all leaders along with the world health organizations is important to eradicate the virus, minimizing the time period from signs and symptoms start to segregation of infected patients, secluding and isolating the suspected cases as well as all confirmed number of cases of the patients. Africans must united together to mitigate the spatial distribution of COVID 19. Well preparing and fighting the novel virus at early stage is the best tactic for Africans to reduce the body bags of its lives, this can be ensured if all Africans strongly united together more than ever. The expansion of health facilities, health

equipment's, materials and health professionals are more encouraged to mitigate the expansion of the virus from the world.

Declarations

Conflict of Interest:

There is no conflict of interest in this work.

Competing interests:

There is no competing interest of any one with this paper. This paper is done only to fill the current outbreak gap of the epidemic.

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Authors' contributions:

The author's contribution is reading all articles in this area and analyzing the data released by WHO and make into more meaningful. Therefore, this data and all the ideas are done by the author alone.

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Ethics approval and consent to participate:

In this study, the research considers data released by WHO including the reported data of confirmed cases, deaths and along with time.

Consent for publication:

This paper is purely done based on the data released by WHO and all information related to others article is already cited in the mother document.

Availability of data and materials:

In this research the available data are attained based on the daily reported cases of the WHO.

Trial Registration:

The trial registration of the study considers data related to world health organizations that were being infected, died and recovered due to COVID 19. Therefore, all relevant information is obtained from this world health organization. The results were not published therefore it is retrospectively registered.

Authors' Information

Habte Tadesse Likassa received his B.Sc from University of Gondar, Ethiopia and M.Sc from Addis Ababa University, Ethiopia, in 2008 and 2011 respectively. Additionally, received his PhD degree in Statistical Signal Processing from National Taiwan University of Science and Technology, Taiwan Republic of China. He has been served as a graduate assistant in 2009, Lecturer from 2012–2013 at Debre Birhan University, Ethiopia. He also worked as lecturer and head, department of Statistics from 2014–2015 at Ambo University, Ethiopia. Currently, he is working as an Assistant Professor of Statistical Signal Processing and V/Dean of College of Natural Sciences at Ambo University, Ethiopia. His research interest areas are Robust Methods, Spatial and Temporal Modeling, Statistical Signal Processing, Multivariate Analysis, Big Data Processing and Machine Learning with strong skills in Statistical Packages (R, SAS, STATA, SPSS, Matlab and Python).

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Figures

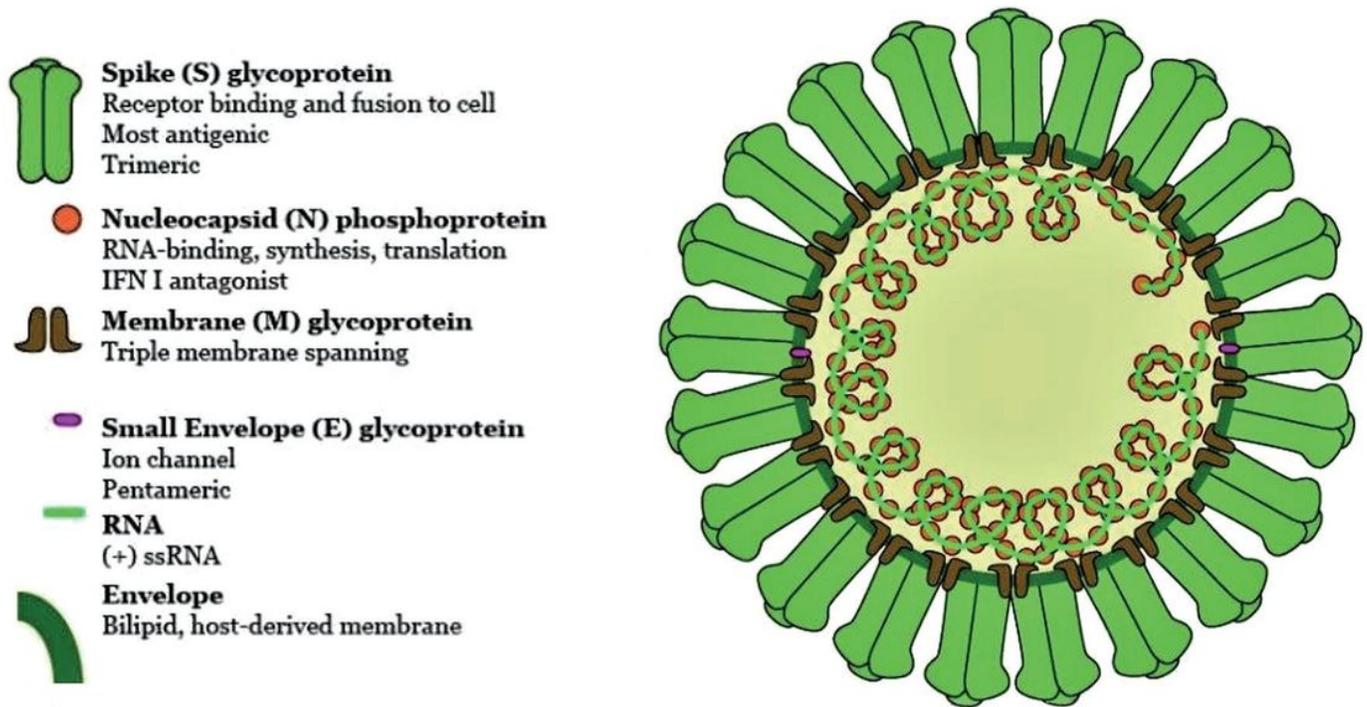
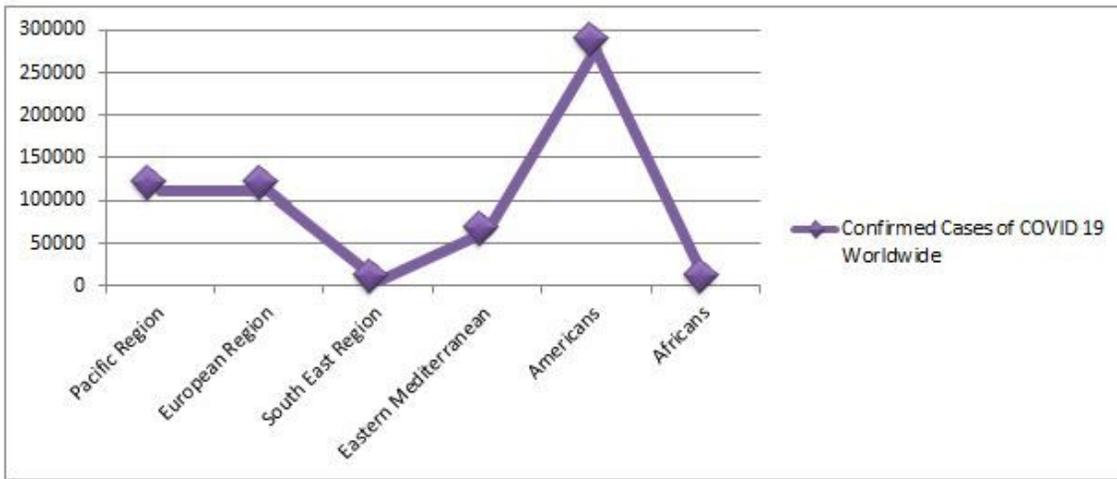


Figure 1

COVID 19 diagrammatic Representation



(a)

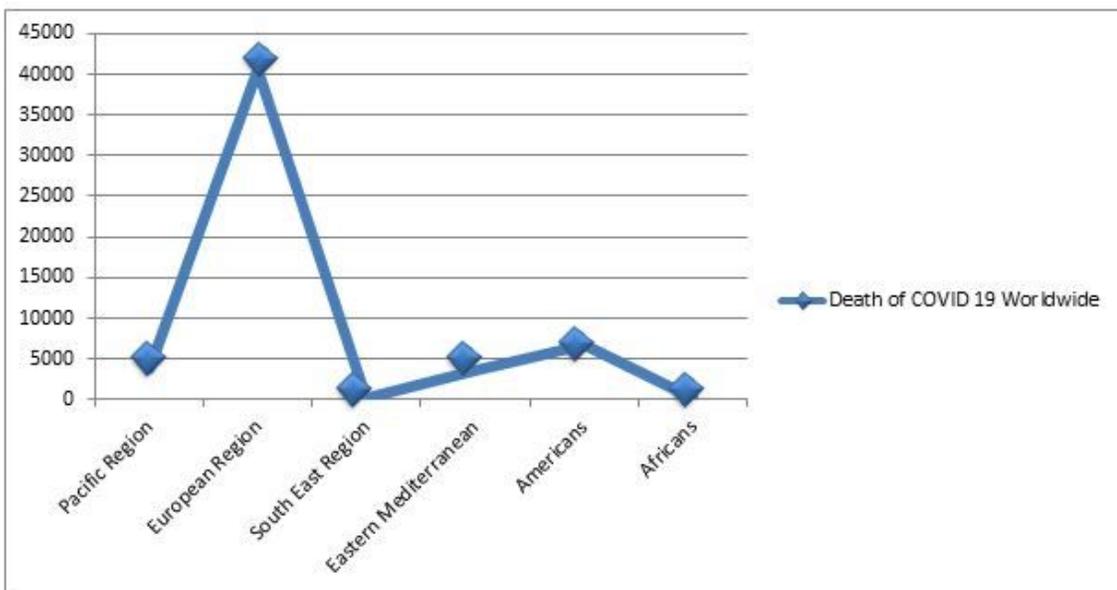


Figure 2

The Spatial distribution of COVID 19: (a) Confirmed cases distribution due to COVID 19; (b) death rate distribution due to COVID 19

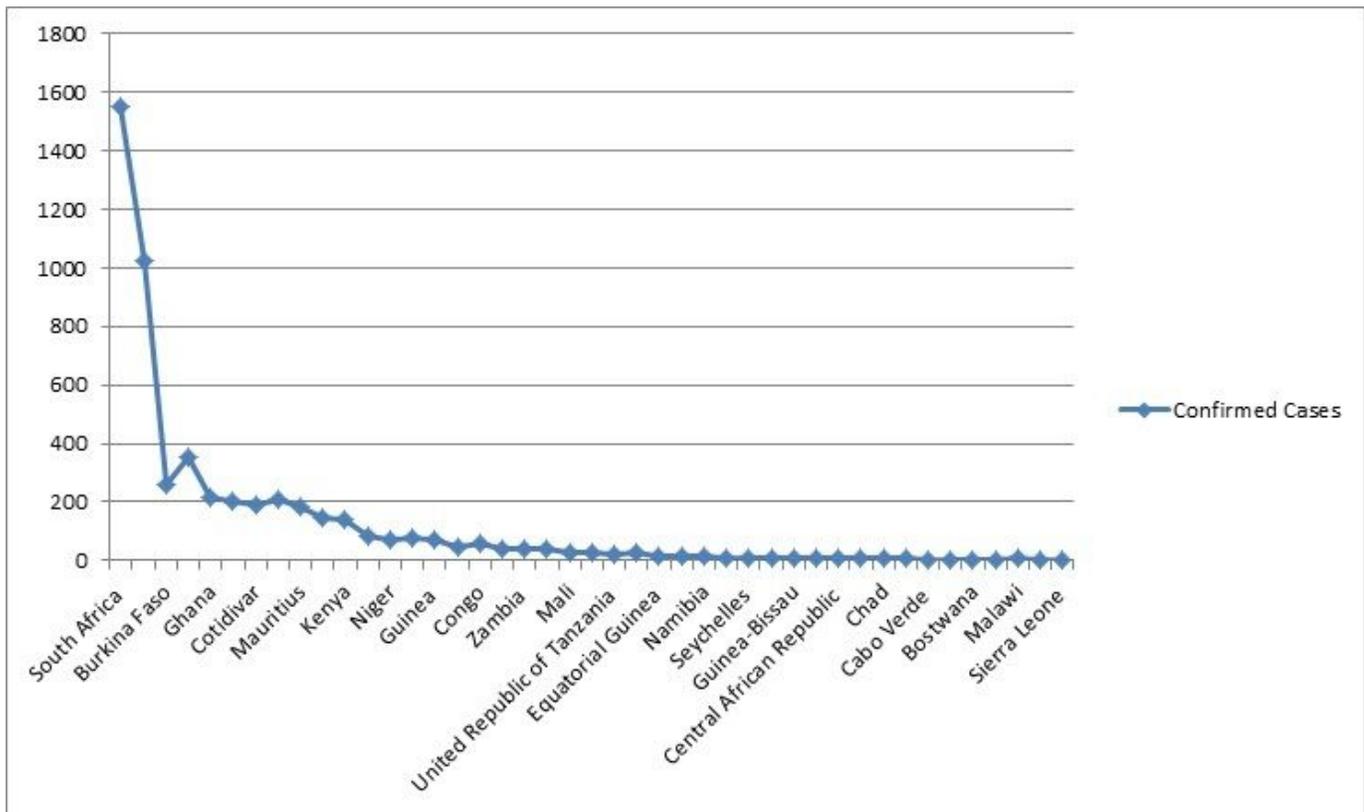


Figure 3

The Spatial distribution of COVID 19 based on Confirmed Cases in Africa

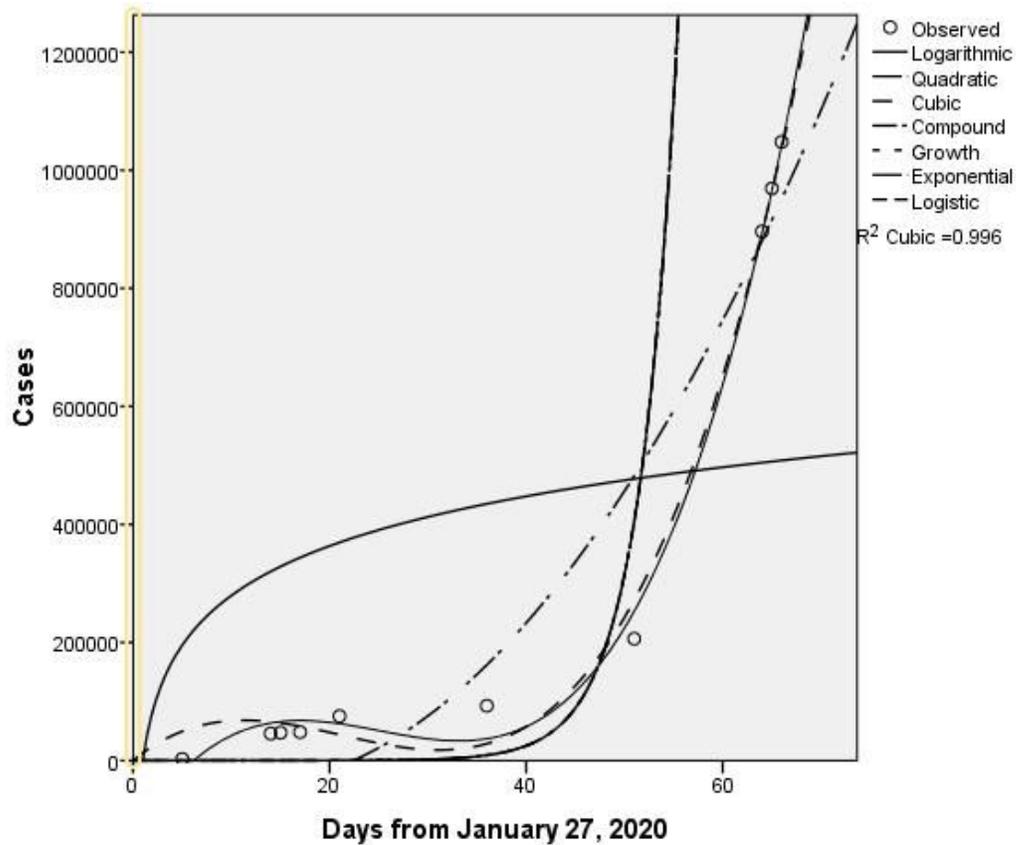


Figure 4

Best fitting of the model to the data of cumulative confirmed cases between 27, January 2020 and 3, April, 2020

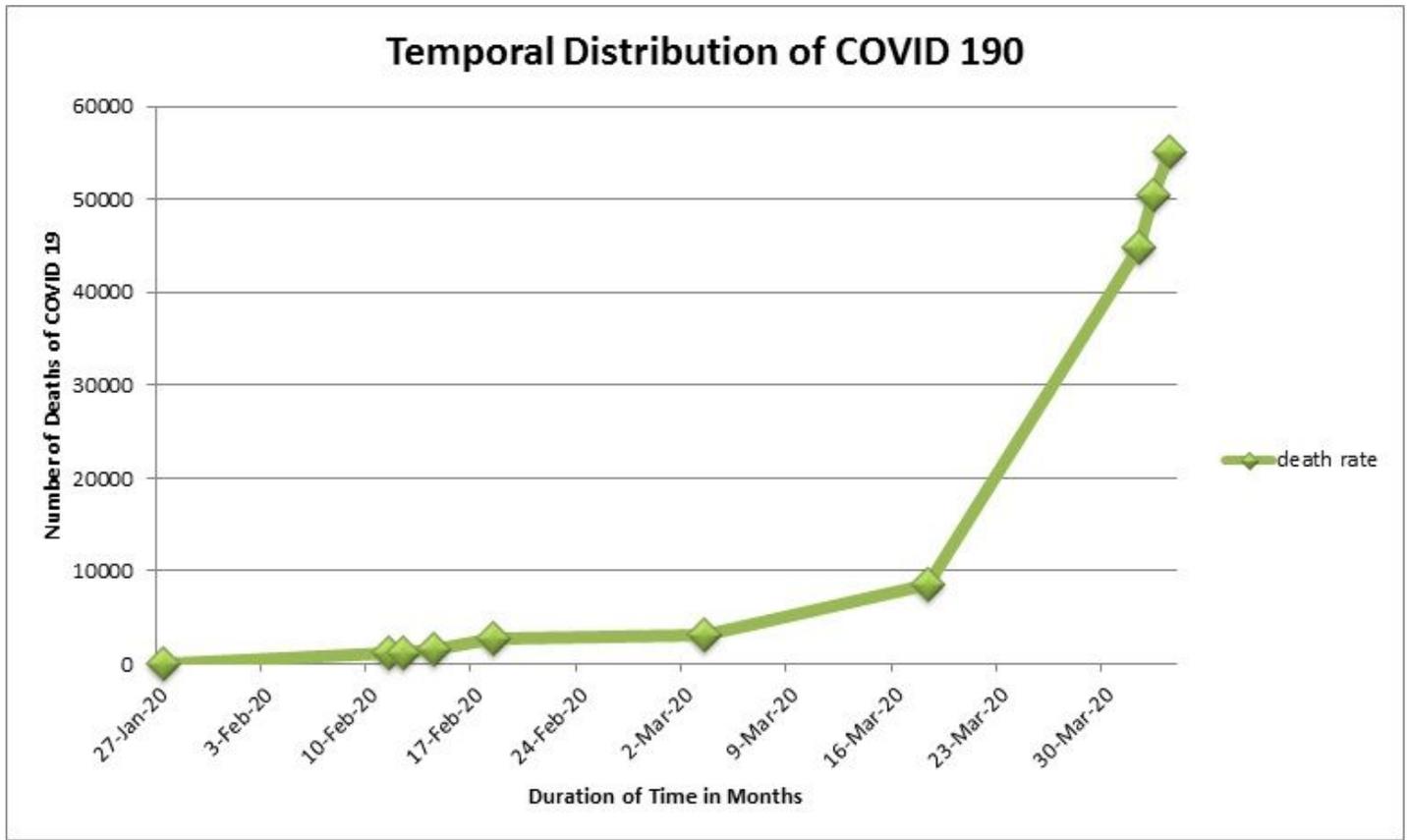


Figure 5

The Temporal Distribution of Deaths of COVID 19

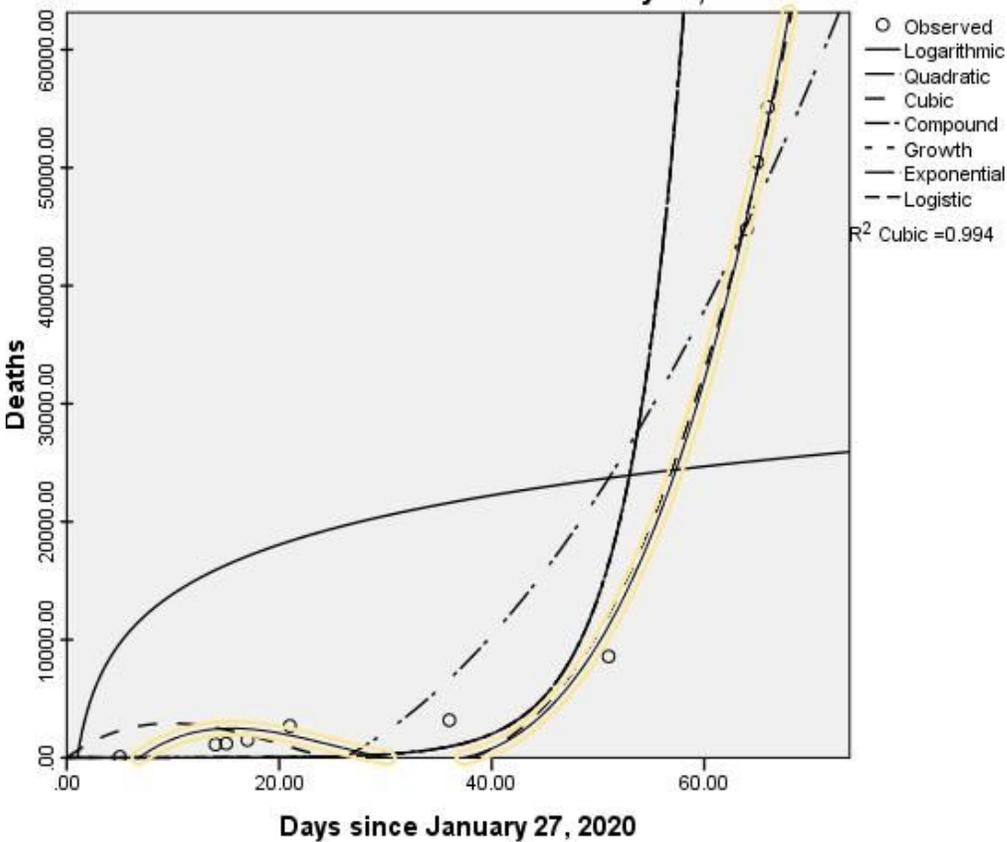


Figure 6

Best fitting of the model to the data of cumulative deaths between 27, January 2020 and 3, April, 2020

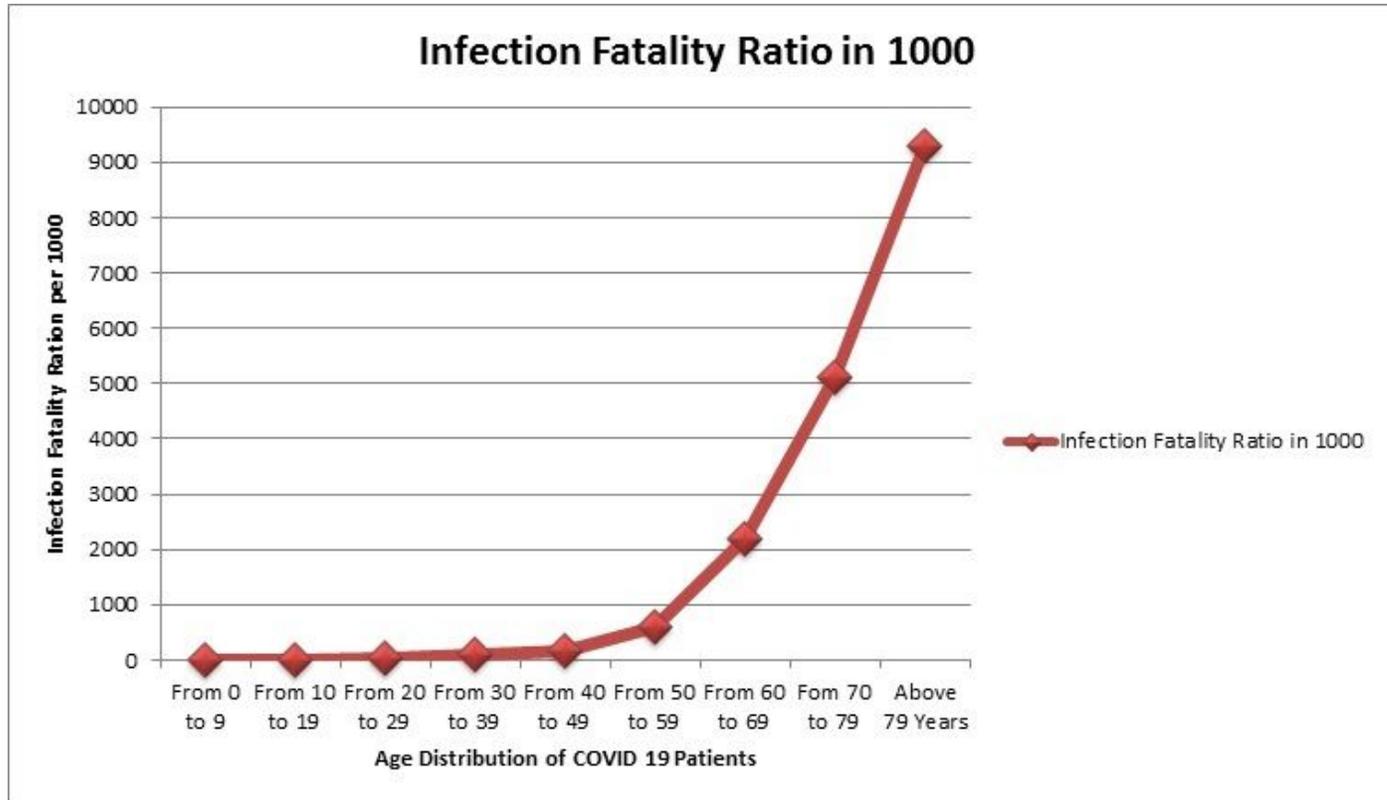


Figure 7

Age distribution of infection fatality ratio per 1000